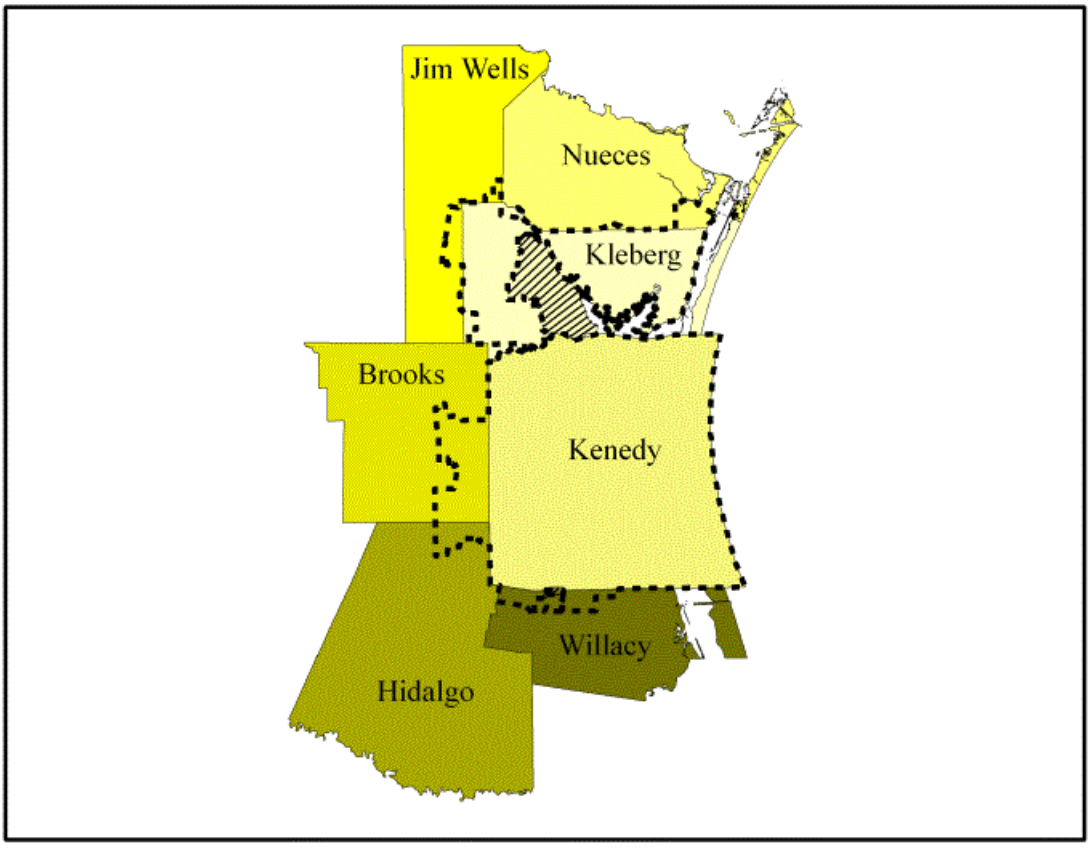
Kenedy County Groundwater Conservation District's Management Plan



Adopted by KCGCD: July 6, 2007
Approved by TWDB: _____

Board of Directors

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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 protect and enhance the groundwater resources of the District.

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 manage and conserve the groundwater resources of the State of Texas. This legislation requires that each groundwater water conservation district develop a management plan that defines the district's water needs and supply within the district and to establish 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 managed 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. Finally, the District may consider whether transport permits are 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. During the fall of 2006, the District received petitions from landowners in Brooks, Hidalgo, and Willacy counties requesting annexation into the District. These petitions were approved by the Board. Exhibit A shows the current boundaries of the District.

B. Directors

The Board of Directors consists of five members. These five directors are elected by the voters of the District and serve four-year terms. Four of the Directors are from the four Kenedy County Commissioner precincts. The fifth Director is elected from a precinct comprised of western Kleberg County in the Santa Gertrudis Independent School District. Director four-year terms are staggered with a two year interval. Directors from Precincts 2 and 5 serve the same term while directors from Precincts 1, 3, and 4 serve the same term. Elections are held in May in even numbered years.

C. Authority

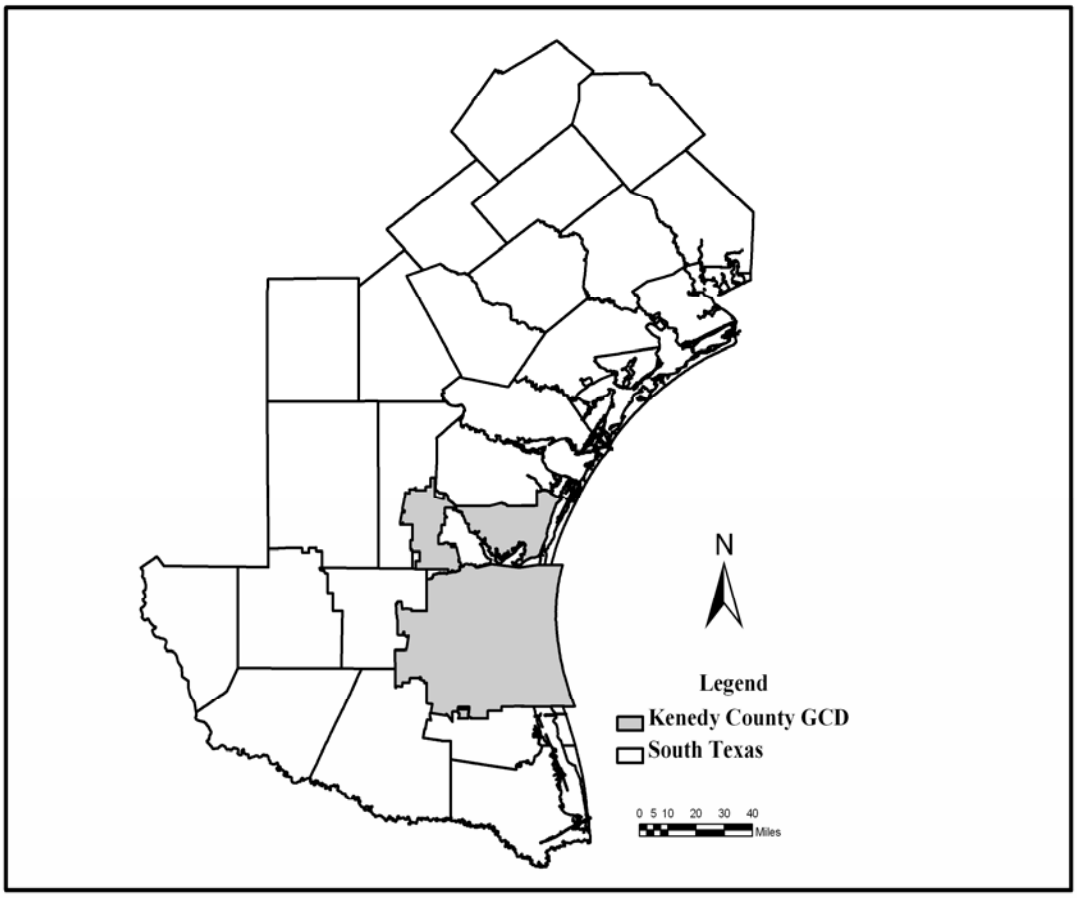
According to its enabling legislation, the District has all of the powers, authority, and duties of a Texas Water Code Chapter 36 groundwater conservation district. Therefore, it has the duty to provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater, 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 and which allow 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 A. The District encompasses approximately 2,958 square miles**.** The primary economic activities within the District are oil and gas production and agriculture, primarily livestock. While the District does not have a large-sized city or township, it is close to the City of Kingsville, which has traditionally relied on groundwater supplies.

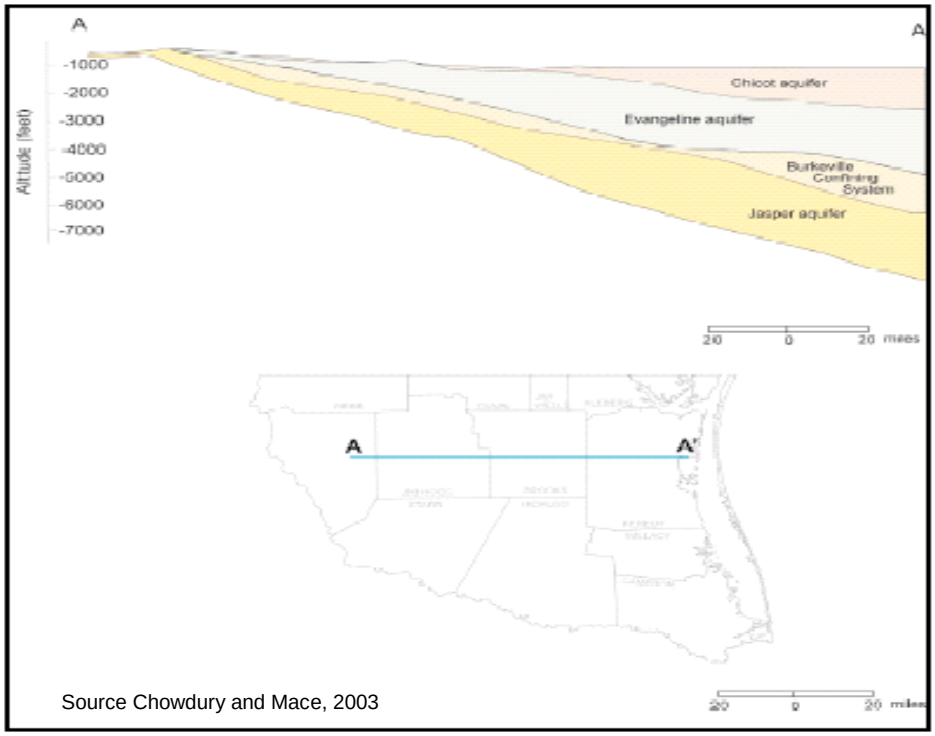
Exhibit A: Kenedy County Groundwater Conservation District



E. Aquifer Formations

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. There are four major aquifer formations within the District: the Chicot, Evangeline, Burkeville and Jasper formations (Baker, 1979).

Exhibit B: Aquifer Cross-Section of Kenedy County Groundwater Conservation District (from Chowdhury and Mace, 2003)



A representative cross-section of the aquifer depicting the four major aquifer formations in the District is presented in Exhibit B. Select cross-sectional maps and general information regarding the thickness of these formations, their variability and the extent of sand thicknesses have been summarized by Chowdhury and Mace (2003) and Waterstone (2004). This information was used to summarize salient features of aquifer formations within the District.

Exhibit C: Approximate Depth to the Top of Aquifer Formations in Various Administrative Units (Depth to the top is measured from MSL)

County	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**
Brooks[1]	0 (20 – 100)	0-1600	~1200	~2000
Hidalgo[1]	0 (20-100)	400-1600	~1200	~1200
Jim Wells[1]	0 (20 – 100)	400 – 1600	700 – 1000	1000 - 2000
Kenedy	0 (100 – 1600)[2]	800 – 2800	1500-3500	2000 - > 4000
Kleberg	0 (100 – 1600)	800 – 2800	1200 – 3500	2000 - > 4000
Nueces[1]	0 (1000 – 1600)	800 – 2800	1500-2500	2000 - > 4000
Willacy[1]	0 (100-600)	400-1600	~1200	~2000

[1] Considers thickness of only the portions of the county within the District.
[2] Numbers in parentheses are the approximate thickness of the Chicot formation.

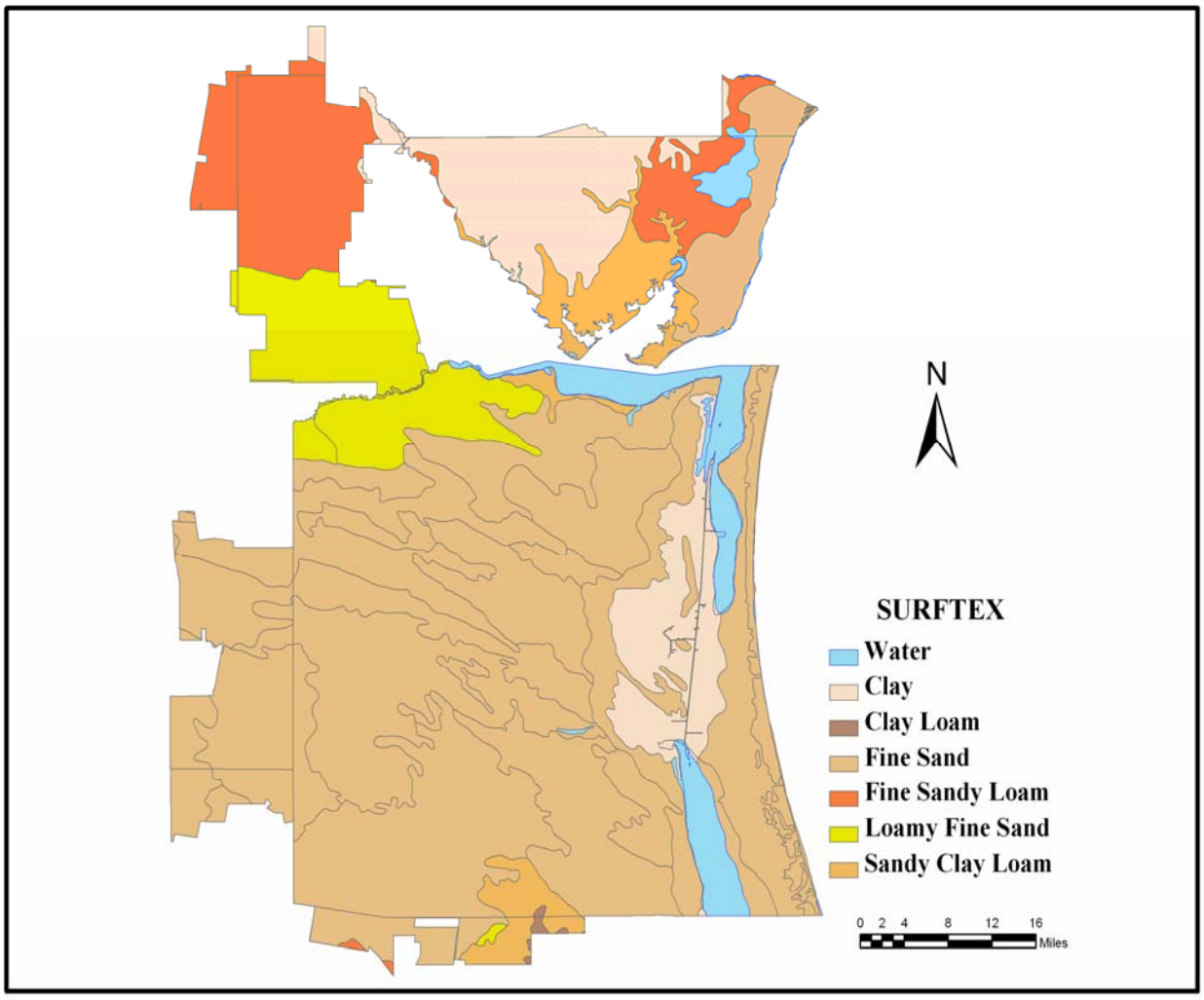
The thickness of the stratigraphic units increase eastward and the larger numbers in Exhibit C are to be expected near the coast (Baker, 1979). The Chicot formation covers the surface of the District and is the only formation that is directly recharged by precipitation. The thickness of the Chicot formation is very small: 20 – 100 feet in the western sections of the District and the water quality of this formation is characterized by high total dissolved solids (TDS), especially near the coast. As result, this aquifer formation 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 formations along the western sections of the District.

Further information about groundwater level measurements and hydrogeologic parameters are included in Appendix A, which includes excerpts from "Hydrologic and Hydrogeologic Data Compilation and Assessment in Support of Groundwater Management in Kenedy County Groundwater Conservation District," prepared by Venkatesh Uddameri, Ph.D., Department of Environmental Engineering, Texas A&M University-Kingsville on October 13, 2005. A copy of the complete report is available from the District upon request. Note that the report was prepared prior to extension of the District's boundaries through annexation.

