HPWD
Management Plan
2014-2024

Contents

Section 1—Introduction

District Mission

As defined in statute, the purpose of groundwater conservation districts in Texas is to provide for the conservation, preservation, and protection of the groundwater resources within their jurisdictional boundaries. Therefore, it is the mission of the High Plains Underground Water Conservation District No. 1 (The District) to provide for the conservation, preservation, and protection of groundwater resources within the jurisdictional boundaries of the District, in order to make every effort to ensure that an abundant and high quality supply of groundwater will be available for future water users.

Guiding Principles/Groundwater Management Planning

The District was formed, and is operated, with the guiding belief that the ownership and production of groundwater is a private property right. It is understood that, without the District, there is no protection of private property rights.

In developing its management plan, the Board of Directors of the District considers historical groundwater use, water demand projections, current and projected water supply availability, and water supply needs to establish its policies. Rules promulgated by the Board of Directors are carefully considered and are adopted only after considerable public input. The rules provide a fair and equal opportunity for all users to produce groundwater for beneficial purposes, while at the same time meeting the goals of the District. The Board of Directors also establishes the processes by which the District will monitor changes in supply and demand, which affect the near- and long-term viability of the aquifers.

Additionally, the Board realizes that the aquifers extend beyond the District's boundaries, and the sharing of information, programs and ideas with neighboring districts is important. As a result, the District will consider the joint administration of certain programs when appropriate.

This document is a dynamic management plan meant to be reviewed, evaluated and revised as necessary to ensure that the District's goals are being met. As conditions change, the Board of Directors will re-evaluate its policies and rules. Recent changes in Texas law related to groundwater management clearly illustrate the need to routinely review, evaluate, and revise district management plans and rules in order to meet new requirements and changed conditions. The goals, management objectives, and performance standards set forth in this document are considered by the Board of Directors to be reasonable and prudent. Whenever the Board of Directors determines that a change is needed, they will act accordingly after careful consideration of all the facts, and after receiving public input. The following guidelines are used to determine if the management objectives are set at a sufficient level to be realistic and effective:

- The duly elected Board will guide and direct the staff and measure the achievement of the goals established in this document.
- The Board will maintain local control of the privately owned resource over which the District has jurisdictional authority, as provided by Chapter 36, Texas Water Code.

- The Board will evaluate District activities on a fiscal year basis. The District's fiscal year is October 1-September 30.

Section 2—History and Description of the HPWD

District Creation, Location and Extent

The Texas State Board of Water Engineers delineated the original boundaries of the High Plains Underground Water Conservation District No. 1 (the District) in March 1951. Later that year, voters in 13 Southern High Plains counties created the district in accordance with the Underground Water Conservation Districts Act passed by the Texas Legislature in 1949. After several annexation elections, the district now consists of Bailey, Cochran, Hale, Lamb, Lubbock, Lynn, Parmer and Swisher counties, and portions of Armstrong, Castro, Crosby, Deaf Smith, Floyd, Hockley, Potter and Randall counties (see Figure 1). The district's jurisdictional area now consists of approximately 11,850 square miles or 7,584,000 acres.

The District is represented by a five member elected board of directors. The directors represent precincts, which are comprised of multiple counties. Table 1 lists the current Board of Directors and the officer designation of each.

Table 1: Board of Directors of the High Plains Underground Water Conservation District No. 1

Office	Name	Precinct	Whole Counties	Partial Counties
President	Lynn Tate	4		Armstrong, Deaf Smith, Potter and Randall
Vice-President	James Powell	1	Lubbock and Lynn	Crosby
Secretary	Mike Beauchamp	3	Bailey and Parmer	Castro
Member	Brad Heffington	2	Lamb	Cochran and Hockley
Member	Ronnie Hopper	5	Hale and Swisher	Floyd

Other groundwater conservation districts (GCDs) that border HPWD include Garza UWCD, Mesa UWCD, Panhandle GCD, Sandy Land UWCD, and South Plains UWCD. HPWD boundaries also overlie several other administrative boundaries. HPWD counties Armstrong, Potter and Randall are in the Region A Water Planning area, as well as Groundwater Management Area #1. The remaining counties of the HPWD are in Region O Water Planning Area and Groundwater Management Area #2. Figures 2-4 illustrate these boundaries.

Figure 1: HPWD Boundary and Precincts

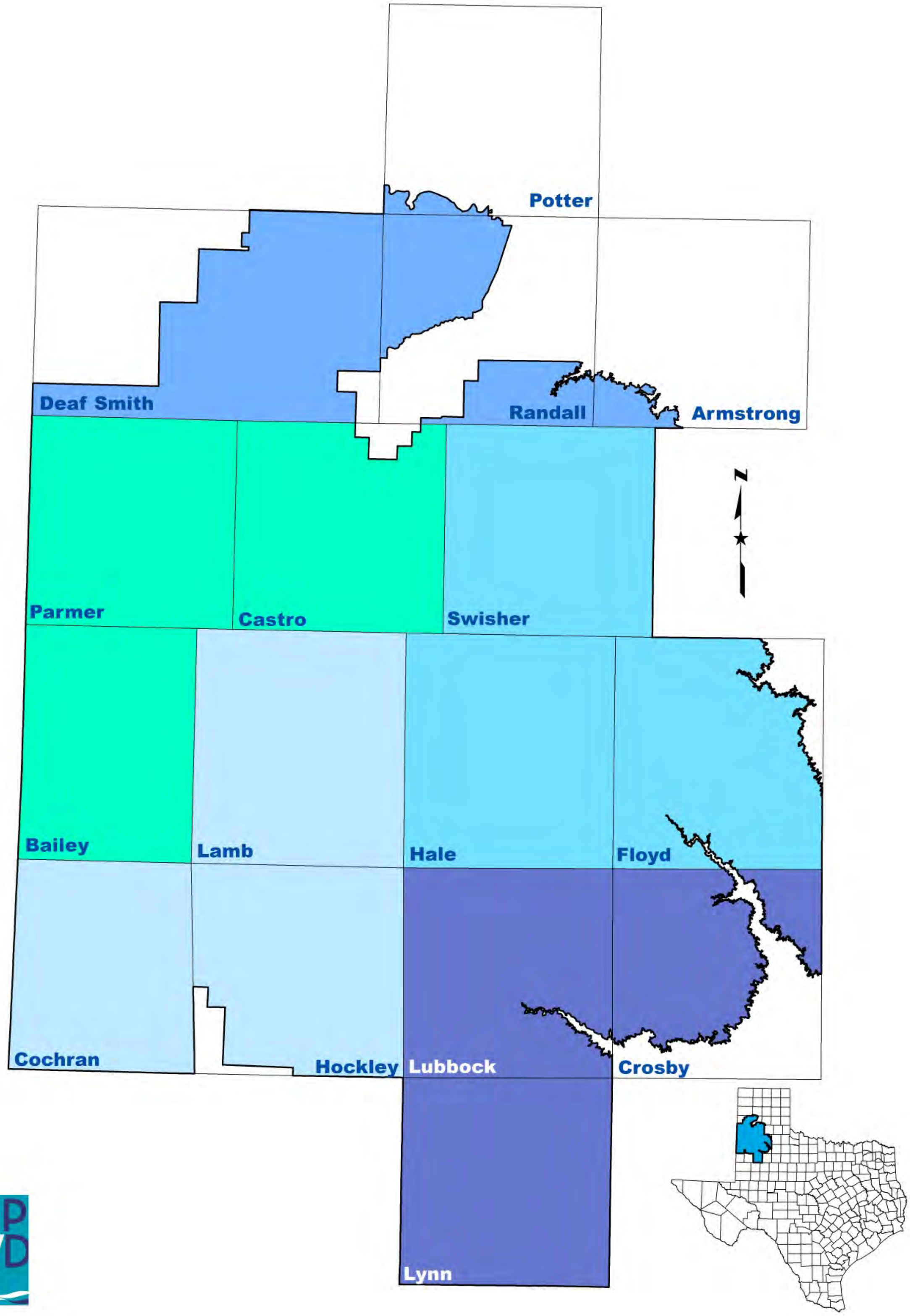


Figure 2: Locations of GMAs and GCDs

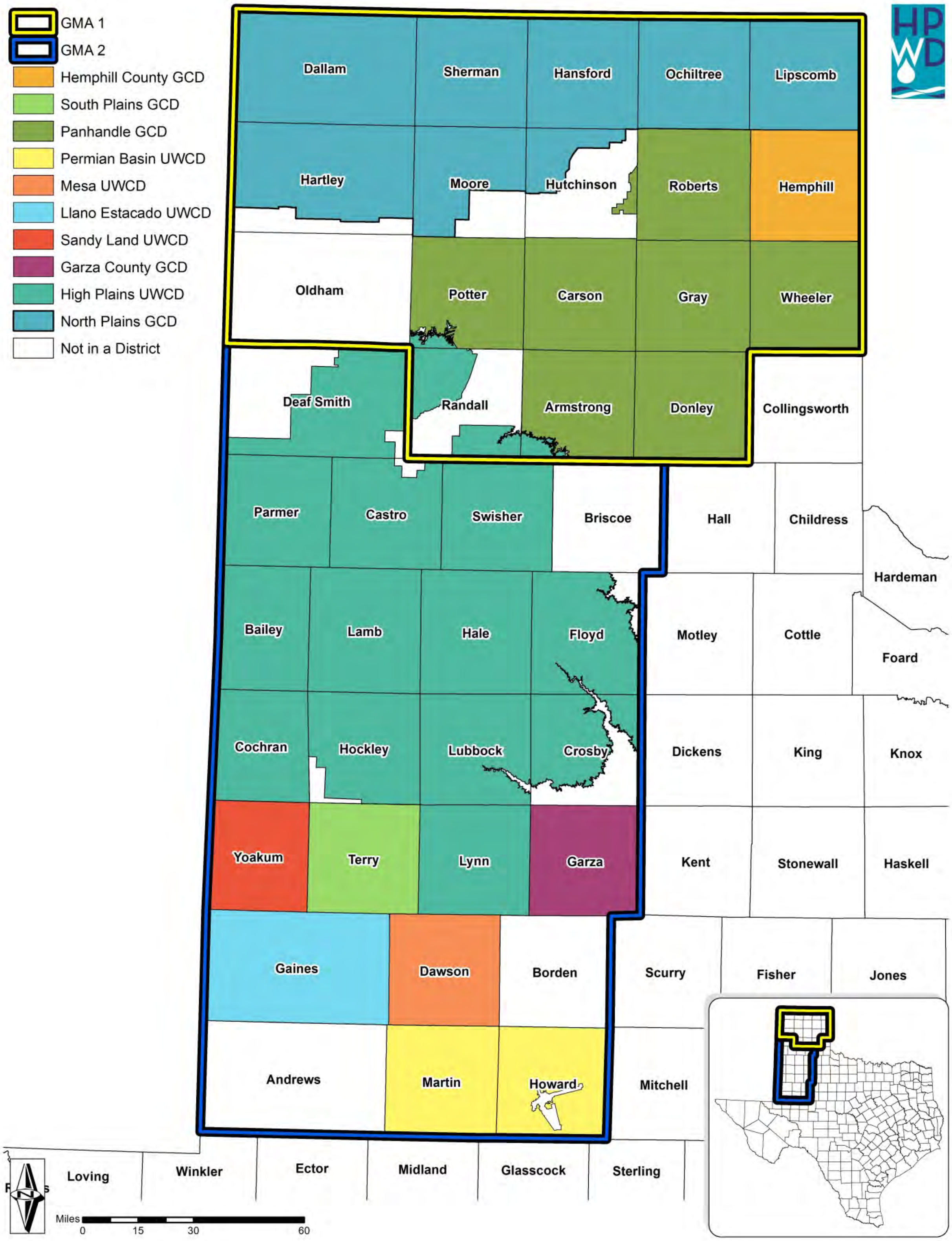


Figure 3: Boundaries of Regional Water Planning Areas

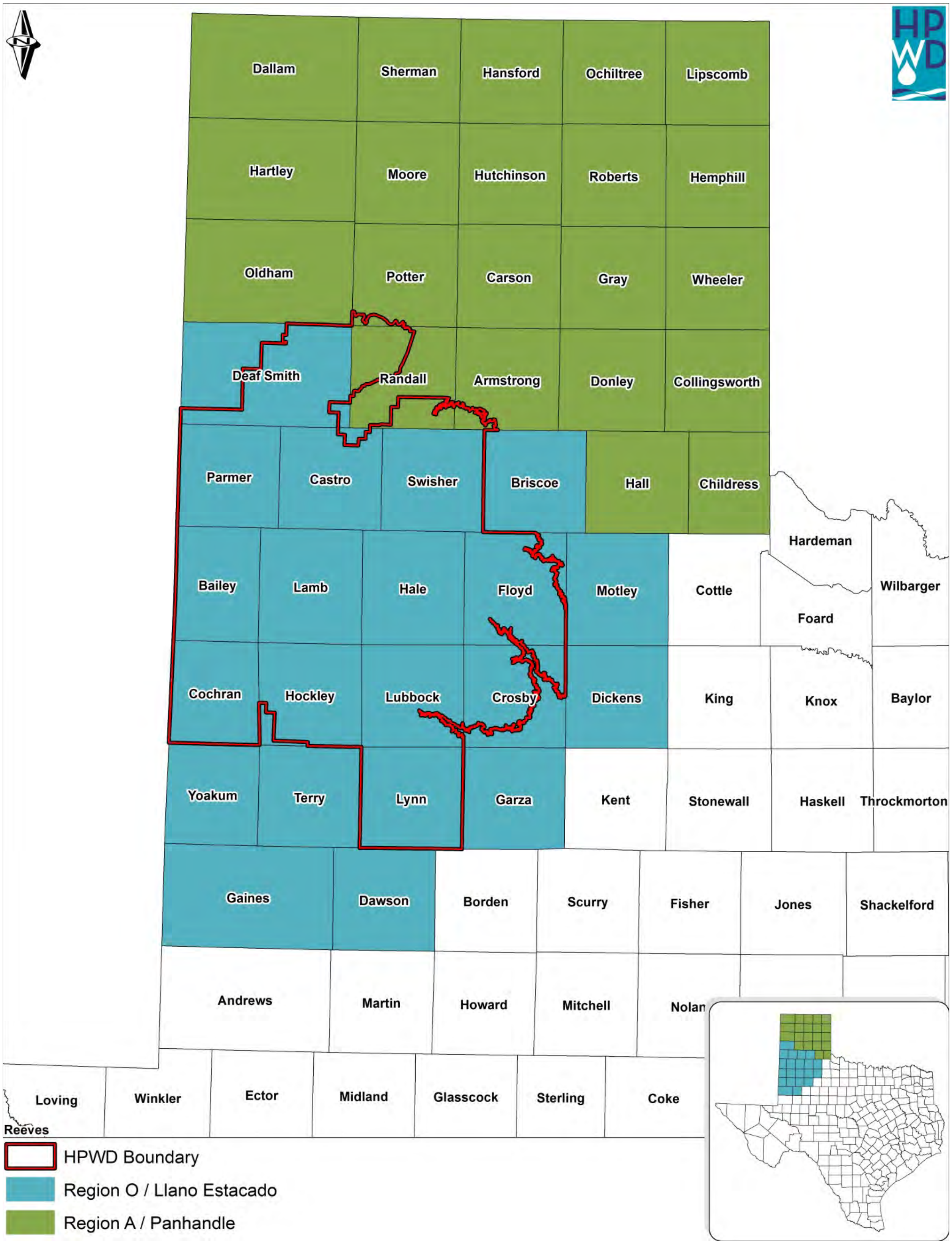
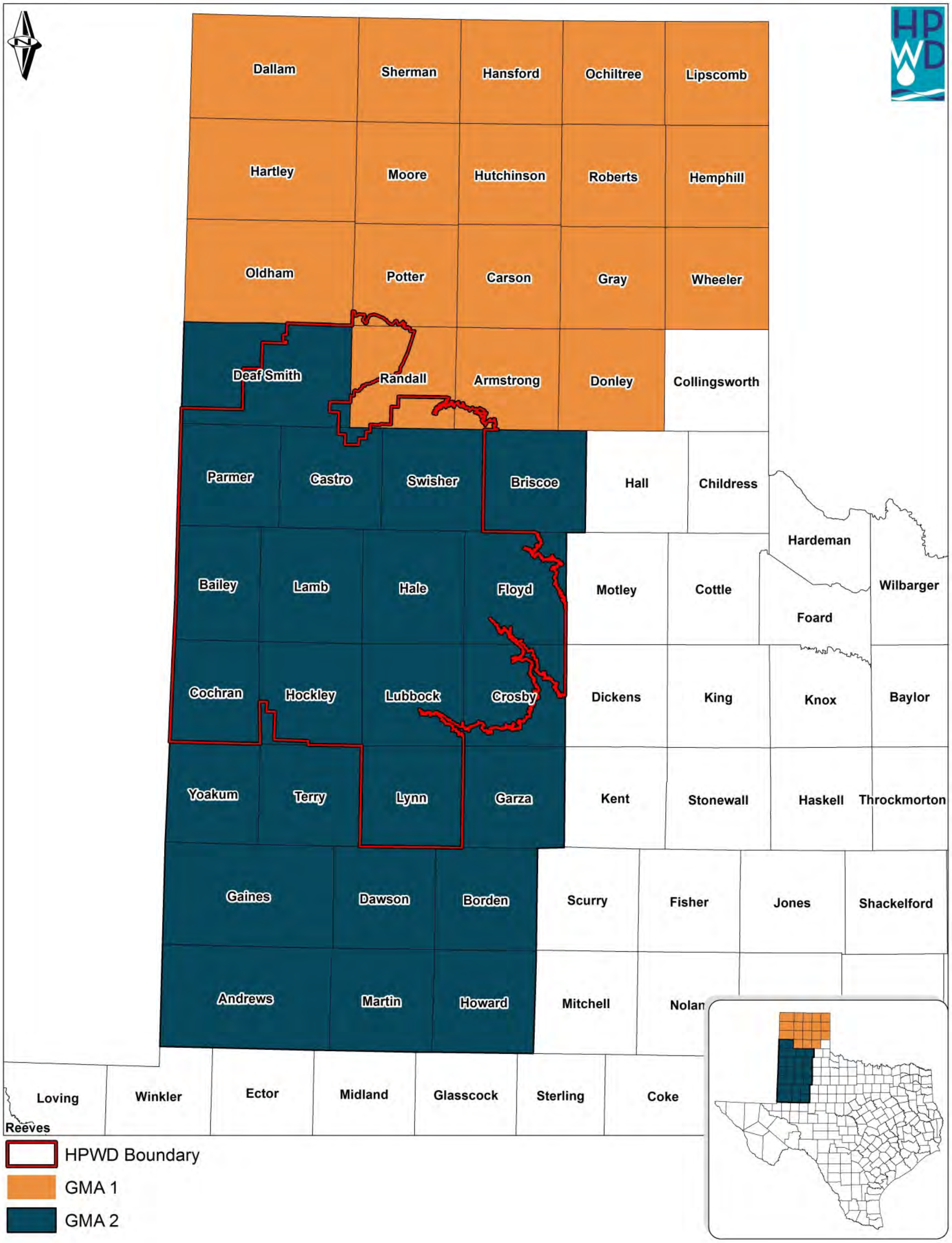


Figure 4: Boundaries of Groundwater Management Areas



General Description

The economy of the District is supported predominately by agriculture. Approximately 2.5 million acres of the District are irrigated using groundwater. These irrigated farms afford economic stability to the area, and support a number of other industries. Major animal feeding operations are in the HPWD, and include 65 beef cattle feed yards. Also, the dairy industry relies heavily on the resources of this region, as 69 dairies currently operate in this area. Various agri-businesses also support these industries, and may include animal health businesses, crop fertilizer and pesticide dealers, cotton gins, grain elevators, farm equipment dealers, irrigation dealers, and many more.

Other important industries of the area include beef processing, steam electric power generation, and oilfield operations. These industries supply a good portion of the tax base for the District, and employ a number of people in this region.

Most of the communities of the HPWD are small, rural towns. The larger cities of the HPWD include Amarillo, Lubbock and Plainview. The total population of the HPWD, according to the 2010 U.S. Census, is about 625,000. These residents depend on the groundwater available locally, as well as the water available from several other sources outside the District. For instance, the Canadian River Municipal Water Authority (CRMWA) delivers water to the following cities within the HPWD service area: Amarillo, Levelland, Lubbock, O'Donnell, Plainview, Slaton and Tahoka. The CRMWA supply is predominately found in Roberts County, where its well field draws water from the Ogallala Aquifer.

Lubbock depends on water supplied by CRMWA, Lake Alan Henry in Garza County, and groundwater from its well field in Bailey County. Some Ogallala wells within the city limits also supply landscape irrigation water for city residents.

Topography and Drainage

The land surface elevation ranges from about 2,659 feet above sea level in the southeastern part of the district to 4,442 feet in the northwestern part. The eastern boundary of the district lies along the caprock escarpment in Floyd and Crosby counties. A number of draws also cross the District, generally running from northwest to southeast. They are mostly shallow and seldom contain water. Playa lakes are numerous in the District, and most prevalent in Hale and Floyd counties. These provide some surface drainage, and may contribute to aquifer recharge. The HPWD also covers four major river basins in Texas, including the Canadian River, Red River, Brazos River, and the Colorado River.

Section 3—Groundwater Resources

Ogallala

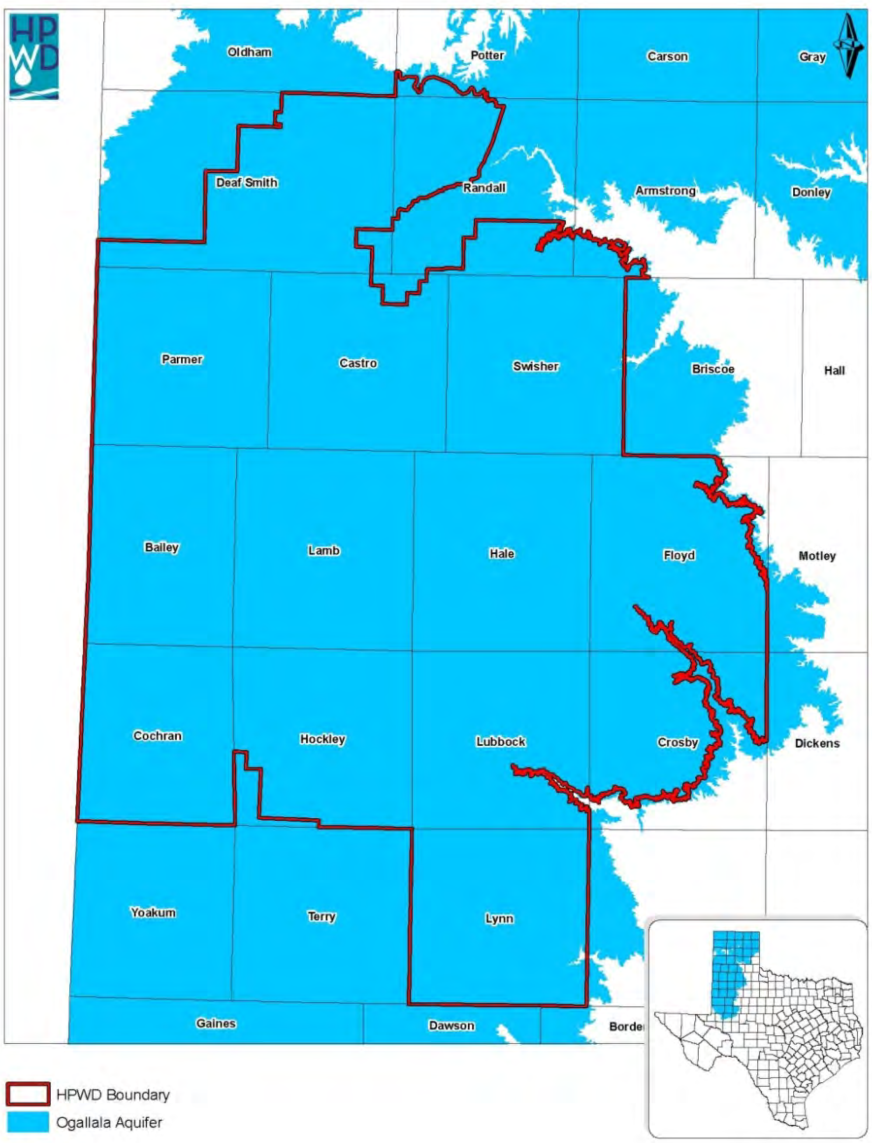
The Ogallala is the major aquifer within the district. It is an unconfined (water table) aquifer, and depths to water cover a wide range. District water level measurements vary from 10 feet below land surface, to over 450 feet below land surface. The Ogallala overlies Cretaceous age sediments in parts of Bailey, Lamb, Hale, Floyd, Cochran, Hockley, Lubbock and Lynn counties. (Ashworth and Hopkins, 1995) In these areas, the Ogallala section is generally thinner than where it directly overlies the Triassic red beds.

The Ogallala Formation is heterogeneous, and contains sequences of clay, silt, sand and gravel. These sediments are thought to have been deposited by ancient steams which filled buried valleys which were eroded into pre-Ogallala rocks.

Groundwater moves slowly downhill through the formation, which is generally southeast. Saturated thickness of the aquifer may be only a few feet in some areas, while others still have over 150 feet of saturated thickness.

Discharge of the aquifer occurs primarily through pumping. According to GAM studies, recharge occurs primarily through precipitation, although some areas are also influenced by upward leakage from underlying aquifers.

Figure 5: Extent of the Ogallala Within the HPWD



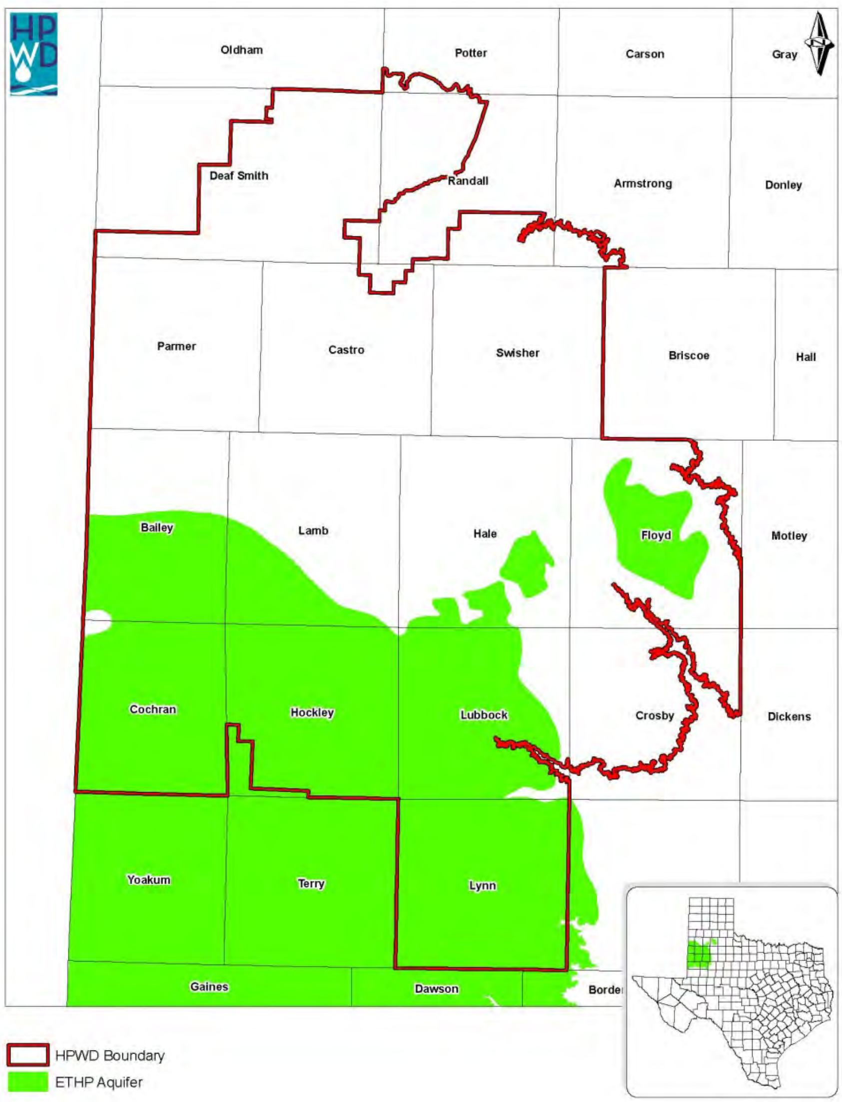
Edwards-Trinity (High Plains)

Cretaceous age sediments are contained in the Edwards-Trinity (High Plains) aquifer, which is considered a minor aquifer. In some areas of the District, this aquifer and the Ogallala may be hydraulically connected. This occurs where Ogallala sand and gravel directly overlie Edwards limestone or Antlers Sand. (Blandford, et. al, 2008)

In some instances, water wells may be completed in both the Ogallala section and the Edwards-Trinity (High Plains) aquifer. As Ogallala water levels decline, this minor aquifer may provide usable quantities of water in some locations. Groundwater in this minor aquifer is generally fresh to slightly saline, but typically poorer in quality than the overlying Ogallala (Ashworth and Hopkins, 1995).

Recharge of this aquifer may occur from the bounding Ogallala formation, or the underlying Dockum. Movement of water is generally east to southeast.

