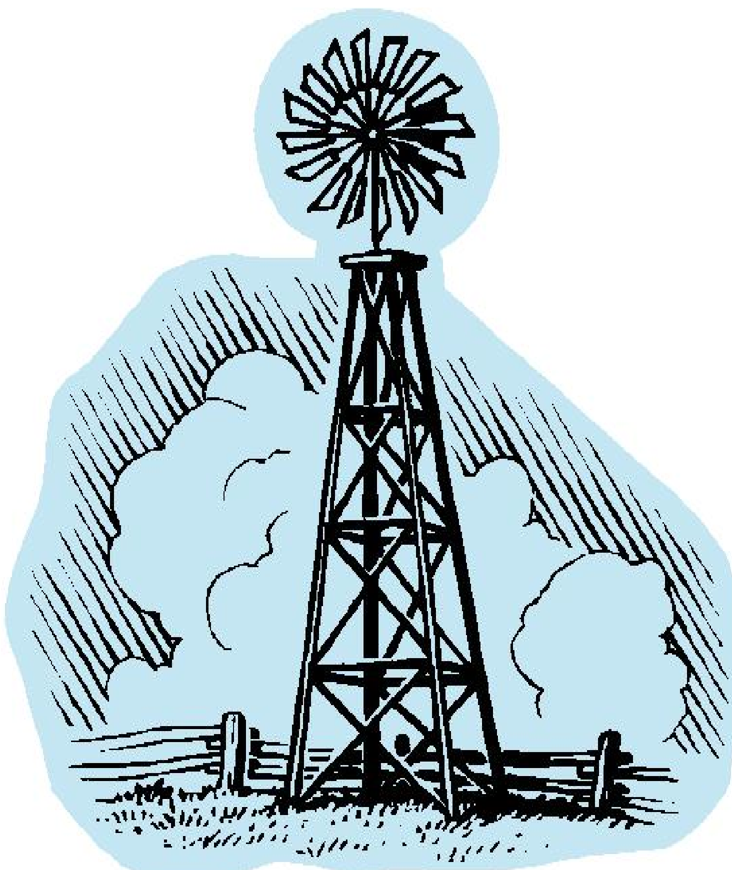
Coastal Plains
Groundwater Conservation District
Groundwater Management Plan



CPGCD Board Adoption: 5-25-04

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Groundwater Management Plan
November 2014

I. District Mission

The Coastal Plains Groundwater Conservation District ("the District") is committed to manage and protect the groundwater resources of the District. The District is committed to maintaining a sustainable, adequate, reliable, cost effective and high quality source of groundwater to promote the vitality, economy and environment of the District. The District will work with and for the citizens of the District and cooperate with other local, regional and state agencies involved in the study and management of groundwater resources. The District will take no action without a full consideration of the groundwater needs of the citizens of the District and due consideration of private property rights.

II. Purpose of Management Plan

In 1997 the 75th Texas Legislature established a statewide comprehensive regional water planning initiative with the enactment of Senate Bill No. 1 ("SB1"). Among the provisions of SB1 were amendments to Chapter 36 of the Texas Water Code requiring groundwater conservation districts to develop a groundwater management plan that shall be submitted to the Texas Water Development Board for approval as administratively complete. The groundwater management plan is specified to contain estimates on the availability of groundwater in the District, details of how the District would manage groundwater and management goals for the District. In 2001 the 77th Texas Legislature further clarified the water planning and management provisions of SB1 with the enactment of Senate Bill No. 2 ("SB2").

In addition, in 2005 the 79th Texas Legislature enacted House Bill No. 1763, which 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 districts will submit the DFCs to the executive administrator of the Texas Water Development Board ("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.

The administrative requirements of the Chapter 36, Water Code, provisions for groundwater management plan development are specified in 31 Texas Administrative Code, Chapter 356 of the Texas Water Development Board Rules. This plan fulfills all requirements for groundwater management plans in SB1, SB2, Chapter 36, Water Code, and administrative rules of the Texas Water Development Board.

III. Time Period of Management Plan

This plan shall be in effect for a period of ten years from the date of approval by TWDB, unless a new or amended management plan is adopted by the District Board of Directors and approved by TWDB. This plan will be reviewed within five years as required by

Sec. 36.1072(e), Water Code. The District will consider the necessity to amend the plan and re-adopt the plan with or without amendments as required by Sec. 36.1072(e), Water Code.

IV. Coastal Plains Groundwater Conservation District

The District was created in 2001 by the 77th Texas Legislature enacting House Bill No. 3640, which was recorded in Chapter 1358 of the Acts of the 77th Texas Legislature and codified as Chapter 8831, Special District Local Laws Code. The District was confirmed by local election held in Matagorda County on November 6, 2001 with 68.7 percent of the voters in favor of the District.

The District is located in Matagorda County, Texas. The District boundaries are the same as the area and extent of Matagorda County. The District is bounded by Jackson, Calhoun, Brazoria and Wharton Counties. As of the plan date, groundwater conservation districts (GCDs) exist in all counties bounding the district. The GCDs neighboring the District are: Brazoria County GCD (Brazoria), Calhoun County GCD (Calhoun County), Coastal Bend GCD (Wharton), and Texana GCD (Jackson) (see Figure 1).

The District is located in Groundwater Management Area (GMA) 15. Chapter 36, Water Code, authorizes the District to co-ordinate its management of groundwater with other GCDs in GMA 15. The other confirmed GCDs that are located in GMA 15 are: Fayette County GCD (Fayette), Pecan Valley GCD (DeWitt), Texana GCD (Jackson), Calhoun County GCD (Calhoun County), Coastal Bend GCD (Wharton), Colorado County GCD (Colorado), Victoria County GCD (Victoria), Evergreen UWCD (Karnes), Goliad County GCD (Goliad), Refugio County GCD (Refugio), and Bee County GCD (Bee). (See Figure 2).

The District Board of Directors is composed of seven members elected to staggered four-year terms. Four directors are elected from county precincts and three directors are elected at-large. The Board of Directors holds regular meetings at the District offices on the fourth floor of the County of Matagorda Office Building at 2200 Seventh Street in Bay City, Texas. Meetings of the Board of Directors are public meetings and held in accordance with requirements of the Texas Open Meetings Act and Chapter 36, Water Code.

V. Authority of the District

The District derives its authority to manage groundwater within the District by virtue of the powers granted and authorized in the District's enabling act, Chapter 8831, Special District Local Laws Code. (Appendix A). The District, acting under authority of the enabling legislation, assumes all the rights and responsibilities of a groundwater conservation district specified in Chapter 36, Water Code. Upon adoption of the District rules by the Board of Directors in a public meeting, the authority to manage the use of groundwater in the District will be governed at all times by the due process specified in the District rules. (Appendix B).

VI. Geological Formations and Aquifers

All groundwater pumped in Matagorda County originates from the Gulf Coast Aquifer. The Gulf Coast Aquifer is a major aquifer paralleling the Gulf of Mexico coastline from the Louisiana border to the border of Mexico (George and others, 2011). The Gulf Coast Aquifer is comprised of, from shallowest to deepest, the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper Aquifer, with parts of the Catahoula Formation acting as the Catahoula Confining System.