F. Surfacial Soil Texture Characteristics

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

Exhibit D: Surfacial Soils



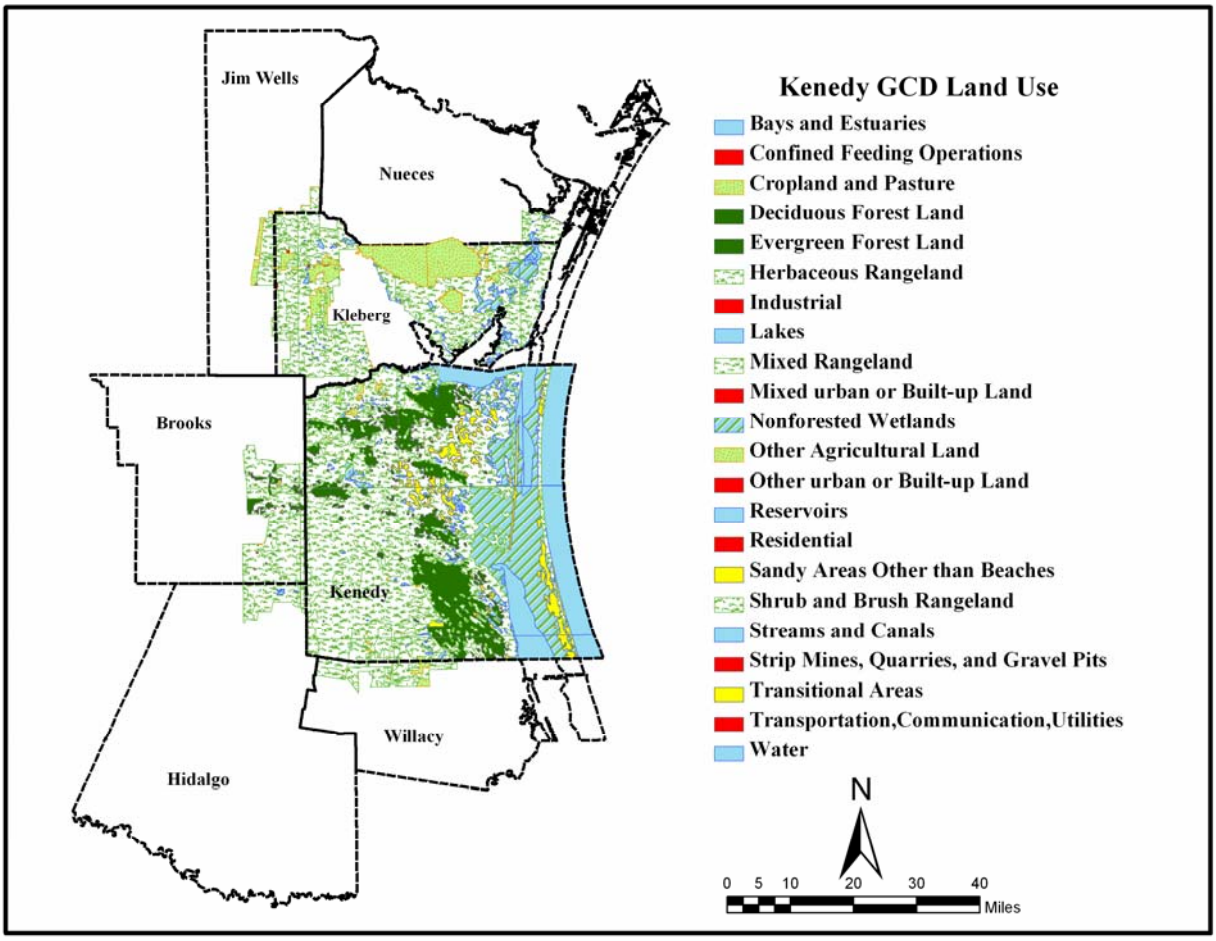
The surfacial soils within the District range from clayey soils to fine sands. The silt and clay deposits are commonly referred to as Beaumont clays and Lissie formations and they outcrop in the eastern sections of Kleberg, Kenedy and Nueces counties. Most of the District is overlain by tan to white, unfossilferous, fine to very fine sand deposits that are intermixed with clay and sandy clay that are referred to as South Texas eolian plain deposits as they are primarily comprised of wind blown 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 wind blown and are underlain by Beaumont clays and Lissie formation (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 Land Cover Characteristics

The area covered by the District is predominantly a mix of herbaceous and mixed rangelands with very little urban area (Exhibit E). As a result, agriculture and livestock demands are of critical importance within the District. In addition to livestock and agricultural uses, groundwater supplies for oil and natural gas production are important as well. While the District does not have 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) 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.

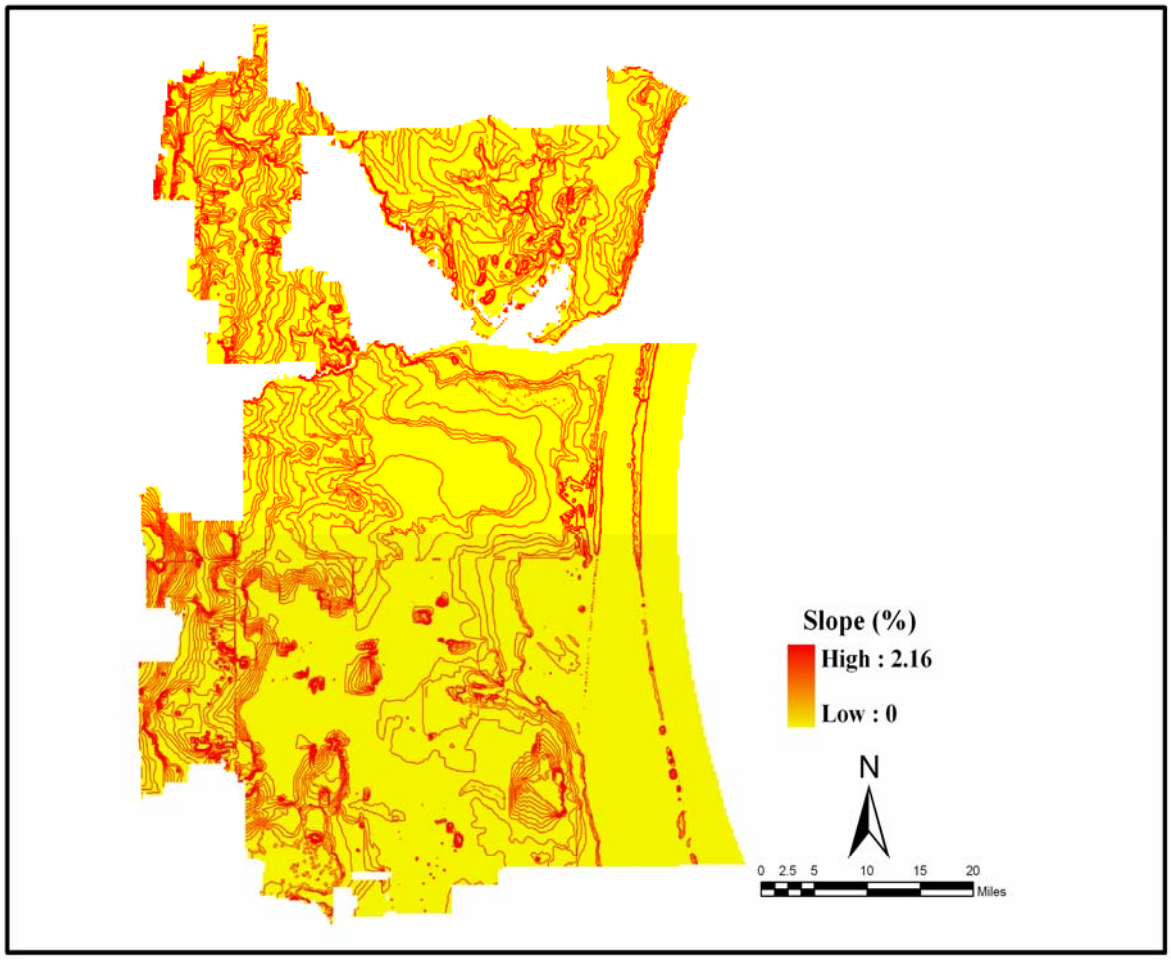
Exhibit E: Land Use Cover Characteristics (based on 1999 USGS data modified by 2006 ground-truth survey information provided by King Ranch Inc.)



H. Land Slope

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 range from near zero to little over 2% near the surface water bodies. 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 interactions.

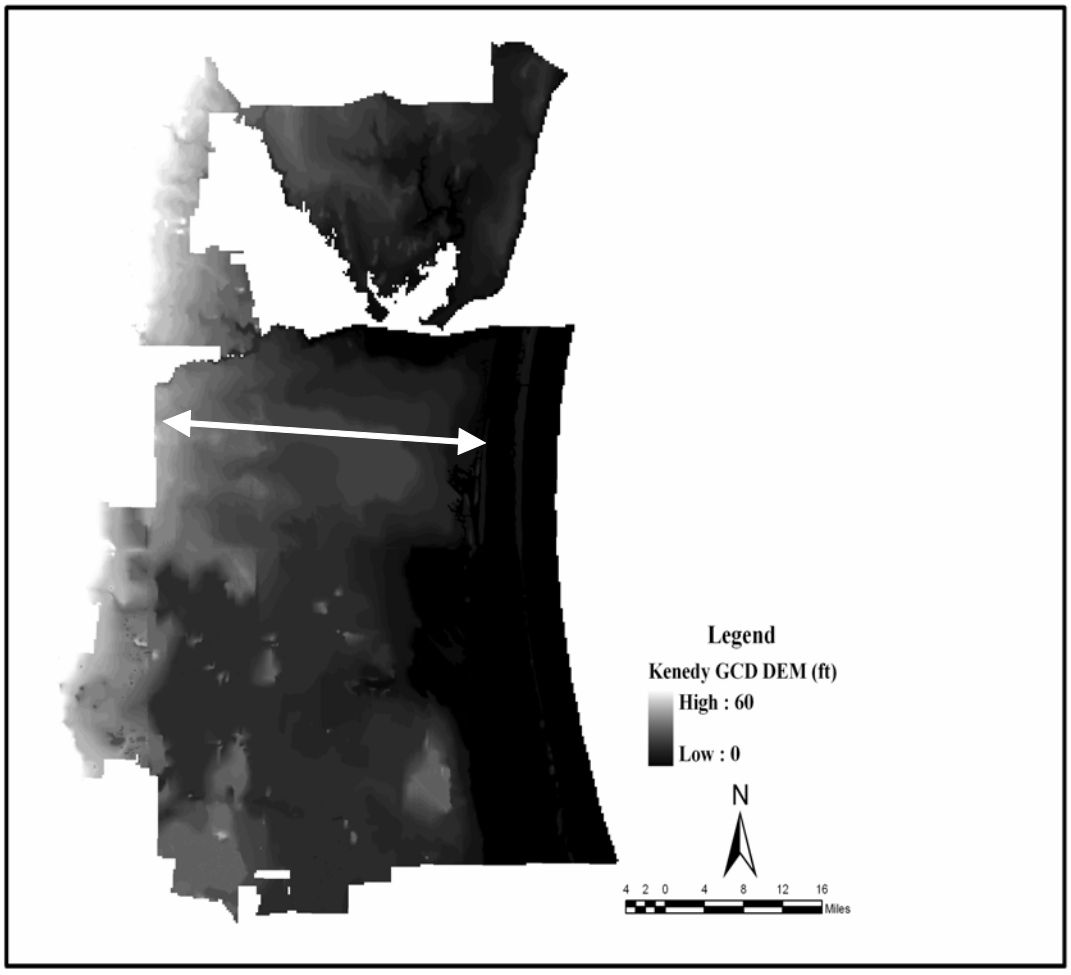
Exhibit F: Calculated Slopes



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 60 feet in Jim Wells and Brooks County to about mean sea level in the eastern sections of Nueces, Kleberg and Kenedy counties. A cross-section of higher elevation can be found in the northern portion of Kenedy County (depicted by a straight arrow in the figure). This topographic feature would correspond to a groundwater divide and is consistent with the boundary used to demarcate between the Central and Southern Gulf Coast Aquifer models (GAMs) developed by the Texas Water Development Board (TWDB).

Exhibit G: Topography. (The white arrow indicates a potential groundwater divide. All dimensions are in feet.)



IV. STATEMENT OF GUIDING PRINCIPLES

The District recognizes that the groundwater resources of the District are of vital importance. The preservation 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 as a tool to focus the thoughts and actions of those given the responsibility for implementing 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 plan becomes effective upon adoption by the District Board of Directors (Board) and subsequent certification 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.

B. Board Resolution

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

A certified copy of the Kenedy County Groundwater Conservation District resolution adopting the plan is attached as Appendix B – 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 plan was adopted following appropriate public notice and hearing is attached as Appendix C – 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 management entities within the District. A letter transmitting a copy of this plan to Region M (Rio Grande Regional Water Planning Area) and Region N (Coastal Bend Regional Water Planning Group) is attached as Appendix D – Letter to Surface Water Management Entities/Regional Water Planning Groups.

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

A. Managed available groundwater

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

Managed available groundwater is defined in TWC §36.001 as "the amount of water that may be permitted by a district for beneficial use in accordance with the desired future condition of the aquifer." Under Texas Water Code § 36.108(d), the desired future condition may only be determined through joint planning with other groundwater conservation districts (GCDs) in the same groundwater management area (GMA). The District is located in GMA 16. The GCDs of GMA 16 have not completed the joint planning process to determine the desired future condition of the aquifers in the GMA. As a result, the District is unable to present a value for the managed available groundwater in the aquifers of the District.

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)).

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 for year 1997 used in the most recent approved state water plan. Because the District encompasses only portions of some counties and site-specific measurements were not available, a GIS based surrogate factor method was employed to apportion use to the various types of uses in those portional counties (values calculated according to land use areas for irrigation, livestock, industrial, and mining; and population for municipal usage.) The results are shown in Exhibit H.

Exhibit H: Groundwater Use in the District (Based on data from TWDB WIID database) [1]

Estimated Groundwater Use (1997) in Ac-ft/yr					
County	**Municipal**	**Irrigation**	**Livestock[2]**	**Industrial**	**Mining**
Brooks	36.92	0.70	0.10	0.00	44.27
Hidalgo	0.33	0.37	0.02	0.00	0.00
Jim Wells	17.01	13.35	1.87	0.00	0.00
Kenedy	70.00	0.00	61.00	0.00	1.00
Kleberg	154.12	66.65	72.65	19.28	0.00
Nueces	0.84	0.00	0.09	14.98	0.09
Willacy	0.00	0.00	0.17	0.00	0.00
Total	**279.22**	**81.07**	**135.90**	**34.26**	**45.36**

The county-wide estimates used in the most recent state water plan were obtained from the Texas Water Development Board (TWDB) WIID database. See Appendix E, WIID Database Groundwater Use (1997). Municipal use in Kleberg County was apportioned by identifying the fraction of the county population that resided within the District because several public water supply wells are located in Kleberg County within the District. The recent census block data (Census 2000) was used to develop the population fraction and is depicted in Exhibit I.

Of note: Although the City of Kingsville is not located within the District, its location is surrounded by territory that lies within the District. Kingsville uses water derived from surface and subsurface sources. In recent years, the proportion of groundwater used is roughly 85% and in the year 2006, nearly 3425 ac-ft of water was extracted by the City from the Evangeline (Goliad sands) aquifer formation. The drawdowns in the Kingsville area were greater than 200 ft during the period of 1932-1969 (Shafer and Baker, 1973) and continue to be greater than 150 ft in recent times (Chowdhury et al., 2004). Hence, localized groundwater movement away from the central portions of the District boundaries towards the City are to be expected and may limit the amount of groundwater available in some sections of the District. As a result, it is important to monitor and evaluate the impacts of Kingsville's groundwater extraction rates for any future policy formulation and planning endeavors.

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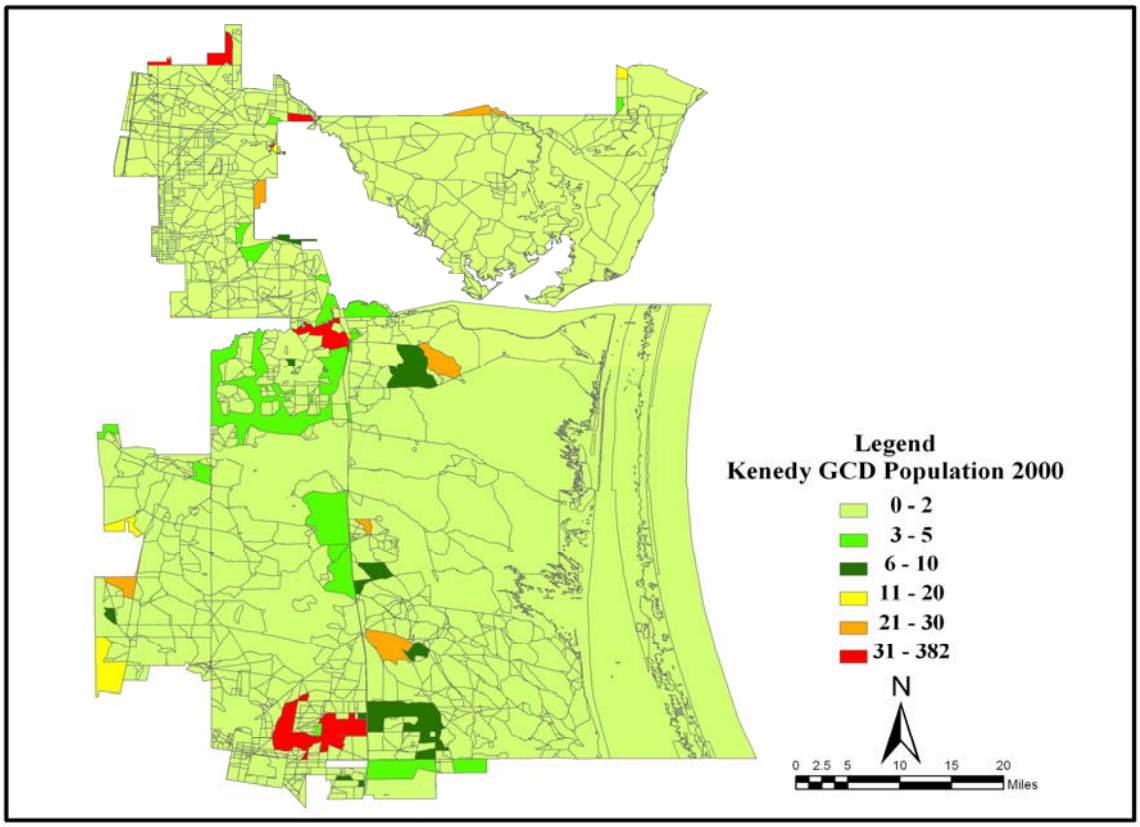
[1] The data in TWDB WIID database are presented per county. The District covers only portions of Brooks, Hidalgo, Jim Wells, Kleberg, Nueces, and Willacy counties. Area landowners provided information to assist the District in apportioning the data to the parts of the counties located within the District.

[2] Livestock may also include wildlife. The groundwater component of livestock use is likely underestimated under 1997 TWDB guidelines.

