CCGCD

COLORADO COUNTY GROUNDWATER CONSERVATION DISTRICT

MANAGEMENT PLAN

Adopted by CCGCD: March 19, 2025

Approved by TWDB: April 11, 2025

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CHAPTER 1 – ABOUT CCGCD

SECTION 1.1 – District Mission Statement

The mission of the Colorado County Groundwater Conservation District (CCGCD) is to evaluate, preserve and protect the groundwater of Colorado County and to prevent waste and ensure an adequate supply for current and future residents, industry and agriculture.

SECTION 1.2 – Purpose of the Management Plan

Senate Bill 1 (SB 1), enacted by the 75th Texas Legislature in 1997, and Senate Bill 2 (SB 2), enacted by the 77th Texas Legislature in 2001, established a comprehensive statewide water resource planning process and the actions necessary for the groundwater conservation districts to manage and conserve the groundwater resources of the State of Texas. These bills required all groundwater conservation districts to develop a management plan which defines the groundwater needs and groundwater supplies within each district and the goals each district has set to achieve its mission. Additionally, the 79th Texas Legislature enacted House Bill 1763 (HB 1763) in 2005 that requires joint planning among districts that are in the same groundwater management area.

SECTION 1.3 – Jurisdiction

With one exception, the boundaries of the CCGCD are congruent with the boundaries of Colorado County (figure 1).

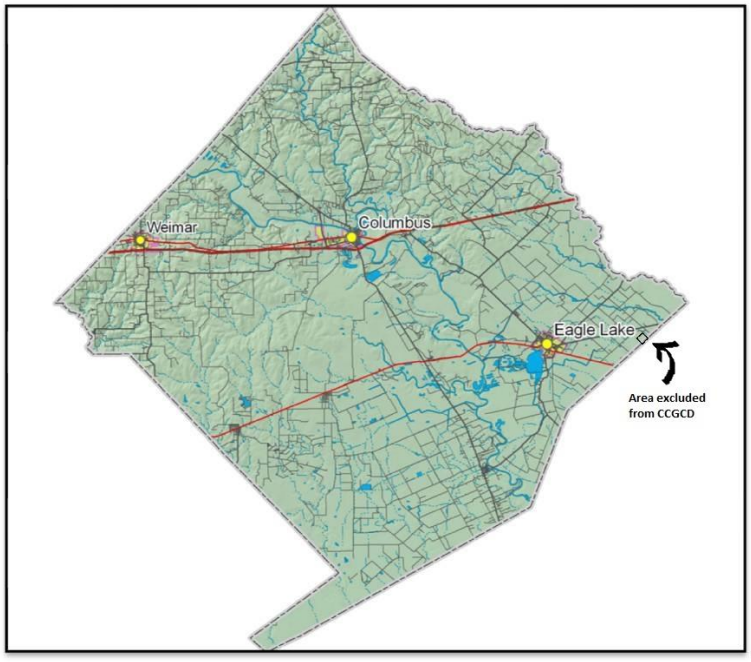

Figure 1: Shaded relief map of Colorado County (Texas Tech Center for Geospatial Technology, 2004).

The noted exception is an approximately 800-acre parcel of land located east of Eagle Lake along the Wharton County line. The landowner of this acreage elected to join the Coastal Bend Groundwater Conservation District prior to the formation of the CCGCD.

SECTION 1.4 – Creation of the CCGCD

The Colorado County Groundwater Conservation District (CCGCD) was created under authority of Section 59, Article XVI of the Texas Constitution and in accordance with Chapter 36 of the Texas Water Code by the 80th Texas Legislature with the Act of May 23, 2007, House Bill 4032, 2007 ("An act relating to the creation"), as a governmental agency and a body politic and corporate. The CCGCD was later confirmed by the voters of Colorado County in November 2007, in accordance with the Underground Water Conservation Districts Act passed by the Texas Legislature in 1949 (currently codified as Chapters 35 and 36 of the Water Code, Vernon's Texas Codes Annotated).

In January 2007, a Colorado County citizen's group was organized to present and promote the case for forming a groundwater conservation district. This group gave numerous presentations to local organizations and brought in speakers with expertise in groundwater conservation. In April 2007, the group received Enabling Legislation through the Colorado County Commissioner's Court and in July of that year, documentation from the State of Texas was received and seven directors were appointed to the Board of the proposed Colorado County Groundwater Conservation District.

In November of 2007, the proposal for the CCGCD was placed on the ballot for voter approval. Also at that time, elections were held for the Board of Directors for the CCGCD. The voters of Colorado County approved the creation of the District and the elected Board members were sworn in shortly after the election.

The Enabling Act was amended by the 82nd Texas Legislature with the Act of May 23, 2011 ("An act relating to the term of office and qualifications for a director in the Colorado County Groundwater Conservation District"). This amendment changed the qualifications for directors serving in at-large positions from residing in the cities of Columbus, Eagle Lake and Weimar to residing in Colorado County.

The Enabling Act was again amended by the 85th Texas Legislature with the Act of May 24, 2017 ("An act relating to the fees charged by the Colorado County Groundwater Conservation District"). This amendment allows the District to assess an export fee on water exported from the District in an amount not to exceed 150 percent of the maximum wholesale water rate charged by the City of Houston.

SECTION 1.5 – Roles and Responsibilities

The governing Board of Directors for the CCGCD consists of seven members and is elected under the general laws of Texas. Of the seven members, four are elected by each of the county's four precincts.

As a result of the 2011 amendment to the Enabling Act, the remaining three at-large members are required only to be residents of Colorado County. The first Board of Directors was elected in November 2007 at the same time the CCGCD was placed on the ballot for approval. Starting in November of 2008, elections were held for four-year terms for places 1, 3, 5 and 7. Two years later, elections were scheduled for places 2, 4 and 6.

The person employed by the Board as General Manager is the chief administrative officer of the District and shall have full authority to manage and operate the affairs of the District, subject to Board approval (Texas Water Code, §36.056).

The CCGCD office is located at 910 Milam Street, Columbus, TX. The District's mailing address is P.O. Box 667, Columbus, TX 78934. Regular office hours of the District are 8:00 am to 5:00 pm, Monday through Friday, except for District holidays or as may be set from time to time by the General Manager (CCGCD, Bylaws, 2017; p 14).

Under the provisions of the Texas Water Code, §36.1071(f), the District adopted rules necessary to implement the management plan. The rules and regulations for the CCGCD are contained in a separate document entitled "Colorado County Groundwater Conservation District Rules and Regulations."

CHAPTER 2 – THE GULF COAST AQUIFER

SECTION 2.1 – Area Stratigraphy

The formations that comprise the Gulf Coast Aquifer range in age from Oligocene to Holocene. The lowermost formation of interest is the Oligocene age Catahoula Sandstone. In Colorado County, the Catahoula consists of alternating beds of clay, tuff and sandstone (Loskot et al., 1982; p 9). Unconformably overlying the Catahoula is the Oakville Sandstone. In the central part of the coastal plain, the formation is predominantly sand is readily distinguishable from the underlying Catahoula and overlying Fleming Formations which is composed predominantly of clay and subordinate amounts of sand. The Fleming outcrops along the northwestern part of Colorado County and the southeastern portions of Fayette County.

The Pliocene aged Goliad Formation unconformably overlies the Fleming. The Goliad consists mostly of non-marine fluvial plain deposits (Culotta et al., 1992; p 274). The upper Goliad is about seven percent higher sand-class material than the lower Goliad. The Goliad Formation outcrops in a band between five and ten miles across in Lavaca County; however, in Colorado County, it is overlain by the younger sediments and only outcrops in very small areas just east of the Colorado River (Barnes, 1974).

The delineation of the Pleistocene units – Willis Sand, Bentley Formation, Montgomery Formation and the Beaumont Formation – is exceedingly difficult due to the lithologic similarity of the sediments and lack of paleontological control (Baker, 1979; p 38). The Beaumont Formation is sometimes referred to as the Beaumont Clay, although in Colorado County the formation is composed of a higher percentage of silt and sand facies than to the south. The Willis has been mapped as outcropping through the center of Colorado County and is the lowermost and hence oldest of the Quaternary sediments, unconformably lying on the Pliocene Goliad Sand. The Willis is described as consisting of reddish, coarse and gravelly sands and subordinate clays attaining a maximum thickness of about 350 ft.

In the Colorado County area, the Bentley and Montgomery formations are often referred to as the Lissie Formation. The Lissie, along with the underlying Willis, averages an abundant 65 percent sand. Lissie sediments consist of reddish, orange, and gray fine-to-coarse grained and cross bedded sands that contain intercalations of clays and sandy clays. They include abraded fossils and lentils of gravel of varied composition (Solis, 1981; p 9). The Willis and Lissie are distinctly sandier than the underlying Upper Goliad. The updip sections of the Willis and Lissie are the sandiest reflective of a fluvial setting whereas downdip they tend to consist of more bay-fill sediments.

The shallowest of the regionally deposited formations is the Beaumont Formation. Except in areas along the present-day Colorado River, the formation pinches out southeast of Colorado County in

Wharton County. The formation consists of clays, silt and sand, but also includes concretions of calcium carbonate, iron oxide and iron-manganese oxides common in zones of weathering.

The youngest of the zones of consideration is the Holocene alluvium section. The alluvium would mostly be associated with the floodplain of the recent Colorado River, which bisects the county, and its major tributaries. Thicknesses of alluvial deposits typically do not exceed 60 feet. The deposits consist of dark gray to dark brown clay and silt, sand with a high component of quarts, cherty gravel and high amounts of limestone, igneous and metamorphic rock fragments, probably reworked form terrace deposits. Fluvial morphology is well preserved with point bars, oxbows and abandoned channel segments clearly visible (Barnes, 1974; Proctor et al., 1974).

SECTION 2.2 – Overview of the Aquifer

The Gulf Coast Aquifer in Texas extends along a band of roughly 100 miles in width from the Sabine River to the Rio Grande (figure 2). Colorado County is located just north of the central Gulf Coast along the Colorado River. George, et al (2011; p 43) provides cross-sections that show how the Gulf Coast Aquifer thins updip (to the northwest).

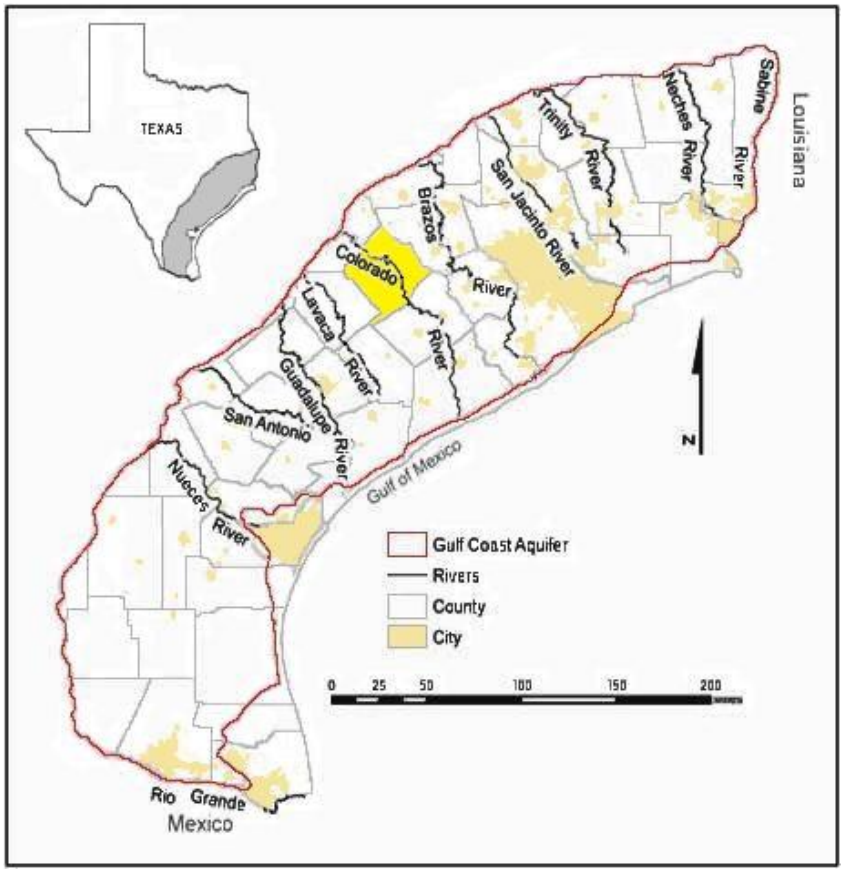

Figure 2: Regional extent of the Gulf Coast Aquifer. Colorado County designated in yellow. Modified from Chowdhury and Turco, 2006 (p 24).

Figure 3 shows correlations between the geologic formations described in the previous section (stratigraphic units) and the associated aquifer zone with the Gulf Coast Aquifer (Baker, 1979; p 4). The sand units of the Catahoula may well be in hydraulic continuity with the overlying sands of the Jasper Aquifer (Loskot et al., 1982; p 9). However, the water quality is generally poorer in the Catahoula. Further downdip, the Catahoula contains a greater percentage of fine-grained material and often acts as a hydrogeological barrier and is frequently designated as the Catahoula Confining Unit (Loskot et al., 1982; p 9) (Davidson and Mace, 2006; p 9). The Catahoula does not contribute any meaningful amount of groundwater in Colorado County.

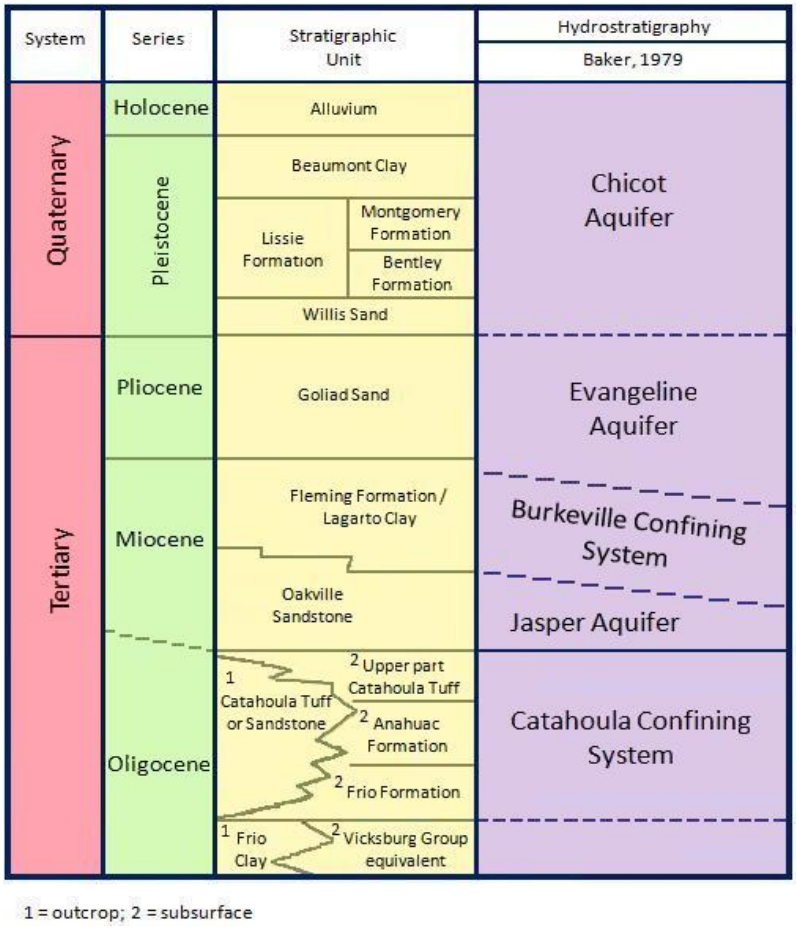

Figure 3: Hydrostratigraphy and the associated stratigraphic units that comprise the Gulf Coast Aquifer (from Baker, 1979).

The Jasper Aquifer was not delineated west of Washington, Austin and Fort Bend counties until Baker (1986; p 39) made more detailed delineations of the Jasper and other related hydrologic units. The Jasper Aquifer ranges in thickness from about 200 feet near the outcrop, to about 2,500 feet in Wharton County. The average range in thickness within the zones of fresh to slightly saline water is about 200 to 800 feet (Loskot et al., 1982; p 9-14). The maximum thickness occurs in the region where the aquifer contains moderately saline water to brine.

In the northern parts of Lavaca and Colorado counties, the Jasper Aquifer contains fresh water, though the water quality varies widely. The largest user of the Jasper Aquifer in Colorado County is the City of Weimar.

The Burkeville Confining System consists wholly of the Fleming Formation (figure 3) which is composed largely of massive clays interbedded with calcareous sand and shale (Rogers, 1967; p 20) and typically ranges from 300 to 500 ft thick in the subsurface. In the Colorado County area, the low porosity and transmissivity of the clays make the Burkeville an effective confining unit hydrologically separating the underlying Jasper from the overlying Evangeline. However, parts of the unit in the outcrop area and in the shallow subsurface do contain sufficient amounts of saturated sand to supply small quantities of fresh to slightly saline water to rural-domestic and livestock wells (Loskot et al., 1982; p 14).

The Evangeline Aquifer is composed largely of sediments from the Goliad Formation and the uppermost Fleming and ranges in thickness from near surface in Lavaca and Fayette counties to 2,300 feet below mean sea level in Wharton County. Because the Evangeline and overlying Chicot aquifers are geologically similar, the basis for separating them is primarily a noticeable but often subtle difference in hydraulic conductivity. The up-dip portion of the Evangeline Aquifer exists under water-table conditions whereas down dip, it is confined (Carr et al., 1985; p 10). Fresh water occurs in the Evangeline Aquifer throughout most of Colorado County and can occur as deep as 2,000 feet in east-central Wharton County (Loskot et al., 1982; p 14). The Evangeline is a large source of water for irrigation in the southern portion of the county and domestic and livestock use in the northern part. The City of Columbus uses water from the Evangeline Aquifer.

The Chicot Aquifer is the main source of ground water in Colorado County. This aquifer overlies the Evangeline and is composed of water-bearing units of the Willis Sand, Lissie and Beaumont Formations as well as Quaternary alluvium. The base of the Chicot ranges from zero near the outcrop in north central portion of Colorado County, to 1,100 feet below mean sea level in southern Wharton County. Groundwater from the Chicot is used for irrigation and for rural domestic and livestock uses in the southern portions of the county. The City of Eagle Lake uses water from the Chicot Aquifer. Because the Chicot aquifer pinches out within the county, the aquifer is under water-table conditions in the up-dip part and becomes confined down dip.

Although the Region K Water Planning Group acknowledges the Colorado River Alluvium and related terrace deposits as a potential 'Other Aquifer', there were no strategies developed for Colorado County to specifically develop the alluvium (LCRWPG, 2020; p 3-47). The alluvium of the Colorado River is typically modeled by TWDB together with the underlying Gulf Coast Aquifer and is not treated as a distinct aquifer. Water from the Colorado River alluvium is typically found near the river and is used primarily for rural domestic and livestock uses.

