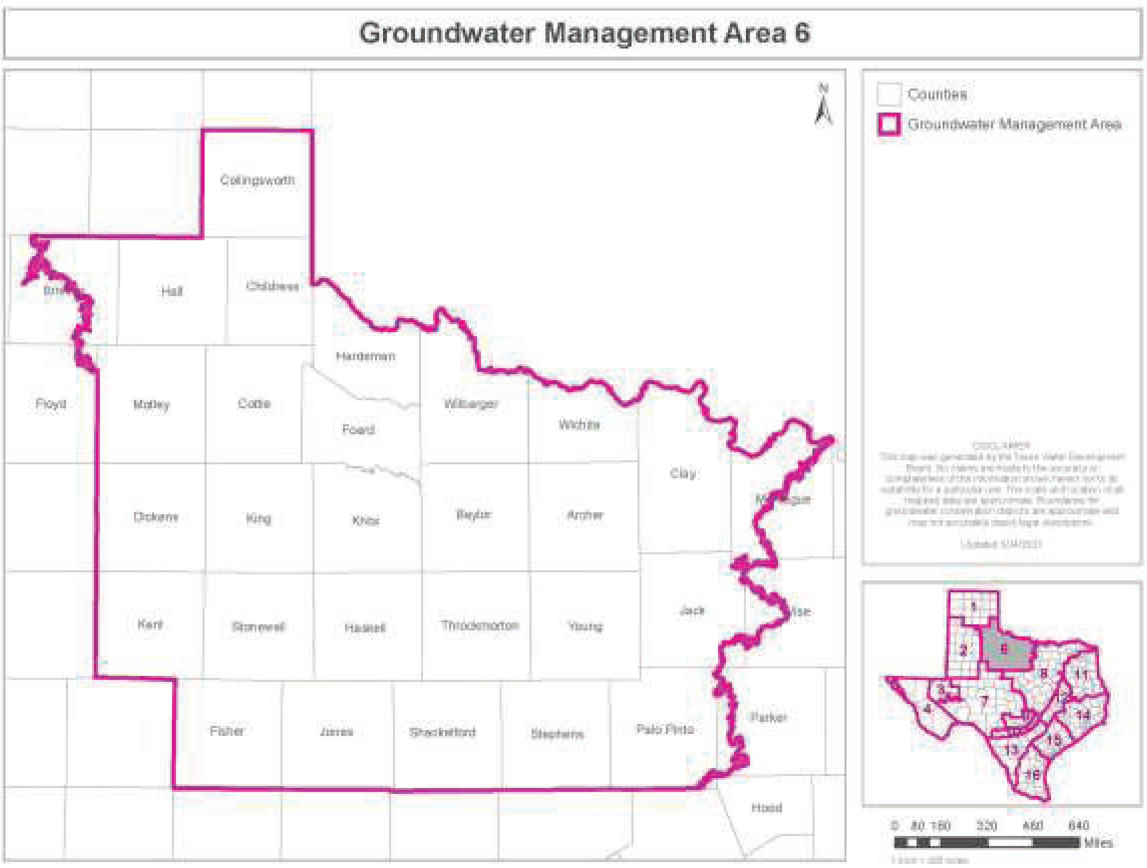
