Groundwater Management Plan

Pecos County

Prepared by:

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Groundwater Conservation District
Fort Stockton, Texas

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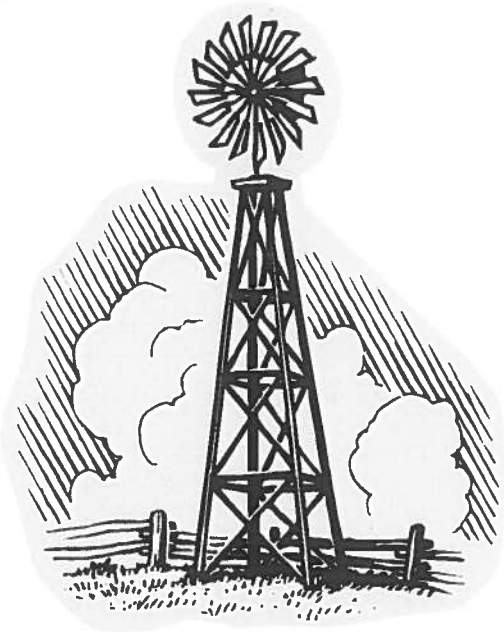

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Middle Pecos Groundwater Conservation District

Groundwater Management Plan

July 21, 2015

District Mission

The Middle Pecos Groundwater Conservation District (the District) is committed to manage and protect the groundwater resources of The District. The District was created to help maintain a sustainable, adequate, reliable, cost effective and high quality source of groundwater to promote the vitality, economy and environment of the District. The District will work with and for the citizens of the District and cooperate with other local, regional and State agencies involved in the study and management of groundwater resources.

Purpose of Management Plan

In 1997 the 75th Texas Legislature established a statewide comprehensive regional water planning initiative with the enactment of Senate Bill 1 (SB1). Among the provisions of SB1 were amendments to Chapter 36 of the Texas Water Code requiring groundwater conservation districts to develop a groundwater management plan that shall be submitted to the Texas Water Development Board (TWDB) for approval. The groundwater management plan was specified to contain estimates on the availability of groundwater in the district, details of how the district would manage groundwater, and management goals for the district. In 2001 the 77th Texas Legislature further clarified the water planning and management provisions of SB1 with the enactment of Senate Bill 2 (SB2).

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

Time Period of Management Plan

This plan shall be in effect for a period of five years from the date of approval by TWDB, unless a new or amended management plan is adopted by the District Board of Directors and approved by TWDB. The management plan will be readopted with or without changes by the District Board and submitted to TWDB for approval at least every five years.

Middle Pecos Groundwater Conservation District

The District was created in 1999. The creation of the District is recorded in Chapter 1331 of the Acts of the 76th Texas Legislature (SB 1911). This act enabled the District to function in a limited capacity until the creation of the District was fully validated in the 77th Legislature. The validation of the District is recorded in Chapter 1299 of the Acts of the 77th Texas Legislature (HB 1258). The District was confirmed by local election held in Pecos County on November 5, 2002.

The District boundaries are coterminous with the boundaries of Pecos County, Texas. The District is bounded by Reeves, Ward, Crane, Crockett, Terrell, Brewster, and Jeff Davis counties. As of the plan date, groundwater conservation districts (GCDs) that bound the District are in Jeff Davis, Brewster, and Crockett Counties. The GCDs neighboring the District are: Brewster County GCD, Jeff Davis County Underground Water Conservation District (UWCD), Terrell County GCD, and Crockett County GCD. Fig.1

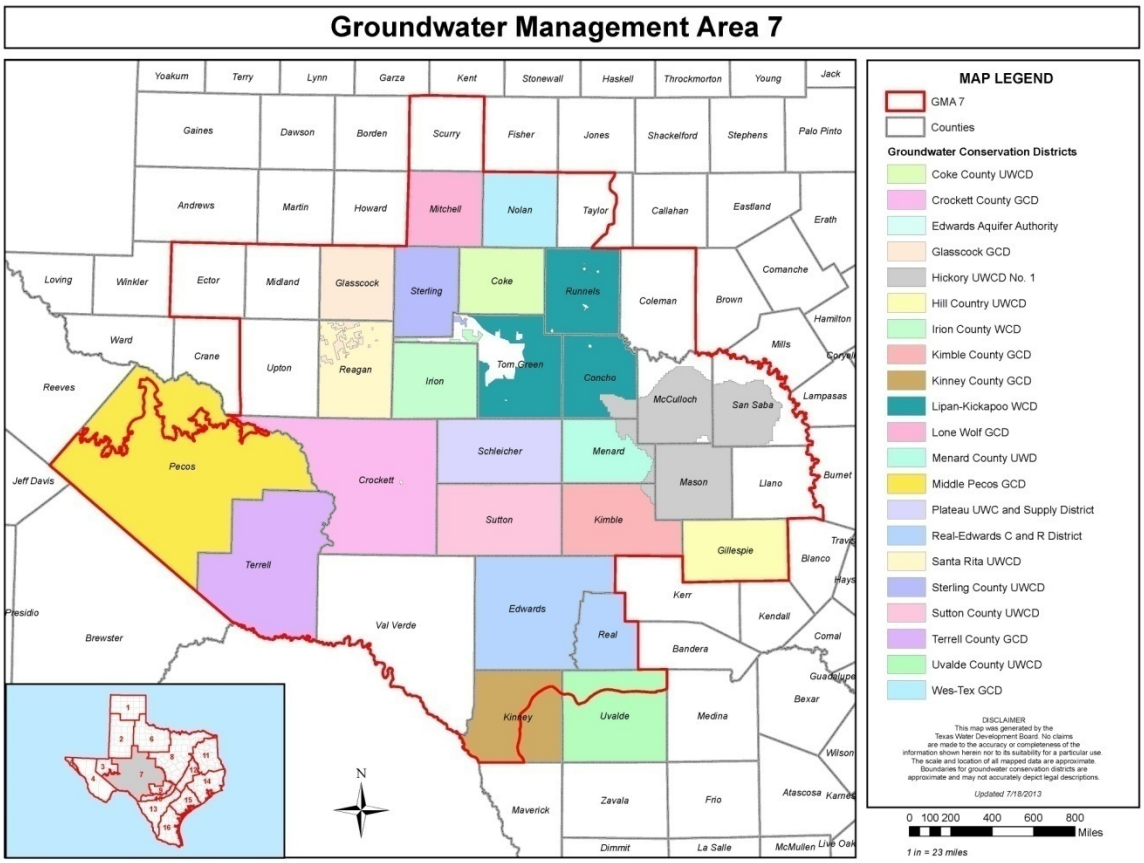

Figure1, Neighboring Districts to Middle Pecos Groundwater Conservation District

Most of the District is in Groundwater Management Area (GMA) 7, with the northern part of the District in GMA 3. Chapter 36 of the Texas Water Code authorizes the District to co-ordinate its management of groundwater with other GCDs in both GMA 7 and GMA 3. The District is currently the only GCD in GMA 3. The other GCDs that are located in GMA 7 are: Crockett County GCD, Santa Rita UWCD (Reagan), Irion County Water Conservation District (WCD), Glasscock GCD, Sterling County UWCD, Lone Wolf GCD (Mitchell), Terrell GCD, Wes-Tex GCD (Nolan), Coke County UWCD, Lipan-Kickapoo WCD (Tom Green, Concho, and Runnels), Hickory UWCD No. 1 (McCulloch, San Saba, and Mason), Menard County UWD, Hill Country UWCD (Gillespie), Kimble County GCD, Plateau Underground Water Conservation and Supply District (Schleicher), Sutton County UWCD, Real-Edwards Conservation and Reclamation District, Uvalde County UWCD, Edwards Aquifer Authority and Kinney County GCD. Fig. 2

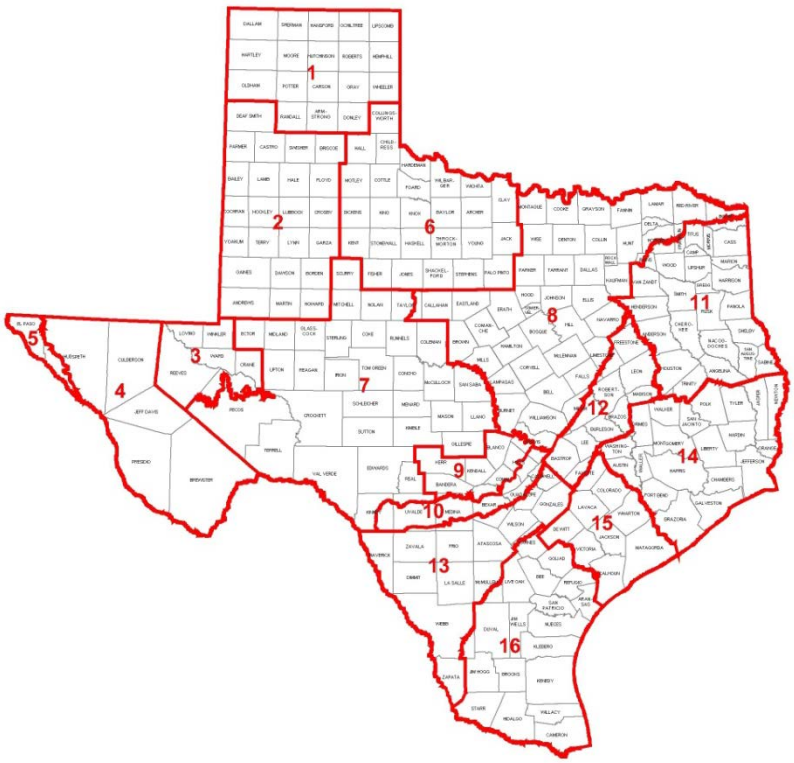

Figure 2, Groundwater Management Areas in Texas

The District Board of Directors is composed of eleven members elected to staggered four-year terms. Two directors are elected from each of the four county precincts, one director is elected at-large, one director is elected from the City of Iraan and one director is elected from the City of Fort Stockton. The Board of Directors holds regular meetings, at least quarterly. Meetings of the Board of Directors are public meetings noticed and held in accordance with public meeting requirements.

Authority of the District

The District derives its authority to manage groundwater use within the District by virtue of the powers granted and authorized in the District enabling act HB 1258 of the 77th Texas Legislature (Appendix A). The District, acting under authority of the enabling legislation, assumes all the rights and responsibilities of a groundwater conservation district specified in Chapter 36 of the Texas Water Code. The District has developed rules specifying the bounds of due process governing District actions. (Appendix C).

Groundwater Resources of the District

There are 5 sources of groundwater recognized by TWDB in the District. Two of these sources; the Edwards-Trinity (Plateau) aquifer and the Pecos Valley aquifer are classified as major aquifers by TWDB. (Fig. 3) The other three sources of groundwater; the Rustler aquifer, the Dockum aquifer and the Capitan Reef Complex aquifer are classified as minor aquifers by TWDB. (Fig. 4)

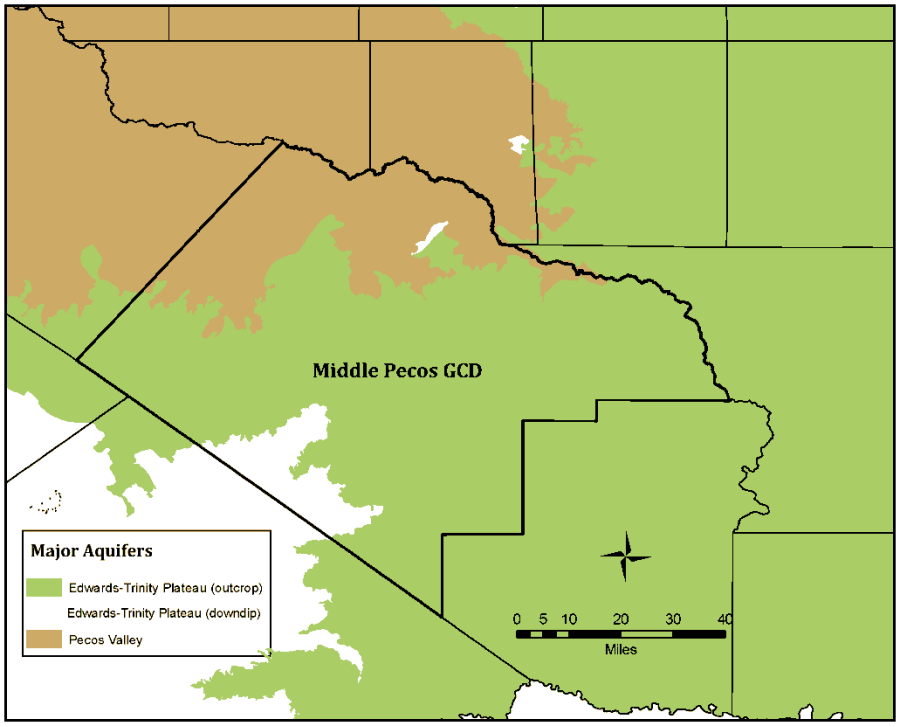

Figure 3, Major Aquifers in Middle Pecos GCD

A major aquifer produce large amounts of water over larger areas and minor aquifers produce minor amounts of water over large areas or large amounts of water over small areas.

The groundwater sources in the District may produce both fresh and moderately saline (brackish) water. The geologic origins of the groundwater sources of the District cover a broad range of geologic time. Listed in ascending order by geologic age, these sources and their ages are: Rustler Formation and Capitan Reef Complex (Permian), Dockum aquifer (Triassic), Edwards-Trinity (Plateau) aquifer (Cretaceous), and Pecos Valley (Quaternary). The geologic age of the various sources of groundwater in the District and the geologic history of Pecos County have a bearing on the structure of the groundwater sources of the District and their relationships.

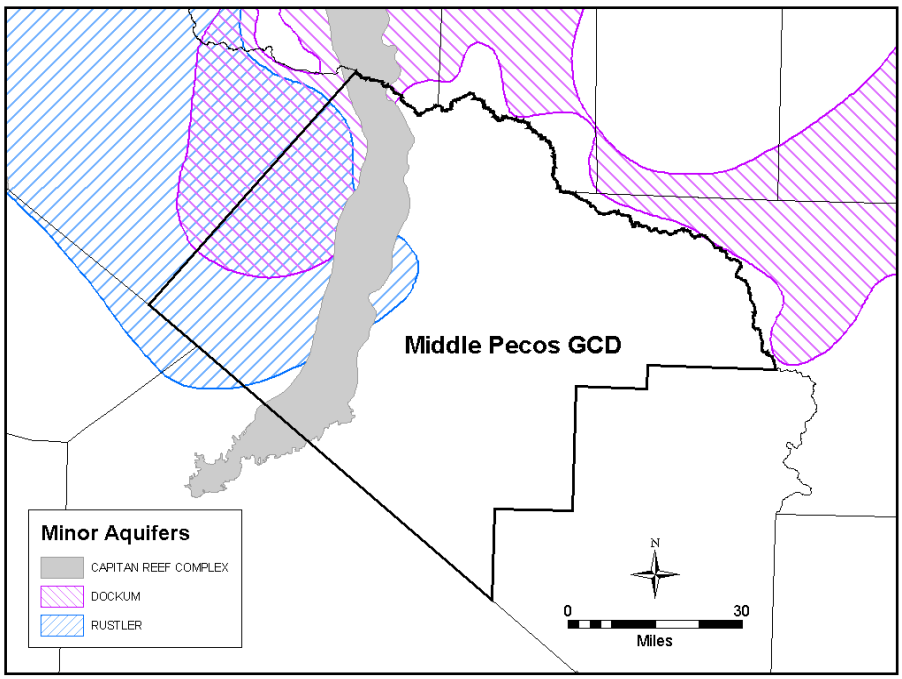

Figure 4, Minor Aquifers in Middle Pecos GCD

Aquifer Relationships in the Western Portion of the District

Parts of the District lie within the Delaware and Val Verde Basins. These basins were centers of sediment deposition at various times in geologic history. Near the end of Permian time, the seas of the Delaware Basin became shallow and restricted. This resulted in high evaporation rates of the sea water and allowed the deposition of very large amounts of evaporite minerals such as Halite (Sodium Chloride - NaCl), Anhydrite (Calcium Sulfate – $CaSO_4$) and Gypsum (Calcium Sulfate – $CaSO_4+H_2O$). (Rees and Buckner, 1980)

In Cretaceous time, seas again advanced and deposited significant amounts of additional sediment that covered the Permian evaporite mineral deposits. When the Cretaceous seas eventually withdrew, fresh groundwater percolated through the Permian evaporite deposits. The groundwater percolation dissolved much of the evaporite minerals beneath the overlying Cretaceous rocks taking away much of their support. The unsupported Cretaceous rocks subsided with extensive faulting and folding. (Fig. 5) The areas where the Cretaceous rocks subsided were filled with erosional material from the nearby volcanic activity associated with the formation of the Davis Mountains. (Rees and Buckner, 1980)

The western portion of the District lies within the Delaware Basin. In the area bounded generally by the Capitan Reef Complex, the Edwards-Trinity (Plateau) aquifer is covered and dissected by the Pecos Valley aquifer. In this area water is commingled between the two aquifers. The water quality in this area is affected mainly by sulfates from water percolating upward from the Rustler aquifer. Water that is recharged by infiltration on the Rustler outcrops in highlands to the west of the District leeches anhydrite and gypsum as it moves down-gradient into the District. The faulted and collapsed condition of the rocks of the Edwards-Trinity (Plateau) aquifer allows the sulfate laden water to infiltrate relatively easily. In the portion of the District which lies outside of the Delaware Basin, the Edwards-Trinity (Plateau) aquifer is undisturbed. (Rees and Buckner, 1980) (Fig 5)

Aquifer Descriptions

Capitan Reef Complex Aquifer – The Capitan Reef Complex aquifer is a Permian age reef complex on the eastern and western margins of the Delaware Basin. Within the District the aquifer occurs as a generally north-south trending strip approximately 10 to 20 miles wide. This strip is part of a trend which runs from northern Brewster County to the New Mexico state line through Pecos, Ward and Winkler Counties. The aquifer is composed of various cavernous limestone formations that make up the reef complex. The Capitan Reef Complex aquifer outcrops in the Glass Mountains but is deeply buried below the Edwards-Trinity (Plateau) aquifer in other parts of the District. The aquifer may be 1,500 to 2,000 feet thick and up to 3,600 feet deep. Water quality in the Capitan Reef Complex aquifer may be fresh near the mountain outcrop areas but may be moderately saline in other areas. Because of the cavernous nature of the aquifer, well yields may be high with a generally high availability of groundwater. The Capitan Reef Complex aquifer has been little studied in Texas. (Ashworth, 1990) (Guyton, 2003)

Rustler Aquifer – The Rustler aquifer is made up of the Permian age Rustler Formation. The Rustler Formation is approximately 200 to 500 feet thick. It is mostly dolomite and anhydrite but has sand and conglomerate at its base and also contains some shale and limestone. From outcrops in Culberson County the Rustler aquifer dips into the subsurface to the east. It is deformed by folding and may not produce groundwater in all areas. The Rustler is recharged by runoff infiltration in the outcrop areas but age-dating of the water may indicate that more water is recharged by cross-formation flow than from infiltration. The water quality of the Rustler aquifer is moderately saline. Well yields may vary from low to high. The Rustler aquifer is relatively deeply buried in the District and contributes water to the Edwards-Trinity (Plateau) and Pecos Valley aquifers. The principal use of the Rustler aquifer is for irrigation and oil field uses. The Rustler aquifer is not well understood and has been little studied. (Guyton, 2003)

Dockum Aquifer – The Dockum aquifer is composed of the Triassic age formations of the Dockum Group; the Santa Rosa and Tecovas Formations within the District. The aquifer has upper and lower shale sections with a fine grained sand in the middle often referred to as the “Santa Rosa” sand. The Dockum aquifer occurs only under artesian conditions in a limited area of the north western part of the District. It receives recharge from infiltration of runoff in the outcrop areas but may only receive cross-formation recharge within the area of the District. In areas where the Dockum aquifer is hydraulically connected to the Pecos Valley aquifer, the two units have been referred to as the Allurosa aquifer. Water quality in the Dockum aquifer within the District is slightly (3,000 mg/l) to moderately (5,000 mg/l) saline with a generally low productivity of wells. (Rees and Buckner, 1980) (Ashworth, 1990) (Guyton, 2003)

