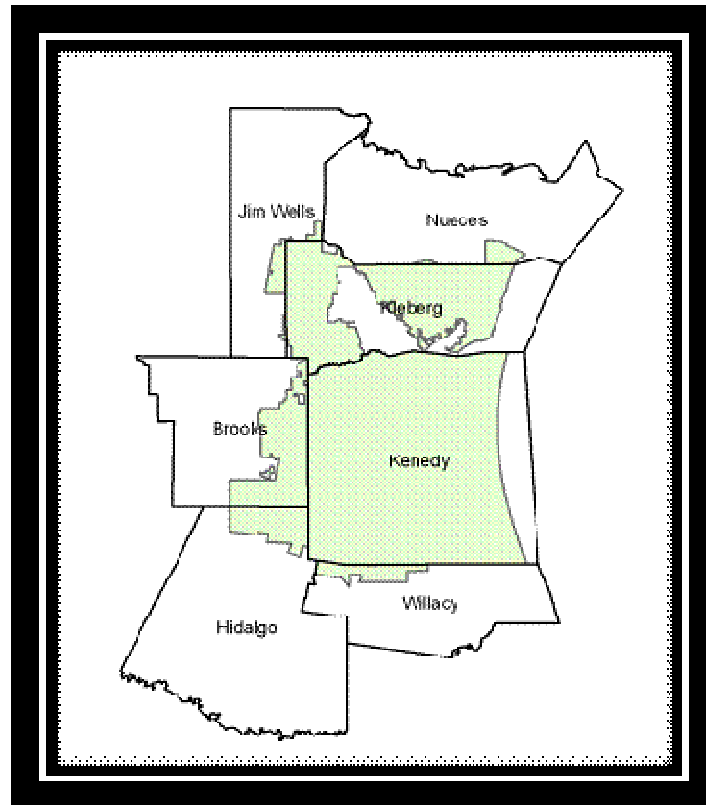


Kenedy County Groundwater Conservation District's Management Plan



Original Plan Adopted by KCGCD: July 6, 2007
Original Plan Approved by TWDB: September 11, 2007
2012 Plan Adopted by KCGCD: July 25, 2012
2012 Plan Approved by TWDB:
2017 Plan Adopted by KCGCD: May 24, 2017
2017 Plan Approved by TWDB: July 18, 2017

Board of Directors

Chuck Burns, President (Precinct 3)
Homero Vera, Vice-President (Precinct 1)
David S. DeLaney, Secretary/Treasurer (Precinct 5)
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APPENDIX E:	GAM Run 11-016: Kenedy County Groundwater Conservation District Management Plan (Author: Rohit Raj Goswami 2016)
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KENEDY COUNTY GROUNDWATER CONSERVATION DISTRICT'S MANAGEMENT PLAN

I. DISTRICT MISSION

The Kenedy County Groundwater Conservation District's (District) mission is to develop and implement an efficient, economical and environmentally sound groundwater management program to manage, protect and conserve the groundwater resources of the District, consistent with Texas Water Code Section 36.0015. The District's policies and actions will be consistent with the fact that a landowner owns the groundwater below the surface of the landowner's land as real property.

II. PURPOSE OF THE MANAGEMENT PLAN

Senate Bill 1 (SB 1), enacted in 1997, and Senate Bill 2 (SB 2), enacted in 2001, established a comprehensive statewide planning process, including requirements for groundwater conservation districts under Texas Water Code Chapter 36 to provide conservation, preservation, protection, recharging and prevention of waste for the groundwater resources of the State of Texas. This legislation requires that each groundwater conservation district develop a management plan that defines the district's water needs and supply within the district and establishes goals that the district will use to manage groundwater in order to meet those needs.

House Bill 1763, enacted in 2005, requires joint planning among districts that are in the same Groundwater Management Area (GMA). These districts must establish the desired future conditions of the aquifers within their respective GMAs. Through this process, the districts will submit the desired future conditions to the executive administrator of the Texas Water Development Board (TWDB). The TWDB will calculate the modeled available groundwater in each groundwater district within the management area based on the desired future conditions of the aquifers in the GMA. Once this has been accomplished, each district must include this information in its groundwater management plan.

Further, the District is required to adopt rules necessary to implement the management plan. The District must consider whether permits are consistent with the management plan. Production limits must be consistent with the plan.

III. DISTRICT INFORMATION

A. Creation

The District was created in 2003 by the 78th Texas Legislature under H.B. 3374. It was confirmed by an election held on November 2, 2004. As of January 2011, the District has received petitions from landowners in Brooks, Hidalgo, Jim Wells, Kleberg, and Willacy counties requesting annexation into the District. These petitions were approved by the Board. The maps on the cover and in Exhibit A depict the current boundaries of the District.

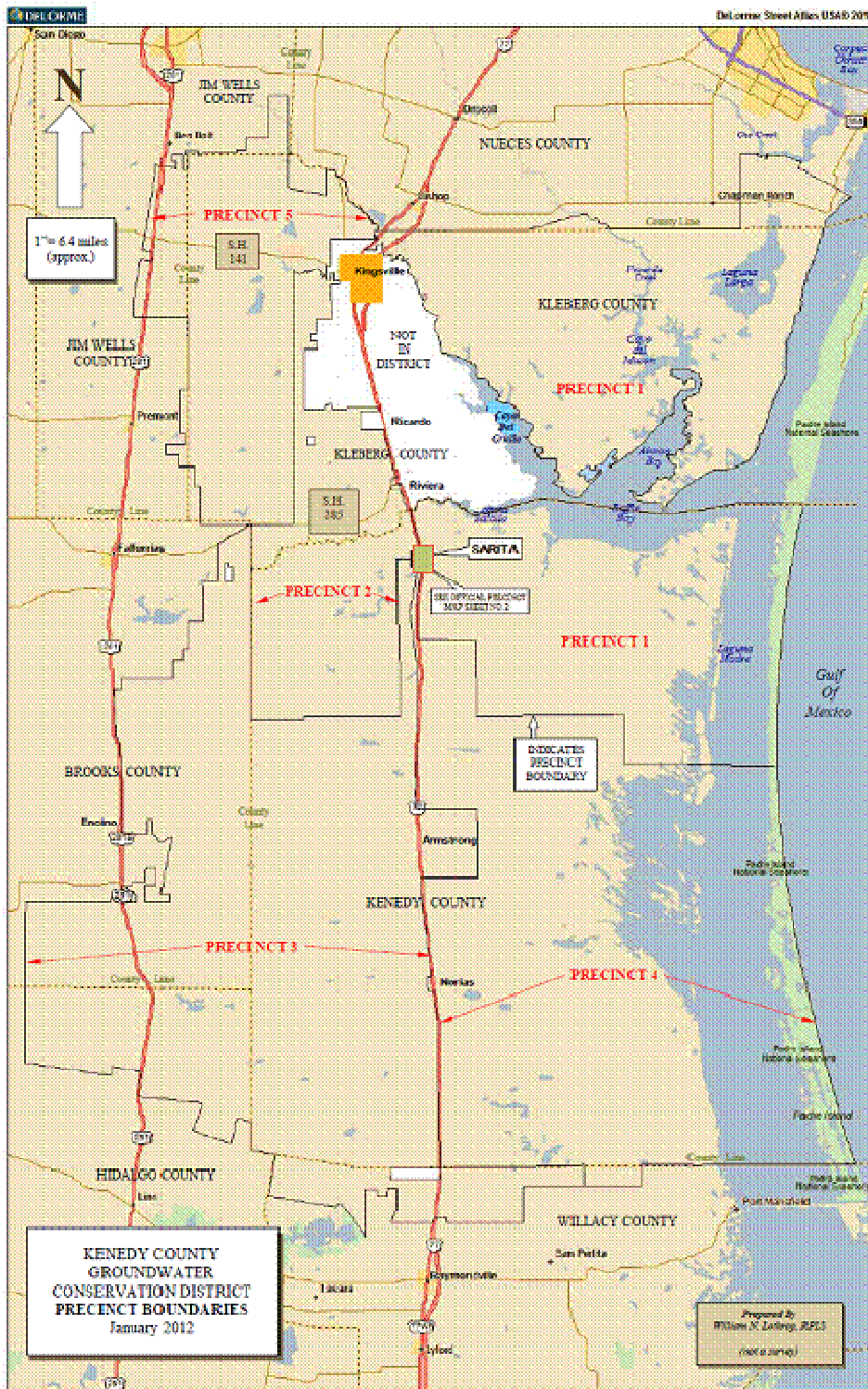
B. Directors

The Board of Directors consists of five members - one Director from each Precinct. These five directors are elected by the voters of their Precinct and serve four-year terms. Precinct 1 consists of Kenedy County's Precinct 1 and the King Ranch Laureles Division. Precinct 2 consists of Kenedy County's Precinct 2, part of Kleberg County north of Precinct 2, and the Southeast section of the Santa Gertrudis ISD. Precinct 3 consists of Kenedy County's Precinct 3 and all of the annexed tracts of land in Brooks and Hidalgo counties and westernmost part of Willacy County. Precinct 4 consists of Kenedy County's Precinct 4 and the annexed tracts of land in the easternmost part of Willacy County. Precinct 5 consists of the Santa Gertrudis ISD, less the southeastern section thereof, and all of the annexed tracts of land in Jim Wells and Kleberg County, except for the portion that is part of Precinct 2. Director four-year terms are staggered with a two year interval. Directors from Precincts 1 and 5 serve the same term, while directors from Precincts 2, 3, and 4 serve the same term. Elections are held in November in even numbered years. See Exhibit A for a map of the District showing the five Precincts.

C. Taxing Authority

The District has the taxing authority provided by its enabling legislation and Texas Water Code, Chapter 36, specifically section 36.020. The levy of a maintenance tax at a rate not to exceed 5 cents for each \$100 of assessed valuation was approved by the voters on November 2, 2004. To date, the tax rate has not exceeded 5 cents for each \$100 of assessed valuation.

Exhibit A: District Map Showing Directors' Precincts



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www.delorme.com

MN (45° E)

0 2 4 6 8 10 mi.
Data Zoom 8.5

C. Authority

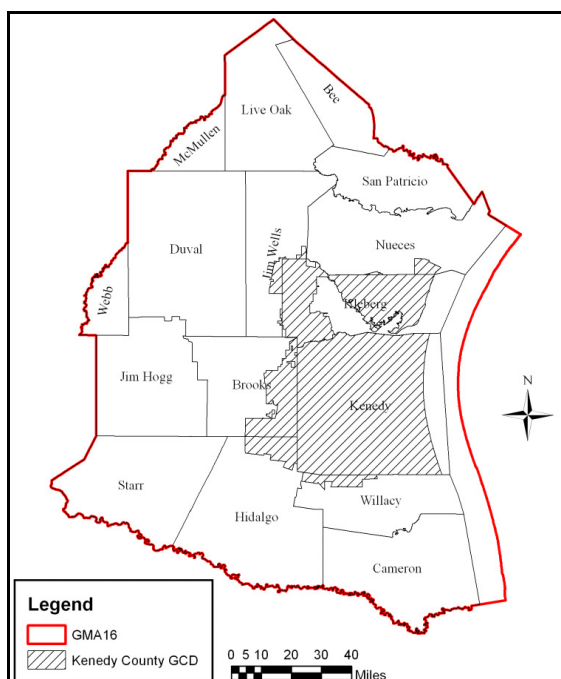
According to its enabling legislation, the District has all of the powers, authority, and duties of a Texas Water Code Chapter 36 groundwater conservation district. Therefore, it has the duty to provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater, and to control subsidence. Under Chapter 36 it has the duty to develop this groundwater management plan to express how the District will meet those duties.