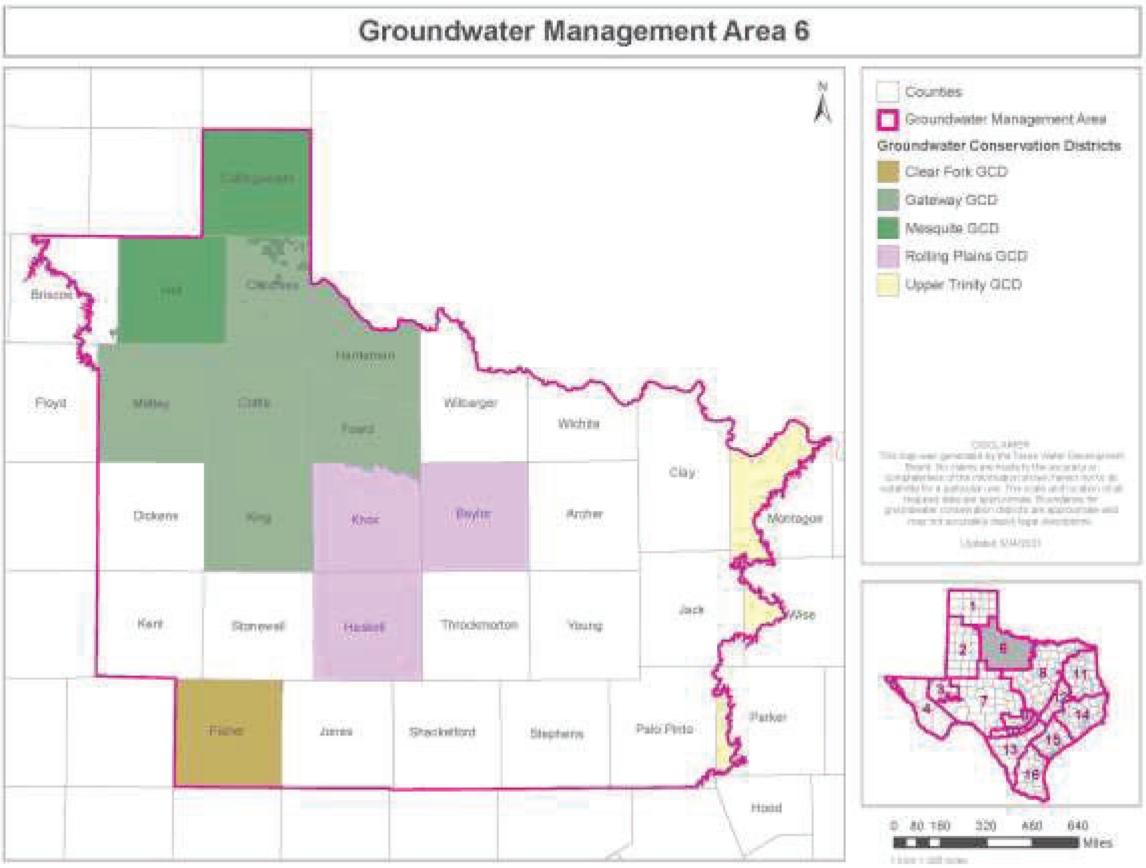
Explanatory Report