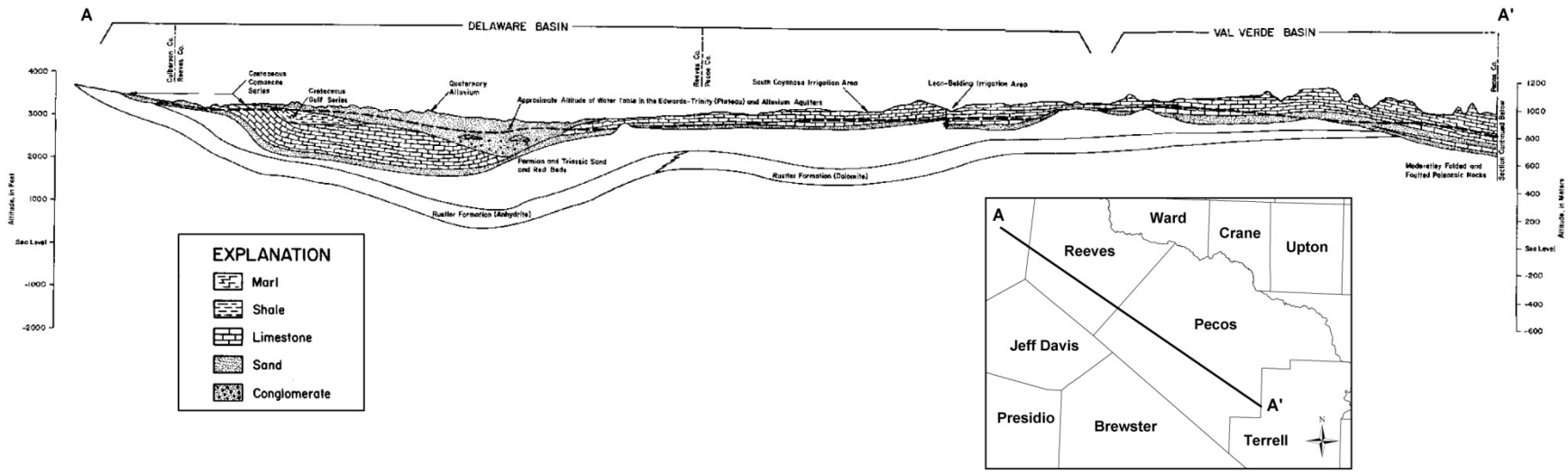

Figure 5, Geologic Cross Section of Reeves and Pecos Counties (Rees and Buckner, 1980)

Edwards-Trinity (Plateau) Aquifer – The Edwards-Trinity (Plateau) aquifer is of Cretaceous age and consists of the Edwards Group limestones and the sands and limestone of the Trinity Group. Within the District the Edwards Group is currently considered to consist of the Segovia and Fort Terrett Formations, but other terminology conventions may be applied to the Edwards Group. (BEG, 1975, 1981, 1982) The Trinity Group consists of the Maxon Sand, the Glen Rose Limestone and may include a basal conglomerate. (Rees and Buckner, 1980) The aquifer may be up to 1,200 feet in thickness and produces small to moderately large quantities of fresh to slightly saline (3,000 mg/l) water. The Edwards-Trinity (Plateau) aquifer is hydraulically connected to the Rustler and Pecos Valley aquifers in the western part of the District. (Ashworth, 1990)

Pecos Valley Aquifer – Consists of up to 1,500 feet of unconsolidated to partially consolidated sand, silt, clay and caliche. The alluvial fill material of the aquifer had two main deposition centers; the Pecos trough and the Monument Draw trough. The aquifer is a principal source of irrigation supply in the northern and western portions of the District. The water quality is fresh to moderately (5,000 mg/l) saline and well yields may be high. The Pecos Valley aquifer is hydraulically connected to the Rustler and Edwards-Trinity (Plateau) aquifers in the western part of the District. (Ashworth, 1990)

System	Geologic Unit	Hydrologic Unit
Quaternary	Alluvial Fill Material	Pecos Valley aquifer
Cretaceous	Edwards Group	Edwards-Trinity (Plateau) aquifer
	Trinity Group	
Triassic	Santa Rosa and Tecovas Formations	Dockum aquifer
Permian	Rustler Formation	Rustler aquifer
	Capitan Reef Complex	Capitan Reef Complex aquifer

Figure 6, Water-bearing Geologic and Hydrologic Units of Pecos County, Modified from Rees and Buckner, 1980; Ashworth, 1990

Geomorphology of the District

The topography of the District ranges from nearly level to gently undulating in the northern half and hilly to mountainous in the southern half. The eastern and central portions of the District are on the edge of the Edwards Plateau and are marked by mesas of varying sizes with intervening arroyos. Hills become more rounded and valleys more pronounced with generally undulating terrain further west. The northern part of the District slopes generally toward the Pecos River. Elevation ranges from about 2,200 feet above mean sea level (amsl) near the Pecos River to about 5,200 feet amsl in the mountains. All drainages flow to the Pecos River. The Pecos River flows continuously, but other streams in the county flow only after infrequent torrential rains. Springs were at one time an important water source for the area, but many no longer flow. (Rives 1980 and TSHA 2002). Reduced spring flow is attributed to redirected use of available groundwater.

Modeled Available Groundwater in the District

Modeled available groundwater is defined in TWC §36.001 means "the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition established under Section 36.108." The desired future condition of the aquifer may only be determined through joint planning with other groundwater conservation districts (GCDs) in the groundwater management area (GMA) or GMAs in which the District is located as required in TWC §36.108. The District is located in GMAs 3 and 7. The GCDs of GMAs 3 and 7 have completed the joint planning process and adopted desired future conditions for the following aquifers in Pecos County:

GMA-3

- Edwards-Trinity(Plateau)/Pecos Valley aquifers
- Dockum aquifer
- Capitan Reef Complex aquifer
- Rustler aquifer

GMA-7

- Edwards-Trinity(Plateau)/Pecos Valley aquifers
- Capitan Reef Complex aquifer
- Rustler aquifer
- Dockum aquifer

The desired future conditions of aquifers as adopted by GMAs 3 and 7 are given below. The Modeled Available Groundwater (MAG) the District developed for use in the GMA-3 and GMA-7 processes are presented below for each aquifer in the District.

For the purposes of managing groundwater within the boundaries of the District and pursuant to Chapter 36 of the Texas Water Code, the District used the desired future conditions of the aquifers as a benchmark. The desired future conditions were identified through the GMA process and deliberations by GMAs 3 and 7.

Edwards-Trinity (Plateau) and Pecos Valley Aquifers

To assess groundwater availability, the District participated in the GMA 3 and 7 requests that TWDB perform a series of simulations using the most recent 1-layer version of the TWDB Groundwater Availability Model (GAM) for the Edwards-Trinity (Plateau) aquifer and Pecos Valley aquifer. The series of GAM simulations iteratively applied varying amounts of groundwater pumping from the aquifer over a predictive period. Pumping was varied, until the amount of pumping that could be sustained by the aquifer without exceeding the desired future conditions was identified.

A. Desired Future Conditions

The desired future conditions for the Edwards-Trinity (Plateau) and Pecos Valley aquifers of Pecos County, as follows:

GMA 7 – Indexed to 2010 conditions, the combined aquifer draw down over 50 years should not exceed 11 feet when averaged over the entire portion of Pecos County where the Edwards-Trinity (Plateau) and Pecos Valley aquifers occur within GMA 7 and 7 feet when averaged over the areas where the aquifers occur in GMA-7 overall.

GMA 3 – Indexed to 2010 conditions, the combined aquifer draw down over 50 years should not exceed 12 feet when averaged over the entire portion of Pecos County where the Edwards-Trinity (Plateau) and Pecos Valley aquifers occur within GMA-3 and 28 feet when averaged over the areas where the aquifers occur in GMA-3 overall.

The District estimates of the selected management conditions related to draw down in the Edwards-Trinity and Pecos Valley Aquifers are based on GAM-run 09-35 of version 3 (single-layer model):

- Scenario 10 for GMA-7 (results presented by TWDB July 29, 2010)
- Scenario 11 for GMA-3 (results presented by TWDB August 9, 2010)

B. Modeled Available Groundwater

The Modeled Available Groundwater for the Edwards-Trinity (Plateau) and Pecos Valley aquifers in MPGCD is **240,120** acre-feet per year which is based on the amounts of groundwater that could be pumped while maintaining the selected management conditions in each aquifer management zone discussed above. In determining the volume of water available for permitting, a total of **4,124** acre-feet per year is allocated for exempt well users. This leaves a total of **235,996 acre-feet per year as the groundwater available for permitting for the Edwards-Trinity (Plateau) and Pecos Valley aquifers.** The Modeled Available Groundwater in GMAs 3 and 7 is given below:

GMA-7 Portion of Pecos County is (GAM RUN 10-043 MAG version 2):

- 117,386 acre-feet per year

GMA-3 Portion of Pecos County (GAM RUN 10-042 MAG):

- 122,734 acre-feet per year

The District estimates of groundwater availability in the Edwards-Trinity (Plateau) and Pecos Valley Aquifers are based on TWDB spatial distribution of simulated pumping in GAM-run 09-35 of version 3 (single-layer model):

- Scenario 10 for GMA-7 (results presented by TWDB July 29, 2010)
- Scenario 11 for GMA-3 (results presented by TWDB August 9, 2010)

C. Management Zones for the Edwards-Trinity (Plateau) and Pecos Valley Aquifers

The District has established groundwater management zones in the principal areas of irrigation (or other groundwater demand) and pertinent surrounding areas of Pecos County, as described below:

1) The Leon-Belding Irrigation Area and the vicinity of the City of Fort Stockton to include the outlets of Comanche Springs. The area is generally bounded by the TWDB Edwards-Trinity (Plateau) / Pecos Valley Aquifer GAM-Grid cells that contain the following sets of latitude and longitude coordinates: (30.90321 N, -102.8566 W); (30.85306 N, -102.8928 W); (30.69796 N, -103.15137 W). The specific GAM-grid cells composing the management zone are given in Appendix G.
2) The Bakersfield Irrigation Area. The area is generally bounded by the TWDB Edwards-Trinity (Plateau) / Pecos Valley Aquifer GAM-Grid cells that contain the following sets of latitude and longitude coordinates (except where cells are truncated by intersection with the Pecos County-line): (31.05667 N, -102.3717 W); (30.8992 N, -102.28911 W); (30.95167 N, -102.1653 W); (30.96833 N, -102.2169 W). The specific GAM-grid cells used to compose the management zone are given in Appendix G.
3) The Coyanosa Irrigation Area. The area is generally bounded by the TWDB Edwards-Trinity (Plateau) / Pecos Valley Aquifer GAM-Grid cells that contain the following sets of latitude and longitude coordinates (except where cells are truncated by intersection with the Pecos County-line): (31.1805 N, 103.0202 W); (31.3169 N, 103.0511 W); (31.2097 N, 103.0026 W); (31.1105 N, 102.9924 W); (31.1025 N, 103.1022 W); (31.1834 N, 103.1347 W). The specific GAM-grid cells used to compose the management zone are given in Appendix G.

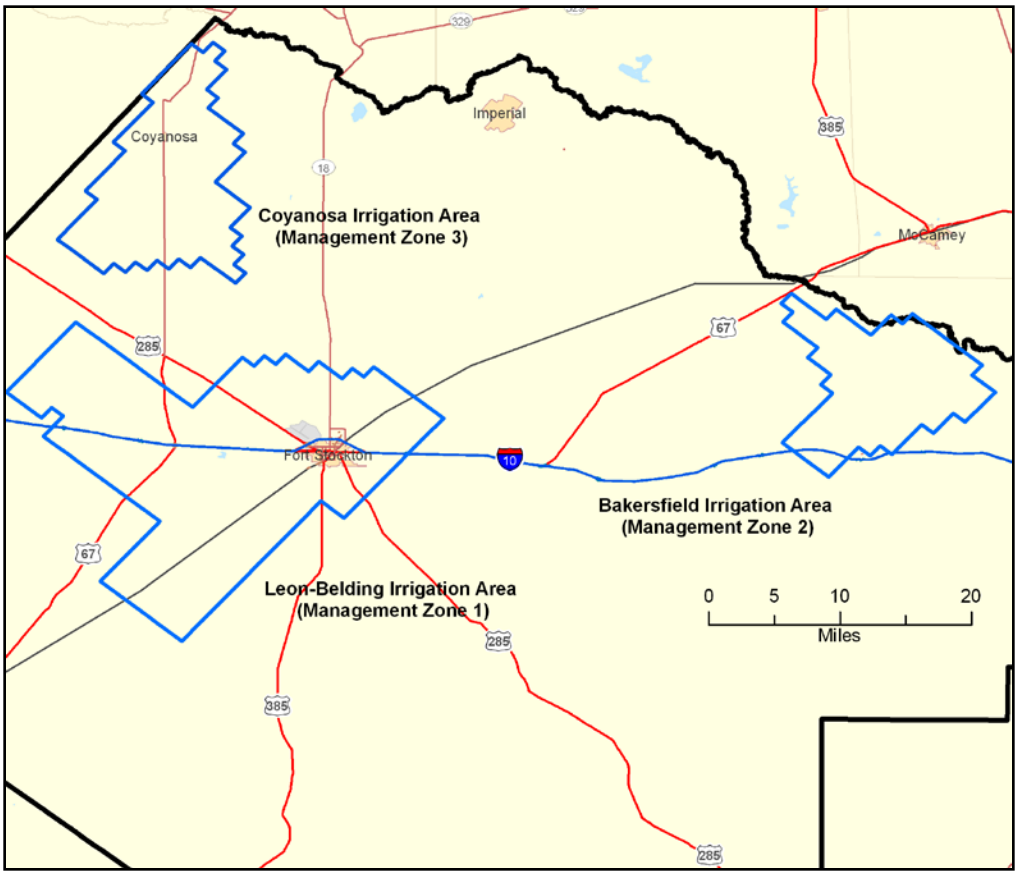

Figure 7, Groundwater Management Zones in MPGCD

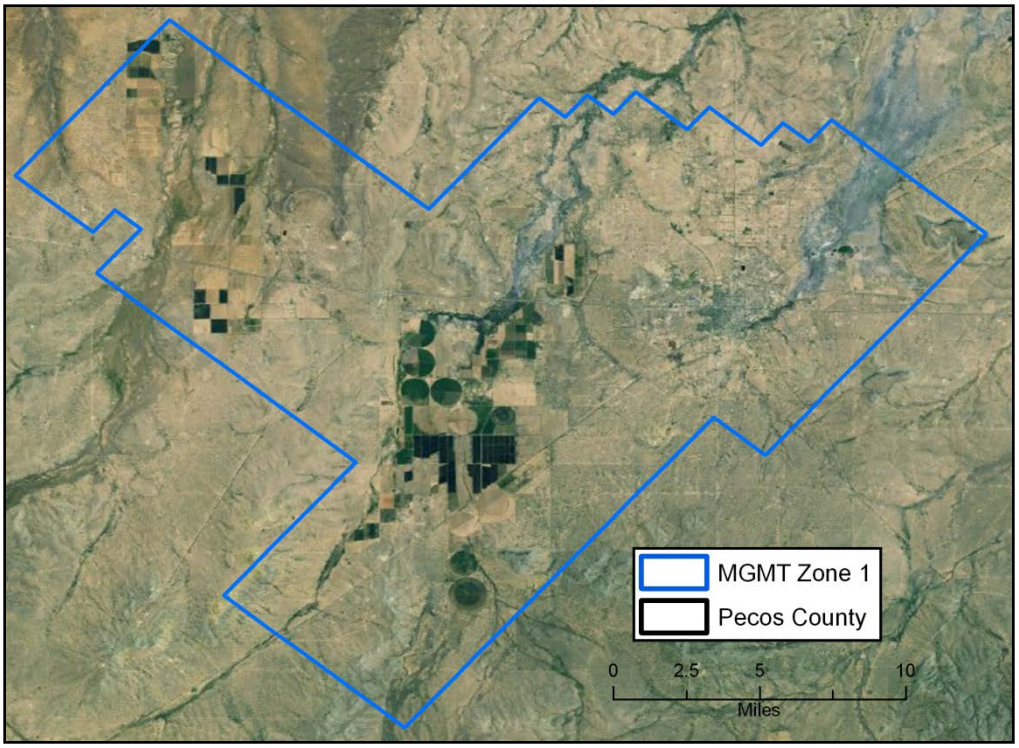

Figure 8, Groundwater Management Zone 1 in MPGCD

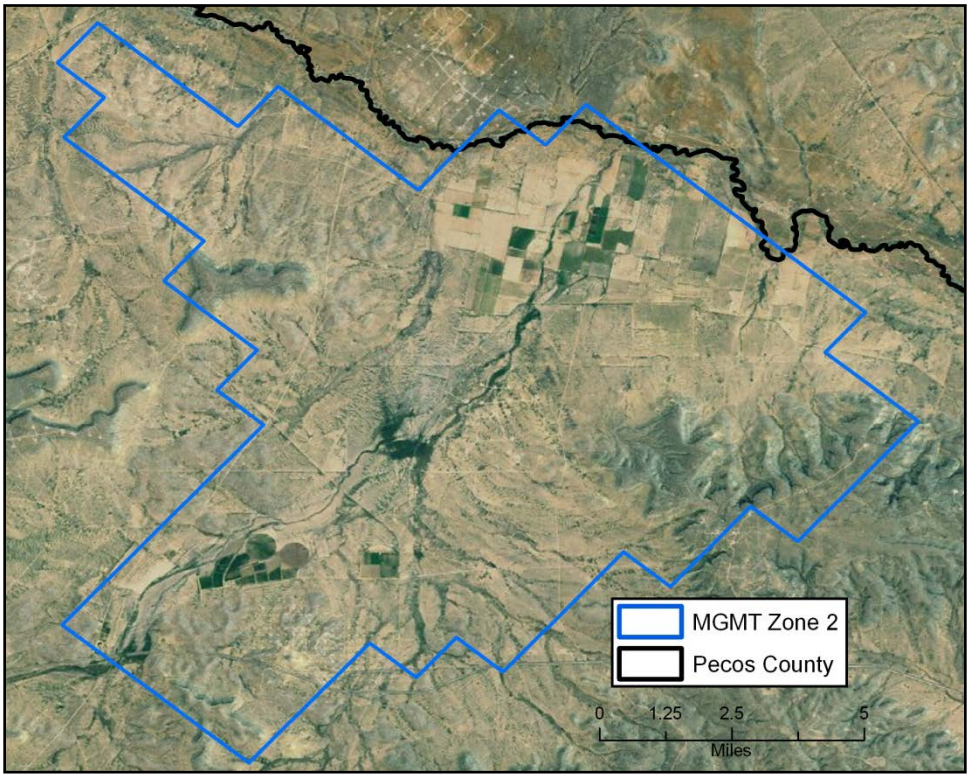

Figure 9, Groundwater Management Zone 2 in MPGCD

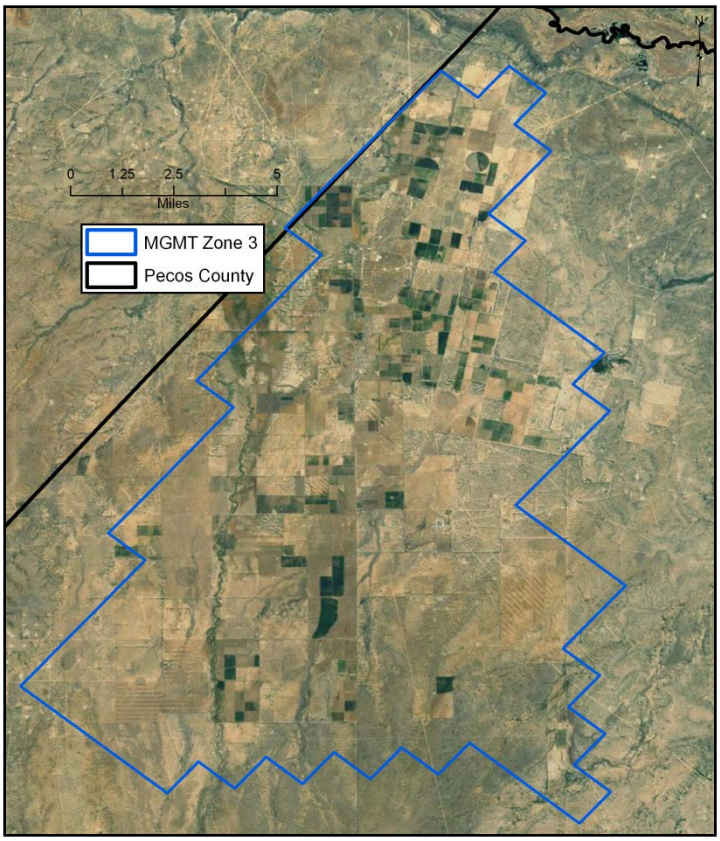

Figure 10, Groundwater Management Zone 3 in MPGCD

The District recognizes that groundwater use in the areas of principal groundwater demand in the District has the potential to result in localized aquifer draw down sufficient to possibly impair the DFCs of the aquifer in District as a whole (within each GMA). In each Management Zone described about a center of groundwater demand, the District seeks to avoid impairment of the adopted DFCs for the District as a whole (within the portions of the District in each of GMAs 3 and 7) by establishing benchmarks of sustainable groundwater use over time in the District Rules. The benchmarks of sustainable groundwater use over time established in the District Rules for each groundwater management zone may be based on the rates of change and the amounts of average aquifer draw-down described by the results of Scenario 10 of GAM-run 09-35 of version 3 (single-layer model) for the GMA-7 portion of MPGCD and Scenario 11 for the GMA 3 portion of MPGCD or other information such as water-level data. The assessment of the change in average draw-down values over time will be indexed to year 2010 water levels to be consistent with the adopted DFCs of the Edwards-Trinity (Plateau) and Pecos Valley aquifers. By managing the change in aquifer water levels over time in the management zones, the District can provide for the sustainability of the aquifers and avoid impairment of the aquifer DFCs established by the GMAs.