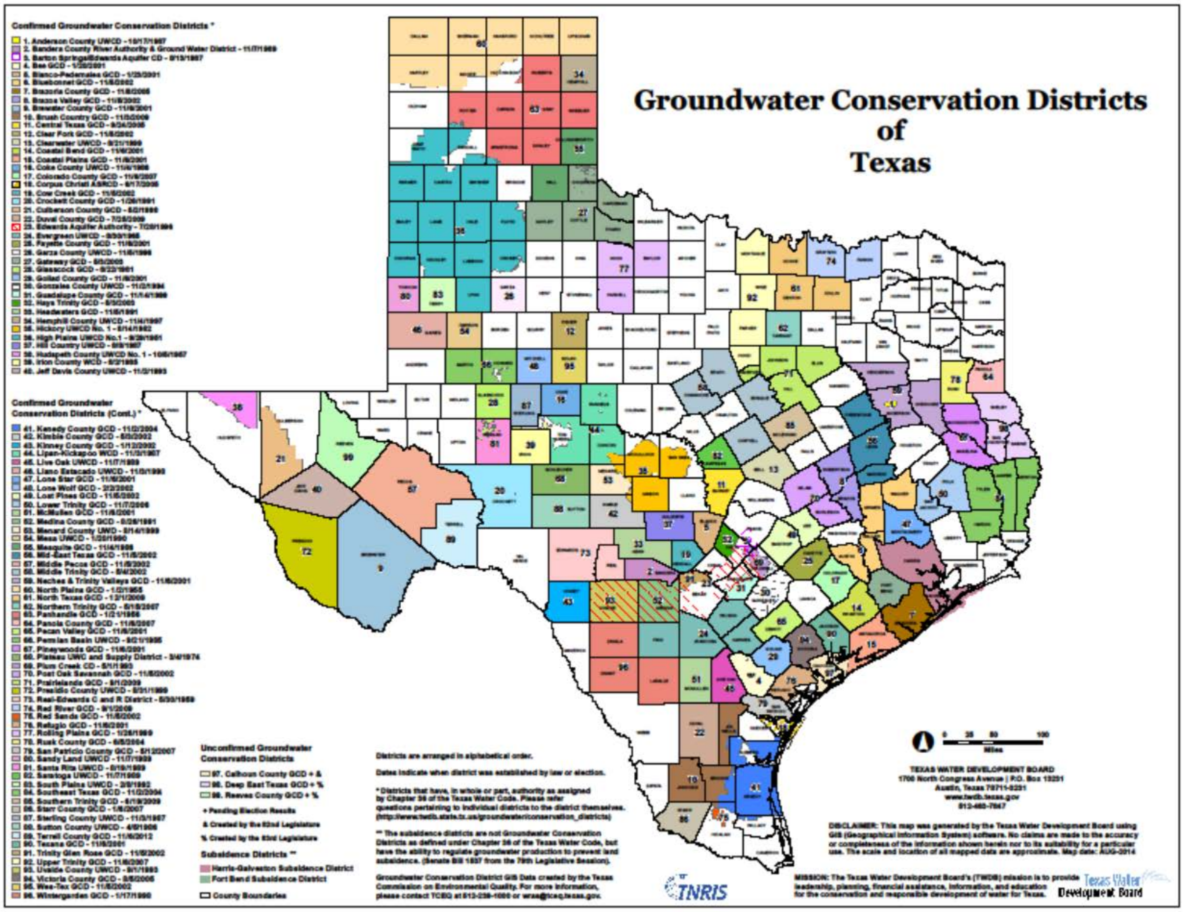

Figure 1. Neighboring Districts to Coastal Bend Groundwater Conservation District

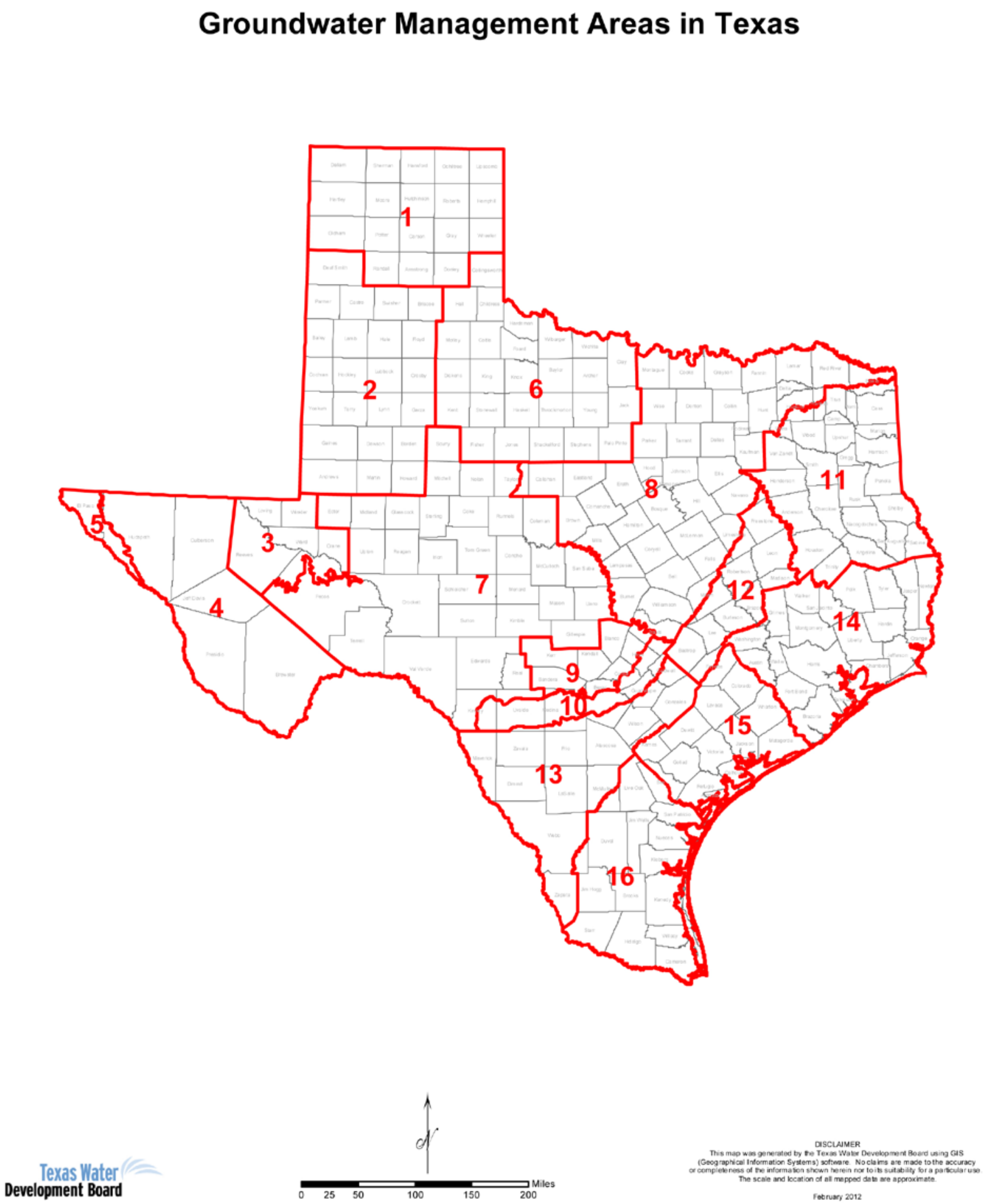

Figure 2. Groundwater Management Areas in Texas

The most recent studies funded by the TWDB that delineate the structure and stratigraphy of the Gulf Coast Aquifer are by Young and others (2010; 2012). These studies subdivided the aquifer units into geological formations based on chronostratigraphic correlations. Figure 3 shows the relationships between geological formations and aquifers as defined by Young and others (2010, 2012) and study of the Catahoula Aquifer (LGB Guyton and INTERA, 2013). Figure 4 is a vertical cross-section through the Gulf Coast Aquifer that crosses through Matagorda County.