Groundwater Management Area 6

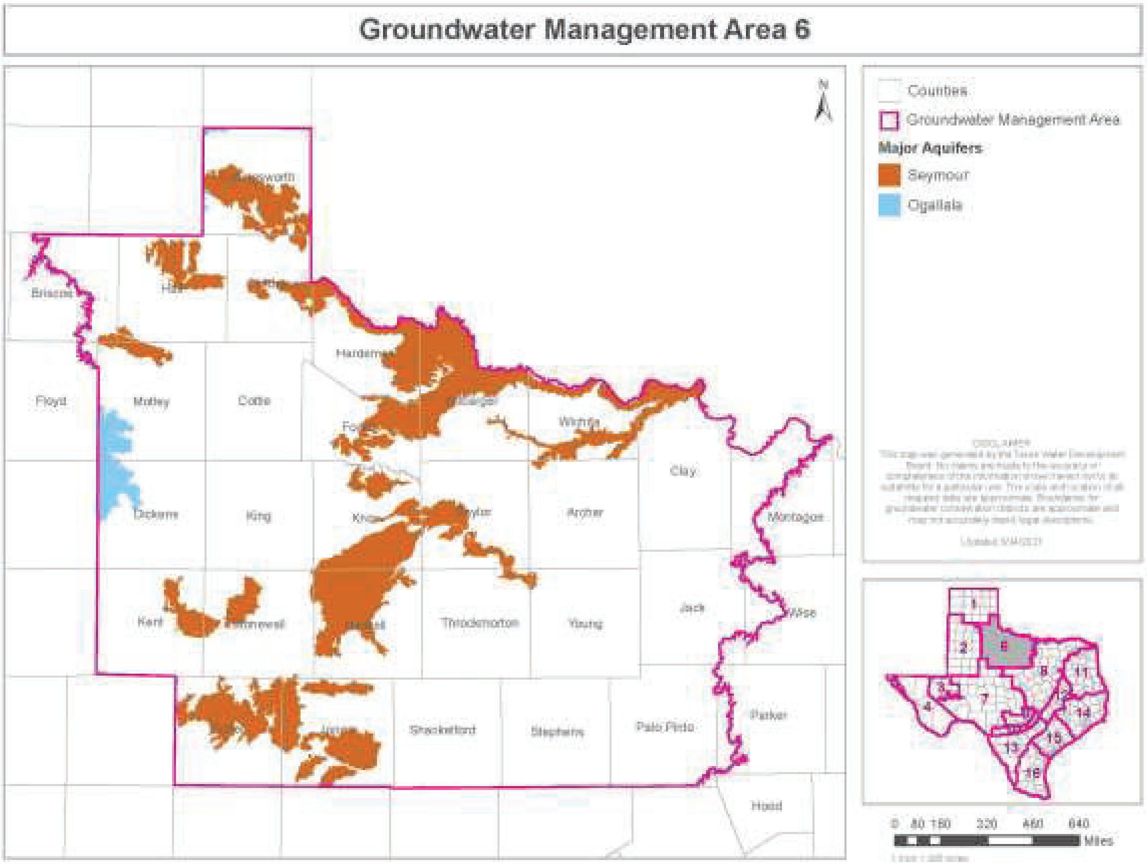
January 14, 2022



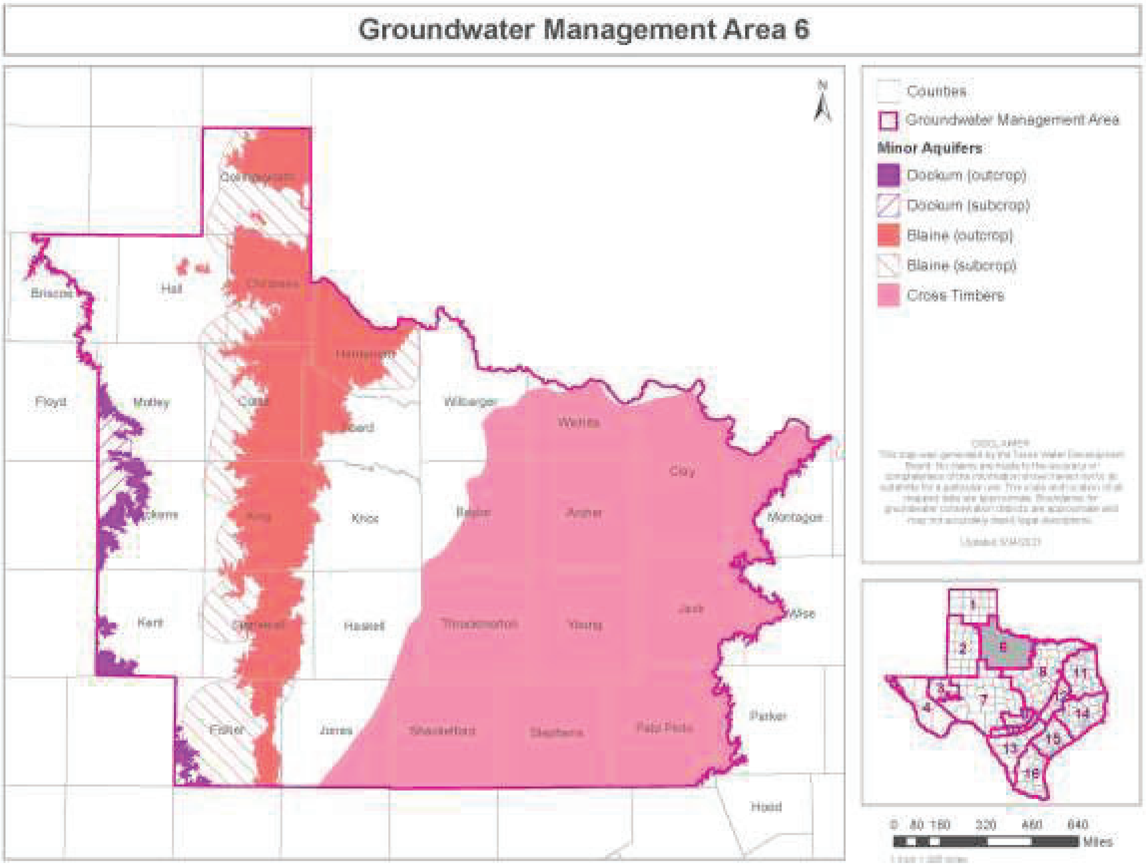


Groundwater Management Area 6

GMA 6 covers all or parts of 30 counties in north central Texas as shown in the map on the cover page. There are 5 groundwater conservation districts in this GMA, as shown above. This area varies widely from east to west. The eastern parts of the area are mainly served by surface water, are more urban, and have very little groundwater supplies. The western parts of the area are mainly served by groundwater, are more rural, and depend on groundwater for their water supplies. A unique factor in GMA 6 is that three of the aquifers, the Blaine, Cross Timbers and Seymour, are discontinuous. The Blaine has discontinuous solution cavities and channels, the Seymour has geographically isolated pods of sand and gravel, and the Cross Timbers is typically discontinuous within sandstone layers. This allows smaller areas of each aquifer to be produced and managed independently without effect on the neighboring producers.



GMA 6 Major Aquifers (From TWDB)



GMA 6 Minor Aquifers (From TWDB)

Aquifer Descriptions

Blaine Aquifer

The Blaine Aquifer is a minor aquifer located at the east end of the High Plains in North Texas. The aquifer is part of the Permian Blaine Formation, which is composed of red silty shale, gypsum, anhydrite, salt, and dolomite. The formation consists of cycles of marine and nonmarine sediments deposited in a broad, shallow sea that once covered the southwestern United States. Saturated thickness reaches 300 feet in the aquifer, but freshwater saturated thickness averages 137 feet. Groundwater occurs primarily in solution channels and caverns within the beds of anhydrite and gypsum that contribute to the overall poor quality of the water. Although some wells contain slightly saline water, with total dissolved solids between 1,000 and 3,000 milligrams per liter, most contain moderately saline water, with total dissolved solids between 3,000 and 10,000 milligrams per liter, exceeding secondary drinking water standards for Texas. Sulfate values are also well in excess of the secondary drinking water standard of 300 milligrams per liter. Water from the Blaine Aquifer is used for livestock and for irrigation of crops that are highly tolerant of salt. – Taken from TWDB Report R380 “Aquifers of Texas”.