Capitan Reef Complex Aquifer

As of the date of this plan; a TWDB GAM for the Capitan Reef Complex aquifer has not been released. To assess groundwater availability, a spreadsheet model was developed. The model uses estimates of: the area of the aquifer recharge (unconfined) and the artesian (confined) zones; the annual amount of aquifer use (pumping, where pumping is assumed to be approximately equal to recharge); and the coefficient of storage of the aquifer in the confined and unconfined zones to predict the annual volume of water that could be produced from the aquifer and result in a specified amount of aquifer draw-down after 50 years. Predictions are made for the unconfined and confined zones of the aquifer within MPGCD. Predictions of the estimated annual amount of groundwater that could be produced in the unconfined zone and confined zone of the aquifer are summed for presentation. Aquifer-zone area estimates in Pecos County are from the TWDB GIS shape-files for the Capitan Reef Complex aquifer. Estimates of the annual aquifer use are from estimates developed by MPGCD. The coefficients of storage values are reasonable estimates. Pumping was increased, until the amount of pumping that could be sustained by the aquifer without exceeding the selected management conditions. Details of the groundwater availability estimates for the Capitan Reef Complex aquifer are given in Appendix F.

A. Desired Future Conditions

The Desired Future Condition describes the maintenance of the water levels expressed as an average draw down value for each aquifer zone where they occur in MPGCD over a 50-year horizon (2010-2060) at or above the levels specified below. *The desired future conditions are intended to define sustainable use by establishing management goals for each aquifer.* The District applied the spreadsheet models in 2010. The average draw-down values are indexed to year 2010 water levels. By maintaining the aquifer water levels the District can provide for the sustainability of the aquifer. The following 50-year criteria (rounded to the nearest foot) were applied to the individual aquifer zones in each county to assess the amounts of sustainable use:

Unconfined Zone (GMA 7):

- Approximately 15 feet average draw down across the area of occurrence of the aquifer zone over 50-years

Confined Zone (GMA 3 and GMA 7):

- Approximately 200 feet average draw down across the area of occurrence of the aquifer zone over 50-years

B. Modeled Available Groundwater

The estimated total groundwater availability for the Capitan Reef Complex aquifer in MPGCD is **11,122** acre-feet per year which is based on the amounts of groundwater that could be pumped while maintaining the selected management conditions in the aquifer subdivisions discussed above. In determining the volume of water available for permitting, **100** acre-feet per year is allocated for exempt well users. This leaves **11,022 acre-feet per year as the groundwater available for permitting for the Capitan Reef Complex aquifer**.

A summary is given by GMA and aquifer zone below:

Unconfined Zone in GMA 7 (AA 10-09 MAG):

- 1,287 acre-feet per year (80 acre-feet per year reserved for exempt use)

Confined Zone in GMA 3 (AA 10-36 MAG):

- 1,361 acre-feet per year (10 acre-feet per year reserved for exempt use)

Confined Zone in GMA 7 (AA 10-09 MAG):

- 8,474 acre-feet per year (10 acre-feet per year reserved for exempt use)

Rustler Aquifer

As of the date of this plan; a TWDB GAM Report for the Rustler Aquifer was released August 2012. Since MPGCD 2016 DFC are not completed a spreadsheet model was developed. The model uses estimates of the area of the artesian (confined) zone in MPGCD; the annual amount of aquifer use (pumping, where pumping is assumed to be approximately equal to aquifer inflow); and the coefficient of storage of the aquifer in the confined zone to predict the annual volume of water that could be produced from the aquifer and result in a specified amount of aquifer draw-down after 50 years. Predictions are made for the confined zone of the aquifer within MPGCD. The predictions of the estimated annual amount of groundwater that could be produced in the confined zone of the aquifer are summed for presentation. Aquifer-zone area estimates in Pecos County are from the TWDB GIS shape-files for the Rustler aquifer. Estimates of the annual aquifer use are from estimates developed by MPGCD. The coefficients of storage values are reasonable estimates. Pumping was increased, until the amount of pumping that could be sustained by the aquifer without exceeding the selected management conditions. Details of the estimates of groundwater availability for the Rustler aquifer are given in Appendix F.

A. Desired Future Conditions

The Desired Future Condition describes the maintenance of the water levels expressed as an average draw down value for each section of aquifer where they occur in MPGCD over a 50-year horizon (2010-2060) at or above the levels specified below. *The desired future conditions are intended to define sustainable use by establishing management goals for each aquifer.* The District applied the spreadsheet models in 2010. The average draw-down values are indexed to year 2010 water levels. By maintaining the aquifer water levels the District can provide for the sustainability of the aquifer. The following 50-year criteria (rounded to the nearest foot) were applied to the individual aquifer zones in each county to assess the amounts of sustainable use:

Confined Zone in GMA 3 and GMA 7:

- Approximately 300 feet average draw down across the area of occurrence of the aquifer zone over 50-years

B. Modeled Available Groundwater

The Modeled Available Groundwater for the Rustler aquifer in MPGCD is 10,508 acre-feet per year which is based on the amounts of groundwater that could be pumped while maintaining the selected management conditions in the aquifer subdivisions discussed above. In determining the volume of water available for permitting, 100 acre-feet per year is allocated for exempt well users. This leaves **10,408 acre-feet per year as the groundwater available for permitting for the Rustler aquifer**.

A summary is given by GMA and aquifer zone below:

Confined Zone in GMA 3 (AA 10-37 MAG):

- 3,466 acre-feet per year (50 acre-feet per year reserved for exempt use)

Confined Zone in GMA 7 is (AA 10-13 MAG):

- 7,042 acre-feet per year (50 acre-feet per year reserved for exempt use)

Dockum Aquifer

To assess groundwater availability, the District requested through GMAs-3 and 7 that TWDB perform a series of simulations using the TWDB's Groundwater Availability Model (GAM) for the Dockum aquifer. The series of GAM simulations iteratively applied varying amounts of groundwater pumping from the aquifer over a predictive period. Pumping was varied, until the amount of pumping that could be sustained by the aquifer without exceeding the selected management conditions was identified.

A. Desired Future Conditions

The Desired Future Condition describes the maintenance of the water levels expressed as an average draw down value for the aquifer where it occurs in MPGCD over a 50-year horizon (2010-2060) at or above the levels specified below. *The selected management conditions are intended to define sustainable use by establishing management goals for each aquifer.* The average draw-down values are indexed to year 2010 water levels. By maintaining the aquifer water levels the District can provide for the sustainability of the aquifer. The following 50-year criteria (rounded to the nearest foot) were applied to the individual aquifer zones in each county to assess the amounts of sustainable use:

Confined Zone in GMA 3:

- Approximately 47 feet average draw down across the area of occurrence of the aquifer zone over 50-years

Confined Zone in GMA 7:

- Draw down is not to exceed approximately 4 feet on average across the area of occurrence of the aquifer zone by year 2060

B. Modeled Available Groundwater

The estimated total groundwater availability for the Dockum aquifer in MPGCD is 13,965 acre-feet per year which is based on the amounts of groundwater that could be pumped while maintaining the selected management conditions in the aquifer discussed above. In determining the volume of water available for permitting, 100 acre-feet per year is allocated for exempt well users. This leaves 13,865 acre-feet per year as the groundwater available for permitting for the Dockum aquifer. The Dockum Aquifer **MAG report for the confined zone in GMA-3 is GR10-039 MAG and the confined zone for GMA-7 is GR10-040 MAG version 2.**

GMAs 3 and 7:

- 13,965 acre-feet per year (100 acre-feet per year reserved for exempt use)

TWDB Historical Groundwater Use in the District and 2012 State Water Plan. See Appendix D.

Details on the Development of the Estimate of Annual Recharge to the Capitan Reef Complex aquifer in Pecos County. See Appendix E.

Details on the Development of the Estimates of Annual Groundwater Availability in the Capitan Reef Complex and Rustler aquifers in Pecos County. See Appendix F.

2010 Baseline Water Levels for Management and Identification of Edwards-Trinity (Plateau)/Pecos Valley aquifer GAM Grid Cells Defining Groundwater Management Zones in MPGCD. See Appendix G.

GAM Run 14-010 - Middle Pecos GCD (March 26,2014). See Appendix H.

Details on How the District Will Manage Groundwater in the District

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 seeks to manage the groundwater resources of the District as practicably as possible in a sustainable manner through the development of the Desired Future Conditions of Aquifers within the District. The Texas Legislature established that groundwater conservation districts are the preferred method of groundwater management in Section 36.0015 of the Texas Water Code. The District will cooperate with the other Groundwater Conservation Districts in the Groundwater Management Areas which Pecos County is located. In consideration of the economic and cultural activities occurring within the District, the District will identify and engage in such activities and practices, that if implemented may result in the conservation of groundwater in the District. The District will manage groundwater resources through rules developed and implemented in accordance with Chapter 36 of the Texas Water Code and the provisions of the District Enabling Act recorded in Chapter 1299 of the Acts of the 77th Texas Legislature (HB 1258). The District will require that any well constructed as an exempt well under activities regulated by the Texas Railroad Commission (TRC) and later converted to another use not regulated by the TRC will be required to seek a permit for the use of groundwater in the District if the converted use of the well is otherwise not exempted from permitting under the Texas Water Code or Rules of the District.

An observation well network may be established and maintained in order to monitor changing storage conditions of groundwater supplies within the District. When a monitoring well network has been established the District will make a regular assessment of water supply and groundwater storage conditions and will report those conditions to the District Board of Directors and to the public. The District may undertake, as necessary, investigations of the groundwater resources within the District and will make the results of investigations available to the public upon adoption by the District Board of Directors. The District will co-operate with investigations of the groundwater resources of the District undertaken by other local political subdivisions or agencies of the State of Texas.

In order to better manage groundwater resources the District may establish management zones for all sources of groundwater within the District. In each management zone the District may:

a) Establish Desired Future Conditions and authorize the production of groundwater
b) Determine and implement the proportional reductions of the use of groundwater for all classes of groundwater use that are established by the District in order to maintain the established Desired Future Conditions of the management zone.
c) Allow for the transfer of the permitted right to use groundwater if a process is established in the District rules

Section 36.116 of the Texas Water Code provides that the District may use the management zones to adopt different rules for each:

a) Aquifer
b) Aquifer subdivision
c) Geologic formation
d) Geographic area in which any part of a through c above may occur within the District

For the purpose of managing the use of groundwater within the District, the District may address the use of groundwater in the aquifers in the District as a whole or within any management zone established by the District in order that the Desired Future Condition of the aquifer or aquifer subdivision in which the use occurs is not impaired. In furtherance of the District management of groundwater, the District may also establish any other criteria by Rule, as a threshold of use beyond which withdrawals from the aquifer or aquifer subdivision in excess of the threshold may result in a specified undesirable or injurious condition to the aquifer or aquifer subdivision. If the District determines that the Desired Future Conditions or other criteria established by the District are being or may imminently be impaired with reasonable certainty, the District may take such actions or implement such conservation measures as may be necessary to restore the aquifer or aquifer subdivision to conditions which do not impair the Desired Future Conditions or other criteria established by the District under this section for the aquifer or aquifer subdivision.

The District will use the available estimates of groundwater recharge, movement and Managed Available Groundwater within the District in exercising the statutory responsibility of managing the groundwater in the District. As more information on groundwater conditions in the District becomes available, the District may use that information to refine the specific methodology by which the District will seek to sustainably manage the groundwater in the District.

The annual amount of water used from an aquifer or aquifer subdivision in the District or in a management zone established by the District will be averaged over a period of years specified in the District rules to aid in determining if the Managed Available Groundwater value or the Desired Future Condition has been exceeded. If the Desired Future Condition of an aquifer or aquifer subdivision in the District or a management zone is found to have been exceeded the District may implement proportional reductions in the permitted use of groundwater in the District or management zone to reduce the levels of use in order to maintain the Desired Future Condition. The District will implement proportional reductions in the permitted use of groundwater only to the extent that is required to maintain the Desired Future Condition in an aquifer, aquifer subdivision or a management zone.

The District rules will specify the methodology by which the District will track the usage of groundwater from an aquifer or aquifer subdivision in the District or a management zone to determine whether the sustainable use has been exceeded. The District rules will specify the

methodology by which the District will implement any proportional reductions in the permitted use of groundwater in the District. All District actions with regard to proportional reductions of the permitted use of groundwater will be taken in noticed public meetings and in accord with the District rules.

The District has implemented rules establishing a claims process in which the District required existing or historic users of groundwater to obtain historic use permits. The claims process was intended to protect existing use as provided for in Section 36.113(e) of the Texas Water Code. To the extent practicable while remaining consistent with this plan, the District's existing and historic use permit process and period will preserve historic use as provided in Section 36.116(b) of the Texas Water Code.

The District will protect the existing and historical use of groundwater that occurred in the District prior to the effective date of the rules establishing the claims process. To obtain a historic use permit, an existing or historic user had to prove the maximum annual amount of groundwater that the user put towards a beneficial use during an existing and historic use period established in the District rules. The protection extended to historic use permit holders is achieved by imposing more restrictive permit conditions on new permit applications. In extending this protection to historic use permit holders the District established limitations that:

a) Apply to all subsequent new applications for the permitted use of groundwater and applications for the increased use of groundwater by holders of historic user permits regardless of the type or location of use
b) Bear a reasonable relationship to the District's management plan
c) Are reasonably necessary to protect existing use and maintain established Desired Future Conditions of aquifers, aquifer subdivisions or management established by the District.

The District may adopt rules to regulate groundwater withdrawals by means of spacing and/or production limits. The District may deny a well construction permit or limit groundwater withdrawals in accordance with the guidelines stated in the rules of the District. In making a determination to deny a permit or reduce the amount of groundwater withdrawals authorized in an existing permit, the District will weigh the public benefit in managing the aquifer to be derived from the denial of a groundwater withdrawal permit or the reduction of the amount of authorized groundwater withdrawals against the individual hardship imposed by the permit denial or authorization reduction.

The relevant factors to be considered in making a determination to deny a permit or limit groundwater withdrawals may include:

a) The rules of the District
b) The distribution of groundwater resources in the aquifers or aquifer subdivisions of the District or any management zones established by the District
c) The economic hardship resulting from grant or denial of a permit or the terms prescribed by the permit

In pursuit of the District's mission of protecting the resource, the District may require reduction of groundwater withdrawals. To achieve this purpose, the District may, at the Boards discretion amend or revoke any permits after notice and hearing. The determination to seek the amendment, reduction or revocation of a permit by the District will be based on aquifer conditions observed by the District. The District will, when necessary, enforce the terms and

conditions of permits and the rules of the District by enjoining the permit holder in a court of competent jurisdiction as provided for in Texas Water Code Chapter 36.102.

The District will establish rules for the proportional reduction of the permitted use of groundwater in the District that will recognize the following priorities of use:

1) Exempt users with particular consideration to livestock and domestic use
2) Holders of historic use of groundwater permits
3) Holders of non-historic groundwater use permits

The District may employ technical resources at its disposal, as needed, to evaluate the resources available within the District and to determine the effectiveness of regulatory or conservation measures. In consideration of particular individual, localized or District-wide conditions the District may allow the production in a management zone to exceed the sustainable amount for a period of time considered necessary by the District. The exercise of this discretion by the District shall not be construed as limiting the authority of the District in any other matter. A public or private user may appeal to the Board for discretion in enforcement of the provisions of a reduction in the permitted use of groundwater on grounds of adverse economic hardship or unique local conditions. The exercise of said discretion by the Board shall not be construed as limiting the power of the Board.

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

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

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

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

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

The General Manager of the District will prepare and submit an annual report (Annual Report) to the District Board of Directors. The Annual Report will include an update on the District's performance in achieving the management goals contained in this plan. The general manager will present the Annual Report to the Board of Directors within one hundred twenty (120) days following the completion of the District's Fiscal Year, currently the District fiscal year ends on September 30 of each calendar year. A copy of the annual audit of District financial records will be included in the Annual Report. The District will maintain a copy of the Annual Report on file for public inspection at the District offices, upon adoption by the Board of Directors. A copy of MPGCD rules can be found here.
http://www.middlepecosgcd.org/pdf/rules/2014/rules_adopted_10-21-2014.pdf

Management Goals

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

1.1 Objective – Each year, the District will require all new exempt or permitted wells that are constructed within the boundaries of the District to be registered with the District in accordance with the District rules.

1.1 Performance Standard – Each Year the number of exempt and permitted wells registered by the District for the year will be incorporated into the Annual Report submitted to the Board of Directors of the District.

2. Controlling and Preventing the Waste of Groundwater in the District

2.1 Objective – Each year, the District will make an evaluation of the District Rules to determine whether any amendments are recommended to decrease the amount of waste of groundwater within the District.

2.1 Performance Standard – The District will include a discussion of the annual evaluation of the District Rules and the determination of whether any amendments to the rules are recommended to prevent the waste of groundwater in the Annual Report of the District provided to the Board of Directors.

2.2 Objective – Each year, the District will provide information to the public on eliminating and reducing wasteful practices in the use of groundwater either by a page on groundwater waste reduction or a link to information on groundwater waste reduction on the District's website or by providing an article on eliminating and reducing wasteful practices to a newspaper of general circulation in the District for potential publication.

2.2 Performance Standard – Each year, a copy of the information provided on groundwater waste reduction on the District's website or a copy of the article provided to a newspaper of general circulation in the District will be included in the District's Annual Report to be given to the District Board of Directors.

3. Controlling and Preventing Subsidence

This Management Goal is not Applicable to the District.

4. Conjunctive Surface Water Management Issues

4.1 Objective – Each year, the District will participate in the regional planning process by being represented at the Region F Regional Water Planning Group meetings.

4.1 Performance Standard – The attendance of a District representative to at least 50 percent of the Region F Regional Water Planning Group meetings will be noted in the Annual Report presented to the District Board of Directors.

5. Natural Resource Issues That Affect the Use and Availability of Groundwater or are Affected by the Use of Groundwater

5.1 Objective – Each year the District will monitor the permitting and integrity testing of salt-water or waste-disposal injection wells permitted by the Texas Railroad Commission within the District.

5.1a Performance Standard – Each year, a summary of the salt-water or waste-disposal injection wells permitted by the Texas Railroad Commission within the District will be included in the Annual Report submitted to the District Board of Directors.

5.1b Performance Standard – Each year a summary of the results of the integrity tests performed on the salt-water or waste-disposal injection wells permitted by the Texas Railroad Commission to operate within the District will be included in the Annual Report submitted to the District Board of Directors.

5.2 Objective – Each year the District will monitor the discharge of Comanche and related springs or acquire the monitoring data on spring discharge developed by others.

5.2 Performance Standard – Each year, a summary of the timing of the appearance of the seasonal spring-discharge, an estimate of the annual volume of discharge from Comanche and related springs and a discussion comparing the most recent estimates of spring-discharge to previous estimates will be included in the Annual Report submitted to the District Board of Directors.

5.3 Objective – From year 2010, each third year, the District will assess the changes in the quantity of the discharge of Comanche and related springs and recommend to the Board of Directors whether any conservation measures are necessary to maintain the discharge of Comanche and related springs.

5.3 Performance Standard – From year 2010, each third year, a summary of the assessment of the changes in the quantity of annual seasonal spring-discharge and any recommendations for conservation measures to be considered for implementation will be included in the Annual Report submitted to the District Board of Directors.

6) Addressing Drought Conditions

6.1 Objective – Each month, the District will download available drought information, for the counties in the District, from available websites on the internet..

6.1 Performance Standard – Quarterly, the District will make an assessment of the status of drought in the District and prepare a quarterly briefing for the Board of Directors. The downloaded maps, reports and information will be included with copies of the quarterly briefing in the District Annual Report to the Board of Directors.

TWDB Drought Resources:
http://www.twdb.texas.gov/publications/shells/Droughtresources.pdf

7. Addressing

A. Conservation

7A.1 Objective – The District will submit an article annually, regarding water conservation for publication to at least one newspaper of general circulation in Pecos County.

7A.1 Performance Standard – A copy of the article submitted by the District for publication to a newspaper of general circulation in Pecos County regarding water conservation will be included in the Annual Report to the Board of Directors.

B. Recharge Enhancement

This management goal is not applicable to the District.

C. Rainwater Harvesting

7C.1 Objective – The District will post an article or a link to an article annually, regarding rainwater harvesting on the District website www.middlepecosgcd.org

7C.1 Performance Standard – A copy of the article posted on the District website regarding rainwater harvesting will be included in the Annual Report to the Board of Directors.

D. Precipitation Enhancement

This management goal is not applicable to the District.

E. Brush Control

This management goal is not applicable to the District.