Under Chapter 36 the District has the authority to adopt and enforce rules, including rules to limit groundwater production, to provide for conserving, preserving, protecting, and recharging groundwater, to control subsidence, to prevent degradation of water quality, and to prevent waste of groundwater. The District has many other powers that are enumerated in Chapter 36 allowing it to accomplish its duties.

D. General Description of the District

The District includes all territory located within Kenedy County and parts of Brooks, Hidalgo, Jim Wells, Kleberg, Nueces, and Willacy counties. The boundaries are shown in Exhibit B. The District encompasses approximately 3,028 square miles and is part of groundwater management area 16 (GMA-16). The primary economic activities within the District are oil and gas production and agriculture, primarily livestock. While the District does not include a large-sized city or township, it is close to the City of Kingsville, which has traditionally relied on groundwater supplies.

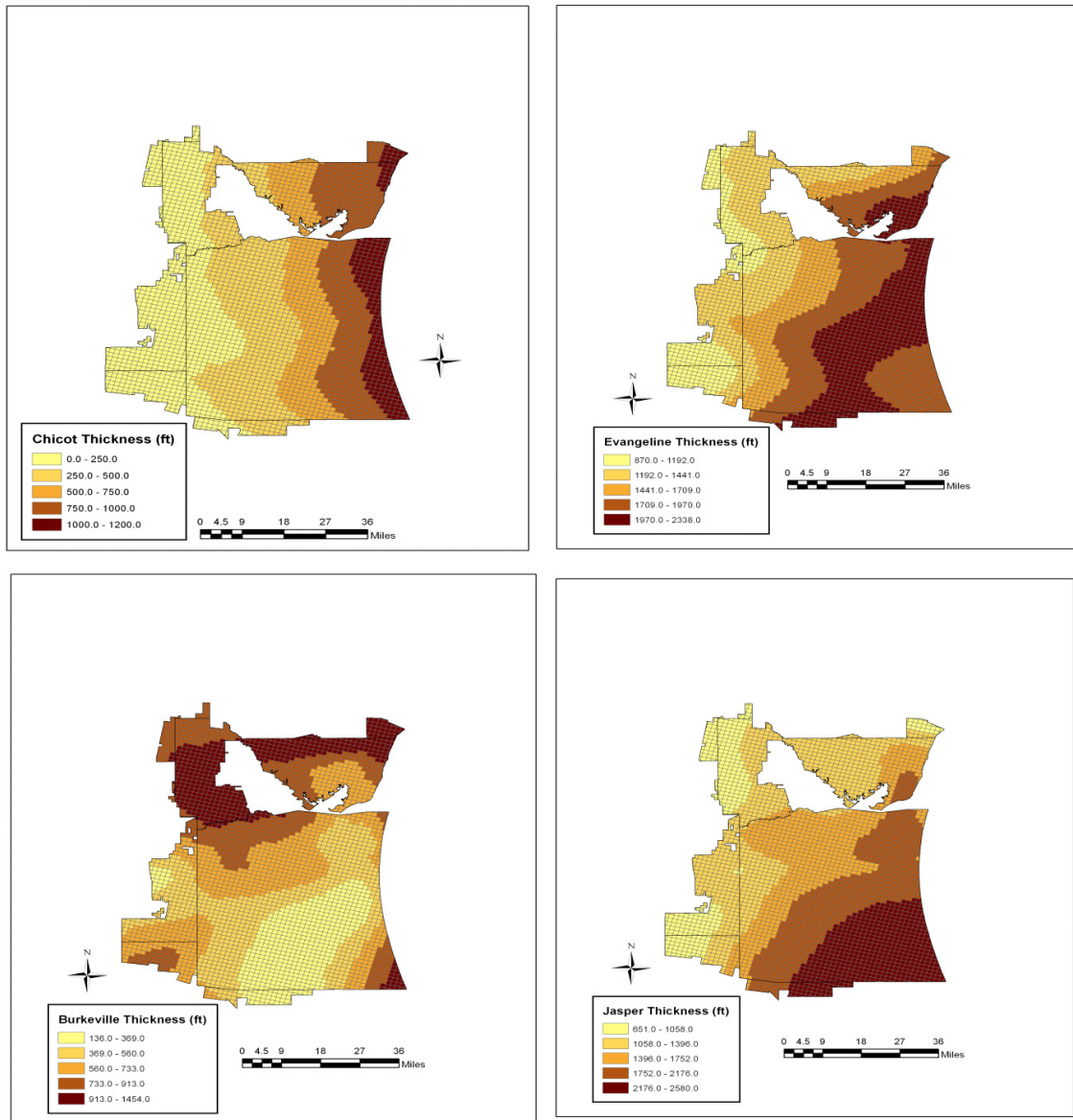
Exhibit B: Kenedy County GCD and GMA-16 (February 2012)



E. Aquifer and Stratigraphic Units

The District is underlain by the Gulf Coast Aquifer, which is a large, leaky aquifer system that spans along the Gulf of Mexico. The aquifer consists of interbedded deposits of sands, silt and clay. The Gulf Coast aquifer is sometimes further classified into four major aquifers: the Chicot, Evangeline, Burkeville confining unit and Jasper aquifers (Baker, 1979).

Exhibit C: Aquifer Thickness of the Gulf Coast Aquifer Units in Kenedy County GCD Based on Data in GMA-16 GAM Model (Hutchison et al. 2011)



The thicknesses of the aquifers found within the District are depicted in Exhibit C, which is based on the conceptualization used in GMA-16 GAM model (Hutchison et al., 2011). In addition, select cross-sectional maps and general information regarding the thicknesses of these aquifers, their variability and the extent of sand thicknesses have been summarized by Chowdhury and Mace (2007) and Waterstone (2004).

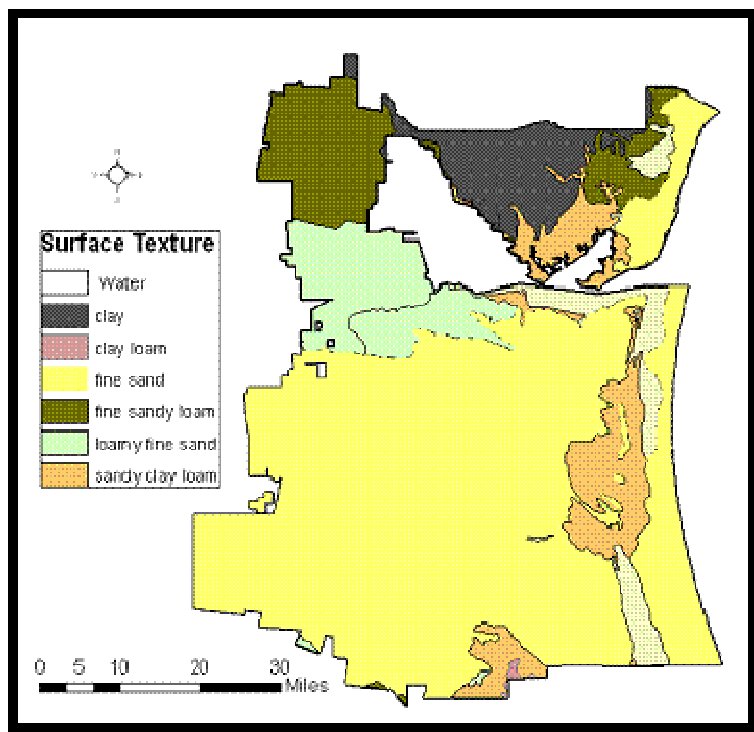
As can be seen from Exhibit C, the thicknesses of the aquifers increase eastward towards the coast (Baker, 1979). The Chicot aquifer covers the surface of the District and is the aquifer that is directly recharged by precipitation. The thickness of the Chicot aquifer is very small: 20 – 100 feet in the western sections of the District. The water quality of this aquifer is characterized by high total dissolved solids (TDS), especially near the coast. As result, this aquifer currently is not used for major water supply purposes. Based on the thicknesses, groundwater supply wells tap into Chicot and Evangeline aquifers along the eastern sections of the District, while major water supply wells tap into Evangeline and possibly Jasper aquifers along the western sections of the District.

F. Surficial Soil Texture Characteristics

A surficial soil texture map for the District was prepared using the USDA STATSGO database and is depicted in Exhibit D.

Exhibit D: Surficial Soils

Updated February 2012



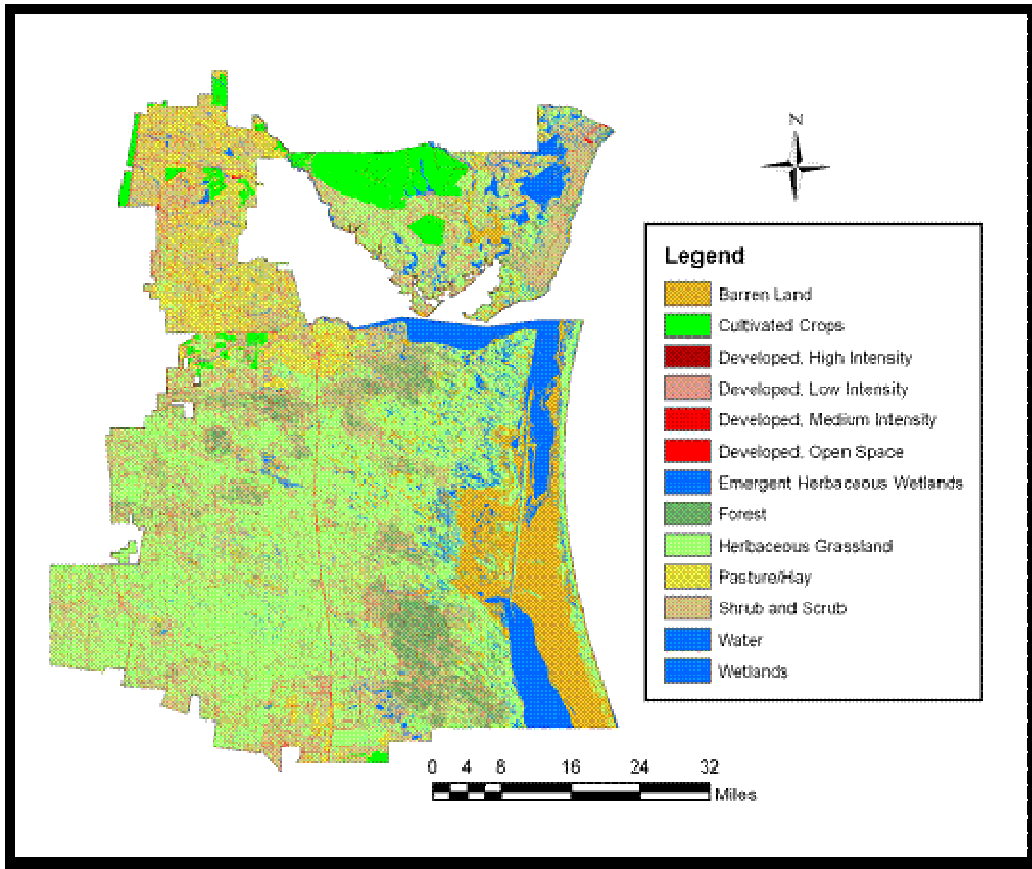
The surficial soils within the District range from clayey soils to fine sands. The silt and clay deposits are commonly referred to as the Beaumont Clay and Lissie Formation and they outcrop in the eastern sections of Kleberg, Kenedy and Nueces counties. Most of the District is overlain by tan to white, unfossiliferous, fine to very fine sand deposits that are intermixed with clay and sandy clay that are referred to as South Texas eolian plain deposits. They are primarily comprised of windblown sediments (Shafer and Baker, 1973). The barrier island and beach deposits of the Pleistocene age crop out in an area 4 to 8 miles wide bordering the landward side of the Laguna Madre and are mostly comprised of fine sands (Shafer and Baker, 1973). Beaumont and Lissie clay formations can be found in the southeastern portions of Kenedy County.

