

Item 5 – Five-year District Management Plan Update

At least once every five years, the District is required to update the District Management Plan inserting the most recently adopted Desired Future Conditions for all managed aquifers and any revisions to groundwater management strategies to be employed by the District. The Management Plan Committee Chairman, John Elliott, and I have decided on a schedule to accomplish this task for final TWDB approval no later than November 30, 2023. The suggested schedule is below.

April 4 - April 10 – Committee members review the red-lined plan making changes deemed necessary

April 13 – Place a discussion and possible action item on the board agenda for parts of the plan on which the committee has agreed

April 14 - May 8 – Committee continues to work on portions of the plan not already approved by the Board

May 11 – Place a discussion and possible action item on the board agenda for the remaining portions the plan not approved by the Board April 13th.

May 12 - June 5 – Committee continues to work on portions of the plan not already approved by the Board (if necessary). The GAM run for District values will hopefully be made available by the June 8th board meeting.

June 8 – Place a discussion and possible action item on the board agenda for final initial approval of the updated plan for submission to the TWDB for preapproval (hopefully).

June 9 – Send initially approved updated Management Plan to TWDB for preapproval

Following is the initial red-lined version presented to the committee for their review and comment.

It is the recommendation of the General Manager and committee members that board agreement is reached on updated sections, those sections be approved.

9. MANAGEMENT GOALS AND OBJECTIVE21

A. Management Goals

1. Implement Strategies Providing for the Most Efficient Use of Groundwater
2. Implement Strategies to Control and Prevent Waste of Groundwater
3. Implement Strategies to Address Conjunctive Surface Water Management Issues
4. Implement Strategies to Address Natural Resource Issues that Impact the Use and Availability of Groundwater and that are Impacted by the Use of Groundwater
5. Implement Strategies to Address Drought Conditions
6. Implement Strategies to Promote Water Conservation
7. Implement Strategies to Protect Water Quality
8. Implement Strategies to Assess Adopted Desired Future Conditions
9. Implement Strategies to Assess, Control, and Prevent Subsidence

shale. The Simsboro Sand is older than the Calvert Bluff, Carrizo, Queen City, Sparta, and Yegua-Jackson aquifers. The Carrizo Sand and Queen City Sand are separated by the Reklaw, which is a clay rich zone. The Cook Mountain Formation is composed of mostly clay separating the Sparta Sand and Yegua-Jackson aquifers. The Catahoula Sandstone or Catahoula Aquifer of the Gulf Coast Aquifer is composed of clay and sand in cross-bedded lenses. The Brazos River Alluvium can be found in a ~~two to six mile wide~~two- to six-mile-wide zone of floodplain alluvial deposits along the Brazos River on the western boundary of the District. Sand, small gravel and clay compose the relatively thin Brazos River Alluvium. *Figure 2* illustrates a geologic cross section through Brazos and Robertson Counties and depicts the position, depth, thickness, and dip of the aquifers and confining units.

The Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers outcrop within the District's boundaries in northeast to southwest trending belts paralleling the Gulf coastline. An aquifer outcrop map is included for Brazos and Robertson counties in *Figure 3*. The aquifer outcrops extend outside of the two counties shown on the map.

The general trend of the aquifers, ~~with the exception of~~ except for the Brazos River Alluvium, is to dip underground southeastward towards the Gulf Coast from their surface exposure. The aquifers dip at a maximum rate of about 110 feet per mile. Each aquifer underlies younger aquifers that have a similar dip toward the coast. A salt dome occurs in the southern part of Brazos County. The top of the salt dome occurs at an elevation of about -4,600 feet relative to sea level and the approximate location of the dome is shown on Figure 2. The thickness and position of the Simsboro Sand is influenced by the salt dome, but the dome occurs significantly down dip of the area where the Simsboro Sand contains potable quality groundwater.

Topography and Drainage

Natural topography in Brazos and Robertson counties range from gently hilly terrain in the center of the counties to relatively flat terrain along the Brazos and Navasota river corridors. The western border of the counties is the Brazos River and the eastern is the Navasota River. The land surface elevation above sea level for Brazos and Robertson counties is shown on *Figure 4*. Altitudes in the District range from about 140 feet to ~~550~~ 590 feet above mean sea level, with higher elevations in the center of the counties.