CHAPTER 3 – CCGCD MAG AND WATER USE

SECTION 3.1 – Modeled Available Groundwater

Section 36.1071(e)(3)(A) of the Texas Water Code states that the district's management plan shall include an estimate of the "modeled available groundwater in the district based on desired future conditions." Section 36.001 of the Texas Water Code defines modeled available groundwater (MAG) as "the amount of water that the Executive Administrator (of the TWDB) determines may be produced on an average annual basis to achieve a desired future condition established under §36.108." Desired future condition (DFC) is defined in §36.001 of the Texas Water Code as "a quantitative description, adopted in accordance with §36.108 of the Texas Water Code, of the desired condition of the groundwater resources in a management area at one or more specified future times."

The 79th Texas Legislature enacted HB 1763 in 2005 that requires joint planning among districts that are in the same groundwater management area (GMA). These districts must jointly agree upon and establish the desired future conditions (DFC) of the aquifers within their respective GMAs. Through this process, the groundwater conservation districts will submit the DFC to the executive administrator of the TWDB who, in turn, will provide each district within the GMA with the amount of modeled available groundwater (MAG) within each district. The MAG will be based on the DFCs jointly established for each aquifer within the GMA.

Colorado County Groundwater Conservation District is located wholly within GMA 15 (figure 4).

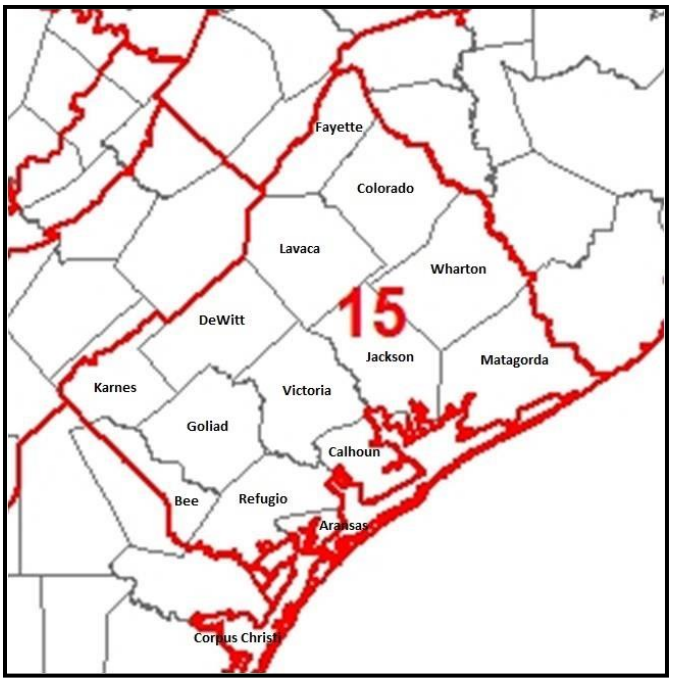

Figure 4: Map showing counties within Groundwater Management Area 15.

GMA 15 district representatives adopted, by resolution (#2021-1), DFCs for the Gulf Coast Aquifer on October 14, 2021. TWDB designated the GMA 15 Explanatory Report administratively complete on April 22, 2022. TWDB provided the MAG estimates for GMA 15 to district representatives on August 16, 2022.

The desired future condition for the entire area is stated as follows:

"Drawdown of the Gulf Coast Aquifer system shall not exceed an average of 13 feet in December 2080 from estimated January 2000 conditions."

The desired future condition for Colorado County is stated as follows:

"Drawdown of the Chicot and Evangeline Aquifers shall not exceed an average of 17 feet and drawdown of the Jasper Aquifer shall not exceed an average of 25 feet in December 2080 from estimated January 2000 conditions."

The TWDB reported the MAG for GMA 15 based on the desired future condition in GAM Run 21-020 MAG which is incorporated into the management plan as Appendix B. The MAG, in acre-feet per year, of the Chicot-Evangeline and Jasper Aquifers within the district per Table 1 of the GAM Run 21-020 MAG is as follows:

County/Aquifer	Year						
	2020	2030	2040	2050	2060	2070	2080
Colorado/ Chicot + Evangeline	71,665	71,665	71,665	71,665	71,665	71,665	71,665
Colorado/ Jasper	918	918	918	918	918	918	918
Total	72,583	72,583	72,583	72,583	72,583	72,583	72,583

Table 1: MAG values for the Gulf Coast Aquifer (Chicot+Evangeline and Jasper) as documented in TWDB GAM Run 21-020 MAG (Dowlearn, 2022). Units are in acre-feet per year. See Appendix B for the complete report.

SECTION 3.2 – Historical Water Use

Section 36.1071(e)(3)(B) of the Texas Water Code states that the district's management plan shall include an estimate of "the amount of groundwater being used on an annual basis." A significant portion of the economy of Colorado County can be attributed to agribusiness, most notably farming. The dominant crop type is rice which is heavily dependent upon irrigation. Colorado County and Wharton and Matagorda counties to the south are leading rice producers in the state and by far account for the most irrigation water use in Region K.

The Lower Colorado River Authority (LCRA) provides the bulk of the irrigation water needed to farmers in Colorado County. Specifically, the water is diverted from the rivers to LCRA-owned

irrigation districts which consists of hundreds of miles of canals used to deliver the water to individual farmer's fields. In Colorado County, the Garwood Irrigation District provides water to farmers on the west side of the Colorado River and the Lakeside Irrigation District provides farmers on the east side. Both these irrigation districts extend southward into Wharton County.

Typically, irrigation usage is a function of precipitation. In wet years, farmers require less water for irrigation. Conversely, in dry years, there is often an uptick in water usage by these farmers.

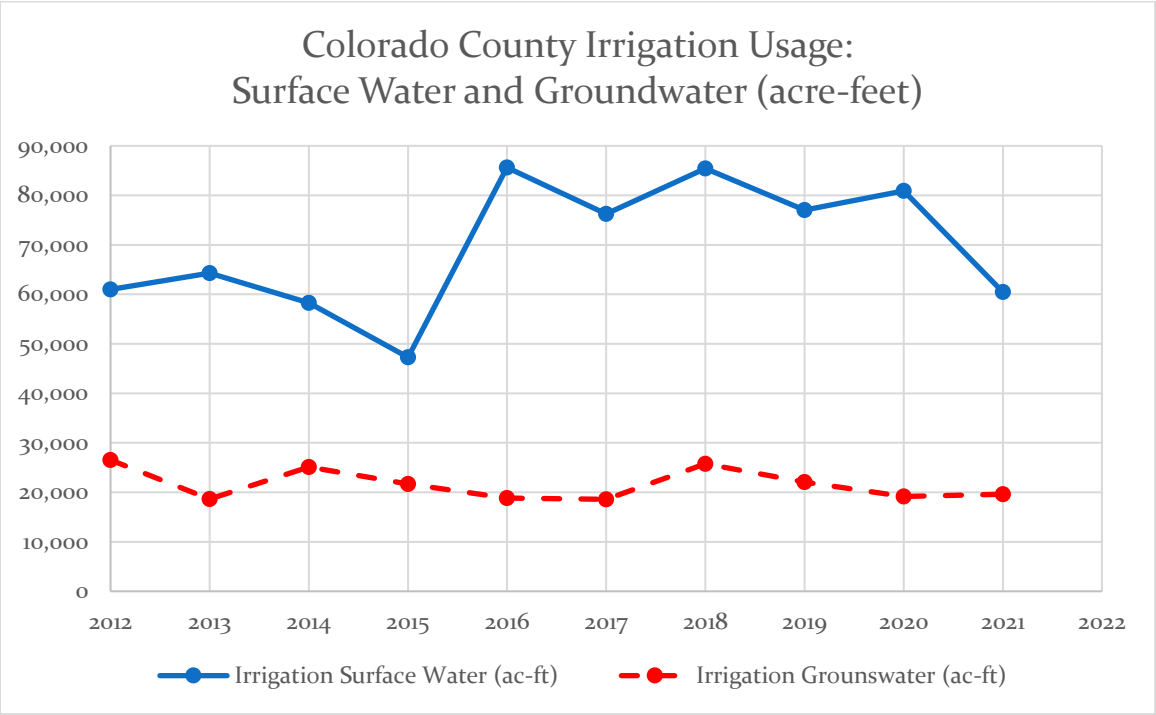

Figure 5. Usage of surface water (solid line) and groundwater (dashed line) for irrigation in Colorado County from year 20012 through 2021 (Appendix C; Allen, 2024, Estimated Historical Water Use; p. 3).

Another factor affecting irrigation usage is the storage volume in the Highland Lake System located along the Colorado River northwest of Austin. Two of these lakes (Travis and Buchanon) were built to act as reservoirs and their water levels rise and drop according to need and conditions. In most dry years, if water was taken from these reservoir lakes, ensuing rains would replenish the lake levels. However, 2008 marked the beginning of a severe and sustained drought that had a discernible impact on the region. As the drought persisted and inflows into the highland lakes diminished, the lake levels began to fall. Eventually, water storage reached a critical point where LCRA restricted release of waters downstream for irrigation purposes. In 2012, for the first time, farmers that used water through the irrigation districts were denied access to water from LCRA. However, because of the senior water rights and due to the LCRA purchase contract, water continued to be supplied to the Garwood Irrigation District. Figure 5 shows the suppressed surface water usage from 2012 through 2015. Though the drought had broken by 2015, reservoir lake levels had not recovered sufficiently for LCRA to supply

water to the irrigation districts, aside from Garwood. Surface water usage increased considerably in 2016 when LCRA once again made water available to the Lakeside Irrigation District and other districts down river (figure 5).

The drought and availability of surface water impacted the amount of groundwater used for irrigation as well. Though farmers were not cutoff from surface water until 2012, LCRA did impose some restrictions of usage in years prior. Groundwater was used to supplement the water needed because of these restrictions.

As the drought continued and farmers became increasingly aware that surface water was not guaranteed, more water wells were drilled, and groundwater usage increased to compensate for the lack of surface water. The number of irrigation wells present in the Lakeside Irrigation District area in Colorado County increased from seven prior to 2012 to 26 by mid-2014. Comparable drilling activity occurred across the county line in Wharton County. These additional 'straws' in the aquifer caused a serious drop in water levels in the immediate area. Unfortunately, many household wells were lost during 2014 east and southeast of Eagle Lake. The increased irrigation usage in this area was reflected by the slight uptick in groundwater usage in 2014 (figure 5).

The amount of water pumped from other user groups pales in comparison to irrigation. The next largest user groups are mining and municipal. Water use from mining is due to the prolific sand and gravel operations in the county. Owing to the relatively small population of Colorado County, municipal use is on the same scale. For a complete listing of water user groups usage from year 2012 through 2021, see Appendix C.

CHAPTER 4 – WATER BUDGET

SECTION 4.1 – Overview of Statutory Requirements

According to §36.1071(e)(3)of the Texas Water Code, the district management plan shall include estimates of the following: the amount of recharge from precipitation, if any, to the groundwater resources within the district; for each aquifer, the annual volume of water that discharge from the aquifer to the springs and any surface water bodies, including lakes, streams, and rivers; and, the annual volume of flow into and out of the district within each aquifer and between aquifers in the district, if a groundwater availability model is available.

Furthermore, according to §36.1071(h) of the Texas Water Code, "in developing its management plan, the district shall use the groundwater availability modeling information provided by the executive administrator of the TWDB together with any available site-specific information that has been provided by the district to the TWDB executive administrator for review and comment before being used in the plan."

SECTION 4.2 – Overview of the Model

The groundwater availability model (GAM) for the central portion of the Gulf Coast Aquifer System was run for this analysis. Assumptions and limitations of the model can be found from Chowdhury et al., (2004).

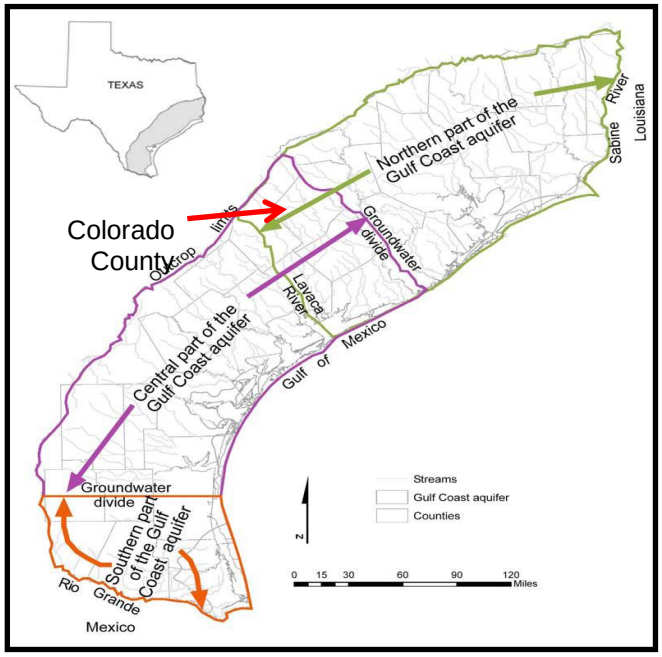

Figure 6: Map showing the groundwater model areas for the northern, central and southern parts of the Gulf Coast Aquifer (Chowdhury and Mace, 2006; p 175). Red arrow designates the location of Colorado County.

The GAM that covers the central portion of the Gulf Coast Aquifer System extends from just past the northeastern Colorado County boundary southward along the coast to the middle of Jim Hogg, Brooks and Kennedy counties (figure 6). The model comprises four layers which generally correspond as follows: Chicot Aquifer (Layer 1), Evangeline Aquifer (Layer 2), Burkeville Confining Unit (Layer 3), and the Jasper Aquifer and parts of the Catahoula Formation (Layer 4) (Goswami, 2013; p 5).

For the purposes of this report, the water budget will be concerned with the study of the Gulf Coast Aquifer in a study area that encompasses Colorado County. Figure 7 shows the model grid configuration over the subject area.

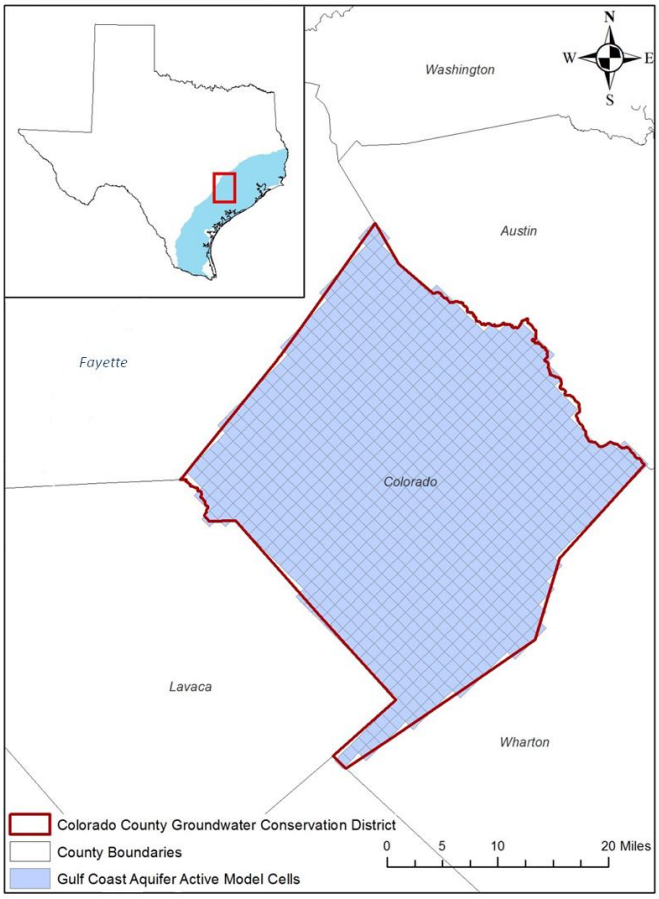

Figure 7: Map showing the grid cells used in GAM Run 13-027 to calculate results depicted in Appendix D (altered slightly from Goswami, 2013; p 8).

GAM Run 13-027 provides the most recent methods, assumptions, and results from a model run for Colorado County using the groundwater availability model for the central portion of the Gulf Coast Aquifer System.

SECTION 4.3 – Model Results

Copious data is incorporated into the TWDB groundwater computer simulation model to obtain reliable outputs. The result of the GAM runs help to understand recharge, discharge, groundwater-surface interactions, and cross-formational flow through the aquifer (Chowdhury et al., 2004; p 32). Though these models tend to be more reliable on a regional scale, the information provided on a county scale is still the best estimate available for determining important groundwater interactions.

The aquifer is impacted by movements of water into, through, and out of a particular study area – in this case, Colorado County. Prior to development (i.e. before pumping commenced), a steady-state system existed where the water that entered the aquifer, dominantly from recharge, was balanced by water that exited the aquifer. Once pumping commenced, the system entered a transient state where, for some period of time, more water was leaving the system than was entering it. Over time, water is released from storage and another steady-state system may develop.

Table 2 below shows the model results of groundwater movement through the Gulf Coast Aquifer in and around Colorado County. Appendix D includes the entire report for GAM Run 13-027. This GAM Run, though run in 2013, was deemed acceptable by TWDB for usage in the updated 2019 CCGCD Management Plan (Walker, 2019).

Management Plan Requirement	TX Water Code Requirement	Aquifer or Confining Unit	Results
Estimated annual amount of recharge from precipitation to the district	Sec. 36.1071.e.3.C	Gulf Coast Aquifer System	34,764
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sec. 36.1071.e.3.D	Gulf Coast Aquifer System	11,412[1]
Estimated annual volume of flow into the district within each aquifer in the district	Sec. 36.1071.e.3.E	Gulf Coast Aquifer System	18,088
Estimated annual volume of flow out of the district within each aquifer in the district	Sec. 36.1071.e.3.E	Gulf Coast Aquifer System	36,968
Estimated net annual volume of flow between each aquifer in the district	Sec. 36.1071.e.3.E	From underlying units into the Gulf Coast Aquifer System[2]	185[2]

Table 2: Output from GAM Run 13-027 (Goswami, 2013; p 7) and the associated Texas Water Code requirement being fulfilled. Results are in acre-feet per year. [1] – This total includes 14 acre-feet per year springs discharge and 11,39 acre-feet per year leakage to streams; [2] – Estimated from layer 1 of the Yegua-Jackson Aquifer groundwater availability model.

CHAPTER 5 – SUPPLY, DEMAND, NEED AND ASSOCIATED STRATEGIES

SECTION 5.1 – Projected Surface Water Supply

Section 36.1071(e)(3)(F) of the Texas Water Code states that the district's management plan shall include estimates of 'the projected surface water supply in the district' according to the most recently adopted state water plan. Colorado County is wholly within the Lower Colorado Regional Water Planning Group commonly designated as Region K (figure 8). Each regional water group supplies their specific assessments to TWDB for incorporation into the state water plan.