While a major portion of the District is covered by fine sandy deposits, these deposits are predominantly windblown and are underlain by Beaumont clays and Lissie formations (consisting of clays, silts and sands). As a result, recharge to the underlying aquifer is expected to be fairly limited. Most of the infiltrated water in these sandy deposits is hypothesized to flow laterally eastwards towards the Gulf of Mexico, especially when it encounters tight clayey units.

G. Land Use and Land Cover Characteristics

The District consists predominantly of range land supporting a mixture of herbaceous and woody vegetation. The District has no urban areas. (See Exhibit E). Agriculture and livestock demands are of critical importance within the District, although there is minimal irrigated agriculture within the District. In addition to livestock and agricultural uses, groundwater supplies for oil and natural gas production are important as well, although to date groundwater use for this purpose has been small. While the District does not include a large-sized city or township, it is close to the City of Kingsville, which has traditionally relied on groundwater supplies. Model results (Chowdhury et al., 2004; Hutchison et al., 2011) indicate a cone of depression around the Kingsville area, indicating that groundwater could be flowing out of the District boundaries, especially in the northwestern sections of the District.

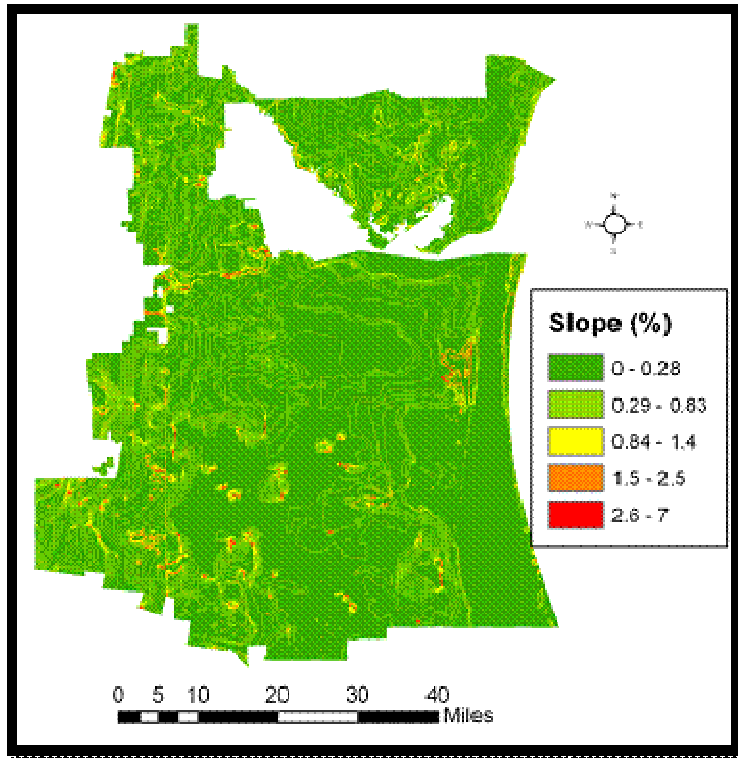
Exhibit E: Land Use Cover Characteristics [based on 2006 USGS Multi-Resolution Land Cover (MRLC) Dataset.]



H. Land Slopes

Land slopes were calculated using ArcGIS Spatial Analyst extension using 1:250K Digital Elevation Models (DEM) and are depicted in Exhibit F. The District consists primarily of gently rolling plains with a relatively flat topography especially near the coast. The regional-scale slopes are typically less than 1%. Greater slopes may be found at scales smaller than the one used for this assessment. The gentle slopes are again indicative of relatively small groundwater-surface water interaction.

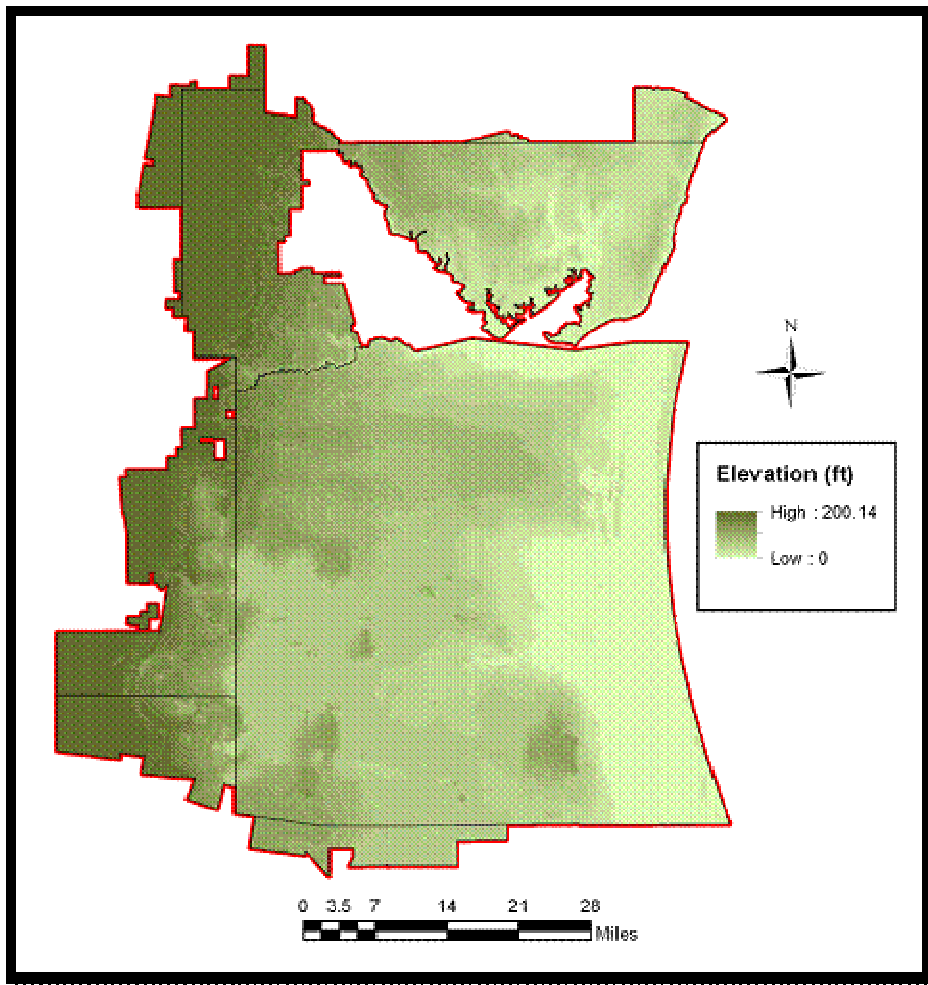
Exhibit F: Calculated Slopes
Updated February 2012



I. Topography

The topographic digital elevation map (DEM) was intersected for the District and is depicted in Exhibit G. The elevation within the District slopes in the east-south-east direction. The elevation ranges from roughly 200 feet in the western sections of the District to about mean sea level in the eastern sections of Nueces, Kleberg and Kenedy counties. The gently sloping topography indicates the general direction of groundwater flow in the aquifers (moving in northwest to southeastern directions).

Exhibit G: Topography.
Updated February 2012



IV. STATEMENT OF GUIDING PRINCIPLES

The District recognizes that its groundwater resources are of vital importance. The use of this most valuable resource can be managed in a prudent and cost effective manner through education, cooperation and development of a comprehensive understanding of the aquifers in the District. The greatest threat to the District's ability to achieve its stated mission is the inappropriate management of its groundwater resources due to a lack of understanding of local conditions. The District's management plan is intended to serve provide focus to the District's Board of Directors and staff, who must implement the District's duties and authority under Texas Water Code Chapter 36 and the District's enabling legislation.

V. CRITERIA FOR PLAN CERTIFICATION

A. Planning Horizon

This 2012 Plan becomes effective upon adoption by the District Board of Directors (Board) and subsequent approval by the Texas Water Development Board (TWDB). This Plan uses a ten-year planning horizon. As required by Texas Water Code §36.1072(e), the plan will be reviewed and readopted, with or without revisions, every five years. The plan may be reviewed and revised annually as necessary to address any changes in law, new or revised data, Groundwater Availability Models, or District management strategies. Under Texas Water Code § 36.1082(b)(5), enacted in 2011, the Plan must be reviewed and revised within two years of the adoption of desired future conditions for GMA-16. This revision fulfills both the required five-year update and the post-DFC adoption update.

B. Board Resolution

Certified copy of the Kenedy County Groundwater Conservation District resolution adopting the 2012 Plan, as required by 31 TAC §356.6(a)(2).

A certified copy of the Kenedy County Groundwater Conservation District resolution adopting the 2012 Plan is attached as Appendix A – Board Resolution.

C. Plan Adoption

Evidence that the plan was adopted after notice and hearing, as required by 31 TAC §356.6(a)(4).

Public notice documenting that the 2012 Plan was adopted following appropriate public notice and hearing is attached as Appendix B – Notice of Hearing.

D. Coordination with Surface Water Management Entities

Evidence that following notice and hearing the District coordinated in the development of its management plan with surface water management entities, as required by Texas Water Code § 36.1071(a).

There are no surface water management entities within the District. Letters transmitting a draft of this 2012 Plan for comments by Region M (Rio Grande Regional Water Planning Area) and Region N (Coastal Bend Regional Water Planning Group) are included in Appendix C – Letter to Surface Water Management Entities/Regional Water Planning Groups. Appendix C also includes letters transmitting the adopted 2012 Plan to these Regional Water Planning Groups.

VI. TECHNICAL INFORMATION REQUIRED BY TEXAS WATER CODE §36.1071 AND 31 TAC § 356.5

A. Modeled available groundwater

Estimate of the modeled available groundwater in the District based on the desired future condition of the aquifers developed under Texas Water Code § 36.108, as required by Texas Water Code § 36.1071(e)(3)(A) and 31 TAC § 356.5(a)(5)(A).