Exhibit I: Population Distribution in the District (Based on Census 2000 Data)

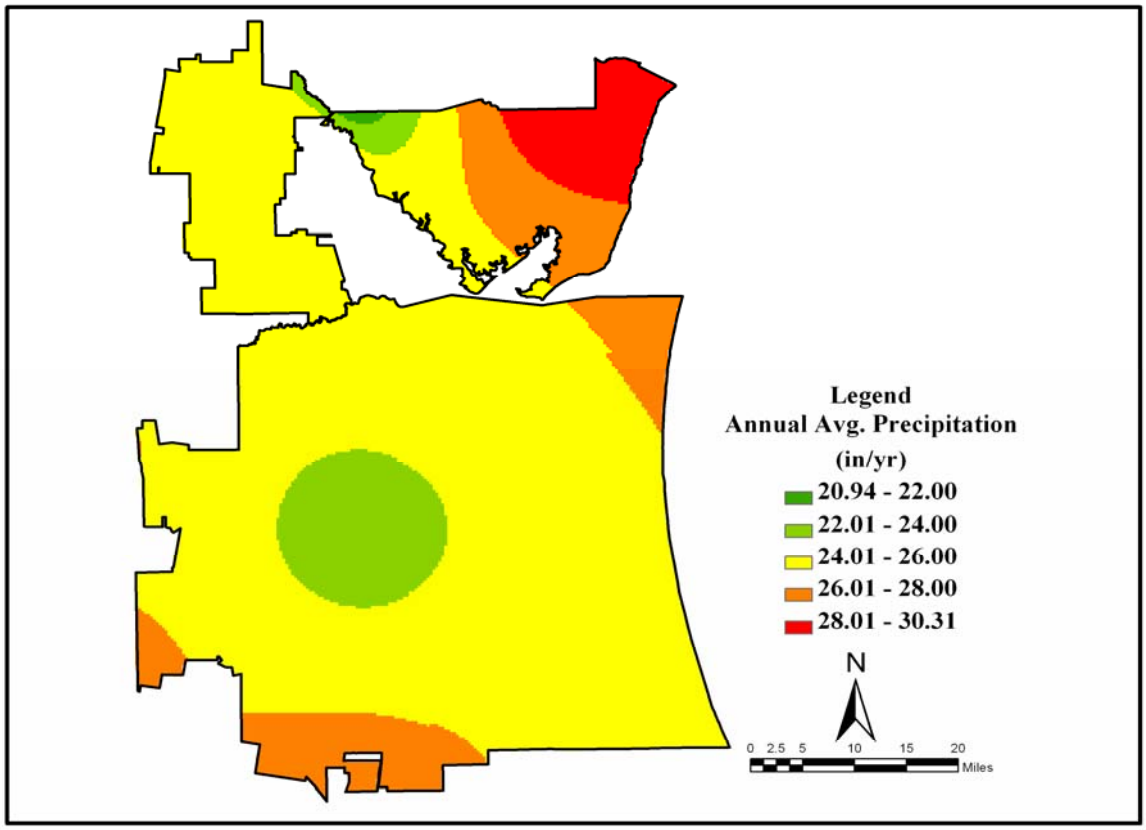


The apportionment of groundwater use for other demands in Exhibit H was based on land use land cover characteristics depicted in Exhibit E. The land use land cover data obtained from the United States Geological Survey was refined when local and more recent ground-truth data were available. Similarly, the mining and industrial demands were based on the fraction of lands occupied by mines, quarries and industries as identified in the land use land cover map, and ground-truthed by area landowners. The irrigation water use data was based on information provided by the land owners, who stated that there is no irrigated agriculture within the District. The total groundwater use was estimated to be approximately 379 acre-feet/year.

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 J: Long-Term Average Precipitation Profile

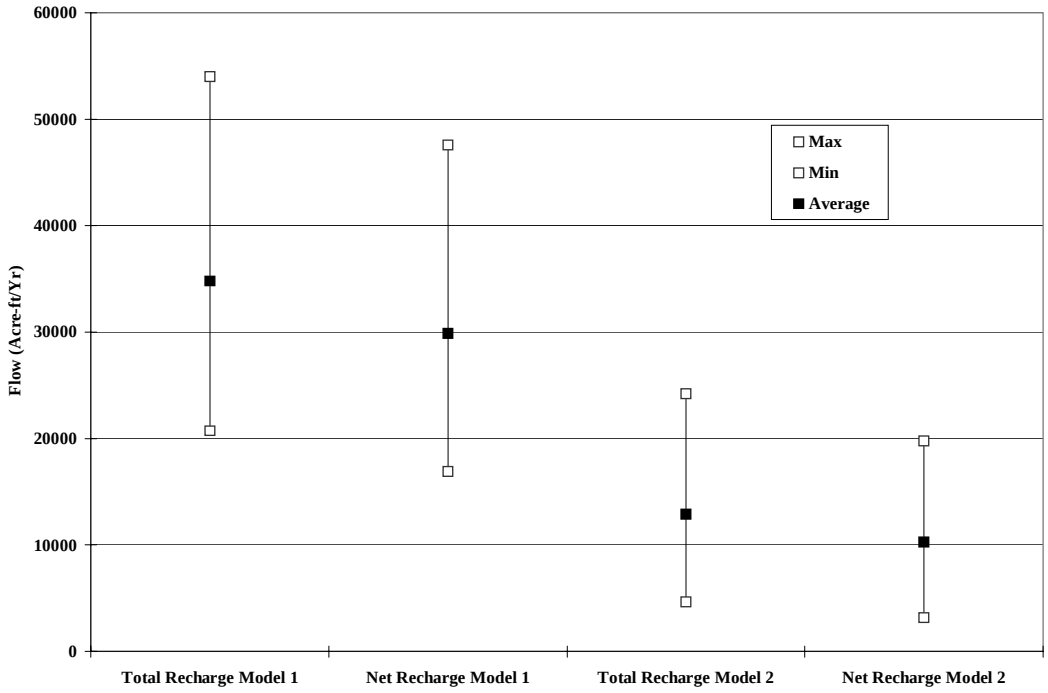


Precipitation information is used in conjunction with soils information to derive recharge characteristics. The climate in South Texas is characterized by mild winters and dry summers. The long term average precipitation data (1950 – 2003) collected at weather stations in and around the District were used to develop the precipitation contour map depicted in Exhibit J. 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.

Calibrated recharge values from the Central Gulf Coast Aquifer GAM (CGC-GAM) and the Southern Gulf Coast Aquifer GAM (SGC-GAM) developed by the Texas Water Development Board were extracted to obtain a more refined estimates of recharge, as shown in Exhibit K. These estimates indicate that the average recharge is roughly 0.13

inches/year in the southern parts of the District covered by the SGC-GAM and the recharge is about 0.2 inches/year in the parts of the District covered by the CGC-GAM. Groundwater budgets for the District were developed by making SGC-GAM and CGC-GAM runs for the period 1990 – 1999 and super-imposing the results. This period corresponds to the most recently calibrated stress period which has the same length as the District's adopted planning horizon of 10 years, and is reflective of the current conditions.

Exhibit K: Recharge Estimates from Water Budgets Based on CGC-GAM and SGC-GAM



In Model 1 the domain of the District falling within the CGC-GAM till its southern boundary was retained and the remaining area of the District was modeled in SGC-GAM. In Model 2 the domain of the District falling within the SGC-GAM till its northern boundary was retained and the remaining area of the District was modeled in CGC-GAM (see Exhibits L and M).

Exhibit L: Depiction of Area Covered by the SGC-GAM in Model 1(Remaining Area of the District was Covered by the CGC-GAM)

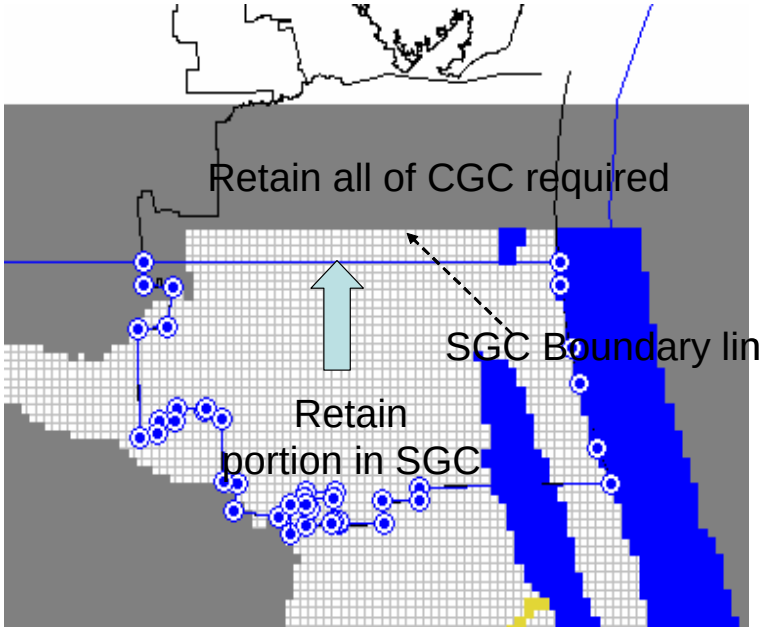
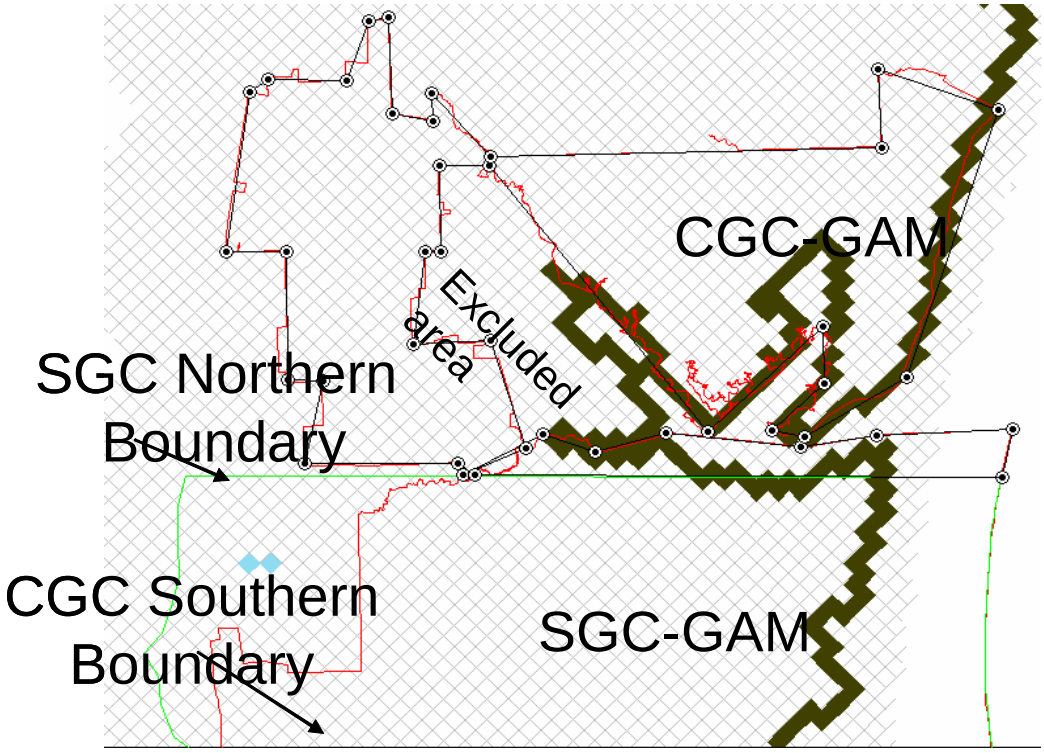


Exhibit M: Depiction of Area Covered by the CGC-GAM in Model 2 (Remaining Area of the District was Covered by the SGC-GAM)



The total recharge corresponds to recharge from precipitation while the net recharge removes the effects of evapo-transpiration (ET) from the total recharge. The model results presented in Exhibit K indicate that the average total recharge varies between 12,000 – 35,000 ac-ft/year depending upon how the two available GAMs are coupled. The variability between the GAM results is to be expected because being regional–scale models the inputs (recharge and ET) are only effective properties averaged over a large domain and also differences arise due to non-uniqueness of the calibration process. However, as depicted in Exhibit K the temporal variability of recharge is larger than the differences between the model calibrations. Hence, an average total recharge obtained by averaging both the models is computed to be 23,000 ac-ft/yr and recommended as the recharge estimate for planning purposes. The recharge due to precipitation mostly occurs in the upper Chicot formation within the District. However, model results indicate that there is some recharge to the Evangeline aquifer when it outcrops within the District (particularly, along the western sections of the District in Brooks County). The average recharge of the Evangeline aquifer was noted to range between 34 ac-ft/yr – 194 ac-ft/yr using Model 1 with an average of 103 ac-ft/yr and between 67 ac-ft/yr – 394 ac-ft/yr using Model 2. The average total recharge is roughly 0.3% and 1.7% of the recharge to the Chicot formation and as such is insignificant.

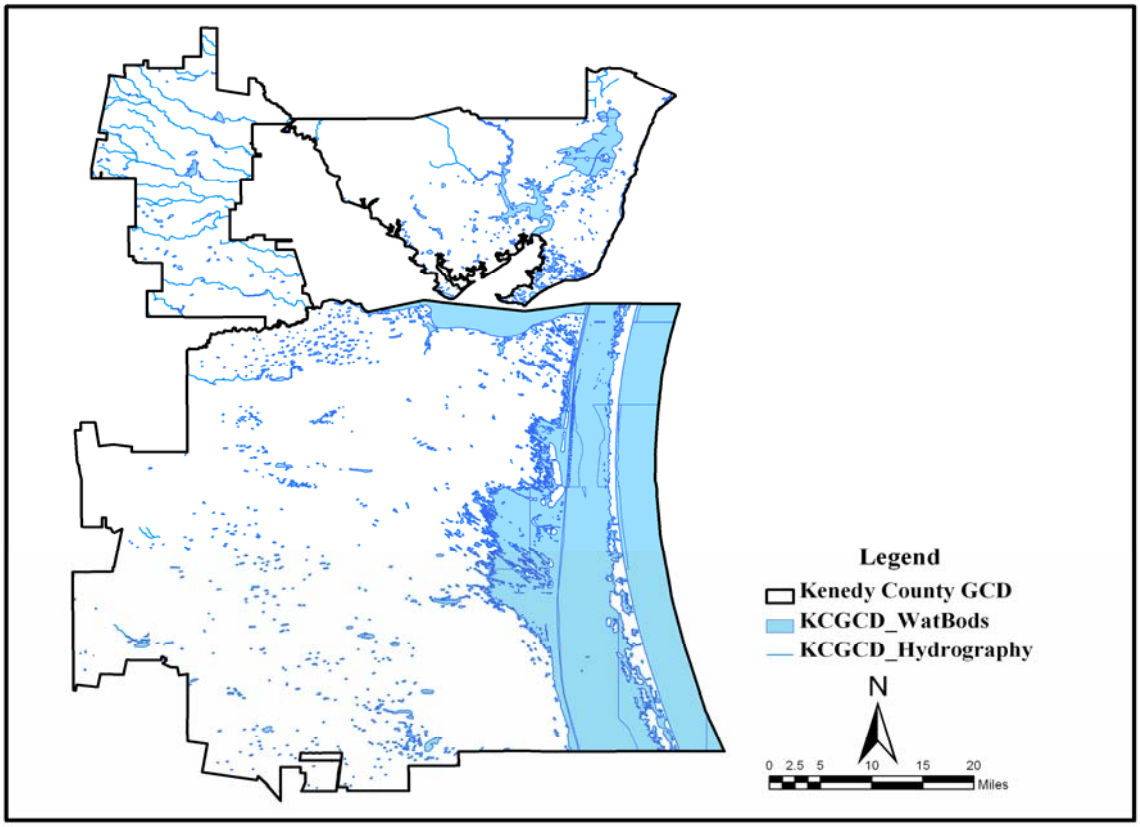
D. Annual Discharge to Surface Water Bodies

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 N). However, sensitive coastal water bodies like Baffin Bay and Laguna Madre abut the District. Research being carried out by Texas A&M University-Kingsville, funded through the National Oceanic and Atmospheric Administration (NOAA), indicate that a significant amount of groundwater (on the order of 1 cm/day) discharges into Baffin Bay. Hence, coastal groundwater interactions will be of significance.

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 these 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.

Exhibit N: Major Surface Water Bodies



Surface water-groundwater interaction data in the GAM models was gathered from head dependent boundaries (generally representing discharges to coastal bodies); drains (generally representing groundwater discharges to wetlands); and stream leakage (generally representing groundwater interactions with streams). The decadal average (1990 – 1999) for different water budget elements pertinent to surface water – groundwater interactions are presented in Exhibit O. Again, differences between the two models are to be expected given their regional-scale nature, differences in conceptualization, and calibration non-uniqueness. Although not reported here, the temporal variability is higher than the differences between the models.

Exhibit O – Average Surface Water –Groundwater Interactions (All values in Ac-ft/.year)

Water Budget Component	Model1	Model 2	Average
Head Dependent Boundaries	-27217	-11645	-19431
Drains	-2	-1	-1.5
River Leakage	415	5366	2890

The water budget results indicate that roughly 20,000 Ac-ft/yr flows into the coastal bodies within the District through the Chicot formation and this is the major interaction. The aquifers within the District gain roughly 2,890 Ac-ft/yr of water through leakage from surface water bodies, although, some streams could be gaining in nature. This result is consistent with the general hydrological profile of the region wherein most streams are intermittent and the water table is sufficiently deep. Based on the land-use/ land-cover information, nearly 300 acres of land within the District (especially in Kenedy and Kleberg counties) is classified as wetlands, especially along the coast. The exchanges through drains (potentially wetlands) are only modeled in the CGC-GAM and not in the SGC-GAM. Also, the gridding used in the models may exclude some of the coastal wetland areas. As a result, the surface water - groundwater interactions presented in Exhibit O could somewhat underestimate the water exchange process occurring in these wetlands.

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 was estimated using the horizontal exchange components of the GAM water budget. Generally, flows into the District occur along the western boundaries. The model results indicate that there is a net gain from all the inflows into the District.

The inflows and outflows for each model conceptualization broken down by the aquifer formations are presented in Exhibits P and Q. There is a net gain of roughly 2000 ac-ft/yr in both Chicot and Evangeline formations and smaller gains in Burkeville and Jasper. These gains partially offset the discharges to the coastal bodies that were presented earlier.

Exhibit P: Inflows into the District by Aquifer Formation (all values in Ac-ft/Yr)

Model 1	Chicot	Evangeline	Burkeville	Jasper
Max	25857	11481	33	1646
Min	21268	8026	26	1015
Average	23938	9835	30	1394
Model 2	Chicot	Evangeline	Burkeville	Jasper
Max	27852	11015	16	1591
Min	10763	4122	6	628
Average	22097	8375	13	1231
Model Av.	Chicot	Evangeline	Burkeville	Jasper
Max	26854	11248	25	1618
Min	16016	6074	16	821
Average	**23017**	**9105**	**22**	**1312**

Note: Includes a small exchange from SGC-GAM at the southern boundary of the CGC-GAM; and a small exchange from CGC-GAM at the northern boundary of the SGC-GAM.