All of the District's registered wells are located in either the Chicot Aquifer or the Evangeline Aquifer. As shown in Figure 4, these two aquifers comprise the majority of the upper 2,000 feet of the Gulf Coast Aquifer in Matagorda County. These two aquifers are described below.

Chicot Aquifer - The Chicot Aquifer includes, from the shallowest to deepest, the Beaumont and Lissie Formations of Pleistocene age and the Pliocene-age Willis Formation. The Beaumont outcrop covers a large part of the lower coastal plain except where cut by modern river valleys or covered by Holocene wind-blown sand in south Texas. The Beaumont is often composed of clay-rich sediments transected by sandy fluvial and deltaic-distributary channels. Much of the original depositional morphology of Beaumont fluvial, deltaic, and marginal-marine systems, such as abandoned channels and relict beach ridges, can be seen at the surface in aerial photographs. At outcrop the Lissie is composed of fine-grained sand and sandy clay and unconformably overlies and onlaps the Willis (Morton and Galloway, 1991). The Lissie is dominated by nonmarine depositional systems in the onshore part across most of the Texas Gulf Coast, although some shore-zone facies occur in Matagorda County as well as other coastal counties. At outcrop, the Willis is composed of gravelly coarse sand in several upward-fining successions that are interpreted as incised valley fills overlain by transgressive deposits (Morton and Galloway, 1991). Near the modern shoreline and offshore, Willis deltaic and marine systems record four cyclic depositional episodes bounded by transgressive shales (Galloway and others, 2000). Willis fluvial systems include dip-oriented sand-rich channel-fill facies and sand-poor interchannel areas, which grade toward the coast into shore-parallel deltaic and shore-zone sands and interdeltaic muddy bay deposits. Individual Willis sands vary widely in thickness from about 20 to 200 feet and are separated by muds of similar thickness (Knox and others, 2006).

Evangeline Aquifer- The Evangeline Aquifer includes the upper Goliad Formation of earliest Pliocene and late Miocene age, the lower Goliad Formation of middle Miocene age, and the upper unit of the Lagarto Formation (a member of the Fleming Group) of middle Miocene age. The Goliad Formation in Matagorda County was formed as part of the Eagle Lake Extrabasinal fluvial system. In this system the Goliad fluvial depositional systems consist of channel-fill and interchannel deposits (Young and others, 2012). Channel belts typically are 10 to miles wide with about 50% sands and the interchannel deposits having less than 20 percent sand. The Upper Lagarto is comprised of deposits from the Fleming Group. The Fleming Group comprises several large fluvial systems that grade downdip into equally large delta and shore-zone systems (Rainwater, 1964; Doyle, 1979; Spradlin, 1980; DuBar, 1983; Galloway and others, 1982, 1991). In Matagorda, the Fleming sands tend to be align parallel to the shoreline and to have sand contents between 10 and 40 percent (Young and others, 2012).

Burkeville - The Burkeville Confining Unit is represented by the middle unit of the Lagarto Formation of middle and early Miocene age, which is the chronostratigraphic layer with the most widespread clayey interval between the Evangeline and Jasper Aquifers.

ERA	Epoch		Est. Age (M.Y)	Geologic Unit	Hydrogeologic Unit
Cenozoic	Pleistocene		0.7	Beaumont	CHICOT AQUIFER
			1.6	Lissie	
	Pliocene		3.8	Willis	
			11.2	Upper Goliad	EVANGELINE AQUIFER
	Miocene	Late	14.5	Lower Goliad	
			17.8	Upper Lagarto	
		Middle		Middle Lagarto	BURKEVILLE
		Early		Lower Lagarto	JASPER AQUIFER
			24.2	Oakville	
	Oligocene		32	Frio	CATAHOULA
			34	Vicksburg	

Figure 3. Geologic and Hydrologic Units of the Gulf Coast aquifer in Matagorda County, Modified from (based on Young and others (2010; 2012) and LGB Guyton and INTERA (2012)).