8. Addressing the Desired Future Conditions (DFC) of the Groundwater Resources in the District

8.1 Objective – Each year, the District will collect at least 5 water-level measurements from the District monitor wells located in the portion of the District located withinGMA-7.

8.1a Performance Standard – Each year, the District will post the water-level measurements collected from the portion of the District within GMA-7 and identify the aquifer from which the measurement is taken, in the Annual Report to the Board of Directors.

8.1b Performance Standard – Each year, the District will include a discussion of the change in water-levels in each aquifer for which a Desired Future Condition is established by GMA-7, in the Annual Report to the Board of Directors.

8.1c Performance Standard – Each five years, the District will include a discussion of the change in water-levels in each aquifer for which a Desired Future Condition is established by GMA-7 comparing the change to the incremental time-appropriate change in water-levels indicated by the established Desired Future Condition of the aquifer, in the Annual Report to the Board of Directors.

8.2 Objective – Each year, the District will collect at least 5 water-level measurements from the District monitor wells located in the portion of the District located withinGMA-3.

8.2a Performance Standard – Each year, the District will post the water-level measurements collected from the portion of the District within GMA-3 and identify the aquifer from which the measurement is taken, in the Annual Report to the Board of Directors.

8.2b Performance Standard – Each year, the District will include a discussion of the change in water-levels in each aquifer for which a Desired Future Condition is established by GMA-3, in the Annual Report to the Board of Directors.

8.3c Performance Standard – Each five years, the District will include a discussion of the change in water-levels in each aquifer for which a Desired Future Condition is established by GMA-3 comparing the change to the incremental time-appropriate change in water-levels indicated by the established Desired Future Condition of the aquifer, in the Annual Report to the Board of Directors.

References

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United States Department of Agriculture-Natural Resource Conservation Service USDA-NRCS National Cartography and Geospatial Center 1999; *Map of Average Annual Precipitation in Texas 1961-1990*; Available on-line: ftp://ftp.ftw.nrcs.usda.gov/pub/ams/prism/maps/tx.pdf

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Appendix A:

District Enabling Act HB 1258 of 77th Texas Legislature Validating Creation of the Middle Pecos Groundwater Conservation District

AN ACT

relating to the ratification of the creation of and to the administration, powers, duties, operation, and financing of the Middle Pecos Groundwater Conservation District.
BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF TEXAS:

SECTION 1. RATIFICATION OF CREATION. The creation by Chapter 1331, Acts of the 76th Legislature, Regular Session, 1999 (Senate Bill No. 1911), of the Middle Pecos Groundwater Conservation District in Pecos County is ratified as required by Section 15(a) of that Act, subject to approval at a confirmation election under Section 7 of this Act.

SECTION 2. DEFINITION. In this Act, "district" means the Middle Pecos Groundwater Conservation District.

SECTION 3. BOUNDARIES. The boundaries of the district are coextensive with the boundaries of Pecos County, Texas.

SECTION 4. GENERAL POWERS. (a) The district has all of the rights, powers, privileges, authority, functions, and duties provided by the general law of this state, including Chapter 36, Water Code, applicable to groundwater conservation districts created under Section 59, Article XVI, Texas Constitution. This Act prevails over any provision of general law that is in conflict or inconsistent with this Act, including any provision of Chapter 1331, Acts of the 76th Legislature, Regular Session, 1999 (Senate Bill No. 1911).

(b) Notwithstanding Subsection (a) of this section, the following provisions prevail over a conflicting or inconsistent provision of this Act:

(1) Sections 36.1071-36.108, Water Code;

(2) Sections 36.159-36.161, Water Code; and

(3) Subchapter I, Chapter 36, Water Code.

(c) Section 36.121, Water Code, does not apply to the district.

(d) The rights, powers, privileges, authority, functions, and duties of the district are not subject to the continuing right of supervision of the state through the Texas Natural Resource Conservation Commission.

(e) In addition to other fees assessed by the district, the district may assess an additional fee on groundwater transferred out of the district not to exceed 10 percent of the amount of the fee assessed for the production of water for use within the district.

(f) The district may not impose any additional rules or regulations on the production of groundwater for use outside of the district than imposed upon production for in-district use.

SECTION 5. BOARD OF DIRECTORS. (a) The district is governed by a board of 11 directors.

(b) Temporary directors serve until initial directors are elected under Section 7 of this Act.

(c) Initial directors serve until permanent directors are elected under Section 8 of this Act.

(d) Permanent directors serve staggered four-year terms.

(e) Each director must qualify to serve as director in the manner provided by Section 36.055, Water Code.

(f) A director serves until the director's successor has qualified.

(g) If there is a vacancy on the board, the remaining directors shall appoint a director to serve the remainder of the term. If at any time there are fewer than three qualified directors, the Pecos County Commissioners Court shall appoint the necessary number of persons to fill all the vacancies on the board.

(h) A director may not receive a salary or other compensation for service as a director but may be reimbursed for actual expenses of attending meetings at the rate in effect for employees of Pecos County.

SECTION 6. METHOD OF ELECTING DIRECTORS. (a) The directors of the district shall be elected according to the method provided by this section.

(b) One director shall be elected by the qualified voters of the entire district, two directors shall be elected from each county commissioners precinct by the qualified voters of that precinct, one director shall be elected from the city of Iraan by the qualified voters of that city, and one director shall be elected from the city of Fort Stockton by the qualified voters of that city.

(c) To be qualified to be a candidate for or to serve as a director at large, a person must be a registered voter in the district. To be a candidate for or to serve as director from a county commissioners precinct or a city, a person must be a registered voter of that precinct or city, as applicable.

(d) A person shall indicate on the application for a place on the ballot:

(1) the precinct or city that the person seeks to represent; or

(2) that the person seeks to represent the district at large.

(e) At the first election after the county commissioners precincts are redrawn under Section 18, Article V, Texas Constitution, eight new directors shall be elected to represent the precincts. The directors elected shall draw lots to determine which four directors serve two-year terms and which four directors serve four-year terms.

SECTION 7. CONFIRMATION AND INITIAL DIRECTORS' ELECTION. (a) The temporary board of directors shall call and hold an election to confirm establishment of the district and to elect initial directors.

(b) At the confirmation and initial directors' election, the temporary board of directors shall have placed on the ballot the name of any candidate filing for an initial director's position and blank spaces to write in the names of other persons. A temporary director who is qualified to be a candidate under Sections 5 and 6 may file for an initial director's position.

(c) Section 41.001(a), Election Code, does not apply to a confirmation and initial directors' election held as provided by this section.

(d) Except as provided by this section, a confirmation and initial directors' election must be conducted as provided by Sections 36.017(b)-(h), Water Code, and the Election Code.

(e) The elected initial directors shall draw lots to determine their terms. One director from each county commissioners precinct and the director from the district at large serve terms that expire on the date of the first election held under Section 8 of this Act. The remaining directors serve terms that expire on the date of the second election held under Section 8 of this Act.

(f) If the majority of the votes cast at an election held under this section is against the confirmation of the district, the temporary directors may call another election under this section not later than August 31, 2003.

SECTION 8. ELECTION OF DIRECTORS. On the first Saturday in May of the first even-numbered year after the year in which the district is authorized to be created at a confirmation election

and on the first Saturday in May of each subsequent second year, an election shall be held in the district to elect the appropriate number of directors.

SECTION9. FINDINGS RELATED TO PROCEDURAL REQUIREMENTS. (a) The proper and legal notice of the intention to introduce this Act, setting forth the general substance of this Act, has been published as provided by law, and the notice and a copy of this Act have been furnished to all persons, agencies, officials, or entities to which they are required to be furnished by the constitution and other laws of this state, including the governor, who has submitted the notice and Act to the Texas Natural Resource Conservation Commission.

(b) The Texas Natural Resource Conservation Commission has filed its recommendations relating to this Act with the governor, lieutenant governor, and speaker of the house of representatives within the required time.

(c) All requirements of the constitution and laws of this state and the rules and procedures of the legislature with respect to the notice, introduction, and passage of this Act are fulfilled and accomplished.

SECTION 10. EFFECTIVE DATE; EXPIRATION DATE. (a) This Act takes effect September 1, 2001.

(b) If the creation of the district is not confirmed at a confirmation election held under Section 7 of this Act before September 1, 2003, the district is dissolved and this Act expires on that date.

_____ _____

President of the Senate Speaker of the House

I certify that H.B. No. 1258 was passed by the House on March 29, 2001, by a non-record vote; and that the House concurred in Senate amendments to H.B. No. 1258 on May 24, 2001, by a non-record vote.

_____

Chief Clerk of the House

I certify that H.B. No. 1258 was passed by the Senate, with amendments, on May 17, 2001, by a viva-voce vote.

_____

Secretary of the Senate

APPROVED: _____

Date

_____

Governor

Appendix B

Evidence of the Administrative Processes Required for the Approval of the Groundwater Management Plan as Administratively Complete

RESOLUTION
OF THE BOARD OF DIRECTORS OF THE MIDDLE PECOS
GROUNDWATER CONSERVATION DISTRICT
HEARING HELD August 18, 2015

A RESOLUTION ADOPTING THE DISTRICT'S MANAGEMENT PLAN

WHEREAS, the Middle Pecos Groundwater Conservation District (the "District") is a political subdivision of the State of Texas organized and existing under and by virtue of Article XVI, Section 59, of the Texas Constitution, and a groundwater conservation district acting under Chapter 36 of the Texas Water Code and the District's enabling act, Act of May 26, 1999, 76th Leg., R.S., ch. 1331, 1999 Tex. Gen. Laws 4536 (Senate Bill 1911), as amended by Act of May 24, 2001, 77th Leg., R.S., ch. 1299, 2001 Tex. Gen. Laws 3177 (House Bill 1258)(Tex. Spec. Dist. Code Chapter 8851);

WHEREAS, under the direction of the Board of Directors (the "Board"), and in accordance with Section 36.1071, Texas Water Code; Chapter 356, Title 31, Texas Administrative Code, and Section 8 of the District's rules, the District has revised its Management Plan; **WHEREAS,** the District held a properly noticed public hearing to receive and consider public comments on the Management Plan for the District at 405 North Spring Drive (District Office), Fort Stockton, Texas on August 18, 2015;

WHEREAS, in early August 2015, more than 10 days prior to its August 18th public hearing, the District made its Management Plan available for public review at the District's office and on the District's webpage;

WHEREAS, the District obtained comments from the Texas Water Development Board ("TWDB") through a preliminary review of the District's Management Plan conducted by TWDB staff, and the District has considered and addressed all such comments in the development of its Management Plan;

WHEREAS, the Board received and considered the advice of the District's legal counsel and consultant on the revisions to the District's Management Plan;

WHEREAS, the Board received public comments on the District's Management Plan, considered and reviewed those comments in preparing revisions to its Management Plan, completed its five-year review, and took formal action to adopt its revised Management Plan;

WHEREAS, the District will coordinate with the appropriate surface water management entities after the public hearing and adoption of its revised Management Plan to afford surface water management entities within the boundaries of the District the opportunity to review and address the Management Plan with the District; and

WHEREAS, the Board of Directors finds that the Management Plan meets all of the requirements of Chapter 36, Texas Water Code, and Chapter 356, Title 31, Texas Administrative Code.

COPY

NOW THEREFORE BE IT RESOLVED THAT:

The above recitals are true and correct.

The Management Plan is hereby adopted as the groundwater management plan for the District.

The District's Board, General Manager, legal counsel and consultant are further authorized to take any and all action necessary to file and the adopted Management Plan with the Texas Water Development Board, to coordinate with the Texas Water Development Board as may be required in furtherance of TWDB's approval pursuant to the provisions of Chapter 36 of the Texas Water Code and other applicable law.

AND IT IS SO ORDERED.

Upon motion duly made by Director John N Dorris, and seconded by Director JANet GRoth, and upon discussion, the Board voted 8 in favor and 0 opposed, 0 abstained, and 3 absent, and the motion thereby PASSED on this 18th day of August, 2015.

MIDDLE PECOS GROUNDWATER CONSERVATION DISTRICT

By: _____
Board President

ATTEST:

_____
Board Secretary

COPY

FILED
JUL 23 2015
CLERK COUNTY COURT, PECOS CO., TEXAS
By _____ Deputy

MIDDLE PECOS GROUNDWATER CONSERVATION DISTRICT

P.O. Box 1644 Fort Stockton, Texas 79735 432-336-0698 fax 432-336-3667
e-mail mpgcd@sbcglobal.net - www.middlepecosgcd.com

July 23, 2015

Notice of Public Hearing on Management Plan

The **MIDDLE PECOS GROUNDWATER CONSERVATION DISTRICT** (District) is undertaking its five-year review and readopting of its management plan required by the Texas Water Code.Public input will be received and considered at this hearing, after which the District's Board of Directors will readopt then submit its plan to the Texas Water Development Board.

The hearing is scheduled for **August 18, 2015 at 11:00 AM.** The hearing will be held at 405 North Spring Drive, Ft. Stockton, Tx 79735. A copy of the draft management plan may be picked up at the Middle Pecos Groundwater Conservation District office. They are also available on our website at middlepecosgcd.org. For further information, you may call 432-336-0698.

Paul Weatherby
General Manager
Middle Pecos Groundwater Conservation District

Texas Water Code

Sec. 36.1071. MANAGEMENT PLAN. (a) Following notice and hearing, the district shall, in coordination with surface water management entities on a regional basis, develop a management plan that addresses the following management goals, as applicable:

(1) providing the most efficient use of groundwater;

(2) controlling and preventing waste of groundwater;

(3) controlling and preventing subsidence;

(4) addressing conjunctive surface water management issues;

(5) addressing natural resource issues;

(6) addressing drought conditions;

(7) addressing conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, or brush control, where appropriate and cost-effective; and

(8) addressing the desired future conditions adopted by the district under Section 36.108.

(b) The management plan, or any amendments to the plan, shall be developed using the district's best available data and forwarded to the regional water planning group for use in their planning process.

(c) The commission and the Texas Water Development Board shall provide technical assistance to a district in the development of the management plan required under Subsection (a) which may include, if requested by the district, a preliminary review and comment on the plan prior to final approval by the board. If such review and comment by the commission is requested, the commission shall provide comment not later than 30 days from the date the request is received.

(d) The commission shall provide technical assistance to a district during its initial operational phase. If requested by a district, the Texas Water Development Board shall train the district on basic data collection methodology and provide technical assistance to districts.

(e) In the management plan described under Subsection (a), the district shall:

(1) identify the performance standards and management objectives under which the district will operate to achieve the management goals identified under Subsection (a);

(2) specify, in as much detail as possible, the actions, procedures, performance, and avoidance that are or may be necessary to effect the plan, including specifications and proposed rules;

(3) include estimates of the following:

(A) modeled available groundwater in the district based on the desired future condition established under Section 36.108;

(B) the amount of groundwater being used within the district on an annual basis;

(C) the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;

(D) for each aquifer, the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers;

(E) 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;

(F) the projected surface water supply in the district according to the most recently adopted state water plan; and

(G) the projected total demand for water in the district according to the most recently adopted state water plan; and

(4) consider the water supply needs and water management strategies included in the adopted state water plan.

(f) The district shall adopt rules necessary to implement the management plan. Prior to the development of the management plan and its approval under Section 36.1072, the district may not adopt rules other than rules pertaining to the registration and interim permitting of new and existing wells and rules governing spacing and procedure before the district's board; however, the district may not adopt any rules limiting the production of wells, except rules requiring that groundwater produced from a well be put to a nonwasteful, beneficial use. The district may accept applications for permits under Section 36.113, provided the district does not act on any such application until the district's management plan is approved as provided in Section 36.1072.

(g) The district shall adopt amendments to the management plan as necessary. Amendments to the management plan shall be adopted after notice and hearing and shall otherwise comply with the requirements of this section.

(h) In developing its management plan, the district shall use the groundwater availability modeling information provided by the executive administrator together with any available site-specific information that has been provided by the district to the executive administrator for review and comment before being used in the plan.

Added by Acts 1995, 74th Leg., ch. 933, Sec. 2, eff. Sept. 1, 1995. Redesignated from 36.107(b) and (c) and amended by Acts 1997, 75th Leg., ch. 1010, Sec. 4.28, eff. Sept. 1, 1997. Amended by Acts 2001, 77th Leg., ch. 966, Sec. 2.46, eff. Sept. 1, 2001.

Amended by:

Acts 2005, 79th Leg., Ch. 970 (H.B. 1763), Sec. 5, eff. September 1, 2005.

Acts 2011, 82nd Leg., R.S., Ch. 17 (S.B. 727), Sec. 1, eff. April 29, 2011.

Acts 2011, 82nd Leg., R.S., Ch. 18 (S.B. 737), Sec. 2, eff. September 1, 2011.

Acts 2011, 82nd Leg., R.S., Ch. 1233 (S.B. 660), Sec. 16, eff. September 1, 2011.

Sec. 36.1072. TEXAS WATER DEVELOPMENT BOARD REVIEW AND APPROVAL OF MANAGEMENT PLAN. (a) In this section, "development board" means the Texas Water Development Board.

(a-1) A district shall, not later than three years after the creation of the district or, if the district required confirmation, not later than three years after the election confirming the district's creation, submit the management plan required under Section 36.1071 to the executive administrator for review and approval.

(b) Within 60 days of receipt of a district's management plan adopted under Section 36.1071, readopted under Subsection (e) or (g) of this section, or amended under Section 36.1073, the executive administrator shall approve the district's plan if the plan is administratively complete. A management plan is administratively complete when it contains the information required to be submitted under Section 36.1071(a) and (e). The executive administrator may determine whether conditions justify waiver of the requirements under Section 36.1071(e)(4).

(c) Once the executive administrator has approved a district's management plan:

(1) the executive administrator may not revoke but may require revisions to the approved management plan as provided by Subsection (g); and

(2) the executive administrator may request additional information from the district if the information is necessary to clarify, modify, or supplement previously submitted material, but a request for additional information does not render the management plan unapproved.

(d) A management plan takes effect on approval by the executive administrator or, if appealed, on approval by the development board.

(e) The district may review the plan annually and must review and readopt the plan with or without revisions at least once every five years. The district shall provide the readopted plan to the executive administrator not later than the 60th day after the date on which the plan was readopted. Approval of the preceding management plan remains in effect until:

(1) the district fails to timely readopt a management plan;

(2) the district fails to timely submit the district's readopted management plan to the executive administrator; or

(3) the executive administrator determines that the readopted management plan does not meet the requirements for approval, and the district has exhausted all appeals to the Texas Water Development Board or appropriate court.

(f) If the executive administrator does not approve the district's management plan, the executive administrator shall provide to the district, in writing, the reasons for the action. Not later than the 180th day after the date a district receives notice that its management plan has not been approved, the district may submit a revised management plan for review and approval. The executive administrator's decision may be appealed to the development board. If the development board decides not to approve the district's management plan on appeal, the district may request that the conflict be mediated. The district and the board may seek the assistance of the Center for Public Policy Dispute Resolution at The University of Texas School of Law or an alternative dispute resolution system established under Chapter 152, Civil Practice and Remedies Code, in obtaining a qualified impartial third party to mediate the conflict. The cost of the mediation services must be specified in the agreement between the parties and the Center for Public Policy Dispute Resolution or the alternative dispute resolution system. If the parties do not resolve the conflict through mediation, the decision of the development board not to approve the district's management plan may be appealed to a district court in Travis County. Costs for the appeal shall be set by the court hearing the appeal. An appeal under this subsection is by trial de novo. The commission shall not take enforcement action against a district under Subchapter I until the latest of the expiration of the 180-day period, the date the development board has taken final action withholding approval of a revised management plan, the date the mediation is completed, or the date a final judgment upholding the board's decision is entered by a district court. An enforcement action may not be taken against a district by the commission or the state auditor under Subchapter I because the district's management plan and the approved regional water plan are in conflict while the parties are attempting to resolve the conflict before the development board, in mediation, or in court. Rules of the district continue in full force and effect until all appeals under this subsection have been exhausted and the final judgment is adverse to the district.

(g) A person with a legally defined interest in groundwater in a district, or the regional water planning group, may file a petition with the development board stating that a conflict requiring resolution may exist between the district's approved management plan developed under Section 36.1071 and the state water plan. If a conflict exists, the development board shall provide technical assistance to and facilitate coordination between the involved person or regional water planning group and the district to resolve the conflict. Not later than the 45th day after the date the person or the regional water planning group files a petition with the development board, if the conflict has not been resolved, the district and the involved person or regional planning group may mediate the conflict. The district and the involved person or

regional planning group may seek the assistance of the Center for Public Policy Dispute Resolution at The University of Texas School of Law or an alternative dispute resolution system established under Chapter 152, Civil Practice and Remedies Code, in obtaining a qualified impartial third party to mediate the conflict. The cost of the mediation services must be specified in the agreement between the parties and the Center for Public Policy Dispute Resolution or the alternative dispute resolution system. If the district and the involved person or regional planning group cannot resolve the conflict through mediation, the development board shall resolve the conflict not later than the 60th day after the date the mediation is completed. The development board action under this provision may be consolidated, at the option of the board, with related action under Section 16.053(p). If the development board determines that resolution of the conflict requires a revision of the approved management plan, the development board shall provide information to the district. The district shall prepare any revisions to the plan based on the information provided by the development board and shall hold, after notice, at least one public hearing at some central location within the district. The district shall consider all public and development board comments, prepare, revise, and adopt its management plan, and submit the revised management plan to the development board for approval. On the request of the district or the regional water planning group, the development board shall include discussion of the conflict and its resolution in the state water plan that the development board provides to the governor, the lieutenant governor, and the speaker of the house of representatives under Section 16.051(e). If the groundwater conservation district disagrees with the decision of the development board under this subsection, the district may appeal the decision to a district court in Travis County. Costs for the appeal shall be set by the court hearing the appeal. An appeal under this subsection is by trial de novo.