DFCs Adopted by GMA 12.

The District's current DFCs for the area covered by GMA 12 are the average drawdowns listed in *Table 1*. The average drawdowns are for a 70-year period beginning January, 2000 and ending **December** 2069. For each of the aquifers, the DFC average drawdowns are for the area covered by each aquifer in Brazos and Robertson counties as defined by the stratigraphy used in the TWDB Groundwater Availability Models (GAMs). ~~The GMA 12 2020 update for the Central portion of the Sparta, Queen City-Sparta, and Carrizo-Wilcox GAM released in 2003~~ was used to develop DFCs for the Sparta, Queen City, Carrizo, Calvert Bluff, Simsboro and Hooper aquifers. The Yegua-Jackson Aquifer GAM released in 2010 was used to develop DFCs for the Yegua and Jackson aquifers and the Brazos River Alluvium GAM released in 2016 was used to develop DFCs for the Brazos River Alluvium.

Changes to the DFCs Between 2016 & 2021

Significant changes to the DFCs for the Sparta, Queen City, and Carrizo-Wilcox aquifers occurred cycle over cycle and are listed in Table 1 below. The primary reason for these modifications is the updating of the GAM for the Central portion of the Sparta, Queen City, and Carrizo-Wilcox. Districts had long known that the model failed at properly predicting the interaction between aquifers. Some of the aquifer-to-aquifer flow was underestimated (Sparta, Queen City, Carrizo) while others were overestimated (Wilcox group). Measurements obtained from static water level monitoring wells had for years indicated the GAM needed to be updated and improved. TWDB along with GMA 12 funded the 2018 update resulting in a more reliable GAM.

The DFCs for the Yegua-Jackson aquifer changed slightly due to an amalgamation of the two aquifers into one DFC. This action mirrors the other members of GMA 12 whose DFCs have always seen the Yegua-Jackson as one aquifer for planning purposes.

There was no change in the DFCs for the Brazos River Alluvium Aquifer.

Compliance with the Adopted 2021 DFCs

Table 1. Adopted Aquifer DFCs based on the Average Threshold that occurs between January, 2000 and December 2069. Yegua-Jackson (2010-2069), Brazos River Alluvium (2013-2070)	<u>Artesian Head (ft)</u> <u>DFCs – 2016</u>	<u>Artesian Head (ft)</u> <u>DFCs – 2021</u>
Sparta	<u>12</u>	<u>1253</u>
Queen City	<u>12</u>	<u>1244</u>
Carrizo	<u>61</u>	<u>6184</u>
Upper Wilcox (Calvert Bluff Formation)	<u>125</u>	<u>125111</u>
Middle Wilcox (Simsboro Formation)	<u>295</u>	<u>295262</u>
Lower Wilcox (Hooper Formation)	<u>207</u>	<u>207167</u>
Yegua-Jackson	<u>Yegua – 70</u> <u>Jackson – 114</u>	<u>Yegua – 7067</u> <u>Jackson – 114</u>
Brazos Alluvium Aquifer	<p data-bbox="1045 691 1732 821"><u>North of State Highway 21: Percent saturation shall average at least 30% of total well depth from January 2013 to December 2069.</u></p> <p data-bbox="1045 870 1732 967"><u>South of State Highway 21: Percent saturation shall average at least 40% of total well depth</u></p>	
	<p data-bbox="1045 976 1732 1386"><u>from January 2013 to December 2069. BVGCD Brazos and Robertson Counties Percent saturation above total well depth shall average at least 30 percent for wells located north of State Highway 21 and 40 percent for wells located south of State Highway 21. If the percent saturation criteria are reached for three consecutive years then the DFC would be reached.</u></p>	

A. Resolution to Adopt Desired Future Conditions, ~~October~~ November 30, 2021, ~~2017~~, letter from Gary Westbrook, General Manager, Post Oak Savannah GCD to Jeff Walker, Executive Administrator, Texas Water Development Board (Sparta, Queen City, Carrizo, Upper Wilcox, Middle Wilcox, Lower Wilcox, Yegua, Jackson, and Brazos River Alluvium).

