Groundwater Management Plan 2019-2024

Adopted February 13, 2019

Mesa Underground Water Conservation District Management Plan

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Appendices:

District Mission

Mesa Underground Water Conservation District (Mesa UWCD) will provide technical assistance and develop, promote and implement management strategies to provide for the conservation, preservation, recharging and prevention of waste of the groundwater reservoir, thereby extending the quantity and quality of the Ogallala and the Edwards-Trinity (High Plains) aquifers in Dawson County.

Time Period for this Plan

This plan will become effective upon adoption by the Mesa Underground Water Conservation District Board of Directors and once approved as administratively complete by the Texas Water Development Board. This plan will remain in effect for five years from the date of approval (on or around February 2019) or until a revised plan is adopted and approved.

Statement of Guiding Principles

Mesa Underground Water Conservation District recognizes that the groundwater resources of the region are of vital importance to the continued vitality of the citizens, economy, and environment within the District. The preservation of the groundwater resources can be managed in the most prudent and cost-effective manner through the regulation of production as affected by the District's production limits, well permitting, and well spacing rules. This management plan is intended as a tool to focus the thoughts and actions of those individuals charged with the responsibility for the execution of District activities.

General Description

Mesa Underground Water Conservation District was created in 1989 by authority of SB 1727 of the 71st Legislature. The District has the same areal extent as Dawson County, TX and contains 577280 acres. The Caprock Escarpment squeezes off the Ogallala on, along or near the east boundary of the District. Borden County joins us on the east, Martin County on the south, Gaines County on the west, and Lynn County along with Terry County on the north, respectively. (Figure 1) The local economy is vibrantly substantiated by agriculture, ranching, and oil and gas production. The agricultural income is derived from cotton, peanuts, grain sorghums, alfalfa, and beef production. The sharp increase in irrigated agriculture 20 years ago has greatly helped to stabilize the economy and expanded the cropping possibilities for agriculture in this semi-arid community.

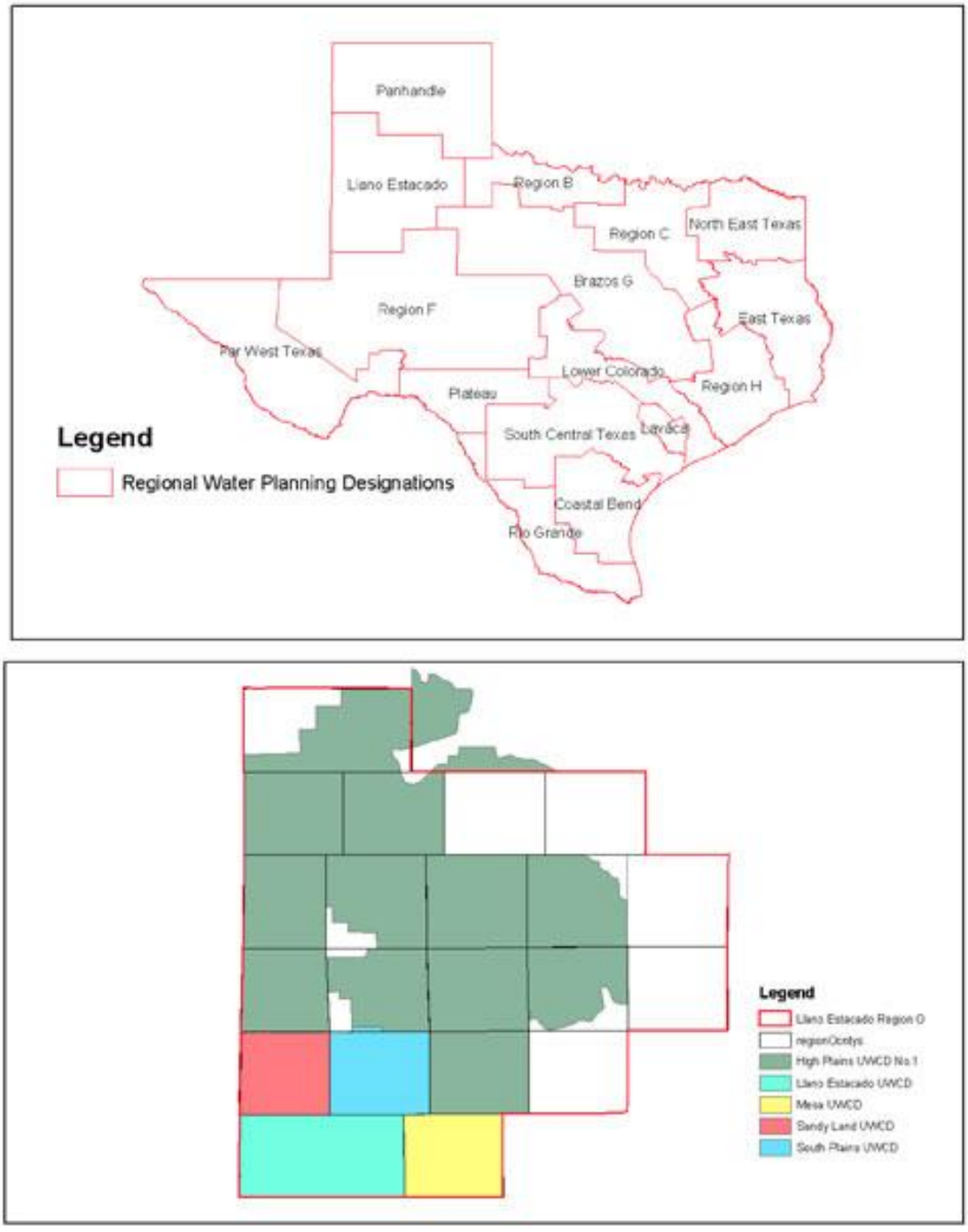

Figure 1. Location of Mesa Underground Water Conservation District

Groundwater Resources for Mesa UWCD

The district has jurisdictional authority over all groundwater that lies with the District's boundaries. The Ogallala aquifer is the primary source of water for Dawson County, (Figure 2). The Ogallala aquifer yields water from interfingered sands, gravel, and silts of the Ogallala Formation which is of Pliocene age. These sediments represent deposits eroded from the ancestral Rocky Mountains to the west. Within the District, groundwater in the Ogallala aquifer is under water table or unconfined conditions. In this portion of the Southern High Plains, the Ogallala Formation is predominantly covered by dune sands of Quaternary age. Underlying the Ogallala aquifer are sandstones and limestones of the Edwards-Trinity aquifer. These sediments were deposited during the Cretaceous time upon an eroded surface and were in turn eroded before being covered by deposition of the Ogallala formation. The result is that the Edwards-Trinity aquifer with the District if highly variable in thickness and depth of occurrence and represents a minor source of groundwater to the District.