Added by Acts 1997, 75th Leg., ch. 1010, Sec. 4.28, eff. Sept. 1, 1997. Amended by Acts 2001, 77th Leg., ch. 966, Sec. 2.47, eff. Sept. 1, 2001.
Amended by:

Acts 2005, 79th Leg., Ch. 970 (H.B. 1763), Sec. 6, eff. September 1, 2005.

Acts 2011, 82nd Leg., R.S., Ch. 17 (S.B. 727), Sec. 2, eff. April 29, 2011.

Sec. 36.1073. AMENDMENT TO MANAGEMENT PLAN. Any amendment to the management plan shall be submitted to the executive administrator within 60 days following adoption of the amendment by the district's board. The executive administrator shall review and approve any amendment which substantially affects the management plan in accordance with the procedures established under Section 36.1072.

Added by Acts 1997, 75th Leg., ch. 1010, Sec. 4.28, eff. Sept. 1, 1997.

Amended by:

Acts 2005, 79th Leg., Ch. 970 (H.B. 1763), Sec. 7, eff. September 1, 2005.

Sec. 36.1086. JOINT EFFORTS BY DISTRICTS IN A MANAGEMENT AREA. Districts located within the same management areas or in adjacent management areas may contract to jointly conduct studies or research, or to construct projects, under terms and conditions that the districts consider beneficial. These joint efforts may include studies of groundwater availability and quality, aquifer modeling, and the interaction of groundwater and surface water; educational programs; the purchase and sharing of equipment; and the implementation of projects to make groundwater available, including aquifer recharge, brush control, weather modification, desalination, regionalization, and treatment or conveyance facilities. The districts may contract under their existing authorizations including those of Chapter 791, Government Code, if their contracting authority is not limited by Sections 791.011(c)(2) and (d)(3) and Section 791.014, Government Code.

Added by Acts 2011, 82nd Leg., R.S., Ch. 1233 (S.B. 660), Sec. 17, eff. September 1, 2011.

Appendix C

Rules of the Middle Pecos Groundwater Conservation District

http://www.middlepecosgcd.org/pdf/rules/2014/rules_adopted_10-21-2014.pdf

Appendix D

TWDB Historical Groundwater Use Estimates in the District and 2012 State Water Plan

	GMA 3				
AQUIFER	DFC (expressed in drawdown)	MAG	Permits-Authorized Amount	Permits-Actual Production	Estimated Exempt Production
Pecos Valley/Edwards Trinity	28' GMA-wide; 12' in Pecos	122,734 a-f	144,971.14 a-f	86,166 a-f	530 a-f
Capitan Reef	200'	1,361 a-f	8,525 a-f	564 a-f	50 a-f
Dockum	27' GMA-wide; 47' in Pecos	13,962 a-f	0 a-f	0 a-f	0 a-f
Rustler	300' in the confined area within Pecos, Reeves, Loving, Ward	3,466 a-f	1,475 a-f	1,475 a-f	50 a-f

	GMA 7				
AQUIFER	DFC (expressed in drawdown)	MAG	Permits-Authorized Amount	Permits-Actual Production	Estimated Exempt Production
Edwards-Trinity	7' GMA-wide; 11' in Pecos	117,426 a-f	119,564.77 a-f	66,693 a-f	3,542 a-f
Pecos Valley	7' GMA-wide; 11' in Pecos	0 a-f	0 a-f	0 a-f	0 a-f
Capitan Reef	15' unconfined; 200' confined	9,761 a-f	3,347 a-f	1,787 a-f	50 a-f
Dockum	4'	3 a-f	0 a-f	0 a-f	0 a-f
Rustler	300'	7,042 a-f	7,291 a-f	6,527 a-f	50 a-f

Exempt Wells: **2,062**

Non-Exempt Wells: **920**

Export Authorized Outside District Boundaries: **18,598 ac-ft per year**

Estimated Historical Water Use
TWDB Historical Water Use Survey (WUS) Data

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2014. TWDB staff anticipates the calculation and posting of these estimates at a later date.

PECOS COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2013	GW	5,630	137	56	0	139,488	601	145,912
	SW	0	0	0	0	0	31	31
2012	GW	4,161	252	121	0	110,247	619	115,400
	SW	0	0	0	0	0	33	33
2011	GW	6,421	244	260	0	125,090	694	132,709
	SW	0	0	81	0	55,000	37	55,118
2010	GW	4,771	247	182	0	122,675	703	128,578
	SW	0	0	57	0	3,358	37	3,452
2009	GW	4,902	211	263	0	90,845	714	96,935
	SW	0	0	81	0	1,345	38	1,464
2008	GW	5,229	239	342	0	56,914	774	63,498
	SW	0	0	105	0	0	41	146
2007	GW	4,565	231	5	0	54,562	688	60,051
	SW	0	0	0	0	3,348	37	3,385
2006	GW	4,649	184	5	0	61,906	886	67,630
	SW	0	0	0	0	7,150	47	7,197
2005	GW	4,406	195	5	0	41,404	792	46,802
	SW	0	0	0	0	5,199	42	5,241
2004	GW	4,361	178	5	0	42,478	746	47,768
	SW	0	0	0	0	191	39	230
2003	GW	4,818	142	6	0	37,644	743	43,353
	SW	0	0	0	0	0	39	39
2002	GW	4,334	142	7	0	61,255	867	66,605
	SW	0	0	0	0	1,250	46	1,296
2001	GW	4,478	235	11	0	64,255	982	69,961
	SW	0	0	0	0	2,384	52	2,436
2000	GW	4,768	353	15	0	72,412	932	78,480
	SW	0	0	0	0	1,824	49	1,873

Projected Surface Water Supplies

TWDB 2012 State Water Plan Data

PECOS COUNTY All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
F	IRRIGATION	RIO GRANDE	PECOS RIVER COMBINED RUN-OF-RIVER IRRIGATION	4,444	4,444	4,444	4,444	4,444	4,444
F	IRRIGATION	RIO GRANDE	RED BLUFF LAKE/RESERVOIR	1,558	1,558	1,558	1,558	1,558	1,558
F	LIVESTOCK	RIO GRANDE	LIVESTOCK LOCAL SUPPLY	52	52	52	52	52	52
Sum of Projected Surface Water Supplies (acre-feet/year)				**6,054**	**6,054**	**6,054**	**6,054**	**6,054**	**6,054**

Projected Water Demands

TWDB 2012 State Water Plan Data

Please note that the demand numbers presented here include the plumbing code savings found in the

Regional and State Water Plans.

PECOS COUNTY All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
F	LIVESTOCK	RIO GRANDE	1,239	1,239	1,239	1,239	1,239	1,239
F	IRRIGATION	RIO GRANDE	79,681	78,436	77,191	75,945	74,700	73,475
F	MINING	RIO GRANDE	159	158	158	158	158	158
F	MANUFACTURING	RIO GRANDE	2	2	2	2	2	2
F	COUNTY-OTHER	RIO GRANDE	702	722	731	730	726	712
F	FORT STOCKTON	RIO GRANDE	3,267	3,397	3,461	3,481	3,479	3,411
F	IRAAN	RIO GRANDE	452	469	478	480	479	470
F	PECOS COUNTY WCID #1	RIO GRANDE	395	403	401	399	395	387

Projected Water Supply Needs

TWDB 2012 State Water Plan Data

Negative values (in red) reflect a projected water supply need, positive values a surplus.

PECOS COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
F	COUNTY-OTHER	RIO GRANDE	0	0	0	0	0	0
F	FORT STOCKTON	RIO GRANDE	2,646	2,516	2,452	2,432	2,434	2,502
F	IRAAN	RIO GRANDE	115	98	89	87	88	97
F	IRRIGATION	RIO GRANDE	2,902	4,147	5,392	6,638	7,883	9,108
F	LIVESTOCK	RIO GRANDE	1	1	1	1	1	1
F	MANUFACTURING	RIO GRANDE	1	1	1	1	1	1
F	MINING	RIO GRANDE	127	128	128	128	128	128
F	PECOS COUNTY WCID #1	RIO GRANDE	83	75	77	79	83	91
Sum of Projected Water Supply Needs (acre-feet/year)			**0**	**0**	**0**	**0**	**0**	**0**

Projected Water Management Strategies

TWDB 2012 State Water Plan Data

PECOS COUNTY

WUG, Basin (RWPG) All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
IRRIGATION, RIO GRANDE (F)							
IRRIGATION CONSERVATIONCONSERVATION	[PECOS]	0	6,300	12,600	12,600	12,600	12,600
Sum of Projected Water Management Strategies (acre-feet/year)		**0**	**6,300**	**12,600**	**12,600**	**12,600**	**12,600**

Appendix E

Details on the Development of the Estimate of Annual Recharge to the Capitan Reef Complex Aquifer in Pecos County

Discussion

As mentioned in the plan text, as of the date of the plan no publish estimates on the amount or rates of annual recharge to the Capitan Reef Complex aquifer have been identified. In order to meet the TWDB requirement that groundwater management plans include an estimate of the annual recharge rates used by other researchers for the Edwards-Trinity (Plateau) aquifer near the outcrop area of the Capitan Reef Complex aquifer in Pecos County may be applicable. The preliminary rate of recharge used in the development of the TWDB Edwards-Trinity (Plateau) aquifer groundwater availability model (GAM) is 4 percent of annual precipitation. (Anaya 2002) The Edwards-Trinity (Plateau) aquifer GAM includes the area of Pecos County adjacent to the Capitan Reef Complex aquifer outcrop area. A rate of 1.6 percent of annual precipitation was estimated for the Edwards-Trinity (Plateau) aquifer for Crockett County. (Inglehart 1967) In order to develop a preliminary estimate of the annual recharge to the Capitan Reef Complex aquifer in Pecos County the District used a median value of 2.8 percent of annual precipitation as an assumptive recharge rate to meet TWDB groundwater management plan requirements.

The area of the outcrop of the Capitan Reef Complex was estimated using a GIS to calculate the area from a scanned image of the Fort Stockton Sheet of the Geologic Atlas of Texas. (BEG, 1994) The 1961-1990 annual average precipitation for the portion of Pecos County where the Capitan Limestone outcrops is given as 16-18 inches in the USDA-NRCS map of Texas Annual Precipitation. (USDA-NRCS 1999) The District used the lower value of 16 inches per year to develop the estimate of annual recharge. The estimate of annual recharge to the Capitan Reef Complex aquifer was calculated in the following manner:

2.8 percent of 16 inches annual precipitation = 0.448 inches per year

0.448 inches per year / 12inches (1 foot) = 0.037333 feet per year

0.037333 feet per year rounded to 0.037 feet per year

Estimated Area of the Capitan Limestone in Pecos County = 22,279 acres

0.037 feet per year x 22,279 acres = 824.323 ac-ft per year

Rounded to **824 ac-ft per year**

Appendix F

Details on the Development of the Estimates of Annual Groundwater Availability in the Capitan Reef Complex aquifer and Rustler Aquifers in Pecos County

Calculation Methodology for Capitan Reef Complex and Rustler Aquifers

Assumptions: aquifer has both unconfined and confined zones

Q(t) = R(t) – D(t) + dS/dt

Where:
Q(t) = the total rate of groundwater withdrawal (ac-ft/yr)
R(t) = the total rate of groundwater recharge to the basin (aquifer) (ac-ft/yr)
D(t) = the total rate of groundwater discharge from the basin (aquifer) (ac-ft/yr)
dS/dt = change in aquifer storage of groundwater over time (draw down in feet)
(Freeze and Cherry, 1979)

If annual pumping is approximately equal to annual recharge; the factors for recharge and discharge in the aquifer will cancel each other and the relationship may be simplified to:

Q(t) = dS/dt

If it is assumed that the annual amount of recharge to the aquifer is approximately equal to groundwater use from the aquifer in where it occurs in MPGCD; the step-by-step description of the process to project the effects of use in each county is as follows:

1. The total area occupied by the aquifer in each county is subdivided by aquifer zone (unconfined, confined).
2. The area of each aquifer zone is divided by the total area occupied by the aquifer in the County to give the percentage of the total aquifer area in the County represented by each zone.
3. The estimate of annual recharge (assumed to be equal to the estimate annual aquifer pumping) is divided by the percentage value of the total aquifer area in the County represented by each aquifer sub-zone in the County to give an estimate of recharge to each aquifer sub-zone (in acre-feet per year).
4. The area (in acres) of each aquifer sub-zone is multiplied by an estimated amount of aquifer draw-down (in feet) $_1$ and then multiplied by the storage coefficient of the aquifer zone (expressed as a decimal fraction) $_2$ to give an estimate of the amount of water (in acre-feet) that could be removed from the aquifer if the estimated amount of aquifer draw-down occurred.
5. The estimated volume of water that could be produced from each aquifer zone with the specified estimate of aquifer draw-down is divided by 50 (years) to estimate the amount of water that could be produced each year from the aquifer zone over a 50-year period to result in the estimated amount of aquifer draw-down at the end to the 50-year time period.
6. The estimated annual amount of water that could be produced from each aquifer zone (in acre-feet per year) is added to the estimate of annual recharge for the zone (in acre-feet per year) to give the estimated availability value for the aquifer zone (in acre-feet per year).
7. The estimated availability values (in acre-feet per year) of the several aquifer zones are summed to give a total estimated availability value for the aquifer.

Notes:

1. The estimated average aquifer draw-down values were kept constant for the two sub-zones of the confined zone and for the unconfined zone of the aquifer.
2. The storage coefficient values for the confined and unconfined zones were kept constant in the aquifer zone in all sub-zones.

County	Aquifer	Aquifer zone	Sub-divsion Area (acres)	Total Aquifer Area in County (acres)	Sub-division Percent of Total Area	Estimated Total County Pumping (ac-ft per year)	Assigned Annual Recharge Volume (ac-ft)	Estimated Average Aquifer Draw-down (ft)	Storage Co-efficient (dimen-sionless)	Total With-drawal Volume (ac-ft)	Annual With-drawal Volume (ac-ft)	MAG Estimate (ac-ft)
Pecos	Rustler	Confined GMA 3	241,707	741,398	33%	10,063	3321	300	0.0001	7251	145	3466
Pecos	Rustler	Confined GMA 7	499,691	741,398	67%	10,063	6742	300	0.0001	14991	300	7042
Totals			**741,398**				**10,063**			**22,242**	**445**	**10,508**

Table F-1, Groundwater Availability Estimates for the Rustler Aquifer in MPGCD

County	Aquifer	Aquifer zone	Sub-divsion Area (acres)	Total Aquifer Area in County (acres)	Sub-division Percent of Total Area	Estimated Total County Pumping (ac-ft per year)	Assigned Annual Recharge Volume (ac-ft)	Estimated Average Aquifer Draw-down (ft)	Storage Co-efficient (dimen-sionless)	Total With-drawal Volume (ac-ft)	Annual With-drawal Volume (ac-ft)	MAG Estimate (ac-ft)
Pecos	Capitan	Recharge un-confined	22,279	369,708	6%	10,315	619	15	0.1	33419	668	1287
Pecos	Capitan	Confined GMA 7	298,622	369,708	81%	10,315	8355	200	0.0001	5972	119	8474
Pecos	Capitan	Confined GMA 3	48,807	369,708	13%	10,315	1341	200	0.0001	976	20	1361
Totals			**369,708**				**10,315**			**40,367**	**807**	**11,122**

Table F-2, Groundwater Availability Estimates for the Capitan Reef Complex aquifer in MPGCD

Appendix G

2010 Baseline Water Levels for Management and Identification of Edwards-Trinity (Plateau) / Pecos Valley Aquifer GAM Grid Cells Defining Groundwater Management Zones in MPGCD

2013

Allan R. Standen LLC

Middle Pecos Groundwater Conservation District (MPGCD)

2010 BASELINE WATER LEVEL ELEVATIONS FOR DISTRICTS MANAGEMENT ZONES

Allan R. Standen LLC

Memorandum

To: Paul Weatherby, MiddlePecos Groundwater Conservation District (MPGCD) General Manager

From: Allan R. Standen LLC, P. G. 1227

Date: January 11, 2013

Re: 2010 Water-Level Conditions in MPGCD Management Zones

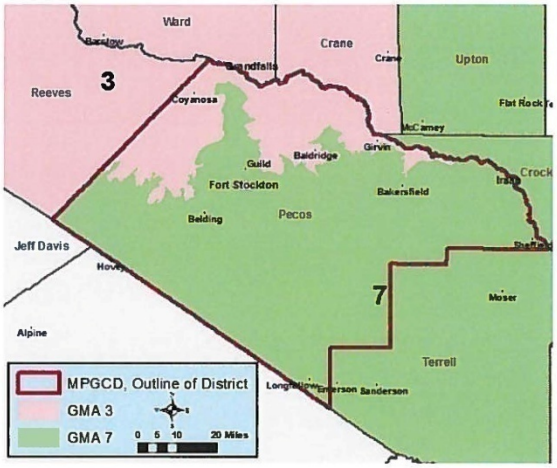

Figure 1. MPGCD GMA 3 and 7

Purpose

At the request of the MPGCD, Allan R. Standen LLC (ARS LLC) revised maps and text from the draft report submitted to the District by Bar-W Groundwater Exploration LLC dated July 23, 2012. The MPGCD is subdivided into Groundwater Management Areas (GMAs) 3 and 7 as is illustrated in Figure 1. The Pecos Valley Alluvium Aquifer (PVA) lie within the GMA 3's areal extent and the Edwards-Trinity Plateau (ETP) Aquifer lies within the GMA 7's areal extent within the District.

In October 2010, the MPGCD established three Management Zones (1, 2 and 3) (MPGCD Management Plan, 2010). These management zones are based on areas of intensive irrigation use of groundwater and the recognition that these identified zones have the greatest potential to impair DFC's adopted for the PVA and the ETP aquifers in Pecos County (Williams, 2012). The Management Zone extents are comprised of specific Groundwater Availability Model (GAM) grid cells which are 5,280 by 5,280 feet (one square mile) and the GAM grid is rotated 42 degrees east of North (Williams, 2012 and Anaya and Jones, 2009). Figure 2 illustrates the location and extent of MPGCD's present three management zones.

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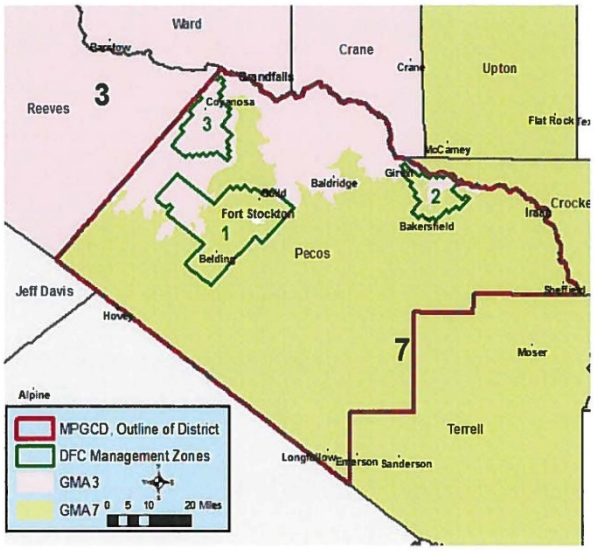
Zones



The purpose of this report is to establish baseline water level elevation (relative to sea level) surfaces and maps, according to MPGCD Rule 10.5 for each of the three management zones established by the MPGCD for the ETPand the PVA aquifers. The ETP and PVA aquifers are assumed to be unconfined and hydro-geologically connected (Hutchison, 2010). These 2010 water level elevation maps would be used as baseline water-level references for the monitoring of water level fluctuations during the 50-year Desired Future Conditions (DFC) planning period within the management zones.

Figure 2. MPGCD GMA's and Groundwater Management Zones

Monitor Wells in MPGCD

Presently, there are approximately 100 water wells being monitored for water levels by the MPGCD in Pecos and surrounding counties, including Rustler and Capitan Reef Complex water wells. Water level data has been collected by the MPGCD staff, Texas Water Development Board (TWDB) staff and/or various consultants. The majority of the MPGCD monitoring wells are equipped with some form of automated data collection, with 25 wells in cooperation with the TWDB (Williams, 2012). Location coordinates (latitude and longitude) of the selected Management Zone monitor wells were confirmed and/or revised by recent GPS measurements collected by the MPGCD staff. DFC water levels are collected at the end of the irrigation season (October), usually between January and February, when water levels have fully recovered from the previous season's irrigation activities.