Cross Timbers Aquifer

The Cross Timbers Aquifer was designated as a minor Aquifer by the Texas Water Development Board in 2017. It consists of formations within four Paleozoic-age water bearing geologic groups including, from oldest to youngest, the Strawn (Middle Pennsylvanian). Canyon (Upper Pennsylvanian), Cisco (Upper Pennsylvanian), and Wichita (Lower Permian) groups. The outcrop area of the Aquifer covers about 11,800 square miles extending from the Red River southward to the Colorado River, covering all or part of 31 counties. The geologic formations of the Cross timbers aquifer primarily consist of limestone, shale and sandstone. The rocks occur in layers and lenses, reflecting riverine and deltaic depositional environments. Formations in most of the area are exposed at the land surface (outcrop areas) and generally dip to the west. The formations in the northers portion of the aquifer dip to the north and east, particularly where the formations are covered by the younger trinity Aquifer formations. Groundwater in the Cross Timbers Aquifer occurs under mostly water-table (unconfined) conditions and is typically discontinuous within sandstone layers. Overall, groundwater resides in a shallow flow system that is susceptible to water level changes due to variable recharge and discharge. The geometry and aquifer properties of water-bearing strata vary widely and contribute to variability in well yields. Groundwater quality ranges from fresh to brackish. About 75 percent of the identified wells in the Cross timbers Aquifer are domestic wells and about 20 percent are stock wells. The TWDB has identified fifty-one public supply wells that obtain their water from this aquifer. -Extracted from: Groundwater Conditions in the Cross Timbers Aquifer; Ballew, Natalie and Lawrence N French, P.G.; Texas Water Development Board; September 2019.

Dockum Aquifer

The Dockum Aquifer is a minor aquifer found in the northwest part of the state. It is defined stratigraphically by the Dockum Group and includes, from oldest to youngest, the Santa Rosa Formation, the Tecovas Formation, the Trujillo Sandstone, and the Cooper Canyon Formation. The Dockum Group consists of gravel, sandstone, siltstone, mudstone, shale, and conglomerate. Groundwater located in the sandstone and conglomerate units is recoverable, the highest yields coming from the coarsest grained deposits located at the middle and base of the group. Typically, the water-bearing sandstones are locally referred to as the Santa Rosa Aquifer. The water quality in the aquifer is generally poor—with freshwater in outcrop areas in the east and brine in the western subsurface portions of the aquifer—and the water is very hard. Naturally occurring radioactivity from uranium present within the aquifer has resulted in gross alpha radiation in excess of the state's primary drinking water standard. Radium-226 and -228 also occur in amounts above acceptable standards. Groundwater from the aquifer is used for irrigation, municipal water supply, and oil field waterflooding operations, particularly in the southern High Plains. – Taken from TWDB Report R380 "Aquifers of Texas".

Ogallala Aquifer

The Ogallala Aquifer is the largest aquifer in the United States and is a major aquifer of Texas underlying much of the High Plains region. The aquifer consists of sand, gravel, clay, and silt and has a maximum thickness of 800 feet. Freshwater saturated thickness averages 95 feet. Water to the north of the Canadian River is generally fresh, with total dissolved solids typically less than 400 milligrams per liter; however, water quality diminishes to the south, where large areas contain total dissolved solids in excess of 1,000 milligrams per liter. High levels of naturally occurring arsenic, radionuclides, and fluoride in excess of the primary drinking water standards are also present. The Ogallala Aquifer provides significantly more water for users than any other aquifer in the state. The availability of this water is critical to the economy of the region, as approximately 95 percent of groundwater pumped is used for irrigated agriculture. – Taken from TWDB Report R380 "Aquifers of Texas".

Seymour Aquifer

The Seymour Aquifer is a major aquifer extending across northcentral Texas. The aquifer consists of Quaternary-age, alluvial sediments unconformably overlying Permian-age rocks. Water is contained in isolated patches of alluvium as much as 360 feet thick composed of discontinuous beds of poorly sorted gravel, conglomerate, sand, and silty clay. Water ranges from fresh to slightly saline, containing from approximately 100 to 3,000 milligrams per liter of total dissolved solids; however, moderately to very saline water, containing 3,000 to more than 10,000 milligrams per liter of total dissolved solids, exists in localized areas. Throughout its extent, the aquifer is affected by nitrate in excess of primary drinking water standards. Excess chloride also occurs throughout the aquifer. Almost all of the groundwater pumped from the aquifer—90 percent—is used for irrigation, with the remainder used primarily for municipal supply. – Taken from TWDB Report R380 "Aquifers of Texas".