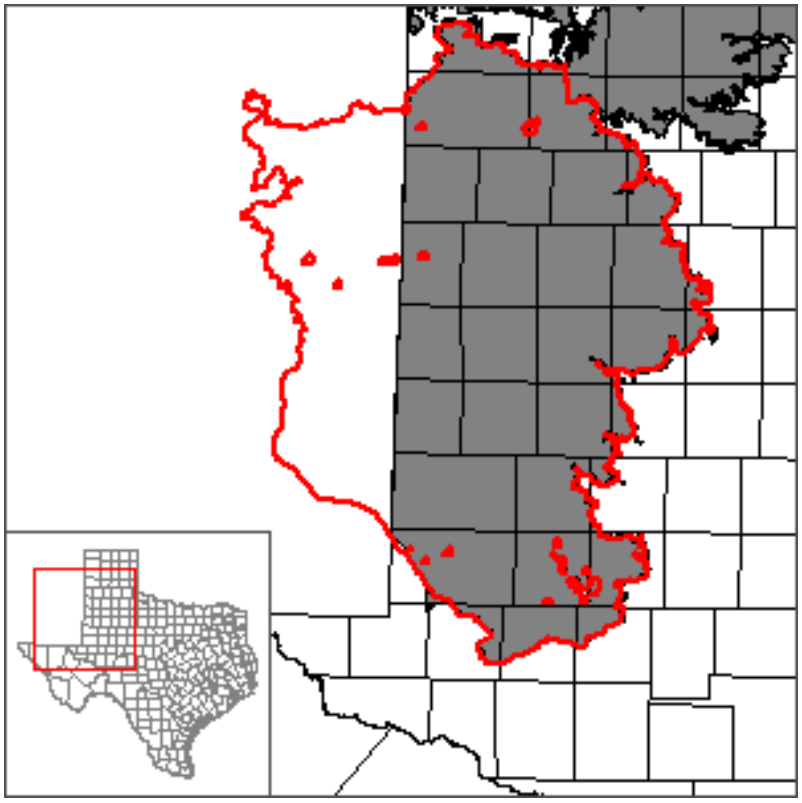

Figure 2. Map of the Ogallala Aquifer

Natural recharge in the District is mostly through direct infiltration of precipitation into the course wind-blown sand and silty surficial sediments. This is different from the more northern portions of the Southern High Plains where natural recharge is focused through the floors of the thousands of playas. The District is very proud of the Aquifer Evaluation Program (AEP) that has been developed with the cooperation and financial support of the TWDB. The District has gathered data in the AEP that strongly indicates the possibility of a recharge rate in Mesa UWCD that is a much higher rate than anything which has been discovered in prior studies. This data also indicates the recharge occurs in a much quicker time period, from when the rain event occurs until the aquifer shows a profound rise in the water levels, than prior studies have shown.

Addressing Desired Future Conditions and Modeled Available Groundwater

The District participated in Joint Planning in GMA 2. The GMA considered the 9 factors required and used the High Plains Aquifer Groundwater Availability Model (TWDB) to run multiple simulations. This Joint Planning led to GMA 2 adopting DFC's for all aquifers in the area in October 2016. The GMA 2 overall Ogallala / Edwards Trinity DFC was to have no more than 23 - 27 feet drawdown in the whole GMA by 2070. Dawson County's allocation of this DFC is no more than 34 feet drawdown by 2070. The GMA also set a DFC for the Dockum Aquifer of no more than 27 feet drawdown by 2070 in the whole GMA, but Dawson County declared the Dockum Aquifer to be not relevant. Using these DFC's, GAM Run 18-009 was generated for the District to assign MAG values. The MAG values for Dawson County are as follows:

Groundwater Conservation District	County	Aquifer	Modeled Available Groundwater							TWDB Report
			2012	2020	2030	2040	2050	2060	2070	
Mesa UWCD	Dawson	Ogallala and Edwards-Trinity (High Plains)	122,802	172,851	123,476	96,796	82,283	74,610	69,928	GR16-028 MAG

The District is analyzing long term water level trends annually to ensure the District is within their adopted DFC values.

Estimates of Modeled Available Groundwater

GMA 2 adopted Desired Future Conditions for relevant aquifers in October 2016. The relevant aquifers are the Ogallala and Edwards-Trinity (High Plains) Aquifers. Refer to GMA #2, MAG Report, Appendix C

Estimated Historical Annual Groundwater Usage

Refer to Estimated Historical Groundwater Use and 2017 State Water Plan Data Sets, Appendix B.

Estimates of Annual Groundwater Recharge from Precipitation

Refer to GAM Run 18-009, Appendix A

Estimates of Annual Groundwater Discharge to Springs/Surface Water Bodies

Refer to GAM Run 18-009, Appendix A

Estimates of Annual Groundwater Flow Into/out of the District for the Ogallala; Estimates of Annual Groundwater Flow between Aquifers in the District.

Refer to GAM Run 18-009, Appendix A

Estimates of Projected Surface Water Supplies

Estimated Historical Groundwater Use and 2017 State Water Plan Data Sets, Appendix B.

Estimates of Projected Total Demand for Water in the District

Refer to Estimated Historical Groundwater Use and 2017 State Water Plan Data Sets, Appendix B

Water Supply Needs

Refer to Estimated Historical Groundwater Use and 2017 State Water Plan Data Sets, Appendix B

Water Management Strategies

Dawson County and Other Local areas will use Groundwater Development starting in 2040 at 150 acft/yr. Irrigation use in Dawson County will be met by Demand Reduction. The needs for the city of Lamesa will use Demand Reduction within the County and Conjunctive Use from Lake Meredith and Expansion of the Roberts well field. All projects and needs for the city of Lamesa are performed by CRMWA (Canadian River Municipal Water Authority).

City of O'Donnell will use Conjunctive Use for the reservoir along with Expanding and Replacing the Roberts well field. All projects and needs for the city of O'Donnell are performed by CRMWA (Canadian River Municipal Water Authority).

Refer to Estimated Historical Groundwater Use and 2017 State Water Plan Data Sets, Appendix B. Look in the Regional Plan and see what they will use.

Management of Groundwater Resources

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. 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, would result in a reduction of groundwater use. A monitor well observation network shall be established and maintained in order to evaluate changing conditions of groundwater supplies (water in storage) within the District. The District will make a regular assessment of water supply and groundwater storage conditions and will report those conditions to the Board and to the public.

Actions, Procedures, Performances and Avoidance for Implementation

The District will implement the provisions of the approved management plan and will utilize the provisions of this plan as a guidepost for determining the direction or priority for District activities. Operations, agreements, and planning efforts of the District will be consistent with this plan. The District will seek the cooperation of all interested parties in the implementation of this plan. The District will adopt all Management Plans by means of a District Board Resolution. The District will provide "Notice and Hearing" as prescribed by District Rule 14.1 (B) (2) "At its discretion the Board may hold a hearing and consider adoption of a new District Management Plan and provide evidence to the TWDB of such happenings". The District will coordinate with all surface water management entities in the District that includes Canadian River Municipal Water Authority, Brazos River Authority, and Colorado River Municipal Water District. This plan is for a 5-year planning period; however, the Board of Directors of Mesa UWCD may review the plan annually and re-adopt the plan with or without revisions at least every five (5) years. At any time, the Rules of Mesa UWCD may be found on the District website www.mesauwcd.org.