Modeled available groundwater is defined in the Texas Water Code, Section 36.001, Subsection (25), as “the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition established under Section 36.108.” Under Texas Water Code § 36.108(d), the desired future condition may only be determined through joint planning with other GCDs in the same GMA. The District is located in GMA-16. See Exhibit B. As part of the first round of joint planning, GMA-16 adopted a desired future condition on August 30, 2010. A series of model runs were performed using the GMA-16 GAM developed by the TWDB (Hutchison et al., 2011) during the GMA-16 joint planning process. The Groundwater Availability Modeling (GAM) Run 09-008, Scenario 10, was used as the basis for developing the desired future condition for the Gulf Coast Aquifer. Details of the Modeled Available Groundwater are presented in TWDB Report GAM Run 10-047 MAG (Hassan and Jigmond, 2011). The Modeled Available Groundwater for GMA-16 is estimated to be 358,100 acre-ft/year. The MAG corresponding to Kenedy County Groundwater Conservation District is 97,335 acre-feet/year.

The exempt groundwater use in the district for domestic and livestock purposes was estimated to be approximately 2,500 acre-feet/year. Subtracting this exempt use from the Modeled Available Groundwater and dividing it by the district area of 3,028 sq. miles, results in a correlative right of 0.587 acre-inches/acre/year of groundwater production.

B. Annual groundwater use

Estimate of the amount of groundwater being used within the District on an annual basis, as required by Texas Water Code § 36.1071(e)(3)(B) and 31 TAC § 356.5(a)(5)(B). (All site-specific information relied upon in developing this estimate has previously been provided to the Executive Administrator for comment, as required by Texas Water Code §36.1071(b) and 31 TAC § 356.5(b)).

Historical estimates of the amount of groundwater being used within the District on an annual basis were developed based on county-wide estimates for groundwater use that were provided by the Texas Water Development Board (Allen, 2016; Appendix D) and used in the 2012 State Water Plan, which is the most recently approved Water Plan. Because the District encompasses only portions of some counties and site-specific measurements were not available, the county-wide water use was apportioned based on the fraction of the land area within the District. The land fractions were also provided by Allen (2016) and district wide apportionments were provided by Allen (2016) in the

April 28, 2016 report (Both are included in Appendix D). Based on the groundwater use data (most recent 10 years for which data are available) presented in Exhibit H, the amount of groundwater used in the District is estimated to be approximately 8,600 acre-feet/year.

**Exhibit H: Total Groundwater Use in the District in acre-feet/year
(Based on data from 2012 State Water Planning Dataset as Reported in
Allen, April 28, 2016; Please refer to Appendix D)¹**

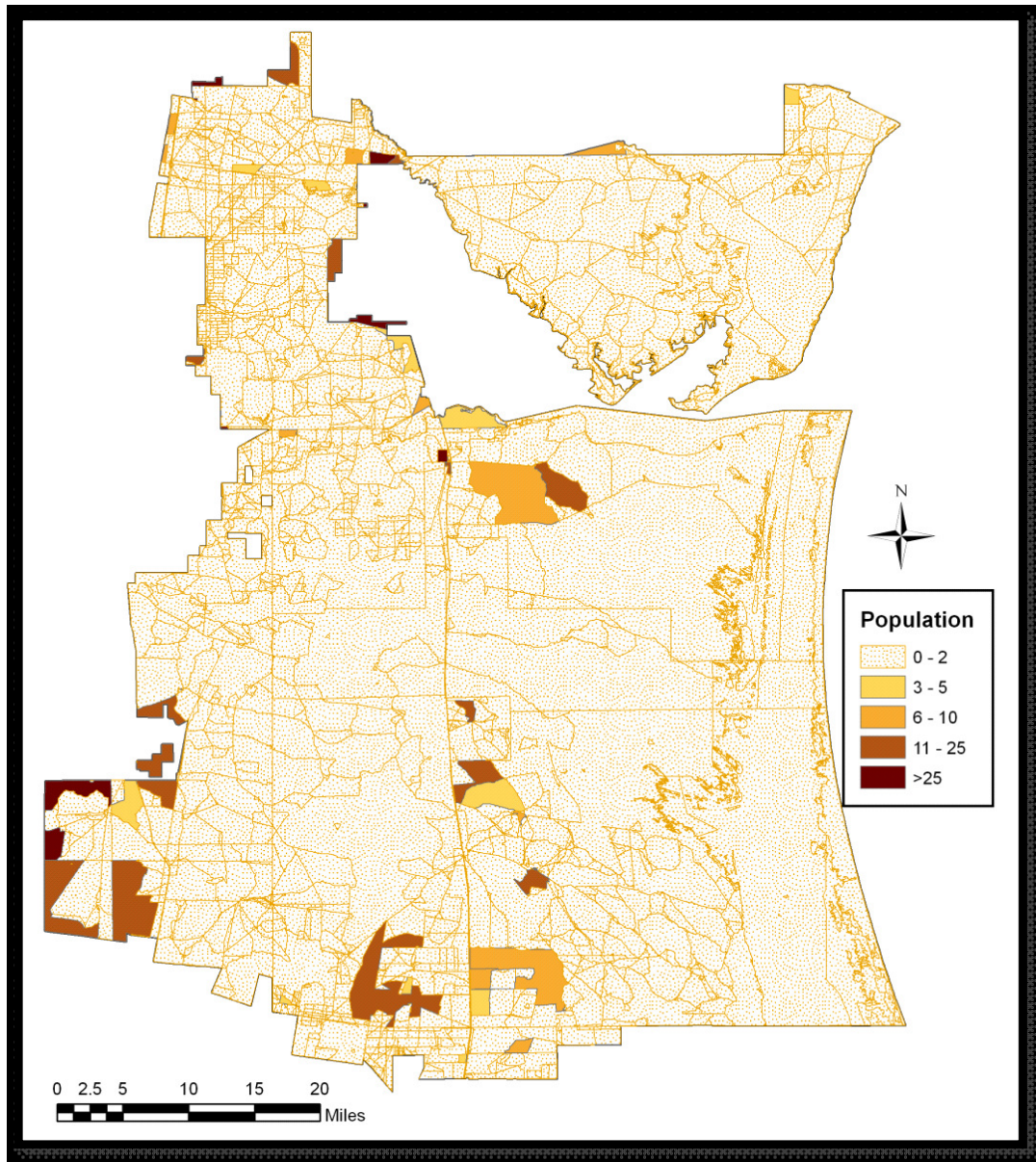
Year	Portions of the County within the GCD							Total
	Brooks (27.98%)	Hidalgo (7.2%)	Jim Wells (5.14%)	Kenedy (100%)	Kleberg (81.75%)	Nueces (4.04%)	Willacy (10.92%)	
2000	578	867	328	330	6707	73	7	8890
2001	591	729	258	308	6724	72	7	8689
2002	594	684	263	317	6328	83	8	8277
2003	672	616	278	193	5301	153	8	7221
2004	639	557	295	187	4736	166	9	6589
2005	792	649	336	778	7160	178	20	9913
2006	792	529	358	782	6038	168	24	8691
2007	665	548	249	545	5826	143	26	8002
2008	825	633	229	1040	5505	184	31	8447
2009	1437	947	259	868	5446	196	62	9215
2010	872	736	230	967	3181	300	112	6398
2011	999	1051	256	961	3363	370	100	7100
2012	797	971	218	831	5248	326	101	8492
2013	747	1000	215	719	4919	261	93	7954

As depicted in Exhibit I, the District is predominantly rural. Groundwater is the major source of water supply for the residents of the District. In addition, the District is in close proximity to the City of Kingsville, which historically has relied on groundwater supplies for its municipal use. The City of Kingsville uses nearly 3,500 acre-feet of water annually, which is extracted from the Evangeline (Goliad sands) aquifer formation. There are also mining and oil and gas activities both within the District and in the vicinity of the District that rely on groundwater resources. Hence, it is important to measure and evaluate groundwater levels in the District. Long-term monitoring of groundwater levels

¹ Numbers in parenthesis represent the fraction of land area of the county that is within the District. The numbers presented are apportioned for the land area within the District.

is also necessary to evaluate compliance with the adopted desired future conditions (DFCs).

**Exhibit I: Population Distribution in the District
(Based on Census 2010 Data in units of persons/census block)**

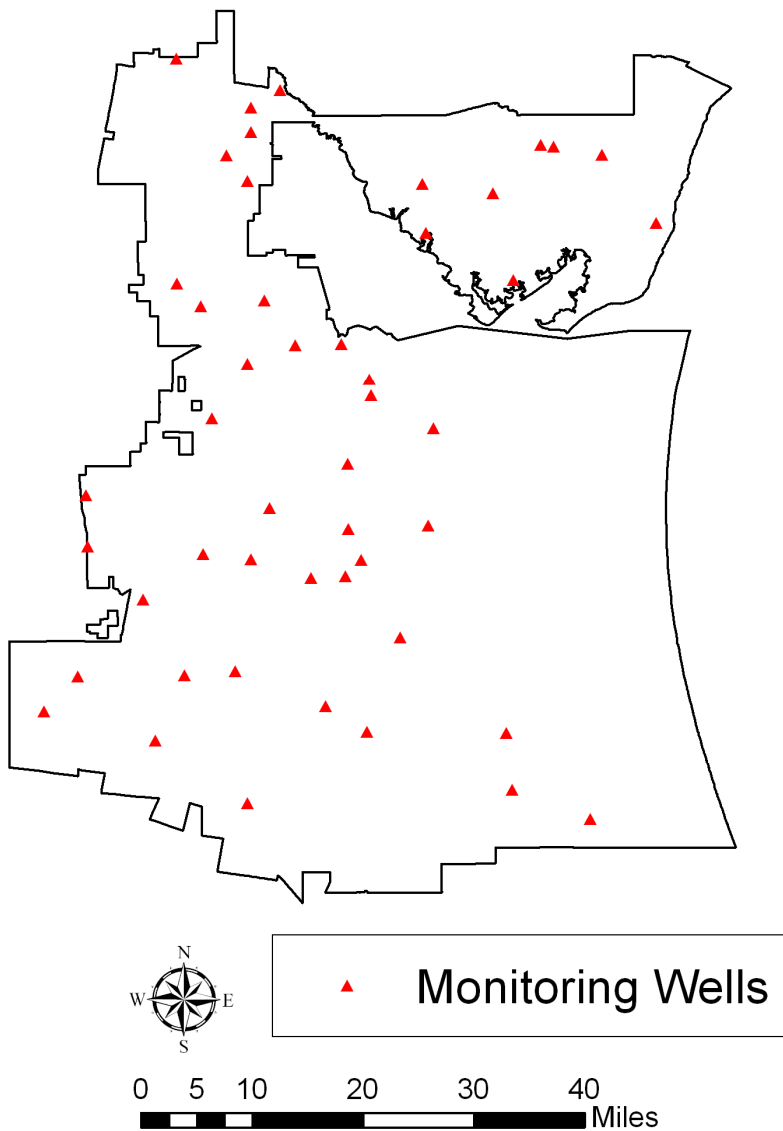


The District has established a groundwater monitoring program with the goal of measuring groundwater levels semi-annually in a network of more than 45 water wells. Exhibit J depicts the location of these monitored wells. Beginning in 2012, the District will be performing water quality analyses on a subset of at least 25 of these wells. Water from this subset of monitored wells will be analyzed for electrical conductivity, total dissolved solids, and pH to develop a basic understanding and historical record of water quality in the aquifers. The network provides a comprehensive coverage of the District.

The lack of wells in the network along the coast is reflective of limited groundwater production in that area but efforts are underway to identify additional wells for inclusion in the network.