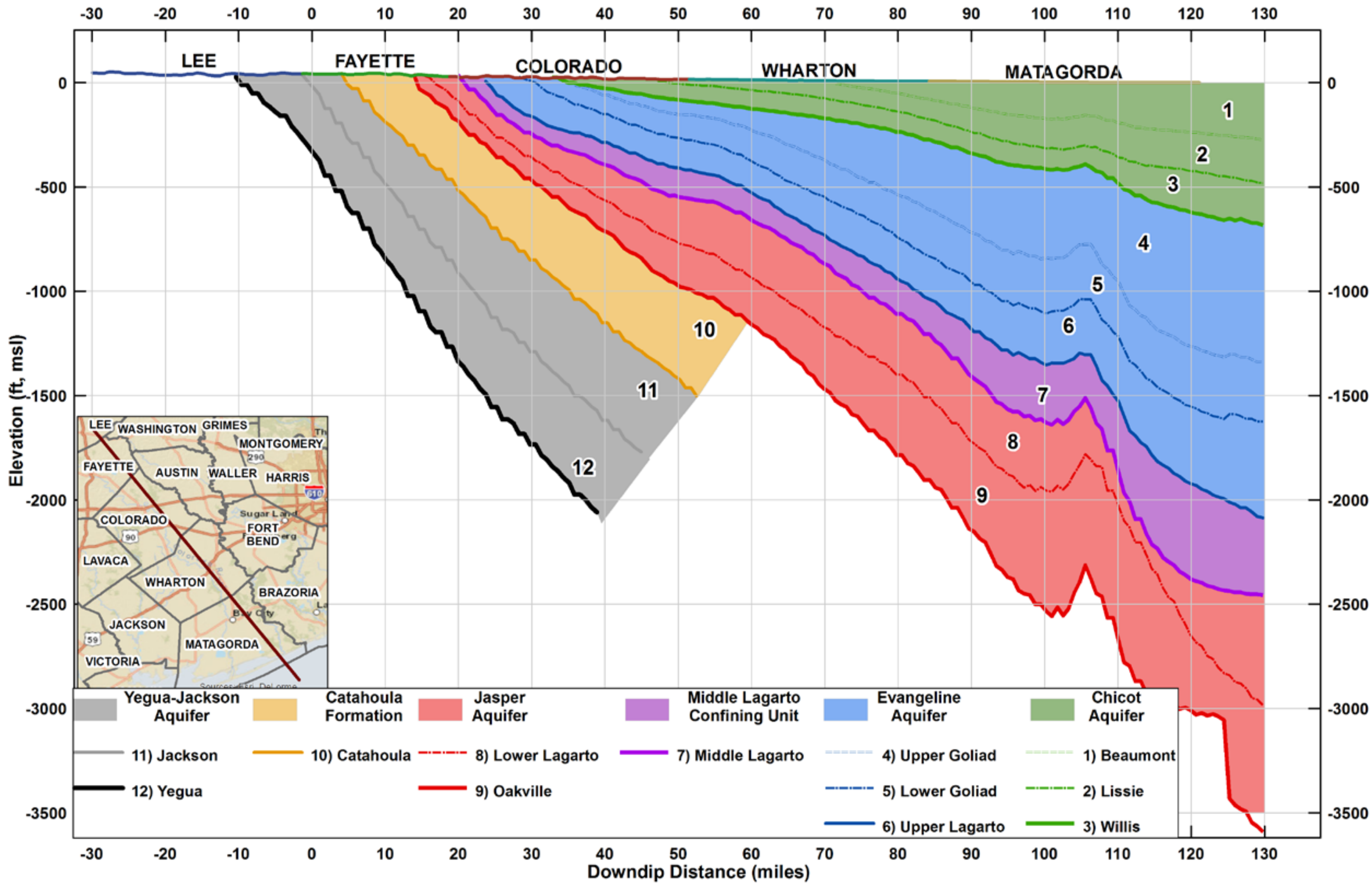

Figure 4. Vertical Cross-Section of the Geological Units through the middle of Matagorda County based

Jasper Aquifer -Jasper Aquifer includes the lower Lagarto unit of early Miocene age, the early Miocene Oakville sandstone member of the Fleming Group, and the sandy intervals of the Oligocene-age Catahoula Formation.

VII. Geomorphology of the District

Matagorda County topography ranges from very flat coastal marshes to very gently rolling hills. There is a very gentle seaward slope of approximately 2 feet per mile. The drainage of Matagorda County streams were determined by the initial slope of the land. There are three major drainages in the county: Tres Palacios Creek in the west, the Colorado River in the center, and Caney Creek in the east. The valley of the Colorado River has steep walls and smaller streams exhibit the V-shaped cross profile of streams in the youthful stage. The very poorly drained coastal marshes have sinuous tidal channels and shallow round lakes. The Colorado River delta, meander belts in the stream valleys, coastal marshes, barrier islands, wash-over fans, and abandoned river valleys are other notable features.

Piercement type salt domes affect the topography of the county. At Old Gulf a subsurface salt dome caused a topographic high about 40 feet above the surrounding land surface. Sulfur associated with the salt dome was mined intensively and the area is now a topographic low. At Clemville the slight surface expression of another salt dome has been reduced by the removal of oil and gas. (Hammond, 1969)

VIII. Management of Groundwater Supplies.

The District will evaluate and monitor groundwater conditions and regulate production consistent with this plan and the District Rules. Production will be regulated as needed to conserve groundwater, and protect groundwater users, in a manner not to unnecessarily and adversely limit production or impact the economic viability of the public, landowners and private groundwater users. In consideration of the importance of groundwater to the economy and culture of the District, the District will identify and engage in activities and practices that will permit groundwater production and, as appropriate, protect the aquifer and groundwater in accordance with this Management Plan and the District's rules. A monitoring well network will be maintained to monitor aquifer conditions within the District. The District will make a regular assessment of water supply and groundwater storage conditions and will report those conditions as appropriate in public meetings of the Board or public announcements. The District will undertake investigations, and co-operate with third-party investigations, of the groundwater resources within the District, and the results of the investigations will be made available to the public upon being presented at a meeting of the Board.

The District will amend the current rules to implement this plan to regulate groundwater withdrawals by means of well spacing and production limits as appropriate to implement this Plan. In making a determination to grant a permit or limit groundwater withdrawals, the District will consider the available evidence and, as appropriate and applicable, weigh the public benefit against the individual needs and hardship.

To accomplish the purposes of Texas Water Code Chapter 36, and to achieve the stated purposes and goals of the District, including managing the sustainability of the aquifers and preventing significant, sustained water-level declines within the aquifers, the District shall manage total groundwater production on a long-term basis to achieve the applicable desired future condition. The District may establish production limits on new regular permits or existing permits. All permits are issued subject to any future production limits adopted by the District.

The factors that the District may consider in making a determination to grant a drilling and operating or operating permit or limit groundwater withdrawals will include:

1. The purpose of the rules of the District;
2. The equitable distribution of the resource;
3. The economic hardship resulting from grant or denial of a permit, or the terms prescribed by the permit;
4. This Management Plan and Desired Future Conditions of the District as adopted in Joint Planning under Tex. Water Code, Sec. 36.108; and
5. The potential effect the permit may have on the aquifer, and groundwater users.

The transport of groundwater out of the District will be regulated by the District according to the Rules of the District.

As allowed under §36.116(b), Water Code, in promulgating rules, the district may preserve historic or existing use to the maximum extent practicable. If production limitations are necessary, historic user permits and regular permits will be required to reduce permits based on aquifer levels. The Board will determine if permit limits are necessary, and will consider:

1. the modeled available groundwater determined by the executive administrator;
2. the executive administrator's estimate of the current and projected amount of groundwater produced under exemptions granted by District Rules (Appendix B) and §36.117, Water Code;
3. the amount of groundwater authorized under permits previously issued by the District;
4. a reasonable estimate of the amount of groundwater that is actually produced under permits issued by the District; and
5. yearly precipitation and production patterns.

Permit limitations will be triggered if average aquifer levels decline below the Desired Future Condition. The first permit limitations will be triggered when aquifer levels drop at least one foot below the Desired Future Condition level; the second permit limitations will be triggered when aquifer levels drop at least two feet below the Desired Future Condition level; the third permit limitations will be triggered when aquifer levels drop at least four feet below the Desired Future Condition level. The percentage reduction will be based on hydrogeologic calculations of that amount of production that must be reduced to restore aquifer levels above the Desired Future Condition level. The exact amount of percentage reduction for each type of permit will be established by rule.

The District will employ reasonable and necessary technical resources at its disposal to evaluate the groundwater resources available within the District and to determine the effectiveness of regulatory or conservation measures. A public or private user may appeal to the Board for discretion in enforcement of the provisions of the water supply deficit contingency plan on grounds of adverse economic hardship or unique local conditions. The exercise of discretion by the Board shall not be construed as limiting the power of the Board.

IX. Desired Future Conditions -- (§36.108, Water Code, and 31 TAC 356.5 (a)(5)(A))

Per §36.001, Water Code, "Desired future condition" means a quantitative description, adopted in accordance with Section 36.108, Water Code, of the desired condition of the groundwater resources in a management area at one or more specified future times. To establish a Desired Future Condition, the District shall participate in the joint planning process in GMA 15 as defined per §36.108, Water Code, including establishment of Desired Future Conditions (DFCs) for management areas within the District.