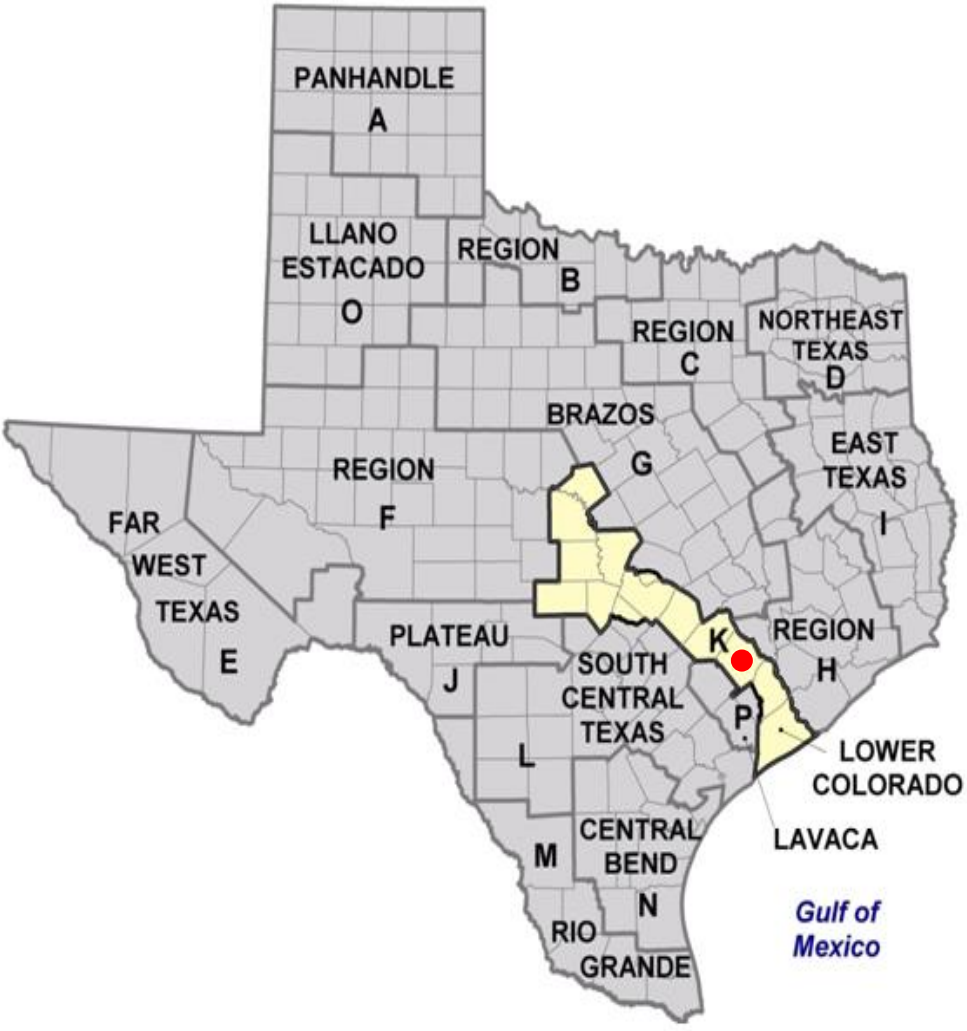

Figure 8: Map showing location of Region K relative to other regional water planning groups (LCRWPG, 2020; p 1-2). Red dot designates the location of Colorado County.

An estimation of how much water Colorado County will have to meet their water demands is a two-step process that examines both water availability and existing supply. Water availability refers to the maximum volume of raw water that could be withdrawn annually from each source during a repeat of the drought of record. It does not account for whether the supply is connected to or legally authorized for use by a specific water user group. Existing water supplies are based on legal access to the water as well as the infrastructure already in place to treat and deliver the water to the "doorstep" of water user groups (Allen, 2024, 2022 State Water Plan Datasets; p 4; LCRWPG, 2020; 3C p 3-4) (Appendix E1).

Surface water sources include any water resources where water is obtained directly from a surface water body. This would include rivers, streams, creeks, lakes, ponds, and tanks. In the State of Texas, all waters contained in a watercourse (rivers, natural streams, and lakes, and the storm water, flood water, and rainwater of every river, natural stream, canyon, ravine, depression, and watershed) are waters of the State and thus belong to the State. The State grants individuals, municipalities, water suppliers, and industries the right to divert and use this water through water rights permits. Water rights are considered property rights and can be bought, sold, or transferred with state approval. These permits are issued based on the concept of prior appropriation, or "first-in-time, first-in-right". Water rights issued by the State generally fall into two major categories: run-of-river (ROR) rights and stored water rights (LCRWPG, 2020; p 3-2).

In addition to the water rights permits issued by the State, individual landowners may use state waters without a specific permit for certain types of uses. The most common of these uses is domestic and livestock use. These types of water sources are generally referred to as "Local Supply Sources". Many individuals with land along a river or stream that still have an old riparian right can also divert a reasonable amount of water for domestic and livestock uses without a permit (LCRWPG, 2020; p 3-2).

Three basins intersect Colorado County – Colorado; Brazos-Colorado; and Lavaca (figure 9). While the Colorado River Basin is broad and encompasses most of the Region K counties to the north, the basin starts to narrow considerably in Colorado County, especially in the southern portion of the county where most of the agricultural irrigation occurs. In Colorado County, the basin comprises less than half the county. Nevertheless, the primary source of water within this basin are the run-of-river (ROR) water from the Colorado River and the two water storage reservoirs in the Highland Lakes System (Lakes Travis and Buchanan) located northwest of Austin (LCRWPG, 2020; p 3-4 and 3-5).

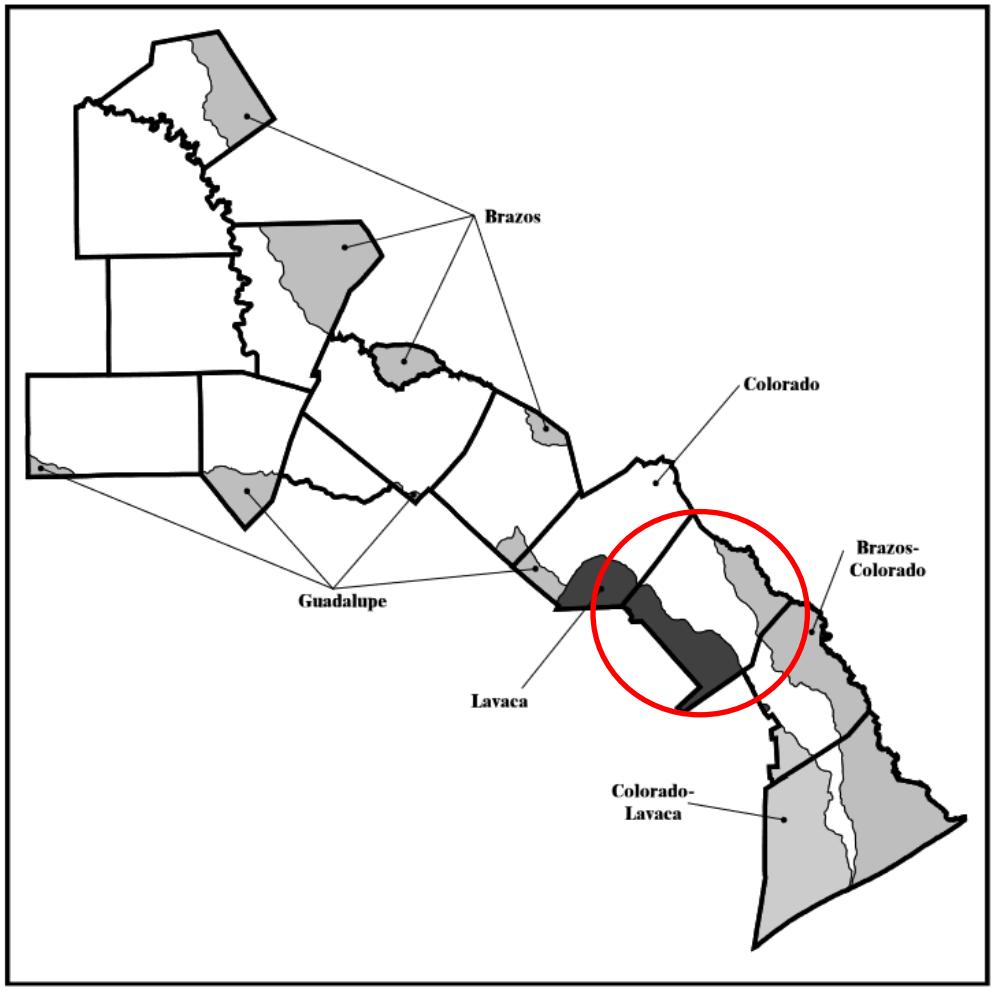

Figure 9: Map showing river basins associated with the Lower Colorado Regional Water Planning Area (Region K) including Colorado County (red circle) (LCRWPG, 2020; p 3-4).

Within each of the three Colorado County basins, irrigation is the dominant water user group. The Garwood and Lakeside Irrigation Districts in Colorado County typically have access to run-of-river and supplemental interruptible supplies from the Highland Lakes. LCRA, as the major provider of surface water in the county, designates how much interruptible water supply can be made available during a repeat of a drought of record while continuing to ensure availability of water to firm customers. This is done through use of a system of curtailment triggers that are linked to actual water in storage. As firm commitments and demands for water under those commitments increase over time, interruptible supplies must be reduced more often even at higher storage levels to ensure availability of water to firm customers even in a drought of record (LCRWPG, 2020; p 3-52). During the most recent 'drought of record', reservoir lake levels at Buchanan and Travis were impacted such that storage capacity for each were below the curtailment triggers designated by LCRA. As a result, stored water was not available to

many farmers in Colorado County relying on water from the irrigation districts for four consecutive years (2012-2015). Irrigation districts do have major ROR rights in the Colorado River Basin, but access to the waters is based on a priority system where senior rights have first call on water. Because the Garwood Irrigation District has the most senior rights of any on the river, it had access to river water during the most recent drought. The Lakeside Irrigation District however had no river water access for the four years from 2012 through 2015.

The Lavaca River Basin accounts for more than one third of the county (figure 9), primarily to the west and southwest. Surface water sources are limited to local sources since there are no major reservoirs in this portion of the Lavaca River Basin and no water user groups have rights to water from reservoirs in the Lavaca River Basin. However, many farmers (primarily rice) that are located with the Lavaca River Basin are part of the Garwood Irrigation District and as such access ROR rights from the Colorado River through purchases from LCRA. Because of this, the largest single water user group in Colorado County is irrigation from users located in the Lavaca River Basin (Appendix E1).

The third basin within Colorado County is the Brazos-Colorado Coastal Basin which comprises less than 20% of the county (figure 9), primarily to the east. As with the Lavaca River Basin, surface water sources are limited to local sources and a run-of-river water right from the San Bernard River. There are no major reservoirs within the Colorado County portion of the Brazos-Colorado Coastal Basin. A significant number of farmers in the Lakeside Irrigation District are located within the Brazos-Colorado Coastal Basin and therefore have access to ROR rights from the Colorado River through purchases from LCRA. The second largest water user group in Colorado County is irrigation from users located in the Brazos-Colorado Coastal Basin (Appendix E1).

Despite data from Appendix E1, there are currently no steam electric power plants in Colorado County. Irrigation, livestock, mining comprise the water user groups that are supplied surface water. No municipal or manufacturing usage in the county is supplied from surface water. Appendix E1 contains the projected surface water supplies for Colorado County as recorded in the 2021 Regional Water Plan and subsequent 2022 State Water Plan.

SECTION 5.2 – Projected Total Water Demand

Section 36.1071(e)(3)(G) of the Texas Water Code states that the district's management plan shall include an estimate of 'the projected total demand for water in the district according to the most recently adopted state water plan.'

Projected surface demands are the quantity of water projected to meet the overall necessities of a water user group in a specific future year. This is not groundwater pumpage or demand based on any existing water source. Instead, this demand is how much water each water user

group is projected to require in each decade over the planning horizon.

During assessments of water demand for Region K, the planning group was understandably focused heavily on population projections. Population growth projections for the region are estimated to increase by 87% from 2020 to 2070 with the Austin metropolitan area accounting for the vast portion of this projected increase (LCRWPG, 2020; p 2-1). However, owing to the relatively small population of Colorado County and projected modest growth rate, the associated water demand was overshadowed by water demands for irrigation (Appendix E2).

As discussed in previous sections, farming is a key economic driver for Colorado County. The southern portion of Colorado County by far has the bulk of the agricultural water use and is similar to Wharton County to the south. By contrast, northern Colorado County has minimal agricultural water use that is on par with Fayette County to the north. Table 3 shows a comparison of Colorado with the adjacent counties.

County	2020 (ac-ft/yr)	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)
Fayette	828	828	828	828	828	828
Colorado	173,112	168,455	163,924	159,514	155,223	151,048
Wharton (p)	189,110	184,023	179,073	174,256	169,569	165,008

Table 3: Projected irrigation demand (LCRWPG, 2020, p 2-14) for Colorado and adjacent counties to the north and south. (p) - only the portion of Wharton County within Region K reported in table.

The most common crop type in Colorado County is rice which requires significant water for growth. Though irrigation demand over the next 60 years will continue to far exceed other projected water user groups, demand is expected to decrease over that span. This decrease is expected due to improvements in irrigation efficiency and reductions in irrigation acreage due to urbanization (LCRWPG, 2020; p 2-13). However, since irrigation demand is still two orders of magnitude greater than the next largest water user group, mining, the overall water demand trend for the county largely mirrors the trend for irrigation demand (table 3).

Water-User Group	2020 (ac-ft/yr)	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)
Irrigation	173,112	168,455	163,924	159,514	155,223	151,048
Municipal	3,647	3,703	3,737	3,856	3,984	4,114
Mining	5,325	5,378	5,433	5,487	5,542	5,597
Manufacturing	960	1,132	1,132	1,132	1,132	1,132
Steam Electric	4,971	4,971	4,971	4,971	4,971	4,971
Livestock	1,276	1,276	1,276	1,276	1,276	1,276
Total Demand	*189,291*	*184,915*	*180,473*	*176,236*	*172,128*	*168,138*

Table 3: Projected WUG demand for Colorado County (Allen, 2024). that County-Other and Corix Utilities are included in the Municipal numbers. See Appendix E2 for complete data.

SECTION 5.3 – Projected Total Water Supply Needs

Section 36.1071(e)(4) of the Texas Water Code states that the district's management plan shall 'consider the water supply needs…included in the adopted state water plan.'

Water supply needs are the projected water demands in excess of existing water supplies for a water user group or a wholesale water provider. These are the volumes of water that result from comparing each Water User Group's projected existing water supplies to its projected water demands. This identified shortage is based on conservative water availability estimates which assume (1) only water is available during a repeat of the historic drought of record, (2) that all water rights in the basin are being fully and simultaneously utilized, (3) both water available from the Lower Colorado River Authority (LCRA) on an interruptible basis and water projected to potentially be available, for planning purposes, as a result of municipal return flows to the Colorado River are excluded, and (4) groundwater availability is limited to the modeled available groundwater based on desired future conditions (LCRWPG, 2020; p 4-1).

If the volume listed is a negative number, then the Water User Group (WUG) shows a projected need during a drought if they do not implement any water management strategies. If the volume listed is a positive number, then the Water User Group shows a projected surplus. Note that if a WUG shows a need in any decade, then they are considered to have a potential need during the planning horizon, even if they show a surplus elsewhere.

Appendix E3 shows a listing of the projected water supply needs for Colorado County for each water user group. Of the 23 water user groups designated, 16 show a projected surplus or met needs in all outlying years. The remaining seven show a negative number which indicates a projected need during a drought. Of the seven showing a water need, two show relatively minor deficits while the remaining five indicate sizable deficits.

As might be expected, the largest deficit is attributed to irrigation. The next largest is for steam electric power. There are currently no plans for a steam electric power plant in Colorado County and thus, no strategies were developed (LCRWPG, 2020; p 5-178). Of the nine municipal users, seven show a surplus or met needs from 2020 through 2070. Only Corix Utilities which serves Alleyton and the rural area in the Colorado River Basin (designated as 'County-Other' in Appendix E3) show a small deficit.

WUG Group Need	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs	2070 Needs
Municipal & County-Other	(99)	(106)	(108)	(138)	(172)	(208)
Irrigation	(54,318)	(49,661)	(45,130)	(40,720)	(36,429)	(32,254)
Steam Electric Power	(4,971)	(4,971)	(4,971)	(4,971)	(4,971)	(4,971)
Total Needs	**(59,388)**	**(54,738)**	**(50,209)**	**(45,829)**	**(41,572)**	**(37,433)**

Table 4: Water needs designated by water user group (WUG) for Colorado County based on data from 2021 Region K Water Plan (LCRWPG, 2020; p 5-176; Allen, 2024, p 6). Units in ac-ft/yr. See Appendix E3 for complete data.

SECTION 5.4 – Water Management Strategies

Section 36.1071(e)(4) of the Texas Water Code states that the district's management plan shall 'consider the…water management strategies included in the adopted state water plan.'

A projected water management strategy is a specific project or action to increase water supply or maximize existing supply to meet a specific need. Each water need identified in the previous section, regardless of how large or small and regardless of when during the planning horizon, is required to have at least one identified water management strategy that will provide the additional water to fully serve the projected need.

For Colorado County, water management strategies fall into one of the following categories: conservation; groundwater development; drought management; LCRA management of run-of-river (ROR) rights and highland lake reservoirs; and return flows.

One of the most prominent, if not obvious, water management strategies is conservation. The water needed for irrigation in the three counties of the lowermost Colorado River basin (Colorado, Wharton and Matagorda) represents the largest deficit identified within Region K. A significant conservation strategy for irrigation is 'on-farm water conservation'. Rice is the dominant crop type in Colorado County and utilizes significantly more water than other crops because of the growing environment adopted for rice production. Rice is grown in standing water due to the plant's requirement for saturated soil moisture conditions during most of its vegetative and reproductive stages, and secondarily to minimize competition from undesirable

plants. In general, water savings can best be achieved by minimizing flooding depth and improving management of the flushing and flooding operations. The techniques that have the most significant impact in accomplishing these goals include precision or laser land leveling, use of levees with permanent water control structures, use of field laterals with multiple field inlets and improved management of water control activities (LCRWPG, 2020; p 5-30 thru 5-33).

Another conservation strategy to address irrigation shortfalls is improvements in water conveyance operations. Substantial water can be saved by improving the efficiency of the canal systems that deliver water to the individual irrigator. These improvements would include: 1) automating the operation of major checks structures within the irrigation division; 2) creating a centralized control system for each irrigation division, allowing each canal system to be monitored and operated remotely; 3) automating the operation of flow control structures delivering water to individual fields (turnouts); 4) adding flow regulating reservoirs to balance flows; 5) targeted lining of high-loss canal segments; and 6) regular maintenance of canal banks, including vegetation control and repairing sections damaged by cattle and other animals (LCRWPG, 2020; p 5-34).

Converting field irrigation from field flooding to sprinkler irrigation would represent another water conservation strategy. Flushing is the standard method for maintaining soil moisture. Use of sprinkler-delivered water would provide a means maintaining soil moisture while eliminating the standard two to four flushing periods at the beginning of the growing season and shortening the duration of the traditional flood irrigation period. Also, the most used weed herbicides in rice require water applications for maximum effectiveness. Timely sprinkler applications for the activation of these herbicides offers some hope for reducing weed pressures early thereby potentially enabling the delay of the permanent flood and therefore reducing the period that flood waters are lost to direct evaporation (LCRWPG, 2020; p 5-37 thru 5-40).