The TWDB's MAG Estimates based on GMA 12 adopted DFCs: GAM Run 21-017 MAG

Carrizo

Modeled Available Groundwater for the Carrizo Aquifer summarized by county in GMA 12 for each decade between 2010 and ~~2069~~2070. Results are in ac-ft/yr.

County	<u>2010</u>	<u>2010</u> <u>2020</u>	<u>2020</u> <u>2030</u>	<u>2030</u> <u>2040</u>	<u>2040</u> <u>2050</u>	<u>2050</u> <u>2060</u>	<u>2060</u> <u>2070</u>
Brazos	<u>1,196</u>	<u>1,196</u> <u>864</u>	<u>3,717</u> <u>1,444</u>	<u>3,724</u> <u>2,023</u>	<u>3,737</u> <u>2,603</u>	<u>3,761</u> <u>3,183</u>	<u>3,763</u>
Robertson	<u>887</u>	<u>887</u> <u>81</u>	<u>1,707</u> <u>412</u>	<u>1,698</u> <u>743</u>	<u>1,713</u> <u>1,074</u>	<u>1,730</u> <u>1,405</u>	<u>1,731</u> <u>1,736</u>

Calvert Bluff

Modeled Available Groundwater for the Calvert Bluff Aquifer summarized by county in GMA 12 for each decade between 2010 and ~~2069~~2070. Results are in ac-ft/yr.

County	<u>2010</u>	<u>2010</u> <u>2020</u>	<u>2020</u> <u>2030</u>	<u>2030</u> <u>2040</u>	<u>2040</u> <u>2050</u>	<u>2050</u> <u>2060</u>	<u>2060</u> <u>2070</u>
Brazos	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Robertson	<u>776</u>	<u>776</u> <u>252</u>	<u>1,764</u> <u>546</u>	<u>1,757</u> <u>841</u>	<u>1,758</u> <u>1,136</u>	<u>1,757</u> <u>1,430</u>	<u>1,757</u> <u>1,725</u>

Simsboro

Modeled Available Groundwater for the Simsboro Aquifer summarized by county in GMA 12 for each decade between 2010 and ~~2069~~2070. Results are in ac-ft/yr.

County	<u>2010</u>	<u>2010</u> <u>2020</u>	<u>2020</u> <u>2030</u>	<u>2030</u> <u>2040</u>	<u>2040</u> <u>2050</u>	<u>2050</u> <u>2060</u>	<u>2060</u> <u>2070</u>
Brazos	<u>35,086</u>	<u>35,086</u> <u>37,282</u>	<u>41,115</u> <u>42,709</u>	<u>44,120</u> <u>48,137</u>	<u>45,681</u> <u>53,565</u>	<u>50,208</u> <u>58,993</u>	<u>53,404</u> <u>64,421</u>
Robertson	<u>37,236</u>	<u>37,236</u> <u>38,219</u>	<u>41,673</u> <u>47,140</u>	<u>42,061</u> <u>56,061</u>	<u>42,468</u> <u>64,982</u>	<u>42,794</u> <u>73,903</u>	<u>42,794</u> <u>82,824</u>

Brazos River Alluvium

Modeled Available Groundwater for the Brazos River Alluvium Aquifer summarized by county in GMA 12 for each decade between 2013 and 2070. Results are in ac-ft/yr.

County	<u>2013</u>	<u>2013</u> <u>2020</u>	<u>2020</u> <u>2030</u>	<u>2030</u> <u>2040</u>	<u>2040</u> <u>2050</u>	<u>2050</u> <u>2060</u>	<u>2060</u> <u>2070</u>
Brazos	<u>122,785</u>	<u>122,785</u> <u>77,816</u>	<u>81,581</u> <u>76,978</u>	<u>80,311</u> <u>76,393</u>	<u>80,081</u> <u>76,195</u>	<u>79,976</u> <u>76,100</u>	<u>79,913</u> <u>76,039</u>
Robertson	<u>66,608</u>	<u>66,608</u> <u>55,907</u>	<u>61,161</u> <u>55,424</u>	<u>57,959</u> <u>55,157</u>	<u>57,633</u> <u>54,839</u>	<u>57,544</u> <u>54,723</u>	<u>57,503</u> <u>54,6118</u>

B. Historical Water Use Data

Data from the TWDB Historical Water Use Survey, included in *Appendix B1*, provides annual historical water use projections from 2010-2004 to 2016-2019, the most recent years of record availability. The table includes groundwater and surface water accounting for municipal, manufacturing, steam electric, irrigation, mining, and livestock usage. Data presented in *Table 2* reflects groundwater use within the District from metered wells required to report water production to the District.