Exhibit Q: Outflows in the District by Aquifer Formation (all values in Ac-ft/Yr)

Model 1	Chicot	Evangeline	Burkeville	Jasper
Max	22649	7179	16	588
Min	18090	6097	14	364
Average	20612	6726	15	497
Model 2	Chicot	Evangeline	Burkeville	Jasper
Max	19707	6342	8	542
Min	7557	2278	3	213
Average	15705	4922	7	418
Model Av.	Chicot	Evangeline	Burkeville	Jasper
Max	21178	6761	12	565
Min	12823	4187	9	289
Average	18159	5824	11	458

Note: Includes a small exchange from SGC-GAM at the southern boundary of the CGC-GAM; and a small exchange from CGC-GAM at the northern boundary of the SGC-GAM.

The cross-formational flows within the aquifers of the District were also assessed by developing water budgets using CGC-GAM and SGC-GAM. The inflows into the formation are denoted by positive numbers while outflows are denoted using negative values. The inflows into an upper layer are also equal to the outflow from the lower layer. The results summarized in Exhibit R indicate that the upper Chicot, Evangeline and Burkeville formations gain water from their immediate lower formations while Jasper loses water to Burkeville formation immediately above it. These results are consistent with what is to be expected as the District has the down-dip sections of the aquifer. The model results obtained by different couplings of CGC-GAM and SGC-GAM are very consistent and on an average Chicot formation gains nearly 3000 Ac-ft/yr and the Evangeline formation gains over 900 Ac-ft/yr.

Exhibit R: Average Net Cross-formational Flows Among Different Aquifer Formations in Ac-ft/Yr Obtained Using GAM Models for the Period (1990 – 1999)

Model 1	Chicot	Evangeline	Burkeville	Jasper
Max	5392	1283	639	-639
Min	971	884	504	-504
Average	2450	1056	579	-579
Model 2	Chicot	Evangeline	Burkeville	Jasper
Max	4971	1003	611	-611
Min	1820	368	239	-239
Average	3398	781	483	-483
Av. Model	Chicot	Evangeline	Burkeville	Jasper
Max	5181	1143	625	-625
Min	1395	626	371	-371
Average	2924	918	531	-531

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 S presents the projected surface water supply data. These data were estimated from the basin-wide data available in the TWDB WIID database and are based on basin-wide projections for the years 2010 and 2020. For estimating municipal demands, the demands for the named municipalities that do not fall within the District were excluded. The county-other municipal data from the database was apportioned based on population estimates obtained from Census tract data. The irrigation demands were apportioned based on cropland ratios obtained from land-use land-cover GIS coverage (LULC). Similarly, the livestock, manufacturing and mining demands were apportioned based on

rangeland, industrial and mining area ratios obtained form the LULC coverage respectively. The steam-electric data was apportioned based on overall land area as no suitable LULC category was available. See Appendix F, Basin-Wide Estimates for Projected Water Supply Demands from the TWDB WIID Database.

Exhibit S: Projected Surface Water Supply Data

Projected Surface Water Supply Data from TWDB (Averaged for 2010 & 2020)						
Surface water Use (Ac-ft/yr)	**Municipal**	**Irrigation**	**Livestock**	**Manufacturing**	**Mining**	**Steam Electric**
Brooks	0.00	0.00	121.44	0.00	0.00	0.00
Hidalgo	1.51	28.52	62.21	0.00	0.00	162.68
Jim Wells	0.00	0.00	78.16	0.00	0.00	0.00
Kenedy	0.00	0.00	0.00	0.00	0.00	0.00
Kleberg	5.79	0.00	910.92	0.00	0.00	0.00
Nueces	1.01	3.08	49.65	555.13	0.00	128.96
Willacy	2.72	544.31	0.00	0.00	0.00	0.00
Total	**11.03**	**575.91**	**1222.38**	**555.13**	**0.00**	**291.64**

Note: Data from WIID database was apportioned for counties partially located within the District.

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). (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)).

The total water demands in the District were also apportioned using GIS-based techniques from the county-wide demand estimates available in the TWDB WIID database that was used for state and regional water planning (Exhibit T). The total county-wide water demand projections for the years 2010 and 2020 were averaged and used in the apportionment process (values calculated according to land use areas for irrigation, livestock, industrial, and mining; and population for municipal use). The total projected demand within the District was estimated to be around 4400 ac-ft/yr with livestock being the major water use group. This result is consistent with the land use patterns within the District. See Appendix G, County-Wide Estimates for Total Water Demands from WIID Database.

Exhibit T: Estimate of Total Demands in Ac-ft/year Obtained from TWDB WIID Database

Estimated Total Demands in Ac-ft/yr					
County	**Municipal**	**Irrigation**	**Livestock**	**Industrial**	**Mining**
Brooks	44.75	0.49	135.52	0	34.86
Hidalgo	4.38	47.64	62.21	0	0.00
Jim Wells	48.10	16.95	90.96	0	0.00
Kenedy	58.50	0.00	712.00	0	1.00
Kleberg	251.35	100.77	1191.00	0	0.00
Nueces	45.98	1.08	69.46	515.79	0.07
Willacy	17.46	909.02	37.13	0	0.00
Total	**470.52**	**1075.95**	**2298.28**	**515.79**	**35.93**

Based on an average of the demand projections for the years 2010 and 2020.

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 2007 adopted 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 U). In addition to covering the entire Kenedy County, the District partially covers several counties (Brooks, Hidalgo, Jim Wells, Kleberg, Nueces, and Willacy).The projected deficits in these counties 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 indicated that no significant shortages were projected over the next 10 years (the planning horizon of this management plan). The regional plan also identifies increasing the pump capacity as a strategy to meet some of these demand deficits. A listing of potential deficits of interest along with an assessment on groundwater resources within the District is presented in Exhibit U. As the deficits are fairly small, the impacts on the groundwater resources should be minimal. The District will however continue to track the progress of water management strategies in the regional water planning process and evaluate new proposals and projects as appropriate.

Exhibit U: Impacts of Regional Water Management Strategies on Groundwater Resources (Based on 2007 Adopted State Water Plan)

County	Water Use Group Experiencing Shortage	Deficit Period	Groundwater Use to Meet the Deficit	Impact to the District
Brooks	None	None	No projected shortages	None
Hidalgo	Some municipal; steam and electric and irrigation	2030	Localized municipal shortages; small localized municipal and steam and electric	Not significant, but groundwater extraction and brackish water desalination have been proposed.
Jim Wells	County - Other	2000 - 2060	Shortages of ~200 ac-ft/yr limited by well capacity	Not significant
Kenedy	None	None	No projected shortages	None
Kleberg	County - Other	2020-2060	Shortages of ~100 ac-ft/yr limited by well capacity	Not significant; no short-term deficit
Nueces	County - Other; mining and manufacturing	2000 - 2060	Municipal shortages due to contract limitations; mining and manufacturing deficits during 2030 - 2060	Not significant in the short-term
Willacy	Irrigation; some municipal	2010 – 2060	Major irrigation deficits 2010 onward; nearly 25,000 ac-ft/yr deficit during 2010 – 2030	Groundwater extraction and brackish water desalination have been proposed as strategies. Water use/management plans of the county need to be monitored.

VIII. MANAGEMENT OF GROUNDWATER SUPPLIES

The District will manage the supply of groundwater within the District in order to conserve 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 protect groundwater resources in the District while considering the economic and cultural activities occurring within the District;
- establish and maintain a water monitoring network in order to monitor changing storage conditions of groundwater supplies within the District;
- make a regular assessment of water supply and groundwater storage conditions and will report those conditions to the Board and to the public;
- undertake, as necessary and co-operate with investigations of the groundwater resources within the District; and
- make the results of investigations available to the public upon adoption by the Board.

The District will adopt rules to regulate groundwater withdrawals as authorized by Texas Water Code Chapter 36. In pursuit of the District's mission of protecting the resource, the District may require reduction of groundwater withdrawals to amounts that will not cause harm to the aquifer. To achieve this purpose, the District may, at the Board's discretion, amend or revoke any permits after notice and hearing. The determination to seek the amendment or revocation of a permit by the District will be based on aquifer conditions observed by the District. 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 TWC § 36.102.

The District will develop a contingency plan to cope with the effects of water supply deficits due to climatic or other conditions, which the Board will adopt after notice and hearing. In developing the contingency plan, the District will consider the economic effect of conservation measures upon all water resource user groups, the local implications of the degree and effect of changes in water storage conditions, the unique hydrogeologic conditions of the aquifers within the District and the appropriate conditions under which to implement the contingency plan. The contingency plan will be referred to as the Drought Management Plan.

The District will 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. A public or private user may appeal to the Board for discretion in enforcement of the provisions of the Drought Management Plan on grounds of adverse economic hardship or unique local conditions.

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 impact groundwater quality and quantity. The District is committed to monitoring 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 will adopt rules relating to the permitting of wells and the production of groundwater. The rules adopted by the District shall be 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 shall 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 of discretion to any rule, the Board shall consider the potential for adverse effect on adjacent landowners. The exercise of discretion by the Board shall not be construed as limiting the power of the Board.

The District will seek the cooperation in the implementation of this plan and the management of groundwater supplies within the District. All activities of the District will be undertaken with cooperation and coordination with the appropriate state, regional or local water management entity.

Proposed Rules

The District will adopt rules after this Plan is approved by the Texas Water Development Board for several reasons. First, the District understands that it must implement the Plan through its rules. Second, recent changes to Texas Water Code §36.1071(f) restrict the types of rules that the District could adopt prior to approval of the Plan. Third, only through this process of planning did the District gain the information and expertise to make the decisions necessary for adopting rules. Finally, the District has used considerable resources in developing this Plan. The rulemaking process can also be resource intensive.

The District intends to propose rules covering the following:

- Well Registration, Drilling Permits, and Operating Permits
    - As required by Texas Water Code 36.117(h), the District will require all wells to be registered. The District will comply with the exemptions from permitting set out in § 36.117 and will determine whether other categories of wells will also be exempt. The District will establish the criteria for consideration and approval of operating permits and whether production will be limited. If so, the District will establish in its rules the criteria for setting production limits, as authorized by §§ 36.101(a) and 36.116.

- Fees
    - As authorized by Texas Water Code 36.205, the District will consider whether fees will be charged for activities associated with water wells, such as registration fees, application fees, production fees, or export fees.

- Well Construction and Completion Standards
    - The District will adopt well construction and completion standards, at a minimum requiring that construction of all wells and installation of all pumps located within the District shall 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. The District will determine based on the hydrogeology of the area, whether additional standards are required.

- Reporting and Recordkeeping
    - The District will consider various recordkeeping and recording requirements such as submittal of well drilling and completion reports, pump reports, annual water use reports, or other reports that may be helpful to the District in fulfilling its statutory duties.

- Plugging, Sealing, and Capping of Wells
    - The District will adopt at a minimum 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.

- Well Spacing
    - The District will adopt at a minimum the spacing requirements of the Water Well Driller's rules, 16 Texas Administrative Code Section 76.1000, as amended. Based on District-specific conditions, the District may decide to impose additional spacing requirements.

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

- Procedural Rules
    - The District will adopt procedural rules establishing required notice and hearing for various District activities such as approval of the management plan and budget; approval of rules, including emergency rules; actions on drilling and operating permits; permit actions requiring a contested case hearing; and enforcement matters.

- Prohibition Against Waste
    - The District will adopt a rule prohibiting waste of groundwater.

- Drought Management
    - The District may adopt rules to address drought conditions.

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 first year after this Plan is approved, the District will identify all public water supply (PWS) wells located within the District that are listed on the Texas Commission on Environmental Quality PWS database. The District will register these wells and will process permit applications for those wells requiring a permit under District Rules.

1. Performance Standard: The identity and location of the public water supply wells and the status of their registration and permitting will be presented in the District's annual report.

2. Objective: Each year thereafter, the District will locate and register a minimum of 25 existing wells and all new wells.

2. Performance Standard: Each year the number of existing and new wells registered with the District will be presented in the District's annual report.

3. Objective: Each year the District will require registration of and a plugging report on all wells that are plugged during that year.

3. Performance Standard: Each year the number of plugging reports received by the District for wells plugged during that year will be presented in the District's annual report.

4. Objective: At least once annually, the District will contact all licensed water well drillers and pump installers doing business in the District and will provide written educational information about District Rules and policies.

4. Performance Standard: Each year include in the District's annual report a list of licensed water well drillers and pump installers doing business in the District and a description of the educational information provided.

5. Objective: Each year the District will maintain a database containing all registration data obtained during the year.

5. Performance Standard: Each year the information in the District's annual report regarding Items A.1. through A. 3 will be compiled from the database. The report will also include an evaluation of the software being used and any recommendations regarding needed changes.

6. Objective: The District will implement a District-wide voluntary monitoring network to evaluate groundwater availability. Wells will be monitored annually for static water levels.

6. Performance Standard: The number of wells involved in the project and the respective static levels will be included in the District's annual report. All wells in the project will be registered.

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: Within two working days of receiving each report of waste of groundwater, the District will conduct an on-site investigation.

1. Performance Standard: 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).

The gulf coast aquifer contains sufficient amounts of clays interbedded within fairly prolific sand and gravel formations to be vulnerable to subsidence. However, this category of management goal is not applicable to the District because 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. However, the District recognizes the vulnerability to subsidence and the subsidence impacts of any near coast, large-scale groundwater extraction proposal will be appropriately evaluated.

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: Each year the District will monitor water quality within the District by obtaining water samples from at least 3 wells in the voluntary monitoring system described in A.6. The samples will be tested for water quality.

1. Performance Standard: A status report on the number of wells tested during the previous year, including testing results, will be included in the District's 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: Each month the District will download the updated Palmer Drought Severity Index (PDSI) map and check for the periodic updates to the Drought Preparedness Council Situation Report posted on the Texas Water Information Network website.

1. Performance Standard: At least quarterly, the District will make an assessment of the status of drought in the District and prepare a quarterly briefing to the Board. 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 submit an article regarding water conservation for publication each year to at least one newspaper of general circulation in the District.

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

1.b. Conservation Objective: District personnel will be available to present water conservation programs to school, 4-H, scouting, and community groups per request. These programs will be scheduled through the administrative office, and will be appropriate to the audience. The manager will present programs at least twice a year.

1.b. Conservation Performance Standard: A summary of programs presented, content, and audience group will be submitted 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.

2. Recharge Enhancement Objective: The District will begin to identify recharge areas in the District.

2. Recharge Performance Standard: All recharge areas identified during the year will be discussed in the District's annual report.

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

4. Precipitation Enhancement: At this time, the District does not intend to participate in precipitation enhancement because it is not cost effective and not feasible for the District.

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

5. Brush Control Performance Standard: Information about brush control obtained from the NRCS and the Kleberg- Kenedy SWCD offices and provided to the public will be included in the District's annual report.

H. Desired Future Conditions

Management objectives and performance standards for addressing in a quantitative manner 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).

This category of management goal is not applicable to the District because the desired future condition of the groundwater resources in GMA-16 has not been defined. The District intends to coordinate with other groundwater conservation districts in GMA-16 to define the desired future condition of the aquifers, as required by Texas Water Code §36.108.

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).

The District Manager will prepare and present an Annual report to the Board of Directors covering District performance in achieving management goals and objectives for the preceding fiscal year. The Report will be presented to the Board within 120 days after the end of the fiscal year, beginning with fiscal year 2007. The District will maintain the Report in its files and it will be available for public inspection or copying.

APPENDIX A

Appendix A includes excerpts from "Hydrologic and Hydrogeologic Data Compilation and Assessment in Support of Groundwater Management in Kenedy County Groundwater Conservation District," prepared by Venkatesh Uddameri, Ph.D., Department of Environmental Engineering, Texas A&M University-Kingsville, on October 13, 2005. A copy of the complete report is available from the District upon request. Note that the report was prepared prior to extension of the District's boundaries through annexation in fall 2006.

Groundwater Level Measurements

Utility of this Information for Management Plan Purposes:

1. Modeling groundwater flow and directions
2. Modeling flow into and out of the district
3. Estimating groundwater availability

Groundwater level measurements reported by well drillers and other sources are tabulated in the Groundwater Database maintained by the Texas Water Development Board. This database is certainly not exhaustive and according to best estimates contains roughly 10% of all the wells in the state. The number is likely to be smaller in counties that have not undergone significant groundwater development such as those in Kenedy GCD. Most of these wells contain only one water level measurement (possibly obtained when the well was installed). Figure 8 shows the amount of data available and the number of wells in the Kenedy GCD area. As can be seen only a handful of wells have long-term historical data. These wells can serve as a useful starting point for establishing a groundwater monitoring program within the district.