In addition to the long-term monitoring network, the District undertook the collection of water level measurements and water quality samples in 11 water wells as part of a project to establish background water quality data prior to initiation of uranium exploration under a Railroad Commission permit issued for land within the District. These samples were analyzed for metals and uranium, anions, alkalinity, ammonia, Radium 226, and gross alpha and beta activity. This information is available from the District upon request.

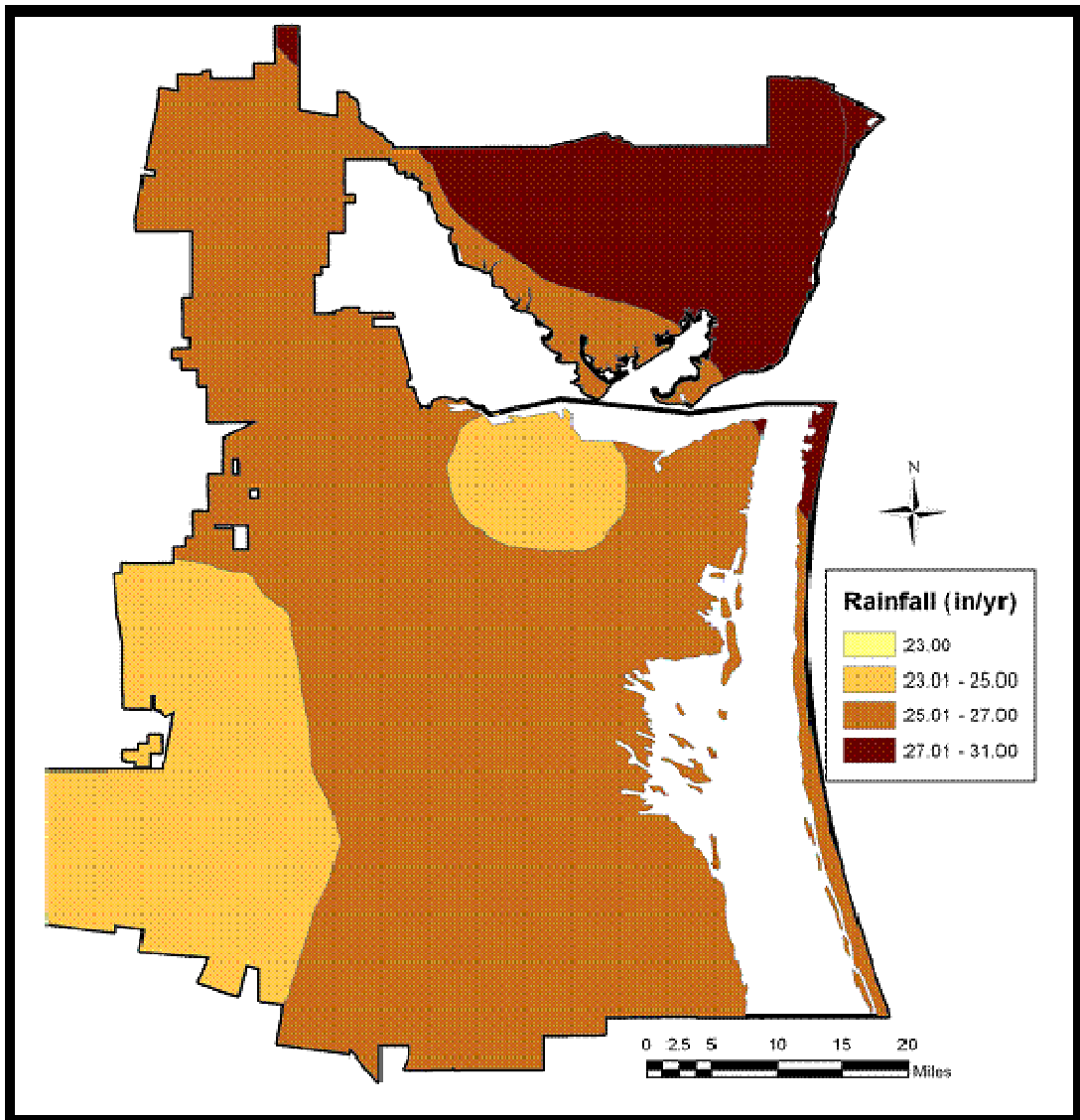
Exhibit J: District's Groundwater Level Monitoring Network as of January 2012



C. Annual recharge from precipitation

Estimate of the annual amount of recharge from precipitation to the groundwater resources within the District, as required by Texas Water Code § 36.1071(e)(3)(C) and 31 TAC § 356.5(a)(5)(C). No site-specific information was used in developing this estimate.

Exhibit K: Long-Term Average Precipitation Profile
Updated February 2012

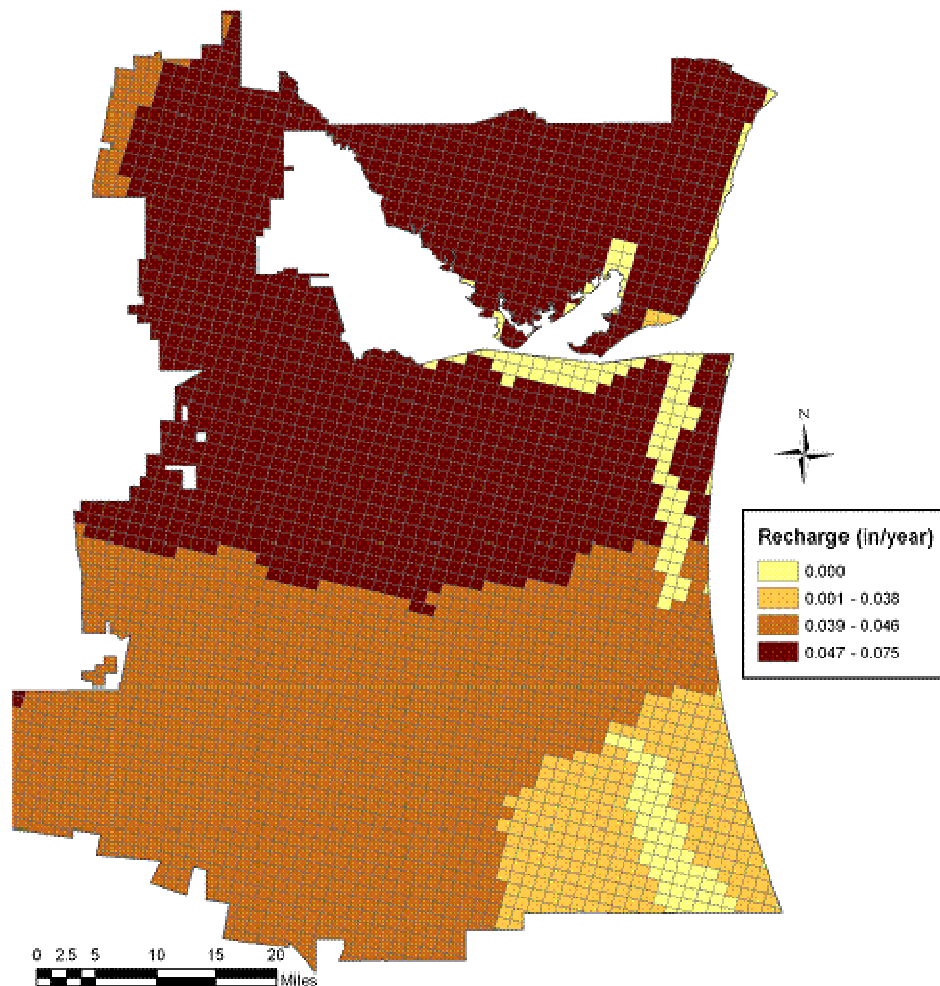


Precipitation information was used in conjunction with soils information to derive recharge characteristics. The climate in South Texas is characterized by mild winters and dry summers. The long term average precipitation data were used to develop the

precipitation contour map depicted in Exhibit K. The average annual precipitation is roughly 24 in/yr indicating that the recharge to the shallow aquifer is probably in the order of 0.024 in/yr. Field measured values for recharge specific to the District could not be found. The estimate is consistent with Groschen (1985), where a recharge value of 0.05 in/yr was used for the unconfined portions of the Evangeline aquifer covering from San Patricio to Jim Hogg counties. Chowdhury and Mace (2003) estimated recharge from precipitation to vary between 0.08 in/yr (toward the coast) to about 0.14 in/yr in the region covered by the District. Recently Hutchinson et al. (2011) developed a GMA-16 GAM that was calibrated over the period of 1963 – 1999. A map of the calibrated recharge values corresponding to the year 1999 (the last year of calibration) was developed and is presented as Exhibit L. The calibrated recharge values are consistent with the estimates presented in earlier studies. As can be seen from Exhibit L, recharge values reflect considerable variability in the District with higher values in the northern sections of the District.

Exhibit L: Recharge Estimates based on GMA-16 GAM (Data corresponds to the last calibrated year of 1999)

Prepared February 2012



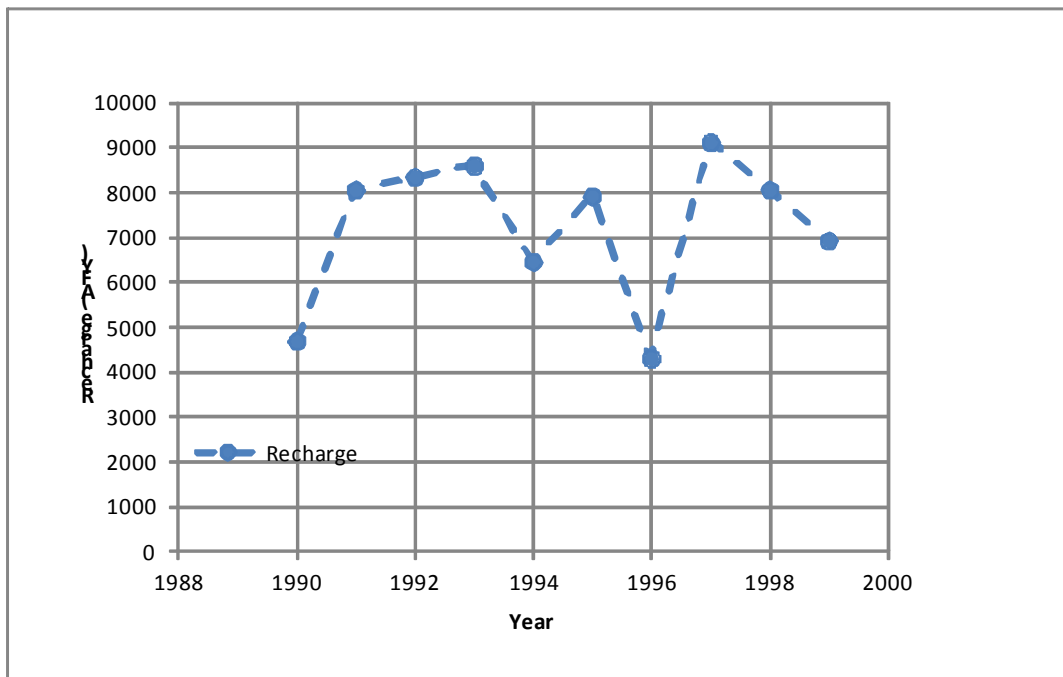
Groundwater model run, GAM Run GR16-009, was performed by the TWDB (Goswami, 2016; Appendix E) to obtain estimates pertaining to groundwater flow in the District. The GMA-16 GAM (Hutchison et al., 2011) was used to obtain the necessary estimates. As stated in Exhibit M, the recharge from precipitation is estimated to be around 6,400 acre-feet/year. The calibrated recharge values during 1980 – 1999 are used to derive these estimates. See Shi, 2012; Appendix E, which includes a copy of GAM Run 11-016.