The data is for the 2011-2015-2018-2022 period and delineated by aquifer. Exempt well use (domestic, livestock, wells used for oil and gas rig supply) are not included. Brazos River Alluvium wells have no requirement to be metered and are not a part of *Table 2*.

Table 2. Metered Groundwater Use by Aquifer (ac-ft/yr)

<u>Aquifer</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>
Hooper	621	956	794	1,065	1,084	909	756	809
Simsboro	69,378	53,327	64,107	62,946	56,638	54,237	53,326	55,229
Calvert Bluff	153	72	82	184	160	132	272	130
Carrizo	1,563	849	806	852	666	762	630	825
Queen City	582	69	64	497	190	100	237	147
Sparta	4,337	3,177	3,402	5,358	4,122	4,153	4,241	4,500
Yegua-Jackson	1,659	1,419	1,438	2,533	1,664	1,565	1,510	1,183
Totals	78,293	59,869	70,693	73,435	64,524	61,858	60,972	62,823
<u>Aquifer</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	<u>2022</u>
Hooper	1,084	909	756	809	700	746	918	1,045
Simsboro	56,638	54,237	53,326	55,229	50,528	53,164	51,128	58,313
Calvert Bluff	160	132	272	130	177	230	133	251
Carrizo	666	762	630	825	992	1,062	956	1,575
Queen City	190	100	237	147	401	103	45	93
Sparta	4,122	4,153	4,241	4,500	3,870	3,389	3,161	4,288
Yegua-Jackson	1,664	1,565	1,510	1,183	1,278	1,253	948	1,261
Totals	64,524	61,858	60,972	63,823	57,946	59,947	57,289	66,826

Projected surface water supplies are described in the 2017-2022 State Water Plan and are referenced in a table provided by the TWDB in *Appendix B2*.

Current and projected water demands by user group within each county in the District through the year 2070 are described in *Appendix B3*. These estimates are in the current 2017-2020 State Water Plan. Projected water demands were significantly adjusted in the 2017-2020 State Water Plan regarding agricultural and public water supply needs and addressed the District's concerns relative to projected growth and current usage by these user groups. The District will continue to work to collect accurate data about current production as well as projected demands. This information will be provided to the TWDB for inclusion in future Regional and State water plans. As indicated in the regional water plan, these projections take into account population growth, rainfall, and conservation measures to be taken by each user group.

Projected Water Supply Needs

The projected need for additional water supplies stated in the 2017-2020 State Water Plan clearly indicates three primary areas of need; Agricultural irrigation, domestic/municipal use and potentially steam electric production. Each of these sectors faces their own hurdles and will meet their demand needs in different manners.

I. Projected Water Management Strategies to Meet Future Supply Needs

Demand and supply data developed as part of the Region G planning process in 2017-2020, District records, and GMA 12 planning efforts indicate that groundwater and surface water supplies should be adequate to meet the recommended strategies. There will be a need for infrastructure improvements to provide water at higher rates as water demands increase. However, if current conditions and projected needs from the State Water Plan are low, these shortages will be satisfied by further development of

7. **METHODOLOGY TO TRACK DISTRICT PROGRESS IN ACHIEVING
MANAGEMENT GOALS 31 TAC 356.5 (a)(6)**

An annual report will be developed by the General Manager and District staff and provided to the District's Board of Directors. The Annual Report will cover activities of the District including information on the District's performance regarding achieving the District's management goals and objectives. The Annual Report will be delivered to the District Board within 60 days following the completion of the District's fiscal year, ~~beginning with the fiscal year that starts on January 1, 2018~~. A copy of the Annual Report will be kept on file and available for public inspection at the District's offices upon adoption.