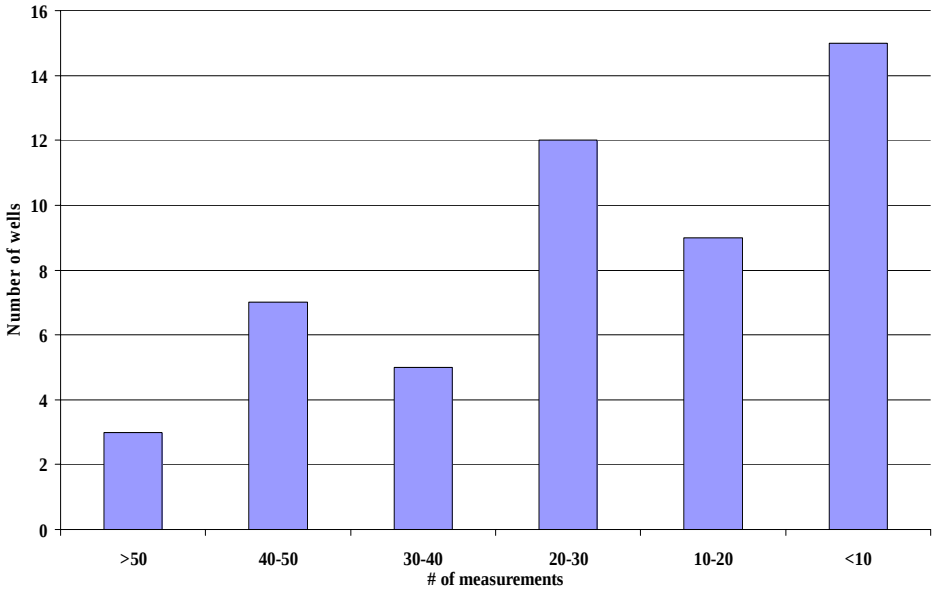


Figure 8: A Graph Depicting the Number of Wells and Corresponding Water Level Measurements in the District

However, additional wells and data collected by other groups (such as ranchers and farmers) need to be identified and compiled as well. In addition to limited water level measurements, information on well depths, screened intervals and other pertinent data is often missing as well. Most wells within the district tap into the Chicot and Evangeline formations along the eastern sections and in Evangeline and Jasper formations along the western sections. The Evangeline formation consisting of Goliad Sands is the most prolific of all the formations and as such the available data and the number of wells tapping into this formation is larger than that for the other formations.

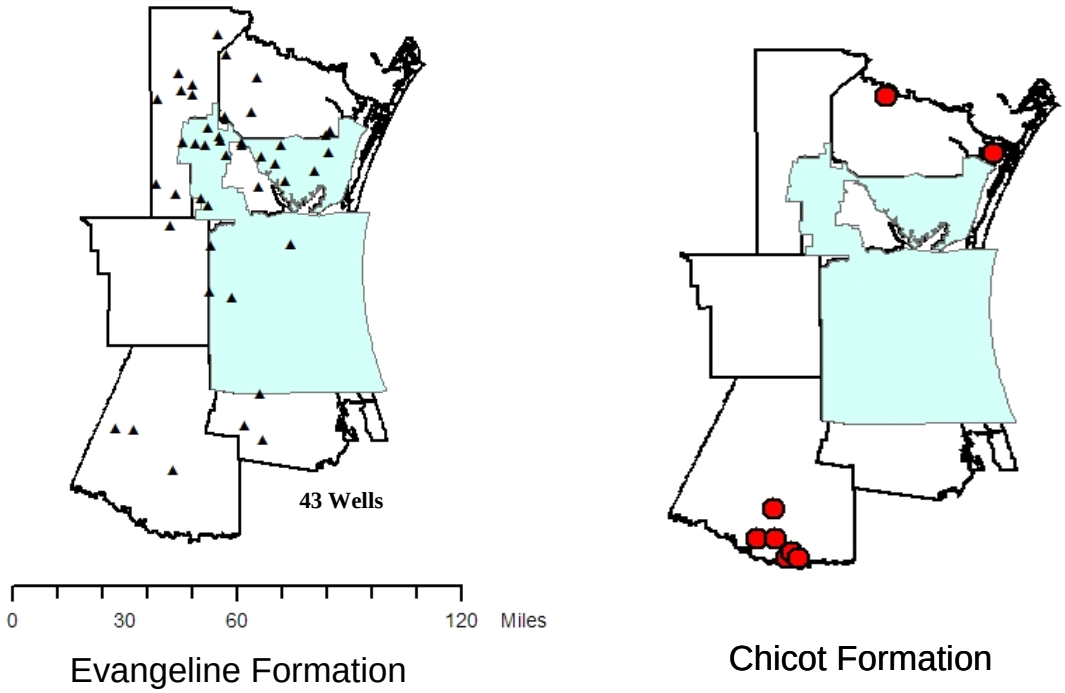


Figure 9: Figure Depicting Wells in Chicot and Evangeline Formations Having at Least Two Measurements

Figure 9 depicts the spatial locations of certain wells in the Chicot and Evangeline formations. These wells have at least two reported water level measurements along with depth and screening information. As can be seen, data on wells in the Chicot formation is virtually non-existent and identification of shallow wells that tap into the Chicot formation is necessary to understand how the shallow aquifer responds to precipitation events. Shallow wells (< 500 feet deep) were queried and extracted from the TWDB database (Figure 10). The wells in the western sections tap into the Evangeline formation. However, the wells in the central and eastern section tap into the Chicot

formation. The wells in the central and eastern sections of the district have one reported water level measurement and in many instances, screening information is missing as well. However, they could serve as a useful starting point to identify a subset of wells for further monitoring.

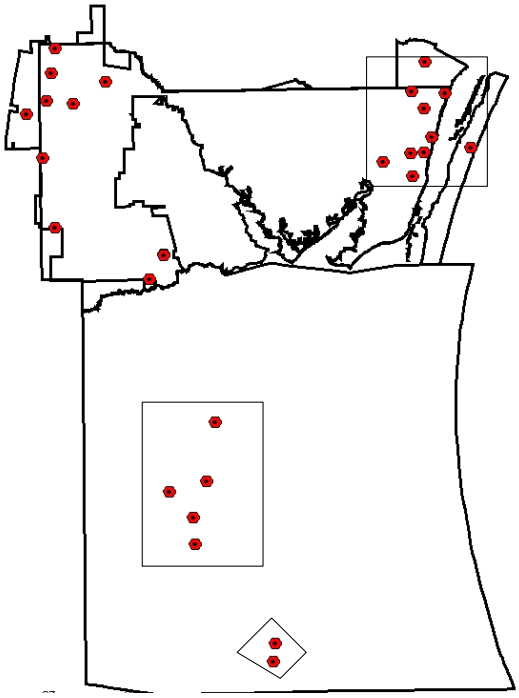


Figure 10: Locations of Shallow (< 500 feet deep) Wells Recorded in the TWDB Groundwater Database (Boxed wells tap into the Chicot formation)

Long-term historical trend of groundwater levels is schematically depicted in Figure 11. All these wells tap into the Evangeline (Goliad Sands) formation.

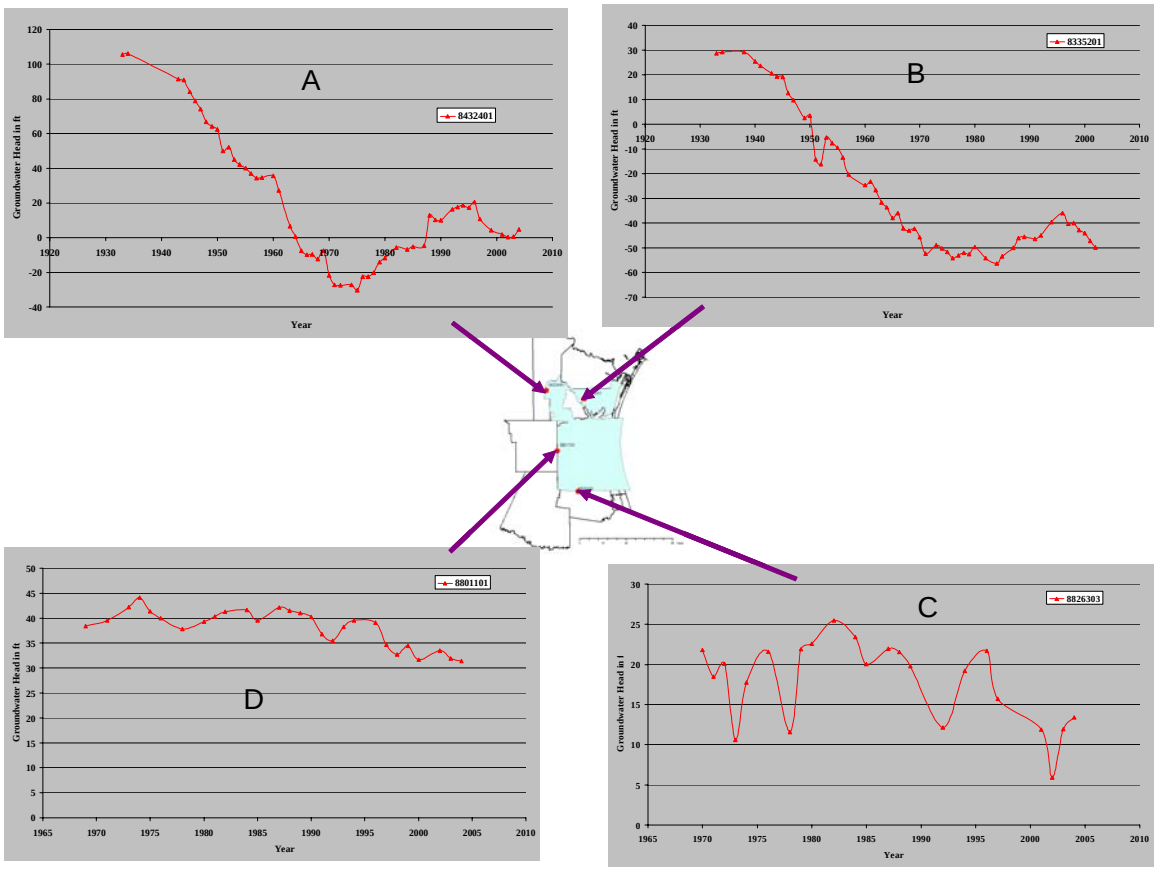


Figure 11: Historical Water Level Trends at Four Different Wells Tapping Into the Evangeline Formation

Figure 11 indicates that considerable drawdown and groundwater fluctuations are to be expected despite very little urbanization and development within the district. The wells in the southern portions (C and D) exhibit 10 – 25 feet variability over a 40 year period and these variations are mostly indicative of natural climatic fluctuations. Wells in the northern sections of the district (A and B) exhibit much larger (80 – 140 feet) variability over a 70 year period and are representative of anthropogenic and climatic influences.

Well C is in particular close to Kingsville and is indicative of groundwater moving towards the cone of depression in the City of Kingsville. This well showed some recovery in the 1980s probably due to reducing oil and gas production as well as the City of Kingsville shifting towards surface water supplies. There has however been a slight declining trend over the last few years. The Well C in Jim Wells County depicts the cumulative impacts of groundwater withdrawals for agriculture, oil and gas exploration and municipal (City of Alice) demands. Again, recovery was noted in this well since about the mid-seventies when oil and gas exploration and urbanization reduced considerably.

Hydrogeologic Parameters

Utility of this Information for Management Plan Purposes:

1. Modeling groundwater flow within the district
2. Modeling flows between different formations
3. Modeling flow into and out of the district
4. Estimating groundwater availability

Hydrogeologic parameters, namely, aquifer hydraulic conductivity (transmissivity) and storage are vital for understanding how the aquifer responds under pumping stresses. These data are required to assess the reliability of the calibrated groundwater availability models. Data on these measurements are typically scant as they require carefully planned field studies. Compilations of field measurements (Mayers et al., 1969) were searched to obtain estimates for transmissivity and storage coefficients. Figure 12 depicts locations where hydraulic testing data has been reported. As can be seen, district specific information is not readily available.

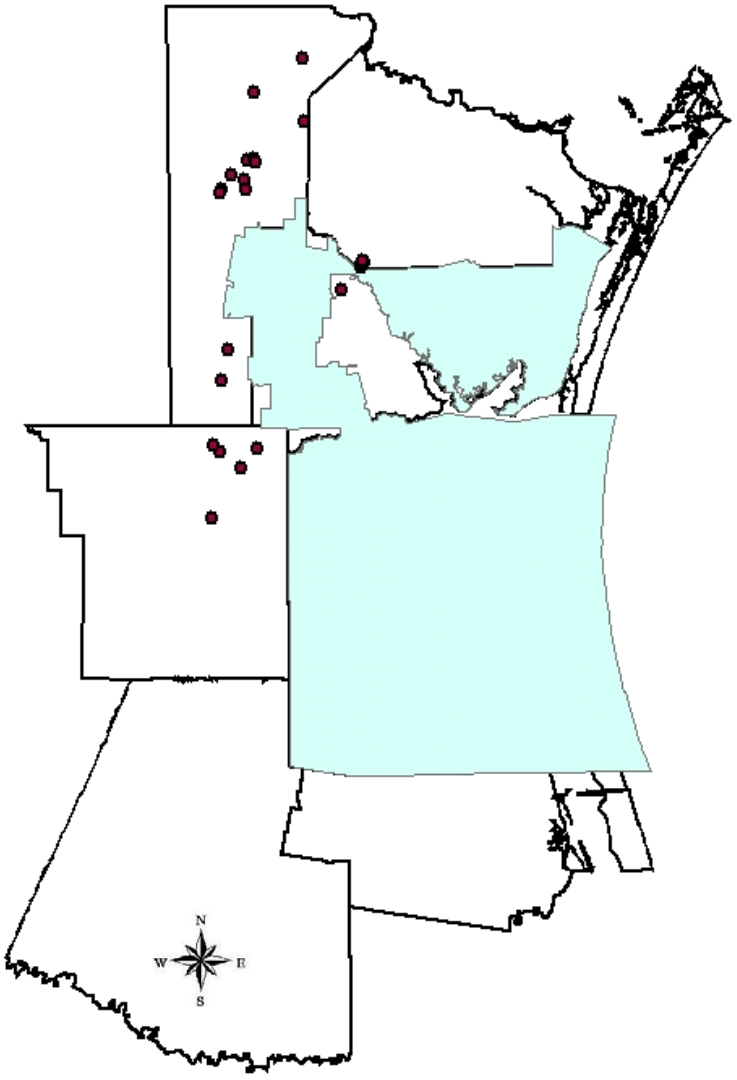


Figure 12: Location of Reported Pump Test Locations (Mayers et al., 1969)

Literature review for transmissivity and storage coefficient values provided some estimates near the vicinity of the district. Again, information for aquifer parameters in the shallower Chicot formation was not available in the literature. The compiled hydraulic information is presented in Table 4.

Table 4: Estimates for Transmissivity and Storage Coefficient for Different Aquifer Formations in the District

Location	Transmissivity (gpd/ft)	Storage Coefficient	Source
Kingsville Area (Evangeline formation)	24,000 – 30,000	0.002	Shafer and Baker (1973)
Southern Jim Wells County (Evangeline formation)	10,200		Shafer and Baker (1973)
Southern Jim Wells (Jasper Formation)	7100	0.0007	Shafer and Baker
Chicot Formation[1]	400 – 1000	0.001 – 0.0005[2]	Chowdhury & Mace (2003)

[1] Based on model calibrations and formation thickness; [2] represents specific yield

The compiled transmissivity and storage parameters indicate that the Evangeline aquifer is fairly prolific in comparison to the Jasper and Chicot formations and can produce reasonable amounts of water. However, the storage coefficients are on the lower end and as such, the drawdown effects of pumping are likely to be felt over large distances. The water needs to be drawn from a larger cone of influence due to smaller storage within the aquifer. The calibrated specific yields for the Chicot formation are lower than the ranges suggested in the literature (0.1 - 0.3; Freeze and Cherry, 1979). However, Chowdhury and Mace (2003) report that literature values did not yield good model calibration.

Short-term pump tests are often carried out during the installation of large-scale wells (municipal and irrigation wells). Hence, additional efforts to obtain this information from any available local sources and contacts would be beneficial given the importance and cost-prohibitive nature of the data.

Appendix B:

Resolution Adopting the Kenedy County Groundwater Conservation District Groundwater Management Plan

KENEDY COUNTY GROUNDWATER CONSERVATION DISTRICT
CERTIFICATION OF RESOLUTION

I, Leo Villarreal, General Manager of the Kenedy County Groundwater Conservation District, hereby certify that the annexed Resolution adopting the Kenedy County Groundwater Conservation District Management Plan is a true and correct copy of the Resolution Adopting the Kenedy County Groundwater Conservation District Management Plan; that on July 6, 2007, the Kenedy County Groundwater Conservation District Board of Directors, by majority vote, passed and approved said Resolution.

SIGNED on the 6th day of July, 2007.

Leo Villarreal

RESOLUTION
ADOPTING KENEDY COUNTY
GROUNDWATER CONSERVATION DISTRICT'S
MANAGEMENT PLAN
July 6, 2007

PREAMBLE

WHEREAS, on May 30, 2007, the Kenedy County Groundwater Conservation District Board of Directors directed that Notice of a Public Hearing regarding the adoption of the District's management Plan be published in the Kingsville Record, Corpus Christi Caller Times, Raymondville Chronicle, McAllen Monitor, Falfurrias Facts and Alice Echo News newspapers; and

WHEREAS, the Kenedy County Groundwater Conservation District printed, through the above newspapers, its Notice of Public Hearing to be held on June 26, 2007, at 9:00 a.m. at the Kenedy County Courthouse in Sarita, Texas; and

WHEREAS, on June 26, 2007, the Kenedy County Groundwater Conservation District Board of Directors, with a quorum being present, held the June 26, 2007, Public Hearing regarding the adoption of the Kenedy County Groundwater Conservation District's Management Plan; and

WHEREAS, the Kenedy County Groundwater Conservation District Board of Directors, after the Public Hearing was held, convened to consider the adoption of the Kenedy County Groundwater Conservation District Management Plan; and

The Kenedy County Groundwater Conservation District Board of Directors, after a motion being made and seconded, it was unanimously passed and it was

RESOLVED that the Kenedy County Groundwater Conservation District Management Plan be ADOPTED as presented as is more particularly described in the Kenedy County Groundwater Conservation District's Management Plan attached hereto and made part hereof for all purposes.

DATED this 6th day of July, 2007.

Chuck Burns, Chairman

Sister Maria Meister, Member

David Delaney, Member

Joseph Clements, Member

Jerry Miller, Member

Appendix C:

Notice of Hearing on the Kenedy County Groundwater Conservation District Groundwater Management Plan

#40004346 - Law Office of Leo Villarreal - 90371655

THE MONITOR

PUBLISHER'S AFFIDAVIT

State of Texas
County of Hidalgo

LETICIA BERNAL, being duly sworn on his/her oath states that he/she is a Sales Representative of THE MONITOR and that the attached notice appeared in the following issues:

June 14 & 21, 2007

Subscribed and sworn to before me this the 25th day of June A.D. 2007

Notary Public, Hidalgo County

ELIZABETH D. FLORES
NOTARY PUBLIC
STATE OF TEXAS
EXPIRES
9-29-2009

NOTICE OF PUBLIC HEARING
Kenedy County Groundwater Conservation District

The Kenedy County Groundwater Conservation District will hold a Public Hearing regarding the adoption of the proposed Kenedy County Groundwater Conservation District's Management Plan.