Exhibit M: Estimated Recharge from Precipitation using GMA-16 Groundwater Availability Model (Data obtained from Goswami, 2016; Appendix E).

Parameter	Estimate (AFY)	Remarks
Recharge from Precipitation	5,998	Obtained as average of 1980-1999

The average estimate of recharge was divided by the area of the District to obtain an approximate average recharge rate of 0.04 inches/year (< 0.2% of average annual rainfall). As seen from exhibit L, there is considerable spatial variability within the District. The water budgets presented by Hutchison et al., 2011, indicate that recharge from precipitation also varies considerably from year to year and is affected by climatic fluctuations. The temporal variations in recharge due to precipitation are summarized in Exhibit N.

Exhibit N: Temporal Variability in Recharge from Precipitation (in acre-feet/year) Estimated using Water Budgets presented in Hutchison et al., 2011.

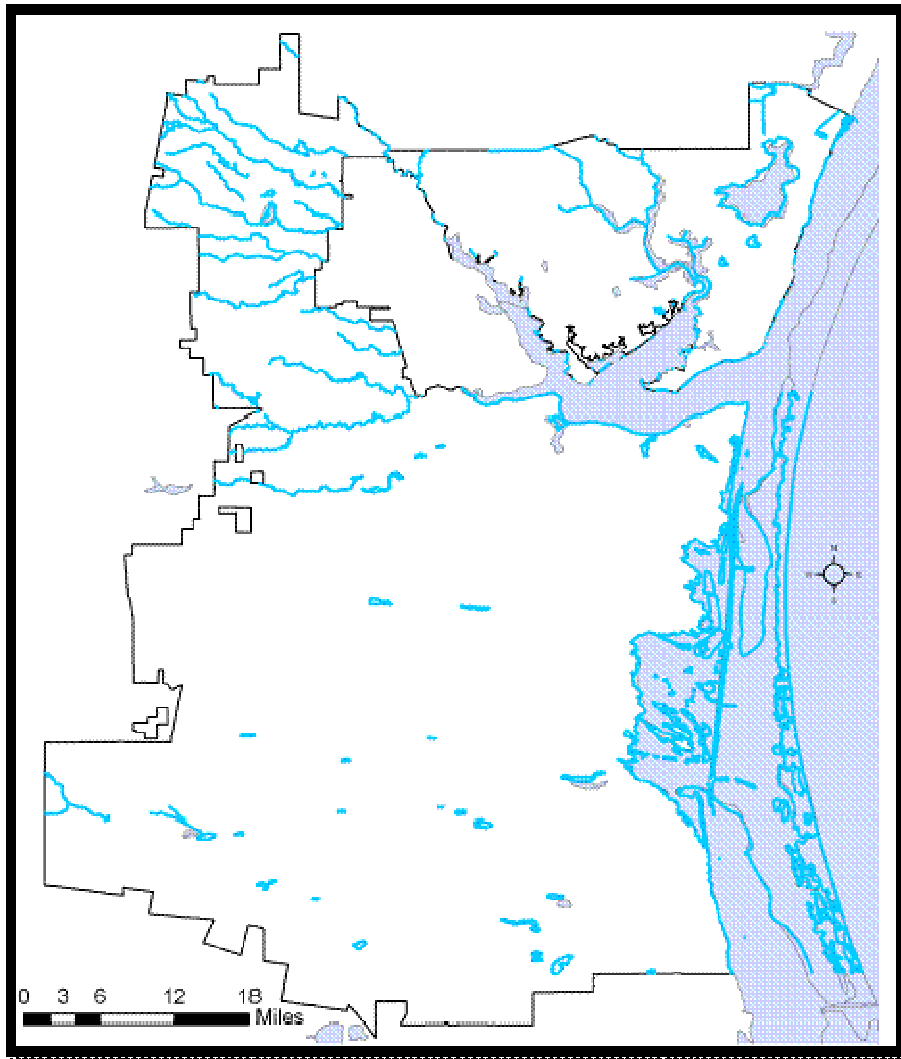


D. Annual Discharge to Surface Water Bodies

For each aquifer in the District, estimate the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers, as required by Texas Water Code § 36.1071(e)(3)(D) and 31 TAC §356.5(a)(5)(D). No site-specific information was used in developing this estimate.

No major inland surface water bodies exist within the District (Exhibit O). However, sensitive coastal water bodies like Baffin Bay and Laguna Madre abut the District. Research carried out by Texas A&M University-Kingsville, funded through the National Oceanic and Atmospheric Administration (NOAA), indicates that a significant amount of groundwater (on the order of 1 cm/day) discharges into Baffin Bay. Hence, coastal groundwater interactions are of significance.

Exhibit O: Major Surface Water Bodies in KCGCD



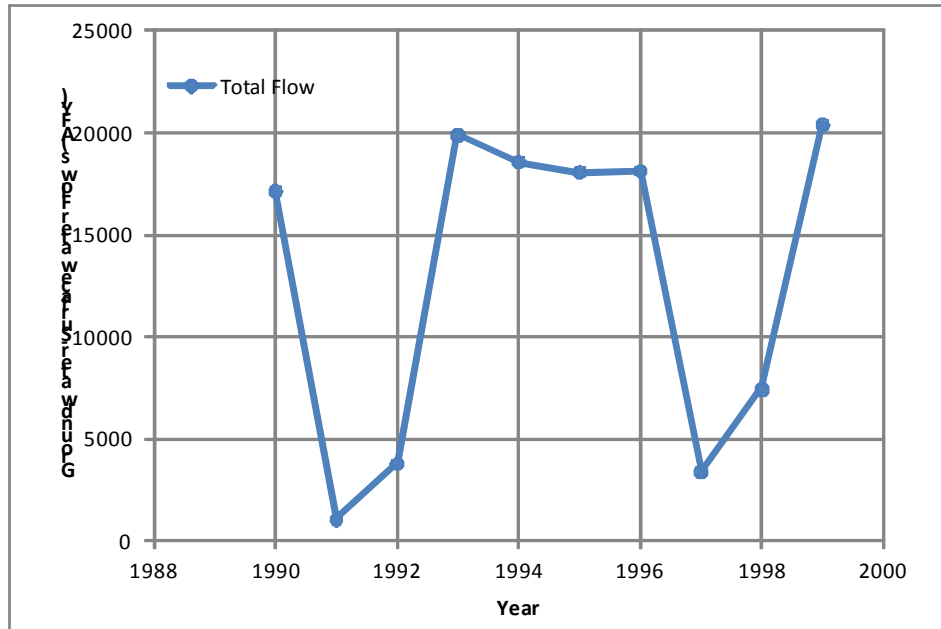
While there are no major water bodies present, there are several creeks and streams, primarily in the western and northeastern sections of the District. In addition, there are springs arising from artesian flow conditions in the District. Recharge to the shallow aquifer can also occur when rainwater is channelized through gullies and streams. The District did not perform field measurements quantifying stream-aquifer interactions. Stream gain-loss studies could be performed to better estimate groundwater-surface water interactions. In the absence of field data, surface water-groundwater interactions have been ascertained using model derived groundwater budgets summarized in Exhibit P.

Exhibit P: Estimated Groundwater Discharges to Surface Water Bodies using GMA-16 Groundwater Availability Model (Data obtained from Goswami, 2016; Appendix E).

Parameter	Estimate (AFY)	Remarks
Estimated Annual Volume of Water that Discharges from the aquifer to springs and any surface water body including lakes, streams and rivers	20,643	Obtained as average of 1980-1999

As with recharge, groundwater discharges to surface water bodies also exhibit considerable temporal variability. Exhibit Q depicts the temporal variability over the last 10 years of the calibration period. As can be seen, the groundwater discharges are significantly curtailed during dry periods.

Exhibit Q: Temporal Variability of Groundwater Discharges to Surface Water Bodies (in acre-feet/year) in KCGCD using GMA-16 GAM (Data obtained from Hutchison et al., 2011 for the period of 1990-1999).



E. Groundwater Flow Into and Out of the District and Between Aquifers in the District

Estimate of 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, as required by Texas Water Code § 36.1071(e)(3)(E) and 31 TAC § 356.5(a)(5)(E). No site-specific information was used in developing this estimate.)

The groundwater flows into and out of the District are estimated using the horizontal exchange components of the GAM water budget. Generally, flows into the District occur along the western boundaries. The water budget results indicate that there is a net gain from all the inflows into the District under ambient conditions. This result is to be expected because a significant portion of the District lies in the down-dip areas of the Gulf Coast Aquifer. However, it is important to recognize that large-scale groundwater withdrawals in neighboring areas can alter groundwater flow patterns and cause greater amounts of groundwater to leave the District. Exhibit R presents the average annual inflows and outflows from the District. The values are obtained from the water budgets of the GMA-16 GAM and represent an average over the 1980-1999 period.

Exhibit R: Estimated Groundwater Discharges along District Boundaries Calculated using GMA-16 Groundwater Availability Model (Data obtained from Goswami, 2016; Appendix E).

Parameter	Estimate (AFY)	Remarks
Estimated annual volume of flow into the district within each aquifer of the district	41,396	Obtained as average of 1980-1999
Estimated annual volume of flow out of the district within each aquifer of the district	32,644	Obtained as average of 1980-1999

Exhibit S: Net Annual Flow Between Each Aquifer within the District (Data obtained from Goswami, 2016; Appendix E)

Parameter	Estimate (AFY)	Remarks
Estimated net annual volume of flow between each aquifer in the district	1,216	From Gulf Coast Aquifer System to brackish water containing formations. GAM model does not simulate the interaction between the Gulf Coast Aquifer system and the underlying units

The Gulf Coast Aquifer is the major aquifer formation underlying the District. While the Gulf Coast formation is sometimes differentiated as Chicot, Evangeline, Burkeville Confining Unit and Jasper aquifer formations (Baker, 1979) the Gulf Coast Aquifer is represented as a single aquifer unit in State and Regional Water Planning Process. Most Groundwater Availability Models do not explicitly model the interaction between the Gulf Coast Aquifer System and underlying units. Currently, only the shallow sections of the Gulf Coast Aquifer are used within the District. Because of the thickness of the Gulf Coast Aquifer in most of the District, anthropogenic influences are unlikely to have a major influence on cross-aquifer flows. Flows within the different formations of the Gulf Coast Aquifer, however, could be locally significant.

F. Projected Surface Water Supply

Estimate of the projected surface water supply within the District, according to the most recently adopted state water plan, as required by Texas Water Code § 36.1071(e)(3)(F) and 31 TAC § 356.5(a)(5)(F).

Exhibit T presents the projected surface water supply data. These data were estimated from the basin-wide data made available by the TWDB in the report dated April 28, 2016 (Allen, 2016; Appendix D), which appears in the 2012 State Water Plan. Only the county-wide water user group (WUG) data values (county other, manufacturing, steam electric power, irrigation, mining and livestock) are modified using the multiplier. WUG values for municipalities, water supply corporations, and utility districts are not apportioned; instead, their full values are retained when they are located within the district, and eliminated when they are located outside the district.