Drought Contingency Plan

Drought is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. Drought is also a temporary aberration, and differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate ("What is Drought?" National Drought Mitigation Center). The Mesa Underground Water Conservation District is in a semi-arid region that also experiences drought. However, even in the midst of a drought, rainfall at crucial times of the growing season may significantly reduce irrigation water demand.

Drought response conservation measures typically used in other regions of Texas (i.e. rationing) cannot and are not used in this region due to extreme economic impact potential. In the District, groundwater conservation is stressed at all times. The Board recognizes that irrigated agriculture provides the economic stability to the communities within the District. Therefore, through the notice and hearing provisions required in the development and adoption of this management plan, the Board adopts the official position that, in times of precipitation shortage, irrigated agricultural producers will not be limited to any less usage of groundwater than is provided for by District rules.

In order to treat all other groundwater user groups fairly and equally, the District will encourage more stringent conservation measures, where practical, but likewise, will not limit groundwater use in any way not already provided for by District rules.

Regional Water Planning

The Board of Directors recognizes the regional water plan requirements listed in Ch. 36, TWC, §36.1071. Namely, the District's management plan must be forwarded to the regional water planning group for their consideration in their planning process, and the plan must address water supply needs such that there is no conflict with the approved regional water plan. It is the Board's belief that no such conflict exists.

The Board agrees that the regional water plan should include the District's best data. The Board also recognizes that the regional water planning process provides a necessary overview of the region's water supply and needs. However, the Board also believes it is the duty of the District to develop the best and most accurate information concerning groundwater within the District.

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

The District Manager will prepare an annual report of the District's performance achieving management goals and objectives. The report will be prepared in a format that will be reflective of the performance standards listed following each management objective. The report will be maintained on file in the open records of the District.
The District will actively enforce all rules of the District in order to conserve, preserve, protect and prevent the waste of groundwater resources over which the District has jurisdictional authority. The Board may periodically review the District's rules, and may modify the rules, with public approval to better manage the groundwater resources with the District and to carry out the duties prescribed in Chapter 36, Texas Water Code.

Goal 1.0 **Provide for the most efficient use of groundwater with the District.**

Management Objective- Water Level Monitoring

1.01 Measure the depth to water in the District's water level monitoring well network.

Performance Standards

1.01a Report in the annual report to the board the number of wells measured

1.01b Report the number of wells added to the network, if required, each year

Management Objective- Technical Field Services

1.02 Provide technical field services including flow testing and drawdown measurements for wells and irrigation systems.

Performance Standards

1.02a Report the number of field services tests performed each year

Management Objectives- Laboratory Services

1.03 Provide basic water quality testing services. Maintain a record of tests performed by entering the results in the District's computer database.

Performance Standards

1.03a Report the number of laboratory service tests into the Districts database each year

Management Objective- Water Use Monitoring

1.04 Monitor seasonal irrigation applications using a network of cooperative producers.

Performance Standards

1.04a Report the number of irrigation systems and average production in the cooperative metering program and production data

Goal 2.0 **Controlling and preventing waste of groundwater**

Management Objective- Well Permitting and Well Completion

2.01 Issue temporary water well drilling permits for the drilling and completion of non-exempt water wells. Inspect all well sites to be assured that the District's completion and spacing standards are meet.

Performance Standards

2.01a Report the number of water well drilling permits issued and inspected each year in the annual report to the board.

Management Objective- Open, Deteriorated or Uncovered Wells

2.02 If an open, deteriorated or uncovered well is found, the District will insure that the open hole is properly closed according to the District's rule, and in doing so, prevent potential contamination of the groundwater resource. The District will contact the party responsible for the open, deteriorated or uncovered well. The site will be inspected after notification to insure the well closure process occurs.

Performance Standards

2.02a Report number of open, deteriorated or uncovered wells

2.02b Report number of initial inspections accomplished each year

Management Objective- Water Quality Monitoring

2.04 Conduct a District wide water quality testing program. The results will be entered into the District's database and will be made available to the public.

Performance Standards

2.04a Report the number of samples collected and analyzed each year.

Goal 3.0 **Addressing Drought Conditions**

Management Objective- Rain Gauges

3.01 Maintain a network of rain gauges in the District. Publish rainfall data on the District's website.

Performance Standards

3.01a Publish at least 1 rainfall data map on the District's website annually of rain gauges in network.

Goal 4.0 **Addressing Conservation**

Management Objective- Classroom Education

4.01 This District will promote water conservation through presentations given within the District.

Performance Standards

4.01a Report the number of classroom presentations

Management Objective- Public Speaking Engagements

4.02 The District staff and/or directors will present programs addressing groundwater conservation, groundwater quality and District information or activities.

Performance Standards

4.02a Report the number of programs presented.

Goal 5.0 **Addressing Precipitation Enhancement**

5.01 This program has been determined not to be cost-effective. Therefore, this goal is not applicable.

Goal 6.0 **Addressing Brush Control**

6.01 Existing programs administered by the USDA-NRCS are sufficient for addressing this goal. The Board not believe that this activity is cost effective at this time.

Goal 7.0 **Addressing Future Desired conditions of the aquifers**

Management Objective- Calculate Annual Drawdown.

7.01 The District will calculate the average annual drawdown using the results of annual water level measurements each year.

Performance Standards

7.01a Report in the annual report Present the average drawdown results to the District Board

Goal 8.0 **Addressing rainwater harvesting projects**

Management Objective—Public Awareness Program

8.01 The District will conduct an educational program for this conservation strategy at least once a year.

Performance Standards

8.01a Document the type of program conducted (i.e. newsletter article, public presentation)

Management Goals Determined Not-Applicable

1.0 Controlling and preventing subsidence.

No historical evidence of subsidence. At this time, we are preparing and completing a Subsidence Calculation Sheet. TWDB subsidence tool risk number is 0.3 ft. Complete worksheet will be available upon request.

2.0 Addressing conjunctive surface water management issues within the District.

The District is not directly involved in conjunctive surface water management issues. This issue is not cost effective and not appropriate at this time.

3.0 Addressing natural resource issues which impact the use and availability of groundwater

The District will investigate, or refer to the proper agency, any citizen's or District initiated complaint related to surface water, groundwater, or any natural resource within the District. The District will record all complaints and report these annually to the District Board of Directors. Therefore, the management goal for addressing natural resource issues which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District is not applicable to the operations of the District.

4.0 Addressing recharge enhancement projects which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District.

A review of past work conducted by others indicates this goal is not appropriate at the present time.

5.0 Addressing a precipitation enhancement project which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District.

This program has been determined not to be cost-effective. Therefore, this goal is not applicable.

6.0 Addressing a brush control project which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District.

Existing programs administered by the USDA-NRCS are sufficient for addressing this goal. The Board not believe that this activity is cost effective at this time. There are provisions through the EQUIP program for cost share for the removal of Salt Cedar.