Figure 6: Location of the Edwards-Trinity (High Plains) Aquifer Within the HPWD

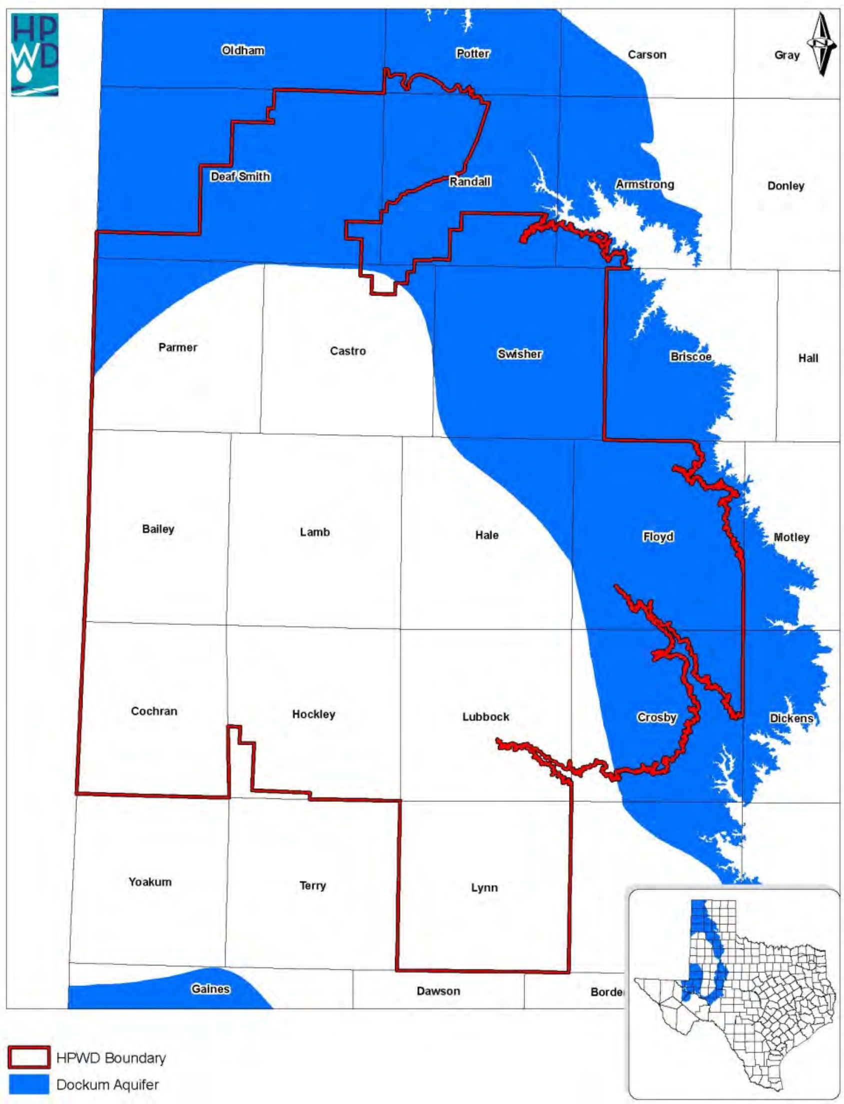


Dockum

The Dockum Aquifer underlies the Ogallala and Edwards-Trinity (High Plains) aquifers throughout the district. It contains layers of silt and shale, interbedded with other conglomerates. The Santa Rosa sandstone is likely the most productive zone in this aquifer.

Water quality of the Dockum is the primary limiting factor when considering its use. In most of the district, it is highly saline, and tends to deteriorate with depth. In fact, total dissolved solids (TDS) concentrations may exceed 60,000 mg/L in the deeper parts of the aquifer (Bradley and Kalaswad, 2003). However, in parts of Deaf Smith, Randall and Swisher counties, there are Dockum wells that provide fresh water to users.

Figure 7: Location of the Dockum Aquifer Within the HPWD



Section 4—Technical Water Data

Estimates of Modeled Available Groundwater

Estimates of modeled available groundwater for the adopted DFC are found in Appendix A.

Estimates of Annual Groundwater Use

The estimates of annual groundwater use from the TWDB are taken from the Water Use Survey (WUS). These are used as a guide, and may have limitations, but are useful when examining trends in groundwater withdrawals. Refer to Appendix C for estimates of annual usage.

Estimates of Annual Groundwater Recharge from Precipitation

Refer to GAM Run 11-009 found in Appendix B.

Estimates of Annual Groundwater Discharge to Springs/Surface Water Bodies

Refer to GAM Run 11-009 found in Appendix B.

Estimates of Annual Groundwater Flow Into/Out of the District Within Each Aquifer; Estimates of Annual Groundwater Flow Between Aquifers in the District

Refer to GAM Run 11-009 found in Appendix B.

Estimates of Projected Surface Water Supply

Refer to Appendix C for estimates of projected surface water supply.

Estimates of Projected Total Demand for Water in the District

Projecting water demand is a challenging task, and contains some uncertainty. Irrigation demand projections are particularly difficult, since rainfall, commodity prices, and federal farm policy are but a few factors that complicate the matter.

Refer to Appendix C for projected total demand for water in the District.

Section 5—Needs and Strategies

Water Supply Needs and Water Management Strategies

Refer to Appendix C for water supply needs and water management strategies included in the most recently adopted State Water Plan.

Section 6—Plan Implementation

Actions, Procedures, Performance and Avoidance for Plan Implementation and Groundwater Management

The District has rules that address the spacing of wells from property lines, as well as other valid well sites. There is also an annual production limit that limits total withdrawals from non-exempt wells. A conservation reserve program allows well owners to set aside all, or a portion, of the annual production rate. This reserve may be used during times of limited rainfall when additional pumping may be necessary.

The effectiveness of HPWD conservation programs is continually evaluated. Water conservation technology continues to improve, and the District has a history of supporting innovative research and demonstration programs.

The rules of the District have been evaluated by the county advisory committees, comprised of about 100 individuals. Other water user groups have also provided valuable input to the rules of the District. The Board has developed this plan, as well as the rules, using a very transparent and deliberate process. A copy of the District rules is available here: www.hpwd.org.

Section 7—Goals, Objectives, Performance Standards and Methodology

The district staff will prepare an annual report of the District's achievement of its management goals and objectives. The report will be prepared in a format that is reflective of the performance standards for each management objective. The report will be presented to the Board at the end of each fiscal year. The report will be maintained on file in the open records of the District.

The District will enforce its rules in order to conserve, preserve, protect and prevent the waste of groundwater within its service area. The Board may periodically review the District's rules, and may modify the rules, following public input, to better manage the groundwater resources within the District and to carry out the duties prescribed by Chapter 36 Texas Water Code.

Goal 1: Providing the Most Efficient Use of Groundwater

Management Objective 1.1 (Monitor water levels):

Water level measurements are vital to the study of the aquifers in the district. Annual measurements are taken each winter, during which time most of the irrigation usage is at a minimum.

Performance Standards

1.1a Number of wells measured each year.

1.1b Number of wells district staff are unable to measure each year

1.1c Number of new wells added to the network of observation sites each year

1.1d Construct maps illustrating the yearly changes in water levels

1.1e Maintain continuous water level monitoring transducers in at least 10 water wells

Management Objective 1.2 (Monitor saturated thickness):

Saturated thickness represents the aquifer section where pumping occurs. Water users should be aware of changing saturated thickness.

Performance Standards

1.2a Calculate saturated thickness for water level observation wells that have a log of well construction

1.2b Provide saturated thickness data via the district website

Management Objective 1.3 (Technical field services):

The district is frequently consulted for determining well capacities. A variety of tools are used by district staff for this purpose. These may include ultrasonic flow meters, e-lines, and others.

Performance Standards

1.3a Number of flow tests performed by district staff each year

1.3b Number of flow tests performed by the public using the metering equipment loaned to water users

1.3c Number of water level measurements performed for individual well owners

Management Objective 1.4 (Irrigation assessment program):

Agricultural irrigation comprises the majority of groundwater usage within the district. For this reason, it is important that the district understand the patterns of usage on different crops. Using a network of cooperators, the district should monitor application amounts and crop types.

Performance Standards

1.4a Number of sites enrolled in the district's irrigation assessment program

1.4b Document the types of crops being irrigated

1.4c Document the irrigation methods being utilized

Management Objective 1.5 (Data availability):

The district should provide the best available hydrologic information to water users of the district. This information should be usable on a variety of platforms, such as electronic or print. Timeliness of delivery and ease of access are also critically important.

Performance Standards

1.5a Summary and description of new/improved data tools

1.5b Summary and description of existing data tools

1.5c Inventory of all data tools available to the public

Management Objective 1.6 (Irrigation system inventory):
As groundwater availability changes, it is expected that irrigated acreage does, too. Monitoring this change may be accomplished using remote imagery or other tools.

Performance Standards

1.6a Number of irrigation systems documented

1.6b Calculate acreage covered by the irrigation systems

Goal 2: Controlling and Preventing Waste of Groundwater

Management Objective 2.1 (Well permitting and well completion):
The district issues permits for wells expected to produce 17.5 gpm or more.

Performance Standards

2.1a Number of water well permits issued by aquifer each year

2.1b Number of well completions by aquifer documented each year

2.1c Production categories of well permits issued

Management Objective 2.2 (Open, deteriorated or uncovered wells):
Open, uncovered or deteriorated wells pose a threat to groundwater quality, as well as human and/or animal safety. A staff member may discover such a well during routine field work, or the office may receive notice of the same from a member of the public.

Performance Standards

2.2a Number of open, uncovered or deteriorated wells reported each year

2.2b Number of well caps provided to cover open wells

2.2c Number of open, uncovered or deteriorated wells that are capped, closed or repaired in accordance with district rules

Management Objective 2.3 (Waste of groundwater):
Waste of groundwater is typically reported to the district office by a member of the public, but may also be discovered by a staff member conducting routine field work. Since waste is prohibited by state law, these reports are investigated by staff and the corresponding well owner is notified of the wasteful practice.

Performance Standards

2.3a Number of waste reports investigated by district staff

2.3b Number of newsletter articles addressing waste prevention

Goal 3: Controlling and preventing subsidence (not applicable)

Goal 4: Conjunctive surface water management issues

Management Objective 4.1 (Coordination with surface water management agencies):
There are very limited surface water resources in the district. Participation in the Region O Water Planning Group will ensure that the district stays current with issues that affect surface water agencies in the region.

Performance Standard

4.1a Number of Region O Water Planning Group meetings attended by district staff

Goal 5: Natural resource issues (not applicable)

Goal 6: Drought Conditions

Management Objective 6.1 (Provide ongoing and relevant drought information):
Drought awareness helps water users understand the level of conservation required to meet a particular need.

Performance Standards

6.1a Provide drought related articles to the public (can include website)

6.1b Provide rainfall data to the public

Goal 7: Conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, or brush control, where appropriate and cost-effective

Management Objective 7.1 (Newsletter):
The district will produce a newsletter and distribute it to area residents and other interested parties. Articles discussing methods to conserve and preserve groundwater quality and quantity will be included.

Performance Standards

7.1a Number of newsletter subscribers

7.2b Number of electronic newsletters published

7.2c Number of articles addressing conservation practices

Management Objective 7.2 (News releases):
The district will prepare news releases about water conservation practices and other relevant subjects for distribution to print media, electronic media and other interested parties.

Performance Standards

7.2a Number of news releases published

7.2b Number of news releases addressing conservation practices

Management Objective 7.3 (Radio announcements):
The district will distribute pre-recorded radio announcements about water conservation practices and other subjects to stations within the district.

Performance Standards

7.3a Number of radio announcements produced

Management Objective 7.4 (Public presentations):
HPWD representatives will present information about water conservation practices, HPWD programs, and other subjects to civic clubs, professional groups, and other interested parties.

Performance Standards

7.4a Number of public presentations delivered each year

7.4b Document the estimated attendance at each venue

Management Objective 7.5 (Rainwater harvesting):
The district will promote awareness of this conservation practice to residents of the district.

Performance Standards

7.5a Number of public presentations dedicated to rainwater harvesting

7.5b Number of rainwater devices distributed to the public

Management Objective 7.6 (Conservation research):
The district will seek opportunity to participate and partner with other groups conducting water conservation research and development.

Performance Standards

7.6a Number of water conservation research projects in which the district participates

7.6b Number of newsletter articles describing the research projects

Management Objective 7.7 (Public information):
District staff will provide general water conservation information at suitable venues within the district each year. This may include exhibits at farm shows and information tables with publications at other meetings.

Performance Standards

7.7a Document the venues at which water conservation information is provided

7.7b Estimate the attendance at each venue

Management Objective 7.8 (Classroom education):
The district will promote water conservation education at schools within its service area. HPWD staff will share water conservation information with students.

Performance Standards

7.8a Document the number of classroom presentations and students reached

Management Objective 7.9 (Website):
The district will provide information about groundwater, water conservation, and other subjects on its website.

Performance Standards

7.9a Document annual web traffic using an analytical program, such as Google Analytics

Goal 8: Recharge Enhancement (A review of past work conducted by others indicates this goal is not appropriate at present. Therefore this goal is not applicable.)

Goal 9: Precipitation Enhancement (This goal is not applicable.)

Goal 10: Brush Control (Existing programs administered by the USDA-NRCS are addressing this issue. This activity is not cost-effective and applicable for the District at this time. Therefore, this goal is not applicable.)

Goal 11: Desired future condition of the aquifers

Management Objective 11.1 (Water use reporting):
The board's adopted desired future condition requires that water users adhere to a yearly allowable production rate (APR). To facilitate compliance with this, the district will provide a variety of reporting options for well owners and operators.

Performance Standards

11.1a Number of water users reporting annual usage

11.1b Type of reporting methods used (how did they report)

11.1c Reporting by count of water user group (# municipal, # ag, # industrial, etc.)

Management Objective 11.2 (Estimating annual usage):
Calculating annual usage is necessary for monitoring progress toward achieving the desired future conditions. Although a regional groundwater model provides estimations of usage to meet that goal, a more specific local estimate may increase our understanding of the usage and corresponding changes in volume.

Performance Standards

11.2a Estimate total usage within the district using reported data

11.2b Compare estimated annual usage to data from the Ogallala GAM

References

Ashworth, J. and Hopkins, J., 1995, Aquifers of Texas: Texas Water Development Board, 44-45 p.

Blandford, T.N., Kuchanur, M., Standen, A., Ruggiero, R., Calhoun, K.C., Kirby, P., and Shah, G., 2008, Groundwater availability model of the Edwards-Trinity (High Plains) Aquifer in Texas and New Mexico: Final report prepared for the Texas Water Development Board by Daniel B. Stephens & Associates, Inc., 80 p.

Bradley, R. and Kalaswad, S, 2003, The Groundwater Resources of the Dockum Aquifer inTexas: Texas Water Development Board, 51 p.

Appendix A

GAM RUN 12-005 MAG: MODELED AVAILABLE GROUNDWATER FOR THE OGALLALA AQUIFER IN GROUNDWATER MANAGEMENT AREA 1

by Marius Jigmond
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-8499
August 21, 2012

Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section, is responsible for oversight of work performed by Marius Jigmond under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on August 21, 2012.

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GAM RUN 12-005 MAG: MODELED AVAILABLE GROUNDWATER FOR THE OGALLALA AQUIFER IN GROUNDWATER MANAGEMENT AREA 1

by Marius Jigmond
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-8499
August 21, 2012

EXECUTIVE SUMMARY:

An updated Groundwater Availability Model (GAM) for the Ogallala Aquifer (northern portion) developed by INTERA, Inc. (Kelley and others, 2010) has been approved by the Texas Water Development Board (TWDB). Accordingly, the TWDB has conducted a GAM model run and is issuing updated modeled available groundwater numbers as requested by members of Groundwater Management Area 1. This model run supersedes model run 09-026 (Oliver, 2011) with respect to results extracted from the groundwater availability model for the northern portion of the Ogallala Aquifer. Estimates of modeled available groundwater extracted from the groundwater availability model for the southern portion of the Ogallala Aquifer remain unchanged.

In addition, legislation that became effective September 1, 2011 changed the definition and meaning of “Managed Available Groundwater” to “Modeled Available Groundwater.” Modeled available groundwater represents estimates of total pumping as presented in the former “Managed Available Groundwater” report 09-026 (Oliver, 2011). The modeled available groundwater for the Ogallala Aquifer, as a result of the desired future conditions adopted by Groundwater Management Area 1, declines from 3,666,259 acre-feet per year in 2010 to 2,151,403 acre-feet per year in 2060. This report summarizes modeled available groundwater by county, groundwater conservation district, river basin, and geographic area for each decade between 2010 and 2060. The pumping estimates were extracted from the Groundwater Availability Model Run performed by INTERA, Inc. (Kelley and others, 2010) as part of the recalibration process.

REQUESTOR:

Mr. John R. Spearman, chairman of Groundwater Management Area 1.

DESCRIPTION OF REQUEST:

In a letter dated December 22, 2011, Mr. Spearman requested that the updated groundwater flow model for the Ogallala Aquifer (northern portion) be considered for adoption as an official GAM by TWDB. TWDB has adopted the updated model as the official GAM and is issuing revised modeled available groundwater estimates. The modeled available groundwater estimates are based on the desired future conditions for the Ogallala Aquifer as described in Resolution 2009-01 and adopted July 7, 2009:

- **"40 [percent] volume in storage remaining in 50 years in the following:**
    - **North Plains [Groundwater Conservation District] consisting of all or parts of the following counties: Dallam, Hartley, Moore and Sherman; and**
    - **Parts of the following counties that are not in a Groundwater Conservation District will also fall under the 40/50 [desired future condition], those counties being Dallam, Hartley and Moore**
- **50 [percent] volume in storage remaining in 50 years in the following:**
    - **High Plains Underground Water Conservation District consisting of parts of the following counties: Armstrong, Potter and Randall;**
    - **North Plains [Groundwater Conservation District] consisting of all or parts of the following counties: Hansford, Hutchinson, Lipscomb and Ochiltree;**
    - **Panhandle Groundwater Conservation District consisting of all or part of the following counties: Armstrong, Carson, Donley, Gray, Hutchinson, Potter, Roberts and Wheeler; and**
    - **All or parts of the following counties that are not in a Groundwater Conservation District will also fall under the 50/50 [desired future condition], those counties being Hutchinson, Oldham and Randall**
- **80 [percent] volume in storage remaining in 50 years in Hemphill County; provided that, in the event it is legally determined that the roughly 390-acre tract of land located in southwest Hemphill County and described more particularly in Attachment A (the "390-acre tract") lies within the jurisdiction of the Panhandle Groundwater Conservation District and not within the jurisdiction of the Hemphill County Underground Water Conservation District, then the Desired Future Condition for the 390-acre tract shall be 50 [percent] volume in storage remaining in 50 years and the Desired Future Condition for the remainder of Hemphill County shall be 80 [percent] volume in storage remaining in 50 years"**

The three geographic areas defined in the above desired future conditions statement are shown in Figure 1. Please note that the Attorney General of Texas, Opinion No. GA-0792, dated August 26, 2010, indicates the roughly 390-acre tract of land located in southwest Hemphill County lies within the jurisdiction of the Hemphill County

Underground Water Conservation District. As such the 80 percent volume in storage remaining in 50 years condition applies to the entire Hemphill County.

METHODS:

The Ogallala Aquifer within Groundwater Management Area 1 is covered by two GAMs. The GAM for the northern portion of the Ogallala Aquifer, documented in Dutton and others (2001), Dutton (2004), and Kelley and others (2010) covers the majority of Groundwater Management Area 1 and includes the Rita Blanca Aquifer. The GAM for the southern portion of the Ogallala Aquifer, documented in Blandford and others (2003) and Blandford and others (2008), covers the remaining areas of the Ogallala Aquifer within Groundwater Management Area 1. The area covered by each of the groundwater availability models is shown in Figure 2. Notice that there is an area in Potter and Randall counties where the two models overlap. Since the model for the northern portion of the Ogallala Aquifer is the primary model for Groundwater Management Area 1, results from the northern model were preferentially used over the results from the southern model in the overlap area.

The previously completed availability model run (Kelley and others, 2010) documents the model results reviewed by members of Groundwater Management Area 1. This new model run honors the above desired future conditions. The model run for the northern portion of the Ogallala Aquifer presented in this report divides the modeled available groundwater by county, groundwater conservation district, geographic area, and river basin within Groundwater Management Area 1. Note that Groundwater Management Area 1 is entirely contained within the Panhandle Regional Water Planning Area (Region A). The locations of these areas are shown in Figure 3.

For the southern portion of the Ogallala Aquifer, which covers portions of Oldham, Potter, Randall, and Armstrong counties, the Groundwater Availability Model Run 08-016 Supplement (Smith, 2008) was previously completed and meets the above request. Since completion of the model run, however, the groundwater availability model for the southern portion of the Ogallala Aquifer has been updated (Blandford and others, 2008). For this reason, the updated groundwater availability model was used to reassess these areas. This report documents the methods used in the updated groundwater availability model run for the southern portion of the Ogallala Aquifer in addition to reporting modeled available groundwater for Groundwater Management Area 1.

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits. The estimated amount of pumping exempt from permitting, which the Texas Water Development Board is required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

PARAMETERS AND ASSUMPTIONS:

Northern Portion of the Ogallala Aquifer

The parameters and assumptions for the GAM run for the northern portion of the Ogallala Aquifer are described below:

- We used version 3.01 of the GAM for the northern portion of the Ogallala Aquifer. This model is an update to the previous versions documented in Dutton and others (2001) and Dutton (2004). See Kelley and others (2010), Dutton (2004), and Dutton and others (2001) for assumptions and limitations of the GAM.
- The GAM for the northern portion of the Ogallala Aquifer has only one layer which collectively represents the Ogallala and Rita Blanca aquifers. As described in the Resolution 2009-01 adopted by the members of Groundwater Management Area 1, the adopted desired future conditions apply to both the Ogallala and Rita Blanca aquifers. In both the desired future conditions statement and this report as a whole the Ogallala and Rita Blanca aquifers are referred to collectively as the "Ogallala Aquifer."
- The root mean squared error (a measure of the difference between simulated and measured water levels during model calibration) for the model for the northern portion of the Ogallala Aquifer is 45.7 feet. This represents 1.6 percent of the range of measured water levels across the model area.
- Cells were assigned to individual counties, groundwater conservation districts, and river basins as shown in the February 3, 2012 version of the file that associates the model grid to political and natural boundaries for the northern portion of the Ogallala. Note that some minor corrections were made to county

and groundwater conservation district grid cell assignments compared to the original Groundwater Availability Model Run 09-001 (Smith, 2009).

- See section 4.2 of Kelley and others (2010) for additional details about the pumping in the model run for the northern portion of the Ogallala Aquifer that meets the above desired future conditions.

Southern Portion of the Ogallala Aquifer

The parameters and assumptions for the GAM run for the southern portion of the Ogallala Aquifer are described below:

- We used version 2.01 of the GAM for the southern portion of the Ogallala Aquifer, which also includes the Edwards-Trinity (High Plains) Aquifer. This model is an expansion on and update to the previously developed groundwater availability model for the southern portion of the Ogallala Aquifer described in Blandford and others (2003). See Blandford and others (2008) and Blandford and others (2003) for assumptions and limitations of the GAM.
- The model includes four layers representing the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer. However, only Layer 1 of the model, representing the Ogallala Aquifer, is active within Groundwater Management Area 1. For this reason, results are only presented for the Ogallala Aquifer from the GAM.
- The mean absolute error (a measure of the difference between simulated and measured water levels during model calibration) for the Ogallala Aquifer in 2000 is 33 feet. This represents 1.8 percent of the range of measured water levels across the model area.
- Cells were assigned to individual counties, groundwater conservation districts, and river basins as shown in the September 14, 2009 version of the file that associates the model grid to political and natural boundaries for the southern portion of the Ogallala Aquifer and Edwards-Trinity (High Plains) Aquifer.

The pumping for areas outside of Groundwater Management Area 1 is the same as described for the “base” scenario in GAM Run 09-023 (Oliver, 2010).

RESULTS:

Table 1 contains modeled available groundwater for the Ogallala Aquifer within Groundwater Management Area 1. It contains pumping totals from the groundwater availability models for the northern and southern portions of the Ogallala Aquifer subdivided by county, groundwater conservation district, and river basin. These areas are shown in figure 1. Note that all of Groundwater Management Area 1 is within the Panhandle Regional Water Planning Area (Region A). For this reason results have not been divided by Regional Water Planning Area.

Table 2 shows modeled available groundwater summarized by county and geographic area within Groundwater Management Area 1 and the total for the area as a whole. The modeled available groundwater for Groundwater Management Area 1 in 2010 is 3,666,259 acre-feet per year. This declines to 2,151,403 acre-feet of pumping per year by 2060 due to reductions in pumping necessary to minimize the occurrence of dry cells. A model cell becomes inactive when the water level in the cell drops below the base of the aquifer. In this situation, pumping cannot occur for the remainder of the model simulation.

Table 3 shows modeled available groundwater summarized by groundwater conservation district and geographic area. Geographic areas are shown in figure 3.

Table 4 shows modeled available groundwater summarized by geographic area. The decline in the volume of water stored in the Ogallala Aquifer over 50 years for each of these areas matches the desired future condition adopted by the members of Groundwater Management Area 1. For Area 1, which consists of Dallam, Sherman, Hartley, and Moore counties modeled available groundwater declines from 1,387,054 acre-feet per year to 691,874 acre-feet per year between 2010 and 2060. For Area 2, consisting of Hemphill County, pumping remains relatively constant between 42,000 and 45,000 acre-feet per year. For Area 3, which encompasses the remaining counties in Groundwater Management Area 1, modeled available groundwater declines from 2,234,035 to 1,416,370 acre-feet per year for the same time period.

Table 5 shows the results summarized by river basin. Between 2010 and 2060, the estimated total pumping declines from 3,027,060 to 1,739,871 acre-feet per year in the Canadian River basin. In the Red River basin for the same time period, modeled available groundwater declines from 639,199 to 411,532 acre-feet per year.

LIMITATIONS:

The groundwater model used in developing estimates of modeled available groundwater is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future conditions. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. 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 develop estimates of modeled available groundwater is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition.

Given these limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are 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 future groundwater pumping as well as whether or not they are achieving their desired future conditions. Because of the limitations of the model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine the modeled available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

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TABLE 1: MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE OGALLALA AND RITA BLANCA AQUIFERS IN GROUNDWATER MANAGEMENT AREA 1. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE DIVIDED BY COUNTY, GROUNDWATER CONSERVATION DISTRICT (GCD), AND RIVER BASIN. UWCD REFERS TO UNDERGROUND WATER CONSERVATION DISTRICT.

County	District	Basin	Year					
			2010	2020	2030	2040	2050	2060
Armstrong	High Plains UWCD No. 1	Red	8,301	8,301	8,301	8,301	8,241	8,186
	Panhandle GCD	Red	44,587	37,066	32,778	29,115	25,920	23,142
Carson	Panhandle GCD	Canadian	96,113	81,718	73,958	66,324	59,324	53,120
		Red	93,885	89,424	80,108	71,529	63,665	56,289
Dallam	North Plains GCD	Canadian	314,814	277,174	245,338	216,215	188,745	163,943
	No District	Canadian	89,793	75,300	63,738	54,102	46,068	39,548
Donley	Panhandle GCD	Red	82,437	74,540	70,208	64,373	58,707	53,537
Gray	Panhandle GCD	Canadian	43,874	39,813	36,848	33,749	30,659	27,766
		Red	147,516	120,860	109,180	98,784	89,135	80,128
Hansford	North Plains GCD	Canadian	284,588	262,271	240,502	218,405	197,454	177,536
Hartley	North Plains GCD	Canadian	424,813	368,430	319,149	276,075	238,186	205,137
	No District	Canadian	27,646	21,118	17,852	15,019	12,780	10,961
Hemphill*	Hemphill County UWCD	Canadian	24,763	22,931	22,969	23,262	23,412	23,642
		Red	20,407	18,828	19,429	19,515	19,577	19,517
Hutchinson	North Plains GCD	Canadian	61,306	58,383	50,723	44,360	39,048	34,580
	Panhandle GCD	Canadian	14,798	13,968	14,414	14,293	13,865	13,194
	No District	Canadian	85,918	64,082	59,436	53,496	47,662	42,664
Lipscomb	North Plains GCD	Canadian	290,510	283,794	273,836	256,406	237,765	219,100
Moore	North Plains GCD	Canadian	193,001	186,154	162,142	137,321	114,658	95,490
	No District	Canadian	14,304	13,200	11,845	10,296	8,915	7,623
Ochiltree	North Plains GCD	Canadian	269,463	246,475	224,578	203,704	183,227	164,265
Oldham	No District	Canadian	20,553	19,360	18,722	17,694	16,406	15,198
		Red	3,952	3,122	2,885	2,772	2,306	2,269
Potter	High Plains UWCD No. 1	Canadian	1,731	1,118	1,041	1,041	1,041	740
		Red	3,521	2,664	1,147	326	326	326
	Panhandle GCD	Canadian	26,810	20,926	19,580	17,919	16,277	14,710
		Red	3,351	2,164	1,770	1,489	1,270	1,080
Randall	High Plains UWCD No. 1	Red	61,381	57,858	56,203	51,346	47,118	39,007
	No District	Red	28,773	27,756	26,195	24,352	21,763	19,377
Roberts	Panhandle GCD	Canadian	419,579	372,950	350,415	321,680	290,903	261,482
		Red	15,380	17,951	18,202	17,565	16,609	15,557
Sherman	North Plains GCD	Canadian	322,683	300,908	263,747	229,122	197,480	169,172
Wheeler	Panhandle GCD	Red	125,708	119,556	114,817	107,697	100,289	93,117
Total			**3,666,259**	**3,310,163**	**3,012,056**	**2,707,647**	**2,418,801**	**2,151,403**

*Hemphill county 2010 is taken from simulation year 2011

TABLE 2: MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE OGALLALA AND RITA BLANCA AQUIFERS IN GROUNDWATER MANAGEMENT AREA 1. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE DIVIDED BY COUNTY AND GEOGRAPHIC AREA.