Methodology

Upon review of all available historical water well and well construction information, monitor wells from the ETP and PVA aquifers were selected for each management zone that had reasonable geospatial distribution and are considered to be representative of the aquifers. Water wells with the greatest aquifer recovery (least depth below land surface) were preferred during the selection process (Williams, 2012).

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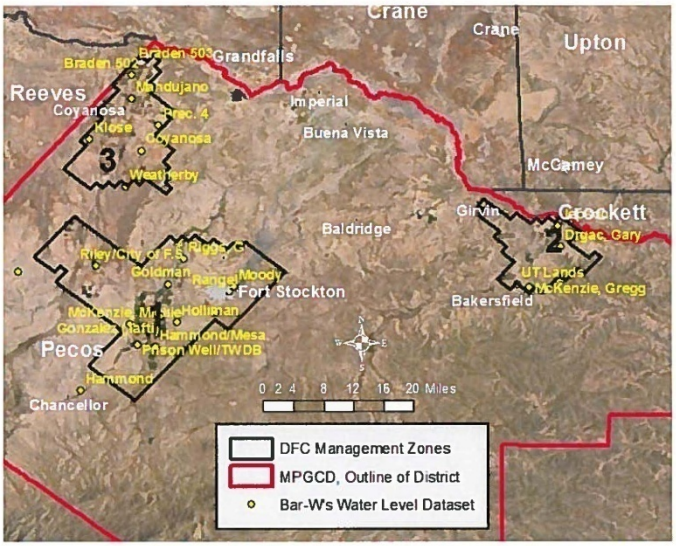
A USGS 30 meter Digital Elevation Model (DEM) using ArcGIS 10.2 software was used to calculate land surface elevations for all water-level monitoring well locations.



The draft report submitted by Bar-W Groundwater Exploration LLC dated July 23, 2012 selected a total of 25 monitor wells (14 wells Management Zone 1, 4 wells for Management Zone 2 and 7 wells for Management Zone 3). All of the water levels were collected between December 9, 2010 and February 20, 2011 (Table 1). Figure 3 illustrates the locations for Bar-W's initially proposed water level monitoring wells.

Figure 3. Bar-W's original water level dataset

Grids or raster files of the water level elevation contours for the figures in this report were created using measured depth to water from land surface and the subtracting the water depth from DEM surface elevations to determine the water level elevation surface data points. ArcGIS 10.2 Spatial Analyst "Spline with Barriers" interpolation method was used to create the water level surface elevation contour grid from the data points. The contour grid cell size is approximately 2,700 feet.

Water Level Elevation Contour Maps

Water level elevation contours from Bar-W's water level dataset of Management Zones 1 and 3 are illustrated in Figure 4. Management Zones 1 and 3 were combined in Figure 4 because of the relative close proximity (5 to 10 miles) of the two management zones. Colored intervals are 50 foot variations in water level elevation and the water level elevations are highest in the south and become lower approaching the Pecos River in Figure 4.

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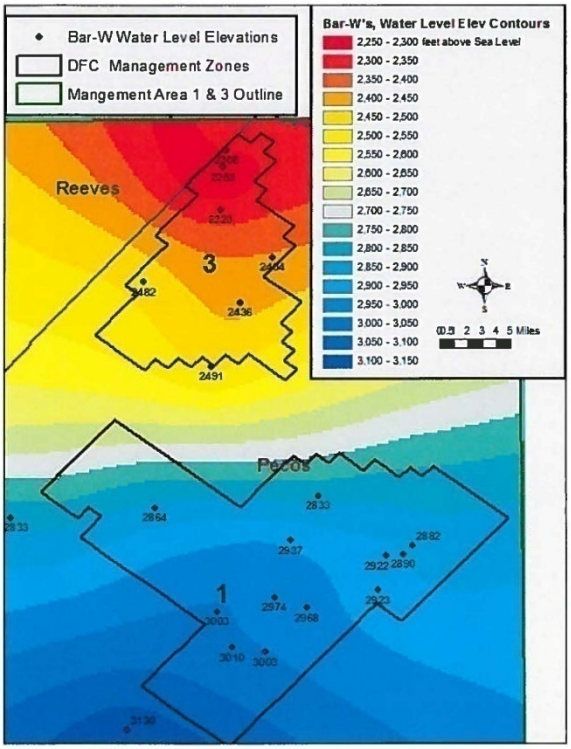

A review of the monitor well locations in Figure 4 using Bar-W's water level dataset indicates poor well control along the northern edge of Management Zone 1 with no monitor wells present between Management Zones 1 and 3. A decision was made to supplement the existing dataset.

The MPGCD staff researched the District's database and initially identified ten additional wellsto supplement Bar-W's well dataset which were later reduced to seven wells after recommendations from Thornhill Group Inc. (Thornhill, 2013). The water level measurements for the seven additional wells were collected between 2/2/2011 and 2/27/2011. Well Temp 259 was removed from the original Bar-W dataset because of a 12/9/2010 water level measurement date to make the final water level dataset more synoptic.

Figure 4, Bar-W's 2010,50 foot, water level elevation contoursfor Zones 1 and 3

The District's revised final water level dataset consists of 32 wells to monitor the ETP and PVA aquifers within the three management zones. The locations of the additional seven wells are illustrated in Figure 5. MPGCD's Management Zone 2 final 2010 water level elevation contours are illustrated in Figure 6. MPGCD's Management Zone's 1 and 3 final 2010 level elevation contours using the additional seven wells wasre-contoured and is illustrated in Figure 7. When comparing Figure 4 with Figure 7, note that with additional well data, the contouring interval shapes shifted. A specific example is the gray interval (2,700 to 2,750 feet).

GAM-Run 10-033 groundwater modeling by Hutchison in 2011 established the modeled aquifer drawdowns. MPGCD rule 10.5 (b) Table 1 (MPGCD District Rules, 2011) defines average drawdown for the management zones. The GIS water level surface elevation grids created for this report can be used to interpolate one foot contour intervals, however additional well control is recommended to increase the accuracy of these interpolations.

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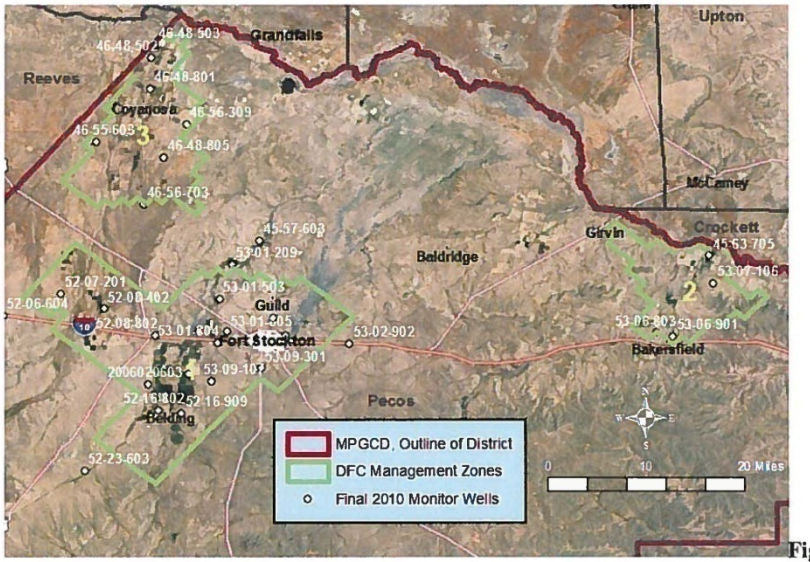

Figure 5.MPGCD's 2010 water level dataset

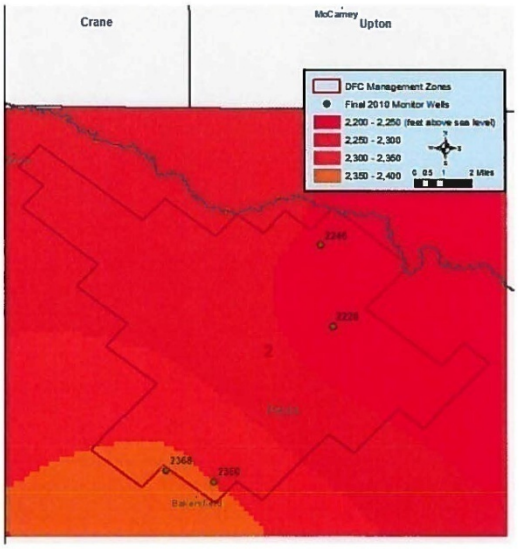

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Figure 6, MPGCD's, 50 foot water level elevation contours for Management Zone 2

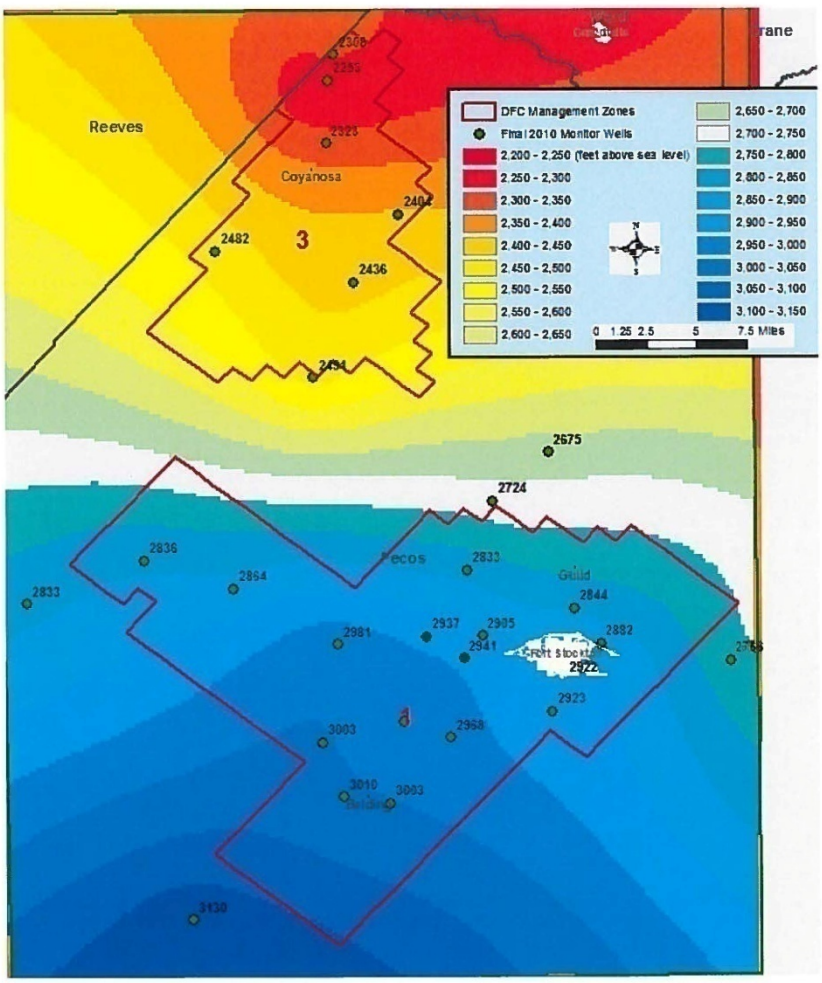

Figure 7, MPGCD's, 50 foot, water level elevation contours forManagement Zones 1 and 3

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The MPGCD's Assessment Process

The development of the 2010 baseline water level elevation maps for each Management Zone "is the first step in an on-going process of the MPGCD monitoring aquifer conditions and determining if the adopted DFCs are or may be impaired. At least every 5 years and at other intervals as considered necessary, the MPGCD will develop maps and pertinent gridding values of conditions in each Management Zone. Over time, the differences in the values contained in the map-grids for each Management Zone will be compiled and averaged. The averaged values for the difference in water-levels over time (drawdown) will be compared to the schedule of acceptable average drawdown values over time, which will not impair the adopted DFCs given in the MPGCD Rules. In making this comparison of average drawdown values, the MPGCD may determine if conservation measures are warranted to avoid impairment of the DFCs or if the aquifer conditions in the Management Zones are not likely to result in DFC impairment at the levels of groundwater use existing at the time of the assessment" (modified after Williams, 2012). The selection of additional monitoring wells is encouraged to improve resolution.

Conclusions and Recommendations

Overall, the 2010 baseline water level elevation surface for Management Zones 1, 2 and 3 for the Edwards-Trinity Plateau and the Pecos Valley Alluvium aquifers has been established. The District should consider increasing the number of water level monitoring wells within and adjacent to the existing MPGCD's management zones. If the District added two or three additional, strategically placed wells within each management zone, it would establish an effective groundwater level monitoring system for the determination of annual DFC water level fluctuations.

Note: The observations and assessments in this report were based on data supplied by the MPGCD or available from referenced published sources available at the time of the report. The conclusions drawn in the report are based on the available and reasonable methods of assessment. If new or different data is made available, the conclusions of this report may change.

References

Anaya, Roberto and Jones, Ian; 2009; Groundwater Availability Model of the Edwards-Trinity (Plateau) and Pecos Valley Aquifers of Texas – Texas Water Development Board Report 373

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Middle Pecos Groundwater Conservation District, 2011; District Rules as amended February 15, 2011

Thornhill Group Inc, 2013, email received by Elizabeth Ferry on 1/10/2013

William, Charles, R. 2012, Draft 2010 Year-End Water-level Conditions in MPGCD Management Zones, submitted draft report, 14 p.

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Management Zone 1 – Cell Identification

ROW	COL	CELL_ID	CentroidX	CentroidY
190	123	1190123	4034257.10000000000	19604086.00000000000
190	124	1190124	4038180.99999999000	19600553.00000000000
190	125	1190125	4042104.85000000000	19597020.00000000000
190	126	1190126	4046028.60000000000	19593487.00000000000
190	127	1190127	4049952.35000000000	19589954.00000000000
190	128	1190128	4053876.20000000000	19586421.00000000000
190	129	1190129	4057800.10000000000	19582888.00000000000
190	130	1190130	4061723.85000000000	19579355.00000000000
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191	127	1191127	4046419.35000000000	19586030.00000000000
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192	122	1192122	4023267.33258082000	19599771.66580000000
192	123	1192123	4027191.11742362000	19596238.33420000000
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192	126	1192126	4038962.58257637000	19585639.66580000000
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193	118	1193118	4004039.10000000000	19609980.00000000000
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193	120	1193120	4011886.75013735000	19602913.99740000000
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Management Zone 1 – Cell Identification Continued

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Management Zone 1 – Cell Identification Continued

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Management Zone 1 – Cell Identification Continued

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200	127	1200127	4014622.35000000000	19550716.00000000000
200	128	1200128	4018546.10000000000	19547183.00000000000
200	129	1200129	4022469.85000000000	19543650.00000000000
200	130	1200130	4026393.70000000000	19540117.00000000000
201	106	1201106	3928689.33258082000	19620985.66580000000
201	107	1201107	3932613.18399916000	19617452.33600000000
201	108	1201108	3936537.01600083000	19613919.66400000000
201	109	1201109	3940460.86741917000	19610386.33420000000
201	110	1201110	3944384.58257637000	19606853.66580000000
201	111	1201111	3948308.36741917000	19603320.33420000000
201	112	1201112	3952232.18256748000	19599787.66580000000
201	113	1201113	3956156.11742362000	19596254.33420000000
201	114	1201114	3960079.83258082000	19592721.66580000000
201	115	1201115	3964003.61742362000	19589188.33420000000
201	116	1201116	3967927.43244416000	19585655.66840000000
201	117	1201117	3971851.26755583000	19582122.33160000000
201	118	1201118	3975775.08257637000	19578589.66580000000
201	119	1201119	3979698.86741917000	19575056.33420000000
201	120	1201120	3983622.58257637000	19571523.66580000000
201	121	1201121	3987546.51743251000	19567990.33420000000

Management Zone 1 – Cell Identification Continued

ROW	COL	CELL_ID	CentroidX	CentroidY
201	122	1201122	3991470.35000000000	19564457.00000000000
201	123	1201123	3995394.10000000000	19560924.00000000000
201	124	1201124	3999317.85000000000	19557391.00000000000
201	125	1201125	4003241.60000000000	19553858.00000000000
201	126	1201126	4007165.49999999000	19550325.00000000000
201	127	1201127	4011089.35000000000	19546792.00000000000
201	128	1201128	4015013.10000000000	19543259.00000000000
201	129	1201129	4018936.85000000000	19539726.00000000000
201	130	1201130	4022860.70000000000	19536193.00000000000
202	106	1202106	3925156.35000000000	19617062.00000000000
202	107	1202107	3929080.10000000000	19613529.00000000000
202	108	1202108	3933003.99999999000	19609996.00000000000
202	109	1202109	3936927.85000000000	19606463.00000000000
202	110	1202110	3940851.60000000000	19602930.00000000000
202	111	1202111	3944775.35000000000	19599397.00000000000
202	112	1202112	3948699.20000000000	19595864.00000000000
202	113	1202113	3952623.10000000000	19592331.00000000000
202	114	1202114	3956546.85000000000	19588798.00000000000
202	115	1202115	3960470.60000000000	19585265.00000000000
202	116	1202116	3964394.35000000000	19581732.00000000000
202	117	1202117	3968318.20000000000	19578199.00000000000
202	118	1202118	3972242.10000000000	19574666.00000000000
202	119	1202119	3976165.85000000000	19571133.00000000000
202	120	1202120	3980089.60000000000	19567600.00000000000
202	121	1202121	3984013.49999999000	19564067.00000000000
202	122	1202122	3987937.33258082000	19560533.66580000000
202	123	1202123	3991861.11742362000	19557000.33420000000
202	124	1202124	3995784.83258082000	19553467.66580000000
202	125	1202125	3999708.61742362000	19549934.33420000000
202	126	1202126	4003632.48256748000	19546401.66580000000
202	127	1202127	4007556.36741917000	19542868.33420000000
202	128	1202128	4011480.08257637000	19539335.66580000000
203	106	1203106	3921623.35000000000	19613138.00000000000
203	107	1203107	3925547.10000000000	19609605.00000000000
203	108	1203108	3929470.99999999000	19606072.00000000000
203	109	1203109	3933394.85000000000	19602539.00000000000
203	110	1203110	3937318.60000000000	19599006.00000000000
203	111	1203111	3941242.35000000000	19595473.00000000000
203	112	1203112	3945166.20000000000	19591940.00000000000
203	113	1203113	3949090.10000000000	19588407.00000000000
203	114	1203114	3953013.85000000000	19584874.00000000000
203	115	1203115	3956937.60000000000	19581341.00000000000
203	116	1203116	3960861.35000000000	19577808.00000000000
203	117	1203117	3964785.20000000000	19574275.00000000000
203	118	1203118	3968709.10000000000	19570742.00000000000
203	119	1203119	3972632.85000000000	19567209.00000000000

Management Zone 1 – Cell Identification Continued

ROW	COL	CELL_ID	CentroidX	CentroidY
203	120	1203120	3976556.60000000000	19563676.00000000000
203	121	1203121	3980480.49999999000	19560143.00000000000
203	122	1203122	3984404.35000000000	19556610.00000000000
203	123	1203123	3988328.10000000000	19553077.00000000000
203	124	1203124	3992251.85000000000	19549544.00000000000
203	125	1203125	3996175.60000000000	19546011.00000000000
203	126	1203126	4000099.49999999000	19542478.00000000000
203	127	1203127	4004023.35000000000	19538945.00000000000
203	128	1203128	4007947.10000000000	19535412.00000000000
204	106	1204106	3918090.35000000000	19609214.00000000000
204	107	1204107	3922014.10000000000	19605681.00000000000
204	108	1204108	3925937.99999999000	19602148.00000000000
204	109	1204109	3929861.85000000000	19598615.00000000000
204	110	1204110	3933785.60000000000	19595082.00000000000
204	111	1204111	3937709.35000000000	19591549.00000000000
204	112	1204112	3941633.16657507000	19588016.00170000000
204	113	1204113	3945557.03342443000	19584482.99830000000
204	114	1204114	3949480.85000000000	19580950.00000000000
204	115	1204115	3953404.60000000000	19577417.00000000000
204	116	1204116	3957328.35000000000	19573884.00000000000
204	117	1204117	3961252.20000000000	19570351.00000000000
204	118	1204118	3965176.10000000000	19566818.00000000000
204	119	1204119	3969099.85000000000	19563285.00000000000
204	120	1204120	3973023.60000000000	19559752.00000000000
204	121	1204121	3976947.44986338000	19556219.00260000000
204	122	1204122	3980871.25013735000	19552685.99740000000
204	123	1204123	3984795.10000000000	19549153.00000000000
204	124	1204124	3988718.85000000000	19545620.00000000000
204	125	1204125	3992642.60000000000	19542087.00000000000
204	126	1204126	3996566.49999999000	19538554.00000000000
204	127	1204127	4000490.35000000000	19535021.00000000000
204	128	1204128	4004414.10000000000	19531488.00000000000
205	106	1205106	3914557.35000000000	19605290.00000000000
205	107	1205107	3918481.10000000000	19601757.00000000000
205	108	1205108	3922404.99999999000	19598224.00000000000
205	109	1205109	3926328.85000000000	19594691.00000000000
205	110	1205110	3930252.60000000000	19591158.00000000000
205	111	1205111	3934176.35000000000	19587625.00000000000
205	112	1205112	3938100.10000000000	19584092.00000000000
205	113	1205113	3942023.99999999000	19580559.00000000000
205	114	1205114	3945947.85000000000	19577026.00000000000
205	115	1205115	3949871.60000000000	19573493.00000000000
205	116	1205116	3953795.35000000000	19569960.00000000000
205	117	1205117	3957719.20000000000	19566427.00000000000
205	118	1205118	3961643.10000000000	19562894.00000000000
205	119	1205119	3965566.85000000000	19559361.00000000000