Appendix A

GAM Run 18-009
Mesa Underground Water Conservation District Groundwater Management Plan

GAM Run 18-009: Mesa Underground Water Conservation District Groundwater Management Plan

Shirley C. Wade, Ph.D., P.G.
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512-936-0883
May 25, 2018

Shirley C Wade
5/25/2018

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GAM RUN 18-009: MESA UNDERGROUND WATER CONSERVATION DISTRICT GROUNDWATER MANAGEMENT PLAN

Shirley C. Wade, Ph.D.,
P.G. Texas Water
Development Board
Groundwater
Division Groundwater Availability Modeling
Department
512-936-0883
May 25,
2018

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h) (Texas Water Code, 2015), states that, in developing its groundwater management plan, a groundwater conservation district 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.

The TWDB provides data and information to the Mesa Underground Water Conservation District in two parts. Part 1 is the Estimated Historical Water Use/State Water Plan dataset report, which will be provided to you separately by the TWDB Groundwater Technical Assistance Department. Please direct questions about the water data report to Mr. Stephen Allen at (512)463-7317 or stephen.allen@twdb.texas.gov. Part 2 is the required groundwater availability modeling information and this information includes:

1. the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;
2. 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
3. the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

The groundwater management plan for the Mesa Underground Water Conservation District should be adopted by the district on or before December 10, 2018, and submitted to the Executive Administrator of the TWDB on or before January 9, 2019.

The current management plan for the Mesa Underground Water Conservation District expires on March 10, 2019.

This model run, GAM Run 18-009, replaces the results of GAM Run 12-008 (Boghici, 2012). GAM Run 18-009 meets current standards set after GAM Run 12-008 was released and includes results from the newly released groundwater availability model for the High Plains Aquifer System (Deeds and Jigmond, 2015). Tables 1 and 2 summarize the groundwater availability model data required by statute and Figures 1 and 2 show the area of the model from which the values in the tables were extracted. If, after review of the figures, the Mesa Underground Water Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability model for the High Plains Aquifer System was used to estimate information for the Mesa Underground Water Conservation District management plan. Water budgets were extracted for the historical model period (1980 through 2012) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface-water outflow, inflow to the district, and outflow from the district for the aquifers within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

High Plains Aquifer System

- We used version 1.01 of the groundwater availability model for the High Plains Aquifer System for this analysis. See Deeds and Jigmond (2015) for assumptions and limitations of the model.
- The model has four layers which, in the area under the Mesa Underground Water Conservation District, represent the Ogallala Aquifer (Layer 1), the Edwards-Trinity (High Plains) Aquifer (Layer 2), and the Dockum Units (Layers 3 and 4). Within the Mesa Underground Water Conservation District, the Dockum units are not designated as part of the Dockum Aquifer.
- Water budgets for the district were determined for the Ogallala Aquifer (Layer 1) and the Edwards-Trinity (High Plains) Aquifer.
- The model was run with MODFLOW-NWT (Niswonger and others, 2011).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifers according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the groundwater availability model results for the Ogallala and Edwards-Trinity (High Plains) aquifers located within Mesa Underground Water Conservation District and averaged over the historical calibration periods, as shown in Tables 1 through 2.

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

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

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

4. Flow between aquifers—the net vertical flow between the aquifer and adjacent aquifers or confining units. This flow is controlled by the relative water levels in each aquifer and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs.

The information needed for the district's management plan is summarized in Tables 1 and 2. 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 a district or county boundary, 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.

TABLE 1. SUMMARIZED INFORMATION FOR THE OGALLALA AQUIFER FOR MESA UNDERGROUND WATER 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	Ogallala Aquifer	54,289
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Ogallala Aquifer	1,478
Estimated annual volume of flow into the district within each aquifer in the district	Ogallala Aquifer	2,288
Estimated annual volume of flow out of the district within each aquifer in the district	Ogallala Aquifer	5,161
Estimated net annual volume of flow between each aquifer in the district	Flow from the Ogallala Aquifer into the Edwards-Trinity (High Plains) Aquifer	1,446
	Flow into the Ogallala Aquifer from underlying Dockum units	478