Real-time monitoring involves the installation of meters that assess water use by automatically recording and transferring flow data at regular intervals. These meters are equipped with sensors that allow water providers and users to accurately quantify the usage, generating awareness of consumption and cost, and thereby improving irrigation efficiency and providing water savings (LCRWPG, 2020; p 5-40).

All four conservation strategies cited above are used in the three river basins in Colorado County to alleviate anticipated water needs (Appendix E4) (Allen, 2024, p 7-9; LCRWPG, 2020; 5A, Table 5A-2).

Another water management strategy for Colorado County is expansion of the groundwater supply. This alternative would involve pumping additional groundwater from the Gulf Coast Aquifer, either using the WUG's existing wells or drilling additional wells (Allen, 2024, p 7-8; LCRWPG, 2020; p 5-104). For Colorado County, this strategy addresses needs in rural areas

(County-Other and Corix Utilities Texas Inc.) in the Colorado River basin and for irrigation across all river basins (Appendix E4) (Allen, 2024, p 7-9; LCRWPG, 2020; p 5-104).

Considering the most recent 'drought of record', drought management was included as an important and necessary water management strategy. Drought management is different than conservation. Whereas conservation tends to look at more long-term and permanent steps to reduce usage, drought management attempts to reduce usage by a larger amount over a short period of time to address the immediate drought situation. The actual amount of water used is generally higher in the summer and lower in the winter, mainly owing to outdoor watering in the warmer months. One of the common drought management strategies in both municipal and rural areas would be to restrict outdoor watering in the warmer months (LCRWPG, 2020; p 5-155 thru 5-156). In Colorado County, a drought management strategy is used to address water needs in rural areas (County-Other and Corix Utilities) in the Colorado River basin (Appendix E4). Drought management is a strategy used for irrigation as well. This strategy would assume that during severe drought conditions, farmers that use groundwater would cut usage by 25 percent. (LCRWPG, 2020; p 5-155). In Colorado County, drought management for irrigation is used in all three river basins (Appendix E4).

LCRA supplies interruptible water to the Lakeside and Garwood irrigation districts using its run-of-river (ROR) water rights to the extent that flows in the river are available. However, often in the height of irrigation season, ROR flows available in the Colorado River are insufficient to meet the needs of the irrigation operations. LCRA may make stored water from lakes Buchanan and Travis available on an interruptible basis at any time that actual demand for stored water under firm commitments is less than the combined firm yield of these two reservoirs. Generally, the amount of interruptible stored water that can be made available from lakes Buchanan and Travis is curtailed as combined storage in the lakes drops. LCRA's firm customers' demands are typically below their full contract commitments and LCRA does not expect these demands to increase to their full commitments for some time. Therefore, LCRA expects that, absent extraordinary drought conditions, it will be able to supply interruptible water to the agricultural operations for many years without frequent or significant curtailment. However, over time, as the LCRA's current firm customers draw more fully on their commitments and as LCRA contracts to provide more firm water, there will be less interruptible water available for agricultural purposes in Colorado County (Appendix E4) (LCRWPG, 2020; p 5-47 thru 5-49). The lack of water availability for irrigation in Colorado County shown in years 2050 through 2070 for the 'LCRA WMP interruptible water' reflects this anticipated increase in future firm water commitments.

The City of Austin and LCRA gained regulatory approval to effectuate the strategy of joint return flow benefit. The return flows are managed between the two parties. After meeting environmental flow requirements and if the City of Austin does not have indirect reuse projects

in effect, the return flows should be available to meet downstream demands including irrigation in Colorado County. The Lavaca River basin would benefit from these return flows through the Garwood irrigation district. The Brazos-Colorado river basin would benefit primarily via the Lakeside irrigation district. The Colorado river basin would benefit considerably less in both irrigation districts (Appendix E4) (Allen, 2024, p 7-9; LCRWPG, 2020; p 5-4 to 5-5).

CHAPTER 6 – MANAGEMENT OF GROUNDWATER SUPPLIES

SECTION 6.1 – Implementation of District Rules & Policies

The Texas Legislature has determined that groundwater conservation districts are the state's preferred method of groundwater management (Texas Water Code, §36.0015). The Colorado County Groundwater Conservation District (CCGCD) shall manage the use of groundwater in order to protect, preserve, conserve, and prevent waste of the resource while seeking to maintain the economic viability of all resource user groups, public and private, through the rules developed and implanted in accordance to the statutory authority granted in Chapter 36 of the TWC and within the guidelines set forth in the District's enabling legislation.

The rules of the CCGCD were written with the intent to give all landowners a fair and equal opportunity to use the groundwater resource underlying their property for beneficial purposes. It will be the policy of the District to educate constituents of their responsibility for groundwater conservation and to employ regulation only as required to fulfill the District's mission statement and guiding principles. The District will manage the groundwater resources of Colorado County as practically as possible and will give strong consideration to the economic and cultural activities which occur within the District, and which rely upon the continued use of groundwater.

This document is intended to be used as a tool to provide continuity in the management of the District. It will be used by CCGCD staff as a guide to ensure that all aspects of the goals of the District are carried out. The management plan will also be referenced by the Board for future planning for the District. The Board may modify this document and re-submit it to the Texas Water Development Board (TWDB), should conditions warrant it.

The goals, objectives and performance standards put forth in this planning document have been set at a reasonable level in consideration of existing and future fiscal and technical resources. Conditions may change, which could cause a change in the management objectives defined to reach the stated goals. The following guidelines will be used to ensure that the management objectives are set at a sufficient level to be realistic and effective:

- The constituency of Colorado County will appraise the District's overall performance in the process of electing or re-electing Board members;
- The interests and needs of the District's constituency shall control the direction of the management of the CCGCD;
- The CCGCD will endeavor to maintain local governmental control of the privately owned resources over which the District has jurisdictional authority;

- The General Manger of the CCGCD will have day-to-day authority over the District's operations and will be wholly accountable to the Board of Directors;
- The Board will evaluate District activities on a fiscal year basis (January 1 through December 31). Any reference to the terms annual, annually or yearly will refer to the fiscal year of the District.

SECTION 6.2 – Guiding Principles

The CCGCD was formed with the belief that the ownership and pumpage of groundwater is a private property right. It is understood however, that through the confirmation election of the District, the landowners relinquish some of their control over that right for the collective benefit of the community which the District serves.

The CCGCD will monitor water levels in wells, meter high-capacity wells and require annual water usage data from most non-exempt wells to more accurately assess ongoing demands and remaining supplies. The monitor and usage data will allow the District to take preventive action to avoid drastic changes in water level that could severely impact local municipalities, business, farmers and ranchers. The District has adopted rules to regulate groundwater withdrawals by means of spacing and/or production limits. In the event there is evidence of a significant drawdown of the water table, the District may declare a Critical Groundwater Depletion Area and adopt different rules for those areas.

The District shall have responsibility to monitor water quality and ensure that groundwater resources are not contaminated or polluted. To help accomplish this, the District will work toward creating and maintaining a water quality database. Additionally, the CCGCD will formulate and enforce rules that require suspended wells to be properly capped and may further incentivize owners to plug wells that are abandoned or deteriorated.

Using the regulatory tools granted by Chapter 36 to preserve and protect the existing and historic users of groundwater within the District, the CCGCD has adopted rules that protect historic use of groundwater in Colorado County to the maximum extent practical and consistent with this plan. Under the regulatory tools granted by Chapter 36 to preserve and protect the existing and historic users of groundwater within the District, CCGCD has the authority to impose more restrictive conditions on non-historic use permits.

CHAPTER 7 – IMPLEMENTATION OF THE MANAGEMENT PLAN

SECTION 7.1 – Actions, Procedures, Performance and Avoidance for Plan Implementation

The District will use the Management Plan to guide the District in its efforts to preserve and protect the groundwater resources of Colorado County and for determining the direction and priority of district activities. Operations of the District, agreements entered by the District and planning efforts in which the District may participate will be consistent with the provisions of this plan.

The CCGCD will implement the provisions of this management plan through the application of rules consistent with the management plan, using it as a guide to its principles and policies. Rules adopted by the District shall comply with Chapter 36 of the Texas Water Code and the provisions of this management plan. Promulgation and enforcement of the rules will be based on the best technical evidence available to the District. The District may amend the rules as necessary to ensure the best management practices of the groundwater in the District and/or to comply with changes to Chapter 36 of the Texas Water Code. District rules are available from the District website at the following web address: www.ccgcd.net/regulatory.

The District will seek cooperation from municipalities, water supply companies, irrigators, and all other users of groundwater pumped in Colorado County in the implementation of this plan and the management of groundwater supplies within the District. The CCGCD also will seek to cooperate and coordinate with state and regional water planning authorities and agencies and adjacent groundwater conservation districts. The CCGCD is committed to work and plan cooperatively with other GCDs in GMA 15. While managing the supply of groundwater within the district, CCGCD will account for the desired future conditions and MAG derived from the GMA 15 planning process.

The CCGCD will treat all citizens equally. Citizens may apply to the District for discretion in enforcement of the rules on grounds of adverse economic effect or unique local conditions. The Board shall consider the potential adverse effect on adjacent landowners in granting any discretionary ruling. Exercise of its discretion should not be construed as limiting the power and authority of the CCGCD.

SECTION 7.2 – Tracking Performance

An annual report will be prepared and presented to the Board of Directors on District performance regarding achievement of management goals and objectives. The presentation of

this report will occur within 120 days of the end of each fiscal year. The Annual Report will be prepared in a format that will be reflective of the performance standards listed following each management objective. A copy of the annual audit of District financial records will also be presented to the Board. The District will maintain the reports on file for public inspection at the District's office upon adoption.

CHAPTER 8 – MANAGEMENT GOALS, OBJECTIVES AND PERFORMANCE STANDARDS

The CCGCD management plan shall address the goals, as applicable and specified by the Texas Water Code (§36.1071(a)). Additionally, the management plan shall identify the management objectives and performance standards under which the District will operate to achieve the management goals identified.

Upon completion, the CCGCD management plan will be forwarded to Regional Water Planning Group K and Groundwater Management Area 15 member districts for use in their planning process (TWC, §36.1071(b)).

SECTION 8.1 – Goal 1: Providing for the Most Efficient Use of Groundwater (TWC §36.1071(a)(1))

Subsection 8.1.1 – Maintain a Well Registration Process

Management Objective – The CCGCD requires all exempt and non-exempt wells to be registered with the District and has the authority to impose fines against those who do not register their wells. Also, it is a violation of District rules for drillers and pump installers to work on a well that is not registered with the District. District staff will at least twice annually report to the Board the number well registrations to date and the number of violations and associated fines for failure to register or working on wells not registered.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of reports on registration to the Board each year;
- The number of well registrations in the District; and,
- The number of registration violations and the associated fines.

Subsection 8.1.2 – Maintain a Well Permitting Process

Management Objective – The CCGCD requires all active non-exempt wells to be permitted with the District. CCGCD staff will disclose to the Board at least twice annually the number of permit applications, the number of permits granted and the number of permits pending. During these reports, staff will also report the associated total permitted amount. The District will impose fines as necessary to ensure adherence to District rules regarding permitting requirements. Staff will report the number of permit violations and associated fines.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of reports to the Board regarding permitting;

- The number of permit applications received and permits granted each year;
- The amount of associated permit volume for permits granted;
- The number of permits pending at year-end; and,
- The number and amount of fines imposed each year because of failure to permit.

Subsection 8.1.3 – Maintain a Well Metering Program and Enforce Rules Regarding Water Usage Reporting

Management Objective – CCGCD requires that Class C permit holders (wells with the capacity to pump more than 600 gpm) install meters on their wells unless exempted by the CCGCD Board. The Board has the right to require key Class A or B permit holders (wells that pump at a rate less than 600 gpm) to install meters on their wells if warranted. Additionally, permit holders are required to report water usage annually at year end. CCGCD has the authority to impose fines against those who fail to meter their wells as stipulated or to report usage within the required timeframe.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of wells required to be metered, and the number of wells actually metered;
- The number of violations and total fines assessed because of not metering as stipulated; and,
- The number of violations and total fines assessed for failing to report usage.

SECTION 8.2 – Goal 2: Controlling and Preventing Waste of Groundwater (TWC §36.1071(a)(2))

Subsection 8.2.1 – Set and Enforce Spacing Requirements and Pumpage Regulations

Management Objective – In order to minimize the potential for waste of groundwater resources, the CCGCD shall mandate minimum spacing regulations from water production wells from property lines and from each other. For non-exempt wells, spacing from existing wells shall be defined by the pumpage rate put forth in the permit application. The CCGCCD also clearly establishes on the permit a maximum amount to be pumped over the course of the permit period. District staff will investigate and report to the Board all instances where spacing regulations were not followed and where pumpage exceeded the amount allowable.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The annual number of site visits to inspect wells; and,
- The annual number of notices and violations of District rules regarding well maintenance and/or groundwater waste.

Subsection 8.2.2 – Maintain a Water Well Inspection Program for Non-Exempt Wells

Management Objective – The District will monitor and communicate to well owners any indications of inefficiency in well operations that might cause waste of groundwater as defined in Appendix A. The CCGCD staff will report to the Board at least annually the number of site visits to check equipment and the number of notices and violations of District rules regarding waste.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The annual number of site visits to inspect wells; and,
- The annual number of notices and violations of District rules regarding well maintenance and/or groundwater waste.

Subsection 8.2.3 – Disseminate Information on Waste Prevention

Management Objective – In conjunction with efforts in water conservation, the CCGCD will implement a waste prevention program with the purpose of educating constituents of the District on ways to prevent waste of groundwater. The District staff at least once annually shall give notice to the public of ways to prevent waste of groundwater in one or more of the following ways: updates on the District website or District social media; presentations to civic or governmental groups; interviews to media outlets; articles in newspapers, newsletters or other media outlets; or by making available appropriate brochures.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of ways the District provided notice to the public on how to prevent waste of groundwater.

SECTION 8.3 – Goal 3: Addressing Conjunctive Surface Management Issues (TWC §36.1071(a)(4))

Subsection 8.3.1 – Participation in Regional Planning Processes

Management Objective – CCGCD is wholly within the Lower Colorado River Planning Group (Region K). Each year that the regional water planning process is underway, the District will attend at least one Region K meeting.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- Number of Region K meetings attended by a District representative each year.

Subsection 8.3.2 – Work with LCRA to Promote Positive Conjunctive Water Management Projects

Management Objective – The CCGCD will work with LCRA and appropriate government agencies to advance projects that might protect and/or supplement groundwater resources in the area. To help accomplish this, District staff will routinely monitor LCRA conjunctive water projects that might impact CCGCD and report the appropriate news to the Board at least twice annually.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of updates to the CCGCD Board regarding LCRA conjunctive use projects.

Subsection 8.3.3 – Identify and Address Legislative Policies that Might Affect Groundwater Resources

Management Objective – The CCGCD staff regularly uses TAGD to monitor Texas State legislative and judicial activity regarding groundwater issues. Staff will present to the Board at least twice annually while the Texas legislature is in session, updates on legislative and judicial activities that may impact CCGCD constituents. The District Board will pass resolutions, as needed, to help influence the formulation of local and State legislative policies that might positively impact the District.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of updates to the Board of groundwater related legislative policies; and,
- The total number of resolutions passed by the Board and/or testimonies given that were meant to influence legislative policy.

SECTION 8.4 – Goal 4: Addressing Natural Resource Issues (TWC §36.1071(a)(5))

Subsection 8.4.1 – Establish and Maintain a Water-Quality Monitoring Program

Management Objective – The CCGCD will maintain a water-quality monitoring database. Additionally, CCGCD will act on all reasonable requests from constituents involving water quality concerns. The CCGCD staff will report to the Board at least once annually, the number of water quality reports added to the database.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of water-quality monitoring wells;
- The number of reports added to the database;

- A synopsis of results highlighting any areas where contamination has been reported or discovered; and,
- The number of actions taken regarding water quality issues submitted by constituents.

Subsection 8.4.2 – Enforce Proper Maintenance of Suspended Wells and Encourage Plugging of Abandoned Wells

Management Objective – The CCGCD may inspect suspended and abandoned wells to ensure proper closing of wells in accordance with rules set forth by CCGCD. Notices will be sent, and fines may be assessed against well owners whose wells do not adhere to District Rules. To incentivize well owners with abandoned wells to plug them, the District will maintain a rebate program whereby well owners can recover some of the cost of plugging their wells.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of notices sent out and possible fines assessed to well owners or operators for violations of District rules concerning proper closure of abandoned or suspended wells;
- The number of wells plugged each year;
- The number of plugging assistance requests each year; and,
- The annual amount of District money rebated to well owners requesting well plugging assistance.

Subsection 8.4.3 – Monitoring Mining and Oil & Gas Operations

Management Objective – The CCGCD staff will monitor the Texas Railroad Commission (RRC) and other appropriate databases to determine any new locations of saltwater disposal wells and the location of wells that are being hydraulically fracture stimulated. District staff will also monitor new gravel mining operations. CCGCD staff will report to the Board at least annually, any new salt water or waste disposal wells in Colorado County, and any wells scheduled for fracking and any new wells supporting gravel operations. The CCGCD staff will further report any violations for failure to permit groundwater wells in support of hydraulic fracking operations.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of new salt water or wastewater disposal or injection wells in Colorado County;
- The number of groundwater wells being used to support fracking operations;
- The number of violations for failure to permit wells being used in support of fracking operations; and
- The number of new wells supporting gravel mining operations in Colorado County.

SECTION 8.5 – Goal 5: Addressing Drought Conditions (TWC §36.1071(a)(6))

Subsection 8.5.1 – Collect and Review Drought Condition Information

Management Objective – CCGCD will track information on weather, precipitation and drought data on the TWDB drought page (http://waterdatafortexas.org/drought/) and other key sites and post key information and links on the District website and/or District social media at least twice a year.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- At least twice a year, update the CCGCD website and/or social media to reflect the latest drought index and precipitation totals.

SECTION 8.6 – Goal 6: Addressing Conservation, Rainwater Harvesting and Brush Control (TWC §36.1071(a)(7))

Subsection 8.6.1 – Protect Exempt Usage from High-Capacity Wells

Management Objective – District staff shall enforce the following District rules that were implemented to protect offset exempt usage: requiring high-capacity wells to be screened in deeper intervals; requiring offset high-capacity wells to be spaced a sufficient distance away from exempt wells; and, requiring permit applications requesting more than 1000 ac-ft average annual pumpage to provide a conservation plan. Violations will be reported to the Board as they occur.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of violations and associated fines regarding spacing rules;
- The number of violations and associated fines regarding failure to adhere to minimum screening depths; and,
- The number of hydrogeological studies, mitigations plans, and conservation reports required by the District.

Subsection 8.6.2 – Establish a Program to Emphasize Water Conservation

Management Objective – In coordination with efforts in waste prevention, the CCGCD will implement a conservation program with the purpose of educating the constituents of the District on ways to conserve water. The District staff at least once annually shall give notice to the public of ways to conserve water in one or more of the following ways: updates on the District website or District Facebook page; presentations to civic or governmental groups; articles in newspapers or newsletters; or by making available appropriate brochures.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of ways the District provided notice to the public on how to conserve water.