Management Zone 1 – Cell Identification Continued

ROW	COL	CELL_ID	CentroidX	CentroidY
205	120	1205120	3969490.60000000000	19555828.00000000000
205	121	1205121	3973414.35000000000	19552295.00000000000
205	122	1205122	3977338.20000000000	19548762.00000000000
205	123	1205123	3981262.10000000000	19545229.00000000000
205	124	1205124	3985185.85000000000	19541696.00000000000
205	125	1205125	3989109.60000000000	19538163.00000000000
205	126	1205126	3993033.49999999000	19534630.00000000000
205	127	1205127	3996957.35000000000	19531097.00000000000
205	128	1205128	4000881.10000000000	19527564.00000000000
206	106	1206106	3911024.36741917000	19601366.33420000000
206	107	1206107	3914948.08257637000	19597833.66580000000
206	108	1206108	3918872.01743251000	19594300.33420000000
206	109	1206109	3922795.83258082000	19590767.66580000000
206	110	1206110	3926719.61742362000	19587234.33420000000
206	111	1206111	3930643.33258082000	19583701.66580000000
206	112	1206112	3934567.11742362000	19580168.33420000000
206	113	1206113	3938490.98256748000	19576635.66580000000
206	114	1206114	3942414.86741917000	19573102.33420000000
206	115	1206115	3946338.58257637000	19569569.66580000000
206	116	1206116	3950262.36741917000	19566036.33420000000
206	117	1206117	3954186.14915191000	19562503.66750000000
206	118	1206118	3958110.05084808000	19558970.33250000000
206	119	1206119	3962033.83258082000	19555437.66580000000
206	120	1206120	3965957.61742362000	19551904.33420000000
206	121	1206121	3969881.35000000000	19548371.00000000000
206	122	1206122	3973805.20000000000	19544838.00000000000
206	123	1206123	3977729.10000000000	19541305.00000000000
206	124	1206124	3981652.85000000000	19537772.00000000000
206	125	1206125	3985576.60000000000	19534239.00000000000
206	126	1206126	3989500.44986264000	19530706.00260000000
206	127	1206127	3993424.25013661000	19527172.99740000000
206	128	1206128	3997348.10000000000	19523640.00000000000
207	106	1207106	3907491.35000000000	19597443.00000000000
207	107	1207107	3911415.10000000000	19593910.00000000000
207	108	1207108	3915338.94986338000	19590377.00260000000
207	109	1207109	3919262.75013735000	19586843.99740000000
207	110	1207110	3923186.60000000000	19583311.00000000000
207	111	1207111	3927110.35000000000	19579778.00000000000
207	112	1207112	3931034.10000000000	19576245.00000000000
207	113	1207113	3934957.99999999000	19572712.00000000000
207	114	1207114	3938881.85000000000	19569179.00000000000
207	115	1207115	3942805.60000000000	19565646.00000000000
207	116	1207116	3946729.35000000000	19562113.00000000000
207	117	1207117	3950653.10000000000	19558580.00000000000
207	118	1207118	3954576.99999999000	19555047.00000000000
207	119	1207119	3958500.85000000000	19551514.00000000000

Management Zone 1 – Cell Identification Continued

ROW	COL	CELL_ID	CentroidX	CentroidY
207	120	1207120	3962424.60000000000	19547981.00000000000
207	121	1207121	3966348.33258082000	19544447.66580000000
207	122	1207122	3970272.21743252000	19540914.33420000000
207	123	1207123	3974196.08257637000	19537381.66580000000
207	124	1207124	3978119.86741917000	19533848.33420000000
207	125	1207125	3982043.58257637000	19530315.66580000000
207	126	1207126	3985967.36741917000	19526782.33420000000
207	127	1207127	3989891.18256748000	19523249.66580000000
207	128	1207128	3993815.11742362000	19519716.33420000000
208	106	1208106	3903958.35000000000	19593519.00000000000
208	107	1208107	3907882.10000000000	19589986.00000000000
208	108	1208108	3911805.85000000000	19586453.00000000000
208	109	1208109	3915729.70000000000	19582920.00000000000
208	110	1208110	3919653.60000000000	19579387.00000000000
208	111	1208111	3923577.35000000000	19575854.00000000000
208	112	1208112	3927501.10000000000	19572321.00000000000
208	113	1208113	3931424.99999999000	19568788.00000000000
208	114	1208114	3935348.85000000000	19565255.00000000000
208	115	1208115	3939272.60000000000	19561722.00000000000
208	116	1208116	3943196.35000000000	19558189.00000000000
208	117	1208117	3947120.10000000000	19554656.00000000000
208	118	1208118	3951043.99999999000	19551123.00000000000
208	119	1208119	3954967.85000000000	19547590.00000000000
208	120	1208120	3958891.60000000000	19544057.00000000000
208	121	1208121	3962815.35000000000	19540524.00000000000
208	122	1208122	3966739.20000000000	19536991.00000000000
208	123	1208123	3970663.10000000000	19533458.00000000000
208	124	1208124	3974586.85000000000	19529925.00000000000
208	125	1208125	3978510.60000000000	19526392.00000000000
208	126	1208126	3982434.35000000000	19522859.00000000000
208	127	1208127	3986358.20000000000	19519326.00000000000
208	128	1208128	3990282.10000000000	19515793.00000000000
209	123	1209123	3967130.03342492000	19529533.99830000000
209	124	1209124	3971053.85000000000	19526001.00000000000
209	125	1209125	3974977.60000000000	19522468.00000000000
209	126	1209126	3978901.35000000000	19518935.00000000000
209	127	1209127	3982825.20000000000	19515402.00000000000
209	128	1209128	3986749.10000000000	19511869.00000000000
210	120	1210120	3951825.60000000000	19536209.00000000000
210	121	1210121	3955749.35000000000	19532676.00000000000
210	122	1210122	3959673.10000000000	19529143.00000000000
210	123	1210123	3963596.99999999000	19525610.00000000000
210	124	1210124	3967520.85000000000	19522077.00000000000
210	125	1210125	3971444.60000000000	19518544.00000000000
210	126	1210126	3975368.35000000000	19515011.00000000000
210	127	1210127	3979292.20000000000	19511478.00000000000

Management Zone 1 – Cell Identification Continued

ROW	COL	CELL_ID	CentroidX	CentroidY
210	128	1210128	3983216.10000000000	19507945.00000000000
211	120	1211120	3948292.60000000000	19532285.00000000000
211	121	1211121	3952216.35000000000	19528752.00000000000
211	122	1211122	3956140.10000000000	19525219.00000000000
211	123	1211123	3960063.99999999000	19521686.00000000000
211	124	1211124	3963987.85000000000	19518153.00000000000
211	125	1211125	3967911.60000000000	19514620.00000000000
211	126	1211126	3971835.35000000000	19511087.00000000000
211	127	1211127	3975759.16657507000	19507554.00170000000
211	128	1211128	3979683.03342443000	19504020.99830000000
212	120	1212120	3944759.58257637000	19528361.66580000000
212	121	1212121	3948683.36741917000	19524828.33420000000
212	122	1212122	3952607.08257637000	19521295.66580000000
212	123	1212123	3956531.01743251000	19517762.33420000000
212	124	1212124	3960454.83258082000	19514229.66580000000
212	125	1212125	3964378.61742362000	19510696.33420000000
212	126	1212126	3968302.33258082000	19507163.66580000000
212	127	1212127	3972226.11742362000	19503630.33420000000
212	128	1212128	3976149.98256748000	19500097.66580000000
213	120	1213120	3941226.60000000000	19524438.00000000000
213	121	1213121	3945150.35000000000	19520905.00000000000
213	122	1213122	3949074.10000000000	19517372.00000000000
213	123	1213123	3952997.99999999000	19513839.00000000000
213	124	1213124	3956921.85000000000	19510306.00000000000
213	125	1213125	3960845.60000000000	19506773.00000000000
213	126	1213126	3964769.35000000000	19503240.00000000000
213	127	1213127	3968693.10000000000	19499707.00000000000
213	128	1213128	3972616.99999999000	19496174.00000000000
214	120	1214120	3937693.60000000000	19520514.00000000000
214	121	1214121	3941617.35000000000	19516981.00000000000
214	122	1214122	3945541.10000000000	19513448.00000000000
214	123	1214123	3949464.99999999000	19509915.00000000000
214	124	1214124	3953388.85000000000	19506382.00000000000
214	125	1214125	3957312.60000000000	19502849.00000000000
214	126	1214126	3961236.35000000000	19499316.00000000000
214	127	1214127	3965160.10000000000	19495783.00000000000
214	128	1214128	3969083.99999999000	19492250.00000000000
215	120	1215120	3934160.60000000000	19516590.00000000000
215	121	1215121	3938084.35000000000	19513057.00000000000
215	122	1215122	3942008.10000000000	19509524.00000000000
215	123	1215123	3945931.94986338000	19505991.00260000000
215	124	1215124	3949855.75013735000	19502457.99740000000
215	125	1215125	3953779.60000000000	19498925.00000000000
215	126	1215126	3957703.35000000000	19495392.00000000000
215	127	1215127	3961627.10000000000	19491859.00000000000
215	128	1215128	3965550.99999999000	19488326.00000000000

Management Zone 2 – Cell Identification

ROW	COL	CELL_ID	CentroidX	CentroidY
164	147	1164147	4220286.74999999000	19621313.00000000000
164	148	1164148	4224210.49999999000	19617780.00000000000
164	149	1164149	4228134.49999999000	19614247.00000000000
164	150	1164150	4232058.24999999000	19610714.00000000000
164	151	1164151	4235981.99999999000	19607181.00000000000
164	152	1164152	4239905.74999999000	19603648.00000000000
164	153	1164153	4243829.49999999000	19600115.00000000000
164	154	1164154	4247753.49999999000	19596582.00000000000
165	146	1165146	4212829.99999999000	19620922.00000000000
165	147	1165147	4216753.74999999000	19617389.00000000000
165	148	1165148	4220677.49999999000	19613856.00000000000
165	149	1165149	4224601.49999999000	19610323.00000000000
165	150	1165150	4228525.24999999000	19606790.00000000000
165	151	1165151	4232448.99999999000	19603257.00000000000
165	152	1165152	4236372.74999999000	19599724.00000000000
165	153	1165153	4240296.49999999000	19596191.00000000000
165	154	1165154	4244220.49999999000	19592658.00000000000
165	155	1165155	4248144.24999999000	19589125.00000000000
165	156	1165156	4252067.99999999000	19585592.00000000000
166	146	1166146	4209296.99999999000	19616998.00000000000
166	147	1166147	4213220.74999999000	19613465.00000000000
166	148	1166148	4217144.49999999000	19609932.00000000000
166	149	1166149	4221068.49999999000	19606399.00000000000
166	150	1166150	4224992.24999999000	19602866.00000000000
166	151	1166151	4228915.99999999000	19599333.00000000000
166	152	1166152	4232839.74999999000	19595800.00000000000
166	153	1166153	4236763.49999999000	19592267.00000000000
166	154	1166154	4240687.49999999000	19588734.00000000000
166	155	1166155	4244611.24999999000	19585201.00000000000
166	156	1166156	4248534.99999999000	19581668.00000000000
167	143	1167143	4193992.60000000000	19623673.00000000000
167	144	1167144	4197916.49999999000	19620140.00000000000
167	145	1167145	4201840.24999999000	19616607.00000000000
167	146	1167146	4205763.99999999000	19613074.00000000000
167	147	1167147	4209687.74999999000	19609541.00000000000
167	148	1167148	4213611.49999999000	19606008.00000000000
167	149	1167149	4217535.49999999000	19602475.00000000000
167	150	1167150	4221459.24999999000	19598942.00000000000
167	151	1167151	4225382.99999999000	19595409.00000000000
167	152	1167152	4229306.74999999000	19591876.00000000000
167	153	1167153	4233230.49999999000	19588343.00000000000
167	154	1167154	4237154.49999999000	19584810.00000000000
167	155	1167155	4241078.24999999000	19581277.00000000000
167	156	1167156	4245001.99999999000	19577744.00000000000
168	140	1168140	4178688.10000000000	19630349.00000000000
168	141	1168141	4182611.83258082000	19626815.66580000000

Management Zone 2 – Cell Identification Continued

ROW	COL	CELL_ID	CentroidX	CentroidY
168	142	1168142	4186535.71743252000	19623282.33420000000
168	143	1168143	4190459.58257637000	19619749.66580000000
168	144	1168144	4194383.43384931000	19616216.33860000000
168	145	1168145	4198307.06615068000	19612683.66140000000
168	146	1168146	4202231.01743251000	19609150.33420000000
168	147	1168147	4206154.73258971000	19605617.66580000000
168	148	1168148	4210078.51743251000	19602084.33420000000
168	149	1168149	4214002.48256748000	19598551.66580000000
168	150	1168150	4217926.26741028000	19595018.33420000000
168	151	1168151	4221849.98256748000	19591485.66580000000
168	152	1168152	4225773.76741028000	19587952.33420000000
168	153	1168153	4229697.48256748000	19584419.66580000000
168	154	1168154	4233621.51743251000	19580886.33420000000
168	155	1168155	4237545.23258971000	19577353.66580000000
168	156	1168156	4241469.01743251000	19573820.33420000000
169	140	1169140	4175155.10000000000	19626425.00000000000
169	141	1169141	4179078.85000000000	19622892.00000000000
169	142	1169142	4183002.66657556000	19619359.00170000000
169	143	1169143	4186926.53342492000	19615825.99830000000
169	144	1169144	4190850.28342441000	19612292.99830000000
169	145	1169145	4194774.06657502000	19608760.00170000000
169	146	1169146	4198697.99999999000	19605227.00000000000
169	147	1169147	4202621.74999999000	19601694.00000000000
169	148	1169148	4206545.49999999000	19598161.00000000000
169	149	1169149	4210469.49999999000	19594628.00000000000
169	150	1169150	4214393.24999999000	19591095.00000000000
169	151	1169151	4218316.99999999000	19587562.00000000000
169	152	1169152	4222240.74999999000	19584029.00000000000
169	153	1169153	4226164.49999999000	19580496.00000000000
169	154	1169154	4230088.49999999000	19576963.00000000000
169	155	1169155	4234012.24999999000	19573430.00000000000
169	156	1169156	4237935.99999999000	19569897.00000000000
170	140	1170140	4171622.10000000000	19622501.00000000000
170	141	1170141	4175545.85000000000	19618968.00000000000
170	142	1170142	4179469.60000000000	19615435.00000000000
170	143	1170143	4183393.49999999000	19611902.00000000000
170	144	1170144	4187317.35000000000	19608369.00000000000
170	145	1170145	4191241.10000000000	19604836.00000000000
170	146	1170146	4195164.99999999000	19601303.00000000000
170	147	1170147	4199088.74999999000	19597770.00000000000
170	148	1170148	4203012.49999999000	19594237.00000000000
170	149	1170149	4206936.41643786000	19590704.00440000000
170	150	1170150	4210860.08356091000	19587170.99570000000
170	151	1170151	4214783.99999999000	19583638.00000000000
170	152	1170152	4218707.74999999000	19580105.00000000000
170	153	1170153	4222631.49999999000	19576572.00000000000

Management Zone 2 – Cell Identification Continued

ROW	COL	CELL_ID	CentroidX	CentroidY
170	154	1170154	4226555.49999999000	19573039.00000000000
170	155	1170155	4230479.24999999000	19569506.00000000000
171	141	1171141	4172012.85000000000	19615044.00000000000
171	142	1171142	4175936.60000000000	19611511.00000000000
171	143	1171143	4179860.49999999000	19607978.00000000000
171	144	1171144	4183784.35000000000	19604445.00000000000
171	145	1171145	4187708.10000000000	19600912.00000000000
171	146	1171146	4191631.94986338000	19597379.00260000000
171	147	1171147	4195555.65013728000	19593845.99740000000
171	148	1171148	4199479.49999999000	19590313.00000000000
171	149	1171149	4203403.24999999000	19586780.00000000000
171	150	1171150	4207326.99999999000	19583247.00000000000
171	151	1171151	4211250.99999999000	19579714.00000000000
171	152	1171152	4215174.74999999000	19576181.00000000000
171	153	1171153	4219098.49999999000	19572648.00000000000
171	154	1171154	4223022.49999999000	19569115.00000000000
171	155	1171155	4226946.24999999000	19565582.00000000000
172	144	1172144	4180251.35000000000	19600521.00000000000
172	145	1172145	4184175.10000000000	19596988.00000000000
172	146	1172146	4188098.85000000000	19593455.00000000000
172	147	1172147	4192022.60000000000	19589922.00000000000
172	148	1172148	4195946.49999999000	19586389.00000000000
172	149	1172149	4199870.24999999000	19582856.00000000000
172	150	1172150	4203793.99999999000	19579323.00000000000
172	151	1172151	4207717.99999999000	19575790.00000000000
172	152	1172152	4211641.74999999000	19572257.00000000000
172	153	1172153	4215565.49999999000	19568724.00000000000
172	154	1172154	4219489.49999999000	19565191.00000000000
173	146	1173146	4184565.83258082000	19589531.66580000000
173	147	1173147	4188489.61742362000	19585998.33420000000
173	148	1173148	4192413.48256748000	19582465.66580000000
173	149	1173149	4196337.26741028000	19578932.33420000000
173	150	1173150	4200260.98256748000	19575399.66580000000
173	151	1173151	4204185.01743251000	19571866.33420000000
173	152	1173152	4208108.73258971000	19568333.66580000000
173	153	1173153	4212032.51743251000	19564800.33420000000
173	154	1173154	4215956.39902873000	19561267.67010000000
174	147	1174147	4184956.60000000000	19582075.00000000000
174	148	1174148	4188880.49999999000	19578542.00000000000
174	149	1174149	4192804.28342441000	19575008.99830000000
174	150	1174150	4196728.06657502000	19571476.00170000000
174	151	1174151	4200651.99999999000	19567943.00000000000
174	152	1174152	4204575.74999999000	19564410.00000000000
174	153	1174153	4208499.49999999000	19560877.00000000000
174	154	1174154	4212423.24999999000	19557344.00000000000
175	147	1175147	4181423.60000000000	19578151.00000000000

Management Zone 2 – Cell Identification Continued

ROW	COL	CELL_ID	CentroidX	CentroidY
175	148	1175148	4185347.49999999000	19574618.00000000000
175	149	1175149	4189271.35000000000	19571085.00000000000
175	150	1175150	4193195.10000000000	19567552.00000000000
175	151	1175151	4197118.99999999000	19564019.00000000000
175	152	1175152	4201042.74999999000	19560486.00000000000
175	153	1175153	4204966.49999999000	19556953.00000000000
176	147	1176147	4177890.60000000000	19574227.00000000000
176	148	1176148	4181814.49999999000	19570694.00000000000
176	149	1176149	4185738.35000000000	19567161.00000000000
176	150	1176150	4189662.10000000000	19563628.00000000000
176	151	1176151	4193585.94986338000	19560095.00260000000
176	152	1176152	4197509.65013728000	19556561.99740000000
177	147	1177147	4174357.60000000000	19570303.00000000000
177	148	1177148	4178281.44986264000	19566770.00260000000
177	149	1177149	4182205.25013661000	19563236.99740000000
177	150	1177150	4186129.10000000000	19559704.00000000000
177	151	1177151	4190052.85000000000	19556171.00000000000
177	152	1177152	4193976.60000000000	19552638.00000000000
178	147	1178147	4170824.58257637000	19566379.66580000000
178	148	1178148	4174748.36741917000	19562846.33420000000
178	149	1178149	4178672.18256748000	19559313.66580000000
178	150	1178150	4182596.11742362000	19555780.33420000000
178	151	1178151	4186519.83258082000	19552247.66580000000
178	152	1178152	4190443.61742362000	19548714.33420000000