The Public Hearing will be held on June 26, 2007, at 9:00 a.m. at the Kenedy County Courthouse, District Courtroom, Sarita, Texas.

A proposed District Management Plan may be obtained at Leo Villarreal's office at the Kleberg Bank Building, 3rd Floor, Room 304, Kingsville, Texas, phone (361) 595-7311.

CLASSIFIEDS
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05 Per Page Go Back Page 1 of 1

Notice Type : Legal Notice **Posting Date :** 6/15/2007

NOTICE OF PUBLIC HEARING Kenedy County Groundwater Conservation District The Kenedy County Groundswater Conservation District will hold a Public Hearing regarding the adoption of the proposed Kenedy County Groundwater Conservation District's Management Team. The Public Hearing will be held on June 26, 2007, at the Kenendy County Courthouse, District Courtroom, Sarita, Texas. A proposed District Management Plan may be obtained at Leo Villarreal's office at the Kleberg Bank Building, 3rd Floor, Room 304, Kingsville, Texas, phone (361)595-7311.

01 Per Page Page 1 of 1

22 LEGALS

NOTICE OF PUBLIC HEARING
Kenedy County Groundwater Conservation District

The Kenedy County Groundwater Conservation District will hold a Public Hearing regarding the adoption of the proposed Kenedy County Groundwater Conservation District's Management Plan.

The Public Hearing will be held on June 26, 2007, at 9:00 a.m. at the Kenedy County Courthouse, District Courtroom, Sarita, Texas.

A proposed District Management Plan may be obtained at Leo Villarreal's office at the Kleberg Bank Building, 3rd Floor, Room 304, Kingsville, Texas, phone (361) 595-7311.

THE STATE OF TEXAS * GROUNDWATER CONSERVATION DISTRICT

COUNTY OF KENEDY * OF KENEDY COUNTY, TEXAS

On the 26th day of June, 2007, at 9:00 o'clock a.m., a regular meeting and Public Hearing of the Kenedy County Groundwater Conservation District was held in Sarita, Texas, at the Kenedy County Courthouse.

Directors present:
Chuck Burns
Sister Maria Meister
David Delaney

Also present:
Leo Villarreal, General Manager
Dr. Venkatesh Uddameri
Mary Sahs
Jasmine Beitz
Clay Wolter, Kenedy Memorial Foundation
Craig Weiland, La Paloma Ranch
Carola Serrato, Coastal Bend Regional Water Planning Group
Father Francis Kelly Nemeck, La Parra Ranch
Paul Schweizer, Communities Foundation of Texas

Absent:
Jerry Miller, Director
Joey Clements, Director

1. **Call Public Hearing to Order**

A quorum of the Board of Directors being present, Chuck Burns, President, called the Public Hearing to order at 9:10 a.m.

2. **Public Hearing on Adopting the Kenedy County Groundwater Conservation District Management Plan**.

Mary Sahs informed the public and Board of Directors regarding the purpose of the Groundwater Management Plan and the procedure the Board of Directors would conduct the public hearing. Mary Sahs further informed the members of the public present that once the Public Hearing is closed, the Board of Directors would consider the Public Comments and Suggestions and would finalize the Groundwater District's Management Plan. Thereafter the Board of Directors would, by Resolution, approve the Groundwater Management Plan and make it available to the Texas Water Development Board for its approval; and that the Groundwater District's Management Plan would become effective and operational upon the Texas Water Development Board's approval.

The Kenedy County Groundwater Conservation District's Board of Directors would develop the District's Rules and Regulations to implement the Groundwater District's Management Plan after the Texas Water Development Board approved the District's Plan.

The District's Rules and Regulations would also serve as guidelines in coordinating its Management Plan with other Groundwater Districts in Region 16, particularly in developing Regional Desired Future Conditions and how to manage its Aquifers. This is significant because the Region has different and unique geological formations and the District's Plan is a "stepping stone" towards developing the State's Water Plan.

The District's Plan, Mary Sahs commented, had acquired considerable significance because in the Fall of 2006, the District had annexed areas adjacent to the District. The District's boundaries, together with its newly annexed areas, extend to seven counties: Nueces, Kleberg, Kenedy, Brooks, Jim Wells, Hidalgo and Willacy Counties.

Dr. Venkatesh Uddameri addressed the technical data regarding consideration and preparation of the District's Management Plan. Dr. Uddameri's comments included the following matters:

1) Aquifer Formations in the District;
2) Depths to the of top of Aquifer Formations;
3) Surfacial Soil Texture Characteristics;
4) Land use in the District;
5) Calculated Slopes;
6) Topography;
7) Local and Regional Geology;
8) Need for Pumping Distributors;
9) Factors affecting future Groundwater Development supply and demand side - Geology;
10) Favorable locations for freshwater development;
11) Texas Water Development Board Water Deficit Projections (2040);
12) GAM runs recommendations; and
13) Joint Planning.

Chuck Burns, upon Mary Sahs and Dr. Ventakesh Uddameri's concluding comments, proceeded to discuss the District's Management Plan commencing with the District's Mission and proceeding to the Plan's conclusion.

Chuck Burns addressed the topic heading, made general comments relating to the Plan's topic and page number, and thereafter invited comments from members of the public in attendance at the Public Hearing.

Members of the public that offered comments included: Carola Serrato, Craig Weiland, Clay Wolter, and Father Francis Kelly Nemeck.

Carola Serrato, with the South Texas Water Authority, questioned the numbers regarding municipal and livestock in Kenedy County. Once the numbers issues were addressed, it was recommended that Footnote 2 on Page 16 reflect Carola Serrato's concerns.

Father Kelly addressed uranium issues in Kenedy County. Dr. Venkatesh Uddameri responded regarding uranium provisions in the District's Plan. Dr. Uddameri invited the public and the Directors to Texas A&M University-Kingsville's August 9, 2007 Uranium Seminar which is being held at the Texas A&M University-Kingsville campus.

Carola Serrato commented that although the District does not have unilateral control over uranium exploration, the District does have control over water wells in the District.

Chuck Burns assured the public that the District's Rules and Regulations would address the uranium exploration issues.

Father Kelly questioned which governmental entity had oversight of gas and oil exploration.

Chuck Burns assured Father Kelly that the District had limited oversight through its Permitting and Registration of Water Wells in the District.

Dave DeLaney, Board Member, informed the public that the District would have all GPS locations of water wells affecting the gas and oil industry.

Craig Weiland inquired regarding the Groundwater District's Annexation procedures and requested an Annexation Application for La Paloma Ranch which is in Brooks and Kleberg Counties. Mary Sahs and Chuck Burns informed Craig Weiland that annexation of property, at this time, would not be practical or advisable because the new property would delay the finalization of the District's Management Plan. However, once the District's Management Plan is adopted, the District may again address annexation applications.

Clay Wolter addressed the municipal numbers on page 16 of the District's Proposed Plan. Dr. Venkatesh Uddameri responded to Clay Wolter's concerns.

Leo Villarreal recommended that the cover page of the District's Management Plan should have a map depicting the District's boundaries. Dave DeLaney recommended that each of the District's seven counties be in different colors.

Leo Villarreal made suggestions regarding the Mission Statement; the purpose of the District's Management Plan on page 4; the Directors on page 5; and the Proposed Rules on page 30 of the District's Proposed Management Plan.

There being no other comments from the public or explanations requested, Chuck Burns informed the public that the Board of Directors would: 1) take all of the public

comments into consideration in finalizing the District's Management Plan; 2) proceed to prepare the District's Rules and Regulations; and 3) thereafter, the District would hold a Public Hearing relating to the District's Rules and Regulations.

There being no further public comments, Chuck Burns closed the Public Hearing and thanked the members of the public for attending and contributing their comments to the District's Management Plan.

This being a public hearing only, no vote was needed and none was taken.

3. **Discuss and Act on Minutes of May 30, 2007, meeting**

Chuck Burns presented to the Board of Directors the Minutes of the May 30, 2007, regular meeting of the Kenedy County Groundwater Conservation District.

Dave DeLaney moved and Sister Maria Meister seconded the motion; the motion was unanimously passed that the minutes of the May 30, 2007, regular meeting be approved as presented.

4. **Discuss and Act on Payment of Bills**.

Chuck Burns presented to the Board of Directors the bills for the month of June 2006.

Dave DeLaney moved and Sister Maria Meister seconded the motion; the motion was unanimously passed to pay the bills as presented.

5. **Adjournment**.

Chuck Burns informed the Board of Directors that the next meeting needed to be held on July 6, 2007 at 9:00 a.m.; and there being no other business to be discussed, that the meeting be adjourned.

Sister Meister moved and Dave DeLaney seconded the motion; the motion was unanimously passed that the next Board meeting be held on July 6, 2007 at 9:00 a.m. and that this meeting be adjourned at 10:15 a.m.

Chuck Burns, President

ATTESTED TO:

Maria Meister
Sister Maria Meister, Secretary

Appendix D:

Letter to the Relevant Regional Water Planning Groups

SAHS & ASSOCIATES, P. C.

1700 Collier Street
Austin, Texas 78704

(512) 326-2556
(512) 326-2586 Fax
email: marysahs@bga.com

April 25, 2007

Mr. Glenn Jarvis
Rio Grande (M) Water Planning Group
c/o Lower Rio Grande Valley Dev. Council
311 N. 15th Street
McAllen, TX 78501- 4705

Re: Kenedy County Groundwater Conservation District
Draft Groundwater Management Plan

Dear Glenn,

I represent Kenedy County Groundwater Conservation District. The District was created in 2003 and confirmed on November 2, 2004. Under its enabling legislation and subsequent landowner annexation petitions, the District currently covers all of Kenedy County and parts of Brooks, Hidalgo, Jim Wells, Kleberg, Nueces, and Willacy counties. The Board of Directors has been working on the District's groundwater management plan for over two years and has approved a final draft, which has just been submitted to the Texas Water Development Board (TWDB) for pre-review under Texas Water Code § 36.1071(c). Because part of the District lies within Region M, the District has asked me to send you a courtesy copy of this draft.

The TWDB has 30 days to review the draft and provide comments. Based on those comments, the plan will either undergo further revisions, or will be noticed for a public hearing. The District invites your feedback on the enclosed draft. We believe you will find that there are no inconsistencies with the recently approved Rio Grande Regional Water Plan. The District will provide you notice of the public hearing and would welcome participation by any of your representatives. Once the plan is adopted, the District will send you a copy, as required by Texas Water Code § 36.1071(b).

Please call if you have any questions or would like an electronic copy of this draft document.

Sincerely,

Mary K. Sahs

Cc: Mr. Leo Villarreal
General Manager
Kenedy County GCD

SAHS & ASSOCIATES, P. C.

1700 Collier Street
Austin, Texas 78704

(512) 326-2556
(512) 326-2586 Fax
email: marysahs@bga.com

April 25, 2007

Ms. Carola Serrato
Mr. Scott Bledsoe
Coastal Bend (N) Water Planning Group
c/o Nueces River Authority
6300 Ocean Dr.
Corpus Christi, TX 78412

Re: Kenedy County Groundwater Conservation District
Draft Groundwater Management Plan

Dear Ms. Serrato and Mr. Bledsoe,

I represent Kenedy County Groundwater Conservation District. The District was created in 2003 and confirmed on November 2, 2004. Under its enabling legislation and subsequent landowner annexation petitions, the District currently covers all of Kenedy County and parts of Brooks, Hidalgo, Jim Wells, Kleberg, Nueces, and Willacy counties. The Board of Directors has been working on the District's groundwater management plan for over two years and has approved a final draft, which has just been submitted to the Texas Water Development Board (TWDB) for pre-review under Texas Water Code § 36.1071(c). Because part of the District lies within Region N, the District has asked me to send you a courtesy copy of this draft.

The TWDB has 30 days to review the draft and provide comments. Based on those comments, the plan will either undergo further revisions, or will be noticed for a public hearing. The District invites your feedback on the enclosed draft. We believe you will find that there are no inconsistencies with the recently approved Coastal Bend Regional Water Plan. The District will provide you notice of the public hearing and would welcome participation by any of your representatives. Once the plan is adopted, the District will send you a copy, as required by Texas Water Code § 36.1071(b).

Please call if you have any questions or would like an electronic copy of this draft document.

Sincerely,

Mary K. Sahs

Cc: Mr. Leo Villarreal, General Manager
Kenedy County GCD

SAHS & ASSOCIATES, P. C.

1700 Collier Street
Austin, Texas 78704

(512) 326-2556
(512) 326-2586 Fax
email: marysahs@bga.com

June 6, 2007

Mr. Glenn Jarvis
Rio Grande (M) Water Planning Group
c/o Lower Rio Grande Valley Dev. Council
311 N. 15th Street
McAllen, TX 78501- 4705

Re: Kenedy County Groundwater Conservation District
Proposed Groundwater Management Plan

Dear Glenn,

The Kenedy County Groundwater Conservation District Directors approved proposal of the enclosed groundwater management plan at their May 30th Board meeting. A public hearing on the proposed plan will be held at 9:00 a.m. on Tuesday, June 26, at the Kenedy County Courthouse in Sarita. This proposal culminates more than two years of work by the District. It addresses comments made by the Texas Water Development Board (TWDB) during a recent pre-review under Texas Water Code § 36.1071(c).

The District would welcome participation by any of your representatives. Once the plan is adopted, the District will send you a copy, as required by Texas Water Code § 36.1071(b).

Please call if you have any questions or would like an electronic copy of the proposed plan.

Sincerely,

Mary K. Sahs

Cc: Mr. Leo Villarreal
General Manager
Kenedy County GCD

SAHS & ASSOCIATES, P. C.

1700 Collier Street
Austin, Texas 78704

(512) 326-2556
(512) 326-2586 Fax
email: marysahs@bga.com

June 6, 2007

Ms. Carola Serrato
Mr. Scott Bledsoe
Coastal Bend (N) Water Planning Group
c/o Nueces River Authority
6300 Ocean Dr.
Corpus Christi, TX 78412

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Proposed Groundwater Management Plan

Dear Ms. Serrato and Mr. Bledsoe,

The Kenedy County Groundwater Conservation District Directors approved proposal of the enclosed groundwater management plan at their May 30th Board meeting. A public hearing on the proposed plan will be held at 9:00 a.m. on Tuesday, June 26, at the Kenedy County Courthouse in Sarita. This proposal culminates more than two years of work by the District. It addresses comments made by the Texas Water Development Board (TWDB) during a recent pre-review under Texas Water Code § 36.1071(c).

The District would welcome participation by any of your representatives. Once the plan is adopted, the District will send you a copy, as required by Texas Water Code § 36.1071(b).

Please call if you have any questions or would like an electronic copy of the proposed plan.

Sincerely,

Mary K. Sahs

Cc: Mr. Leo Villarreal
General Manager
Kenedy County GCD

APPENDIX E

County-Wide Groundwater Use for the Year 1997
from the WIID-Database.
This information was used to generate Exhibit H

	Groundwater Use (1997) in ac-ft/yr				
County	**Municipal**	**Irrigation**	**Livestock**	**Industrial**	**Mining**
Brooks	2524	465	63	0	127
Hidalgo	7973	5783	321	908	1136
Jim Wells	2504	679	95	0	349
Kenedy	70	0	61	0	1
Kleberg	4688	211	230	24	1905
Nueces	1573	0	104	1405	98
Willacy	0	0	12	0	6

APPENDIX F

Basin-Wide Estimates for Projected Water Supply Demands from the WIID Database. This information was used to Develop Exhibit S

RWPG Name	Source Name	WUG Name	County Name	Supply (ac-ft/yr)		
				2000	2010	2020
COASTAL BEND	LIVESTOCK LOCAL SUPPLY	LIVESTOCK	BROOKS	552	552	552
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	ALICE	JIM WELLS	3420	3338	3265
COASTAL BEND	LIVESTOCK LOCAL SUPPLY	LIVESTOCK	JIM WELLS	156	156	156
COASTAL BEND	LIVESTOCK LOCAL SUPPLY	LIVESTOCK	JIM WELLS	766	766	766
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	COUNTY-OTHER	KLEBERG	176	176	176
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	KINGSVILLE	KLEBERG	1026	1026	1096
COASTAL BEND	LIVESTOCK LOCAL SUPPLY	LIVESTOCK	KLEBERG	1031	1031	1031
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	AGUA DULCE	NUECES	121	121	121
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	ARANSAS PASS	NUECES	3	3	3
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	BISHOP	NUECES	526	536	558

RWPG Name	Source Name	WUG Name	County Name	Supply (ac-ft/yr)		
				2000	2010	2020
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	CORPUS CHRISTI	NUECES	7130	6806	6417
COASTAL BEND	TEXANA LAKE/RESERVOIR	CORPUS CHRISTI	NUECES	41840	41840	41840
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	CORPUS CHRISTI	NUECES	70740	64171	56213
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	COUNTY-OTHER	NUECES	242	242	242
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	COUNTY-OTHER	NUECES	116	116	116
COASTAL BEND	NUECES RIVER RUN-OF-RIVER	COUNTY-OTHER	NUECES	1484	1538	1516
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	DRISCOLL	NUECES	88	88	88
COASTAL BEND	NUECES RIVER RUN-OF-RIVER	IRRIGATION	NUECES	2732	2732	2732
COASTAL BEND	NUECES RIVER RUN-OF-RIVER	IRRIGATION	NUECES	706	706	706
COASTAL BEND	LIVESTOCK LOCAL SUPPLY	LIVESTOCK	NUECES	19	19	19
COASTAL BEND	LIVESTOCK LOCAL SUPPLY	LIVESTOCK	NUECES	154	154	154
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	MANUFACTURING	NUECES	81	106	137
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	MANUFACTURING	NUECES	1151	1335	1568