Section 1 – Desired Future Conditions

GMA 6 used several methods to set the DFC. The Blaine and Seymour Aquifers DFC were set using the modeled values and the previous DFC with the exception of Collingsworth and Hall Counties. These counties were set using their actual average drawdown as calculated from water level measurements because of the age of the model and the irrigation development since the model was created. This is addressed more fully in the technical justifications section. The Dockum Aquifer DFC was set using the information modeled in GMA 2 and GMA 7 adjacent to GMA 6. The Ogallala Aquifer DFC was set using the information modeled in GMA 2 which holds the majority of the Ogallala Aquifer adjacent to GMA 6. The map named "Pods of the Seymour Aquifer" shows the location of the Seymour Aquifer Pods. The table following shows the Desired Future conditions.

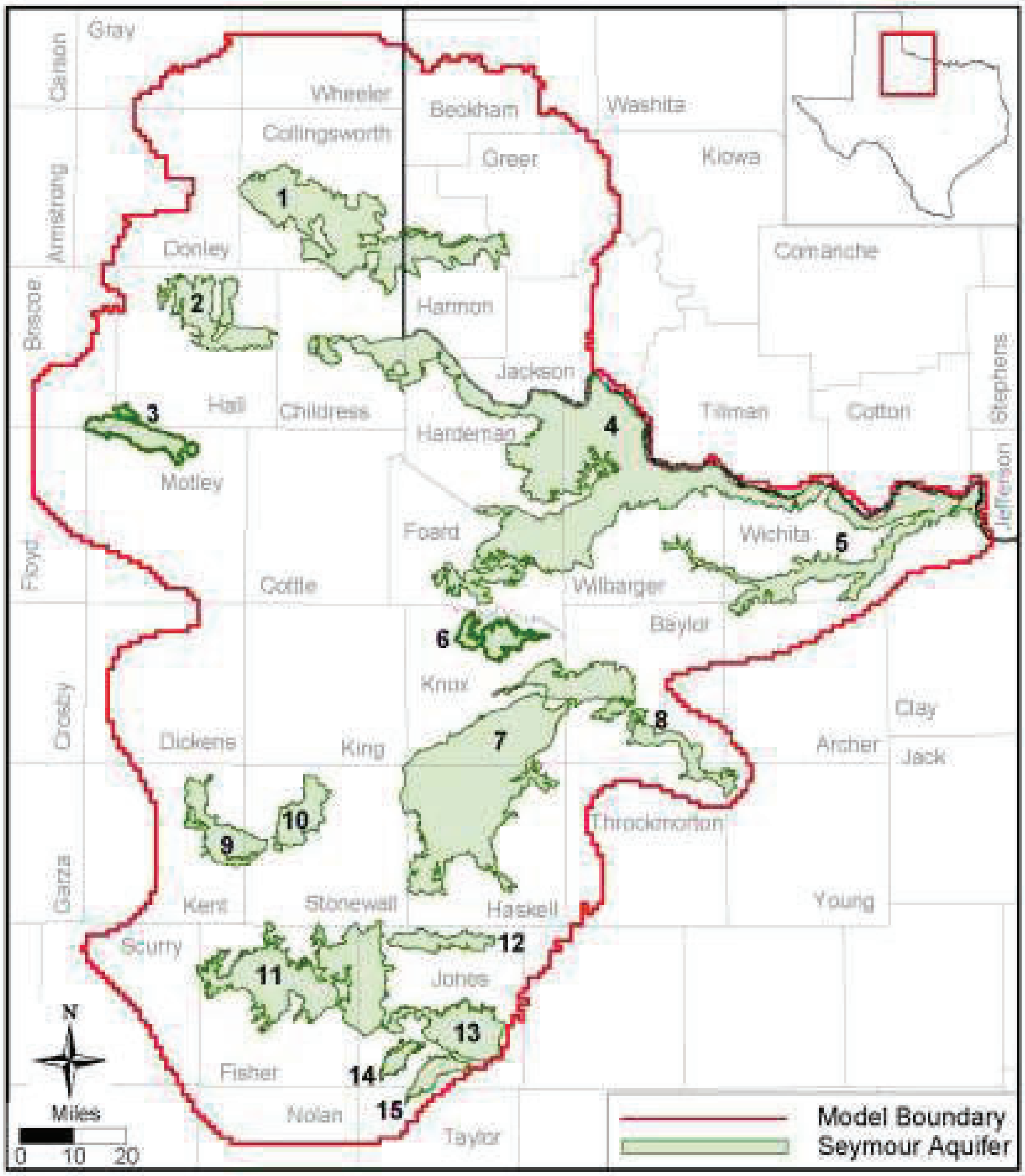


Figure 4.1.1 Pods of the Seymour aquifer.

AQUIFER	POD	COUNTY / COUNTIES	Adopted DFC
BLAINE		Childress - N of Red River	9 ft decline from 2010 - 2080
		Childress - S of Red River	2 ft decline from 2010 - 2080
		Collingsworth	9 ft decline from 2010 - 2080
		Cottle	2 ft decline from 2010 - 2080
		Fisher	4 ft decline from 2010 - 2080
		Foard	2 ft decline from 2010 - 2080
		Hall	9 ft decline from 2010 - 2080
		Hardeman	2 ft decline from 2010 - 2080
		King	7 ft decline from 2010 - 2080
		Stonewall	Not Relevant
DOCKUM		Dickens	Not Relevant
		Fisher	28 ft decline from 2013 - 2080 (GMA 2 & 7)
		Kent	Not Relevant
		Motley	28 ft decline from 2013 - 2080 (GMA 2)
OGALLALA		Collingsworth	Not Relevant
		Dickens	Not Relevant
		Motley	28 ft decline from 2013 - 2080 (GMA 2)
SEYMOUR	1	Childress, Collingsworth	33 ft decline from 2010 - 2080
	2	Hall	15 ft decline from 2010 - 2080
	3	Briscoe, Hall, Motley	15 ft decline from 2010 - 2080
	4	Childress, Foard, Hardeman	1 ft decline from 2010 - 2080