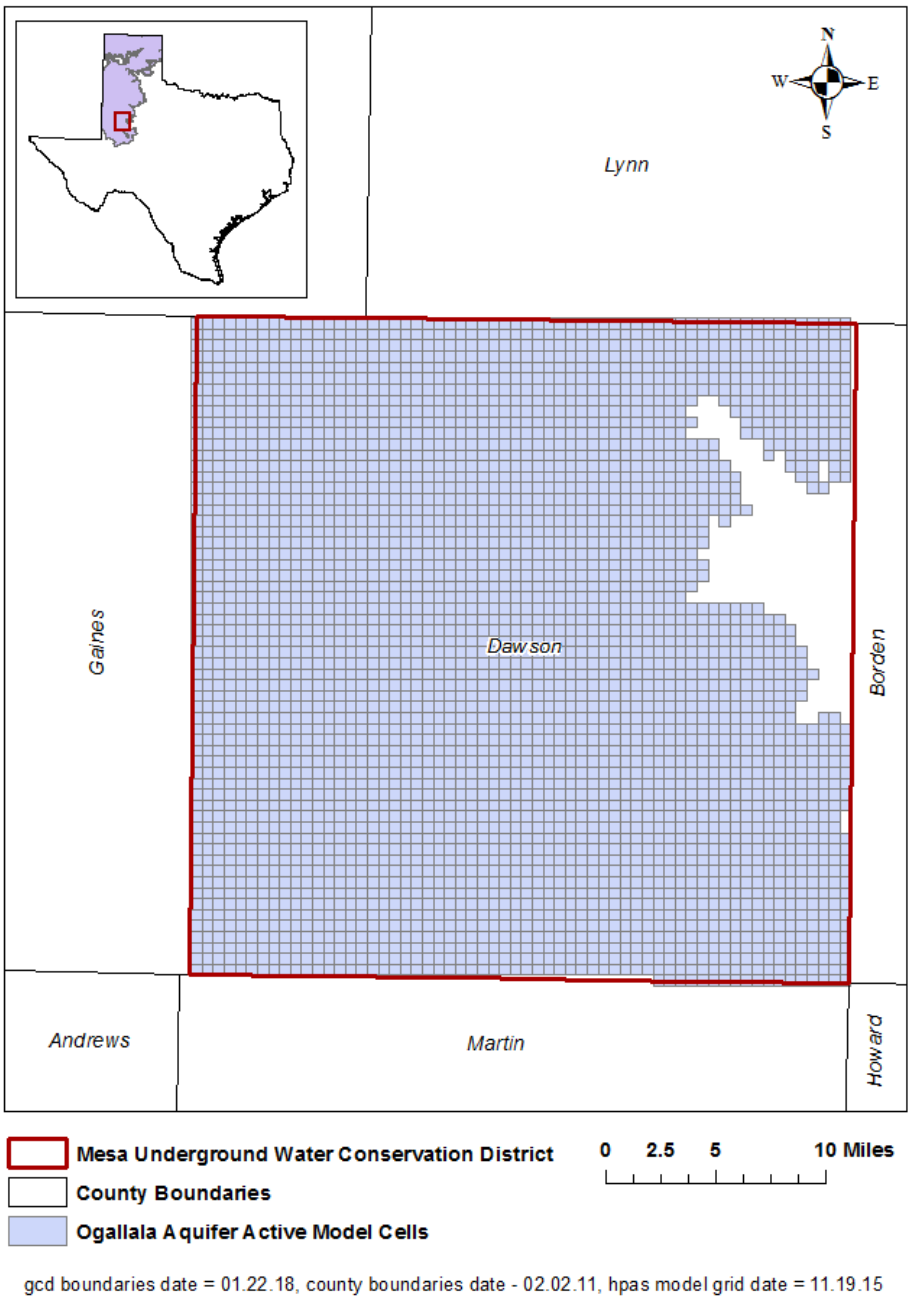

FIGURE 1. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE HIGH PLAINS AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE OGALLALA AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2. SUMMARIZED INFORMATION FOR THE EDWARDS-TRINITY (HIGH PLAINS) AQUIFER FOR MESA UNDERGROUND WATER 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 (High Plains) Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Edwards-Trinity (High Plains) Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Edwards-Trinity (High Plains) Aquifer	1,769
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards-Trinity (High Plains) Aquifer	909
Estimated net annual volume of flow between each aquifer in the district	Flow into the Edwards-Trinity (High Plains) Aquifer from the Ogallala Aquifer	1,446
	Flow from the Edwards-Trinity (High Plains) Aquifer into underlying Dockum units	4

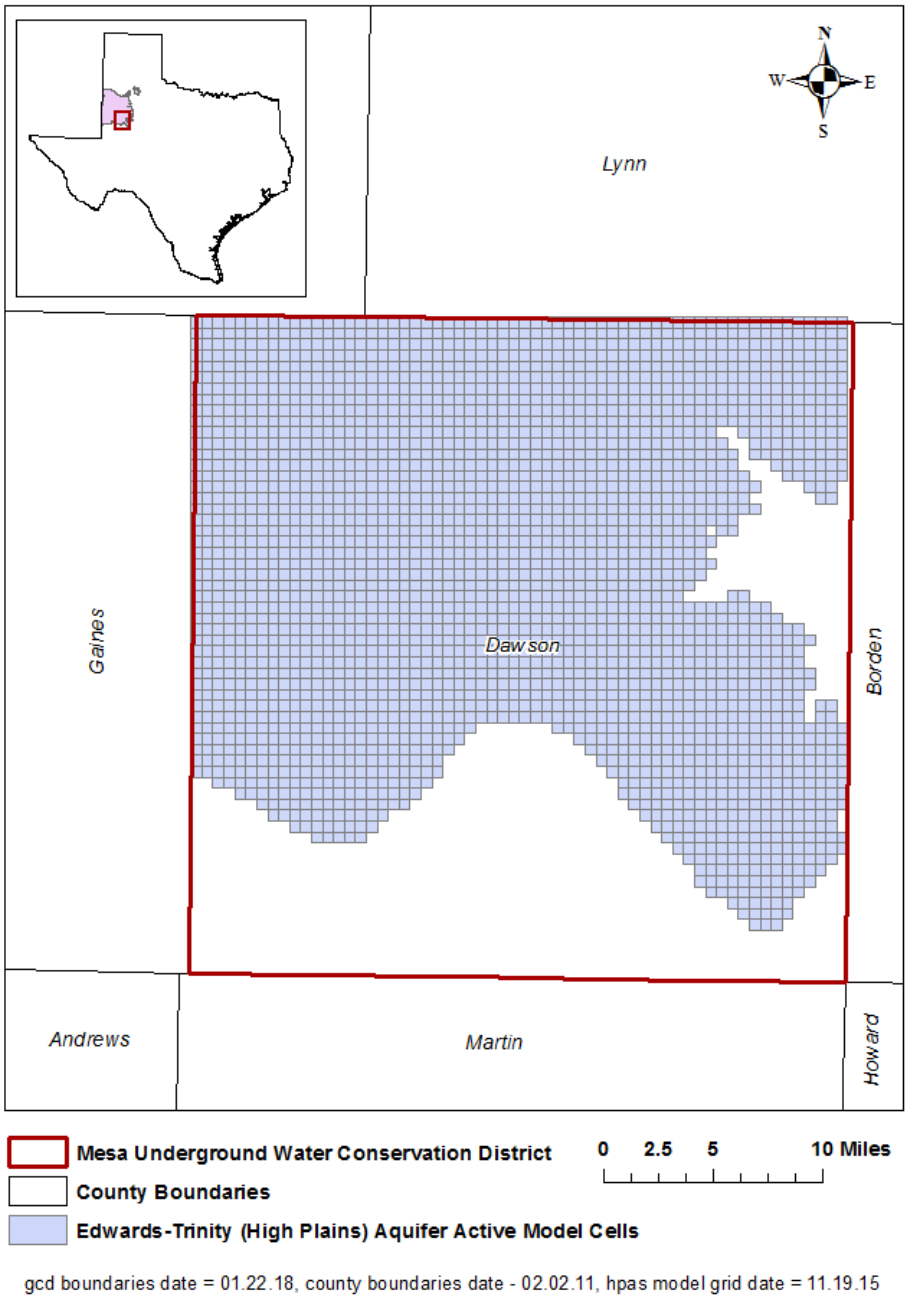

FIGURE 2. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE HIGH PLAINS AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE EDWARDS- TRINITY (HIGH PLAINS) AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

LIMITATIONS:

The groundwater models used in completing this analysis are the best available scientific tools that can be used to meet the stated objectives. 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 historical groundwater flow conditions includes the assumptions about the location in the aquifer where historical pumping was placed. Understanding the amount and location of historical 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 interaction with streams are specific to particular historical time periods.

Because the application of the groundwater models was designed to address regional-scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations related 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. Historical 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.

REFERENCES:

Deeds, N. E. and Jigmond, M., 2015, Numerical Model Report for the High Plains Aquifer System Groundwater Availability Model, 640 p. http://www.twdb.texas.gov/groundwater/models/gam/hpas/HPAS_GAM_Numerical_Report.pdf

Harbaugh, A. W., 2009, Zonebudget Version 3.01, A computer program for computing subregional water budgets for MODFLOW ground-water flow models: U.S. Geological Survey Groundwater Software.

National Research Council, 2007, Models in Environmental Regulatory Decision Making Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p., http://www.nap.edu/catalog.php?record_id=11972.

Niswonger, R. G., Panday, S., and Ibaraki, M., 2011, MODFLOW-NWT, A Newtonian formulation for MODFLOW-2005: U.S. Geological Survey Survey Techniques and Methods 6-A37, 44 p.