**Exhibit T: Projected Surface Water Supply Data within KCGCD
Based on 2012 State Water Plan (Data Obtained from Allen, April 28,
2016; Please refer to Appendix D; All Values in Acre-ft/Yr)**

Year	2010	2020	2030	2040	2050	2060
Brooks	188	188	188	188	188	188
Hidalgo	140,668	141,025	141,426	141,677	141,532	141,401
JimWells	5,655	5,961	6,125	6,151	6,082	5,953
Kenedy	811	811	811	811	811	811
Kleberg	3,253	3,485	3,617	3,660	3,821	3,829
Nueces	81,124	80,145	87,029	93,170	98,886	103,866
Willacy	12,202	12,033	11,879	11,731	11,583	11,455

G. Projected Demand for Water

Estimate of the projected total demand for water within the District according to the most recently adopted state water plan, as required by Texas Water Code § 36.1071(e)(3)(G) and 31 TAC § 356.5(a)(5)(G). (No site-specific information was relied upon in developing this estimate. It is taken from the 2012 State Water Plan.)

The apportioned county-wide projected water demands as per the 2012 State Water Plan were obtained from the Texas Water Development Board (TWDB) (Allen, 2016; Appendix D). The demands for each county within the District were then aggregated over all water user groups and presented in Exhibit U. As can be seen, demands are expected to increase considerably in Hidalgo, Nueces, and Willacy counties in the long-term planning horizon covered by the State Water Plan.

The projected demands presented in Exhibit U were estimated by apportioning any county-wide water user group estimates only the county-wide water user group (WUG) data. Values (county other, manufacturing, steam electric power, irrigation, mining and livestock) are modified using the multiplier. WUG values for municipalities, water supply corporations, and utility districts are not apportioned; instead, their full values are retained when they are located within the district, and eliminated when they are located outside the district. TWDB relies on GCDs to make this determination

Exhibit U: Estimate of Total Demands in Acre-ft/year Obtained from TWDB Based on 2012 SWP (Data from Allen, April 28, 2016; Please refer to Appendix D)

Year	2010	2020	2030	2040	2050	2060
Brooks	2,443	2,806	3,074	3,230	3,292	3,302
Hidalgo	149,346	169,027	190,649	219,554	252,369	286,711
JimWells	7,294	7,655	7,842	7,856	7,755	7,582
Kenedy	1,059	1,061	1,062	1,062	1,061	1,062
Kleberg	10,551	10,836	10,377	10,406	10,587	10,550
Nueces	72,056	80,853	88,270	94,926	101,154	106,687
Willacy	9,615	9,931	10,157	10,296	10,419	10,493

VII. CONSIDERATION OF ADOPTED STATE WATER PLAN

Consideration of water supply needs and water management strategies that are included in the adopted state water plan, as required by Texas Water Code § 36.1071(e)(4) and 31 TAC § 356.5(a)(7).

The District reviewed the 2012 State Water Plan for comparisons of water demands and supply estimates on a county-by-county basis prepared by Region M (Rio Grande Regional Water Planning Area) and Region N (Coastal Bend Regional Water Planning Group). The District identified potential water deficits and management strategies that could have an impact on the groundwater resources within the District (Exhibit V). In addition to covering the entire Kenedy County, the District partially covers several counties (Brooks, Hidalgo, Jim Wells, Kleberg, Nueces, and Willacy). As stated earlier, the projected deficits in the parts of these counties that are not within the District, were also evaluated because groundwater from within the District could potentially be tapped for meeting these deficits.

A county-by-county analysis of the demands for different water use groups was carried out with an emphasis on groundwater related strategies (which are summarized in Exhibit V). As can be seen, there is a growing interest in using groundwater or brackish groundwater in the Lower Rio Grande Valley areas. The District will continue to track the progress of water management strategies in the regional water planning process and evaluate new proposals and projects as appropriate.

Exhibit V: Impacts of Regional Water Management Strategies on Groundwater Resources (Based on 2012 State Water Plan; Data from Allen, April 28, 2016; Refer to Appendix D for additional information; All values in units of Acre-ft/Year)

Year	2010	2020	2030	2040	2050	2060
Aquifer Supplies						
Jim Wells	565	565	565	565	565	565
Kleberg	0	400	400	400	400	400
Brackish Groundwater Desalination						
Hidalgo	15271	15629	18788	19575	21884	23331
Willacy	22427	22627	22627	22627	22627	22627
Expand Existing Groundwater wells						
Hidalgo	212	2052	3463	5794	6812	8297

VIII. MANAGEMENT OF GROUNDWATER SUPPLIES

The District will manage the supply of groundwater within the District in order to utilize the resource while seeking to maintain the economic viability of all resource user groups, public and private. The District will:

- identify and engage in such activities and practices, that, if implemented, would manage groundwater resources in the District while considering the economic and cultural activities occurring within the District;
- maintain and expand its water monitoring network in order to monitor changing groundwater quality and storage conditions of groundwater supplies within the District;
- make a regular assessment of water supply and groundwater storage conditions and report those conditions to the Board and to the public;
- continue to undertake, as necessary, and co-operate with evaluations of the groundwater resources within the District, including those associated with uranium exploration and mining; and
- make the results of evaluations available to the public upon adoption by the Board.

The District adopted rules based on its original management plan. The first set of rules became effective October 8, 2008 and implemented the management plan. The rules covering registration and permitting of wells and production limits were amended, effective November 4, 2009. District Rules allow issuance of operating permits for perpetual terms. The production allowed for a new non-exempt well is based on surface acreage reflecting the GMA-16 adopted desired future condition. The District has prohibited waste of groundwater; has required all water wells to be registered; has issued operating permits to all existing non-exempt wells; and considers all applications for new operating permits based on surface acreage production limit. Under District Rules, the District may, at the Board’s discretion, amend or revoke any permits after notice and

hearing based on certain criteria listed in the Rules, including aquifer conditions. The District will enforce the terms and conditions of permits and the rules of the District by enjoining the permit holder in a court of competent jurisdiction as provided for in Texas Water Code § 36.102.

The District will continue to employ all technical resources at its disposal to evaluate the resources available within the District and to determine the effectiveness of regulatory or conservation measures.

Uranium ore deposits are present within the District and its immediate vicinity. Groundwater is used for exploration and extraction of uranium. Groundwater is also affected by the associated reclamation and restoration activities. These activities can impact groundwater quality and quantity. The District monitors all applications for uranium exploration within and in close proximity to the District. If an exploration or mining permit is issued by the Texas Railroad Commission and Texas Commission on Environmental Quality, the District plays an active role in reviewing and commenting on those authorizations and performs background groundwater measurement collection prior to initiation of those activities.

The District will continue to monitor State law to ensure it is protective of groundwater resources within the District.

IX. ACTIONS, PROCEDURES, PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION

Detailed description of actions, procedures, performance and avoidance necessary to effectuate the management plan, including specifications and proposed rules, as required by Texas Water Code § 36.1071(e)(2) and 31 TAC § 356.5(a)(4).

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

The district has adopted rules relating to the permitting of wells and the production of groundwater. The most current version of the District's Rules are found on the District's website at: http://www.kenedygcd.com/Forms_Rules/rules.aspx. All rules adopted by the District are pursuant to TWC chapter 36 and the provisions of this plan. All rules will be adhered to and enforced. The promulgation and enforcement of the rules will be based on the best technical evidence available. The District is currently revising its Rules to make them consistent with new changes in state law applicable to the District; to make them consistent with the adopted desired future condition for GMA-16; and to address issues of groundwater management that may not have been anticipated by the existing Rules. Once the Rules are amended, the amended Rules will be found on the District's website at the web address provided above.

The District 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. In granting a variance to any rule, the Board shall consider the potential for adverse effect on adjacent landowners.

The District will seek the cooperation from other entities in order to implement this plan and to manage groundwater supplies within the District. All activities of the District will be undertaken in cooperation and coordination with the appropriate state, regional or local water management entity. To this end, the District will continue to be actively engaged with the GMA-16 Joint Planning Committee; Regions N and M Water Planning Groups; the TWDB; Texas Alliance of Groundwater Districts; Texas Water Conservation Association; Texas A&M University-Kingsville; USDA-Natural Resources Conservation Service; Kleberg-Kenedy Soil and Water Conservation District; and Texas AgriLife Extension.

Rules

The District adopted rules based on its original management plan. The first set of rules became effective October 8, 2008 and implemented the management plan. The rules covering registration and permitting of wells and production limits were amended, effective November 4, 2009. The Rules have been amended in 2012 to implement legislative requirements enacted since November 4, 2009, and to more accurately reflect the procedures and practices of the District.

The District has rules covering the following:

- **Well Registration, Drilling Permits, and Operating Permits**
 - As required by Texas Water Code 36.117(h), the District requires all wells to be registered, regardless of when they were drilled and whether they have been plugged. All previous oil and gas wells for which the operator submitted a RRC P-13 indicating conversion to use as a water well, must also be registered. The District Rules implement the exemptions from permitting set out in § 36.117 and establish additional exemptions reflecting the large area and small population of the District. The District Rules include the criteria for consideration and approval of operating permits and production limits, as authorized by §§ 36.101(a) and 36.116.
- **Fees**
 - Because the District is financed through ad valorem taxes, it does not impose fees for activities associated with water wells, such as registration fees, application fees, production fees, or export fees.
- **Well Construction and Completion Standards**
 - The District has adopted well construction and completion standards, at a minimum requiring that construction of all wells and installation of all pumps located within the District must be in accordance with the Texas

Occupations Code Chapter 1901, “Water Well Drillers” and Chapter 1902, “Water Well Pump Installers,” as amended, and the Administrative Rules of the Texas Department of Licensing and Regulation, 16 Texas Administrative Code (“TAC”), Chapter 76, as amended. Additional standards include requiring a sampling port on all new wells. In evaluating each operating permit application, the District evaluates whether additional standards are needed to protect water quality in the area of the well.

- Reporting and Recordkeeping
 - The District has established annual recordkeeping and reporting for water production from all wells with an operating permit and for all temporary rig supply wells. Well owners/water well drillers are also required to submit well drilling and completion reports, pump reports, and other reports that may be helpful to the District in fulfilling its statutory duties. Permitted wells must report all water quality data obtained for raw water from the wells. Uranium exploration companies must submit all water quality data required by statute and District Rule. All data is included in the District Water Well Database.

- Plugging, Sealing, and Capping of Wells
 - The District Rules include the requirement that a deteriorated or abandoned well shall be plugged in accordance with Texas Department of Licensing and Regulation, 16 Texas Administrative Code, Chapter 76, as amended. The rules will also address circumstances requiring the sealing and capping of wells. If a landowner becomes aware of a plugged well, or if a P-13 is filed with the Railroad Commission to convert an oil and gas well (usually a dry hole) into a water well, these are considered water wells under District Rules and must be registered with the District.

- Well Spacing
 - The District has adopted the spacing requirements of the Water Well Driller’s rules, 16 Texas Administrative Code Section 76.1000, as amended. The District has also adopted spacing from property boundaries based on the capacity of the proposed water well.

- Enforcement
 - The District has adopted rules setting out its enforcement authority and policies, as authorized by Texas Water Code §§ 36.101 and 36.102. The rules authorize entry onto property as authorized by Texas Water Code §36.123. They also establish the process by which the District will undertake an enforcement action and the steps to be followed.