Management Zone 3 – Cell Identification

ROW	COL	CELL_ID	CentroidX	CentroidY
186	100	1186100	3958141.70000000000	19701041.00000000000
186	101	1186101	3962065.58257637000	19697507.66580000000
186	102	1186102	3965989.36741917000	19693974.33420000000
186	103	1186103	3969913.08257637000	19690441.66580000000
186	104	1186104	3973836.86741917000	19686908.33420000000
186	105	1186105	3977760.68256748000	19683375.66580000000
186	106	1186106	3981684.61742362000	19679842.33420000000
192	101	1192101	3940867.49999999000	19673965.00000000000
192	102	1192102	3944791.35000000000	19670432.00000000000
192	103	1192103	3948715.10000000000	19666899.00000000000
192	104	1192104	3952638.85000000000	19663366.00000000000
192	105	1192105	3956562.60000000000	19659833.00000000000
192	106	1192106	3960486.49999999000	19656300.00000000000
192	107	1192107	3964410.35000000000	19652767.00000000000
192	108	1192108	3968334.10000000000	19649234.00000000000
192	109	1192109	3972257.85000000000	19645701.00000000000
179	100	1179100	3982872.85000000000	19728507.00000000000
180	99	1180099	3975416.01743251000	19728116.33420000000
180	100	1180100	3979339.83258082000	19724583.66580000000
180	101	1180101	3983263.61742362000	19721050.33420000000
181	99	1181099	3971882.99999999000	19724193.00000000000
181	100	1181100	3975806.85000000000	19720660.00000000000
181	101	1181101	3979730.60000000000	19717127.00000000000
182	99	1182099	3968349.99999999000	19720269.00000000000
182	100	1182100	3972273.85000000000	19716736.00000000000
182	101	1182101	3976197.60000000000	19713203.00000000000
182	102	1182102	3980121.35000000000	19709670.00000000000
183	99	1183099	3964816.94986338000	19716345.00260000000
183	100	1183100	3968740.75013735000	19712811.99740000000
183	101	1183101	3972664.60000000000	19709279.00000000000
183	102	1183102	3976588.35000000000	19705746.00000000000
183	103	1183103	3980512.10000000000	19702213.00000000000
183	104	1183104	3984435.99999999000	19698680.00000000000
183	105	1183105	3988359.85000000000	19695147.00000000000
184	99	1184099	3961283.85000000000	19712421.00000000000
184	100	1184100	3965207.70000000000	19708888.00000000000
184	101	1184101	3969131.60000000000	19705355.00000000000
184	102	1184102	3973055.35000000000	19701822.00000000000
184	103	1184103	3976979.10000000000	19698289.00000000000
184	104	1184104	3980902.99999999000	19694756.00000000000
184	105	1184105	3984826.85000000000	19691223.00000000000
184	106	1184106	3988750.60000000000	19687690.00000000000
185	100	1185100	3961674.71743252000	19704964.33420000000
185	101	1185101	3965598.60000000000	19701431.00000000000
185	102	1185102	3969522.35000000000	19697898.00000000000
185	103	1185103	3973446.10000000000	19694365.00000000000

Management Zone 3 – Cell Identification Continued

ROW	COL	CELL_ID	CentroidX	CentroidY
185	104	1185104	3977369.94986264000	19690832.00260000000
185	105	1185105	3981293.75013661000	19687298.99740000000
185	106	1185106	3985217.60000000000	19683766.00000000000
187	100	1187100	3954608.70000000000	19697117.00000000000
187	101	1187101	3958532.60000000000	19693584.00000000000
187	102	1187102	3962456.35000000000	19690051.00000000000
187	103	1187103	3966380.10000000000	19686518.00000000000
187	104	1187104	3970303.85000000000	19682985.00000000000
187	105	1187105	3974227.70000000000	19679452.00000000000
187	106	1187106	3978151.60000000000	19675919.00000000000
187	107	1187107	3982075.35000000000	19672386.00000000000
187	108	1187108	3985999.10000000000	19668853.00000000000
187	109	1187109	3989922.99999999000	19665320.00000000000
188	100	1188100	3951075.66657556000	19693193.00170000000
188	101	1188101	3954999.53342492000	19689659.99830000000
188	102	1188102	3958923.35000000000	19686127.00000000000
188	103	1188103	3962847.10000000000	19682594.00000000000
188	104	1188104	3966770.85000000000	19679061.00000000000
188	105	1188105	3970694.70000000000	19675528.00000000000
188	106	1188106	3974618.60000000000	19671995.00000000000
188	107	1188107	3978542.35000000000	19668462.00000000000
188	108	1188108	3982466.10000000000	19664929.00000000000
188	109	1188109	3986389.94986264000	19661396.00260000000
189	101	1189101	3951466.49999999000	19685736.00000000000
189	102	1189102	3955390.35000000000	19682203.00000000000
189	103	1189103	3959314.10000000000	19678670.00000000000
189	104	1189104	3963237.85000000000	19675137.00000000000
189	105	1189105	3967161.70000000000	19671604.00000000000
189	106	1189106	3971085.60000000000	19668071.00000000000
189	107	1189107	3975009.35000000000	19664538.00000000000
189	108	1189108	3978933.10000000000	19661005.00000000000
189	109	1189109	3982856.85000000000	19657472.00000000000
189	110	1189110	3986780.70000000000	19653939.00000000000
190	101	1190101	3947933.49999999000	19681812.00000000000
190	102	1190102	3951857.35000000000	19678279.00000000000
190	103	1190103	3955781.10000000000	19674746.00000000000
190	104	1190104	3959704.85000000000	19671213.00000000000
190	105	1190105	3963628.66657507000	19667680.00170000000
190	106	1190106	3967552.53342443000	19664146.99830000000
190	107	1190107	3971476.35000000000	19660614.00000000000
190	108	1190108	3975400.10000000000	19657081.00000000000
190	109	1190109	3979323.85000000000	19653548.00000000000
190	110	1190110	3983247.70000000000	19650015.00000000000
190	111	1190111	3987171.60000000000	19646482.00000000000
191	101	1191101	3944400.51743251000	19677888.33420000000
191	102	1191102	3948324.33258082000	19674355.66580000000

Management Zone 3 – Cell Identification Continued

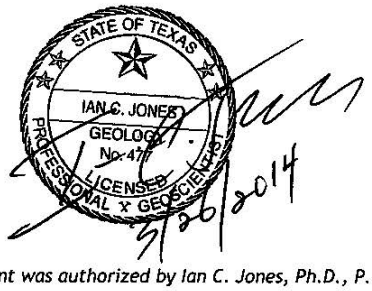
ROW	COL	CELL_ID	CentroidX	CentroidY
191	103	1191103	3952248.11742362000	19670822.33420000000
191	104	1191104	3956171.83258082000	19667289.66580000000
191	105	1191105	3960095.61742362000	19663756.33420000000
191	106	1191106	3964019.48256748000	19660223.66580000000
191	107	1191107	3967943.36741917000	19656690.33420000000
191	108	1191108	3971867.08257637000	19653157.66580000000
191	109	1191109	3975790.86741917000	19649624.33420000000
191	110	1191110	3979714.68256748000	19646091.66580000000
191	111	1191111	3983638.61742362000	19642558.33420000000
191	112	1191112	3987562.33258082000	19639025.66580000000
193	102	1193102	3941258.35000000000	19666508.00000000000
193	103	1193103	3945182.10000000000	19662975.00000000000
193	104	1193104	3949105.85000000000	19659442.00000000000
193	105	1193105	3953029.60000000000	19655909.00000000000
193	106	1193106	3956953.49999999000	19652376.00000000000
193	107	1193107	3960877.35000000000	19648843.00000000000
193	108	1193108	3964801.10000000000	19645310.00000000000
194	102	1194102	3937725.25013735000	19662583.99740000000
194	103	1194103	3941649.10000000000	19659051.00000000000
194	104	1194104	3945572.85000000000	19655518.00000000000
194	105	1194105	3949496.60000000000	19651985.00000000000
194	106	1194106	3953420.49999999000	19648452.00000000000
194	107	1194107	3957344.35000000000	19644919.00000000000
196	102	1196102	3930659.21743252000	19654736.33420000000
196	103	1196103	3934583.08257637000	19651203.66580000000
196	104	1196104	3938506.86741917000	19647670.33420000000
196	105	1196105	3942430.58257637000	19644137.66580000000
195	102	1195102	3934192.20000000000	19658660.00000000000
195	103	1195103	3938116.10000000000	19655127.00000000000
195	104	1195104	3942039.85000000000	19651594.00000000000
195	105	1195105	3945963.60000000000	19648061.00000000000
195	106	1195106	3949887.49999999000	19644528.00000000000

Appendix H

GAM Run 14-010

GAM Run 14-010: Middle Pecos Groundwater Conservation District Management Plan

by Ian C. Jones, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-6641
March 26, 2014



The seal appearing on this document was authorized by Ian C. Jones, Ph.D., P.G. 477 on March 26, 2014.

GAM RUN 14-010: MIDDLE PECOS GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

by Ian C. Jones, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-6641
March 26, 2014

EXECUTIVE SUMMARY:

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

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

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

The groundwater management plan for the Middle Pecos Groundwater Conservation District should be adopted by the district on or before September 1, 2015 and submitted to the executive administrator of the TWDB on or before October 1, 2015. The current management plan for the Middle Pecos Groundwater Conservation District expires on November 30, 2015.

This report discusses the methods, assumptions, and results from model runs using the groundwater availability models for the Dockum, Rustler, Edwards-Trinity (Plateau), and Pecos Valley aquifers. This model run replaces the results of GAM Run 08-75 (Oliver, 2009). GAM Run 14-010 meets current standards set after the release of GAM Run 08-75 including use of the official aquifer boundaries within the district rather than the entire active area of the model within the district. This GAM Run also includes results from the recently released groundwater availability model for the Rustler Aquifer (Ewing and others, 2012). Tables 1 through 4 summarize the groundwater availability model data required by statute, and Figures 1 through 3 show the area of the models from which the values in the tables were extracted. If after review of the figures, the Middle Pecos Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB immediately.

Although the Capitan Reef Complex Aquifer occurs within the Middle Pecos Groundwater Conservation District, a groundwater availability model for this aquifer has not been developed at this time. If the district would like information for the Capitan Reef Complex Aquifer, they may request it from the Groundwater Technical Assistance Section of the TWDB.

METHODS:

Groundwater models for the Pecos Valley and Edwards-Trinity (Plateau) aquifers, the Rustler and the Dockum aquifers were run for this analysis. Water budgets for the transient model period (1980 through 1999) were extracted using ZONEBUDGET version 3.01 (Harbaugh, 1990) and the average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portions of the aquifers located within the district are summarized in this report. The estimated net annual volume of flow between the Pecos Valley and Edwards-Trinity (Plateau) aquifers in the district was calculated as the net lateral flow in the Pecos Valley Aquifer of the Middle Pecos Groundwater Conservation District. This estimate is based

on the assumption that all groundwater flow is assigned to the Pecos Valley Aquifer where the Pecos Valley and Edwards-Trinity (Plateau) aquifers overlap.

PARAMETERS AND ASSUMPTIONS:

Edwards-Trinity (Plateau) and Pecos Valley Aquifers

- We used version 1.01 of the groundwater availability model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers. See Anaya and Jones (2009) for assumptions and limitations of this model.
- The Edwards-Trinity (Plateau) and Pecos Valley aquifers model includes two layers representing the Pecos Valley alluvium and Edwards Group and equivalent limestone hydrostratigraphic units (Layer 1) and the undifferentiated Trinity Group hydrostratigraphic units (Layer 2) in the district.
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

Dockum Aquifer

- We used version 1.01 of the groundwater availability model for the Dockum Aquifer. See Ewing and others (2008) for assumptions and limitations of the groundwater availability model.
- The model includes three layers representing: geologic units overlying the Dockum Aquifer including the Ogallala, Edwards-Trinity (High Plains), Edwards-Trinity (Plateau), Pecos Valley, and Rita Blanca aquifers (Layer 1), the upper portion of the Dockum Aquifer (Layer 2), and the lower portion of the Dockum Aquifer (Layer 3).
- The aquifers represented in Layer 1 of the groundwater availability model are only included in the model for the purpose of more accurately representing flow between these units and the Dockum Aquifer. This model is not intended to explicitly simulate flow in these overlying units (Ewing and others, 2008).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

Rustler Aquifer

- We used version 1.01 of the groundwater availability model for the Rustler Aquifer Groundwater Availability Model (Ewing and Others 2012). See Ewing and others (2012) for assumptions and limitations of the groundwater availability model.
- The model has two active layers representing the Dewey Lake Formation and Dockum Aquifer (Layer 1) and the Rustler Aquifer (Layer 2). Thus, Model Layer 2 was used for the management plan analysis. The model was run with MODFLOW-2000 (Harbaugh and Others, 2000).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected components were extracted from the groundwater budget for the aquifers located within the district and averaged over the duration of the calibration and verification portion of the model runs in the district, as shown in tables 1 through 4. The components of the modified budget shown in tables 1 through 4 include:

Precipitation recharge—The areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.

Surface water outflow—The total water discharging from the aquifer (outflow) to surface water features such as streams, reservoirs, and drains (springs).

Flow into and out of district—The lateral flow within the aquifer between the district and adjacent counties.

Flow between aquifers—The vertical flow between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. "Inflow" to an aquifer from an overlying or underlying aquifer will always equal the "Outflow" from the other aquifer.

The information needed for the District's management plan is summarized in tables 1 through 4. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the

model. To avoid double accounting, a model cell that straddles a political boundary, such as district or county boundaries, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located (see figures 1 through 3).

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

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Pecos Valley Aquifer	43,954
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Pecos Valley Aquifer	50,141
Estimated annual volume of flow into the district within each aquifer in the district	Pecos Valley Aquifer	10,103
Estimated annual volume of flow out of the district within each aquifer in the district	Pecos Valley Aquifer	15,240
Estimated net annual volume of flow between each aquifer in the district	To the Pecos Valley Aquifer from the Edwards-Trinity (Plateau) Aquifer	55,363
	From the Pecos Valley Aquifer to the Dockum Aquifer	432

TABLE 2: SUMMARIZED INFORMATION FOR THE EDWARD-TRINITY (PLATEAU) AQUIFER THAT IS NEEDED FOR THE MIDDLE PECOS GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Edwards-Trinity (Plateau) Aquifer	137,688
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards-Trinity (Plateau) Aquifer	142
Estimated annual volume of flow into the district within each aquifer in the district	Edwards-Trinity (Plateau) Aquifer	26,435
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards-Trinity (Plateau) Aquifer	75,989
Estimated net annual volume of flow between each aquifer in the district	From the Edwards-Trinity (Plateau) Aquifer to the Pecos Valley Aquifer	55,363
	From the Edwards-Trinity (Plateau) Aquifer to the Dockum Aquifer	148

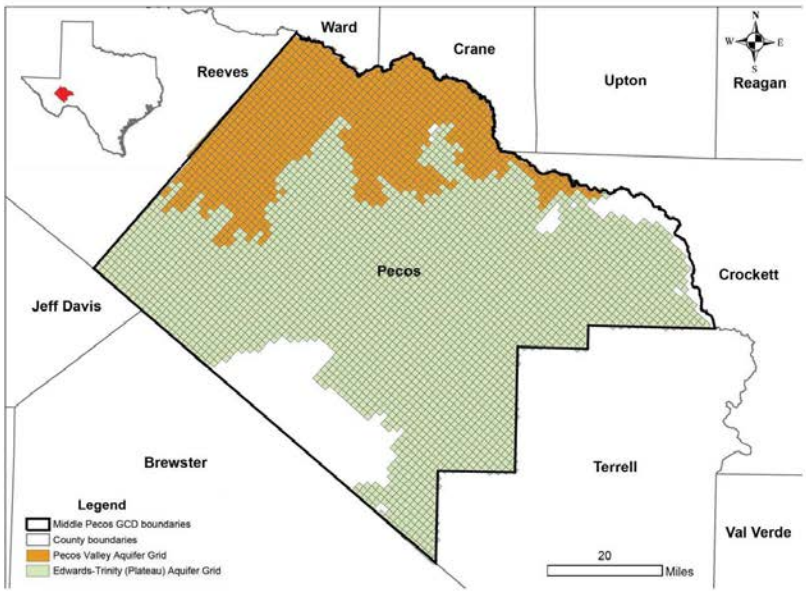


FIGURE 1: AREA OF THE GROUNDWATER MODEL FOR THE EDWARDS-TRINITY (PLATEAU) AND PECOS VALLEY AQUIFERS FROM WHICH THE INFORMATION IN TABLES 1 AND 2 WERE EXTRACTED (THE AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 3: SUMMARIZED INFORMATION FOR THE DOCKUM AQUIFER THAT IS NEEDED FOR THE MIDDLE PECOS GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Dockum Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Dockum Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Dockum Aquifer	561
Estimated annual volume of flow out of the district within each aquifer in the district	Dockum Aquifer	299
Estimated net annual volume of flow between each aquifer in the district	To the Dockum Aquifer from the Pecos Valley Aquifer	432
	To the Dockum Aquifer from the Edwards-Trinity (Plateau) Aquifer	148
	To the Dockum Aquifer from the Rustler Aquifer	514

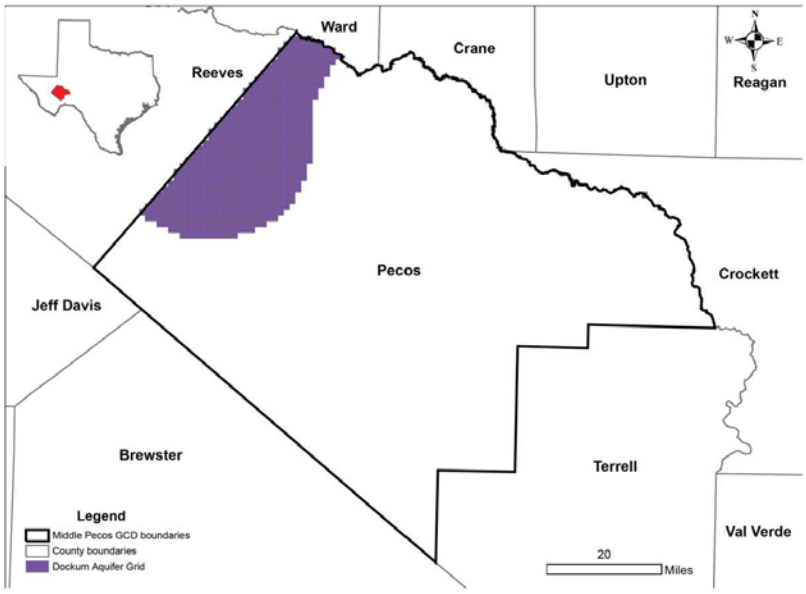


FIGURE 2: AREA OF THE GROUNDWATER MODEL FOR THE DOCKUM AQUIFER FROM WHICH THE INFORMATION IN TABLE 3 WAS EXTRACTED (THE AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 4: SUMMARIZED INFORMATION FOR THE RUSTLER AQUIFER THAT IS NEEDED FOR THE MIDDLE PECOS GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Rustler Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Rustler Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Rustler Aquifer	3,013
Estimated annual volume of flow out of the district within each aquifer in the district	Rustler Aquifer	2,361
Estimated net annual volume of flow between each aquifer in the district	From the Rustler Aquifer to the Dockum Aquifer	514

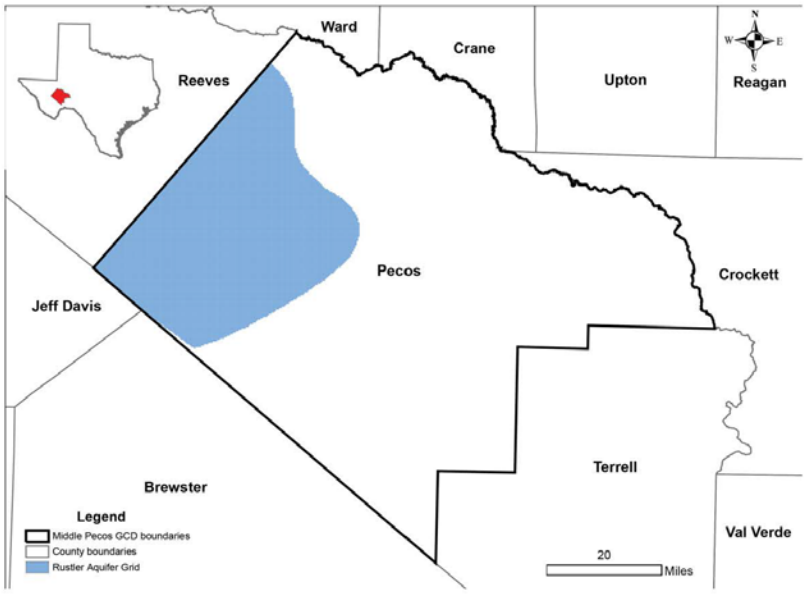


FIGURE 3: AREA OF THE GROUNDWATER MODEL FOR THE RUSTLER AQUIFER FROM WHICH THE INFORMATION IN TABLE 4 WAS EXTRACTED (THE AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

LIMITATIONS

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

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

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

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

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need

to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

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