Boghici, R., 2012, GAM Run 12-008: Mesa Underground Water Conservation District Management Plan, 10 p., http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR12-008.pdf

Texas Water Code, 2015, http://www.statutes.legis.state.tx.us/docs/WA/pdf/WA.36.pdf.

Appendix B Estimated Historical Water Use And 2017 State Water Plan Datasets

Estimated Historical Water Use And 2017 State Water Plan Datasets:

Mesa Underground Water Conservation District

by Stephen Allen
Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Section
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November 26, 2018

GROUNDWATER MANAGEMENT PLAN DATA:

This package of water data reports (part 1 of a 2-part package of information) is being provided to groundwater conservation districts to help them meet the requirements for approval of their five-year groundwater management plan. Each report in the package addresses a specific numbered requirement in the Texas Water Development Board's groundwater management plan checklist. The checklist can be viewed and downloaded from this web address:

http://www.twdb.texas.gov/groundwater/docs/GCD/GMPChecklist0113.pdf

The five reports included in this part are:

1. Estimated Historical Water Use (checklist item 2)

   from the TWDB Historical Water Use Survey (WUS)
2. Projected Surface Water Supplies (checklist item 6)
3. Projected Water Demands (checklist item 7)
4. Projected Water Supply Needs (checklist item 8)
5. Projected Water Management Strategies (checklist item 9)

   from the 2017 Texas State Water Plan (SWP)

Part 2 of the 2-part package is the groundwater availability model (GAM) report for the District (checklist items 3 through 5). The District should have received, or will receive, this report from the Groundwater Availability Modeling Section. Questions about the GAM can be directed to Dr. Shirley Wade, shirley.wade@twdb.texas.gov, (512) 936-0883.

DISCLAIMER:

The data presented in this report represents the most up-to-date WUS and 2017 SWP data available as of 11/26/2018. Although it does not happen frequently, either of these datasets are subject to change pending the availability of more accurate WUS data or an amendment to the 2017 SWP. District personnel must review these datasets and correct any discrepancies in order to ensure approval of their groundwater management plan.

The WUS dataset can be verified at this web address:

http://www.twdb.texas.gov/waterplanning/waterusesurvey/estimates/

The 2017 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

For additional questions regarding this data, please contact Stephen Allen (stephen.allen@twdb.texas.gov or 512-463-7317).

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

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2017. TWDB staff anticipates the calculation and posting of these estimates at a later date.

DAWSON COUNTY

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2016	GW	785	0	53	0	64,174	44	65,056
	SW	1,196	0	0	0	0	5	1,201
2015	GW	909	0	164	0	53,360	43	54,476
	SW	1,113	0	0	0	561	5	1,679
2014	GW	2,158	0	232	0	66,926	43	69,359
	SW	63	0	0	0	0	5	68
2013	GW	2,516	0	194	0	118,586	57	121,353
	SW	15	0	0	0	0	6	21
2012	GW	1,524	0	179	0	105,759	155	107,617
	SW	1,119	0	0	0	0	17	1,136
2011	GW	1,286	0	202	0	158,441	210	160,139
	SW	1,615	0	43	0	0	23	1,681
2010	GW	795	0	188	0	78,974	197	80,154
	SW	1,685	0	39	0	0	22	1,746
2009	GW	812	0	218	0	130,073	159	131,262
	SW	1,734	0	46	0	0	18	1,798
2008	GW	2,173	0	248	0	135,659	174	138,254
	SW	1,551	0	54	0	0	19	1,624
2007	GW	2,263	0	46	0	67,736	98	70,143
	SW	1,591	0	0	0	0	11	1,602
2006	GW	2,257	0	45	0	126,144	98	128,544
	SW	1,591	0	0	0	855	11	2,457
2005	GW	1,612	0	36	0	102,037	83	103,768
	SW	1,160	0	0	0	1,065	9	2,234
2004	GW	1,015	0	31	0	101,796	71	102,913
	SW	816	0	0	0	1,008	21	1,845
2003	GW	977	0	34	0	125,572	73	126,656
	SW	2,324	0	0	0	1,094	22	3,440
2002	GW	1,104	0	21	0	133,731	91	134,947
	SW	2,222	10	0	0	0	27	2,259
2001	GW	1,350	0	25	0	141,495	94	142,964
	SW	2,073	45	0	0	0	29	2,147

Projected Surface Water Supplies
TWDB 2017 State Water Plan Data

DAWSON COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
O	LIVESTOCK, DAWSON	BRAZOS	BRAZOS LIVESTOCK LOCAL SUPPLY	0	0	0	0	0	0
O	LIVESTOCK, DAWSON	COLORADO	COLORADO LIVESTOCK LOCAL SUPPLY	0	0	0	0	0	0
	Sum of Projected Surface Water Supplies (acre-feet)			**0**	**0**	**0**	**0**	**0**	**0**

Projected Water Demands
TWDB 2017 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.

DAWSON COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
O	COUNTY-OTHER, DAWSON	BRAZOS	5	5	5	4	5	5
O	COUNTY-OTHER, DAWSON	COLORADO	583	610	633	649	685	716
O	IRRIGATION, DAWSON	BRAZOS	1,066	1,006	949	896	845	803
O	IRRIGATION, DAWSON	COLORADO	105,564	99,613	93,996	88,698	83,699	79,483
O	LAMESA	COLORADO	2,275	2,303	2,314	2,319	2,382	2,425
O	LIVESTOCK, DAWSON	BRAZOS	2	2	2	2	2	2
O	LIVESTOCK, DAWSON	COLORADO	137	141	145	149	153	157
O	MANUFACTURING, DAWSON	COLORADO	129	137	144	150	162	175
O	MINING, DAWSON	COLORADO	954	1,164	1,023	703	423	255
O	O'DONNELL	BRAZOS	18	18	19	19	20	20
	Sum of Projected Water Demands (acre-feet)		**110,733**	**104,999**	**99,230**	**93,589**	**88,376**	**84,041**

Projected Water Supply Needs
TWDB 2017 State Water Plan Data

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

DAWSON COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
O	COUNTY-OTHER, DAWSON	BRAZOS	10	10	10	11	10	10
O	COUNTY-OTHER, DAWSON	COLORADO	35	12	-20	-56	-114	-149
O	IRRIGATION, DAWSON	BRAZOS	34	94	51	4	5	-356
O	IRRIGATION, DAWSON	COLORADO	1,539	1,490	1,107	1,405	1,404	-3,793
O	LAMESA	COLORADO	-264	-762	-785	-806	-1,018	-1,220
O	LIVESTOCK, DAWSON	BRAZOS	-2	-2	-2	-2	-2	-2
O	LIVESTOCK, DAWSON	COLORADO	12	13	9	10	11	2
O	MANUFACTURING, DAWSON	COLORADO	0	0	0	0	0	-7
O	MINING, DAWSON	COLORADO	-175	-709	-828	-703	-423	-255
O	O'DONNELL	BRAZOS	10	-7	-8	-10	-11	-12
	Sum of Projected Water Supply Needs (acre-feet)		**-441**	**-1,480**	**-1,643**	**-1,577**	**-1,568**	**-5,794**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