RWPG Name	Source Name	WUG Name	County Name	Supply (ac-ft/yr)		
				2000	2010	2020
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	MANUFACTURING	NUECES	44087	47969	53053
COASTAL BEND	NUECES RIVER RUN-OF-RIVER	NORTH SAN PEDRO	NUECES	155	146	148
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	PORT ARANSAS	NUECES	42	42	42
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	PORT ARANSAS	NUECES	35	37	46
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	PORT ARANSAS	NUECES	784	784	784
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	PORT ARANSAS	NUECES	683	715	887
COASTAL BEND	NUECES RIVER RUN-OF-RIVER	ROBSTOWN	NUECES	2027	1982	2002
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	STEAM ELECTRIC POWER	NUECES	3000	3000	3000
COASTAL BEND	CORPUS CHRISTI-CHOKE CANYON LAKE/RESERVOIR SYSTEM	STEAM ELECTRIC POWER	NUECES	300	300	300
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	ALAMO	HIDALGO	1203	1203	1203
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	ALTON	HIDALGO	1096	1230	1346
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	COUNTY-OTHER	HIDALGO	36532	36135	35876

RWPG Name	Source Name	WUG Name	County Name	Supply (ac-ft/yr)		
				2000	2010	2020
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	COUNTY-OTHER	HIDALGO	761	761	761
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	DONNA	HIDALGO	4190	4190	4190
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	EDCOUCH	HIDALGO	1340	1340	1340
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	EDINBURG	HIDALGO	7981	7981	7981
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	ELSA	HIDALGO	1840	1840	1840
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	HIDALGO	HIDALGO	13	13	13
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	IRRIGATION	HIDALGO	462583	446501	407135
RIO GRANDE	IRRIGATION LOCAL SUPPLY	IRRIGATION	HIDALGO	0	0	0
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	IRRIGATION	HIDALGO	18773	18120	16523
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	LA JOYA	HIDALGO	669	669	669
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	LA VILLA	HIDALGO	500	500	500
RIO GRANDE	LIVESTOCK LOCAL SUPPLY	LIVESTOCK	HIDALGO	725	725	725
RIO GRANDE	LIVESTOCK LOCAL SUPPLY	LIVESTOCK	HIDALGO	38	38	38
RIO GRANDE	OTHER LOCAL SUPPLY	MANUFACTURING	HIDALGO	0	0	0

RWPG Name	Source Name	WUG Name	County Name	Supply (ac-ft/yr)		
				2000	2010	2020
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	MANUFACTURING	HIDALGO	3718	4115	4374
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	MCALLEN	HIDALGO	22299	22299	22299
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	MCALLEN	HIDALGO	11250	11250	11250
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	MERCEDES	HIDALGO	3595	3595	3595
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	MINING	HIDALGO	382	370	393
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	MINING	HIDALGO	33	32	34
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	MISSION	HIDALGO	10289	10289	10289
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	PALMVIEW	HIDALGO	313	313	313
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	PHARR	HIDALGO	7341	7341	7341
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	PROGRESO	HIDALGO	267	267	267
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	SAN JUAN	HIDALGO	2346	2346	2346
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	STEAM ELECTRIC POWER	HIDALGO	6243	6243	6243
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR	SULLIVAN CITY	HIDALGO	13	13	13

RWPG Name	Source Name	WUG Name	County Name	Supply (ac-ft/yr)		
				2000	2010	2020
	SYSTEM					
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	WESLACO	HIDALGO	5976	5976	5976
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	WESLACO	HIDALGO	2000	2000	2000
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	COUNTY-OTHER	WILLACY	816	816	816
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	COUNTY-OTHER	WILLACY	260	260	260
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	IRRIGATION	WILLACY	34672	36762	37984
RIO GRANDE	IRRIGATION LOCAL SUPPLY	IRRIGATION	WILLACY	0	0	0
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	LYFORD	WILLACY	1058	1058	1058
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	MINING	WILLACY	7	5	3
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	RAYMONDVILLE	WILLACY	5670	5670	5670
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	SAN PERLITA	WILLACY	107	107	107
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	SAN PERLITA	WILLACY	32	32	32
RIO GRANDE	AMISTAD-FALCON LAKE/RESERVOIR SYSTEM	SEBASTIAN	WILLACY	300	300	300

APPENDIX G

County-wide Estimates for Total Water Demands from WIID Database: This information was used to Generate Exhibit T.

RWPG Name	WUG Name	County Name	Total Demand (ac-ft/yr)		
			2000	2010	2020
COASTAL BEND	FALFURRIAS	BROOKS	2486	2332	2238
COASTAL BEND	COUNTY-OTHER	BROOKS	888	781	767
COASTAL BEND	MINING	BROOKS	129	108	92
COASTAL BEND	IRRIGATION	BROOKS	340	329	320
COASTAL BEND	LIVESTOCK	BROOKS	616	616	616
COASTAL BEND	COUNTY-OTHER	JIM WELLS	256	254	244
COASTAL BEND	ALICE	JIM WELLS	3420	3338	3265
COASTAL BEND	ORANGE GROVE	JIM WELLS	270	273	273
COASTAL BEND	PREMONT	JIM WELLS	1040	1152	1292
COASTAL BEND	SAN DIEGO	JIM WELLS	141	135	134
COASTAL BEND	COUNTY-OTHER	JIM WELLS	1950	1941	1861
COASTAL BEND	MINING	JIM WELLS	155	74	37
COASTAL BEND	MINING	JIM WELLS	172	138	111
COASTAL BEND	IRRIGATION	JIM WELLS	376	331	290
COASTAL BEND	IRRIGATION	JIM WELLS	669	587	516
COASTAL BEND	LIVESTOCK	JIM WELLS	181	181	181
COASTAL BEND	LIVESTOCK	JIM WELLS	892	892	892
COASTAL BEND	KINGSVILLE	KLEBERG	5513	5957	6201
COASTAL BEND	COUNTY-OTHER	KLEBERG	1580	1575	1558
COASTAL BEND	MINING	KLEBERG	1055	844	739
COASTAL BEND	IRRIGATION	KLEBERG	397	343	295
COASTAL BEND	LIVESTOCK	KLEBERG	1348	1348	1348
COASTAL BEND	SARITA	KENEDY	30	32	30
COASTAL BEND	COUNTY-OTHER	KENEDY	31	29	26
COASTAL BEND	MINING	KENEDY	3	1	1
COASTAL BEND	LIVESTOCK	KENEDY	712	712	712
COASTAL BEND	CORPUS CHRISTI	NUECES	3223	3403	3651

RWPG Name	WUG Name	County Name	Total Demand (ac-ft/yr)		
			2000	2010	2020
COASTAL BEND	COUNTY-OTHER	NUECES	742	751	767
COASTAL BEND	AGUA DULCE	NUECES	95	86	76
COASTAL BEND	BISHOP	NUECES	537	547	569
COASTAL BEND	CORPUS CHRISTI	NUECES	65490	69146	74202
COASTAL BEND	DRISCOLL	NUECES	80	78	72
COASTAL BEND	NORTH SAN PEDRO	NUECES	155	146	148
COASTAL BEND	PORT ARANSAS	NUECES	1467	1499	1671
COASTAL BEND	ROBSTOWN	NUECES	2027	1982	2002
COASTAL BEND	COUNTY-OTHER	NUECES	5489	5546	5646
COASTAL BEND	ARANSAS PASS	NUECES	3	3	3
COASTAL BEND	PORT ARANSAS	NUECES	77	79	88
COASTAL BEND	COUNTY-OTHER	NUECES	1	1	1
COASTAL BEND	MINING	NUECES	1	1	1
COASTAL BEND	MINING	NUECES	51	29	19
COASTAL BEND	MINING	NUECES	92	63	37
COASTAL BEND	IRRIGATION	NUECES	1447	1248	1076
COASTAL BEND	IRRIGATION	NUECES	48	41	36
COASTAL BEND	LIVESTOCK	NUECES	27	27	27
COASTAL BEND	LIVESTOCK	NUECES	215	215	215
RIO GRANDE	LYFORD	WILLACY	712	766	808
RIO GRANDE	RAYMONDVILLE	WILLACY	4287	4550	4713
RIO GRANDE	SAN PERLITA	WILLACY	139	155	170
RIO GRANDE	SEBASTIAN	WILLACY	181	178	180
RIO GRANDE	COUNTY-OTHER	WILLACY	1076	1137	1146
RIO GRANDE	MINING	WILLACY	12	8	5
RIO GRANDE	IRRIGATION	WILLACY	61203	61878	62951
RIO GRANDE	LIVESTOCK	WILLACY	144	144	144
RIO GRANDE	ALAMO	HIDALGO	1918	2282	2477
RIO GRANDE	ALTON	HIDALGO	1096	1230	1346
RIO GRANDE	DONNA	HIDALGO	4385	5187	6030
RIO GRANDE	EDCOUCH	HIDALGO	763	816	862
RIO GRANDE	EDINBURG	HIDALGO	9102	10639	12211
RIO GRANDE	ELSA	HIDALGO	1808	1938	2065
RIO GRANDE	HIDALGO	HIDALGO	941	1167	1403
RIO GRANDE	LA VILLA	HIDALGO	441	526	617
RIO GRANDE	MCALLEN	HIDALGO	30136	31382	32489

RWPG Name	WUG Name	County Name	Total Demand (ac-ft/yr)		
			2000	2010	2020
RIO GRANDE	MERCEDES	HIDALGO	3178	3501	3864
RIO GRANDE	MISSION	HIDALGO	10335	12727	16779
RIO GRANDE	PALMVIEW	HIDALGO	529	623	717
RIO GRANDE	PHARR	HIDALGO	6499	7955	9459
RIO GRANDE	PROGRESO	HIDALGO	348	372	382
RIO GRANDE	SAN JUAN	HIDALGO	4848	5220	5539
RIO GRANDE	WESLACO	HIDALGO	6990	8068	9284
RIO GRANDE	COUNTY-OTHER	HIDALGO	24894	31982	39067
RIO GRANDE	LA JOYA	HIDALGO	712	888	1049
RIO GRANDE	SULLIVAN CITY	HIDALGO	583	631	658
RIO GRANDE	COUNTY-OTHER	HIDALGO	315	514	747
RIO GRANDE	MINING	HIDALGO	617	609	651
RIO GRANDE	MINING	HIDALGO	72	61	57
RIO GRANDE	IRRIGATION	HIDALGO	816757	751718	674899
RIO GRANDE	IRRIGATION	HIDALGO	32939	30326	27225
RIO GRANDE	LIVESTOCK	HIDALGO	725	725	725
RIO GRANDE	LIVESTOCK	HIDALGO	38	38	38

Appendix H:

Identification of Pumping Locations in Kenedy County GCD for GMA Planning: Powerpoint Presentation Provided by Venkatesh Uddameri, Ph.D.

Identification of Pumping Locations in Kenedy County GCD for GMA Joint Planning

V. Uddameri, Ph.D.

Texas A&M University-Kingsville

Presented to the Kenedy County Groundwater Conservation District Board of Directors, Feb. 26, 2007

Need for Pumping Distributions

- The “baseline run” being carried out by TWDB is based on Year 1999 conditions
  - Somewhat modified to reflect 2007 conditions
    - Pumping in Victoria and Kingsville in CGC GAM
- The goal of Joint Planning is to establish “desired future conditions (DFC)”
  - Need to figure out future demand for groundwater
- The state currently does not distinguish between local and export uses
  - In addition to intra-GCD demands need to evaluate export-oriented projects as well

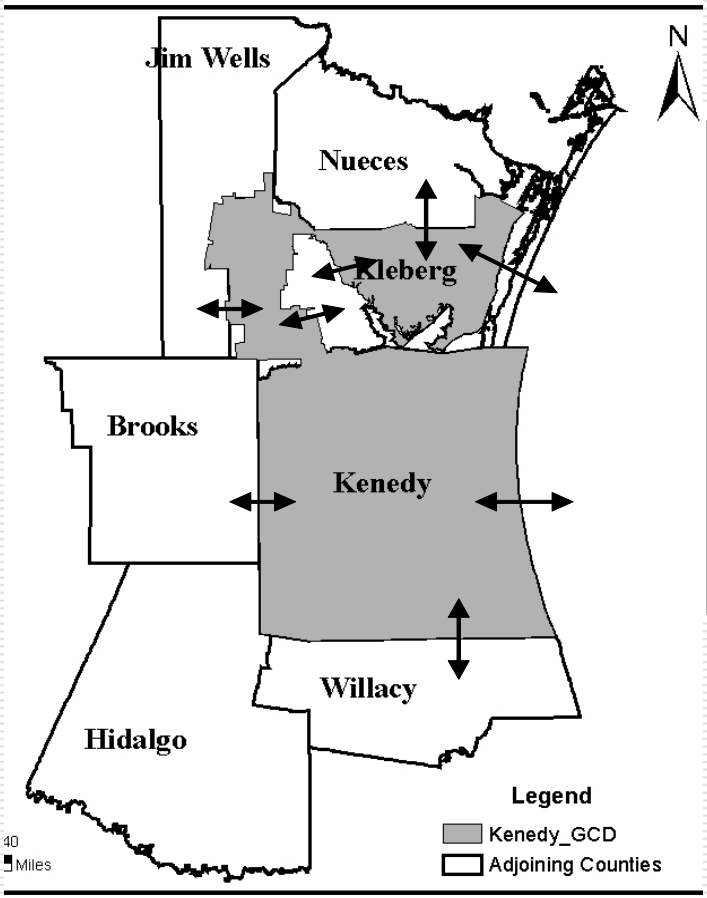
Need for Pumping Distributions

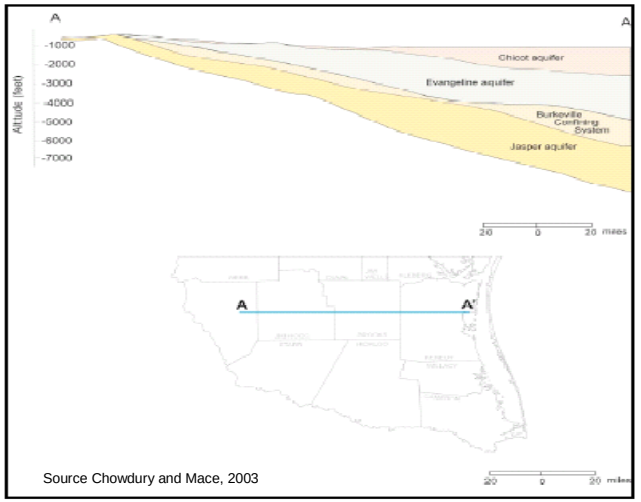
- Groundwater availability is not uniform throughout the GCD
  - Constrained by quantity and quality considerations
- Quantity considerations:
  - Can sufficient amount of groundwater be extracted on a long-term basis
- Quality considerations:
  - Is the extracted groundwater of acceptable quality for its intended use
    - Water treatment can alleviate some problems but controlled by economics

Factors affecting Future Groundwater Development

- Future groundwater development depends upon several factors:
  - Supply Side Factors
    - Favorable geology
    - Low energy costs
    - Economics of brackish water desalination
      - Disposal costs
    - Recharge enhancements or alterations
      - Development in the vicinity of the GCD
  - Demand Side Factors
    - Future growth with the GCD
    - Future growth in the vicinity of the GCD

Supply Side - Geology





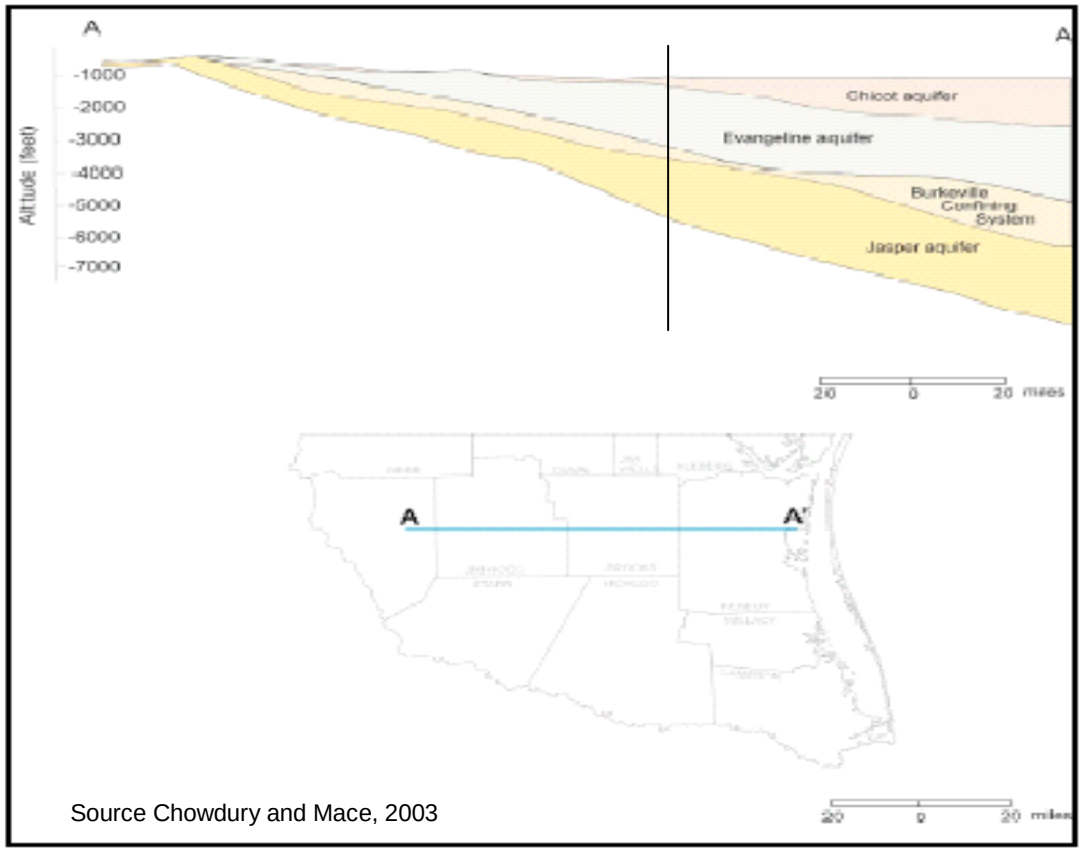
Chicot 100 - 1600
Evangeline 400-2800
700 - 3500
Jasper 1000 – > 4000