County	Geographic Area	Year					
		2010	2020	2030	2040	2050	2060
Armstrong	3	52,888	45,367	41,079	37,416	34,161	31,328
Carson	3	189,998	171,142	154,066	137,853	122,989	109,409
Dallam	1	404,607	352,474	309,076	270,317	234,813	203,491
Donley	3	82,437	74,540	70,208	64,373	58,707	53,537
Gray	3	191,390	160,673	146,028	132,533	119,794	107,894
Hansford	3	284,588	262,271	240,502	218,405	197,454	177,536
Hartley	1	452,459	389,548	337,001	291,094	250,966	216,098
Hemphill*	2	45,170	41,759	42,398	42,777	42,989	43,159
Hutchinson	3	162,022	136,433	124,573	112,149	100,575	90,438
Lipscomb	3	290,510	283,794	273,836	256,406	237,765	219,100
Moore	1	207,305	199,354	173,987	147,617	123,573	103,113
Ochiltree	3	269,463	246,475	224,578	203,704	183,227	164,265
Oldham	3	24,505	22,482	21,607	20,466	18,712	17,467
Potter	3	35,413	26,872	23,538	20,775	18,914	16,856
Randall	3	90,154	85,614	82,398	75,698	68,881	58,384
Roberts	3	434,959	390,901	368,617	339,245	307,512	277,039
Sherman	1	322,683	300,908	263,747	229,122	197,480	169,172
Wheeler	3	125,708	119,556	114,817	107,697	100,289	93,117
Total		**3,666,259**	**3,310,163**	**3,012,056**	**2,707,647**	**2,418,801**	**2,151,403**

*Hemphill county 2010 is taken from simulation year 2011

TABLE 3: MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE OGALLALA AND RITA BLANCA AQUIFERS IN GROUNDWATER MANAGEMENT AREA 1. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE DIVIDED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND GEOGRAPHIC AREA. UWCD REFERS TO UNDERGROUND WATER CONSERVATION DISTRICT.

District	Geographic Area	Year					
		2010	2020	2030	2040	2050	2060
Hemphill County UWCD*	2	45,170	41,759	42,398	42,777	42,989	43,159
High Plains UWCD No. 1	3	74,934	69,941	66,692	61,014	56,726	48,259
North Plains GCD	1	1,255,311	1,132,666	990,376	858,733	739,069	633,742
	3	905,867	850,923	789,639	722,875	657,494	595,481
Panhandle GCD	3	1,114,038	990,936	922,278	844,517	766,623	693,122
No District	1	131,743	109,618	93,435	79,417	67,763	58,132
	3	139,196	114,320	107,238	98,314	88,137	79,508
Total		**3,666,259**	**3,310,163**	**3,012,056**	**2,707,647**	**2,418,801**	**2,151,403**

*Hemphill county 2010 is taken from simulation year 2011

TABLE 4: MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE OGALLALA AND RITA BLANCA AQUIFERS IN GROUNDWATER MANAGEMENT AREA 1. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE DIVIDED BY GEOGRAPHIC AREA.

Geographic Area	Year					
	2010	2020	2030	2040	2050	2060
1	1,387,054	1,242,284	1,083,811	938,150	806,832	691,874
2*	45,170	41,759	42,398	42,777	42,989	43,159
3	2,234,035	2,026,120	1,885,847	1,726,720	1,568,980	1,416,370
Total	**3,666,259**	**3,310,163**	**3,012,056**	**2,707,647**	**2,418,801**	**2,151,403**

*Hemphill county 2010 is taken from simulation year 2011

TABLE 5: MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE OGALLALA AND RITA BLANCA AQUIFERS IN GROUNDWATER MANAGEMENT AREA 1. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE DIVIDED BY RIVER BASIN.

Basin	Year					
	2010	2020	2030	2040	2050	2060
Canadian*	3,027,060	2,730,073	2,470,833	2,210,483	1,963,875	1,739,871
Red*	639,199	580,090	541,223	497,164	454,926	411,532
Total	**3,666,259**	**3,310,163**	**3,012,056**	**2,707,647**	**2,418,801**	**2,151,403**

*Hemphill county 2010 is taken from simulation year 2011

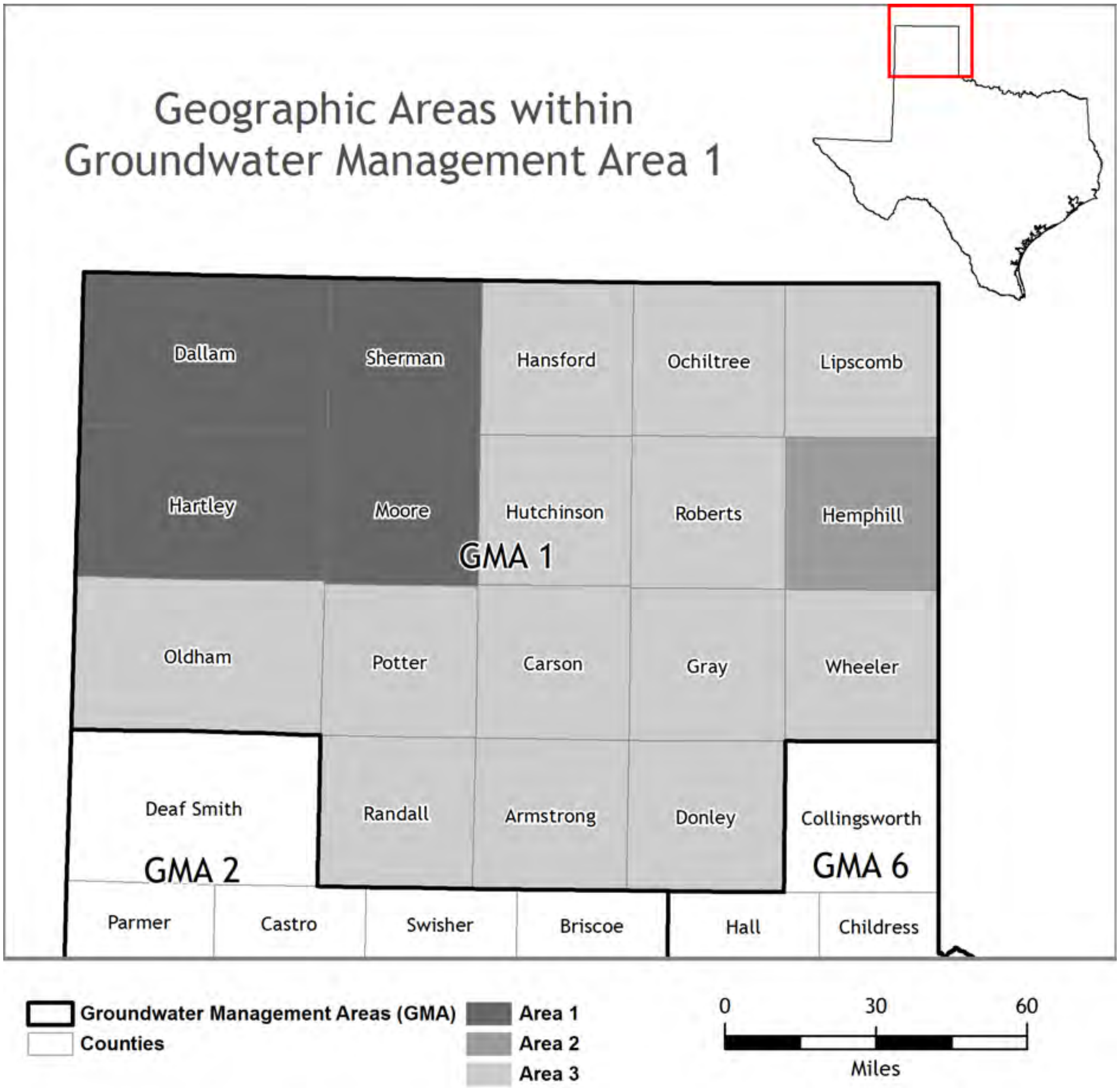


FIGURE 1: MAP SHOWING GEOGRAPHIC AREAS DEFINED BY GROUNDWATER MANAGEMENT AREA 1 IN THE DESIRED FUTURE CONDITIONS PROCESS FOR THE OGALLALA AQUIFER.

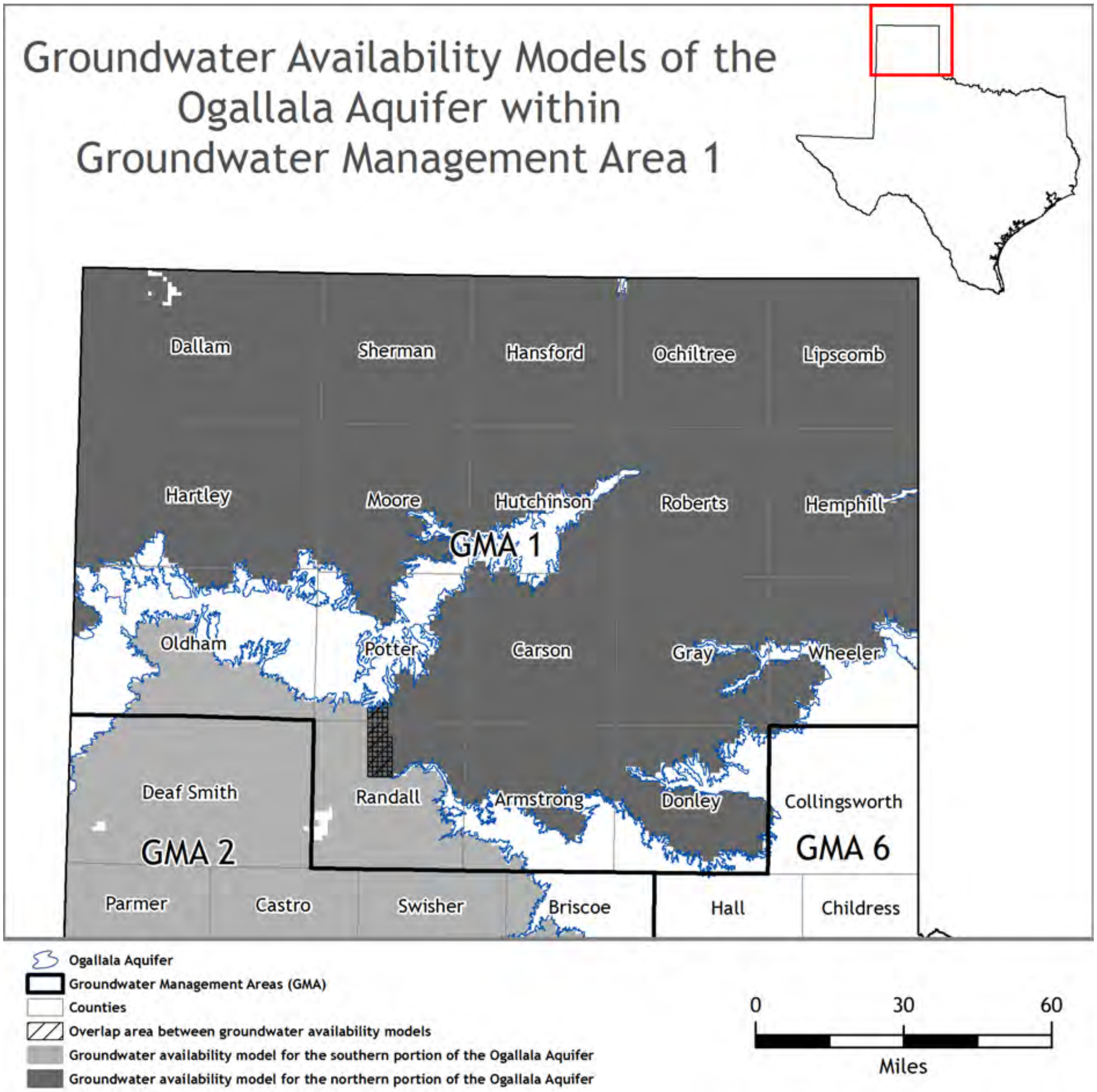


FIGURE 2: MAP SHOWING THE AREAS COVERED BY THE GROUNDWATER AVAILABILITY MODELS FOR THE NORTHERN AND SOUTHERN PORTIONS OF THE OGALLALA AQUIFER.

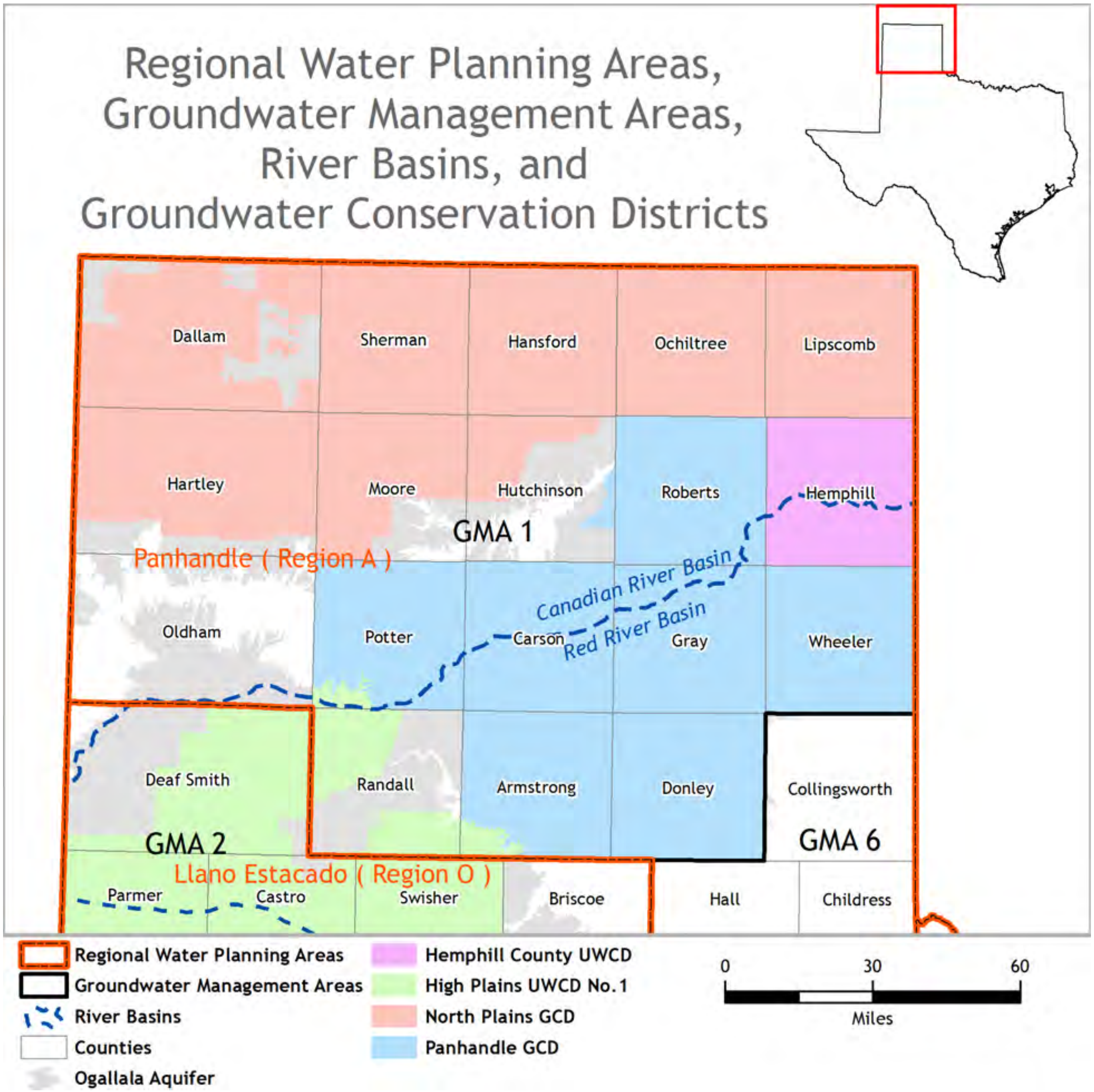
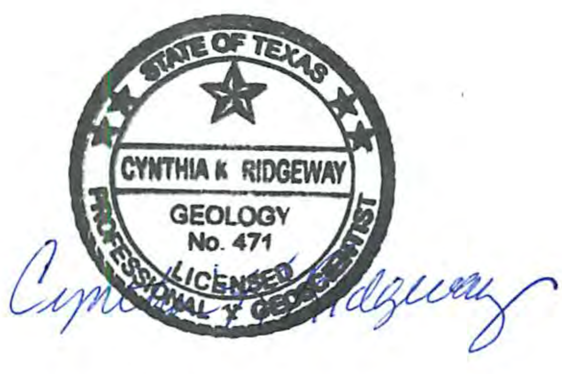


FIGURE 3: MAP SHOWING REGIONAL WATER PLANNING AREAS, GROUNDWATER MANAGEMENT AREAS, RIVER BASINS, AND GROUNDWATER CONSERVATION DISTRICTS.

GAM Run 10-019 MAG Version 2

by Mr. Wade Oliver

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-3132
August 30, 2011



Cynthia K. Ridgeway is the Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on August 30, 2011.

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EXECUTIVE SUMMARY:

The estimated total pumping from the Dockum Aquifer that achieves the desired future condition adopted by the members of Groundwater Management Area 1 is approximately 21,200 acre-feet per year and is summarized by county, regional water planning area, and river basin as shown in Table 1. The estimated managed available groundwater for the groundwater conservation districts within Groundwater Management Area 1 for the aquifer declines from approximately 13,900 acre-feet per year to 12,900 acre-feet per year between 2010 and 2060 and is shown in Table 6. The pumping estimates were extracted from the addendum to Groundwater Availability Model Run 09-014, which Groundwater Management Area 1 used as the basis for developing a desired future condition of an average decline in water levels of "no more than 30 feet over the next 50 years." This second version of the report contains updated estimates of pumping that is exempt from permitting by High Plains Underground Water Conservation District.

REQUESTOR:

Mr. Kyle Ingham of the Panhandle Regional Planning Commission on behalf of Groundwater Management Area 1

DESCRIPTION OF REQUEST:

In a letter received June 14, 2010, Mr. Kyle Ingham provided the Texas Water Development Board (TWDB) with the desired future condition of the Dockum Aquifer adopted by the members of Groundwater Management Area 1. The desired future condition for the Dockum Aquifer, as described in Resolution No. 2010-01 and adopted June 3, 2010 by the groundwater conservation districts within Groundwater Management Area 1, is described below:

> *The Joint Planning Committee adopts the Desired Future Condition of the Dockum Aquifer contained within* [Groundwater Management Area] *1 whereby the average decline in water levels will decline no more than 30 feet over the next 50 years.*

In response to receiving the adopted desired future condition, TWDB has estimated the managed available groundwater that achieves the above desired future condition for each of the groundwater conservation districts within Groundwater Management Area 1.

METHODS:

Groundwater Management Area 1, located in the northern portion of the Texas Panhandle, contains a portion of the Dockum Aquifer, a minor aquifer as defined in the 2007 State Water Plan (TWDB, 2007). The location of Groundwater Management Area 1, the Dockum Aquifer, and the groundwater availability model cells that represent the aquifer are shown in Figure 1. The TWDB previously completed several predictive groundwater availability model simulations for the Dockum Aquifer, documented in GAM Run 09-014 (Oliver, 2010a) and its addendum (Oliver, 2010b). The "30-foot drawdown scenario" in Oliver (2010b) achieves the desired future condition specified by Groundwater Management Area 1. The pumping results for Groundwater Management Area 1 presented here, taken directly from the above scenario, have been divided by county, regional water planning area, river basin, and groundwater conservation district. These areas are shown in Figure 2.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the modified groundwater model for the Dockum Aquifer are described below:

- The results presented in this report are based on the “30-foot drawdown scenario” in the addendum to GAM Run 09-014 (Oliver, 2010b). See GAM Run 09-014 (Oliver, 2010a) and its addendum (Oliver, 2010b) for a full description of the methods, assumptions, and results for the groundwater availability model run.

- The modified version the groundwater model for the Dockum Aquifer described in Oliver and Hutchison (2010) was used for this analysis. This model is an update to the previously developed groundwater availability model for the Dockum Aquifer described in Ewing and others (2008) in order to more effectively simulate predictive conditions. See Oliver and Hutchison (2010) and Ewing and others (2008) for assumptions and limitations of the model.

- The model includes two active layers which represent the upper and lower portions of the Dockum Aquifer. Layer 2 represents the upper portion of the Dockum Aquifer. Layer 3 represents the lower portion of the Dockum Aquifer. Layer 1, which is active in version 1.01 of the model documented in Ewing and others (2008), was inactivated in the modified model as described in Oliver and Hutchison (2010).

- The mean absolute error (a measure of the difference between simulated and measured water levels during model calibration) for the lower portion of the Dockum Aquifer between 1980 and 1997 is 53 feet.

- Cells were assigned to individual counties, river basins, regional water planning areas, and groundwater conservation districts as shown in the August 3, 2010 version of file that associates the model grid to political and natural boundaries for the Dockum Aquifer. Note that some minor corrections were made to the file to correct river basin cell assignments.

- The recharge used for the model run represents average recharge as described in Ewing and others (2008).

Determining Managed Available Groundwater

As defined in Chapter 36 of the Texas Water Code, “managed available groundwater” is the amount of water that may be permitted. The pumping output from groundwater models, however, represents the total amount of pumping from the aquifer. The total pumping includes uses of water both subject to permitting and exempt from permitting. Examples of exempt uses include domestic, livestock, and oil and gas exploration. Each district may also exempt additional uses as defined by its rules or enabling legislation.

Since exempt uses are not available for permitting, it is necessary to account for them when determining managed available groundwater. To do this the Texas Water Development Board developed a standardized method for estimating exempt use for domestic and livestock purposes based on projected changes in population and the distribution of domestic and livestock wells in the area. Because other exempt uses can vary significantly from district to district, and there is much higher uncertainty associated with estimating use due to oil and gas exploration, estimates of exempt pumping outside domestic and livestock uses were not been included. The districts were also encouraged to evaluate the estimates of exempt pumping and, if desired, provide updated estimates. Once established, the estimates of exempt pumping were subtracted from the total pumping output from the groundwater model to yield the estimated managed available groundwater for permitting purposes.

RESULTS:

The estimated total pumping from the Dockum Aquifer in Groundwater Management Area 1 that achieves the above desired future condition is approximately 21,200 acre-feet per year. This pumping has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 1). Note that Groundwater Management Area 1 is located entirely within the Panhandle Regional Water Planning Area (Region A).

The total pumping estimates are also summarized by county, river basin, and groundwater conservation district as shown in tables 2, 3, and 4, respectively. In Table 4, the total pumping both excluding and including areas outside of a groundwater conservation district is shown. Table 5 contains the estimates of exempt pumping in the groundwater conservation districts within Groundwater Management Area 1 either estimated by the TWDB or provided by the districts. The managed available groundwater for each groundwater conservation district, the difference between the total pumping in the district (Table 4) and the estimated exempt use (Table 5) is shown in Table 6.

Notice in Table 6 that the estimated managed available groundwater for Panhandle Groundwater Conservation District is zero beginning in 2030. This is because the estimated exempt use for the district in Table 5 is higher than the total pumping for the district in Table 4.

LIMITATIONS:

Managed available groundwater numbers included in this report are the result of subtracting the estimated future exempt use from the estimated total pumping that would achieve the desired future condition adopted by the groundwater conservation districts in the groundwater management area. These numbers, therefore, are the result of (1) running the groundwater model to estimate the total pumping required to achieve the desired future condition and (2) estimating the future exempt use in the area.

The groundwater model used in developing estimates of total pumping is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future condition. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. 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 develop estimates of total pumping is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition.

In addition, certain assumptions have been made regarding future precipitation, recharge, and streamflow in developing these total pumping estimates. Those assumptions also need to be considered and compared to actual future data when evaluating compliance with the desired future condition.

In the case of TWDB's estimates of future exempt use, key assumptions were made as to the pattern of population growth relative to the need for domestic wells or supplied water, per capita use from domestic wells, and livestock uses of water. In the case of district estimates of future exempt use, including exempt use associated with the exploration of oil and gas, the assumptions are specific to that district. In either case, these assumptions need to be considered when reviewing future data related to exempt use.

Given these limitations, users of this information are cautioned that the total pumping numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are 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 future groundwater pumping as well as whether or not they are achieving their desired future conditions. 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 these managed available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

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Table 1. Estimated total annual pumping for the Dockum Aquifer in Groundwater Management Area 1. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Region	Basin	Year					
			2010	2020	2030	2040	2050	2060
Armstrong	A	Red	582	582	582	582	582	582
Carson	A	Canadian	20	20	20	20	20	20
		Red	263	263	263	263	263	263
Dallam	A	Canadian	4,034	4,034	4,034	4,034	4,034	4,034
Hartley	A	Canadian	3,567	3,567	3,567	3,567	3,567	3,567
Moore	A	Canadian	5,395	5,395	5,395	5,395	5,395	5,395
Oldham	A	Canadian	2,868	2,868	2,868	2,868	2,868	2,868
		Red	104	104	104	104	104	104
Potter	A	Canadian	1,525	1,525	1,525	1,525	1,525	1,525
		Red	155	155	155	155	155	155
Randall	A	Red	2,119	2,119	2,119	2,119	2,119	2,119
Sherman	A	Canadian	591	591	591	591	591	591
Total			**21,223**	**21,223**	**21,223**	**21,223**	**21,223**	**21,223**

Table 2. Estimated total annual pumping for the Dockum Aquifer summarized by county in Groundwater Management Area 1 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Armstrong	582	582	582	582	582	582
Carson	283	283	283	283	283	283
Dallam	4,034	4,034	4,034	4,034	4,034	4,034
Hartley	3,567	3,567	3,567	3,567	3,567	3,567
Moore	5,395	5,395	5,395	5,395	5,395	5,395
Oldham	2,972	2,972	2,972	2,972	2,972	2,972
Potter	1,680	1,680	1,680	1,680	1,680	1,680
Randall	2,119	2,119	2,119	2,119	2,119	2,119
Sherman	591	591	591	591	591	591
Total	**21,223**	**21,223**	**21,223**	**21,223**	**21,223**	**21,223**

Table 3. Estimated total annual pumping for the Dockum Aquifer summarized by river basin in Groundwater Management Area 1 for each decade between 2010 and 2060. Results are in acre-feet per year.