Subsection 8.6.3 – Monitor Potential Ways to Emphasize Rainwater Harvesting and Brush Control

Management Objective – The CCGCD staff will keep abreast of brush control and rainwater harvesting technologies and make that information available at least once annually, to the constituents of the District through brochures, social media announcements or website links.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of ways the District provided notice to the public on how to go about brush control and/or rainwater harvesting.

SECTION 8.7 – Goal 7: Addressing the Desired Future Conditions (TWC §36.1071(a)(8))

Subsection 8.7.1 – Maintain a Water Level Monitoring Program

Management Objective – The CCGCD will maintain a District water-level monitoring network of at least 10 wells. The depth to the water level will be measured at least annually and results will be recorded in the District's database. The CCGCD Board will be updated on key monitor well changes at least twice a year.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of District monitor wells, and the number of monitor wells measured at least once annually; and,
- The number of updates to the Board on key monitor wells.

Subsection 8.7.2 – Analyze Water Level Data for Adherence to DFC

Management Objective – At least once a year, charts will be constructed of each CCGCD monitor well showing the changes in water level through time. The data and charts for the CCGCD monitor wells will be updated on the District website at least annually. The District will also chart TWDB monitor wells within Colorado County. At least once annually, this data will be assimilated to determine compliance with the desired future conditions (DFC) of the Gulf Coast Aquifer in Colorado County.

Performance Standard – The following will be the expected key metrics used to measure progress of management objectives:

- The number of graphic displays (charts) generated for CCGCD monitor wells;

- The number of District website updates of CCGCD monitor well data; and,
- An annual comparison of water level changes compared to the CCGCD DFC.

SECTION 8.8 – Management Goals Not Applicable to the District (TWC §36.1071(a))

After review of the study performed on behalf of TWDB entitled "Final Report: Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping", it is clear that overall, the Gulf Coast Aquifer can be considered a relatively high risk for future subsidence due to pumping, especially in the confined zones of the Jasper, Evangeline, and Chicot aquifers (Furnans et al, 2017; p 4-41). However, the report also states that "When planning additional subsidence investigation in these high-risk aquifers, local stakeholders need to consider the risks to specific infrastructure against the cost of subsidence investigation and monitoring (Furnans et al, 2017; p 7-8)." The thickest and most susceptible portions of the Gulf Coast Aquifer in Colorado County for potential subsidence are in the southern portions of the county where seasonal groundwater withdrawals occur for the purposes of irrigation. These areas comprise relatively flat and open prairies with virtually no significant infrastructure.

CCGCD has determined that the management goal specified in TWC §36.1071(a)(3), 'controlling and preventing subsidence', is not applicable to the District at this time since the projected cost of monitoring would outweigh the potential benefit and the further impact on the sparse infrastructure in the area. However, considering the impact substantial water level drops have had in the greater Houston metropolitan area and the steps that have been needed to mitigate subsidence in Harris, Galveston and Fort Bend counties, it will be prudent for CCGCD to continue to monitor potential impacts of subsidence on Colorado County.

In 2014, CCGCD closely investigated the potential for a recharge enhancement project near the Colorado River. Ultimately it was deemed that the scale of the project would be too large and expensive for the resources available to CCGCD. Additionally, the time allocation and associated cost were deemed prohibitive to CCGCD for any 'precipitation enhancement' goal as specified in TWC §36.1071(a)(7).

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APPENDIX A – Definitions, Acronyms and Abbreviations

DEFINITIONS

- ***Abandoned well*** – a well that has not been used for six consecutive months. A well is considered to be in use in the following cases:
    - A non-deteriorated well which contains casing, pump, and pump column in good condition; or,
    - A non-deteriorated well which has been capped.
- ***Acre-foot*** – the volume of water necessary to cover one acre of land one foot deep. Equivalent to about 325,851 gallons. #
- ***Alluvium*** – an unconsolidated terrestrial sediment composed of sorted or unsorted sand, gravel, and clay deposited by water from rivers, streams or tributaries.
- ***Aquifer*** – a geologic formation that contains sufficient saturated permeable material to yield water to a spring or well in sufficient quantities to make the production of water from this formation feasible for beneficial use. The formation could be sand, gravel, limestone, sandstone, or fracture igneous rocks. **
- ***Beneficial purpose*** – use for:
    - Agriculture, gardening, domestic, stock raising, municipal, mining, manufacturing, industrial, commercial, recreational, or pleasure purposes;
    - Exploring for, producing, handling, or treating oil, gas, sulfur, or other minerals;
    - Any other purpose that is useful and beneficial to the user. *
- ***Board*** – the board of directors of the CCGCD unless otherwise specified. *
- ***Brush control*** – the select control, removal, or reduction of noxious brush that consume water to a degree that is detrimental to water conservation.
- ***Confining unit (or layer)*** – a hydrogeologic unit of impermeable or distinctly less permeable material bounding one or more aquifers.
- ***Conjunctive use*** – the combined use of groundwater and surface water sources that optimize the beneficial characteristics of each source, such as water banking, aquifer storage and recovery, enhanced recharge, and joint management. *
- ***Conservation*** – those water saving practices, techniques, and technologies that will reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative use. **
- ***Desired future conditions (DFC)*** – a quantified description, adopted in accordance with Section 36.108 of the Texas Water Code of the desired condition of the groundwater resources in a management area at one or more specified future times. *
- ***Director*** – a member of the CCGCD Board unless otherwise specified. *

- ***Discharge*** – the amount of water that leaves an aquifer by natural or artificial means.*
- ***Disposal well*** – see injection well.
- ***Domestic use*** – the use of water not delivered through a public water system for personal hygiene needs or for household purposes such as drinking, bathing, heating, cooking, or cleaning in a residence, including pleasure uses, landscape irrigation, and non-commercial gardening use so long as no more than 50% of the garden product is sold or leased.
- ***Drawdown*** – a lowering of the groundwater surface (potentiometric surface) caused by withdrawal or pumping of water from a well. At the well, it is the difference between the static water level and the pumping water level in a well pumped at a constant flow rate.
- ***Drought*** – generally applied to periods of less than average precipitation over a certain period of time. #
- ***Drought of record (DOR)*** – period of time during recorded history when natural hydrological conditions provided the least amount of water supply. For Texas as a whole, the drought of record is generally considered to be from about 1950 to 1957. #
- ***Exempt well*** – a well that is exempt from the requirements to obtain a permit. In the CCGCD, this includes most domestic, livestock, mining (excluding gravel), rig supply and abandoned wells.
- ***Fluvial*** – of or pertaining to a river.
- ***Formation*** – the basic unit for the naming of rocks in lithostratigraphy; a set of rocks that are or once were, horizontally continuous, that share some distinctive feature of lithology, and that are large enough to be mapped.
- ***Fracking (also hydraulic fracturing)*** – a method used by oil and gas operators to artificially 'fracture' the hydrocarbon reservoir in order to enhance production. This method may consume relatively large quantities of water.
- ***General Manager*** – an individual employed by the Board of Directors of a district that is the chief administrator of the office and who has full authority to manage and operate the affairs of the district subject to Board approval.
- ***Groundwater*** – water located beneath the earth's surface.
- ***Groundwater availability model (GAM)*** – numerical groundwater flow models used by the TWDB to determine groundwater availability of the major and minor aquifers in Texas.#
- ***Groundwater management area (GMA)*** – a group of district representatives covering an area designated by the TWDB, that have the task of, at least every five years, considering groundwater availability models and other data or information for the management area and establishing desired future conditions for the relevant aquifers within the area. CCGCD is within GMA 15.
- ***Highland Lakes*** – lake system composed of two major storage reservoirs – Lake Buchanan and Travis – which are owned and operated by LCRA. In addition, the system contains three

intermediary lakes owned and operated by the LCRA – Inks Lake, Lake LBJ, and Lake Marble Falls. Lake Austin is owned by the City of Austin and is operated by the LCRA through an agreement.

- ***Injection well (also disposal well)*** – an artificial excavation or opening in the ground made by digging, boring, drilling, jetting, driving, or some other method, and used to inject, transmit, or dispose of industrial and municipal waste or oil and gas waste into a subsurface stratum; or a well initially drilled to produce oil and gas which is used to transmit, inject, or dispose of industrial and municipal waste or oil and gas waste into a subsurface stratum; or a well used for the injection of any other fluid; but the term does not include any surface pit, surface excavation, or natural depression used to dispose of industrial and municipal waste or oil and gas waste.
- ***Interruptible supply*** – water that is supplied only on an annual basis as water is available that is subject to interruption or curtailment such as during droughts.
- ***Irrigation use*** – the use of water for the purpose of providing water to crops with the intent of growing and sustaining those crops for the consumption by humans or other domestic animals. In Colorado County, rice-growers are the heaviest users of irrigation water.
- ***Irrigation districts*** – LCRA-owned irrigation systems consisting of hundreds of miles of canals that can divert water from the Colorado River to individual farmers. LCRA has senior water rights for direct diversion of water from the Colorado River thereby relieving LCRA from responsibility of releasing water from storage in the Highland Lakes.
- ***Lithology*** – the physical characteristics of a rock based in part on texture and composition.
- ***Management plan*** – a plan approved by the TWDB Executive Administrator, that addresses the efficiency of groundwater use, the prevention of waste and subsidence, the conjunctive use of surface water, natural resource issues, drought conditions and conservation. The plan identifies a district's performance standards and management objectives under which it will operate and includes groundwater availability and use estimates. Regional water planning groups are required to consider these plans in developing their regional plans.
- ***Meter*** – A device used to measure water flow. On well, it typically measures rate of flow in gallons per minute and cumulative production in gallons or acre-feet.
- ***Modeled Available Groundwater (MAG)*** – the amount of water that the executive administrator of the TWDB determines may be produced on an average annual basis to achieve a desired future condition as established under Section 36.108 of the Texas Water Code. *
- ***Monitor well*** – a well that is used to measure or monitor the level, quality, quantity, or movement of subsurface waters.

- ***Most Efficient Use of Groundwater*** – practices, techniques, and technologies that a district determines will provide the least consumption of groundwater for each type of use balanced with the benefits of using groundwater.
- ***Natural Resource Issues*** – issues related to environmental and other concerns that may be affected by a district's groundwater management plan and rules, such as impacts on endangered species, soils, oil and gas production, mining, air and water quality degradation, agriculture, and plant and animal life.
- ***Needs*** – projected water demands in excess of existing water supplies for a water user group or a wholesale water provider. #
- ***Non-exempt well*** – a well required to obtain a permit for the production of groundwater from within the District.
- ***Permit*** – an authorization issued by the District allowing the withdrawal of a specific amount of groundwater from a non-exempt well for a designated period of time, generally in the form of millions of gallons or acre-feet per year.
- ***Plug*** – to close a well permanently in accordance with approved District standards.
- ***Rainwater harvesting*** – accumulation and use of water from precipitation as a supplement to normal water usage.
- ***Recharge*** – the amount of water that infiltrates to the water table of an aquifer. *
- ***Recharge Enhancement*** – increased recharge accomplished by the modification of the land surface, streams, or lakes to increase seepage or infiltration rates or by the direct injection of water into the subsurface through wells.
- ***Regional Water Planning Group*** – a quasi-governmental body representing regional interests and having voting as well as nonvoting members who develop a regional water plan. It provides direction and guidance, determines policy issues, and oversees the progress of the regional plan. The interests presented generally include counties, municipalities, industries, the public, agriculture, environmental interests, small businesses, electric generating utilities, river authorities, water districts, water utilities and groundwater management areas. CCGCD is wholly within Region K Regional Water Planning Group. The TWDB is the lead state agency for coordinating the regional water planning process and developing a comprehensive state water plan.
- ***Registration*** – basic information provided to the groundwater District by the well or landowner usually containing information about the well location, type of use, well capacity and depth. A well identification number is designated by the District for reference purposes. Registration provides the owner or operator of the well with spacing protection and allows for notification in case of spills or accidents.
- ***Return Flows*** – that portion of water diverted from a water supply and beneficially used that is not consumed as a consequence of that use and returns to a watercourse. Return flows include sewage effluent. **

- ***Reuse*** – use of surface water that has already been beneficially used once under a water right or the use of groundwater that has already been used. #
- ***Riparian rights*** – the right to use the riverbed by one who owns river frontage land.
- ***ROR (run-of-river) water rights*** – water right permit that allows the permit holder to divert water directly out of a stream or river. #
- ***Rules*** – standards and regulations promulgated by the District.
- ***Spacing*** – a mandated distance between wells implemented to conserve the aquifer.
- ***Surface Water Management Entities*** – political subdivisions as defined by Texas Water Code Chapter 15 and identified from Texas Commission on Environmental Quality records that are granted authority under Texas Water Code Chapter 11 to store, take, divert, or supply surface water either directly or by contract for use within the boundaries of a district.
- ***Texas Administrative Code*** – the codified body of laws that define the processes and operations of state agencies and their rulemaking authority. TWDB and TCEQ are generally governed by Title 30, Environmental Quality, and Title 31, Natural Resources and Conservation, of the Code.
- ***Texas Water Code*** – the codified portion of state water laws. It is the public policy of the state to provide for the conservation and development of the state's natural resources.
- ***Transmissivity*** – the capacity of an aquifer to transmit water and is dependent on the water-transmitting characteristics of the saturated formation and the saturated thickness.
- ***Unconformity*** – a surface that separates two strata and represents an interval of time in which deposition stopped, erosion removed some sediment and rock, and then deposition resumed.
- ***Waste*** – any one or more of the following:
  - Withdrawal of groundwater from a groundwater reservoir at a rate and in an amount that causes or threatens to cause intrusion into the reservoir of water unsuitable for agriculture, gardening, domestic, or stock raising purposes;
  - The flowing or producing of wells from a groundwater reservoir if the water produced is not used for a beneficial purpose;
  - Escape of groundwater from a groundwater reservoir to any other reservoir or geologic strata that does not contain groundwater;
  - Pollution or harmful alteration of groundwater in a groundwater reservoir by saltwater or by other deleterious mater admitted from another stratum or from the surface of the ground;
  - Willfully or negligently causing, suffering, or allowing groundwater to escape into any river, creek, natural watercourse, depression, lake, reservoir, drain, sewer, street, highway, road, or road ditch, or onto any land other than that of the owner of the well unless such discharge is authorized by permit, rule, or order issued by the commission under Chapter 26;

  - Groundwater pumped for irrigation that escapes as irrigation tailwater onto land other than that of the owner of the well unless permission has been granted by the occupant of the land receiving the discharge; or,
  - For water produced from an artesian well, "waste" has the meaning assigned by Section 11.205.*
- ***Water budget*** – an accounting of the water that enters and leaves an aquifer.
- ***Water demand*** – quantity of water projected to meet the overall necessities of a water user group in a specific future year.
- ***Water management strategy*** – a strategy or specific project identified in a water plan whose purpose is to provide water to meet a demand or identified need. These water management strategies must be specific and provide sufficient detail to allow state agencies to make financial or regulatory decisions.
- ***Water needs*** – see Needs.
- ***Water table*** – the upper boundary of the saturated zone in an unconfined aquifer.
- ***Water-user group (WUG)*** – identified user or group of users for which water demands and water supplies have been identified and analyzed and plans developed to meet water needs. Water user groups are defined at the county level for the manufacturing, irrigation, steam-electric power generation, mining and municipal water use categories. #
- ***Well*** – any artificial excavation or borehole constructed for the purpose of exploring for or producing groundwater, or for injection, monitoring, or dewatering purposes.

* Definitions taken from Chapter 36 of the Texas Water Code
**Definitions were taken from the "Texas Water Law Glossary" (Flores and Wasinger, 2005)
#Definitions taken from 2022 State Water Plan (TWDB, 2021)
##Definitions taken from Chapter 27 of the Texas Water Code

ACRONYMS AND ABBREVIATIONS

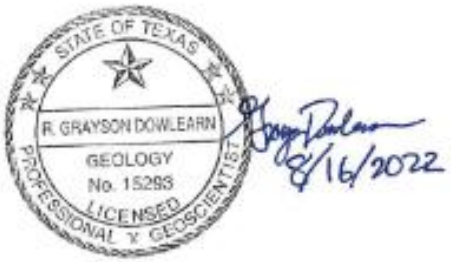
- **CCGCD** – Colorado County Groundwater Conservation District
- **COA** – City of Austin
- **DOR** – drought of record
- **GAM** – groundwater availability model
- **GCD** – groundwater conservation district
- **GMA** – groundwater management area
- **LCRA** – Lower Colorado River Authority
- **LCRWPG** – Lower Colorado Regional Water Planning Group (Region K)
- **MAG** – modeled available groundwater
- **ROR** – run-of-river

- **RRC** – Texas Railroad Commission
- **RWPG** – regional water planning group
- **TAGD** – Texas Alliance of Groundwater Districts
- **TCEQ** – Texas Commission on Environmental Quality
- **TWDB** – Texas Water Development Board
- **WUG** – water user group

APPENDIX B:

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

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



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

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

EXECUTIVE SUMMARY:

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

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

REQUESTOR:

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

DESCRIPTION OF REQUEST:

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

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

August 16, 2022
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TABLE 1. DESIRED FUTURE CONDITIONS FOR EACH COUNTY WITHIN GROUNDWATER MANAGEMENT AREA 15 EXPRESSED AS AVERAGE DRAWDOWN BETWEEN JANUARY 2000 AND DECEMBER 2080 IN FEET SUBMITTED BY GROUNDWATER MANAGEMENT AREA 15. (ADAPTED FROM SUBMITTED RESOLUTION)

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

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

METHODS:

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

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

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

PARAMETERS AND ASSUMPTIONS:

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

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

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

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

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

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

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

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

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

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

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

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

RESULTS:

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

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

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

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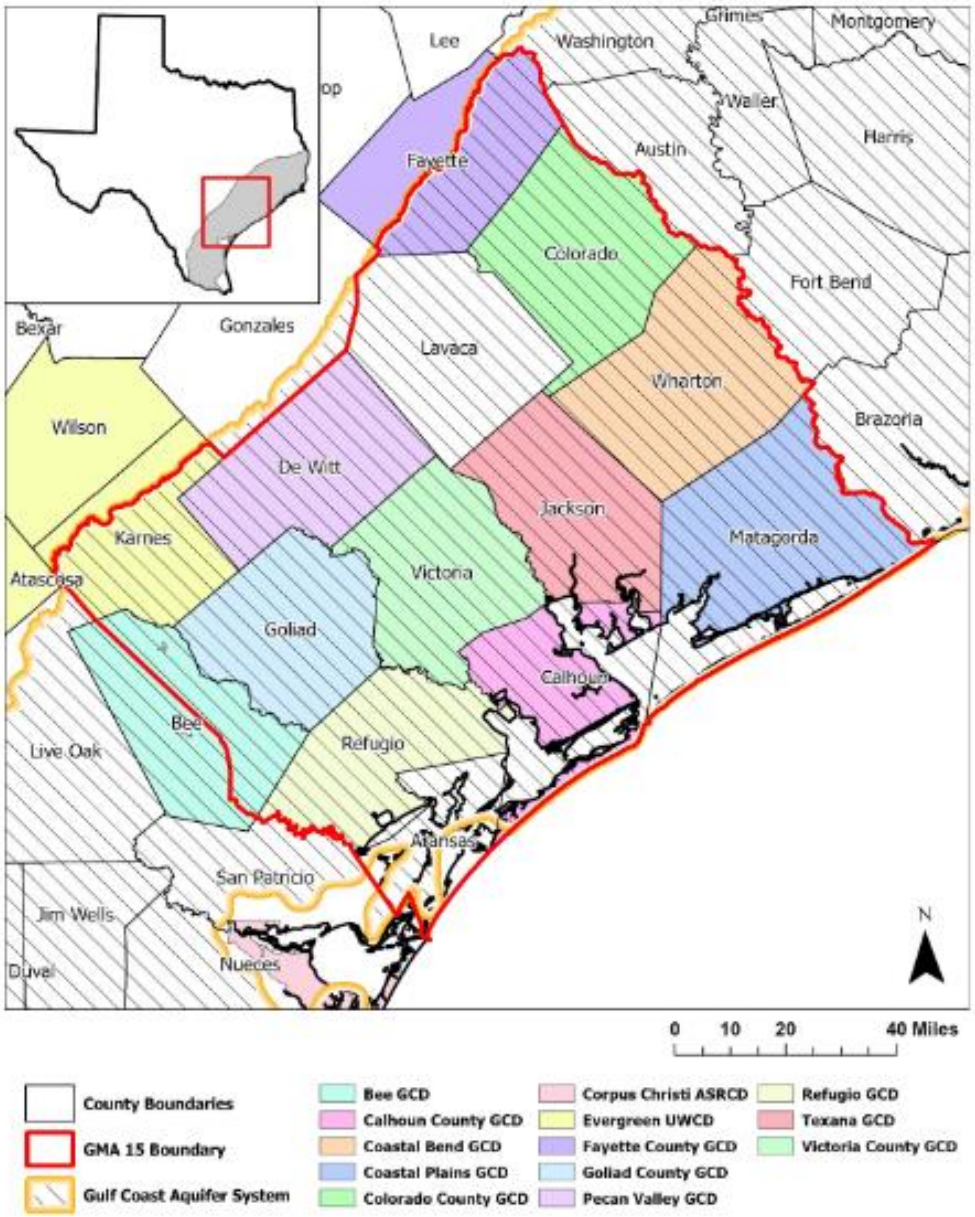

FIGURE 1. MAP SHOWING GROUNDWATER MANAGEMENT AREA (GMA) 15, GROUNDWATER CONSERVATION DISTRICTS (GCD), COUNTIES, AND THE EXTENT OF ACTIVE MODEL CELLS. (UWCD = UNDERGROUND WATER CONSERVATION DISTRICT)

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

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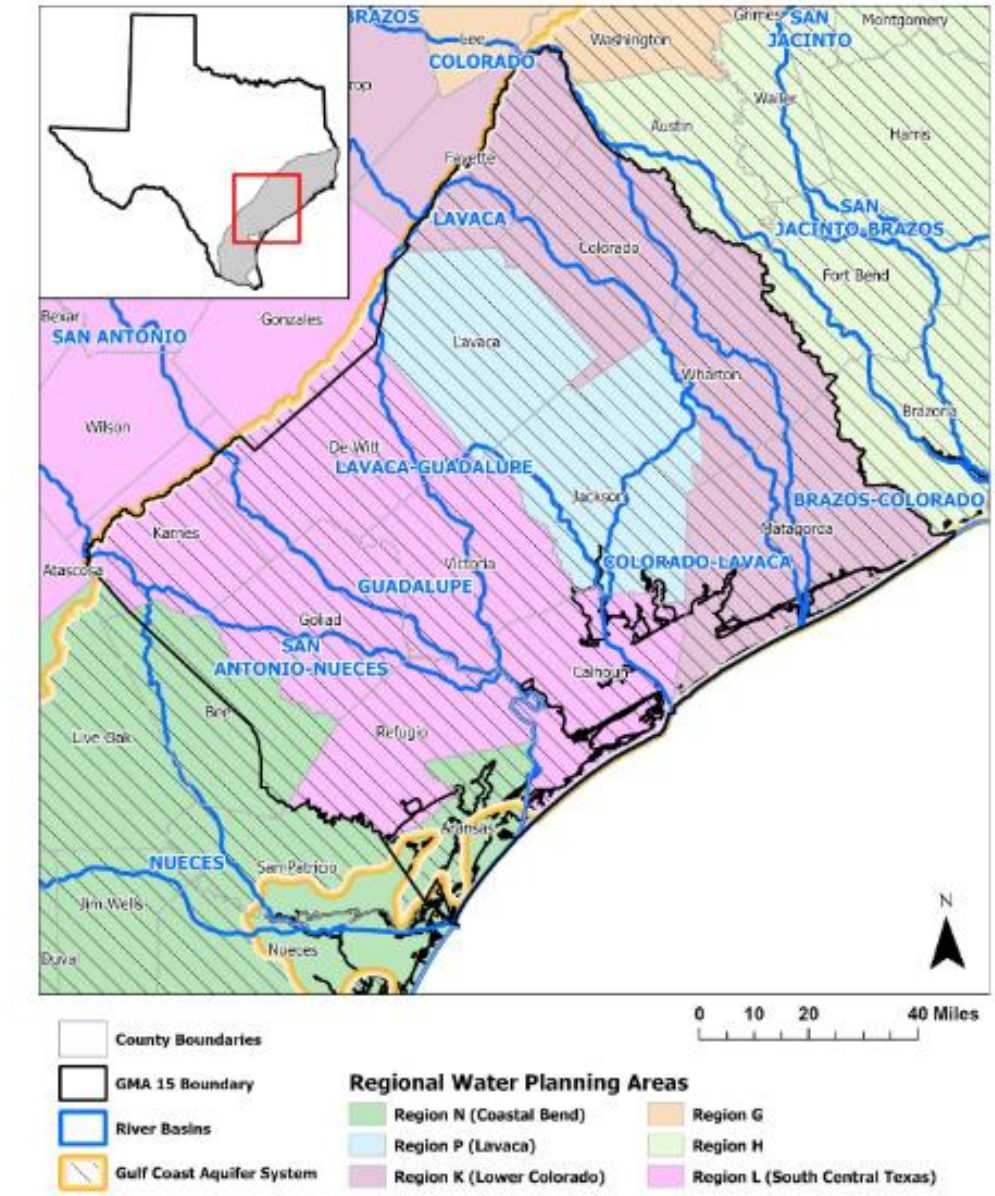

FIGURE 2. MAP SHOWING GROUNDWATER MANAGEMENT AREA (GMA) 15, REGIONAL WATER PLANNING AREAS, RIVER BASINS, COUNTIES, AND EXTENT OF ACTIVE MODEL CELLS.

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

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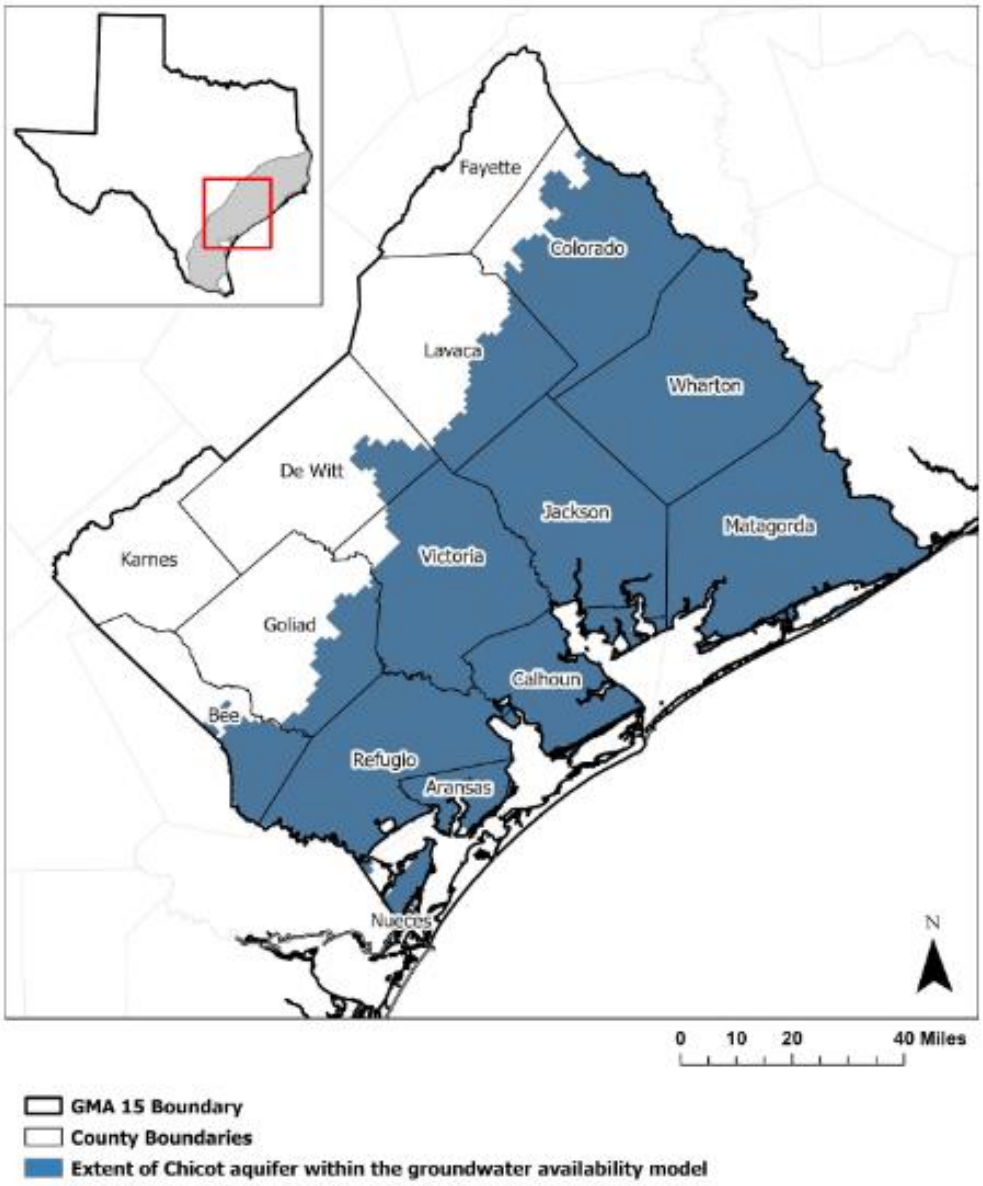

FIGURE 3. MAP SHOWING THE ACTIVE MODEL CELLS WITHIN GROUNDWATER MANAGEMENT AREA (GMA) 15 REPRESENTING THE CHICOT AQUIFER IN LAYER 1 OF THE CENTRAL GULF COAST AQUIFER SYSTEM GROUNDWATER AVAILABILITY MODEL.

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

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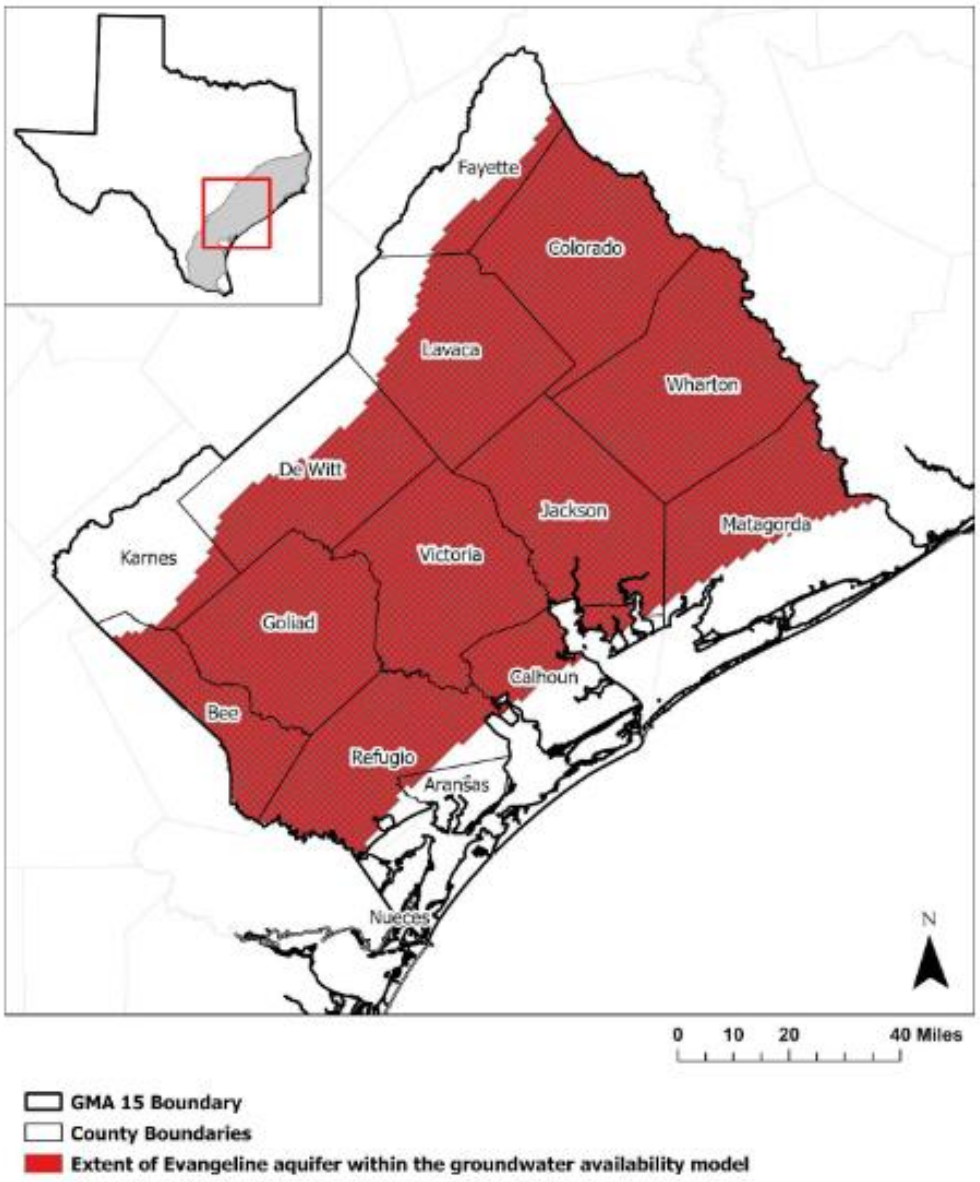

FIGURE 4. MAP SHOWING THE ACTIVE MODEL CELLS WITHIN GROUNDWATER MANAGEMENT AREA (GMA) 15 REPRESENTING THE EVANGELINE AQUIFER IN LAYER 2 OF THE CENTRAL GULF COAST AQUIFER SYSTEM GROUNDWATER AVAILABILITY MODEL.

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

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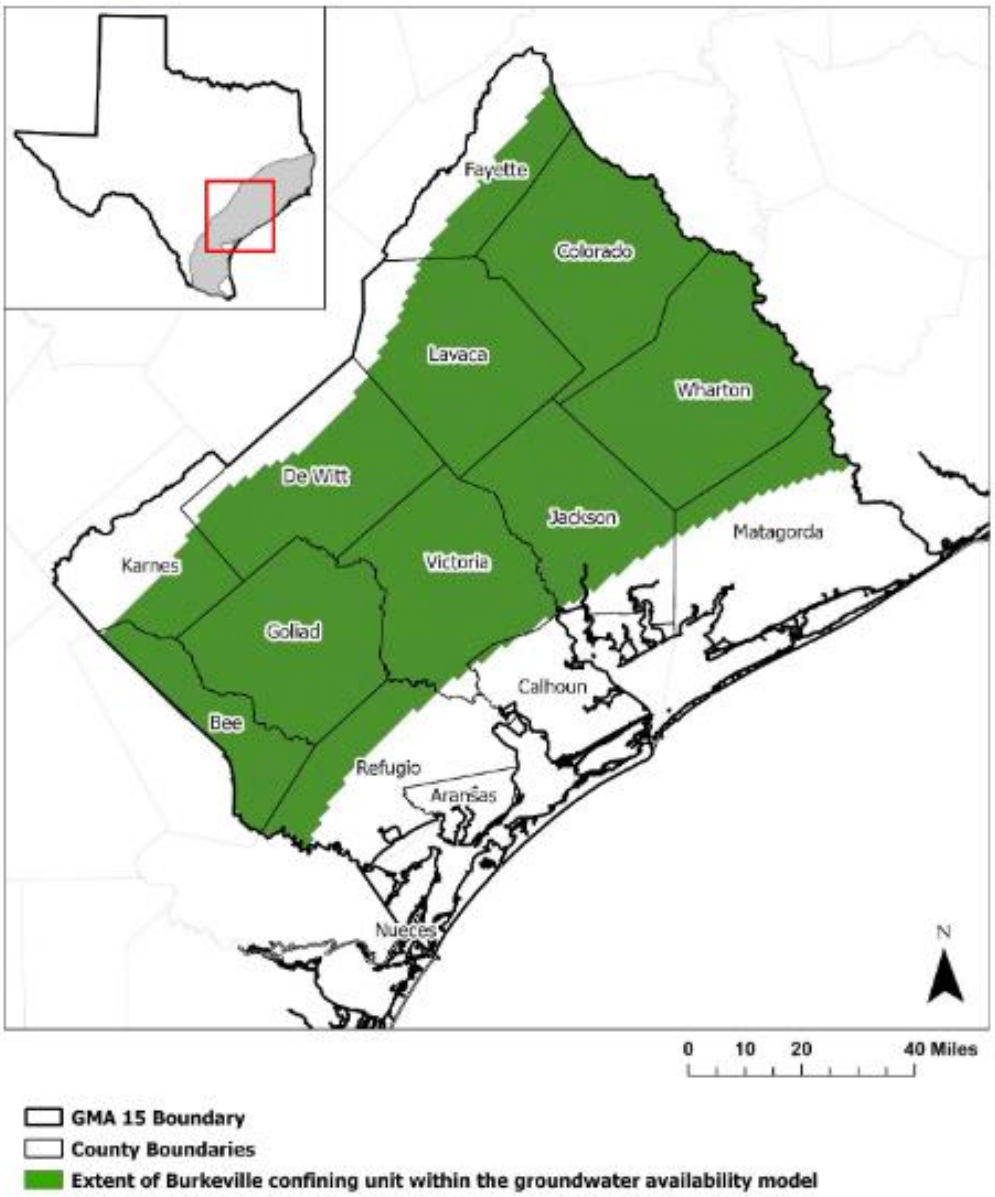

FIGURE 5. MAP SHOWING THE ACTIVE MODEL CELLS WITHIN GROUNDWATER MANAGEMENT AREA (GMA) 15 REPRESENTING THE BURKEVILLE CONFINING UNIT IN LAYER 3 OF THE CENTRAL GULF COAST AQUIFER SYSTEM GROUNDWATER AVAILABILITY MODEL.