DAWSON COUNTY

WUG, Basin (RWPG)

All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
COUNTY-OTHER, DAWSON, COLORADO (O)							
DAWSON COUNTY-OTHER LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [DAWSON]	0	0	150	150	150	150
		0	**0**	**150**	**150**	**150**	**150**
IRRIGATION, DAWSON, BRAZOS (O)							
DAWSON COUNTY IRRIGATION WATER CONSERVATION	DEMAND REDUCTION [DAWSON]	54	54	96	96	129	129
		54	**54**	**96**	**96**	**129**	**129**
IRRIGATION, DAWSON, COLORADO (O)							
DAWSON COUNTY IRRIGATION WATER CONSERVATION	DEMAND REDUCTION [DAWSON]	5,356	5,356	9,514	9,514	12,764	12,764
		5,356	**5,356**	**9,514**	**9,514**	**12,764**	**12,764**
LAMESA, COLORADO (O)							
CONJUNCTIVE USE - CRMWA	MEREDITH LAKE/RESERVOIR [RESERVOIR]	153	179	202	226	226	226
DAWSON COUNTY - LAMESA MUNICIPAL WATER CONSERVATION	DEMAND REDUCTION [DAWSON]	114	115	116	116	119	121
EXPAND CAPACITY CRMWA II	OGALLALA AQUIFER [ROBERTS]	0	860	967	1,087	1,086	1,085
REPLACE WELL CAPACITY FOR CRMWA I	OGALLALA AQUIFER [ROBERTS]	0	161	262	430	520	633
		267	**1,315**	**1,547**	**1,859**	**1,951**	**2,065**
O'DONNELL, BRAZOS (O)							
CONJUNCTIVE USE - CRMWA	MEREDITH LAKE/RESERVOIR [RESERVOIR]	2	2	2	2	2	2
EXPAND CAPACITY CRMWA II	OGALLALA AQUIFER [ROBERTS]	0	9	9	9	9	9
REPLACE WELL CAPACITY FOR CRMWA I	OGALLALA AQUIFER [ROBERTS]	0	2	2	4	4	5
		2	**13**	**13**	**15**	**15**	**16**
Sum of Projected Water Management Strategies (acre-feet)		**5,679**	**6,738**	**11,320**	**11,634**	**15,009**	**15,124**

Appendix C GMA 2 MAG Report

Groundwater Management Area 2 – Modeled Available Groundwater

Groundwater Conservation District	County	Aquifer	Modeled Available Groundwater							TWDB Report
			2012	2020	2030	2040	2050	2060	2070	
Garza County UWCD	Garza	Ogallala and Edwards-Trinity (High Plains)	14,932	16,297	13,648	12,395	11,657	11,180	10,855	GR16-028 MAG
High Plains UWCD No.1	Bailey	Ogallala and Edwards-Trinity (High Plains)	79,604	97,679	67,307	51,199	42,704	37,858	34,815	GR16-028 MAG
High Plains UWCD No.1	Castro	Ogallala and Edwards-Trinity (High Plains)	200,692	261,434	181,190	102,732	55,811	35,734	26,291	GR16-028 MAG
High Plains UWCD No.1	Cochran	Ogallala and Edwards-Trinity (High Plains)	67,032	101,762	79,152	64,503	55,408	47,858	42,674	GR16-028 MAG
High Plains UWCD No.1	Crosby	Ogallala and Edwards-Trinity (High Plains)	124,336	163,188	108,662	68,885	46,778	35,651	29,619	GR16-028 MAG
High Plains UWCD No.1	Deaf Smith	Ogallala and Edwards-Trinity (High Plains)	148,161	182,988	118,471	74,107	51,551	40,042	33,785	GR16-028 MAG
High Plains UWCD No.1	Floyd	Ogallala and Edwards-Trinity (High Plains)	124,867	170,451	94,139	67,802	54,090	46,197	41,537	GR16-028 MAG
High Plains UWCD No.1	Hale	Ogallala and Edwards-Trinity (High Plains)	283,391	220,111	114,928	70,663	48,719	37,740	31,954	GR16-028 MAG
High Plains UWCD No.1	Hockley	Ogallala and Edwards-Trinity (High Plains)	132,145	154,091	96,609	71,741	60,822	55,285	52,185	GR16-028 MAG
High Plains UWCD No.1	Lamb	Ogallala and Edwards-Trinity (High Plains)	244,726	223,477	112,082	71,220	56,582	50,140	46,816	GR16-028 MAG
High Plains UWCD No.1	Lubbock	Ogallala and Edwards-Trinity (High Plains)	131,793	151,056	121,404	109,134	100,850	94,935	90,798	GR16-028 MAG
High Plains UWCD No.1	Lynn	Ogallala and Edwards-Trinity (High Plains)	81,678	112,607	96,151	85,494	78,603	74,349	71,640	GR16-028 MAG
High Plains UWCD No.1	Parmer	Ogallala and Edwards-Trinity (High Plains)	150,001	152,014	91,098	59,259	43,737	35,469	30,537	GR16-028 MAG

Groundwater Management Area 2 – Modeled Available Groundwater

Groundwater Conservation District	County	Aquifer	Modeled Available Groundwater							TWDB Report
			2012	2020	2030	2040	2050	2060	2070	
High Plains UWCD No.1	Swisher	Ogallala and Edwards-Trinity (High Plains)	119,658	129,283	71,638	46,284	33,912	27,019	22,783	GR16-028 MAG
Llano Estacado UWCD	Gaines	Ogallala and Edwards-Trinity (High Plains)	266,072	277,954	218,338	184,298	162,643	147,743	138,294	GR16-028 MAG
Mesa UWCD	Dawson	Ogallala and Edwards-Trinity (High Plains)	122,802	172,851	123,476	96,796	82,283	74,610	69,928	GR16-028 MAG
Permian Basin UWCD	Howard	Ogallala and Edwards-Trinity (High Plains)	12,428	19,285	16,865	15,737	15,105	14,738	14,513	GR16-028 MAG
Permian Basin UWCD	Martin	Ogallala and Edwards-Trinity (High Plains)	41,993	63,463	51,126	43,861	39,793	37,210	35,425	GR16-028 MAG
Sandy Land UWCD	Yoakum	Ogallala and Edwards-Trinity (High Plains)	131,815	138,940	92,952	69,400	58,308	52,469	48,940	GR16-028 MAG
South Plains UWCD	Hockley	Ogallala and Edwards-Trinity (High Plains)	3,527	4,895	2,213	726	389	283	240	GR16-028 MAG
South Plains UWCD	Terry	Ogallala and Edwards-Trinity (High Plains)	205,507	190,768	132,777	105,892	94,696	88,883	85,518	GR16-028 MAG
No District-County	Andrews	Ogallala and Edwards-Trinity (High Plains)	19,037	24,937	21,375	19,795	18,774	18,040	17,474	GR16-028 MAG
No District-County	Borden	Ogallala and Edwards-Trinity (High Plains)	5,025	5,922	4,639	4,069	3,737	3,421	3,212	GR16-028 MAG
No District-County	Briscoe	Ogallala and Edwards-Trinity (High Plains)	27,107	29,022	17,637	11,907	9,053	7,445	6,451	GR16-028 MAG
No District-County	Castro	Ogallala and Edwards-Trinity (High Plains)	3,159	5,859	3,280	2,367	1,814	1,452	1,214	GR16-028 MAG
No District-County	Crosby	Ogallala and Edwards-Trinity (High Plains)	1,691	3,135	2,918	2,292	1,959	1,783	1,671	GR16-028 MAG