Basin	Year					
	2010	2020	2030	2040	2050	2060
Canadian	18,000	18,000	18,000	18,000	18,000	18,000
Red	3,223	3,223	3,223	3,223	3,223	3,223
Total	**21,223**	**21,223**	**21,223**	**21,223**	**21,223**	**21,223**

Table 4. Estimated total annual pumping for the Dockum Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 1 for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
High Plains UWCD No. 1	1,296	1,296	1,296	1,296	1,296	1,296
North Plains GCD	12,118	12,118	12,118	12,118	12,118	12,118
Panhandle GCD	2,237	2,237	2,237	2,237	2,237	2,237
Total (excluding non-district areas)	**15,651**	**15,651**	**15,651**	**15,651**	**15,651**	**15,651**
No District	5,572	5,572	5,572	5,572	5,572	5,572
Total (including non-district areas)	**21,223**	**21,223**	**21,223**	**21,223**	**21,223**	**21,223**

Table 5. Estimates of exempt use for the Dockum Aquifer in Groundwater Management Area 1 by groundwater conservation district (GCD) for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	Source	Year					
		2010	2020	2030	2040	2050	2060
High Plains UWCD No.1	D	0	0	0	0	0	0
North Plains GCD	TA	350	395	442	476	494	493
Panhandle GCD	TA	1,423	1,875	2,290	2,763	3,281	3,703
Total		**1,773**	**2,270**	**2,732**	**3,239**	**3,775**	**4,196**

TA = Estimated exempt use calculated by TWDB and accepted by the district

D = Estimated exempt use provided by the district

Table 6. Estimates of managed available groundwater for the Dockum Aquifer in Groundwater Management Area 1 by groundwater conservation district (GCD) for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
High Plains UWCD No. 1	1,296	1,296	1,296	1,296	1,296	1,296
North Plains GCD	11,768	11,723	11,676	11,642	11,624	11,625
Panhandle GCD	814	362	0	0	0	0
Total	**13,878**	**13,381**	**12,972**	**12,938**	**12,920**	**12,921**

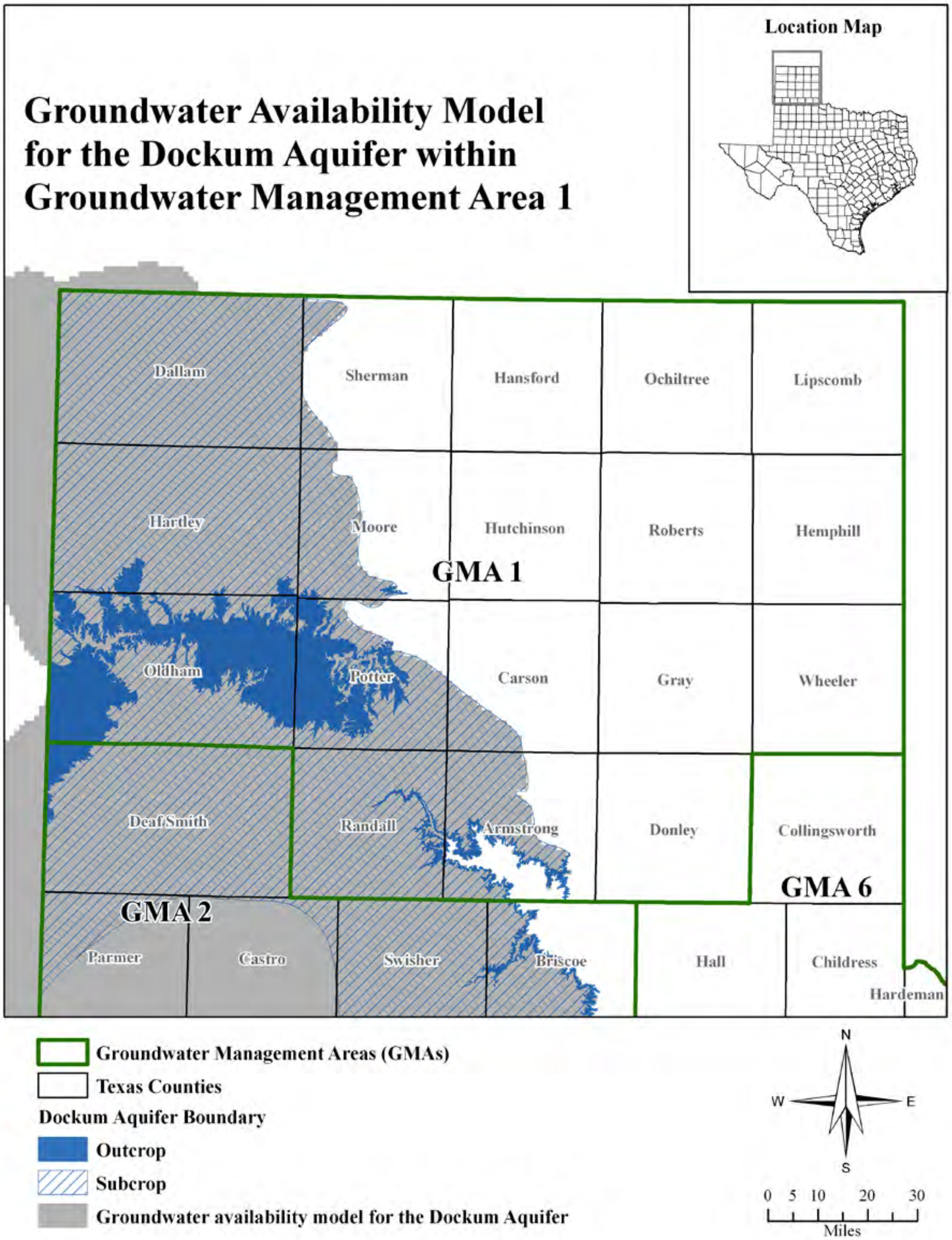

Figure 1. Map showing the areas covered by the groundwater availability model for the Dockum Aquifer and the boundary of Groundwater Management Area 1.

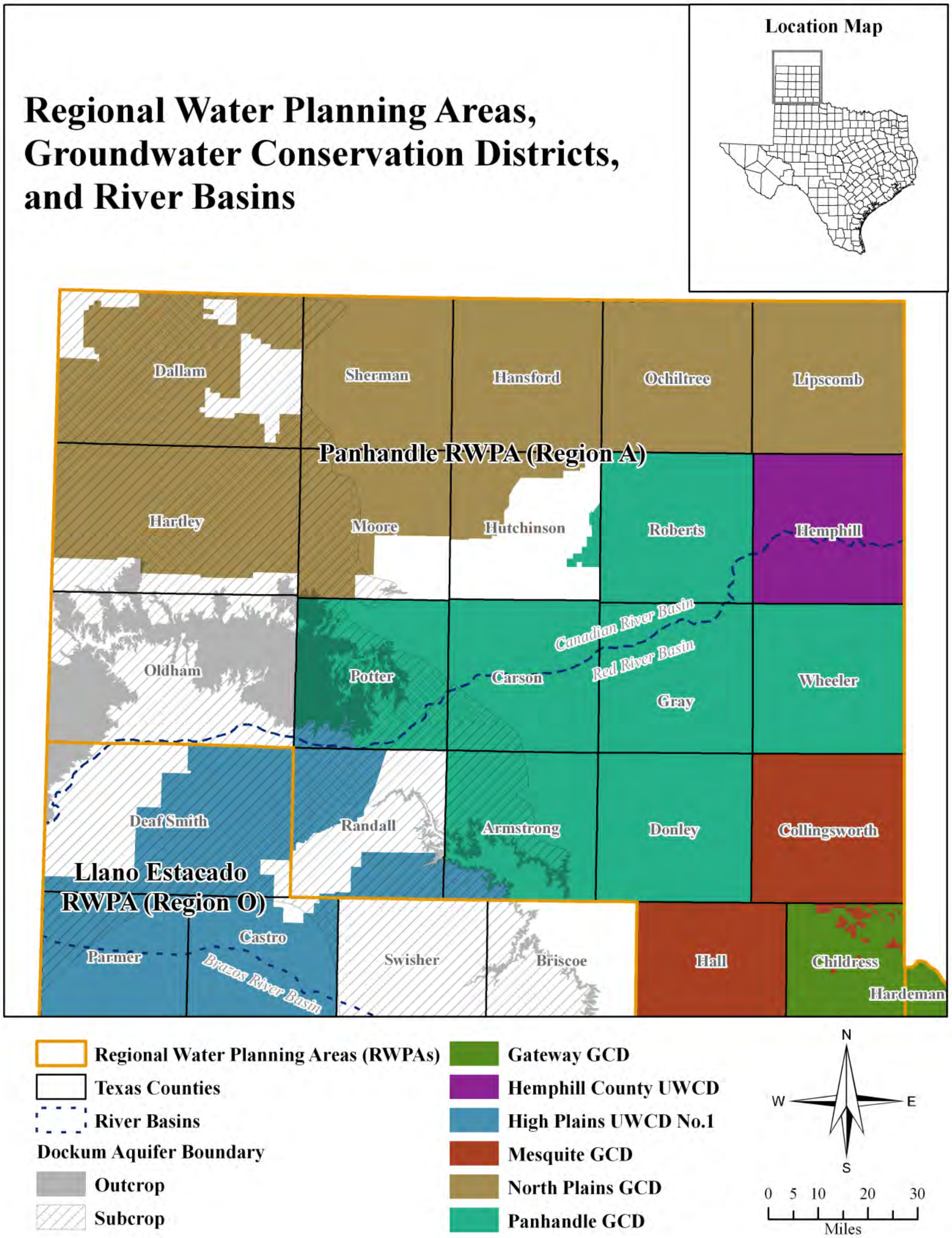

Figure 2. Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in and neighboring Groundwater Management Area 1. UWCD refers to Underground Water Conservation District.

GAM Run 10-030 MAG

by Mr. Wade Oliver

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-3132
June 22, 2011

Cynthia K. Ridgeway is the Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on June 22, 2011.

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EXECUTIVE SUMMARY:

The estimated total pumping from the Ogallala Aquifer that achieves the desired future conditions adopted by the members of Groundwater Management Area 2 declines from approximately 2,367,000 acre-feet per year to 1,307,000 acre-feet per year between 2010 and 2060. This is summarized by county, regional water planning area, and river basin as shown in Table 2. The corresponding total pumping from the Edwards-Trinity (High Plains) Aquifer declines from approximately 96,000 acre-feet per year to 23,000 acre-feet per year over the same time period (Table 3). The estimated managed available groundwater, the amount available for permitting, for the groundwater conservation districts within Groundwater Management Area 2 for the Ogallala and Edwards-Trinity (High Plains) aquifers declines from approximately 2,368,000 acre-feet per year to 1,266,000 acre-feet per year between 2010 and 2060 (Table 9). The pumping estimates were extracted from Groundwater Availability Modeling Task 10-023, Scenario 3, which Groundwater Management Area 2 used as the basis for developing their desired future conditions.

REQUESTOR:

Mr. Jason Coleman of South Plains Underground Water Conservation District on behalf of Groundwater Management Area 2

DESCRIPTION OF REQUEST:

In a letter dated August 10, 2010 and received August 13, 2010, Mr. Jason Coleman provided the Texas Water Development Board (TWDB) with the desired future conditions of the Ogallala and Edwards-Trinity (High Plains) aquifers adopted by the members of Groundwater Management Area 2. Below are the desired future conditions for the Ogallala and Edwards-Trinity (High Plains) aquifers in the northern portion of the management area as described in Resolution No. 2010-01 and adopted August 5, 2010:

> [T]he *members of* [Groundwater Management Area] *#2 adopt the desired future condition of 50 percent of the saturated thickness remaining after 50 years for the Northern Portion of* [Groundwater Management Area] *#2, based on GAM Run 10-023, Scenario 3…*

As described in Resolution No. 2010-01, the northern portion of Groundwater Management Area 2 consists of Bailey, Briscoe, Castro, Cochran, Crosby, Deaf Smith, Floyd, Hale, Hockley, Lamb, Lubbock, Lynn, Parmer, and Swisher counties.

For the southern portion of Groundwater Management Area 2, desired future conditions for the Ogallala and Edwards-Trinity (High Plains) aquifers were stated as average water-level declines (drawdowns) over the same time period. The average drawdowns specified as desired future conditions for the southern portion of Groundwater Management Area 2 are: Andrews–6 feet, Bordon–3 feet, Dawson–74 feet, Gaines–70 feet, Garza–40 feet, Howard–1 foot, Martin–8 feet, Terry–42 feet, and Yoakum–18 feet.

In response to receiving the adopted desired future conditions, the Texas Water Development Board has estimated the managed available groundwater for each of the groundwater conservation districts within Groundwater Management Area 2 for the Ogallala and Edwards-Trinity (High Plains) aquifers.

Although not explicitly stated in the adopted desired future conditions statement, drawdown estimates for the Edwards-Trinity (High Plains) Aquifer associated with Scenario 3 of GAM Task 10-023 are shown in Table 1 below.

Table 1. Average drawdown in feet in the Edwards-Trinity (High Plains) Aquifer by county in Scenario 3 of GAM Task 10-023.

County	Average drawdown (feet)					
	2010	2020	2030	2040	2050	2060
Bailey	0	1	2	4	4	5
Borden	0	1	1	2	3	4
Cochran	-1	0	3	6	9	11
Dawson	3	21	37	50	60	67
Floyd	3	16	29	41	52	61
Gaines	6	28	42	53	61	67
Garza	2	10	18	26	33	40
Hale	1	8	15	22	29	36
Hockley	1	7	13	19	24	28
Lamb	0	1	1	2	3	3
Lubbock	1	8	14	20	25	29
Lynn	0	7	14	21	27	32
Terry	2	14	25	32	37	40
Yoakum	1	6	10	13	15	17

For purposes of developing total pumping and managed available groundwater numbers, it was assumed that by referencing Scenario 3 of GAM Task 10-023, the groundwater conservation districts in Groundwater Management Area 2 intended to fully incorporate the drawdown and pumping estimates of the Edwards-Trinity (High Plains) Aquifer. Thus, this analysis included those pumping numbers.

METHODS:

Groundwater Management Area 2, located in the Texas Panhandle, contains a portion of the Ogallala Aquifer and the entire Edwards-Trinity (High Plains) Aquifer. The location of Groundwater Management Area 2, the Ogallala and Edwards-Trinity (High Plains) aquifers, and the groundwater availability model cells that represent the aquifers are shown in Figure 1.

The Texas Water Development Board previously completed several predictive groundwater availability model simulations of the Ogallala and Edwards-Trinity (High Plains) aquifers to assist the members of Groundwater Management Area 2 in developing desired future conditions.

As stated in Resolution No. 2010-01 and the narrative of the methods used for developing desired future conditions provided by Groundwater Management Area 2, the simulation on which the desired future conditions above are based is Scenario 3 of GAM Task 10-023 (Oliver, 2010). The estimated pumping for Groundwater Management Area 2 presented here, taken directly from the above scenario, has been divided by county, regional water planning area, river basin, and groundwater conservation district. These areas are shown in Figure 2.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the groundwater availability model for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer are described below:

- The results presented in this report are based on “Scenario 3” in GAM Task 10-023 (Oliver, 2010). See GAM Task 10-023 for a full description of the methods, assumptions, and results for the groundwater availability model run.

- Version 2.01 of the groundwater availability model for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer (Blandford and others, 2008) was used for this analysis. This model is an expansion on and update to the previously developed groundwater availability model for the southern portion of the Ogallala Aquifer described in Blandford and others (2003). See Blandford and others (2008) and Blandford and others (2003) for assumptions and limitations of the groundwater availability model.

- The model includes four layers representing the southern portion of the Ogallala and Edwards-Trinity (High Plains) aquifers. The units comprising the Edwards-Trinity (High Plains) Aquifer (primarily Edwards, Comanche Peak, and Antlers Sand formations) are separated from the overlying Ogallala Aquifer by a layer of Cretaceous shale, where present.

- The mean absolute error (a measure of the difference between simulated and measured water levels during model calibration) for the Ogallala Aquifer in 2000 is 33 feet. The mean absolute error for the Edwards-Trinity (High Plains) Aquifer in 1997 is 25 feet (Blandford and others, 2008).

- Cells were assigned to individual counties, river basins, regional water planning areas, and groundwater conservation districts as shown in the August 3, 2010 version of the file that associates the model grid to political and natural boundaries for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer. Note that some minor corrections were made to the file to better reflect the relationship of model cells to political boundaries.

- The recharge used for the model run represents average recharge as described in Blandford and others (2003).

Determining Managed Available Groundwater

As defined in Chapter 36 of the Texas Water Code, "managed available groundwater" is the amount of water that may be permitted. The pumping output from groundwater availability models, however, represents the total amount of pumping from the aquifer. The total pumping includes uses of water both subject to permitting and exempt from permitting. Examples of exempt uses include domestic, livestock, and oil and gas exploration. Each district may also exempt additional uses as defined by its rules or enabling legislation.

Since exempt uses are not available for permitting, it is necessary to account for them when determining managed available groundwater. To do this, the Texas Water Development Board developed a standardized method for estimating exempt use for domestic and livestock purposes based on projected changes in population and the distribution of domestic and livestock wells in the area. Because other exempt uses can vary significantly from district to district, and there is much higher uncertainty associated with estimating use due to oil and gas exploration, estimates of exempt pumping outside domestic and livestock uses have not been included. The districts were also encouraged to evaluate the estimates of exempt pumping and, if desired, provide updated estimates. Once established, the estimates of exempt pumping were subtracted from the total pumping output from the groundwater availability model to yield the estimated managed available groundwater for permitting purposes.

RESULTS:

The estimated total pumping from the Ogallala Aquifer in Groundwater Management Area 2 that achieves the above desired future conditions declines from approximately 2,367,000 acre-feet per year in 2010 to 1,307,000 acre-feet per year in 2060. This pumping has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 2). The corresponding estimated total pumping from the Edwards-Trinity (High Plains) Aquifer declines from approximately 96,000 acre-feet per year to 23,000 acre-feet per year over the same time period (Table 3).

The total pumping estimates for the combined Ogallala and Edwards-Trinity (High Plains) aquifers are also summarized by county, regional water planning area, river basin, and groundwater conservation district as shown in tables 4, 5, 6, and 7, respectively. In Table 7, the total pumping both excluding and including areas outside of a groundwater conservation district is shown. Table 8 contains the estimates of exempt pumping for the Ogallala and Edwards-Trinity (High Plains) aquifers by groundwater conservation district. The managed available groundwater, the difference between the total pumping in the districts (Table 7, excluding areas outside of a district) and the estimated exempt use (Table 8) is shown in Table 9. The total managed available groundwater for the Ogallala and Edwards-Trinity (High Plains) aquifers in Groundwater Management Area 2 declines from approximately 2,368,000 acre-feet per year to 1,266,000 acre-feet per year between 2010 and 2060.

LIMITATIONS:

Managed available groundwater numbers included in this report are the result of subtracting the estimated future exempt use from the estimated total pumping that would achieve the desired future condition adopted by the groundwater conservation districts in the groundwater management area. These numbers, therefore, are the result of (1) running the groundwater model to estimate the total pumping required to achieve the desired future condition and (2) estimating the future exempt use in the area.

The groundwater model used in developing estimates of total pumping is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future condition. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. 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 develop estimates of total pumping is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition.

In addition, certain assumptions have been made regarding future precipitation, recharge, and streamflow in developing these total pumping estimates. Those assumptions also need to be considered and compared to actual future data when evaluating compliance with the desired future condition.

In the case of TWDB's estimates of future exempt use, key assumptions were made as to the pattern of population growth relative to the need for domestic wells or supplied water, per capita use from domestic wells, and livestock uses of water. In the case of district estimates of future exempt use, including exempt use associated with the exploration of oil and gas, the assumptions are specific to that district. In either case, these assumptions need to be considered when reviewing future data related to exempt use.

Given these limitations, users of this information are cautioned that the total pumping numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are 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 future groundwater pumping as well as whether or not they are achieving their desired future conditions. 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 these managed available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

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Blandford, T.N., Blazer, D.J., Calhoun, K.C., Dutton, A.R., Naing, T., Reedy, R.C., and Scanlon, B.R., 2003, Groundwater availability of the southern Ogallala aquifer in Texas and New Mexico—Numerical simulations through 2050: Final report prepared for the Texas Water Development Board by Daniel B. Stephens & Associates, Inc., 158 p.

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Table 2. Estimated total annual pumping for the Ogallala Aquifer in Groundwater Management Area 2. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Region	Basin	Year					
			2010	2020	2030	2040	2050	2060
Andrews	F	Colorado	17,584	15,085	13,678	12,014	10,016	7,377
		Rio Grande	54	50	41	41	41	41
Bailey	O	Brazos	62,538	41,283	34,907	30,064	24,021	21,429
Borden	F	Brazos	292	292	292	292	292	292
		Colorado	107	107	107	107	107	107
Briscoe	O	Red	33,622	26,457	19,722	14,220	13,037	11,933
Castro	O	Brazos	90,367	90,367	90,367	90,367	88,630	84,458
		Red	37,055	36,936	36,141	35,449	34,650	33,540
Cochran	O	Brazos	16,324	7,707	6,556	4,770	4,410	4,179
		Colorado	32,021	28,501	27,085	25,926	23,674	21,192
Crosby	O	Brazos	133,239	133,058	133,058	133,058	133,058	133,058
		Red	1,624	1,624	1,624	1,624	1,624	1,624
Dawson	O	Brazos	5,350	5,350	5,350	5,138	4,075	1,099
		Colorado	196,260	192,758	180,531	156,477	131,379	92,681
Deaf Smith	O	Red	129,167	118,166	106,868	97,057	80,382	65,931
Floyd	O	Brazos	95,488	93,749	92,041	90,930	86,458	84,300
		Red	59,482	55,617	53,320	47,453	43,351	40,061
Gaines	O	Colorado	350,369	240,110	175,175	130,951	97,498	71,544
Garza	O	Brazos	19,203	19,073	18,942	18,812	18,032	17,121
Hale	O	Brazos	130,097	129,291	127,492	125,488	119,612	111,734
		Red	525	525	525	525	525	525
Hockley	O	Brazos	87,712	84,378	80,285	76,847	69,445	60,771
		Colorado	8,256	8,004	8,004	7,571	7,324	7,009
Howard	F	Colorado	3,075	3,075	2,731	2,731	2,731	2,703
Lamb	O	Brazos	147,368	137,304	125,466	111,509	95,696	85,190
Lubbock	O	Brazos	124,519	120,044	115,348	108,699	100,762	91,073
Lynn	O	Brazos	98,003	97,740	96,954	94,600	86,945	78,543
		Colorado	6,020	6,020	6,020	6,020	6,020	5,925
Martin	F	Colorado	13,570	13,570	13,570	13,140	12,299	12,277
Parmer	O	Brazos	50,258	45,572	39,624	35,624	29,978	27,692
		Red	18,436	17,493	16,960	16,525	15,642	13,289
Swisher	O	Brazos	28,248	28,248	26,603	19,889	14,084	8,304
		Red	82,677	79,158	74,399	64,929	59,764	55,994
Terry	O	Brazos	13,342	13,342	13,342	9,793	5,348	4,092
		Colorado	192,317	182,880	121,267	77,305	48,557	29,555
Yoakum	O	Colorado	82,297	59,745	43,575	33,882	26,717	20,040
Total			**2,366,866**	**2,132,679**	**1,907,970**	**1,699,827**	**1,496,184**	**1,306,683**

Table 3. Estimated total annual pumping for the Edwards-Trinity (High Plains) Aquifer in Groundwater Management Area 2. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Region	Basin	Year					
			2010	2020	2030	2040	2050	2060
Bailey	O	Brazos	279	279	279	279	279	279
Borden	F	Brazos	65	65	65	65	65	65
		Colorado	41	41	41	41	41	41
Cochran	O	Brazos	137	137	137	137	137	137
		Colorado	127	127	127	127	127	127
Dawson	O	Brazos	0	0	0	0	0	0
		Colorado	1,103	1,103	1,103	1,103	1,103	1,103
Floyd	O	Brazos	521	521	521	518	505	499
		Red	695	695	695	695	695	683
Gaines	O	Colorado	85,058	46,202	30,316	22,997	16,523	12,904
Garza	O	Brazos	18	18	18	18	18	18
		Colorado	0	0	0	0	0	0
Hale	O	Brazos	3,523	3,523	3,523	3,523	3,523	3,419
Hockley	O	Brazos	96	96	96	96	96	96
		Colorado	0	0	0	0	0	0
Lamb	O	Brazos	164	164	164	164	164	164
Lubbock	O	Brazos	690	690	690	690	690	690
Lynn	O	Brazos	221	221	221	221	221	221
		Colorado	9	9	9	9	9	9
Terry	O	Brazos	23	23	23	23	23	23
		Colorado	959	959	922	922	922	922
Yoakum	O	Colorado	2,532	1,893	1,757	1,642	1,642	1,524
Total			**96,261**	**56,766**	**40,707**	**33,270**	**26,783**	**22,924**

Table 4. Estimated total annual pumping for the Ogallala and Edwards-Trinity (High Plains) aquifers summarized by county in Groundwater Management Area 2 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Andrews	17,638	15,135	13,719	12,055	10,057	7,418
Bailey	62,817	41,562	35,186	30,343	24,300	21,708
Borden	505	505	505	505	505	505
Briscoe	33,622	26,457	19,722	14,220	13,037	11,933
Castro	127,422	127,303	126,508	125,816	123,280	117,998
Cochran	48,609	36,472	33,905	30,960	28,348	25,635
Crosby	134,863	134,682	134,682	134,682	134,682	134,682
Dawson	202,713	199,211	186,984	162,718	136,557	94,883
Deaf Smith	129,167	118,166	106,868	97,057	80,382	65,931
Floyd	156,186	150,582	146,577	139,596	131,009	125,543
Gaines	435,427	286,312	205,491	153,948	114,021	84,448
Garza	19,221	19,091	18,960	18,830	18,050	17,139
Hale	134,145	133,339	131,540	129,536	123,660	115,678
Hockley	96,064	92,478	88,385	84,514	76,865	67,876
Howard	3,075	3,075	2,731	2,731	2,731	2,703
Lamb	147,532	137,468	125,630	111,673	95,860	85,354
Lubbock	125,209	120,734	116,038	109,389	101,452	91,763
Lynn	104,253	103,990	103,204	100,850	93,195	84,698
Martin	13,570	13,570	13,570	13,140	12,299	12,277
Parmer	68,694	63,065	56,584	52,149	45,620	40,981
Swisher	110,925	107,406	101,002	84,818	73,848	64,298
Terry	206,641	197,204	135,554	88,043	54,850	34,592
Yoakum	84,829	61,638	45,332	35,524	28,359	21,564
Total	**2,463,127**	**2,189,445**	**1,948,677**	**1,733,097**	**1,522,967**	**1,329,607**

Table 5. Estimated total annual pumping for the Ogallala and Edwards-Trinity (High Plains) aquifers summarized by regional water planning area in Groundwater Management Area 2 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
F	34,788	32,285	30,525	28,431	25,592	22,903
O	2,428,339	2,157,160	1,918,152	1,704,666	1,497,375	1,306,704
Total	**2,463,127**	**2,189,445**	**1,948,677**	**1,733,097**	**1,522,967**	**1,329,607**

Table 6. Estimated total annual pumping for the Ogallala and Edwards-Trinity (High Plains) aquifers summarized by river basin in Groundwater Management Area 2 for each decade between 2010 and 2060. Results are in acre-feet per year.

Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	1,108,085	1,052,535	1,012,364	961,614	886,567	818,946
Colorado	991,705	800,189	626,018	492,965	386,689	287,040
Red	363,283	336,671	310,254	278,477	249,670	223,580
Rio Grande	54	50	41	41	41	41
Total	**2,463,127**	**2,189,445**	**1,948,677**	**1,733,097**	**1,522,967**	**1,329,607**

Table 7. Estimated total annual pumping for the Ogallala and Edwards-Trinity (High Plains) aquifers summarized by groundwater conservation district (GCD) in Groundwater Management Area 2 for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Garza County UWCD	19,221	19,091	18,960	18,830	18,050	17,139
High Plains UWCD No. 1	1,421,975	1,343,554	1,282,656	1,208,126	1,109,582	1,019,597
Llano Estacado UWCD	435,427	286,312	205,491	153,948	114,021	84,448
Mesa UWCD	202,713	199,211	186,984	162,718	136,557	94,883
Permian Basin UWCD	16,403	16,403	16,099	15,669	14,828	14,795
Sandy Land UWCD	84,829	61,638	45,332	35,524	28,359	21,564
South Plains UWCD	207,257	197,820	136,170	88,659	55,466	35,208
Total (excluding non-district areas)	**2,387,825**	**2,124,029**	**1,891,692**	**1,683,474**	**1,476,863**	**1,287,634**
No District	75,302	65,416	56,985	49,623	46,104	41,973
Total (including non-district areas)	**2,463,127**	**2,189,445**	**1,948,677**	**1,733,097**	**1,522,967**	**1,329,607**

Table 8. Estimates of annual exempt use for the Ogallala and Edwards-Trinity (High Plains) aquifers in Groundwater Management Area 2 by groundwater conservation district (GCD) for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	Source	Year					
		2010	2020	2030	2040	2050	2060
Garza County UWCD	TA	68	71	69	67	64	59
High Plains UWCD No. 1	D	15,482	16,253	16,712	16,925	17,087	17,043
Llano Estacado UWCD	D	2,242	2,332	2,397	2,443	2,435	2,420
Mesa UWCD	TA	542	558	573	582	566	545
Permian Basin UWCD	TA	575	596	605	608	605	599
Sandy Land UWCD	TA	366	402	424	448	436	422
South Plains UWCD	TA	502	537	569	601	603	599
Total		**19,777**	**20,749**	**21,349**	**21,674**	**21,796**	**21,687**

TA = Estimated exempt use calculated by TWDB and accepted by the district

D = Estimated exempt use calculated by the district

Table 9. Estimates of managed available groundwater for the Ogallala and Edwards-Trinity (High Plains) aquifers in Groundwater Management Area 2 by groundwater conservation district (GCD) for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Garza County UWCD	19,153	19,020	18,891	18,763	17,986	17,080
High Plains UWCD No. 1	1,406,493	1,327,301	1,265,944	1,191,201	1,092,495	1,002,554
Llano Estacado UWCD	433,185	283,980	203,094	151,505	111,586	82,028
Mesa UWCD	202,171	198,653	186,411	162,136	135,991	94,338
Permian Basin UWCD	15,828	15,807	15,494	15,061	14,223	14,196
Sandy Land UWCD	84,463	61,236	44,908	35,076	27,923	21,142
South Plains UWCD	206,755	197,283	135,601	88,058	54,863	34,609
Total	**2,368,048**	**2,103,280**	**1,870,343**	**1,661,800**	**1,455,067**	**1,265,947**

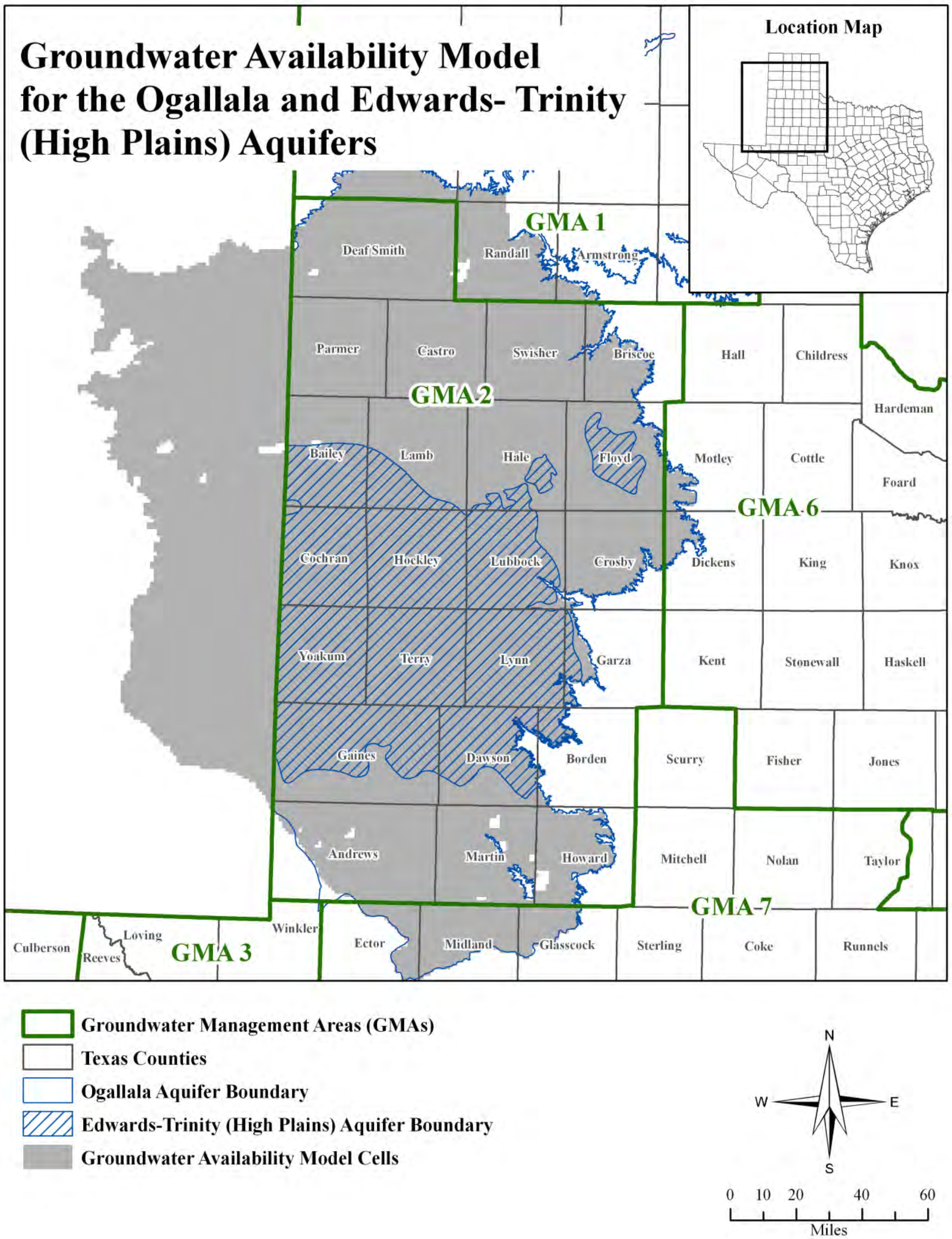

Figure 1. Map showing the areas covered by the groundwater availability model for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer.