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

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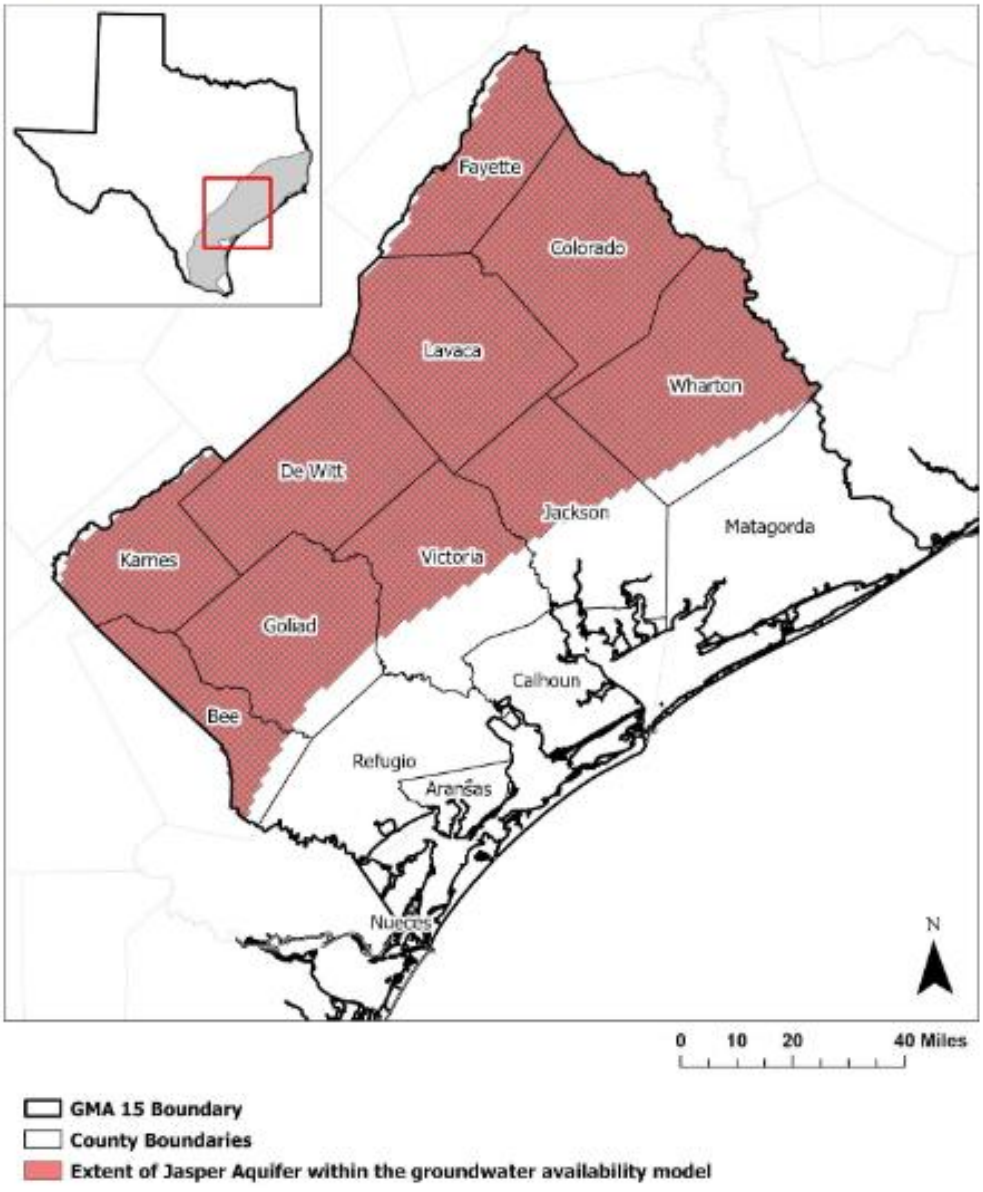

FIGURE 6. MAP SHOWING THE ACTIVE MODEL CELLS WITHIN GROUNDWATER MANAGEMENT AREA (GMA) 15 REPRESENTING THE JASPER AQUIFER AND CATAHOULA FORMATION IN DIRECT HYDROLOGIC CONNECTION WITH THE JASPER AQUIFER IN LAYER 4 OF THE CENTRAL GULF COAST AQUIFER SYSTEM GROUNDWATER AVAILABILITY MODEL.

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

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

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

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

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

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

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

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

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

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

LIMITATIONS:

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

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

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

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

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

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Appendix C: Estimated Historical Water Use

Colorado County Groundwater Conservation District

This appendix shows data from the "TWDB Estimated Historical Water Use and 2022 State Water Plan Datasets" (Allen, 2024; p.3).

The historical water use estimates and survey information are subject to revision as additional data and corrections are made available to TWDB.

Appendix C: Estimated Historical Water Use
TWDB Historical Water Use Survey (WUS) Data

COLORADO COUNTY All values in acre-feet/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2021	GW	2,806	515	2,556	0	19,630	527	26,034
	SW	0	0	0	0	60,480	790	61,270
2020	GW	3,093	552	3,033	0	19,177	540	26,395
	SW	0	0	0	0	80,929	809	81,738
2019	GW	2,305	443	470	0	22,044	539	25,801
	SW	0	0	0	0	77,035	808	77,843
2018	GW	2,607	434	5,338	0	25,744	538	34,661
	SW	0	0	0	0	85,396	806	86,202
2017	GW	3,556	501	3,056	0	18,579	519	26,221
	SW	0	0	0	0	76,243	779	77,022
2016	GW	4,065	539	2,201	0	18,843	488	26,136
	SW	0	0	1,808	0	85,627	730	88,165
2015	GW	4,040	532	2,201	0	21,687	475	28,935
	SW	0	0	1,808	0	47,269	712	49,789
2014	GW	3,619	520	2,201	0	25,090	439	31,869
	SW	0	0	1,808	0	58,300	658	60,766
2013	GW	3,338	769	2,398	0	18,658	431	25,594
	SW	0	0	1,808	0	64,258	646	66,712
2012	GW	3,409	960	2,108	0	26,535	503	33,515
	SW	0	0	1,808	0	60,983	756	63,547

APPENDIX D:

GAM RUN 13-027: COLORADO COUNTY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

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(512) 463-0495

December 20, 2013

Cynthia *K. Ridgeway is the Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by Rohit Raj Goswami under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.C. 471 on December 20, 2013.*

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GAM RUN 13-027: COLORADO COUNTY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

by Rohit Raj Goswami, Ph.D.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-0495
December 20, 2013

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h) (Texas Water Code, 2011), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the executive administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the executive administrator. Information derived from groundwater availability models that shall be included in the groundwater management plan includes:

- the annual amount of recharge from precipitation to the groundwater resources within the district, if any;
- for each aquifer within the district, the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers; and
- the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

This report—Part 2 of a two-part package of information from the TWDB to the Colorado County Groundwater Conservation District—fulfills the requirements noted above. Part 1 of the two-part package is the Historical Water Use/State Water Plan data report. The District will receive this data report from the TWDB Groundwater Technical Assistance Section. Questions about the data report can be directed to Mr. Stephen Allen, stephen.allen@twdb.texas.gov, (512) 463-7317.

The groundwater management plan for the Colorado County Groundwater Conservation District should be adopted by the district on or before September 18, 2014 and submitted to the executive administrator of the TWDB on or before October 18, 2014. The current management plan for the Colorado County Groundwater Conservation District expires on December 17, 2014.

This report discusses the methods, assumptions, and results from a model run using the groundwater availability model for the central portion of the Gulf Coast Aquifer System. This model run replaces the results of GAM Run 09-009 (Oliver, 2009). GAM Run 13-027 meets current standards set after the release of GAM Run 09-009 including use of the extent of the official aquifer boundaries within the district rather than the entire active area of the model within the district. Table 1 summarizes the groundwater availability model data required by statute, and Figure 1 shows the area of the model from which the values in the table were extracted. If after review of the figure, the Colorado County Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the Texas Water Development Board immediately.

Per statute, TWDB is required to provide the districts with data from the official groundwater availability models; however, the TWDB has also approved, for planning purposes, the fully penetrating alternative model for the central portion of the Gulf Coast Aquifer System. The Colorado County Groundwater Conservation District is also included in the model area for the groundwater availability model for the northern portion of the Gulf Coast Aquifer System. Please contact the author of this report if a comparison report using one or both of these models is desired.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability model for the central portion of the Gulf Coast Aquifer System was run for this analysis. The Colorado County Groundwater Conservation District water budgets were extracted for the historical model period (1980 through 1999) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter- aquifer flow (lower) for the portion of the aquifer located within the district is summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Gulf Coast Aquifer System

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

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the model results for the aquifers located within the district and averaged over the duration of the calibration and verification portion of the model run in the district, as shown in Table 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.
- Surface water outflow—The total water discharging from the aquifer (outflow) to surface water features such as streams, reservoirs, and springs.
- Flow into and out of district—The lateral flow within the aquifer between the district and adjacent counties.
- 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 or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs.

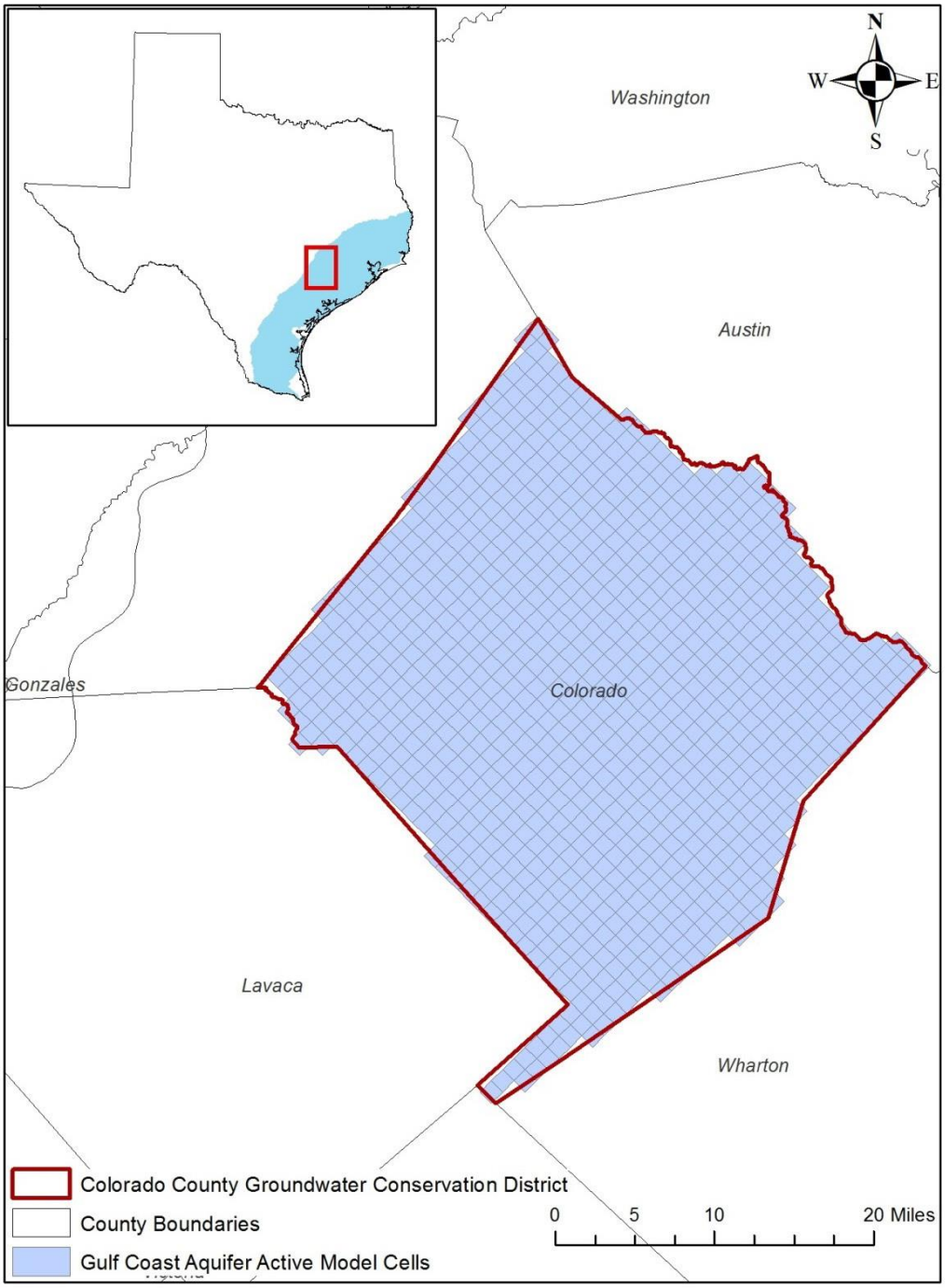
"Inflow" to an aquifer from an overlying or underlying aquifer will always equal the "Outflow" from the other aquifer.

It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

TABLE 1: SUMMARIZED INFORMATION FOR THE GULF COAST AQUIFER SYSTEM THAT IS NEEDED FOR COLORADO COUNTY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE- FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Gulf Coast Aquifer System	34,764
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Gulf Coast Aquifer System	11,412[1]
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer System	18,088
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer System	36,968
Estimated net annual volume of flow between each aquifer in the district	From underlying units into the Gulf Coast Aquifer System [2]	185[2]

[1] This total includes 14 acre-feet per year spring discharge and 11,398 acre-feet per year leakage to streams.
[2] Estimated from layer 1 of the Yegua-Jackson Aquifer groundwater availability model.



gcd boundary date = 09.25.13, county boundary date = 02.20.11, glfc_c model grid date = 08.20.13

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

LIMITATIONS:

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

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

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

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

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

REFERENCES:

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

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

Harbaugh, A. W., and McDonald, M. G., 1996, User's documentation for MODFLOW-96, an update to the U.S. Geological Survey modular finite-difference ground-water flow model: U.S. Geological Survey Open-File Report 96–485, 56 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., 2009, GAM Run 09-009: Texas Water Development Board, GAM Run 09-009 Report, 5 p., http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR09- 09.pdf.

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

Waterstone Environmental Hydrology and Engineering Inc. and Parsons, 2003, Groundwater availability of the Central Gulf Coast Aquifer: Numerical Simulations to 2050, Central Gulf Coast, Texas Contract report to the Texas Water Development Board, 157 p.

Appendix E: 2022 State Water Plan Datasets

Colorado County Groundwater Conservation District

Appendix E1: Projected Water Supplies
2022 Texas State Water Plan

COLORADO COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
K	Irrigation	Brazos-Colorado	Colorado Run-of-River	17,818	17,818	17,818	17,818	17,818	17,818
K	Irrigation	Colorado	Colorado Run-of-River	15,068	15,068	15,068	15,068	15,068	15,068
K	Irrigation	Lavaca	Colorado Run-of-River	30,941	30,941	30,941	30,941	30,941	30,941
K	Irrigation	Lavaca	Lavaca Run-of-River	4,002	4,002	4,002	4,002	4,002	4,002
K	Livestock	Brazos-Colorado	Local Surface Water Supply	39	39	39	39	39	39
K	Livestock	Colorado	Local Surface Water Supply	860	860	860	860	860	860
K	Livestock	Lavaca	Local Surface Water Supply	199	199	199	199	199	199
K	Mining	Colorado	Colorado Run-of-River	1,808	1,808	1,808	1,808	1,808	1,808
Sum of Projected Surface Water Supply (ac-ft/year)				70,735	70,735	70,735	70,735	70,735	70,735

This appendix shows data from the "Estimated Historical Water Use and 2022 State Water Plan Datasets" (Allen, 2024; p. 4).

Appendix E2: Projected Water Demands
2022 Texas State Water Plan

COLORADO COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
K	Columbus	Colorado	1,134	1,164	1,185	1,229	1,271	1,313
K	Corix Utilities	Colorado	43	44	44	46	47	49
K	County-Other	Brazos-Colorado	154	155	156	160	165	170
K	County-Other	Colorado	969	975	977	1,005	1,038	1,072
K	County-Other	Lavaca	330	333	334	343	354	365
K	Eagle Lake	Brazos-Colorado	159	160	160	165	170	176
K	Eagle Lake	Colorado	362	365	366	375	388	400
K	Irrigation	Brazos-Colorado	50,709	49,345	48,017	46,726	45,469	44,246
K	Irrigation	Colorado	34,346	33,422	32,523	31,648	30,797	29,969
K	Irrigation	Lavaca	88,057	85,688	83,384	81,140	78,957	76,833
K	Livestock	Brazos-Colorado	163	163	163	163	163	163
K	Livestock	Colorado	740	740	740	740	740	740
K	Livestock	Lavaca	373	373	373	373	373	373
K	Manufacturing	Brazos-Colorado	13	15	15	15	15	15
K	Manufacturing	Colorado	50	59	59	59	59	59
K	Manufacturing	Lavaca	897	1,058	1,058	1,058	1,058	1,058
K	Mining	Brazos-Colorado	160	162	163	165	167	168
K	Mining	Colorado	4,899	4,947	4,999	5,048	5,098	5,149
K	Mining	Lavaca	266	269	271	274	277	280
K	Steam Electric	Colorado	228	228	228	228	228	228
K	Steam Electric	Lavaca	4,743	4,743	4,743	4,743	4,743	4,743
K	Weimar	Colorado	163	166	169	175	181	187
K	Weimar	Lavaca	333	341	346	358	370	382
Sum of Projected Water Demands (ac-ft/year)			**189,291**	**184,915**	**180,473**	**176,236**	**172,128**	**168,138**

This appendix shows data from the "Estimated Historical Water Use and 2022 State Water Plan Datasets" (Allen, 2024; p. 5).

Appendix E3: Projected Water Supply Needs
2022 Texas State Water Plan

COLORADO COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
K	Columbus	Colorado	586	556	535	491	449	407
K	Corix Utilities	Colorado	-7	-8	-8	-10	-11	-13
K	County-Other	Brazos-Colorado	56	55	54	50	45	40
K	County-Other	Colorado	-92	-98	-100	-128	-161	-195
K	County-Other	Lavaca	172	169	168	159	148	137
K	Eagle Lake	Brazos-Colorado	17	16	16	11	6	0
K	Eagle Lake	Colorado	38	35	34	25	12	0
K	Irrigation	Brazos-Colorado	-21,169	-19,805	-18,477	-17,186	-15,929	-14,706
K	Irrigation	Colorado	-6,578	-5,654	-4,755	-3,880	-3,029	-2,201
K	Irrigation	Lavaca	-26,571	-24,202	-21,898	-19,654	-17,471	-15,347
K	Livestock	Brazos-Colorado	40	40	40	40	40	40
K	Livestock	Colorado	385	385	385	385	385	385
K	Livestock	Lavaca	0	0	0	0	0	0
K	Manufacturing	Brazos-Colorado	2	0	0	0	0	0
K	Manufacturing	Colorado	9	0	0	0	0	0
K	Manufacturing	Lavaca	161	0	0	0	0	0
K	Mining	Brazos-Colorado	10	8	7	5	3	2
K	Mining	Colorado	307	259	207	158	108	57
K	Mining	Lavaca	14	11	9	6	3	0
K	Steam Electric	Colorado	-228	-228	-228	-228	-228	-228
K	Steam Electric	Lavaca	-4,743	-4,743	-4,743	-4,743	-4,743	-4,743
K	Weimar	Colorado	24	21	18	12	6	0
K	Weimar	Lavaca	49	41	36	24	12	0
Sum of Projected Water Demands (ac-ft/year)			**-59,388**	**-54,738**	**-50,209**	**-45,829**	**-41,572**	**-37,433**

This appendix shows data from the "Estimated Historical Water Use and 2022 State Water Plan Datasets" (Allen, 2024; p. 6).