Based on the GMA 15 joint planning resolution dated 14 July 2010 (Hudgins, 2011), the District agreed to adopt the following Desired Future Condition:

> "An average drawdown of the Gulf Coast Aquifer within the GMA 15 boundary of 12 feet relative to year 1999 starting conditions in accordance with Table 7 of GAM Run 10-008 Addendum."

Figure 5 shows Table 7 of Gam Run 10-008 Addendum (Wade, 2010). Currently, the District has no registered wells that intersect either the Burkeville or the Jasper Aquifer. And, as shown in Figure 5, the District does not anticipate any pumping from the Burkeville or the

GAM Run 10-008 Addendum
June 30, 2010
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Table 7 GMA 15 12 feet scenario
Drawdown after 60 years (in feet, 1999 Starting Conditions)

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	0.0	25.6	0.6	--	--	0.6	0.6
Bee	3.3	14.2	10.5	9.7	5.1	8.9	8.5
Calhoun	-0.9	9.7	2.1	2.6	--	2.1	2.1
Colorado	5.9	9.8	8.1	14.7	21.3	13.3	12.8
DeWitt	0.3	5.6	4.8	15.0	23.0	15.3	15.4
Fayette	--	14.2	14.2	42.4	49.3	42.2	42.1
Goliad	-1.2	3.7	2.6	7.4	9.3	6.0	5.4
Jackson	13.4	17.1	15.2	12.1	19.6	15.1	16.1
Karnes	--	-0.2	-0.2	16.1	15.7	14.3	13.7
Lavaca	5.3	5.6	5.5	14.7	29.4	16.1	16.7
Matagorda	3.3	19.0	8.1	14.8	--	8.7	8.1
Refugio	0.6	32.2	15.1	12.8	--	14.7	15.1
Victoria	-9.2	4.1	-2.3	3.5	7.8	1.0	0.0
Wharton	12.7	5.8	9.3	19.3	21.6	14.7	13.1
Overall	**3.7**	**10.8**	**7.4**	**13.5**	**21.1**	**12.0**	**11.5**

Pumping (AF/yr) 12 feet scenario

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	1,863	--	1,863	--	--	1,863	1,863
Bee	3,707	5,480	9,187	17	289	9,493	9,476
Calhoun	2,939	63	3,002	--	--	3,002	3,002
Colorado	24,937	23,102	48,039	--	918	48,957	48,957
DeWitt	1,019	7,071	8,090	128	6,408	14,626	14,498
Fayette (GMA 15)	--	906	906	157	7,408	8,490	8,314
Fayette (GMA 12)	--	--	--	--	339	339	339
Goliad	714	10,582	11,296	306	102	11,704	11,398
Jackson	55,772	20,615	76,387	--	--	76,387	76,387
Karnes	--	105	105	261	2,865	3,231	2,970
Lavaca	3,095	12,647	15,742	151	4,496	20,389	20,238
Matagorda	36,386	9,513	45,899	--	--	45,899	45,899
Refugio	6,379	22,951	29,330	--	--	29,330	29,330
Victoria	8,159	27,539	35,698	--	--	35,698	35,698
Wharton	110,822	67,676	178,498	--	--	178,498	178,498
Overall (GMA 15)	**255,792**	**208,250**	**464,042**	**1,039**	**22,486**	**487,567**	**486,528**

Figure 5. Table 7 from GAM Run Addendum 10-008 (Wade, 2010)

Jasper Aquifer before 2060. For the purpose of joint planning in GMA 15, the District considers the Burkeville Formation and Jasper Aquifer as non-relevant aquifers. Thus, the District will not have a DFC for the Burkeville and the Jasper Aquifer. For the Chicot and the Evangeline Aquifers, the District will manage it groundwater supplies to achieve a DFC of not more than 8.1 ft of average drawdown in the Chicot and Evangeline Aquifers over the period from 1999 to 2060. To manage the Chicot and Evangeline Aquifers so that 8.1 ft DFC will not be violated, the District will adopt rules to regulate groundwater withdrawals by means of well spacing and production limits as appropriate.

X. Modeled Available Groundwater - (§36.1071(e)(3)(A), Water Code and 31 TAC 356.5(a)(5)(A))

Modeled available groundwater is defined in §36.001, Water Code, as "the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition established under Section 36.108. Table X.1 provides the MAG values for Matagorda County as determined by GAM Run 10-28 (Hill and Oliver, 2011). These MAG values are based on the DFC established by GMA 15 (Hudgins, 2011).

Table X.1 Modeled Available Groundwater (acre-feet/yr) for the Gulf Coast Aquifer in Matagorda County (Hill and Oliver, 2011) (Appendix E)

Year	Modeled Available Groundwater (MAG) (acre-feet/yr)
2010	45,896
2020	45,896
2030	45,896
2040	45,896
2050	45,896
2060	45,896

The MAGs listed in Table X.1 were developed through the application of Version 1.01 of the groundwater availability model for the central portion of the Gulf Coast Aquifer (Chowdhury and others, 2004). This model includes four layers represent the Chicot Aquifer (layer 1), the Evangeline Aquifer (layer 2), the Burkeville Unit (layer 3), and the Jasper Aquifer including portions of the Catahoula Unit (layer 4). Wade (2010) provides the description of the methods, assumptions, and results of the groundwater availability model simulations.

The District will consider the MAGs in Table X.1 along with other factors, when issuing permits. Implicit in this consideration is recognition of the limitation of the groundwater availability model simulations (see Wade, 2010) and the TWDB disclaimer associated with MAG report (Hill and Oliver, 2011) that:

> "Given the limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are the 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 a particular time."

XI. Management Zones

The District is divided into a two Management Zones for the purpose of evaluating and managing groundwater resources recognizing the different characteristics and anticipated future development of the aquifers in the District. These zones are named the Shallow Management Zone and Deep Management Zone. In general, the shallow groundwater zone and deep groundwater zone will represent fresh water and brackish water, respectively. The methodology used to identify whether a well is located in the Shallow or Deep Groundwater Zone is determined per the District Rules.

Per District Rules the decision on whether or not a well is located in a Shallow or Deep Groundwater Zone is based on the measured total dissolved solids of groundwater from the water well, the potential for the brackish well to impact groundwater availability in the Shallow Management Zone, and the District's map of estimated depth to groundwater with total dissolved solid concentrations above 1,000 ppm. Figure 6 shows the District's map (at the time of the writing of this management plan) that provides an estimated depth to total dissolved solid concentrations above 1,000 ppm. Figure 6 was developed by the District's hydrogeological consultant based on analyses of geophysical logs include those cited by Young and others (2010) and will change over time as information become available.

XII. Water Well Inventory

The District will assign permitted wells to a management zone and to an aquifer based on the location of the well's screen or well depth using the Rules of the District. If no well screen information is available then a permitted well will be assigned to a management zone and to an aquifer based on the total depth of the well. The assignment of the permitted well will be made at the time of permit. The District will assign exempt wells to a management zone and to an aquifer based on available information for the exempt well. The District will use the assignments to help track the permitted pumping and production for each aquifer and for each management zone.