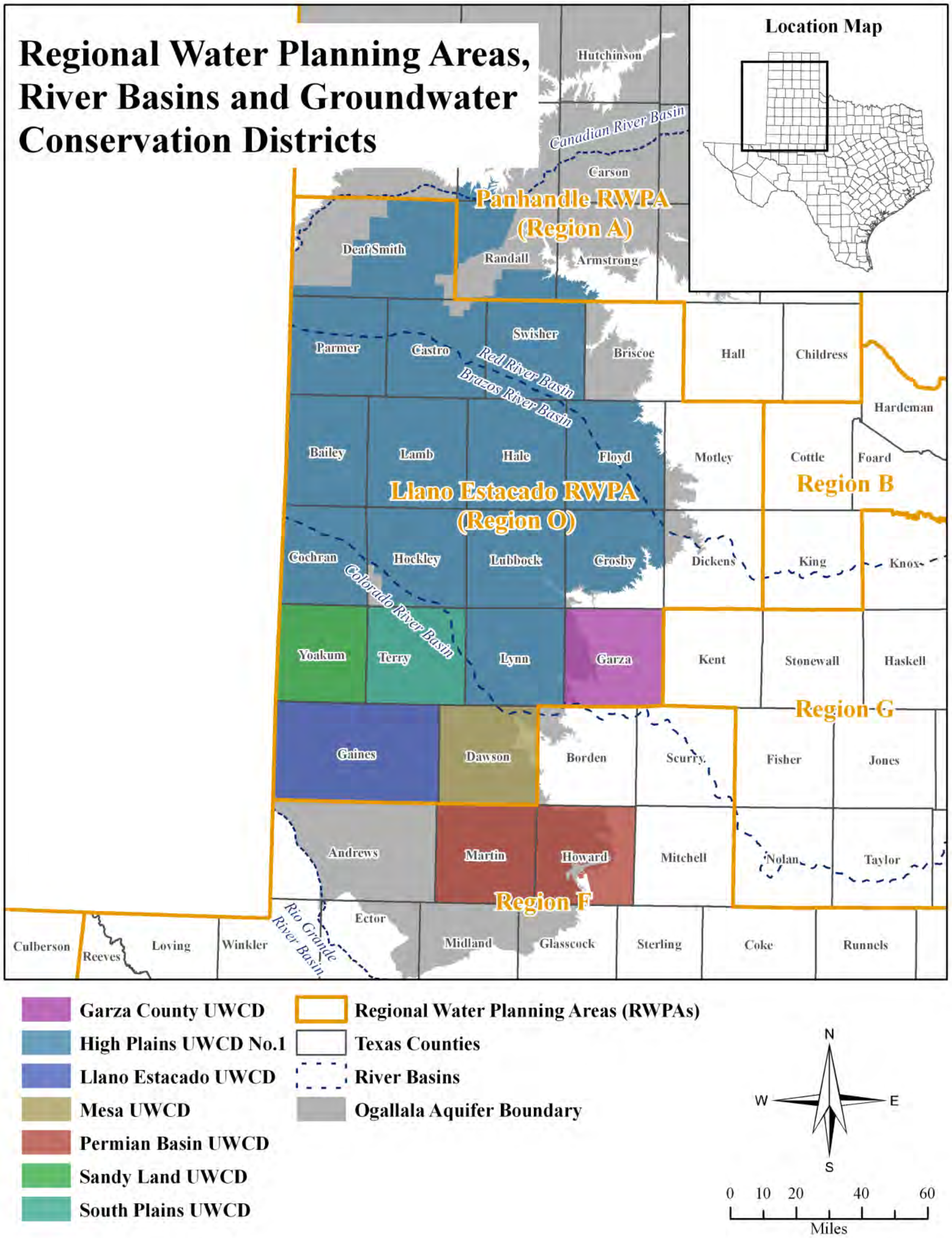

Figure 2. Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in Groundwater Management Area 2. UWCD refers to Underground Water Conservation District.

GAM Run 10-035 MAG Version 3: Modeled Available Groundwater for the Dockum Aquifer

by Mr. Wade Oliver

Edited and finalized by Radu Boghici to reflect statutory changes effective September 1, 2011

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 936-2386
July 9, 2012

Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on July 9, 2012.

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EXECUTIVE SUMMARY:

The modeled available groundwater from the Dockum Aquifer as a result of the desired future condition adopted by the members of Groundwater Management Area 2 is approximately 14,100 acre-feet per year. This is shown divided by county, regional water planning area, and river basin in Table 1 for use in the regional water planning process. Modeled available groundwater is summarized by county, regional water planning area, river basin, and groundwater conservation district in tables 2 through 5. The estimates were extracted from Groundwater Availability Modeling Task 10-025, which Groundwater Management Area 2 used as the basis for developing the desired future condition of an average decline of no more than 40 feet between 2010 and 2060. Earlier versions of this report showed modeled available groundwater for Dawson, Garza, Howard, Martin, Terry, and Yoakum counties based on the pumping assumed in the groundwater availability model simulation. However, Groundwater Management Area 2 declared those counties "not relevant" for joint planning purposes. Since modeled available groundwater only applies to areas with a specified desired future condition, we updated this report to depict modeled available groundwater only in counties with specified desired future conditions.

REQUESTOR:

Mr. Jason Coleman of South Plains Underground Water Conservation District on behalf of Groundwater Management Area 2

DESCRIPTION OF REQUEST:

In a letter dated August 10, 2010 and received August 13, 2010, Mr. Jason Coleman provided the Texas Water Development Board (TWDB) with the desired future condition of the Dockum Aquifer adopted by the members of Groundwater Management Area 2. The desired future condition for the Dockum Aquifer, as described in Resolution No. 2010-01 and adopted August 5, 2010 by the groundwater conservation districts within Groundwater Management Area 2, are described below:

> [T]*he members of* [Groundwater Management Area] *#2 adopt the desired future condition of the Dockum Aquifer as described in Table A-8, GAM Task 10-025 whereby the decline in water levels averages no more than forty feet over the time period 2010-2060 and further declare that the Dockum Aquifer is not relevant for the following counties: Dawson, Garza, Howard, Martin, Terry, and Yoakum.*

In response to receiving the adopted desired future condition, the TWDB has estimated the modeled available groundwater for the above desired future condition in Groundwater Management Area 2 where the Dockum Aquifer was considered by the management area to be relevant for joint planning purposes.

METHODS:

Groundwater Management Area 2 contains a portion of the Dockum Aquifer, a minor aquifer in Texas as defined in the 2007 State Water Plan (TWDB, 2007). The location of Groundwater Management Area 2, the Dockum Aquifer, and the groundwater model cells that represent the aquifer are shown in Figure 1. The TWDB previously completed several predictive groundwater model simulations for the Dockum Aquifer in Groundwater Management Area 2, documented in Groundwater Availability Modeling (GAM) Task 10-025 (Oliver, 2010). As described in the desired future conditions statement above, the model simulation scenario on which the desired future condition is based is shown in Table A-8 of GAM Task 10-025 (Oliver, 2010). The pumping results for Groundwater Management Area 2 presented here, taken directly from the above scenario, achieve the adopted desired future condition for the Dockum Aquifer and have been divided by county, regional water planning area, river basin, and groundwater conservation district. These areas are shown in Figure 2.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the modified groundwater model for the Dockum Aquifer are described below:

- The results presented in this report are based on the “160 percent of base” scenario in GAM Task 10-025 (Oliver, 2010). This is the scenario shown in Table A-8 of Oliver (2010) and referred to in the Groundwater Management Area 2 desired future condition statement for the Dockum Aquifer. See Oliver (2010) for a full description of the methods, assumptions, and results for the groundwater availability model run.

- The modified version the groundwater model for the Dockum Aquifer described in Oliver and Hutchison (2010) was used for this analysis. This model is an update to the previously developed groundwater availability model for the Dockum Aquifer described in Ewing and others (2008) in order to more effectively simulate predictive conditions. See Oliver and Hutchison (2010) and Ewing and others (2008) for assumptions and limitations of the model.

- The model includes two active layers which represent the upper and lower portions of the Dockum Aquifer. Layer 2 represents the upper portion of the Dockum Aquifer. Layer 3 represents the lower portion of the Dockum Aquifer. Layer 1, which is active in version 1.01 of the model documented in Ewing and others (2008), was inactivated in the modified model as described in Oliver and Hutchison (2010).

- The mean absolute error (a measure of the difference between simulated and measured water levels during model calibration) for the lower portion of the Dockum Aquifer between 1980 and 1997 is 53 feet.

- Cells were assigned to individual counties, river basins, regional water planning areas, and groundwater conservation districts as shown in the August 3, 2010 version of file that associates the model grid to political and natural boundaries for the Dockum Aquifer.

Note that some minor adjustments were made to the file better reflect the relationship of model cells to political boundaries.

- The recharge used for the model run represents average recharge as described in Ewing and others (2008).

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. This is distinct from "managed available groundwater," shown in version 2 of this report dated August 30, 2011, which was a permitting value and accounted for the estimated use of the aquifer exempt from permitting. This change was made to reflect changes in statute by the 82nd Texas Legislature, effective September 1, 2011.

Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits. The estimated amount of pumping exempt from permitting, which the Texas Water Development Board is now required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

RESULTS:

The modeled available groundwater for the Dockum Aquifer in Groundwater Management Area 2 consistent with the desired future condition is approximately 14,100 acre-feet per year. This has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 1).

The modeled available groundwater is also summarized by county, regional water planning area, river basin, and groundwater conservation district as shown in tables 2, 3, 4, and 5, respectively. In Table 5, note that the modeled available groundwater is also totaled for those districts that considered the Dockum Aquifer relevant for joint planning purposes: High Plains Underground Water Conservation District No. 1 and Llano Estacado Underground Water Conservation District.

LIMITATIONS:

The groundwater model used in developing estimates of total pumping is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future condition. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. 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 develop estimates of total pumping is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition(s).

In addition, certain assumptions have been made regarding future precipitation, recharge, and streamflow in developing these total pumping estimates. Those assumptions also need to be considered and compared to actual future data when evaluating compliance with the desired future condition.

Given these limitations, users of this information are cautioned that the total pumping numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are 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 future groundwater pumping as well as whether or not they are achieving their desired future conditions. 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 these managed available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

REFERENCES:

Ewing, J.E., Jones, T.L., Yan, T., Vreugdenhil, A.M., Fryar, D.G., Pickens, J.F., Gordon, K., Nicot, J.P., Scanlon, B.R., Ashworth, J.B., Beach, J., 2008, Groundwater Availability Model for the Dockum Aquifer – Final Report: contract report to the Texas Water Development Board, 510 p.

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.

Oliver, W., Hutchison, W.R., 2010, Modification and recalibration of the Groundwater Availability Model of the Dockum Aquifer: Texas Water Development Board, 114 p.

Oliver, W., 2010, GAM Task 10-025: Texas Water Development Board, GAM Task 10-025 Report, 61 p.

Texas Water Development Board, 2007, Water for Texas – 2007—Volumes I-III; Texas Water Development Board Document No. GP-8-1, 392 p.

Table 1. Modeled available groundwater for the Dockum Aquifer in Groundwater Management Area 2 by county, regional water planning area, and river basin. Results are in acre-feet per year.

County	Regional Water Planning Area	Basin	Year					
			2010	**2020**	**2030**	**2040**	**2050**	**2060**
Andrews	F	Colorado	715	715	715	715	715	715
		Rio Grande	135	135	135	135	135	135
Bailey	O	Brazos	1	1	1	1	1	1
Borden	F	Brazos	33	33	33	33	33	33
		Colorado	482	482	482	482	482	482
Briscoe	O	Red	231	231	231	231	231	231
Castro	O	Brazos	0	0	0	0	0	0
		Red	1	1	1	1	1	1
Cochran	O	Brazos	0	0	0	0	0	0
		Colorado	0	0	0	0	0	0
Crosby	O	Brazos	4,061	4,061	4,061	4,061	4,061	4,061
		Red	48	48	48	48	48	48
Deaf Smith	O	Canadian	1,082	1,082	1,082	1,082	1,082	1,082
		Red	3,630	3,630	3,630	3,630	3,630	3,630
Floyd	O	Brazos	745	745	745	745	745	745
		Red	939	939	939	939	939	939
Gaines	O	Colorado	0	0	0	0	0	0
Hale	O	Brazos	734	734	734	734	734	734
		Red	4	4	4	4	4	4
Hockley	O	Brazos	571	571	571	571	571	571
		Colorado	0	0	0	0	0	0
Lamb	O	Brazos	0	0	0	0	0	0
Lubbock	O	Brazos	15	15	15	15	15	15
Lynn	O	Brazos	5	5	5	5	5	5
		Colorado	0	0	0	0	0	0
Parmer	O	Brazos	0	0	0	0	0	0
		Red	2	2	2	2	2	2
Swisher	O	Brazos	83	83	83	83	83	83
		Red	614	614	614	614	614	614
Total			**14,131**	**14,131**	**14,131**	**14,131**	**14,131**	**14,131**

Table 2. Modeled available groundwater for the Dockum Aquifer summarized by county in Groundwater Management Area 2 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Andrews	850	850	850	850	850	850
Bailey	1	1	1	1	1	1
Borden	515	515	515	515	515	515
Briscoe	231	231	231	231	231	231
Castro	1	1	1	1	1	1
Cochran	0	0	0	0	0	0
Crosby	4,109	4,109	4,109	4,109	4,109	4,109
Deaf Smith	4,712	4,712	4,712	4,712	4,712	4,712
Floyd	1,684	1,684	1,684	1,684	1,684	1,684
Gaines	0	0	0	0	0	0
Hale	738	738	738	738	738	738
Hockley	571	571	571	571	571	571
Lamb	0	0	0	0	0	0
Lubbock	15	15	15	15	15	15
Lynn	5	5	5	5	5	5
Parmer	2	2	2	2	2	2
Swisher	697	697	697	697	697	697
Total	**14,131**	**14,131**	**14,131**	**14,131**	**14,131**	**14,131**

Table 3. Modeled available groundwater for the Dockum Aquifer summarized by regional water planning area in Groundwater Management Area 2 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
F	1,365	1,365	1,365	1,365	1,365	1,365
O	12,766	12,766	12,766	12,766	12,766	12,766
Total	**14,131**	**14,131**	**14,131**	**14,131**	**14,131**	**14,131**

Table 4. Modeled available groundwater for the Dockum Aquifer summarized by river basin in Groundwater Management Area 2 for each decade between 2010 and 2060. Results are in acre-feet per year.

Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	6,248	6,248	6,248	6,248	6,248	6,248
Canadian	1,082	1,082	1,082	1,082	1,082	1,082
Colorado	1,197	1,197	1,197	1,197	1,197	1,197
Red	5,469	5,469	5,469	5,469	5,469	5,469
Rio Grande	135	135	135	135	135	135
Total	**14,131**	**14,131**	**14,131**	**14,131**	**14,131**	**14,131**

Table 5. Modeled available groundwater for the Dockum Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 2 for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
High Plains UWCD No. 1	10,092	10,092	10,092	10,092	10,092	10,092
Llano Estacado UWCD	0	0	0	0	0	0
Total (districts where aquifer is relevant)	**10,092**	**10,092**	**10,092**	**10,092**	**10,092**	**10,092**
No District	4,039	4,039	4,039	4,039	4,039	4,039
Total (all areas)	**14,131**	**14,131**	**14,131**	**14,131**	**14,131**	**14,131**

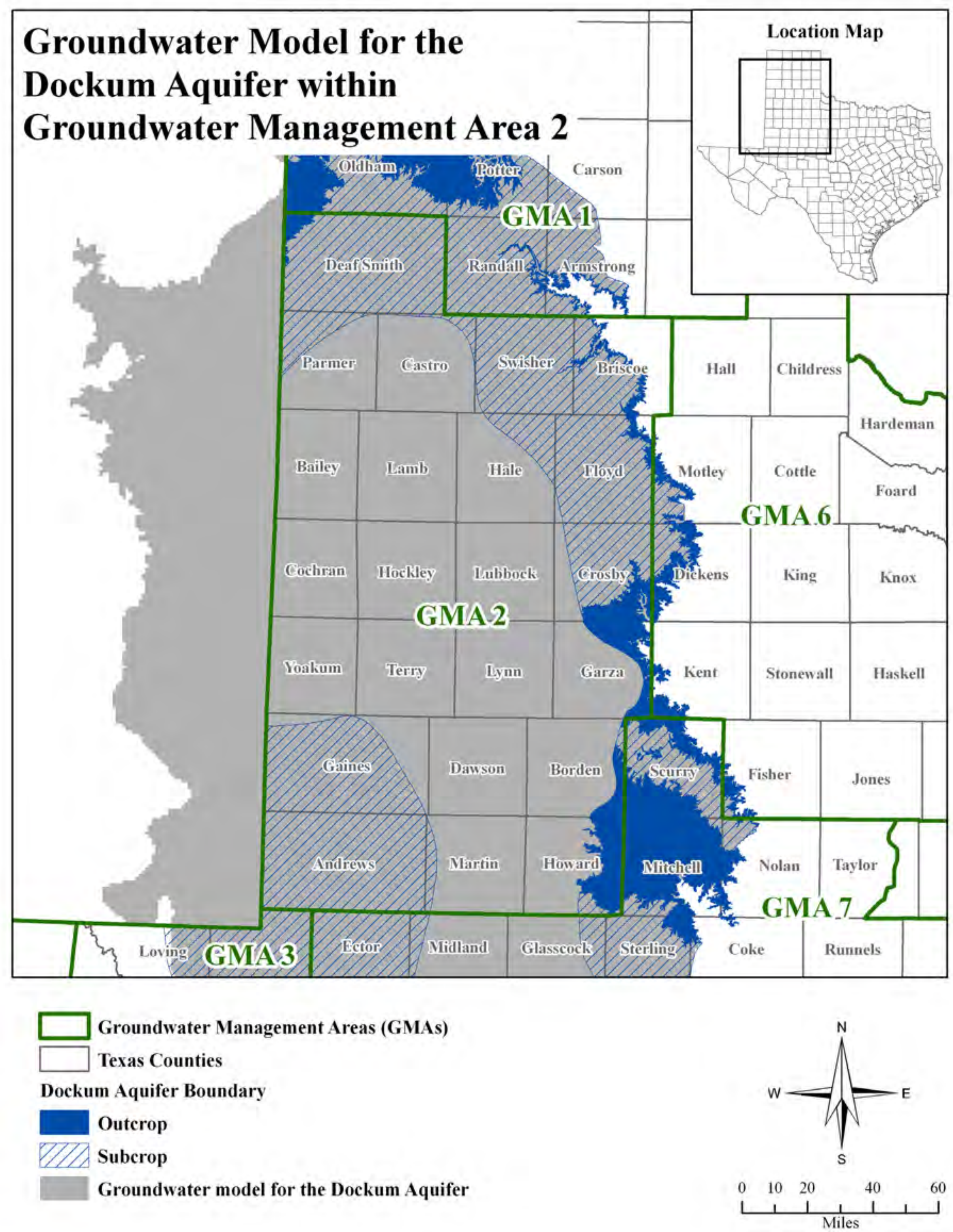

Figure 1. Map showing the areas covered by the groundwater model for the Dockum Aquifer and the boundary of Groundwater Management Area 2.

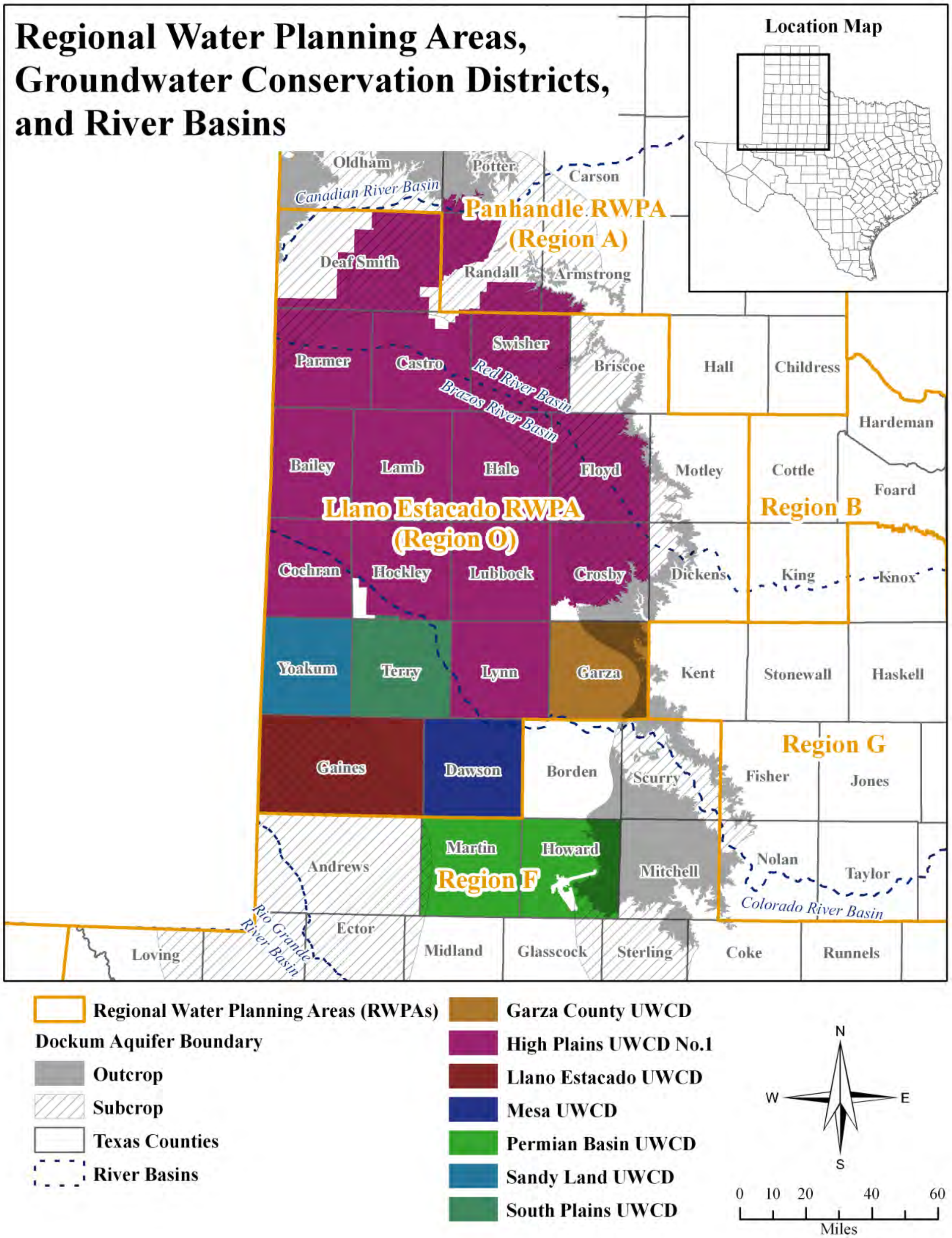

Figure 2. Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in and neighboring Groundwater Management Area 2. UWCD refers to Underground Water Conservation District.

Appendix B

GAM Run 11-009: High Plains Underground Water Conservation District No. 1 Management Plan

by Eric Aschenbach
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-1708
June 24, 2011

Cynthia K. Ridgeway is the Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by Eric Aschenbach under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on June 24, 2011.

GAM RUN 11-009: HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1 MANAGEMENT PLAN

by Eric Aschenbach
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-1708
June 24, 2011

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 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 supersedes Groundwater Availability Model (GAM) Run 09-06. The High Plains Underground Water Conservation District No. 1 boundaries have expanded since the previous report was completed to include Swisher County, and additional areas of Lamb and Hockley counties. The purpose of this report is to provide information to High Plains Underground Water Conservation District No. 1 for its groundwater management plan based on the new district boundaries.

This report discusses the method, assumptions, and results from model runs using the groundwater availability models for the Dockum Aquifer and the southern portion of the Ogallala Aquifer, which includes the Edwards-Trinity (High Plains) Aquifer. See Groundwater Availability Model Run 08-63 (Oliver, 2008) for methods and assumptions relating to the results presented for the northern portion of the Ogallala Aquifer. Tables 1 through 3 summarize the groundwater availability model data required by the statute, and figures 1 through 3 show the area of each model from which the values in the respective tables were extracted. If after review of the figures, High Plains

Water Conservation District No. 1 determines that the district boundaries used in the assessment do not reflect current conditions, please notify the Texas Water Development Board immediately.

METHODS:

The groundwater availability model for the southern portion of the Ogallala Aquifer and Edwards-Trinity (High Plains) Aquifer (1980 through 2000), and the Dockum Aquifer (1980 through 1997) were run for this analysis. Water budgets for each year of the transient model period were extracted 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.

PARAMETERS AND ASSUMPTIONS:

Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer

- Version 2.01 of the groundwater availability model for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer was used for this analysis. This model is an expansion on and update to the previously developed groundwater availability model for the southern portion of the Ogallala Aquifer described in Blandford and others (2003). See Blandford and others (2008) and Blandford and others (2003) for assumptions and limitations of the model.

- The model includes four layers representing the southern portion of the Ogallala and Edwards-Trinity (High Plains) aquifers. The units comprising the Edwards-Trinity (High Plains) Aquifer (primarily Edwards, Comanche Peak, and Antlers Sand formations) are separated from the overlying Ogallala Aquifer by a layer of Cretaceous shale, where present. Water budgets for the district have been determined for the Ogallala Aquifer (Layer 1), as well as the Edwards-Trinity (High Plains) Aquifer (Layer 2 through Layer 4, collectively).

- The mean absolute error (a measure of the difference between simulated and actual water levels during model calibration) for the Ogallala Aquifer in 2000 is 33 feet. The mean absolute error for the Edwards-Trinity (High Plains) Aquifer in 1997 is 25 feet (Blandford and others, 2008). This represents 1.8 and 3.0 percent of the hydraulic head drop across the model area for each aquifer, respectively.

- Irrigation return flow was accounted for in the groundwater availability model by a direct reduction in agricultural pumping as described in Blandford and others (2003).

- Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) was used as the interface to process model output.

Northern Portion of the Ogallala Aquifer

- Version 2.01 of the groundwater availability model for the northern part of the Ogallala Aquifer (Dutton, 2004) was used in this analysis.
- See Dutton and others (2001) and Dutton (2004) for assumptions and limitations of the model for the northern part of the Ogallala Aquifer. Root mean squared error for this model is 53 feet. This error has more of an effect on model results where the aquifer is thin.