Appendix E4: Projected Water Management Strategies 2022 Texas State Water Plan

COLORADO COUNTY

All values are in acre-feet/year

WUG, Basin (RWPG): COLUMBUS, COLORADO (K)							
Water Management Strategy	**Source Name [Origin]**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Drought Management	Demand Reduction [Colorado]	206	194	180	169	157	146
Municipal Conservation - Columbus	Demand Reduction [Colorado]	102	195	286	384	484	581
		308	**389**	**466**	**553**	**641**	**727**

WUG, Basin (RWPG): CORIX UTILITIES TEXAS INC., COLORADO (K)							
Water Management Strategy	**Source Name [Origin]**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Drought Management	Demand Reduction [Colorado]	9	9	9	9	9	10
Expansion of Current Groundwater Supplies – Gulf Coast Aquifer	Gulf Coast Aquifer System [Colorado]	0	0	0	1	1	4
		9	**9**	**9**	**10**	**10**	**14**

WUG, Basin (RWPG): COUNTY-OTHER, COLORADO, BRAZOS-COLORADO (K)							
Water Management Strategy	**Source Name [Origin]**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Drought Management	Demand Reduction [Colorado]	18	14	11	10	10	10
		18	**14**	**11**	**10**	**10**	**10**

WUG, Basin (RWPG): COUNTY-OTHER, COLORADO, COLORADO (K)							
Water Management Strategy	**Source Name [Origin]**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Drought Management	Demand Reduction [Colorado]	113	90	71	61	61	62
Expansion of Current Groundwater Supplies – Gulf Coast Aquifer	Gulf Coast Aquifer [Colorado]	0	133	133	133	133	133
		113	**223**	**204**	**194**	**194**	**195**

WUG, Basin (RWPG): COUNTY-OTHER, COLORADO, LAVACA (K)							
Water Management Strategy	**Source Name [Origin]**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Drought Management	Demand Reduction [Colorado]	39	31	24	21	21	21
		39	**31**	24	**21**	**21**	**21**

WUG, Basin (RWPG): EAGLE LAKE, BRAZOS-COLORADO (K)							
Water Management Strategy	**Source Name [Origin]**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Drought Management	Demand Reduction [Colorado]	30	26	24	22	23	23
		30	**26**	24	**22**	**23**	**23**

WUG, Basin (RWPG): EAGLE LAKE, COLORADO (K)							
Water Management Strategy	**Source Name [Origin]**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Drought Management	Demand Reduction [Colorado]	68	60	54	51	52	54
		68	**60**	54	**51**	**52**	**54**

WUG, Basin (RWPG): IRRIGATION, BRAZOS-COLORADO (K)							
Water Management Strategy	**Source Name [Origin]**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Austin Return Flows	Indirect Reuse [Travis]	1,425	1,394	1,362	1,330	1,297	1,262
Drought Management	Demand Reduction [Colorado]	3,268	3,180	3,094	3,011	2,930	2,851
Expansion of Current Groundwater Supplies – Gulf Coast Aquifer	Gulf Coast Aquifer System [Colorado]	2,500	2,500	2,500	2,500	2,500	2,500
Irrigation Conservation - On Farm	Demand Reduction [Colorado]	2,206	2,647	3,088	3,529	3,971	4,412
Irrigation Conservation - Operations Conveyance Improvements	Demand Reduction [Colorado]	503	1,145	1,788	2,431	3,074	3,716
Irrigation Conservation – Real Time Use Metering and Monitoring	Demand Reduction [Colorado]	3,156	3,071	2,989	2,908	2,830	2,754
Irrigation Conservation - Sprinkler	Demand Reduction [Colorado]	140	701	1,403	1,753	1,753	1,753
LCRA – Interruptible Water for Agriculture (LCRA WMP Amendments)	Highland Lakes Lake/Reservoir System [Reservoir]	5,085	2,356	1,036	0	0	0

		18,283	**16,994**	**17,260**	**17,462**	**18,355**	**19,248**

WUG, Basin (RWPG): IRRIGATION, COLORADO (K)							
Water Management Strategy	**Source Name [Origin]**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Austin Return Flows	Indirect Reuse [Travis]	443	398	351	300	247	189
Drought Management	Demand Reduction [Colorado]	1,015	988	962	936	911	886
Expansion of Current Groundwater Supplies – Gulf Coast Aquifer	Gulf Coast Aquifer [Colorado]	550	550	550	550	550	550
Irrigation Conservation - On Farm	Demand Reduction [Colorado]	685	823	960	1,097	1,234	1,371
Irrigation Conservation - Operations Conveyance Improvements	Demand Reduction [Colorado]	156	356	556	755	955	1,155
Irrigation Conservation – Real Time Use Metering and Monitoring	Demand Reduction [Colorado]	981	954	929	904	879	856
Irrigation Conservation - Sprinkler	Demand Reduction [Colorado]	44	218	436	545	545	545
LCRA – Interruptible Water For Agriculture (LCRA WMP Amendments)	Highland Lakes Lake/Reservoir System [Reservoir]	1,580	732	322	0	0	0
		5,454	**5,019**	**5,066**	**5,087**	**5,321**	**5,552**

WUG, Basin (RWPG): IRRIGATION, LAVACA (K)							
Water Management Strategy	**Source Name [Origin]**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Austin Return Flows	Indirect Reuse [Travis]	1,789	1,704	1,615	1,521	1,422	1,317
Drought Management	Demand Reduction [Colorado]	4,102	3,991	3,884	3,780	3,678	3,579
Expansion of Current Groundwater Supplies – Gulf Coast Aquifer	Gulf Coast Aquifer [Colorado]	5,000	5,000	5,000	5,000	5,000	5,000
Irrigation Conservation - On Farm	Demand Reduction [Colorado]	2,769	3,322	3,876	4,430	4,984	5,537
Irrigation Conservation - Operations Conveyance Improvements	Demand Reduction [Colorado]	631	1,438	2,245	3,051	3,858	4,665

Irrigation Conservation – Real Time Use Metering and Monitoring	Demand Reduction [Colorado]	3,961	3,855	3,751	3,650	3,552	3,457
Irrigation Conservation - Sprinkler	Demand Reduction [Colorado]	176	880	1,761	2,201	2,201	2,201
LCRA – Interruptible Water For Agriculture (LCRA WMP Amendments)	Highland Lakes Lake/Reservoir System [Reservoir]	6,382	2,957	1,301	0	0	0
		24,810	**23,147**	**23,433**	**23,633**	**24,695**	**25,756**

WUG, Basin (RWPG): WEIMAR, COLORADO (K)							
Water Management Strategy	**Source Name [Origin]**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Drought Management	Demand Reduction [Colorado]	30	28	26	25	26	27
Municipal Conservation - Weimar	Demand Reduction [Colorado]	15	27	40	50	51	53
		45	**55**	**66**	**75**	**77**	**80**

WUG, Basin (RWPG): WEIMAR, LAVACA (K)							
Water Management Strategy	**Source Name [Origin]**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Drought Management	Demand Reduction [Colorado]	61	57	53	51	53	55
Municipal Conservation - Weimar	Demand Reduction [Colorado]	30	56	82	102	105	108
		91	**113**	**135**	**153**	**158**	**108**

	2020	**2030**	**2040**	**2050**	**2060**	**2070**
Sum of Projected Strategies (acre-feet)	**49,268**	**46,080**	**46,752**	**47,271**	**49,558**	**51,843**

This appendix shows data from the "Estimated Historical Water Use and 2022 State Water Plan Datasets" (Allen, 2024; p. 7-9).

Appendix F: Public Notices Regarding Hearing Related to Plan Adoption

NOTICE OF PUBLIC MEETING
Date: March 19, 2025
Time: 7:00 p.m.
Location: 910 Milam St., Columbus, TX

CCGCD
COLORADO COUNTY GROUNDWATER CONSERVATION DISTRICT

Public Hearing to Approve Proposed District Management Plan

AGENDA

The Board will consider and/or take action on the following agenda items:

1. Public Comments and Presentations
2. Review and Take Action on the Resolution to Approve the Proposed District Management Plan
3. Adjourn Hearing

FILED FOR RECORD
COLORADO COUNTY, TX
2025 MAR -7 PM 3:41
KIMBERLY MENKE
COUNTY CLERK

Appendix G: Letters Coordinating with Regional Surface Water Management Entities

The following is a list of surface water management entities that are present within the Colorado County Groundwater Conservation District boundaries. A link to the District's adopted management plan has been forward to each of these entities.

List of Water Districts and Utilities with Administrative Contacts

Alleyton Water System
Darrin Barker, President
500 W. Monroe St., Ste 3600
Chicago, IL 60661-3779

Barten Water Supply Corporation
Glen Horndt, President
P. O. Box 805
Columbus, TX 78934-0805

City of Columbus
Donald Warschak, City Manager
P. O. Box 87
Columbus, TX 78934-0087

City of Eagle Lake
Tim Kelley, Mayor
P. O. Box 38
Eagle Lake, TX 77434-0038

City of Weimar
Milton R. Koller, Mayor
106 E. Main St.
Weimar, TX 78962-2009

Colorado County Water Control Improvement District 2 (WCID #2)
David Peacock, President
P. O. Box 317
Garwood, TX 77442-0317

Glidden Fresh Water Supply District (FWSD 1)
Edward E. Pavlicek, President
P. O. Box 85
Columbus, TX 78934-0085

Lower Colorado River Authority (LCRA)
John Hofmann, Executive Vice President of Water
P. O. Box 220
Austin, TX 78767

Rock Island Water Corporation
Calvin Harris, President
P. O. Box 144
Rock Island, TX 77470-0144

Sheridan Water Supply Corporation
Misty Sanders, Office Manager
P. O. Box 206
Sheridan, TX 77475-0206

Colorado County Groundwater
Conservation District
P.O. Box 667
Columbus, TX 78934
Office 979 732-9300
www.ccgcd.net

March 20, 2025

Alleyton Water System
Darrin Barker, President
500 W. Monroe St., Ste 3600
Chicago, IL 60661-3779

Dear Mr. Barker,

The following link will direct you to the recently adopted District Management Plan for the Colorado County Groundwater Conservation District.

https://ccgcd.net/documents/1278/CCGCD_2024_Management_Plan-Reviewed.pdf

This plan is forwarded to you in compliance with Texas Water Code, §36.1071(a) and Texas Administrative Code, §356.51. Pursuant to the Texas Water Code, §36.1072, the District will send a copy of the adopted District Management Plan to the Executive Administrator of the Texas Water Development Board for review and approval.

No action is required on your part, but input is welcome. If you have any questions, please feel free to call the District office.

Regards,

Aaron Weishuhn
General Manager
Colorado County Groundwater Conservation District

Colorado County Groundwater
Conservation District
P.O. Box 667
Columbus, TX 78934
Office 979 732-9300
www.ccgcd.net

March 20, 2025

Barten Water Supply Corporation
Glen Horndt, President
P. O. Box 805
Columbus, TX 78934-0805

Dear Mr. Horndt,

The following link will direct you to the recently adopted District Management Plan for the Colorado County Groundwater Conservation District.

https://ccgcd.net/documents/1278/CCGCD_2024_Management_Plan-Reviewed.pdf

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Aaron C E. Weishuhn

Aaron Weishuhn
General Manager
Colorado County Groundwater Conservation District

Colorado County Groundwater
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P.O. Box 667
Columbus, TX 78934
Office 979 732-9300
www.ccgcd.net

March 20, 2025

City of Columbus
Donald Warschak, City Manager
P. O. Box 87
Columbus, TX 78934-0087

Dear Mr. Warschak,

The following link will direct you to the recently adopted District Management Plan for the Colorado County Groundwater Conservation District.

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General Manager
Colorado County Groundwater Conservation District

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Office 979 732-9300
www.ccgcd.net

March 20, 2025

City of Eagle Lake
Tim Kelley, Mayor
P. O. Box 38
Eagle Lake, TX 77434-0038

Dear Mr. Kelley,

The following link will direct you to the recently adopted District Management Plan for the Colorado County Groundwater Conservation District.

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Colorado County Groundwater Conservation District

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Office 979 732-9300
www.ccgcd.net

March 20, 2025

City of Weimar
Milton R. Koller, Mayor
106 E. Main St.
Weimar, TX 78962-2009

Dear Mr. Koller,

The following link will direct you to the recently adopted District Management Plan for the Colorado County Groundwater Conservation District.

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General Manager
Colorado County Groundwater Conservation District

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Office 979 732-9300
www.ccgcd.net

March 20, 2025

Colorado County Water Control Improvement District 2 (WCID #2)
David Peacock, President
P. O. Box 317
Garwood, TX 77442-0317

Dear Mr. Peacock,

The following link will direct you to the recently adopted District Management Plan for the Colorado County Groundwater Conservation District.

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Aaron C.E. Weishuhn

Aaron Weishuhn
General Manager
Colorado County Groundwater Conservation District

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Conservation District
P.O. Box 667
Columbus, TX 78934
Office 979 732-9300
www.ccgcd.net

March 20, 2025

Glidden Fresh Water Supply District (FWSD 1)
Edward E. Pavlicek, President
P. O. Box 85
Columbus, TX 78934-0085

Dear Mr. Pavlicek,

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Aaron C.E. Weishuhn

Aaron Weishuhn
General Manager
Colorado County Groundwater Conservation District

Colorado County Groundwater
Conservation District
P.O. Box 667
Columbus, TX 78934
Office 979 732-9300
www.ccgcd.net

March 20, 2025

Lower Colorado River Authority (LCRA)
John Hofmann, Executive Vice President of Water
P. O. Box 220
Austin, TX 78767

Dear Mr. Hofmann,

The following link will direct you to the recently adopted District Management Plan for the Colorado County Groundwater Conservation District.

https://ccgcd.net/documents/1278/CCGCD_2024_Management_Plan-Reviewed.pdf

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General Manager
Colorado County Groundwater Conservation District

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Columbus, TX 78934
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www.ccgcd.net

March 20, 2025

Rock Island Water Corporation
Calvin Harris, President
P. O. Box 144
Rock Island, TX 77470-0144

Dear Mr. Harris,

The following link will direct you to the recently adopted District Management Plan for the Colorado County Groundwater Conservation District.

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Colorado County Groundwater Conservation District

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March 20, 2025

Sheridan Water Supply Corporation
Misty Sanders, Office Manager
P. O. Box 206
Rock Island, TX 77475-0206

Dear Ms. Sanders,

The following link will direct you to the recently adopted District Management Plan for the Colorado County Groundwater Conservation District.

https://ccgcd.net/documents/1278/CCGCD_2024_Management_Plan-Reviewed.pdf

This plan is forwarded to you in compliance with Texas Water Code, §36.1071(a) and Texas Administrative Code, §356.51. Pursuant to the Texas Water Code, §36.1072, the District will send a copy of the adopted District Management Plan to the Executive Administrator of the Texas Water Development Board for review and approval.

No action is required on your part, but input is welcome. If you have any questions, please feel free to call the District office.

Regards,

Aaron C.E. Weishuhn

Aaron Weishuhn
General Manager
Colorado County Groundwater Conservation District

Appendix H: Colorado County GCD Board of Directors Resolution Adopting Amended Management Plan

CCGCD
COLORADO COUNTY GROUNDWATER CONSERVATION DISTRICT

RESOLUTION: 2025 - 1

A RESOLUTION ADOPTING AND APPROVING THE COLORADO COUNTY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

WHEREAS, The Colorado County Groundwater Conservation District (the "District") is a political subdivision of the State of Texas, created under authority of Section 59, Article XVI of the Texas Constitution by the 80th Texas Legislature with the Act of May 23, 2007, House Bill 4032, as a governmental agency and a body politic and corporate; and,

WHEREAS, pursuant to the Texas Water Code Section 36.1072(e), the District must review and readopt the management plan at least once every five years; and,

WHEREAS, the prior management plans of the Colorado County Groundwater Conservation District was approved by resolution of the Board on August 15, 2019; and,

WHEREAS, on March 7, 2025, a Notice of Hearing was posted at the District Office and Colorado County courthouse regarding a public hearing on the adoption of the Colorado County Groundwater Conservation District Management Plan; and,

WHEREAS, the proposed District Management Plan was made available for public review as of March 7, 2025; and,

WHEREAS, a public hearing was scheduled for March 19, 2025;

NOW THEREFORE, BE IT RESOLVED that the Board of the Colorado County Groundwater Conservation District does hereby adopt and approve the Colorado County Groundwater Conservation District Management Plan and directs the submission of such Management Plan to the Executive Administrator of the Texas Water Development Board for review and approval.

BE IT FURTHER RESOLVED that this resolution shall take effect immediately from and after its passage, and it is accordingly so resolved,

CONSIDERED, PASSED, APPROVED, ADOPTED, RESOLVED, SIGNED AND DONE IN OPEN MEETING on this 19th day of March 2025.

By: _____
Andrew Labay, President

Attested by: _____
Rebecca Moulder, Secretary

Appendix I: Minutes of Colorado County GCD Board of Directors Meeting Related to the Public Hearing for Adoption of the Amended Management Plan

CCGCD
COLORADO COUNTY GROUNDWATER CONSERVATION DISTRICT

PUBLIC HEARING MINUTES

Minutes of Public Hearing to Approve Proposed District Management Plan
March 19, 2025

The Directors of the Colorado County Groundwater Conservation District met on March 19, 2025 at 7:00 p.m. in the District Office located at 910 Milam Street, Columbus, Texas.

Directors Present:	Andy Labay, Marv Ulbricht, Rebeca Moulder, Ann Pavliska, Michael Lanier, Wanda Anglin
Staff Present:	Aaron Weishuhn, Kim Ferguson, Jim Brasher
Guests:	None

President Labay declared a quorum present and convened the hearing at 10:00 p.m.

District Consultant Brasher presented the proposed District Management Plan. Director Lanier moved to approve the proposed District Management Plan. The motion was seconded by Director Ulbricht and carried unanimously.

The hearing was adjourned at 10:05 p.m.

Minutes submitted by: Kim Ferguson, Office Manager

Meeting minutes approved by:

Rebecca Moulder
Rebecca Moulder, Secretary

3/19/25
Date

Appendix J: Colorado County GCD Contact Information

Mailing Address:
P. O. Box 667
Columbus, TX 78934

Physical Address:
910 Milam Street
Columbus, TX 78934

E-Mail Addresses:
General Manager: aaron@ccgcd.net
Office Manager: kim@ccgcd.net

Phone Numbers:
Main Office: (979) 732-9300
General Manager Cell: (979) 733-2284

District Staff:
General Manager: Aaron Weishuhn
Office Manager: Kim Ferguson

Board of Directors
President: Andrew Labay (Place 7)
Vice-President: Marv Ulbricht (Place 2)
Secretary: Rebecca Moulder (Place 6)
Treasurer: Ann Pavliska (Place 5)
Director: Michael Lanier (Place 1)
Director: Wanda Anglin (Place 3)
Director: Al Mahalitc (Place 4)