- Procedural Rules
 - The District has adopted procedural rules establishing required notice and hearing for various District activities such as approval of rules, including

emergency rules; actions on operating permits; permit actions requiring a contested case hearing; and enforcement matters. These rules have recently been updated to implement changes in state law applicable to the District.

- Prohibition Against Waste
 - The District prohibits waste of groundwater.

X. GOALS, MANAGEMENT OBJECTIVES AND PERFORMANCE STANDARDS

Identify the performance standards and management objectives for effecting the plan, as required by Texas Water Code § 36.1071(e)(1) and 31 TAC § 356.5(a)(2) & (3).

A. Efficient Use of Groundwater

Management objectives and performance standards for providing the most efficient use of groundwater, as required by Texas Water Code § 36.1071(a)(1) and 31 TAC §356.5(a)(1)(A).

1. Objective: The District will continue to register all new wells and locate and register any existing well that may not yet have been registered.

1. Performance Standard: All registered wells are entered into the District's water well database. This includes information from the registration forms, the registration certificate, and for new wells, the drilling log. All information reported to the District regarding each registered well will be entered into the District's water well database. The number of registered wells will be presented in the District's annual report.

4. Objective: The District will continue to require an operating permit for all non-exempt wells.

4. Performance Standard: All permitted non-exempt wells will be entered into the District's water well database, including the application, the permit, annual water use reports, any water quality reports, the driller's log, and any other information available to the District about the wells. The number of wells permitted by the District will be noted in the District annual report.

5. Objective: The District will develop a method of tracking acreage associated with all wells permitted under District Rules as "new wells" under the District's correlative rights production limits.

5. Performance Standard: The District will provide a certificate to each permittee designating the total acreage allocated to each permit. A copy of these certificates will be entered into the District database for each of these permitted wells. The number of such certificates that are issued will be included in the District annual report.

6. Objective: Each year, the district will contact all water well service companies doing business in the District and will provide written educational information about District rules and policies.

6. Performance Standard: The Board of Directors will approve the content of each year's letter based on activities and emerging issues within the District. A file copy of these letters will be kept in the District Office. Each year, the District's annual report will include a list of licensed water well drillers and pump installers doing business in the District and a copy of the educational information provided.

7. Objective: The District will continue to maintain a database that is current with all data acquired by the District about all registered and permitted wells in the District.

7. Performance Standard: Each year, the District's annual report pertinent to items A.1 through A.5 will be derived from the database. Additionally, the report will contain an evaluation of the software being used for the database, and any recommendations regarding needed changes.

B. Preventing Waste of Groundwater

Management objectives and performance standards for controlling and preventing waste of groundwater, as required by Texas Water Code § 36.1071(a)(2) and 31 TAC §356.5(a)(1)(B).

1. Objective: The District will conduct an on-site investigation within two working days of receiving a report of waste of groundwater.

1. Performance Standard: If the District receives a report of waste of groundwater, the General Manager will prepare a written report of the outcome of the investigation and will present it to the Board of Director's at the next Board meeting. A discussion of the waste of groundwater observed by the District, including the number of reports of waste received during the year and the District's response to the reports will be included in the District's annual report.

C. Controlling Subsidence

Management objectives and performance standards for controlling and preventing subsidence, as required by Texas Water Code § 36.1071(a)(3) and 31 TAC §356.5(a)(1)(C).

1. Objective: The Gulf Coast Aquifer contains sufficient amounts of clays interbedded within fairly prolific sand and gravel formations to be vulnerable to subsidence. The current groundwater uses, especially near the coastal areas of the District, are not sufficient to cause dewatering from the clay with a resultant loss of support pressure. The District will evaluate possible subsidence impacts of any near coast, large-scale groundwater production proposal (greater than 100 acre-feet/year).

1. Performance Standard: As part of the Operating Permit Application process, the District will be appropriately evaluate possible subsidence impacts of any near coast, large-scale groundwater production proposal (greater than 100 acre-feet/year). The evaluation will be presented to the Board of Directors during the Operating Permit Application consideration. The number and a description of any near coast, large-scale groundwater production proposals will be presented in the District's annual report, and will include the District's evaluation for possible subsidence impacts from the proposals.

D. Conjunctive Surface Water Management

Management objectives and performance standards for addressing conjunctive surface water management issues, as required by Texas Water Code § 36.1071(a)(4) and 31 TAC §356.5(a)(1)(D).

1. Objective: Each year the District will participate in the regional planning process by attending a minimum of two meetings of the Region N Regional Water Planning Group per fiscal year.

1. Performance Standard: The District representative will give an oral report at the District Board meeting following the Region N meeting and the report will be reflected in the minutes of that Board meeting. Additionally, the District's annual report will include the number of Region N meetings attended during the year and the dates of those meetings.

E. Natural Resource Issues and Groundwater

Management objectives and performance standards for addressing natural resource issues that impact the use and availability of groundwater and which are impacted by the use of groundwater, as required by Texas Water Code § 36.1071(a)(5) and 31 TAC §356.5(a)(1)(E).

1. Objective: The District will continue to require registration of and a plugging report on all wells that are plugged each year. Additionally the District will require a landowner to register all plugged wells when the landowner becomes aware of their existence.

1. Performance Standard: The number of plugging reports received by the District will be noted in the District annual report. All registered plugged wells will be entered into the District's water well database, including the registration application, the registration certificate, and the plugging report, if the well is newly plugged.

2. Objective: The District will require registration of all wells covered by a P-13 submitted to the Railroad Commission. When an oil and gas operator abandons an oil and gas well and desires to convert it into a potential water well, he must submit a P-13.

These wells are considered to be water wells under District Rules, regardless of whether water is ever produced from them.

2. Performance Standard: After approval of this management plan, the District will include information about this requirement in the first annual education letter to all water well service companies and to all oil and gas operators doing business in the District. The District will also study the feasibility of identifying P-13 wells by working with the Railroad Commission. The number of P-13 wells registered with the District will be noted in the District annual report.

3. Objective: Once each year, the District will monitor temperature, total dissolved solids, pH, and electric conductivity by taking measurements of at least 25 wells through the voluntary monitoring project described in A.8.

3. Performance Standard: The number of wells to be measured may be increased as necessary. The water quality data will be entered into the District's water well database. The results of each round of annual measurement events will be provided to the Board of Directors within 30 days after completion of measurement collection and analysis and included in the annual report.

F. Drought Conditions

Management objectives and performance standards for addressing drought conditions, as required by Texas Water Code § 36.1071(a)(6) and 31 TAC §356.5(a)(1)(F).

1. Objective: Links to NOAA Climate Monitoring web-page (<http://www.ncdc.noaa.gov/oa/climate/research/prelim/drought/palmer.html>) and to the Texas Water Development Drought page (<http://www.twdb.state.tx.us/data/drought>) will be maintained on the District website to provide short-term and long-term drought information.

1. Performance Standard: At least quarterly, the website will be checked to ensure that the links are still current. The General Manager will assess the status of drought in the District and prepare a quarterly briefing to the Board showing the impact of drought or weather conditions on water levels. The District's annual report will include the downloaded PDSI maps, Situation Reports, and copies of the quarterly briefing.

G. Conservation Measures

Management objectives and performance standards for addressing conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, brush control where appropriate and cost effective, as required by Texas Water Code § 36.1071(a)(7) and 31 TAC §356.5(a)(1)(G).

1.a. Conservation Objective: The District will collaborate with the local USDA-Natural Resources Conservation Service (NRCS) field office and submit an article on water conservation for publication each year to at least one newspaper of general circulation in the District and post it on the District website.

1.a. Conservation Performance Standard: A copy of the published article on conservation will be included in the District's annual report.

1.b. Conservation Objective: The General Manager will be available to present water conservation programs to schools, 4-H clubs, scouting units and community groups on a request basis. These programs will be scheduled through the District office and will be appropriate for the various audiences. Depending on availability, the District will make every effort to distribute, on an annual basis, conservation education materials to schools that serve students from the District.

1.b. Conservation Performance Standard: A summary of programs presented, content and audience group will be included in the annual report. A bibliography of any conservation literature provided to the audience by the District will be included in the report with the summary.

1.c. Conservation Objective: The General Manager will monitor all continuing education classes on drought and conservation that would be beneficial and attend with the Board's approval.

1.c. Conservation Performance: A summary of classes attended will be included in the annual report.

2. Recharge Enhancement Objective: The District, with the services of a consultant, will attempt to identify recharge areas within the District and present them in connection with the biennial report on water monitoring results.

2. Recharge Performance Standard: All recharge areas identified within the District will be listed in the annual report.

3. Rainwater Harvesting: This management goal category is not applicable to the District due to a low population number.

4. Precipitation Enhancement: The District has no plans to participate in precipitation enhancement because it has not been proven to be cost effective and is not feasible for the District.

5. Brush Control Objective: Annually, the District will contact the USDA-NRCS and the Kleberg-Kenedy Soil and Water Conservation District (SWCD) offices to obtain information about brush control and make that information available to the public.

5. Brush Control Performance Standard: All information on brush control obtained from the USDA-NRCS and the Kleberg-Kenedy SWCD offices and provided to the public will be reported in the District's annual report and posted on the website.

H. Desired Future Conditions

Management objectives and performance standards for addressing the desired future condition of the groundwater resources in the District (if available from the districts in the groundwater management area), as required by Texas Water Code § 36.1071(a)(8) and 31 TAC §356.5(a)(1)(H).

As per Resolution No. R2010-001 submitted in August, 2010, the authorized voting representatives for Groundwater Management Area 16 established a desired future condition (DFC) of the Gulf Coast aquifer which was an area-wide average drawdown of approximately 94 feet through 2060. The DFC established for the Kenedy County GCD was a drawdown of 101 feet in 2060.

1. Objective: The District-wide, voluntary monitoring project will be maintained and includes biennial measurements of hydrostatic levels from approximately 50 wells and the hydrostatic level to bottom of screen measurements in those wells where the screen depth is known.

1. Performance Standard: The number of wells to be included in the monitoring project may be increased as necessary. The respective hydrostatic levels and other related data will be entered into the District's water well database. The results of each round of biennial measurements will be provided to the Board of Directors within 30 days of completion of the measuring round. The number of wells involved in the project and the respective static levels will be included in the District's annual report.

2. Objective: The District will monitor groundwater withdrawals in the District to evaluate compliance with the desired future condition.

2. Performance Standard: As part of the biennial report on water level measurements from the monitoring program described in A.8, above, the General Manager will include in his written report to the Board an evaluation of the drawdown relative to the DFC.

XI. METHODOLOGY FOR TRACKING PROGRESS

Methodology for tracking progress in meeting management goals, objectives, and performance standards, as required by 31 TAC § 356.5(a)(6).

As mentioned in the management objectives and performance standards above, written reports will be presented to the Board of Directors on a timely manner, based on the objective. Additionally, as described in section X, all data related to water wells in the District will be entered into the District's water well database.

The General Manager will prepare and present to the board of directors (BOD) an Annual Report covering District performance in achieving management goals and objectives for the preceding fiscal year. The report will be presented to the BOD in January of the following year. The District will maintain the report in its files and will have copies available to the public. Once the report is approved by the Board, it will be posted on the website.