Dockum Aquifer

- A modified version of the groundwater model for the Dockum Aquifer as described in Oliver and Hutchison (2010) was used for this analysis. This model is an update to the previously developed groundwater availability model for the Dockum Aquifer described in Ewing and others (2008). The modified model version was completed to more effectively simulate the relationship between the Ogallala Aquifer and the Dockum Aquifer and was used for this management plan data extraction analysis due to enhancements in the calibration and in order to be consistent with the Managed Available Groundwater (MAG) process. See Oliver and Hutchison (2010) and Ewing and others (2008) for assumptions and limitations of the model.
- The model includes two active layers. Layer 2 represents the upper portion of the Dockum Aquifer and Layer 3 represents the lower portion of the Dockum Aquifer. Layer 1, which is active in version 1.01 of the model documented in Ewing and others (2008), was inactivated in the modified version of the model as described in Oliver and Hutchison (2010). An individual water budget for the district was determined for the Dockum Aquifer (Layers 2 and Layer 3, collectively). It should be noted that pumping only occurs in the lower portion of the Dockum Aquifer in the groundwater availability model.
- The mean absolute error (a measure of the difference between simulated and measured water levels during model calibration) for the lower portion of the Dockum Aquifer between 1980 and 1997 is 53 feet. This represents 2.5 percent of the hydraulic head drop across the model area (Oliver and Hutchison 2010).
- The MODFLOW Drain package was used to simulate both evapotranspiration and springs. However, the model grid cells representing evapotranspiration within the district did not

contain a drain component for the water budget values, so all drain flow within the district will be considered as the surface water outflow value shown in Table 3.

- The MODFLOW General-Head Boundary package was used to simulate flow between the Dockum Aquifer and overlying aquifers. The water levels in the overlying aquifers were applied as described in Oliver and Hutchison (2010) using Groundwater Availability Model Run 09-001 (Smith, 2009) for the northern portion of the Ogallala Aquifer and Groundwater Availability Model Run 09-023 (Oliver, 2010b) for the southern portion of the Ogallala Aquifer.

- Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) was used as the interface to process model output.

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 3. The components of the modified budget shown in tables 1 through 3 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 3. 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).

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.

TABLE 1: SUMMARIZED INFORMATION FOR THE OGALLALA AQUIFER THAT IS NEEDED FOR HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1'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	678,022
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Ogallala Aquifer	10,524
Estimated annual volume of flow into the district within each aquifer in the district	Ogallala Aquifer	15,378
Estimated annual volume of flow out of the district within each aquifer in the district	Ogallala Aquifer	20,957
Estimated net annual volume of flow between each aquifer in the district	From the Ogallala Aquifer into the Edwards-Trinity (High Plains) Aquifer and adjacent underlying areas	7,545

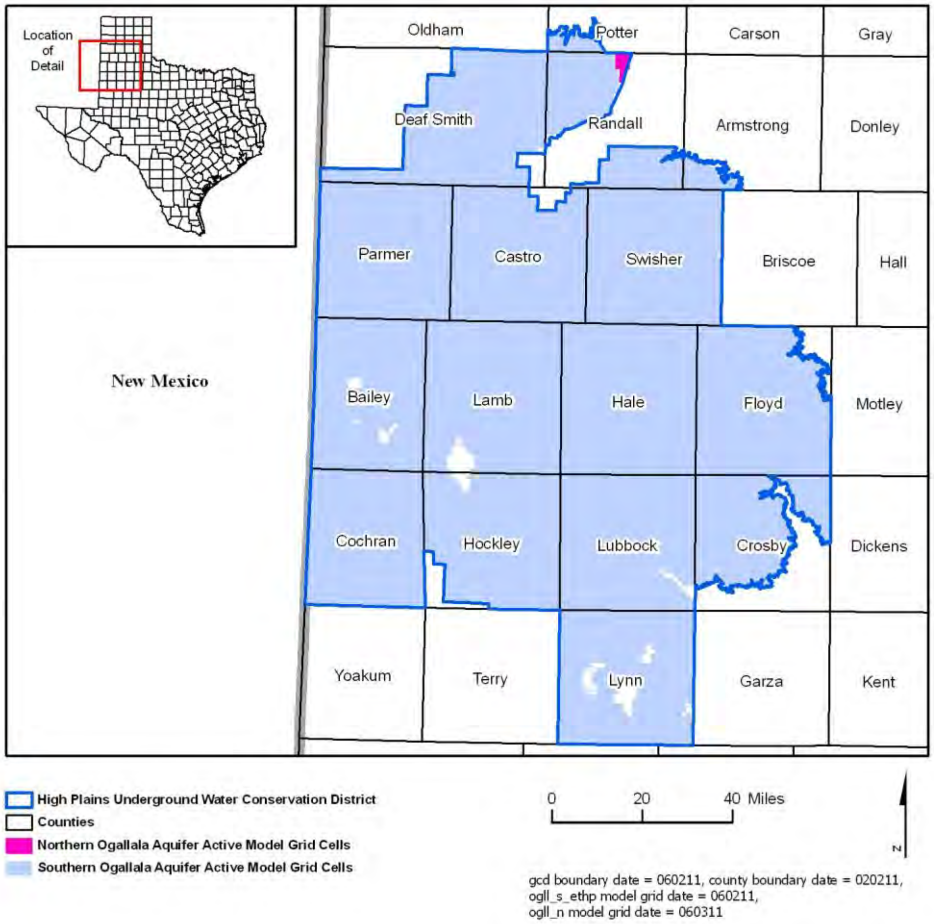

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODELS FOR THE OGALLALA AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2: SUMMARIZED INFORMATION FOR THE EDWARDS-TRINITY (HIGH PLAINS) AQUIFER THAT IS NEEDED FOR HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1'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	896
Estimated annual volume of flow into the district within each aquifer in the district	Edwards-Trinity (High Plains) Aquifer	14,574
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards-Trinity (High Plains) Aquifer	9,962
Estimated net annual volume of flow between each aquifer in the district	From the Ogallala Aquifer and overlying units and into the Edwards-Trinity (High Plains) Aquifer	2,577

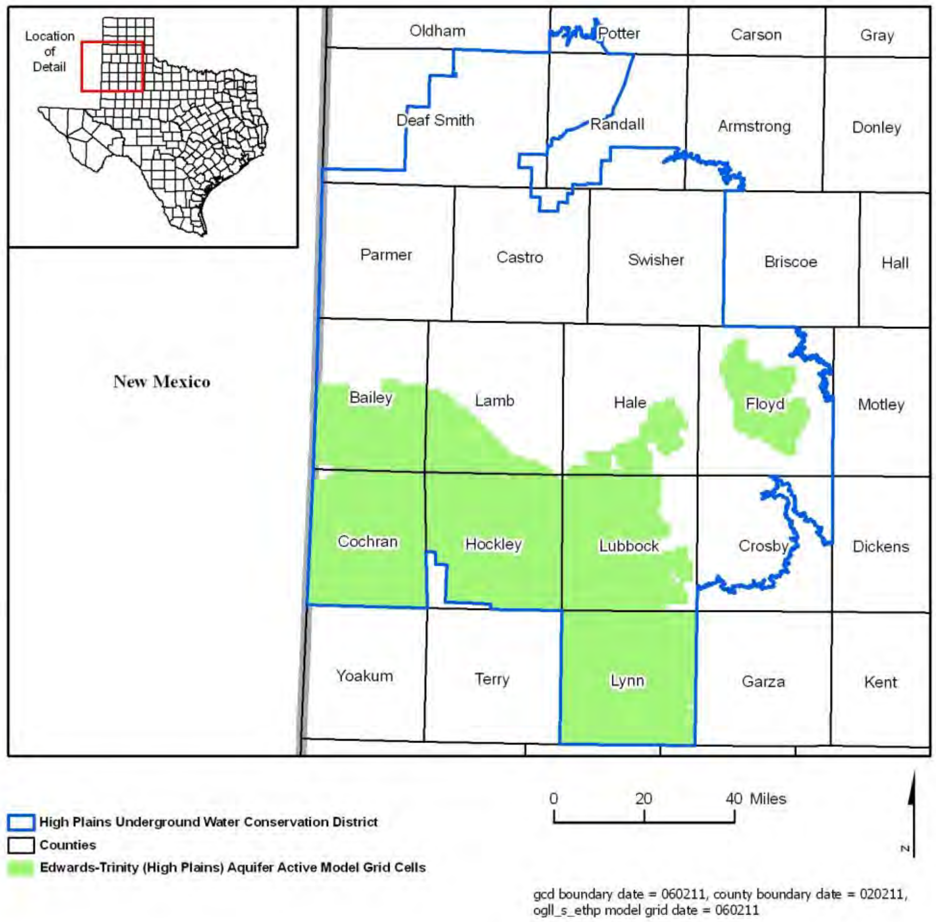

FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE EDWARDS-TRINITY (HIGH PLAINS) AQUIFER FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 3: SUMMARIZED INFORMATION FOR THE DOCKUM AQUIFER THAT IS NEEDED FOR HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1'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	425
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Dockum Aquifer	649
Estimated annual volume of flow into the district within each aquifer in the district	Dockum Aquifer	6,637
Estimated annual volume of flow out of the district within each aquifer in the district	Dockum Aquifer	10,142
Estimated net annual volume of flow between each aquifer in the district	From the Edwards-Trinity (High Plains) Aquifer and overlying younger units and into the Dockum Aquifer	5,014

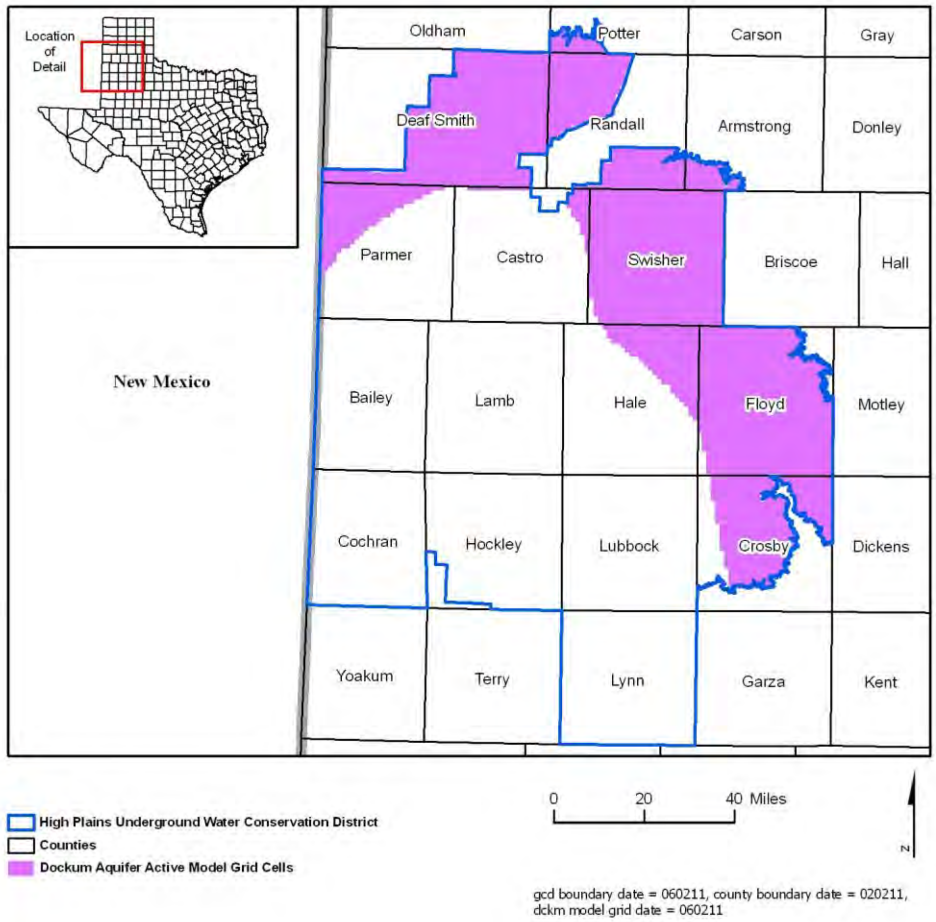

FIGURE 3: AREA OF THE GROUNDWATER MODEL FOR THE DOCKUM AQUIFER FROM WHICH THE INFORMATION IN TABLE 3 WAS EXTRACTED (THE AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

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Appendix C

Estimated Historical Groundwater Use And 2012 State Water Plan Datasets:

High Plains Underground Water Conservation District No. 1

by Stephen Allen
Texas Water Development Board
Groundwater Resources Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
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June 9, 2014

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 part 1 are:

1. Estimated Historical Groundwater 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)

   reports 2-5 are from the 2012 Texas State Water Plan (SWP)

Part 2 of the 2-part package is the groundwater availability model (GAM) report. 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 2012 SWP data available as of 6/9/2014. Although it does not happen frequently, neither of these datasets are static so they are subject to change pending the availability of more accurate WUS data or an amendment to the 2012 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 2012 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

The values presented in the data tables of this report are county-based. In cases where groundwater conservation districts cover only a portion of one or more counties the data values are modified with an apportioning multiplier to create new values that more accurately represent district conditions. The multiplier used in the following formula is a land area ratio: (data value * (land area of district in county / land area of county)). For two of the four SWP tables (Projected Surface Water Supplies and Projected Water Demands) only the county-wide water user group (WUG) data values (county other, manufacturing, steam electric power, irrigation, mining and livestock) are modified using the multiplier. WUG values for municipalities, water supply corporations, and utility districts are not apportioned; instead, their full values are retained when they are located within the district, and eliminated when they are located outside (we ask each district to identify these locations).

The other two SWP tables (Projected Water Supply Needs and Projected Water Management Strategies) are not modified because district-specific values are not statutorily required. Each district needs only “consider” the county values in those tables.

In the WUS table every category of water use (including municipal) is apportioned. Staff determined that breaking down the annual municipal values into individual WUGs was too complex.

TWDB recognizes that the apportioning formula used is not perfect but it is the best available process with respect to time and staffing constraints. If a district believes it has data that is more accurate it can add those data to the plan with an explanation of how the data were derived. Apportioning percentages that the TWDB used are listed above each applicable table.

For additional questions regarding this data, please contact Stephen Allen (stephen.allen@twdb.texas.gov or 512-463-7317) or Rima Petrossian (rima.petrossian@twdb.texas.gov or 512-936-2420).

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

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2012. TWDB staff anticipates the calculation and posting of these estimates at a later date.

ARMSTRONG COUNTY *7.63 % (multiplier)* All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	35	0	0	0	640	38	713
	SW	0	0	0	0	0	4	4
2010	GW	27	0	0	0	335	34	396
	SW	0	0	0	0	0	4	4
2009	GW	29	0	0	0	457	41	527
	SW	0	0	0	0	0	5	5
2008	GW	31	0	0	0	539	41	611
	SW	0	0	0	0	0	5	5
2007	GW	30	0	0	0	441	39	510
	SW	0	0	0	0	0	4	4
2006	GW	36	0	0	0	502	70	608
	SW	0	0	0	0	0	8	8
2005	GW	29	0	0	0	585	63	677
	SW	0	0	0	0	0	7	7
2004	GW	30	0	0	0	549	59	638
	SW	0	0	0	0	0	15	15
2003	GW	32	0	0	0	582	60	674
	SW	0	0	0	0	0	15	15
2002	GW	27	0	0	0	784	40	851
	SW	0	0	0	0	0	10	10
2001	GW	29	0	0	0	590	34	653
	SW	0	0	0	0	0	9	9
2000	GW	31	0	0	0	902	37	970
	SW	0	0	0	0	0	9	9

BAILEY COUNTY

100.00 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	1,386	0	0	0	109,351	2,720	113,457
	SW	0	0	0	0	0	302	302
2010	GW	1,112	0	0	0	61,429	2,454	64,995
	SW	0	0	0	0	0	273	273
2009	GW	1,106	0	0	0	123,620	2,866	127,592
	SW	0	0	0	0	0	318	318
2008	GW	1,168	0	0	0	164,328	2,498	167,994
	SW	0	0	0	0	0	278	278
2007	GW	1,120	0	0	0	161,030	2,145	164,295
	SW	0	0	0	0	0	238	238
2006	GW	1,244	0	0	0	96,024	3,531	100,799
	SW	0	0	0	0	0	392	392
2005	GW	1,138	0	0	0	64,963	2,175	68,276
	SW	0	0	0	0	0	242	242
2004	GW	1,332	0	0	0	151,583	1,547	154,462
	SW	0	0	0	0	0	387	387
2003	GW	1,341	0	0	0	152,977	1,616	155,934
	SW	0	0	0	0	0	404	404
2002	GW	1,358	0	0	0	167,951	1,471	170,780
	SW	0	0	0	0	0	368	368
2001	GW	1,249	0	0	0	185,648	1,637	188,534
	SW	0	0	0	0	0	409	409
2000	GW	1,259	264	0	0	182,865	1,603	185,991
	SW	0	0	0	0	0	401	401

CASTRO COUNTY

96.33 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	1,587	57	0	0	400,227	9,591	411,462
	SW	0	0	0	0	0	1,066	1,066
2010	GW	1,304	58	0	0	339,316	8,410	349,088
	SW	0	0	0	0	0	936	936
2009	GW	1,301	61	0	0	376,930	10,013	388,305
	SW	0	0	0	0	0	1,113	1,113
2008	GW	1,390	105	0	0	488,087	10,641	500,223
	SW	0	0	0	0	0	1,148	1,148
2007	GW	1,273	104	0	0	482,824	7,920	492,121
	SW	0	0	0	0	0	844	844
2006	GW	1,570	104	0	0	313,015	12,462	327,151
	SW	0	0	0	0	0	1,373	1,373
2005	GW	1,383	177	0	0	282,327	7,677	291,564
	SW	0	0	0	0	0	842	842
2004	GW	1,249	1,563	0	0	378,879	2,779	384,470
	SW	0	0	0	0	0	4,124	4,124
2003	GW	1,407	1,792	0	0	381,757	4,274	389,230
	SW	0	0	0	0	0	6,360	6,360
2002	GW	1,651	1,784	0	0	494,807	3,492	501,734
	SW	0	0	0	0	0	5,190	5,190
2001	GW	1,536	1,958	0	0	456,138	3,568	463,200
	SW	0	0	0	0	0	5,220	5,220
2000	GW	1,542	1,669	0	0	485,303	6,795	495,309
	SW	0	0	0	0	0	1,672	1,672

COCHRAN COUNTY

100.00 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	841	0	42	0	99,504	444	100,831
	SW	0	0	9	0	0	49	58
2010	GW	618	0	14	0	66,485	359	67,476
	SW	0	0	3	0	0	40	43
2009	GW	681	0	163	0	99,287	416	100,547
	SW	0	0	41	0	0	46	87
2008	GW	659	0	312	0	118,899	416	120,286
	SW	0	0	78	0	0	46	124
2007	GW	688	0	0	0	155,577	477	156,742
	SW	0	0	0	0	0	53	53
2006	GW	712	0	0	0	86,849	622	88,183
	SW	0	0	0	0	0	69	69
2005	GW	504	0	0	0	71,037	159	71,700
	SW	0	0	0	0	0	18	18
2004	GW	701	0	0	0	137,669	65	138,435
	SW	0	0	0	0	0	86	86
2003	GW	809	0	0	0	148,266	65	149,140
	SW	0	0	0	0	0	86	86
2002	GW	825	0	0	0	121,509	36	122,370
	SW	0	0	0	0	0	47	47
2001	GW	766	0	0	0	115,261	215	116,242
	SW	0	0	0	0	0	280	280
2000	GW	802	0	0	0	119,985	141	120,928
	SW	0	0	0	0	0	35	35

CROSBY COUNTY

64.16 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	248	1	791	0	85,728	100	86,868
	SW	398	0	448	0	445	43	1,334
2010	GW	207	1	243	0	50,357	97	50,905
	SW	303	0	311	0	297	42	953
2009	GW	202	1	186	0	80,869	127	81,385
	SW	275	0	299	0	520	55	1,149
2008	GW	260	1	129	0	107,747	105	108,242
	SW	272	0	289	0	507	45	1,113
2007	GW	304	1	119	0	98,108	119	98,651
	SW	137	1	259	0	316	51	764
2006	GW	231	1	119	0	56,188	123	56,662
	SW	342	1	263	0	522	53	1,181
2005	GW	235	1	119	0	46,877	104	47,336
	SW	337	1	285	0	515	45	1,183
2004	GW	226	0	128	0	88,121	94	88,569
	SW	339	2	258	0	422	34	1,055
2003	GW	254	2	128	0	94,267	96	94,747
	SW	368	1	282	0	455	35	1,141
2002	GW	256	2	128	0	94,830	120	95,336
	SW	364	1	262	0	958	44	1,629
2001	GW	260	3	128	0	100,743	114	101,248
	SW	416	1	265	0	1,018	41	1,741
2000	GW	283	3	117	0	71,675	125	72,203
	SW	420	0	267	0	271	31	989

DEAF SMITH COUNTY

58.64 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	2,457	277	0	0	133,670	6,784	143,188
	SW	0	0	0	0	0	754	754
2010	GW	2,402	279	0	0	104,713	5,868	113,262
	SW	0	0	0	0	0	652	652
2009	GW	2,383	279	0	0	120,120	6,409	129,191
	SW	0	0	0	0	0	712	712
2008	GW	2,368	279	0	0	165,389	7,089	175,125
	SW	0	0	0	0	0	750	750
2007	GW	1,626	278	0	0	145,340	6,346	153,590
	SW	0	0	0	0	0	665	665
2006	GW	1,676	280	0	0	71,530	10,290	83,776
	SW	0	0	0	0	0	1,106	1,106
2005	GW	1,769	169	0	0	83,248	5,744	90,930
	SW	0	0	0	0	0	605	605
2004	GW	1,645	128	0	0	135,947	4,288	142,008
	SW	0	0	0	0	0	1,576	1,576
2003	GW	2,256	309	0	0	143,073	1,109	146,747
	SW	0	0	0	0	0	327	327
2002	GW	2,244	335	0	0	183,000	5,147	190,726
	SW	0	0	0	0	0	1,925	1,925
2001	GW	2,349	736	0	0	174,388	5,397	182,870
	SW	0	0	0	0	0	2,027	2,027
2000	GW	2,392	724	0	0	218,626	1,378	223,120
	SW	0	0	0	0	0	280	280

FLOYD COUNTY

93.14 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	711	0	183	0	156,644	1,060	158,598
	SW	304	0	188	0	0	187	679
2010	GW	386	0	170	0	95,430	915	96,901
	SW	278	0	176	0	0	162	616
2009	GW	652	0	155	0	159,455	1,164	161,426
	SW	258	0	159	0	0	205	622
2008	GW	649	0	139	0	176,513	1,051	178,352
	SW	269	0	143	0	0	186	598
2007	GW	645	0	0	0	154,796	904	156,345
	SW	193	0	0	0	0	160	353
2006	GW	730	0	0	0	117,448	1,647	119,825
	SW	177	0	0	0	0	291	468
2005	GW	726	0	0	0	108,279	1,011	110,016
	SW	182	0	0	0	0	179	361
2004	GW	579	0	0	0	159,885	581	161,045
	SW	312	0	0	0	0	704	1,016
2003	GW	518	0	0	0	180,370	534	181,422
	SW	366	0	0	0	0	646	1,012
2002	GW	522	0	0	0	175,278	574	176,374
	SW	296	0	0	0	0	696	992
2001	GW	575	0	0	0	163,349	498	164,422
	SW	392	0	0	0	0	604	996
2000	GW	657	0	0	0	220,696	1,017	222,370
	SW	430	0	0	0	65	254	749

HALE COUNTY

100.00 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	5,080	657	200	0	389,019	3,063	398,019
	SW	197	97	52	0	154	340	840
2010	GW	2,727	746	215	0	219,525	2,792	226,005
	SW	859	82	56	0	118	310	1,425
2009	GW	3,350	2,463	151	0	368,617	3,190	377,771
	SW	2,154	105	39	0	37	354	2,689
2008	GW	4,824	2,372	87	0	530,510	3,180	540,973
	SW	734	129	22	0	50	353	1,288
2007	GW	4,451	2,365	0	0	491,650	2,244	500,710
	SW	329	139	0	0	117	249	834
2006	GW	4,687	2,300	0	0	277,885	3,747	288,619
	SW	1,091	176	0	0	246	416	1,929
2005	GW	4,431	2,269	0	0	242,795	2,277	251,772
	SW	1,069	354	0	0	244	253	1,920
2004	GW	4,414	2,423	0	0	354,210	1,767	362,814
	SW	1,054	0	0	0	1,399	450	2,903
2003	GW	4,685	3,123	0	0	393,087	2,425	403,320
	SW	2,783	173	0	0	1,422	617	4,995
2002	GW	2,777	3,084	0	0	385,812	2,078	393,751
	SW	759	148	0	0	0	529	1,436
2001	GW	4,249	2,676	0	0	337,770	2,031	346,726
	SW	1,437	0	0	0	0	517	1,954
2000	GW	3,970	2,606	0	0	367,700	2,037	376,313
	SW	2,113	0	0	0	0	509	2,622

HOCKLEY COUNTY

93.43 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	1,824	529	8	0	140,060	382	142,803
	SW	1,678	3	2	0	0	42	1,725
2010	GW	1,291	530	12	0	92,442	334	94,609
	SW	1,549	1	3	0	0	38	1,591
2009	GW	1,305	529	729	0	140,537	323	143,423
	SW	1,707	1	179	0	0	37	1,924
2008	GW	1,247	492	1,445	0	121,218	339	124,741
	SW	1,386	1	356	0	0	38	1,781
2007	GW	2,130	369	0	0	184,522	296	187,317
	SW	584	0	0	0	0	32	616
2006	GW	1,535	370	0	0	101,752	425	104,082
	SW	1,700	0	0	0	0	48	1,748
2005	GW	1,480	370	0	0	84,420	218	86,488
	SW	1,692	0	0	0	0	24	1,716
2004	GW	1,461	370	0	0	173,395	146	175,372
	SW	1,398	0	0	0	0	93	1,491
2003	GW	3,002	370	0	0	177,607	318	181,297
	SW	2	0	0	0	0	203	205
2002	GW	1,474	370	0	0	154,034	367	156,245
	SW	1,818	0	0	0	0	236	2,054
2001	GW	1,777	370	0	0	174,433	357	176,937
	SW	1,719	0	0	0	0	228	1,947
2000	GW	1,711	380	0	0	162,985	433	165,509
	SW	1,613	40	0	0	514	108	2,275

LAMB COUNTY

100.00 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	2,583	415	101	10,658	308,578	3,902	326,237
	SW	0	0	26	0	0	205	231
2010	GW	1,842	389	108	11,591	182,763	3,554	200,247
	SW	0	0	28	0	0	187	215
2009	GW	1,734	361	59	11,132	323,337	4,265	340,888
	SW	0	0	15	0	0	224	239
2008	GW	2,464	513	10	11,938	404,946	3,928	423,799
	SW	0	0	3	0	0	207	210
2007	GW	2,377	512	0	11,195	470,827	3,352	488,263
	SW	0	0	0	0	0	177	177
2006	GW	2,569	459	0	11,964	249,209	4,657	268,858
	SW	0	0	0	0	0	245	245
2005	GW	2,523	459	0	14,197	241,431	3,478	262,088
	SW	0	0	0	0	0	183	183
2004	GW	2,572	459	0	18,295	372,046	2,631	396,003
	SW	0	0	0	0	0	657	657
2003	GW	2,950	422	0	15,432	388,042	2,597	409,443
	SW	0	0	0	0	0	649	649
2002	GW	3,362	418	0	14,237	422,375	1,937	442,329
	SW	0	0	0	0	0	484	484
2001	GW	3,117	330	0	14,879	421,483	1,768	441,577
	SW	0	0	0	0	0	442	442
2000	GW	3,383	427	0	14,553	377,893	1,658	397,914
	SW	0	0	0	0	0	414	414

LUBBOCK COUNTY

100.00 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	52,448	380	889	1,260	158,755	821	214,553
	SW	4,360	239	878	118	0	17	5,612
2010	GW	30,753	562	982	452	106,030	716	139,495
	SW	13,360	235	970	537	0	15	15,117
2009	GW	26,886	450	717	0	178,181	683	206,917
	SW	14,937	254	708	723	0	14	16,636
2008	GW	27,735	460	451	18	241,393	708	270,765
	SW	12,263	276	446	884	0	14	13,883
2007	GW	24,140	388	0	17	219,928	825	245,298
	SW	13,525	272	0	740	6,000	17	20,554
2006	GW	30,627	396	0	12	123,243	1,532	155,810
	SW	16,925	1,244	0	885	6,500	31	25,585
2005	GW	26,642	423	0	4	109,686	922	137,677
	SW	19,644	304	0	836	6,000	19	26,803
2004	GW	29,149	342	0	5	199,872	605	229,973
	SW	14,498	280	0	148,487	5,650	151	169,066
2003	GW	35,771	527	0	8	193,309	680	230,295
	SW	13,980	127	0	562	8,000	170	22,839
2002	GW	25,459	423	0	11	223,230	801	249,924
	SW	20,690	118	0	781	6,904	200	28,693
2001	GW	12,976	558	0	12	220,296	777	234,619
	SW	35,316	84	0	815	6,813	194	43,222
2000	GW	12,586	715	0	2	235,372	609	249,284
	SW	35,133	582	0	1,387	7,606	152	44,860

LYNN COUNTY

100.00 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	349	0	482	0	99,511	77	100,419
	SW	586	0	122	0	0	14	722
2010	GW	298	0	249	0	53,247	75	53,869
	SW	471	0	63	0	0	13	547
2009	GW	419	0	145	0	88,008	167	88,739
	SW	427	0	37	0	0	29	493
2008	GW	431	0	41	0	111,548	75	112,095
	SW	403	0	10	0	0	13	426
2007	GW	643	0	0	0	105,698	94	106,435
	SW	136	0	0	0	5,000	16	5,152
2006	GW	572	0	0	0	60,206	141	60,919
	SW	136	0	0	0	5,446	25	5,607
2005	GW	506	0	0	0	60,788	107	61,401
	SW	182	0	0	0	4,659	19	4,860
2004	GW	540	0	0	0	87,583	62	88,185
	SW	106	0	0	0	4,390	27	4,523
2003	GW	555	0	0	0	86,411	93	87,059
	SW	444	0	0	0	6,204	39	6,687
2002	GW	520	0	0	0	94,197	122	94,839
	SW	438	0	0	0	6,013	51	6,502
2001	GW	428	0	0	0	108,306	135	108,869
	SW	324	0	0	0	6,913	57	7,294
2000	GW	441	0	0	0	112,954	125	113,520
	SW	524	0	0	0	7,418	31	7,973