Groundwater Management Area 2 – Modeled Available Groundwater

Groundwater Conservation District	County	Aquifer	Modeled Available Groundwater							TWDB Report
			2012	2020	2030	2040	2050	2060	2070	
No District-County	Deaf Smith	Ogallala and Edwards-Trinity (High Plains)	16,585	23,348	18,932	15,981	14,110	12,791	11,821	GR16-028 MAG
No District-County	Hockley	Ogallala and Edwards-Trinity (High Plains)	10,604	18,445	13,065	5,303	2,577	1,618	1,185	GR16-028 MAG
No District-County	Howard	Ogallala and Edwards-Trinity (High Plains)	352	550	527	526	534	543	553	GR16-028 MAG
Garza County UWCD	Garza	Dockum	191	911	911	911	911	911	911	GR16-028 MAG
High Plains UWCD No.1	Bailey	Dockum	7	833	833	833	833	833	833	GR16-028 MAG
High Plains UWCD No.1	Castro	Dockum	323	425	425	425	425	425	425	GR16-028 MAG
High Plains UWCD No.1	Cochran	Dockum	0	972	972	972	972	972	972	GR16-028 MAG
High Plains UWCD No.1	Crosby	Dockum	2,883	3,787	3,787	3,787	3,787	3,787	3,787	GR16-028 MAG
High Plains UWCD No.1	Deaf Smith	Dockum	2,134	4,395	4,395	4,395	4,395	4,395	4,395	GR16-028 MAG
High Plains UWCD No.1	Floyd	Dockum	2,456	3,226	3,226	3,226	3,226	3,226	3,226	GR16-028 MAG
High Plains UWCD No.1	Hale	Dockum	135	1,121	1,121	1,121	1,121	1,121	1,121	GR16-028 MAG
High Plains UWCD No.1	Hockley	Dockum	28	973	973	973	973	973	973	GR16-028 MAG
High Plains UWCD No.1	Lamb	Dockum	4	923	923	923	923	923	923	GR16-028 MAG
High Plains UWCD No.1	Lubbock	Dockum	3	1,086	1,086	1,086	1,086	1,086	1,086	GR16-028 MAG
High Plains UWCD No.1	Lynn	Dockum	81	912	912	912	912	912	912	GR16-028 MAG
High Plains UWCD No.1	Parmer	Dockum	0	5,450	5,450	5,450	5,450	4,689	4,589	GR16-028 MAG
High Plains UWCD No.1	Swisher	Dockum	1,200	1,576	1,576	1,576	1,576	1,576	1,576	GR16-028 MAG

Groundwater Management Area 2 – Modeled Available Groundwater

Groundwater Conservation District	County	Aquifer	Modeled Available Groundwater							TWDB Report
			2012	2020	2030	2040	2050	2060	2070	
Permian Basin UWCD	Howard	Dockum	737	1,471	1,471	1,471	1,471	1,471	1,471	GR16-028 MAG
Permian Basin UWCD	Martin	Dockum	6	8	8	8	8	8	8	GR16-028 MAG
No District-County	Andrews	Dockum	4	1,319	1,319	1,319	1,319	1,319	1,319	GR16-028 MAG
No District-County	Borden	Dockum	114	900	900	900	900	900	900	GR16-028 MAG
No District-County	Crosby	Dockum	54	71	71	71	71	71	71	GR16-028 MAG
No District-County	Deaf Smith	Dockum	27	6	6	6	6	6	6	GR16-028 MAG
No District-County	Hockley	Dockum	0	83	83	83	83	83	83	GR16-028 MAG
No District-County	Howard	Dockum	1	118	118	118	118	118	118	GR16-028 MAG
Totals										
Garza County UWCD Total		Ogallala and Edwards-Trinity (High Plains)	14,932	16,297	13,648	12,395	11,657	11,180	10,855	GR16-028 MAG
High Plains UWCD No.1 Total		Ogallala and Edwards-Trinity (High Plains)	1,888,087	2,120,141	1,352,831	943,023	729,567	618,277	555,434	GR16-028 MAG
Llano Estacado UWCD Total		Ogallala and Edwards-Trinity (High Plains)	266,072	277,954	218,338	184,298	162,643	147,743	138,294	GR16-028 MAG
Mesa UWCD Total		Ogallala and Edwards-Trinity (High Plains)	122,802	172,851	123,476	96,796	82,283	74,610	69,928	GR16-028 MAG
Permian Basin UWCD Total		Ogallala and Edwards-Trinity (High Plains)	54,421	82,748	67,991	59,598	54,898	51,948	49,938	GR16-028 MAG
Sandy Land UWCD Total		Ogallala and Edwards-Trinity (High Plains)	131,815	138,940	92,952	69,400	58,308	52,469	48,940	GR16-028 MAG
South Plains UWCD Total		Ogallala and Edwards-Trinity (High Plains)	209,034	195,663	134,990	106,618	95,085	89,166	85,758	GR16-028 MAG

Groundwater Management Area 2 – Modeled Available Groundwater

Groundwater Conservation District	County	Aquifer	Modeled Available Groundwater							TWDB Report
			2012	2020	2030	2040	2050	2060	2070	
No District-County Total		Ogallala and Edwards-Trinity (High Plains)	83,560	111,218	82,373	62,240	52,558	47,093	43,581	GR16-028 MAG
Garza County UWCD Total		Dockum	191	911	911	911	911	911	911	GR16-028 MAG
High Plains UWCD No. 1 Total		Dockum	9,255	25,679	25,679	25,679	25,679	24,918	24,818	GR16-028 MAG
Permian Basin UWCD Total		Dockum	743	1,479	1,479	1,479	1,479	1,479	1,479	GR16-028 MAG
No District-County Total		Dockum	200	2,497	2,497	2,497	2,497	2,497	2,497	GR16-028 MAG
GMA 2 Total		Ogallala and Edwards-Trinity (High Plains)	2,770,723	3,115,812	2,086,599	1,534,368	1,246,999	1,092,486	1,002,728	GR16-028 MAG
GMA 2 Total		Dockum	10,389	30,566	30,566	30,566	30,566	29,805	29,705	GR16-028 MAG
GMA 2			**2,781,112**	**3,146,378**	**2,117,165**	**1,564,934**	**1,277,565**	**1,122,291**	**1,032,433**	**GR16-028 MAG**