2c. **Objective** – Provide information to the general public and schools within the District ~~promoting water conservation, on~~-wise use of water, ~~and to the~~ elimination and reducutione of wasteful practices.

6b. **Objective** – Develop a system for measurement and evaluation of groundwater supplies.

- **Performance Standard** – Water level monitoring wells will be identified for Brazos River Alluvium, Yegua-Jackson, Sparta, Queen City, Carrizo, Calvert Bluff, Simsboro, and Hooper aquifers. At least two (~~25~~) wells per aquifer will be monitored on an annual basis to track changes in static water levels.
- **Performance Standard** – Every monitoring wells designated as a Desired Future Conditions well will be measured at least annually to track compliance with the adopted Desired Future Condition for the relevant aquifer.

8. **Implement Strategies to Assess Adopted Desired Future Conditions**

8a. **Objective** - ~~At least once every three years,~~Annually, the District will evaluate well water level monitoring data and determine whether the change in water levels is in general conformance with the DFCs adopted by the District. The District will estimate total annual groundwater production for each aquifer based on the water use reports, estimated exempted use, and other relevant information, and compare these production estimates to the MAGs.

➤ **Performance Standard** - ~~At least once every three years,~~Annually, the General Manager will report to the District Board the water level data obtained from the monitoring wells in each aquifer, the average artesian head change for each aquifer calculated from the water levels of the monitoring wells in each aquifer, a comparison of the average artesian head change for each aquifer with the DFCs for each aquifer, and the District progress in conforming with the DFCs.

9. Implement Strategies to Assess, Control, and Prevent Subsidence

9a. Objective - The District will monitor changes in water levels in its monitoring wells with due consideration to the potential for land subsidence. At least once every three years, the District will assess the potential for land subsidence for areas where water levels have decreased more than 100 feet since the year 2000. The District will review the sections in "Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping" report (TWDB Contract Number 1648302062, by LRE Water) when discussing subsidence within the Districts aquifers. Those aquifers can be found on page 4-5, 4-104, 4-187, 4-207, and 4-229 of the report.

- Performance Standard – Within three years of the approval of this plan and every three years thereafter, the District will map any region where more than 100 feet of drawdown has occurred since the year 2000 and assess the potential for land subsidence. The results of the assessment will be discussed in a District Board meeting and be documented in a presentation or a report.
- Performance Standard – As outlined in TWC Ch. 36.108 (d), The District will take into consideration the "Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping" when considering subsidence during GMA 12 joint planning.

B. Management Goals Determined Not to be Applicable to the Brazos Valley Groundwater Conservation District

~~1. Controlling and Preventing Subsidence:~~

~~The Carrizo, Simsboro and Brazos River alluvium are aquifers in the District that have and will continue to provide moderate to large amounts of water to wells. The formations that compose the aquifers are principally sand or some gravel for the Brazos River alluvium, with only minor amounts of clay in the Carrizo or Simsboro aquifers and surficial clays for the Brazos River alluvium. With the minor amounts of clay or surficial clays in the formations that compose the aquifers, there is not a significant risk of subsidence occurring due to groundwater pumping. The report "Controlling and Preventing Subsidence" prepared by the Texas Water Development Board was reviewed while considering the potential for significant subsidence occurring due to groundwater pumping.~~

- 21. Rainwater Harvesting:**
With average annual precipitation in the District about 39 inches, a goal of rainwater harvesting is not applicable at this time.
- 32. Recharge Enhancement:**
With an average annual precipitation of about 39 inches and outcrop areas of the Carrizo-Wilcox limited to the northern part of Robertson County, this goal is not applicable at this time. The exception would be the utilization of Aquifer Storage and Recovery projects.
- 43. Precipitation Enhancement:**
With the high amount of annual rainfall in the District, precipitation enhancement does not appear to be needed. This goal is therefore not applicable at this time.
- 54. Brush Control:**
A significant amount of the District's area is heavily forested with other areas in improved pasture or cultivated land. Brush control, as a goal, is not applicable at this time.