PARMER COUNTY *100.00 % (multiplier)* All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	2,137	1,467	0	0	245,279	9,194	258,077
	SW	0	0	0	0	0	1,022	1,022
2010	GW	1,596	1,560	0	0	256,507	7,748	267,411
	SW	0	0	0	0	0	861	861
2009	GW	1,594	1,738	0	0	299,329	8,781	311,442
	SW	0	0	0	0	0	976	976
2008	GW	1,556	1,873	0	0	405,765	9,949	419,143
	SW	0	0	0	0	0	992	992
2007	GW	1,559	1,819	0	0	405,687	7,247	416,312
	SW	0	0	0	0	0	689	689
2006	GW	1,811	1,861	0	0	264,001	12,026	279,699
	SW	0	0	0	0	0	1,211	1,211
2005	GW	1,497	1,917	0	0	291,445	6,613	301,472
	SW	0	0	0	0	0	618	618
2004	GW	2,028	1,961	0	0	467,218	3,531	474,738
	SW	0	0	0	0	0	3,176	3,176
2003	GW	2,210	2,125	0	0	425,739	3,539	433,613
	SW	0	0	0	0	492	3,366	3,858
2002	GW	1,930	1,983	0	0	456,427	3,603	463,943
	SW	0	0	0	0	0	3,099	3,099
2001	GW	1,810	2,017	0	0	363,640	4,063	371,530
	SW	0	0	0	0	0	3,433	3,433
2000	GW	1,993	2,070	0	0	415,449	6,480	425,992
	SW	0	0	0	0	0	1,225	1,225

POTTER COUNTY

5.87 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	1,624	335	24	82	140	42	2,247
	SW	94	5	26	0	0	8	133
2010	GW	1,092	339	26	31	70	39	1,597
	SW	358	27	29	0	0	7	421
2009	GW	1,036	310	25	42	206	37	1,656
	SW	390	24	27	0	0	6	447
2008	GW	1,223	342	24	78	182	35	1,884
	SW	291	14	25	0	0	6	336
2007	GW	1,011	341	8	83	345	37	1,825
	SW	392	22	0	11	0	7	432
2006	GW	1,219	331	9	56	247	32	1,894
	SW	509	27	0	108	0	5	649
2005	GW	1,052	286	9	95	323	32	1,797
	SW	564	15	0	221	0	5	805
2004	GW	1,121	314	9	79	290	3	1,816
	SW	441	19	0	275	0	28	763
2003	GW	686	318	8	85	299	5	1,401
	SW	1,018	18	0	236	0	49	1,321
2002	GW	808	289	8	97	512	6	1,720
	SW	802	21	0	188	301	61	1,373
2001	GW	799	296	16	79	310	3	1,503
	SW	794	26	0	193	181	29	1,223
2000	GW	854	320	11	214	219	3	1,621
	SW	991	18	0	215	366	30	1,620

RANDALL COUNTY

47.32 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	12,177	257	0	0	12,961	1,424	26,819
	SW	914	0	0	0	41	356	1,311
2010	GW	8,701	240	0	0	8,673	1,165	18,779
	SW	2,460	0	0	0	43	291	2,794
2009	GW	7,955	137	0	0	10,298	1,437	19,827
	SW	2,891	0	0	0	42	359	3,292
2008	GW	8,817	259	0	0	12,005	1,408	22,489
	SW	2,229	0	0	0	41	352	2,622
2007	GW	7,246	236	0	0	11,554	1,182	20,218
	SW	2,738	0	0	0	25	295	3,058
2006	GW	8,541	253	0	0	10,903	2,070	21,767
	SW	3,386	0	0	0	54	518	3,958
2005	GW	7,625	262	0	0	15,438	1,054	24,379
	SW	3,709	0	0	0	58	263	4,030
2004	GW	7,820	252	0	0	12,888	1,158	22,118
	SW	3,143	0	0	0	93	319	3,555
2003	GW	5,413	210	0	0	14,692	1,219	21,534
	SW	6,219	255	0	0	128	336	6,938
2002	GW	5,888	210	0	0	13,300	1,125	20,523
	SW	4,834	7	0	0	849	310	6,000
2001	GW	5,735	272	0	0	12,155	1,198	19,360
	SW	4,803	7	0	0	776	330	5,916
2000	GW	5,927	232	0	0	9,436	978	16,573
	SW	5,702	0	0	0	634	244	6,580

SWISHER COUNTY

100.00 % (multiplier)

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	1,151	0	0	0	155,342	3,467	159,960
	SW	176	0	0	0	0	71	247
2010	GW	905	0	0	0	113,473	2,918	117,296
	SW	212	0	0	0	0	60	272
2009	GW	950	0	0	0	240,117	3,990	245,057
	SW	162	0	0	0	0	81	243
2008	GW	944	0	0	0	246,525	3,687	251,156
	SW	226	0	0	0	0	76	302
2007	GW	854	0	0	0	227,875	3,003	231,732
	SW	227	0	0	0	0	62	289
2006	GW	1,051	0	0	0	147,700	6,093	154,844
	SW	163	0	0	0	0	124	287
2005	GW	903	0	0	0	165,346	3,872	170,121
	SW	419	0	0	0	0	79	498
2004	GW	912	0	0	0	168,500	2,532	171,944
	SW	200	0	0	0	0	1,194	1,394
2003	GW	933	0	0	0	169,277	2,609	172,819
	SW	419	0	0	0	0	1,230	1,649
2002	GW	890	0	0	0	158,661	2,515	162,066
	SW	396	0	0	0	0	1,186	1,582
2001	GW	922	0	0	0	168,394	2,403	171,719
	SW	371	0	0	0	0	1,133	1,504
2000	GW	1,007	0	0	0	171,706	2,735	175,448
	SW	435	0	0	0	0	684	1,119

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

ARMSTRONG COUNTY

7.63 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
A	LIVESTOCK	RED	LIVESTOCK LOCAL SUPPLY	9	9	9	9	9	9
	Sum of Projected Surface Water Supplies (acre-feet/year)			**9**	**9**	**9**	**9**	**9**	**9**

BAILEY COUNTY

100.00 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	541	564	587	613	639	667
	Sum of Projected Surface Water Supplies (acre-feet/year)			**541**	**564**	**587**	**613**	**639**	**667**

CASTRO COUNTY

96.33 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	177	206	210	212	215	220
O	LIVESTOCK	RED	LIVESTOCK LOCAL SUPPLY	145	170	171	174	178	181
	Sum of Projected Surface Water Supplies (acre-feet/year)			**322**	**376**	**381**	**386**	**393**	**401**

COCHRAN COUNTY

100.00 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	47	64	67	69	70	70
O	LIVESTOCK	COLORADO	LIVESTOCK LOCAL SUPPLY	88	123	123	124	125	128
	Sum of Projected Surface Water Supplies (acre-feet/year)			**135**	**187**	**190**	**193**	**195**	**198**

CROSBY COUNTY

64.16 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	CROSBYTON	BRAZOS	WHITE RIVER LAKE/RESERVOIR	389	389	389	389	389	8

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	191	194	199	204	209	213
O	LIVESTOCK	RED	LIVESTOCK LOCAL SUPPLY	2	2	3	3	3	3
O	RALLS	BRAZOS	WHITE RIVER LAKE/RESERVOIR	318	318	318	318	0	0
	Sum of Projected Surface Water Supplies (acre-feet/year)			**900**	**903**	**909**	**914**	**601**	**224**

DEAF SMITH COUNTY

58.64 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	CANADIAN	LIVESTOCK LOCAL SUPPLY	52	58	59	60	60	63
O	LIVESTOCK	RED	LIVESTOCK LOCAL SUPPLY	1,832	1,908	1,993	2,083	2,178	2,276
	Sum of Projected Surface Water Supplies (acre-feet/year)			**1,884**	**1,966**	**2,052**	**2,143**	**2,238**	**2,339**

FLOYD COUNTY

93.14 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	FLOYDADA	BRAZOS	MACKENZIE LAKE/RESERVOIR	0	0	0	0	0	0
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	191	196	203	208	213	220
O	LIVESTOCK	RED	LIVESTOCK LOCAL SUPPLY	241	248	252	260	268	276
O	LOCKNEY	BRAZOS	MACKENZIE LAKE/RESERVOIR	0	0	0	0	0	0
	Sum of Projected Surface Water Supplies (acre-feet/year)			**432**	**444**	**455**	**468**	**481**	**496**

HALE COUNTY

100.00 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	331	340	349	358	368	379
O	LIVESTOCK	RED	LIVESTOCK LOCAL SUPPLY	1	1	1	1	1	1
O	PLAINVIEW	BRAZOS	MEREDITH LAKE/RESERVOIR	1,427	1,799	1,799	1,799	1,631	1,631
	Sum of Projected Surface Water Supplies (acre-feet/year)			**1,759**	**2,140**	**2,149**	**2,158**	**2,000**	**2,011**

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

HOCKLEY COUNTY

93.43 % (multiplier) All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LEVELLAND	BRAZOS	MEREDITH LAKE/RESERVOIR	1,079	1,360	1,360	1,360	1,180	1,180
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	211	255	262	267	273	279
O	LIVESTOCK	COLORADO	LIVESTOCK LOCAL SUPPLY	42	51	51	52	53	55
	Sum of Projected Surface Water Supplies (acre-feet/year)			**1,332**	**1,666**	**1,673**	**1,679**	**1,506**	**1,514**

LAMB COUNTY

100.00 % (multiplier) All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	491	511	531	552	576	600
	Sum of Projected Surface Water Supplies (acre-feet/year)			**491**	**511**	**531**	**552**	**576**	**600**

LUBBOCK COUNTY

100.00 % (multiplier) All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	266	272	280	289	298	308
O	LUBBOCK	BRAZOS	MEREDITH LAKE/RESERVOIR	9,887	13,377	13,248	13,121	12,149	12,101
O	NEW DEAL	BRAZOS	MEREDITH LAKE/RESERVOIR	153	153	153	153	153	153
O	RANSOM CANYON	BRAZOS	MEREDITH LAKE/RESERVOIR	440	569	698	825	953	1,004
O	SHALLOWATER	BRAZOS	MEREDITH LAKE/RESERVOIR	187	187	187	187	187	187
O	SLATON	BRAZOS	MEREDITH LAKE/RESERVOIR	150	269	269	269	269	269
	Sum of Projected Surface Water Supplies (acre-feet/year)			**11,083**	**14,827**	**14,835**	**14,844**	**14,009**	**14,022**

LYNN COUNTY

100.00 % (multiplier) All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	132	136	140	144	149	153

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	COLORADO	LIVESTOCK LOCAL SUPPLY	11	11	12	12	12	13
O	O'DONNELL	BRAZOS	MEREDITH LAKE/RESERVOIR	96	121	121	121	109	109
O	TAHOKA	BRAZOS	MEREDITH LAKE/RESERVOIR	178	224	224	224	193	193
	Sum of Projected Surface Water Supplies (acre-feet/year)			**417**	**492**	**497**	**501**	**463**	**468**

PARMER COUNTY

100.00 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	551	575	601	626	651	680
O	LIVESTOCK	RED	LIVESTOCK LOCAL SUPPLY	286	298	309	324	341	356
	Sum of Projected Surface Water Supplies (acre-feet/year)			**837**	**873**	**910**	**950**	**992**	**1,036**

POTTER COUNTY

5.87 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
A	AMARILLO	CANADIAN	MEREDITH LAKE/RESERVOIR	1,402	3,167	3,217	3,313	3,420	3,449
A	AMARILLO	RED	MEREDITH LAKE/RESERVOIR	1,000	2,258	2,293	2,362	2,438	2,458
A	IRRIGATION	CANADIAN	CANADIAN RIVER COMBINED RUN-OF-RIVER	0	0	0	0	0	0
A	LIVESTOCK	CANADIAN	LIVESTOCK LOCAL SUPPLY	28	28	28	28	28	28
A	LIVESTOCK	RED	LIVESTOCK LOCAL SUPPLY	2	2	2	2	2	2
A	MANUFACTURING	CANADIAN	MEREDITH LAKE/RESERVOIR	30	37	37	39	43	53
A	MANUFACTURING	RED	MEREDITH LAKE/RESERVOIR	352	384	378	363	342	329
A	STEAM ELECTRIC POWER	CANADIAN	MEREDITH LAKE/RESERVOIR	15	0	0	0	0	0
	Sum of Projected Surface Water Supplies (acre-feet/year)			**2,829**	**5,876**	**5,955**	**6,107**	**6,273**	**6,319**

RANDALL COUNTY

47.32 % (multiplier) All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
A	AMARILLO	RED	MEREDITH LAKE/RESERVOIR	1,804	4,143	4,261	4,443	4,640	4,723
A	CANYON	RED	MEREDITH LAKE/RESERVOIR	1,000	1,000	917	829	753	695
A	COUNTY-OTHER	CANADIAN	MEREDITH LAKE/RESERVOIR	12	12	10	10	9	8
A	IRRIGATION	RED	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	83	83	83	83	83	83
A	LIVESTOCK	RED	LIVESTOCK LOCAL SUPPLY	242	242	242	242	242	242
A	MANUFACTURING	RED	MEREDITH LAKE/RESERVOIR	142	142	130	118	107	103
	Sum of Projected Surface Water Supplies (acre-feet/year)			**3,283**	**5,622**	**5,643**	**5,725**	**5,834**	**5,854**

SWISHER COUNTY

100.00 % (multiplier) All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	167	141	139	136	133	132
O	LIVESTOCK	RED	LIVESTOCK LOCAL SUPPLY	435	475	493	512	531	551
O	TULIA	RED	MACKENZIE LAKE/RESERVOIR	0	0	0	0	0	0
	Sum of Projected Surface Water Supplies (acre-feet/year)			**602**	**616**	**632**	**648**	**664**	**683**

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.

ARMSTRONG COUNTY

7.63 % (multiplier) — All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
A	LIVESTOCK	RED	43	51	51	52	52	52
A	MINING	RED	1	1	1	1	1	1
A	IRRIGATION	RED	391	358	347	328	292	256
A	CLAUDE	RED	262	270	261	250	247	240
A	COUNTY-OTHER	RED	8	9	8	8	8	8
	Sum of Projected Water Demands (acre-feet/year)		**705**	**689**	**668**	**639**	**600**	**557**

BAILEY COUNTY

100.00 % (multiplier) — All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	3,053	3,618	3,904	4,216	4,555	4,924
O	COUNTY-OTHER	BRAZOS	342	358	364	371	370	363
O	MANUFACTURING	BRAZOS	303	316	326	335	343	365
O	IRRIGATION	BRAZOS	178,478	174,197	170,018	165,939	161,958	158,071
O	MULESHOE	BRAZOS	1,027	1,082	1,109	1,137	1,135	1,114
	Sum of Projected Water Demands (acre-feet/year)		**183,203**	**179,571**	**175,721**	**171,998**	**168,361**	**164,837**

CASTRO COUNTY

96.33 % (multiplier) — All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	DIMMITT	BRAZOS	1,041	1,103	1,137	1,159	1,150	1,130
O	HART	BRAZOS	238	251	258	262	260	256
O	IRRIGATION	BRAZOS	312,685	300,698	289,169	278,083	267,421	257,168
O	MANUFACTURING	BRAZOS	1,852	2,006	2,132	2,251	2,355	2,521
O	COUNTY-OTHER	BRAZOS	214	225	231	234	232	228
O	LIVESTOCK	BRAZOS	3,572	4,153	4,443	4,755	5,092	5,455
O	COUNTY-OTHER	RED	253	268	275	277	276	271
O	LIVESTOCK	RED	4,478	5,142	5,486	5,857	6,253	6,679
O	IRRIGATION	RED	154,010	148,105	142,427	136,966	131,715	126,665
O	MANUFACTURING	RED	108	117	123	131	137	146
	Sum of Projected Water Demands (acre-feet/year)		**478,451**	**462,068**	**445,681**	**429,975**	**414,891**	**400,519**

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.

COCHRAN COUNTY

100.00 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	741	901	947	995	1,045	1,097
O	MINING	BRAZOS	14	10	8	6	4	2
O	COUNTY-OTHER	BRAZOS	183	191	192	185	176	167
O	IRRIGATION	BRAZOS	73,825	70,978	68,239	65,604	63,071	60,636
O	MORTON	BRAZOS	535	560	565	547	521	496
O	COUNTY-OTHER	COLORADO	98	102	103	99	95	90
O	LIVESTOCK	COLORADO	88	123	123	124	125	128
O	MINING	COLORADO	1,448	1,022	852	639	426	256
O	IRRIGATION	COLORADO	41,527	39,925	38,384	36,902	35,478	34,108
		Sum of Projected Water Demands (acre-feet/year)	**118,459**	**113,812**	**109,413**	**105,101**	**100,941**	**96,980**

CROSBY COUNTY

64.16 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	MINING	BRAZOS	46	22	13	5	0	0
O	LIVESTOCK	BRAZOS	191	195	199	204	209	213
O	LORENZO	BRAZOS	275	288	296	302	301	296
O	CROSBYTON	BRAZOS	369	386	394	402	400	394
O	RALLS	BRAZOS	304	315	322	325	323	318
O	IRRIGATION	BRAZOS	67,666	64,940	62,324	59,812	57,403	55,092
O	COUNTY-OTHER	BRAZOS	135	139	141	142	141	139
O	MANUFACTURING	BRAZOS	4	4	4	4	4	4
O	MINING	RED	26	13	7	3	0	0
O	LIVESTOCK	RED	2	2	3	2	3	3
O	COUNTY-OTHER	RED	1	1	1	1	1	1
O	IRRIGATION	RED	1,381	1,326	1,272	1,221	1,172	1,124
		Sum of Projected Water Demands (acre-feet/year)	**70,400**	**67,631**	**64,976**	**62,423**	**59,957**	**57,584**

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.

DEAF SMITH COUNTY

58.64 % (multiplier) All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	COUNTY-OTHER	CANADIAN	1	1	1	1	1	1
O	LIVESTOCK	CANADIAN	52	58	59	60	60	63
O	IRRIGATION	RED	211,699	204,994	198,499	192,210	186,121	180,225
O	MANUFACTURING	RED	2,166	2,248	2,316	2,381	2,438	2,519
O	LIVESTOCK	RED	7,779	8,622	9,168	9,751	10,375	11,040
O	COUNTY-OTHER	RED	436	547	645	729	754	765
O	HEREFORD	RED	3,634	3,694	3,751	3,788	3,801	3,813
		Sum of Projected Water Demands (acre-feet/year)	**225,767**	**220,164**	**214,439**	**208,920**	**203,550**	**198,426**

FLOYD COUNTY

93.14 % (multiplier) All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	1,244	1,405	1,481	1,560	1,643	1,733
O	FLOYDADA	BRAZOS	680	696	693	685	657	623
O	COUNTY-OTHER	BRAZOS	170	172	170	168	160	152
O	IRRIGATION	BRAZOS	116,581	111,939	107,481	103,199	99,089	95,143
O	LOCKNEY	BRAZOS	242	244	240	234	224	212
O	LIVESTOCK	RED	290	329	334	342	350	357
O	IRRIGATION	RED	95,386	91,586	87,938	84,435	81,073	77,844
O	COUNTY-OTHER	RED	99	100	99	97	93	88
		Sum of Projected Water Demands (acre-feet/year)	**214,692**	**206,471**	**198,436**	**190,720**	**183,289**	**176,152**

HALE COUNTY

100.00 % (multiplier) All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	MANUFACTURING	BRAZOS	3,553	3,748	3,899	4,042	4,164	4,400
O	COUNTY-OTHER	BRAZOS	1,144	1,187	1,207	1,203	1,184	1,161
O	IRRIGATION	BRAZOS	351,961	340,300	329,026	318,124	307,583	297,392
O	HALE CENTER	BRAZOS	470	493	509	513	507	498
O	ABERNATHY	BRAZOS	486	508	526	531	525	514
O	PETERSBURG	BRAZOS	289	304	313	316	312	306
O	PLAINVIEW	BRAZOS	4,288	4,490	4,605	4,635	4,577	4,488

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.

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	MINING	BRAZOS	88	34	19	0	0	0
O	LIVESTOCK	BRAZOS	2,632	2,920	3,129	3,356	3,600	3,866
O	LIVESTOCK	RED	1	1	1	1	1	1
O	IRRIGATION	RED	3,555	3,437	3,323	3,213	3,107	3,004
		Sum of Projected Water Demands (acre-feet/year)	**368,467**	**357,422**	**346,557**	**335,934**	**325,560**	**315,630**

HOCKLEY COUNTY

93.43 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	LEVELLAND	BRAZOS	2,310	2,362	2,369	2,322	2,216	2,107
O	ANTON	BRAZOS	263	270	272	268	256	243
O	IRRIGATION	BRAZOS	141,393	135,866	130,554	125,448	120,542	115,829
O	COUNTY-OTHER	BRAZOS	785	799	797	776	739	704
O	MANUFACTURING	BRAZOS	1,103	1,107	1,110	1,113	1,115	1,119
O	LIVESTOCK	BRAZOS	602	692	726	761	797	834
O	MINING	BRAZOS	2,203	1,411	917	353	18	0
O	ROPESVILLE	BRAZOS	89	91	91	89	85	81
O	SMYER	BRAZOS	69	70	70	68	65	62
O	SUNDOWN	COLORADO	341	350	353	347	332	316
O	COUNTY-OTHER	COLORADO	38	39	39	38	36	35
O	LIVESTOCK	COLORADO	42	51	51	52	53	55
O	IRRIGATION	COLORADO	15,710	15,096	14,506	13,939	13,393	12,870
O	MINING	COLORADO	744	476	309	119	6	0
		Sum of Projected Water Demands (acre-feet/year)	**165,692**	**158,680**	**152,164**	**145,693**	**139,653**	**134,255**

LAMB COUNTY

100.00 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	MANUFACTURING	BRAZOS	490	519	541	562	580	618
O	COUNTY-OTHER	BRAZOS	794	830	861	880	872	861
O	IRRIGATION	BRAZOS	363,313	349,294	335,816	322,858	310,401	298,425
O	EARTH	BRAZOS	257	268	277	283	280	276
O	LITTLEFIELD	BRAZOS	1,530	1,602	1,660	1,694	1,676	1,655

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.

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	OLTON	BRAZOS	492	512	532	542	536	529
O	MINING	BRAZOS	52	25	15	6	0	0
O	SUDAN	BRAZOS	226	236	244	249	246	243
O	STEAM ELECTRIC POWER	BRAZOS	17,827	17,663	20,651	24,292	28,731	34,142
O	LIVESTOCK	BRAZOS	3,400	3,724	4,002	4,304	4,632	4,987
O	AMHERST	BRAZOS	168	176	182	185	183	181
		Sum of Projected Water Demands (acre-feet/year)	**388,549**	**374,849**	**364,781**	**355,855**	**348,137**	**341,917**

LUBBOCK COUNTY

100.00 % (multiplier) All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	SLATON	BRAZOS	907	889	870	849	837	836
O	RANSOM CANYON	BRAZOS	440	569	698	825	953	1,004
O	WOLFFORTH	BRAZOS	1,468	1,758	1,822	1,884	1,962	2,006
O	STEAM ELECTRIC POWER	BRAZOS	5,221	4,440	5,191	6,106	7,222	8,582
O	MINING	BRAZOS	209	101	59	25	0	0
O	LIVESTOCK	BRAZOS	1,222	1,360	1,440	1,526	1,617	1,715
O	SHALLOWATER	BRAZOS	344	367	377	371	379	371
O	IDALOU	BRAZOS	289	288	281	274	273	272
O	LUBBOCK	BRAZOS	49,824	51,588	52,417	52,602	53,041	54,306
O	NEW DEAL	BRAZOS	149	165	173	173	178	173
O	ABERNATHY	BRAZOS	171	182	188	186	190	186
O	IRRIGATION	BRAZOS	229,267	216,397	204,248	192,782	181,961	171,747
O	COUNTY-OTHER	BRAZOS	3,006	3,051	3,053	2,909	2,907	2,744
O	MANUFACTURING	BRAZOS	1,881	2,103	2,291	2,472	2,625	2,836
		Sum of Projected Water Demands (acre-feet/year)	**294,398**	**283,258**	**273,108**	**262,984**	**254,145**	**246,778**

LYNN COUNTY

100.00 % (multiplier) All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	IRRIGATION	BRAZOS	112,870	106,796	101,054	95,614	90,473	85,610
O	O'DONNELL	BRAZOS	144	146	142	138	130	121
O	LIVESTOCK	BRAZOS	132	136	140	144	149	153

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.

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	MINING	BRAZOS	39	19	11	5	0	0
O	TAHOKA	BRAZOS	492	504	490	478	453	421
O	WILSON	BRAZOS	67	68	65	63	60	55
O	COUNTY-OTHER	BRAZOS	299	301	292	282	267	249
O	COUNTY-OTHER	COLORADO	7	7	6	6	6	6
O	MINING	COLORADO	9	4	2	1	0	0
O	IRRIGATION	COLORADO	1,025	970	918	868	822	777
O	LIVESTOCK	COLORADO	11	11	12	12	12	13
	Sum of Projected Water Demands (acre-feet/year)		**115,095**	**108,962**	**103,132**	**97,611**	**92,372**	**87,405**

PARMER COUNTY

100.00 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	BRAZOS	5,087	5,775	6,178	6,611	7,079	7,582
O	BOVINA	BRAZOS	321	334	335	330	317	300
O	FARWELL	BRAZOS	388	405	410	408	393	371
O	IRRIGATION	BRAZOS	291,836	288,738	285,673	282,640	279,639	276,670
O	COUNTY-OTHER	BRAZOS	297	305	304	298	286	270
O	LIVESTOCK	RED	3,345	3,787	4,045	4,323	4,619	4,939
O	MANUFACTURING	RED	2,427	2,617	2,772	2,921	3,051	3,261
O	IRRIGATION	RED	119,201	117,935	116,683	115,444	114,219	113,006
O	COUNTY-OTHER	RED	110	113	112	110	106	100
O	FRIONA	RED	835	872	879	870	838	791
	Sum of Projected Water Demands (acre-feet/year)		**423,847**	**420,881**	**417,391**	**413,955**	**410,547**	**407,290**

POTTER COUNTY

5.87 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
A	MINING	CANADIAN	12	14	15	16	17	17
A	MANUFACTURING	CANADIAN	62	68	74	79	83	89
A	AMARILLO	CANADIAN	14,107	15,167	16,158	17,287	18,519	19,529
A	STEAM ELECTRIC POWER	CANADIAN	1,317	1,490	1,573	1,668	1,762	2,003
A	LIVESTOCK	CANADIAN	27	27	27	27	27	27

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.

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
A	IRRIGATION	CANADIAN	174	159	154	146	130	114
A	COUNTY-OTHER	CANADIAN	59	80	99	121	145	165
A	AMARILLO	RED	10,055	10,811	11,517	12,322	13,200	13,920
A	MINING	RED	7	8	8	9	9	10
A	IRRIGATION	RED	191	175	170	161	143	125
A	COUNTY-OTHER	RED	41	55	68	83	100	113
A	LIVESTOCK	RED	3	3	3	3	3	3
A	MANUFACTURING	RED	336	370	399	426	450	483
		Sum of Projected Water Demands (acre-feet/year)	**26,391**	**28,427**	**30,265**	**32,348**	**34,588**	**36,598**

RANDALL COUNTY

47.32 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
A	IRRIGATION	CANADIAN	0	0	0	0	0	0
A	LIVESTOCK	CANADIAN	0	0	0	0	0	0
A	COUNTY-OTHER	CANADIAN	4	5	6	7	8	9
A	MINING	CANADIAN	1	1	1	1	1	1
A	MANUFACTURING	RED	286	317	344	368	388	422
A	LIVESTOCK	RED	1,293	1,297	1,304	1,312	1,320	1,329
A	IRRIGATION	RED	10,636	9,417	9,129	8,648	7,687	6,726
A	MINING	RED	8	8	8	9	9	9
A	CANYON	RED	2,438	2,688	2,922	3,188	3,478	3,718
A	AMARILLO	RED	18,167	19,839	21,404	23,185	25,129	26,739
A	COUNTY-OTHER	RED	1,280	1,580	1,861	2,181	2,529	2,817
A	HAPPY	RED	11	17	22	27	33	38
A	LAKE TANGLEWOOD	RED	160	189	217	248	282	310
		Sum of Projected Water Demands (acre-feet/year)	**34,284**	**35,358**	**37,218**	**39,174**	**40,864**	**42,118**

SWISHER COUNTY

100.00 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	KRESS	BRAZOS	22	22	22	22	21	20

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.