XIII. Groundwater Monitoring

The District will maintain a monitoring well network that will be used by the District to obtain measured water levels. Groundwater monitoring will be designed to monitor changes in groundwater conditions over time. The District encourages well owners to volunteer wells to be used as part of the monitoring network. The District will accept wells into, or replace an existing well in, the monitoring network. The selection process will consider the well proximity to other monitoring wells, to permitted and exempt wells, to streams, and to geographic and political boundaries. If no suitable well locations can be found to meet the monitoring objectives in a specific aquifer or management zone, the District may evaluate the benefits of converting an oil and gas well to a water well, drilling and installing a new well, or using modeled water levels for that area until such time as a suitable well can be obtained for monitoring.

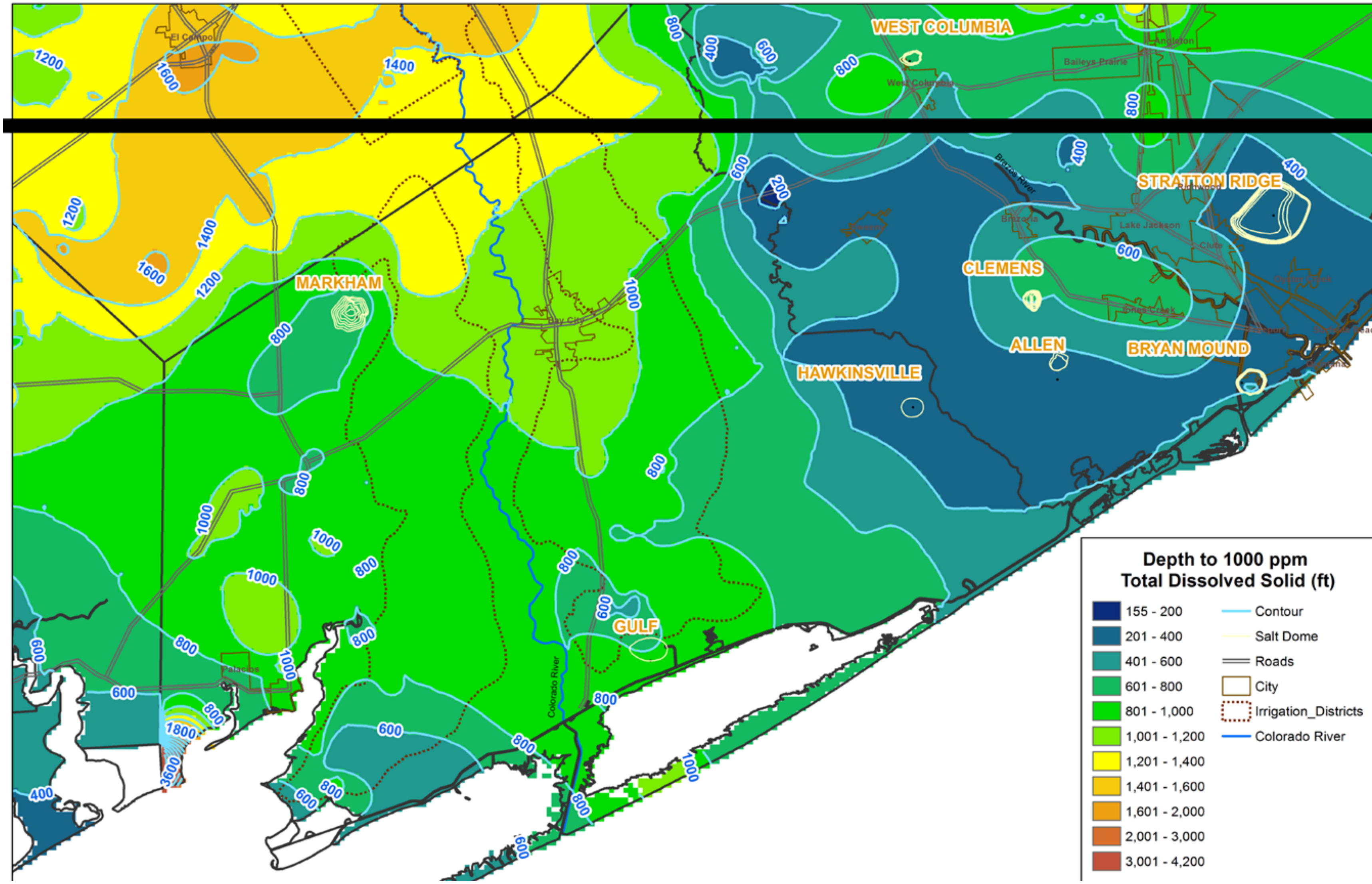

Figure 6. **The Estimated Depth Below Land Surface where Total Dissolved Solid Concentrations in Groundwater Exceed 1,000 ppm.**

XIV. Estimate of the amount of groundwater used in the District on annual basis - (§36.1071(e)(3)(B), Water Code, and 31 TAC 356.5 (a)(5)(B))

The data for groundwater use within the District for years 2000-2011 were obtained from the TWDB Historical Water Use Survey (WUS) Data published as part of the 2012 State Water Plan. (Appendix C).

The Coastal Plains GCD began permitting non-exempt wells in 2005. Since that time, annual water use reports were collected from each permitted user in the District at the end of each calendar year. Exempt uses (*) were calculated based on the initial well registration of a well owner. The reported data for groundwater use within the District for years 2005-2012 is shown below in Table XIV.2.

Table XIV.2. Coastal Plains Groundwater Conservation Total Groundwater Use Source: CPGCD database – July 2013

Type of Use	2005	2006	2007	2008	2009	2010	2011	2012
Aquaculture	1,203	809	2,985	2,660	2,191	1,704	2,771	5,056
Commercial/Industrial	1,693	2,744	3,582	2,567	2,759	2,789	2,949	4,063
Crop Rice	2,241	5,420	1,081	2,260	13,660	4,940	14,213	4,314
Row Crop	0	0	4	93	38	35	256	46
Municipal	2,908	2,770	3,294	3,907	3,802	3,150	4,258	3,411
Nursery/Trees	0	0	130	120	151	130	8	130
Turfgrass	11,669	8,279	5,438	12,011	14,541	12,905	27,278	18,245
Waterfowl	54	0	605	357	712	548	3,396	2,680
Pasture/Hay	102	1,275	181	130	1,186	697	3,410	609
Recreational	0	0	11	14				
*Domestic	1,278	1,540	1,702	1,704				
*Livestock	597	687	702	754	40	3	35	35
Other	0	0	0	0	0	79	0	179
Total Groundwater (ac-ft)	21,745	23,523	19,715	25,528	39,079	26,978	58,574	38,767

XV. Estimate of the Annual Recharge from Precipitation to the Groundwater Resources within the District - (§36.1071(e)(3)(C), Water Code, and 31 TAC 356.5 (a)(5)(C))

The average amount of groundwater recharge from precipitation was estimated using Groundwater budget studies that employed the Central Gulf Coast Aquifer Model (Chowdhury and others, 2004) and the Lower Colorado River Basin Model (Young and others, 2010). The GAM runs were carried out by the Texas Water Development Board and the results were described in the report (GAM Run 13-026, Wade, 2013). The LCRB Model Runs were performed by INTERA. The annual recharge estimate represents the average recharge from 1981-1999. The average annual recharge estimates in Table 3 are 20,943 192,167 AF/yr based on the Central Gulf Coast Aquifer Model and the Lower Colorado Aquifer Model, respectively. As shown in Table XV.1, all recharge from precipitation occurs in the Chicot formation. One of the reasons for the large difference between the recharge values is the different numerical construction between the two models. The LCRB model has significantly smaller grid spacing and model layers than does the GAM so that it can better represent the shallow flow zone (Toth, 1963, 1966, 1970). The shallow flow zone is the upper portion of a groundwater flow system that is primarily responsible for baseflow into the rivers and streams and has hydraulic head gradients, which control flow directions, that largely mimic the topographic gradients.