Gulf Coast Aquifer-4 Major Formations
Chicot, Evangeline, Burkeville, Jasper
Recharge from Precipitation to Chicot

Supply-Side: Geology

- The Evangeline aquifer formation is the most prolific and major source of fresh/slightly saline water
  - Transmissivity: ~ 25,000 to 30,000 gpd/ft
    - Fairly transmissive and can conduct water
  - Storage Coefficient: 0.0002 – 0.0007
    - Storage capacity is low; will pull water from a large area
- The thickness of the formation varies
  - Generally increases in thickness towards the coast

Regional Geology



Source Chowdury and Mace, 2003

Local Geology

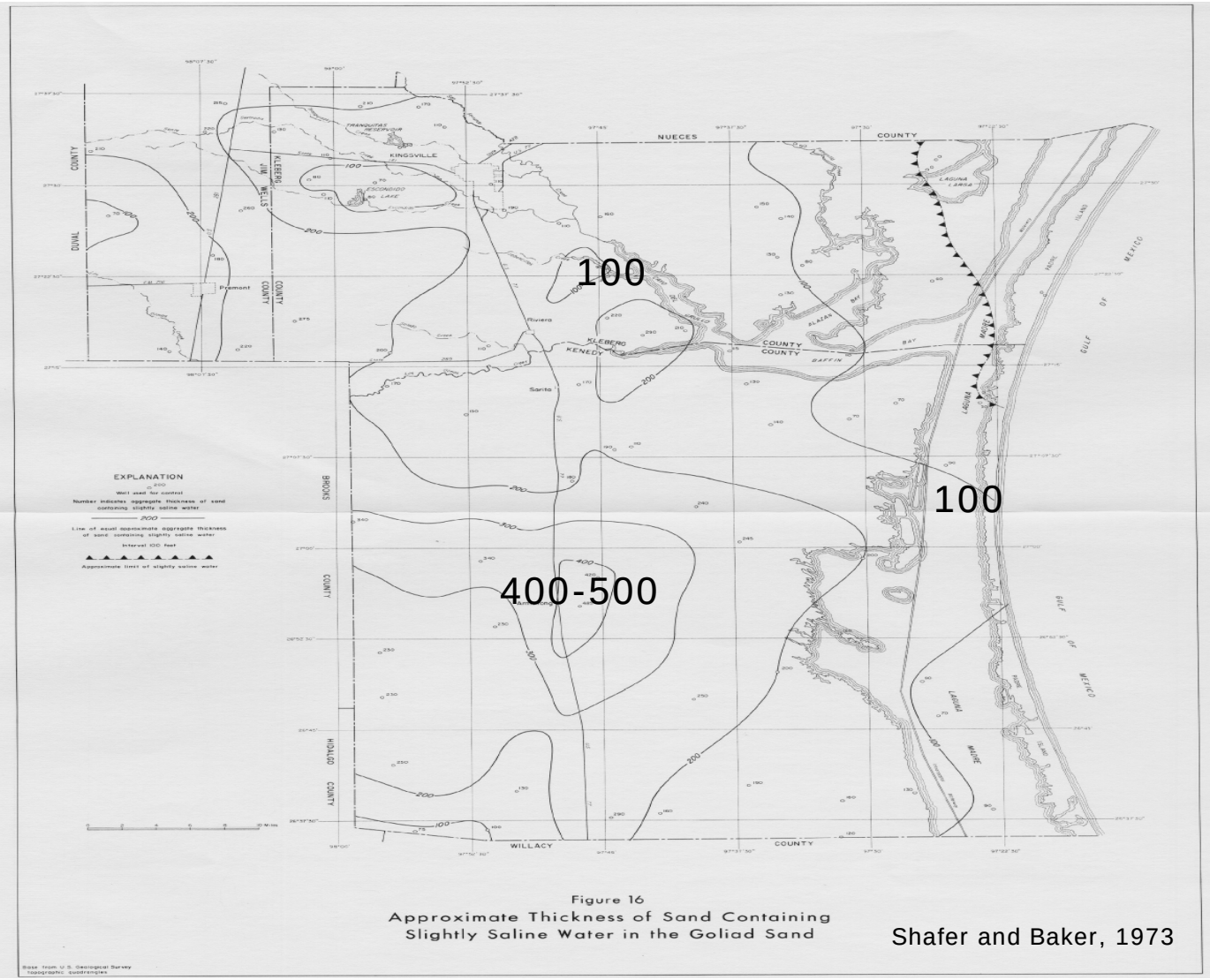


Figure 16
Approximate Thickness of Sand Containing Slightly Saline Water in the Goliad Sand

Shafer and Baker, 1973

Thickness varies locally, especially sands containing freshwater

Water Quality: Goliad Sands/Evangeline

- Fresh/Slightly saline water occurs in the western side and brackish water occurs on the eastern side
  - Regional Features
- Silt and Clays can also accumulate dissolved solids and other impurities and leach them into the sands
  - Goliad Sands ~ 60% Sands
- Impurities also come from leaching of brackish water from the Chicot formation
  - Vertical recharge is very small
  - May have significant local influences
    - Sand Pockets in Chicot formation that are near to /connected to Evangeline formations

Favorable Locations for Freshwater Development

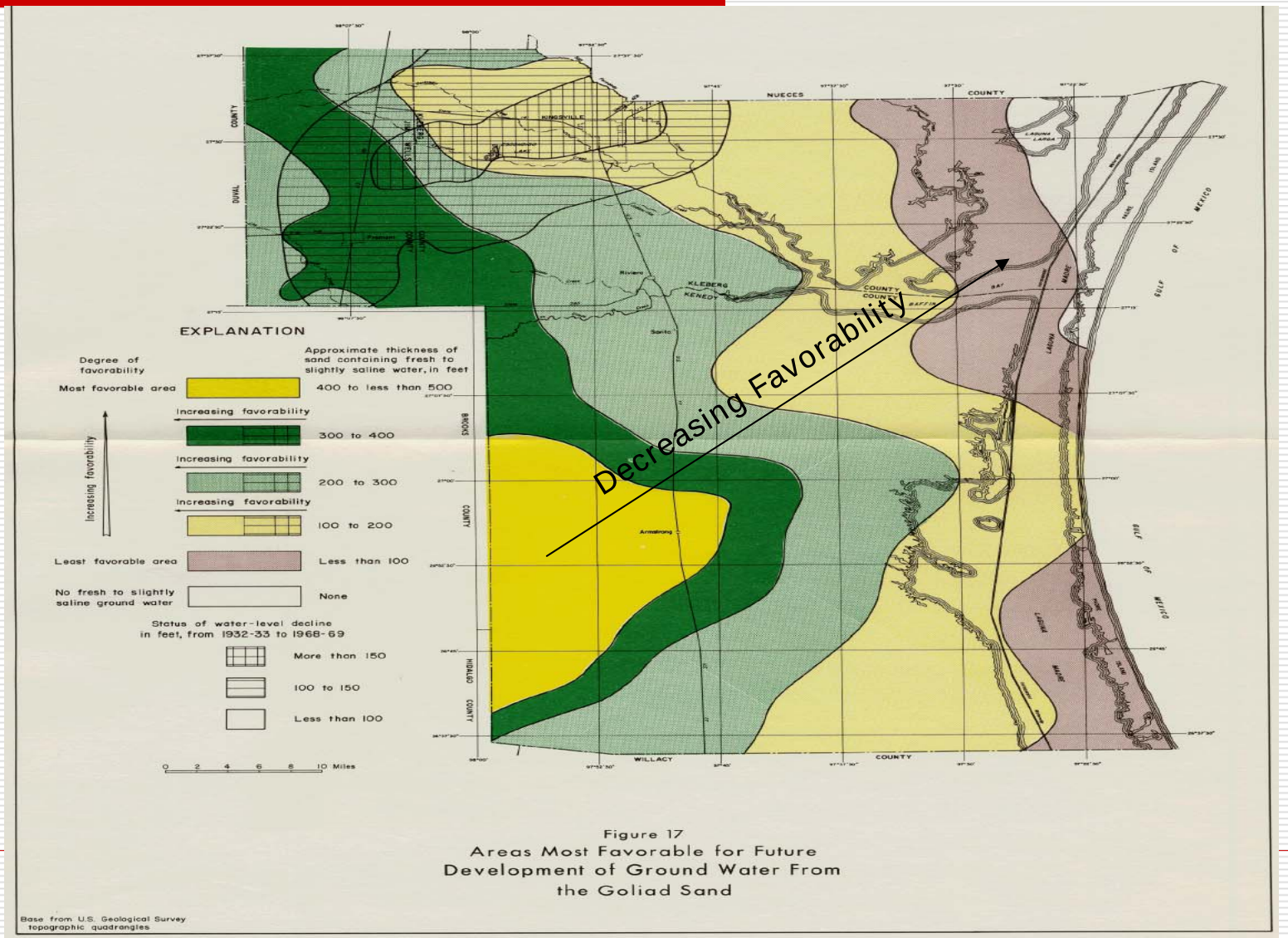
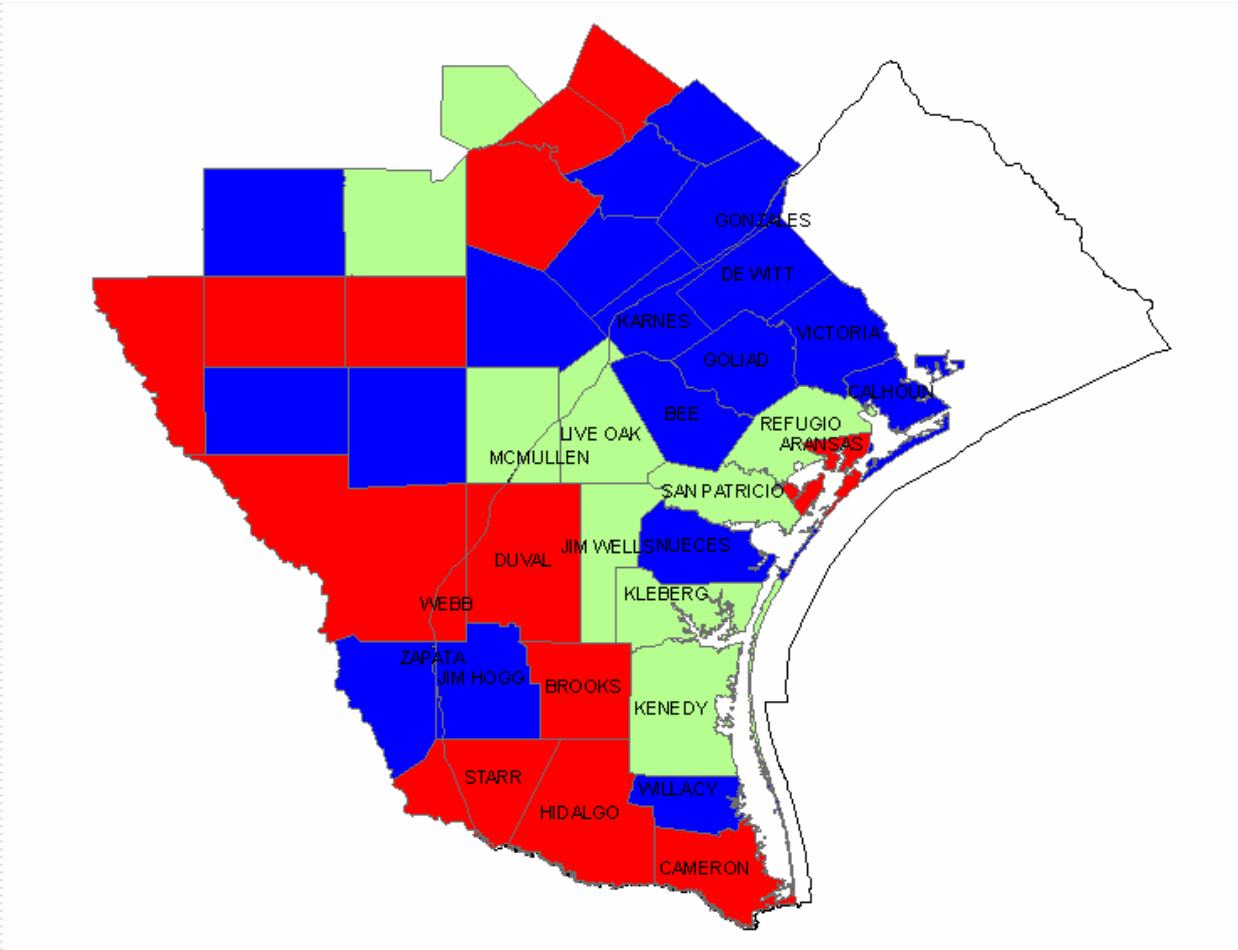


Figure 17
Areas Most Favorable for Future Development of Ground Water From the Goliad Sand

General Comments – Supply Side

- Good potential for “freshwater” in the Southwestern sections of the county
  - Near Armstrong
- Availability in the Northern/Northwest areas of the GCD depends upon external factors
  - Pumping by the City of Kingsville
  - Development in Southern Jim Wells county
- Significant amount of brackish water is available
  - Eastern sections of the county
  - The overlying Chicot formation is thick
    - Increases the cost of extracting water
  - Brackish water can be found inland as well

TWDB Projections for Water Deficits (2040)

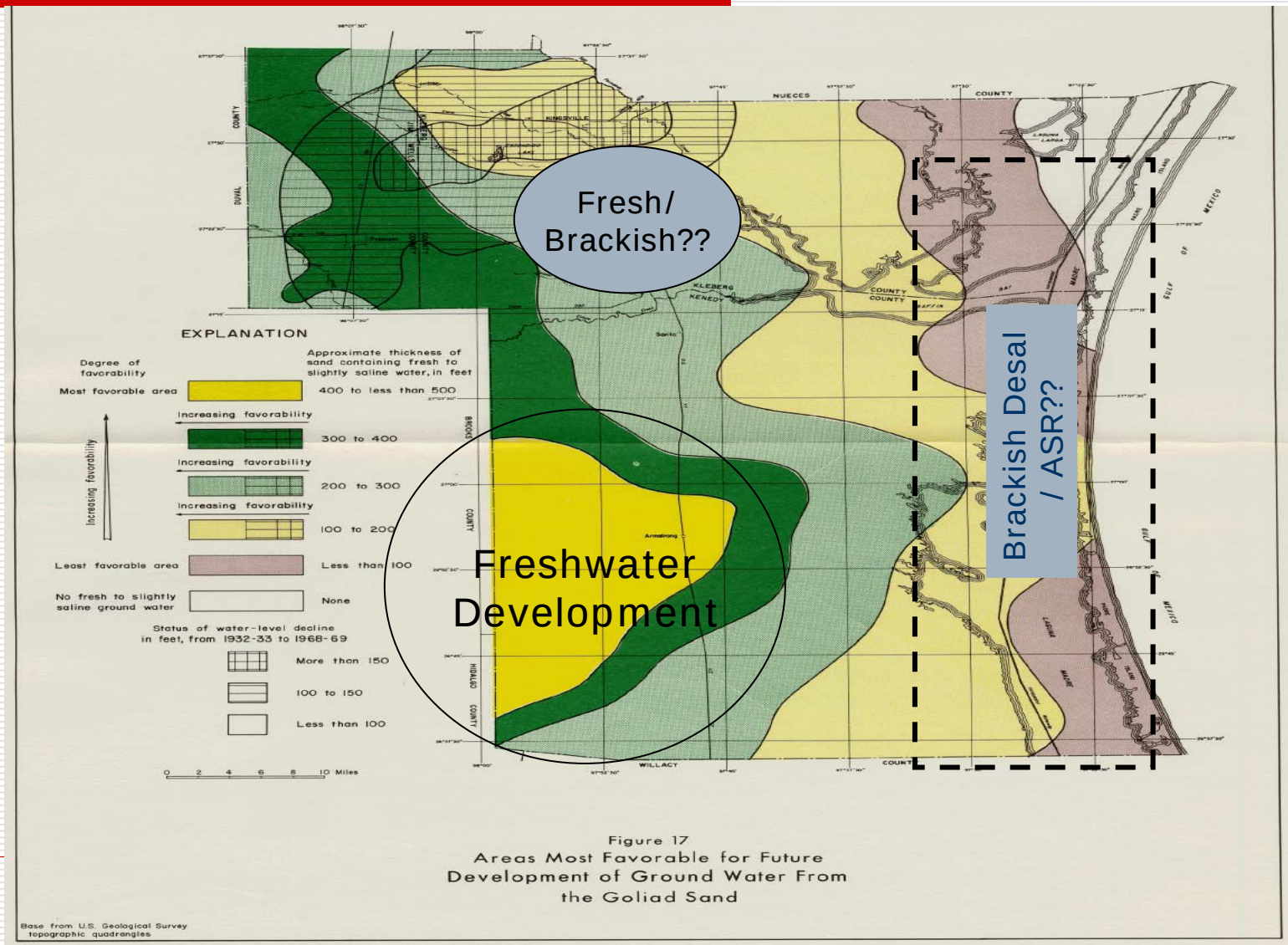


Significant Water Deficits around the Kenedy GCD

Demand Side

- The demands within the district are projected to stay static over the next few decades
  - TWDB projections
- The areas around the GCD projected to experience significant deficits
  - Webb, Starr, Hidalgo, Cameron counties
    - Kleberg to a lesser extent
- Groundwater resources in Kenedy GCD could be viewed as a potential to meet these demands
  - Freshwater will probably be tapped first
- Development of Brackish Groundwater in the future
  - Availability of alternative energy

Potential Locations – Recommendations for GAM Runs



Joint Planning - Scenarios

- The Joint Planning Exercises are carried out over a 50 year horizon
  - 2010 – 2060
- In addition to spatially distributing pumping, we need to identify when these projects are likely to be initiated
  - Initial Freshwater development (2010 →)
  - Brackish water development (2015/2020? →)
- Need to look at multiple scenarios
  - Different spatial and temporal trends

APPENDIX I

REFERENCES

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