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	COUNTY-OTHER	BRAZOS	41	42	41	41	40	38
O	LIVESTOCK	BRAZOS	264	307	304	301	298	297
O	IRRIGATION	BRAZOS	73,412	70,333	72,575	72,161	71,749	71,338
O	KRESS	RED	82	82	83	81	79	76
O	HAPPY	RED	109	110	111	110	108	103
O	IRRIGATION	RED	97,313	93,233	96,205	95,655	95,108	94,565
O	COUNTY-OTHER	RED	211	211	211	207	202	193
O	TULIA	RED	1,050	1,065	1,072	1,064	1,038	993
O	LIVESTOCK	RED	3,493	3,909	4,138	4,380	4,637	4,908
		Sum of Projected Water Demands (acre-feet/year)	**175,997**	**169,314**	**174,762**	**174,022**	**173,280**	**172,531**

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

ARMSTRONG COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
A	CLAUDE	RED	270	209	170	137	100	70
A	COUNTY-OTHER	RED	291	288	292	296	297	300
A	IRRIGATION	RED	0	0	0	0	0	0
A	LIVESTOCK	RED	204	100	97	93	89	85
A	MINING	RED	69	44	40	41	46	52
	Sum of Projected Water Supply Needs (acre-feet/year)		**0**	**0**	**0**	**0**	**0**	**0**

BAILEY COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	COUNTY-OTHER	BRAZOS	0	0	0	0	0	0
O	IRRIGATION	BRAZOS	-81,561	-85,721	-84,647	-84,229	-83,647	-83,220
O	LIVESTOCK	BRAZOS	0	0	0	0	0	0
O	MANUFACTURING	BRAZOS	0	0	0	0	0	0
O	MULESHOE	BRAZOS	0	0	0	0	0	0
	Sum of Projected Water Supply Needs (acre-feet/year)		**-81,561**	**-85,721**	**-84,647**	**-84,229**	**-83,647**	**-83,220**

CASTRO COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	COUNTY-OTHER	BRAZOS	0	0	0	0	0	0
O	COUNTY-OTHER	RED	0	0	0	0	0	0
O	DIMMITT	BRAZOS	0	437	-744	-805	-832	-844
O	HART	BRAZOS	193	193	193	193	-67	-82
O	IRRIGATION	BRAZOS	-92,201	-105,090	-155,470	-229,630	-233,528	-229,668
O	IRRIGATION	RED	-54,494	-86,700	-108,378	-121,663	-118,476	-116,498
O	LIVESTOCK	BRAZOS	0	-760	-2,062	-4,176	-4,746	-5,091
O	LIVESTOCK	RED	0	0	0	-852	-1,207	-1,281
O	MANUFACTURING	BRAZOS	0	0	0	0	0	0
O	MANUFACTURING	RED	0	0	0	0	0	0
	Sum of Projected Water Supply Needs (acre-feet/year)		**-146,695**	**-192,550**	**-266,654**	**-357,126**	**-358,856**	**-353,464**

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

COCHRAN COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	COUNTY-OTHER	BRAZOS	0	0	0	0	0	0
O	COUNTY-OTHER	COLORADO	0	0	0	0	0	0
O	IRRIGATION	BRAZOS	-30,699	-29,184	-33,141	-33,350	-52,456	-49,969
O	IRRIGATION	COLORADO	-9,210	-9,412	-3,865	-2,155	-24,189	-22,675
O	LIVESTOCK	BRAZOS	0	0	0	0	0	0
O	LIVESTOCK	COLORADO	0	0	0	0	0	0
O	MINING	BRAZOS	0	0	0	0	0	0
O	MINING	COLORADO	0	0	0	0	0	0
O	MORTON	BRAZOS	0	-560	-565	-547	-521	-496
	Sum of Projected Water Supply Needs (acre-feet/year)		**-39,909**	**-39,156**	**-37,571**	**-36,052**	**-77,166**	**-73,140**

CROSBY COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	COUNTY-OTHER	BRAZOS	100	100	100	100	100	100
O	COUNTY-OTHER	RED	0	0	0	0	0	0
O	CROSBYTON	BRAZOS	70	53	45	37	39	-336
O	IRRIGATION	BRAZOS	-16,143	-15,742	-15,537	-15,119	-13,768	-13,427
O	IRRIGATION	RED	-887	-831	-790	-751	-726	-675
O	LIVESTOCK	BRAZOS	0	-1	0	0	0	0
O	LIVESTOCK	RED	0	0	0	1	0	0
O	LORENZO	BRAZOS	0	0	-37	-69	-92	-108
O	MANUFACTURING	BRAZOS	0	0	0	0	0	0
O	MINING	BRAZOS	0	0	0	0	0	0
O	MINING	RED	0	0	0	0	0	0
O	RALLS	BRAZOS	14	3	-4	-7	-323	-318
	Sum of Projected Water Supply Needs (acre-feet/year)		**-17,030**	**-16,574**	**-16,368**	**-15,946**	**-14,909**	**-14,864**

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

DEAF SMITH COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	COUNTY-OTHER	CANADIAN	0	0	0	0	0	0
O	COUNTY-OTHER	RED	0	0	0	0	0	0
O	HEREFORD	RED	360	289	3,751	3,788	3,801	3,789
O	IRRIGATION	RED	-171,481	-195,821	-225,001	-254,754	-247,310	-242,805
O	LIVESTOCK	CANADIAN	0	0	0	0	0	0
O	LIVESTOCK	RED	0	0	0	-517	-548	-582
O	MANUFACTURING	RED	0	0	0	0	0	0
	Sum of Projected Water Supply Needs (acre-feet/year)		**-171,481**	**-195,821**	**-225,001**	**-255,271**	**-247,858**	**-243,387**

FLOYD COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	COUNTY-OTHER	BRAZOS	0	0	0	0	0	0
O	COUNTY-OTHER	RED	0	0	0	0	0	0
O	FLOYDADA	BRAZOS	0	0	0	0	0	0
O	IRRIGATION	BRAZOS	-40,667	-40,298	-39,563	-39,216	-38,186	-35,823
O	IRRIGATION	RED	-50,064	-66,093	-69,404	-69,750	-66,962	-64,250
O	LIVESTOCK	BRAZOS	0	0	1	0	1	0
O	LIVESTOCK	RED	0	1	0	0	0	1
O	LOCKNEY	BRAZOS	0	0	-240	-234	-224	-212
	Sum of Projected Water Supply Needs (acre-feet/year)		**-90,731**	**-106,391**	**-109,207**	**-109,200**	**-105,372**	**-100,285**

HALE COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	ABERNATHY	BRAZOS	0	-122	-178	-217	-243	-260
O	COUNTY-OTHER	BRAZOS	0	0	0	0	0	0
O	HALE CENTER	BRAZOS	0	0	98	227	159	101
O	IRRIGATION	BRAZOS	-21,944	-54,709	-152,692	-218,312	-233,313	-230,238
O	IRRIGATION	RED	-273	-603	-1,437	-2,112	-2,275	-2,257
O	LIVESTOCK	BRAZOS	-1	0	-573	-797	-2,146	-2,518
O	LIVESTOCK	RED	0	0	0	0	0	0

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

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	MANUFACTURING	BRAZOS	0	0	0	0	0	0
O	MINING	BRAZOS	0	0	0	0	0	0
O	PETERSBURG	BRAZOS	0	0	0	0	-312	-306
O	PLAINVIEW	BRAZOS	11,342	10,387	9,255	8,305	7,432	6,469
	Sum of Projected Water Supply Needs (acre-feet/year)		**-22,218**	**-55,434**	**-154,880**	**-221,438**	**-238,289**	**-235,579**

HOCKLEY COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	ANTON	BRAZOS	-263	-270	-272	-268	-256	-243
O	COUNTY-OTHER	BRAZOS	0	0	0	0	0	0
O	COUNTY-OTHER	COLORADO	0	0	0	0	0	0
O	IRRIGATION	BRAZOS	-58,612	-69,394	-75,360	-80,580	-76,844	-75,268
O	IRRIGATION	COLORADO	-5,070	-6,281	-7,499	-7,251	-6,993	-6,376
O	LEVELLAND	BRAZOS	926	874	867	914	592	701
O	LIVESTOCK	BRAZOS	0	0	0	0	0	1
O	LIVESTOCK	COLORADO	0	0	0	0	0	0
O	MANUFACTURING	BRAZOS	0	0	0	0	0	0
O	MINING	BRAZOS	0	0	0	0	0	0
O	MINING	COLORADO	0	0	0	0	0	0
O	ROPESVILLE	BRAZOS	0	0	-91	-89	-85	-81
O	SMYER	BRAZOS	0	0	0	0	0	-62
O	SUNDOWN	COLORADO	0	-350	-353	-347	-332	-316
	Sum of Projected Water Supply Needs (acre-feet/year)		**-63,945**	**-76,295**	**-83,575**	**-88,535**	**-84,510**	**-82,346**

LAMB COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	AMHERST	BRAZOS	0	215	170	132	102	76
O	COUNTY-OTHER	BRAZOS	0	0	0	0	0	0
O	EARTH	BRAZOS	0	0	0	-283	-280	-276
O	IRRIGATION	BRAZOS	-114,832	-158,445	-201,653	-238,554	-248,375	-250,645
O	LITTLEFIELD	BRAZOS	900	810	729	656	590	531
O	LIVESTOCK	BRAZOS	0	0	-375	-1,618	-2,348	-3,010

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	MANUFACTURING	BRAZOS	0	0	0	0	0	0
O	MINING	BRAZOS	0	0	0	0	0	0
O	OLTON	BRAZOS	837	753	678	810	552	499
O	STEAM ELECTRIC POWER	BRAZOS	0	0	0	0	0	0
O	SUDAN	BRAZOS	0	196	145	101	69	40
	Sum of Projected Water Supply Needs (acre-feet/year)		**-114,832**	**-158,445**	**-202,028**	**-240,455**	**-251,003**	**-253,931**

LUBBOCK COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	ABERNATHY	BRAZOS	0	-182	-188	-186	-190	-186
O	COUNTY-OTHER	BRAZOS	0	0	0	0	0	0
O	IDALOU	BRAZOS	0	0	0	-274	-273	-272
O	IRRIGATION	BRAZOS	-61,045	-90,653	-99,575	-109,703	-102,293	-96,846
O	LIVESTOCK	BRAZOS	0	0	0	0	0	0
O	LUBBOCK	BRAZOS	-9,384	-11,406	-14,493	-16,932	-20,630	-21,994
O	MANUFACTURING	BRAZOS	0	0	0	0	0	0
O	MINING	BRAZOS	0	0	0	0	0	0
O	NEW DEAL	BRAZOS	4	181	154	137	116	107
O	RANSOM CANYON	BRAZOS	0	0	0	0	0	0
O	SHALLOWATER	BRAZOS	-157	-180	-190	-184	-192	-184
O	SLATON	BRAZOS	0	0	0	0	0	0
O	STEAM ELECTRIC POWER	BRAZOS	0	0	0	0	0	0
O	WOLFFORTH	BRAZOS	67	708	397	113	-165	-388
	Sum of Projected Water Supply Needs (acre-feet/year)		**-70,586**	**-102,421**	**-114,446**	**-127,279**	**-123,743**	**-119,870**

LYNN COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	COUNTY-OTHER	BRAZOS	100	100	100	100	100	100
O	COUNTY-OTHER	COLORADO	0	0	0	0	0	0
O	IRRIGATION	BRAZOS	18,052	16,942	21,942	26,948	31,855	36,750
O	IRRIGATION	COLORADO	-550	-508	-464	-408	-406	-402
O	LIVESTOCK	BRAZOS	0	0	0	0	0	0

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

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	LIVESTOCK	COLORADO	0	0	0	0	0	0
O	MINING	BRAZOS	0	0	0	0	0	0
O	MINING	COLORADO	0	0	0	0	0	0
O	O'DONNELL	BRAZOS	144	142	146	150	129	138
O	TAHOKA	BRAZOS	42	30	44	56	7	39
O	WILSON	BRAZOS	0	-68	-65	-63	-60	-55
	Sum of Projected Water Supply Needs (acre-feet/year)		**-550**	**-576**	**-529**	**-471**	**-466**	**-457**

PARMER COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	BOVINA	BRAZOS	0	0	0	0	0	0
O	COUNTY-OTHER	BRAZOS	0	0	0	0	0	0
O	COUNTY-OTHER	RED	0	0	0	0	0	0
O	FARWELL	BRAZOS	0	-1	-46	-80	-99	-106
O	FRIONA	RED	121	549	-384	-425	-437	-431
O	IRRIGATION	BRAZOS	-114,660	-234,207	-259,793	-272,089	-268,876	-262,375
O	IRRIGATION	RED	-46,722	-97,023	-101,830	-84,951	-82,589	-84,325
O	LIVESTOCK	BRAZOS	0	0	-180	-1,546	-3,712	-5,092
O	LIVESTOCK	RED	0	0	0	0	0	0
O	MANUFACTURING	RED	0	0	0	0	0	0
	Sum of Projected Water Supply Needs (acre-feet/year)		**-161,382**	**-331,231**	**-362,233**	**-359,091**	**-355,713**	**-352,329**

POTTER COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
A	AMARILLO	CANADIAN	9	300	-1,349	-2,961	-4,582	-5,950
A	AMARILLO	RED	7	171	-961	-2,110	-3,266	-4,241
A	COUNTY-OTHER	CANADIAN	756	405	76	-299	-708	-1,043
A	COUNTY-OTHER	RED	138	-103	-329	-586	-866	-1,096
A	IRRIGATION	CANADIAN	1,016	735	379	221	292	391
A	IRRIGATION	RED	66	70	73	76	79	79
A	LIVESTOCK	CANADIAN	88	86	85	83	81	79
A	LIVESTOCK	RED	39	39	39	39	39	39

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

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
A	MANUFACTURING	CANADIAN	0	0	-33	-57	-35	-43
A	MANUFACTURING	RED	417	387	-187	-923	-1,675	-2,486
A	MINING	CANADIAN	88	64	48	32	15	3
A	MINING	RED	33	19	10	1	3	0
A	STEAM ELECTRIC POWER	CANADIAN	0	126	372	663	1,127	0
	Sum of Projected Water Supply Needs (acre-feet/year)		**0**	**-103**	**-2,859**	**-6,936**	**-11,132**	**-14,859**

RANDALL COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
A	AMARILLO	RED	8	313	-1,787	-3,971	-6,217	-8,146
A	CANYON	RED	672	-422	-1,245	-1,903	-2,452	-2,859
A	COUNTY-OTHER	CANADIAN	16	14	9	6	1	-3
A	COUNTY-OTHER	RED	361	-5	-597	-1,273	-2,009	-2,619
A	HAPPY	RED	39	33	28	23	17	12
A	IRRIGATION	CANADIAN	0	0	0	0	0	0
A	IRRIGATION	RED	0	0	0	0	0	0
A	LAKE TANGLEWOOD	RED	0	0	0	0	0	0
A	LIVESTOCK	CANADIAN	0	0	0	0	0	0
A	LIVESTOCK	RED	199	200	202	203	205	207
A	MANUFACTURING	RED	193	110	24	87	48	0
A	MINING	CANADIAN	0	0	0	0	0	0
A	MINING	RED	0	0	0	0	0	0
	Sum of Projected Water Supply Needs (acre-feet/year)		**0**	**-427**	**-3,629**	**-7,147**	**-10,678**	**-13,627**

SWISHER COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	COUNTY-OTHER	BRAZOS	0	0	0	0	0	0
O	COUNTY-OTHER	RED	0	0	0	0	0	0
O	HAPPY	RED	0	0	0	0	0	0
O	IRRIGATION	BRAZOS	-14,031	-47,142	-70,459	-71,418	-71,555	-71,130
O	IRRIGATION	RED	-8,616	-13,281	-25,416	-33,967	-36,047	-36,403
O	KRESS	BRAZOS	100	80	60	46	34	24

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	KRESS	RED	0	0	0	0	0	0
O	LIVESTOCK	BRAZOS	0	-1	0	0	0	0
O	LIVESTOCK	RED	0	0	-1	0	-1	0
O	TULIA	RED	-417	-417	-416	-416	-416	-417
	Sum of Projected Water Supply Needs (acre-feet/year)		**-23,064**	**-60,841**	**-96,292**	**-105,801**	**-108,019**	**-107,950**

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

ARMSTRONG COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
IRRIGATION, RED (A)							
IRRIGATION CONSERVATION	CONSERVATION [ARMSTRONG]	0	2,170	2,251	2,397	2,478	2,558
PRECIPITATION ENHANCEMENT	WEATHER MODIFICATION [ARMSTRONG]	0	785	785	785	785	785
Sum of Projected Water Management Strategies (acre-feet/year)		**0**	**2,955**	**3,036**	**3,182**	**3,263**	**3,343**

BAILEY COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [BAILEY]	18,636	16,772	15,095	13,585	12,227	11,004
MULESHOE, BRAZOS (O)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [BAILEY]	79	81	67	51	44	44
Sum of Projected Water Management Strategies (acre-feet/year)		**18,715**	**16,853**	**15,162**	**13,636**	**12,271**	**11,048**

CASTRO COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
DIMMITT, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [CASTRO]	0	446	810	729	1,070	963
MUNICIPAL WATER CONSERVATION	CONSERVATION [CASTRO]	75	110	97	81	75	74
HART, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [CASTRO]	0	0	0	0	198	178
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [CASTRO]	28,320	25,488	22,939	20,645	18,581	16,723

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
IRRIGATION, RED (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [CASTRO]	13,948	12,553	11,298	10,168	9,151	8,236
Sum of Projected Water Management Strategies (acre-feet/year)		**42,343**	**38,597**	**35,144**	**31,623**	**29,075**	**26,174**

COCHRAN COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [COCHRAN]	14,151	12,735	11,462	10,316	9,284	8,356
IRRIGATION, COLORADO (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [COCHRAN]	6,064	5,458	4,912	4,421	3,979	3,581
MORTON, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [COCHRAN]	0	855	770	693	623	561
MUNICIPAL WATER CONSERVATION	CONSERVATION [COCHRAN]	41	56	48	38	34	32
Sum of Projected Water Management Strategies (acre-feet/year)		**20,256**	**19,104**	**17,192**	**15,468**	**13,920**	**12,530**

CROSBY COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
CROSBYTON, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [CROSBY]	0	400	400	400	400	400
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [CROSBY]	25,589	23,030	20,727	18,654	16,789	15,110
IRRIGATION, RED (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [CROSBY]	791	712	641	577	519	467

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
LORENZO, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [CROSBY]	0	0	206	185	167	150
RALLS, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [CROSBY]	400	400	400	400	400	400
Sum of Projected Water Management Strategies (acre-feet/year)		**26,780**	**24,542**	**22,374**	**20,216**	**18,275**	**16,527**

DEAF SMITH COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
HEREFORD, RED (O)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [DEAF SMITH]	302	572	649	610	596	598
IRRIGATION, RED (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [DEAF SMITH]	42,246	38,022	34,219	30,797	27,718	24,946
Sum of Projected Water Management Strategies (acre-feet/year)		**42,548**	**38,594**	**34,868**	**31,407**	**28,314**	**25,544**

FLOYD COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [FLOYD]	16,526	14,873	13,386	12,048	10,843	9,758
IRRIGATION, RED (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [FLOYD]	28,139	25,325	22,792	20,513	18,462	16,616
LOCKNEY, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [FLOYD]	0	0	410	369	332	299
Sum of Projected Water Management Strategies (acre-feet/year)		**44,665**	**40,198**	**36,588**	**32,930**	**29,637**	**26,673**

HALE COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
ABERNATHY, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [HALE]	317	258	208	332	276	260
MUNICIPAL WATER CONSERVATION	CONSERVATION [HALE]	50	36	32	24	21	20
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [HALE]	41,957	37,762	33,986	30,587	27,528	24,776
IRRIGATION, RED (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [HALE]	424	381	343	309	278	250
PETERSBURG, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [HALE]	0	0	0	0	410	369
MUNICIPAL WATER CONSERVATION	CONSERVATION [HALE]	21	24	20	16	14	14
Sum of Projected Water Management Strategies (acre-feet/year)		**42,769**	**38,461**	**34,589**	**31,268**	**28,527**	**25,689**

HOCKLEY COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
ANTON, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [HOCKLEY]	569	569	512	461	415	373
MUNICIPAL WATER CONSERVATION	CONSERVATION [HOCKLEY]	14	11	6	2	0	0
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [HOCKLEY]	25,809	23,227	20,905	18,814	16,933	15,240
IRRIGATION, COLORADO (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [HOCKLEY]	2,244	2,020	1,818	1,636	1,472	1,325
ROPESVILLE, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [HOCKLEY]	0	0	91	89	85	81

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
SMYER, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [HOCKLEY]	0	0	0	0	0	193
SUNDOWN, COLORADO (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [HOCKLEY]	0	412	569	512	461	415
MUNICIPAL WATER CONSERVATION	CONSERVATION [HOCKLEY]	24	25	19	14	11	11
Sum of Projected Water Management Strategies (acre-feet/year)		**28,660**	**26,264**	**23,920**	**21,528**	**19,377**	**17,638**

LAMB COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
AMHERST, BRAZOS (O)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [LAMB]	7	5	2	0	0	0
EARTH, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [LAMB]	0	0	0	393	354	318
MUNICIPAL WATER CONSERVATION	CONSERVATION [LAMB]	20	28	25	21	20	17
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [LAMB]	28,457	25,611	23,050	20,745	18,670	16,803
LITTLEFIELD, BRAZOS (O)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [LAMB]	118	196	181	161	151	149
OLTON, BRAZOS (O)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [LAMB]	27	17	12	3	0	0
SUDAN, BRAZOS (O)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [LAMB]	15	12	8	4	3	3
Sum of Projected Water Management Strategies (acre-feet/year)		**28,644**	**25,869**	**23,278**	**21,327**	**19,198**	**17,290**

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

LUBBOCK COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
ABERNATHY, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [HALE]	111	170	177	178	183	179
MUNICIPAL WATER CONSERVATION	CONSERVATION [HALE]	0	12	11	8	7	7
IDALOU, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [LUBBOCK]	0	0	0	410	369	332
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [LUBBOCK]	48,909	44,018	39,616	35,655	32,089	28,880
LUBBOCK, BRAZOS (O)							
LAKE ALAN HENRY PIPELINE FOR THE CITY OF LUBBOCK	ALAN HENRY LAKE/RESERVOIR [RESERVOIR]	21,880	21,880	21,880	21,880	21,880	21,880
LUBBOCK BRACKISH GROUNDWATER DESALINATION	EDWARDS-TRINITY-HIGH PLAINS AQUIFER [LUBBOCK]	0	3,360	3,360	3,360	3,360	3,360
LUBBOCK JIM BERTRAM LAKE 7	LAKE 7 (JIM BERTRAM LAKE/RESERVOIR SYSTEM) [RESERVOIR]	0	17,650	17,650	17,650	17,650	17,650
LUBBOCK NORTH FORK DIVERSION OPERATION (A)	BRAZOS RIVER RUN-OF-RIVER [GARZA]	0	3,675	3,675	3,675	3,675	3,675
MUNICIPAL WATER CONSERVATION	CONSERVATION [LUBBOCK]	4,132	7,662	7,112	6,441	6,256	6,405
POST RESERVOIR- DELIVERED TO LAH PIPELINE	POST LAKE/RESERVOIR [RESERVOIR]	0	0	25,750	25,750	25,750	25,750
NEW DEAL, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [LUBBOCK]	0	153	153	153	153	153
RANSOM CANYON, BRAZOS (O)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [LUBBOCK]	35	90	162	248	325	342
SHALLOWATER, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [LUBBOCK]	389	389	350	315	283	255
WOLFFORTH, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [LUBBOCK]	0	0	0	0	437	393

Sum of Projected Water Management Strategies (acre-feet/year)		75,456	99,059	119,896	115,723	112,417	109,261

LYNN COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [LYNN]	11,310	10,179	9,162	8,245	7,420	6,678
IRRIGATION, COLORADO (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [LYNN]	350	315	283	255	230	207
WILSON, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [LYNN]	0	193	174	157	141	127
Sum of Projected Water Management Strategies (acre-feet/year)		**11,660**	**10,687**	**9,619**	**8,657**	**7,791**	**7,012**

PARMER COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
FARWELL, BRAZOS (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [PARMER]	0	0	0	0	147	132
MUNICIPAL WATER CONSERVATION	CONSERVATION [PARMER]	33	64	94	101	97	91
FRIONA, RED (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [PARMER]	0	0	419	753	678	610
MUNICIPAL WATER CONSERVATION	CONSERVATION [PARMER]	46	34	20	5	0	0
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [PARMER]	14,531	13,078	11,770	10,593	9,534	8,580
IRRIGATION, RED (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [PARMER]	4,589	4,130	3,717	3,345	3,011	2,710
Sum of Projected Water Management Strategies (acre-feet/year)		**19,199**	**17,306**	**16,020**	**14,797**	**13,467**	**12,123**

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

POTTER COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
AMARILLO, CANADIAN (A)							
MUNICIPAL CONSERVATION	CONSERVATION [POTTER]	0	455	808	865	925	975
POTTER COUNTY WELL FIELD	OGALLALA AQUIFER [POTTER]	0	2,500	2,500	2,500	2,500	2,500
ROBERTS COUNTY WELL FIELD - AMARILLO	OGALLALA AQUIFER [ROBERTS]	0	0	0	0	1,200	2,600
AMARILLO, RED (A)							
MUNICIPAL CONSERVATION	CONSERVATION [POTTER]	0	325	575	615	660	700
POTTER COUNTY WELL FIELD	OGALLALA AQUIFER [POTTER]	0	2,500	2,500	2,500	2,500	2,500
POTTER COUNTY WELL FIELD	OGALLALA AQUIFER [POTTER]	0	800	800	800	800	800
ROBERTS COUNTY WELL FIELD - AMARILLO	OGALLALA AQUIFER [ROBERTS]	0	0	0	0	0	741
COUNTY-OTHER, CANADIAN (A)							
DRILL ADDITIONAL GROUNDWATER WELL	OGALLALA AQUIFER [POTTER]	0	0	0	1,000	1,000	1,000
MUNICIPAL CONSERVATION	CONSERVATION [POTTER]	0	41	85	103	124	140
COUNTY-OTHER, RED (A)							
DRILL ADDITIONAL GROUNDWATER WELL	OGALLALA AQUIFER [POTTER]	0	600	600	600	1,200	1,200
MUNICIPAL CONSERVATION	CONSERVATION [POTTER]	0	28	58	71	85	96
IRRIGATION, CANADIAN (A)							
IRRIGATION CONSERVATION	CONSERVATION [POTTER]	0	446	464	496	513	531
PRECIPITATION ENHANCEMENT	WEATHER MODIFICATION [POTTER]	0	172	172	172	172	172
IRRIGATION, RED (A)							
IRRIGATION CONSERVATION	CONSERVATION [POTTER]	0	490	510	545	564	583
PRECIPITATION ENHANCEMENT	WEATHER MODIFICATION [POTTER]	0	189	189	189	189	189
MANUFACTURING, CANADIAN (A)							
VOLUNTARY TRANSFER FROM OTHER USERS	OGALLALA AQUIFER [POTTER]	0	0	200	328	313	225

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
MANUFACTURING, RED (A)							
VOLUNTARY TRANSFER FROM OTHER USERS	OGALLALA AQUIFER [POTTER]	0	0	444	1,087	1,846	2,638
Sum of Projected Water Management Strategies (acre-feet/year)		**0**	**8,546**	**9,905**	**11,871**	**14,591**	**17,590**

RANDALL COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
AMARILLO, RED (A)							
MUNICIPAL CONSERVATION	CONSERVATION [RANDALL]	0	595	1,070	1,159	1,256	1,337
POTTER COUNTY WELL FIELD	OGALLALA AQUIFER [POTTER]	0	3,667	3,740	3,745	2,861	1,780
ROBERTS COUNTY WELL FIELD - AMARILLO	OGALLALA AQUIFER [ROBERTS]	0	0	0	11,210	10,010	19,079
CANYON, RED (A)							
DRILL ADDITIONAL GROUNDWATER WELL	DOCKUM AQUIFER [RANDALL]	700	1,400	2,100	2,800	2,800	3,800
MUNICIPAL CONSERVATION	CONSERVATION [RANDALL]	0	80	176	191	208	227
COUNTY-OTHER, CANADIAN (A)							
MUNICIPAL CONSERVATION	CONSERVATION [RANDALL]	0	0	0	0	0	3
COUNTY-OTHER, RED (A)							
DRILL ADDITIONAL GROUNDWATER WELL	OGALLALA AQUIFER [RANDALL]	0	0	600	1,200	1,800	2,400
MUNICIPAL CONSERVATION	CONSERVATION [RANDALL]	0	101	197	231	268	296
IRRIGATION, RED (A)							
IRRIGATION CONSERVATION	CONSERVATION [RANDALL]	0	18,028	18,673	19,835	20,481	21,126
Sum of Projected Water Management Strategies (acre-feet/year)		**700**	**23,871**	**26,556**	**40,371**	**39,684**	**50,048**

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

SWISHER COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [SWISHER]	17,856	8,035	0	0	0	0
IRRIGATION, RED (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION [SWISHER]	34,661	39,231	42,539	38,285	34,457	31,011
TULIA, RED (O)							
LOCAL GROUNDWATER DEVELOPMENT	OGALLALA AQUIFER [SWISHER]	778	778	700	630	567	510
MUNICIPAL WATER CONSERVATION	CONSERVATION [SWISHER]	18	0	0	0	0	0
Sum of Projected Water Management Strategies (acre-feet/year)		**53,313**	**48,044**	**43,239**	**38,915**	**35,024**	**31,521**