Table XV.1. Estimate of the Annual Recharge from Precipitation to the Groundwater Resources within the District rounded to nearest 1 acre-foot.

Aquifer	Recharge from Precipitation	
	Central Gulf Coast GAM	Lower Colorado Basin Model
Gulf Coast Aquifer System	20,943	192,167

XVI. Estimate of the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers - (§36.1071(e)(3)(D), Water Code, and 31 TAC 356.5 (a)(5)(D))

The surface water-groundwater exchanges between various components average over the 1981-1999 time-frame is present in Table XVI.1. The Central Gulf Coast Aquifer Model (Chowdhury and others, 2004) and the Lower Colorado River Basin Model (Young and others, 2010). The GAM runs were carried out by the Texas Water Development Board and the results were described in the report (GAM Run 13-026, Wade, 2010). The LCRB Model Runs were performed by INTERA. Negative values indicate discharge out of aquifer. The results indicated that over the 1981-1999 time frame, there is a net loss of water from the Chicot Aquifer to surface water bodies. One of the reasons for the large difference between the water exchange values that the two models have very different numerical grids and construction. The LCRB model has significantly smaller grid spacing and model layers than does the GAM so that it can better represent the shallow flow zone (Toth, 1963, 1966, 1970). The shallow flow zone is the upper portion of a groundwater flow system that is primarily responsible for baseflow into the rivers and streams and has hydraulic head gradients, which control flow directions, that largely mimic the topographic gradients.

Table XVI.1. Estimate of the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers rounded to nearest 1 acre-foot.

Aquifer	Net Surface Water-Groundwater Water Exchange (AF/yr)	
	Central Gulf Coast GAM	Lower Colorado Basin Model
Gulf Coast Aquifer System	-42,726	-116,597

Note: negative values indicate a net loss of groundwater to surface water

XVII. Estimate of 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 - (§36.1071(e)(3)(E), Water Code and 31 TAC 356.5(a)(5)(E))

The lateral movement of water (inflow into and out of the district) across the district boundaries is referred to as horizontal exchanges. Water budget calculations were made by TWDB for each year during the 1980-1999 time frame over the entire Coastal Plains GCD. Vertical exchanges represent the cross-formational flows within the District boundaries among various aquifer formations. Table XVII.1 shows water budget calculations based on results from the Central Gulf Coast (GAM Run 13-026, Wade, 2013). Table XVII.2 shows water budget calculations based on results from the Lower Colorado River Basin Model .

Table XVII.1. Estimate of annual volume of flow into and out of District rounded to nearest 1 acre-foot based on results from the Gulf Coast Central GAM

Aquifer	Lateral Flow Into the District (acre-ft/yr)	Lateral Flow Out of the District t(acre-ft/yr)	Flow Between Aquifer and Overlying Geologic Unit [1] (acre-ft/yr)
Gulf Coast Aquifer System	15,421	31,543	NA

Note: NA – not applicable
[1] positive values indicate flow into the aquifer; negative numbers indicate flow out of the aquifer

Table XVII.2. Estimate of annual volume of flow between each aquifer in the District rounded to nearest 1 acre-foot based on results from the Lower Colorado River Basin Model

Aquifer	Flow Into the District (acre-ft/yr)	Flow Out of the District t(acre-ft/yr)	Flow Between Aquifer and Overlying Geologic Unit [1] (acre-ft/yr)
Gulf Coast Aquifer System	27,426	-24,894	

Note: NA – not applicable
[1] positive values indicate flow into the aquifer; negative numbers indicate flow out of the aquifer

XVIII. Projected water supply in the district, according to the most recently adopted state water plan - (§36.1071(e)(3)(F), Water Code, and 31 TAC 356.5(a)(5)(F))

The projected surface water supply in the district, according to the most recently adopted state water plan, is provided in Appendix C, in the Table titled, "Projected Surface Water Supplies-TWDB 2012 State Water Plan."

XIX. Projected total demand for water in the district according to the most recent adopted state water plan - 31TAC356.5 (a)(5)(G) (TWC 36.1071(e)(3)(G))

The projected total demand for water in the district, according to the most recently adopted state water plan, is provided in Appendix C, in the Table titled, "Projected Water Demands: TWDB 2012 State Water Plan Data."

XX. Water Supply Needs and Water Management Strategies Included in The Adopted State Water Plan – 31TAC356.5(a)(7) (TWC 36.107(e)(4)

The water supply needs for the district, according to the most recently adopted state water plan, is provided in Appendix C, in the Table titled, "Projected Water Supply Needs: TWDB 2012 State Water Plan Data."

The water management strategies for the district, according to the most recently adopted state water plan, is provided in Appendix C, in the Table titled, "Projected Water Management Strategies: TWDB 2012 State Water Plan Date."

XXI. Actions, Procedures, Performance and Avoidance Necessary to Effectuate the Plan

The District will implement the provisions of this management plan and will utilize the objectives of the plan as a guide for District actions, operations and decision-making. The District will ensure that its planning efforts, activities and operations are consistent with the provisions of this plan.

The District will adopt rules in accordance with Chapter 36 of the Texas Water Code and all rules will be followed and enforced. The development of rules will be based on the best scientific information and technical evidence available to the District.

The District will encourage cooperation and coordination in the implementation of this plan. All operations and activities will be performed in a manner that encourages the cooperation of the citizens of the District and with the appropriate water management entities at the state, regional and local level.

XXII. Methodology for Tracking the District's Progress in Achieving Management Goals

The general manager of the District will prepare and submit an annual report (Annual Report) to the District Board of Directors. The Annual Report will include an update on the District's performance in achieving the management goals contained in this plan. The general manager will present the Annual Report to the Board of Directors Within ninety (90) days following the completion of the District's Fiscal Year, beginning in the fiscal year starting on October 1, 2013. The District will maintain a copy of the Annual Report on file for public inspection at the District offices, upon adoption by the Board of Directors.

XXIII. Management Goals

1) Providing for the Most Efficient Use of Groundwater in the District.

1.1 <u>Objective</u> – Each year, the District will require 100 percent of exempt or permitted wells that are constructed within the boundaries of the District to be registered with the District in accordance with the District rules.

1.1 <u>Performance Standard</u> – The number of exempt and permitted wells registered by the District for the year will be incorporated into the Annual Report submitted to the Board of Directors of the District.

1.2 Objective – Each year, the District will regulate the production of groundwater by maintaining a system of permitting the use of groundwater within the boundaries of the District in accordance with the District Rules.

1.2 Performance Standard – Each year the District will accept and process applications for the permitted use of groundwater in the District in accordance with the permitting process established by District rules. The number and type of applications made for the permitted use of groundwater in the District and, the number and type of permits issued by the District will be included in the Annual Report given to the Board of Directors.

1.3 Objective –The District will maintain a monitoring well network with at least 10 monitoring wells to provide coverage across the aquifers and within the District. The District will measure water levels at the monitoring well locations at least once every calendar year. A written analysis of the water level measurements from the monitoring wells will be made available through a presentation to the Board of the District at least once every three years.

1.3 Performance Standard –The performance standards are as follows:

1. Maintain a monitoring well network and its criteria, and measure at least 10 monitoring wells at least once every calendar year.
2. Number of monitoring wells measured annually by the District.
3. Written report presented to the Board to document that water levels at these monitoring wells have been measured a minimum of once each year.

2) Controlling and Preventing Subsidence.

2.1 Objective – Each year, the District will hold a joint meeting with neighboring Groundwater Conservation Districts focused on sharing information regarding subsidence and the control and prevention of subsidence through the regulation of groundwater use.

2.1 Performance Standard – Each year, a summary of the joint meeting on subsidence issues will be included in the Annual Report submitted to the Board of Directors of the District.

2.2 Objective – Each year, the District will provide one article annually on the District's website to educate the public on the subject of subsidence.

2.2 Performance Standard – The Annual Report submitted to the Board of Directors will include a copy of the article posted on the District's website.

3) Natural Resource Issues That Affect the Use and Availability of Groundwater or are affected by the Use of Groundwater.

3.1 Objective – Each year the District will inquire to the Texas Railroad Commission asking whether any new salt water or waste disposal injection wells have been permitted by the Texas Railroad Commission to operate within the District.

3.1 Performance Standard – Each year a copy of the letter to the Texas Railroad Commission asking for the location of any new salt water or waste disposal wells permitted to operate within the District will be included in the Annual Report submitted to the Board of Directors of the District along with any information received from the TRC.

3.2 Objective – Each year the District will request the Texas Railroad Commission to provide a copy of the results of integrity tests performed on salt water or waste disposal injection wells permitted by the Texas Railroad Commission to operate within the District

3.2 Performance Standard – Each year a copy of the letter to the Texas Railroad Commission requesting the results of the integrity testing performed on salt water or waste disposal injection wells permitted by the Texas Railroad Commission to operate within the District will be included in the Annual Report submitted to the Board of Directors of the District along with any information received from the TRC.

4) Conjunctive Surface Water Management Issues.

4.1 <u>Objective</u> – Each year, the District will participate in the regional planning process by attending 50 percent of the Region K Regional Water Planning Group meetings to encourage the development of surface water supplies to meet the needs of water user groups in the District.

4.1 <u>Performance Standard</u> – The percentage of meetings attended by a District representative at the Region K and Region P Regional Water Planning Group meetings will be noted in the Annual Report presented to the District Board of Directors.

5) Addressing Drought Conditions.

5.1 <u>Objective</u> – Each month, the District will download the updated Palmer Drought Severity Index (PDSI) map and other drought related information from the National Weather Service – Climate Prediction Center website.

5.1 <u>Performance Standard</u> – Quarterly, the District will make an assessment of the status of drought in the District and prepare a quarterly briefing to the Board of Directors. The downloaded PDSI maps and other related information will be included with copies of the quarterly briefing in the District Annual Report to the Board of Directors.

6) Addressing Conservation, Recharge Enhancement, Rainwater Harvesting, Precipitation Enhancement, or Brush Control, where appropriate and cost-effective.

Conservation

6.1a <u>Objective</u> – The District will annually submit an article regarding water conservation for publication to at least one newspaper of general circulation in the District.

6.1a <u>Performance Standard</u> – A copy of the article submitted by the District for publication to a newspaper of general circulation in the District regarding water conservation will be included in the Annual Report to the Board of Directors.

6.1b <u>Objective</u> – The District will develop or implement a pre-existing educational program for use in public or private schools located in the District to educate students on the importance of water conservation.

6.1b <u>Performance Standard</u> – A summary of the educational program developed or implemented by the District for use in public or private schools located in the District will be included in the Annual Report to the Board of Directors for every year this plan is active.

Brush Control

6.2 <u>Objective</u> – Each year, the District will provide one article relating to brush control on the District web site.

6.2 <u>Performance Standard</u> – Each year, the District annual report will include a copy of the information that has been provided on the District web site relating to brush control.

Recharge Enhancement

6.3 <u>Objective</u> – Each year, the District will provide one article relating to recharge enhancement on the District web site.

6.3 <u>Performance Standard</u> – Each year, the District annual report will include a copy of the information that has been provided on the District web site relating to recharge enhancement.

Rainwater Harvesting

6.4 <u>Objective</u> – Each year, the District will provide one article on rainwater harvesting on the District web site.

6.4 <u>Performance Standard</u> – Each year, the District annual report will include a copy of the information on rainwater harvesting that is provided on the District web site.

Precipitation Enhancement

Precipitation enhancement is not an appropriate or cost-effective program for the District at this time because there is not an existing precipitation enhancement program operating in nearby counties in which the District could participate and share costs. The cost of operating a single-county precipitation enhancement program is prohibitive and would require the District to increase taxes. Therefore, this goal is not applicable to the District at this time.

7) Desired Future Conditions (DFCs)

<u>7.1 Management Objective:</u>

At least once every three years, the District will monitor water levels and evaluate whether the change in water levels is in conformance with the DFCs adopted by the District. The District will estimate total annual groundwater production for each aquifer based on the water use reports, estimated exempted use, and other relevant information, and compare these production estimates to the MAGs listed in Table X-1.

<u>7.1 Performance Standard:</u>

1. At least once every three years, the general manager will report to the Board the measured water levels obtained from the monitoring wells within each Management Zone, the average measured drawdown for each Management Zone calculated from the measured water levels of the monitoring wells within the Management Zone, a comparison of the average measured drawdowns for each Management Zone with the DFCs for each Management Zone, and the District's progress in conforming with the DFCs.
2. At least once every three years, the general manager will report to the Board the total permitted production and the estimated total annual production for each aquifer and compare these amounts to the MAGs listed in Table 8-1 for each aquifer.

8) Control and Prevent Subsidence

<u>8.1 Management Objectives:</u>

The District will monitor drawdowns with due consideration to the potential for land subsidence. At least once every three years, the District will report projected land subsidence for areas where water levels will decrease more than 300 feet (over a 50 year period from the year 2000 baseline condition) based on GAM simulations used for the joint planning process.

<u>8.2 Performance Standards:</u>

The number of reports that provide estimates of projected land subsidence.

XXIV. References

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APPENDIX A

Evidence of the Administrative Processes Required For the Certification of the Groundwater Management Plan as Administratively Complete