	4	Wichita, Wilbarger	Not Relevant
	5	Archer, Clay Wichita, Wilbarger	Not Relevant
	6 (new GR)	Knox	18 ft decline from 2010 - 2080
	7 (new GR)	Baylor, Haskell, Knox	18 ft decline from 2010 - 2080
	7	Stonewall	Not Relevant
	8 (new GR)	Baylor	18 ft decline from 2010 - 2080
	8	Throckmorton, Young	Not Relevant
	9	Kent, Stonewall	Not Relevant
	10	Kent, Stonewall	Not Relevant
	11	Fisher	1 ft decline from 2010 - 2080
	11	Jones, Stonewall	Not Relevant
	12	Jones	Not Relevant
	13	Jones	Not Relevant
	14	Jones	Not Relevant
	15	Jones	Not Relevant
CROSS TIMBERS		15 counties	Not Relevant

Section 2 – Policy and Technical Justifications

Policy Justifications

Texas Water Code Chapter 36.108(d) states: Not later than September 1, 2010, and every five years thereafter, the districts shall consider groundwater availability models and other data or information for the management area and shall propose for adoption desired future conditions for the relevant aquifers within the management area. Before voting on the proposed desired future conditions of the aquifers under Subsection (d-2), the districts shall consider:
(1) aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another;
(2) the water supply needs and water management strategies included in the state water plan;
(3) hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the executive administrator, and the average annual recharge, inflows, and discharge;
(4) other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water;
(5) the impact on subsidence;
(6) socioeconomic impacts reasonably expected to occur;
(7) the impact on the interests and rights in private property, including ownership and the rights of management area landowners and their lessees and assigns in groundwater as recognized under Section 36.002;
(8) the feasibility of achieving the desired future condition; and
(9) any other information relevant to the specific desired future conditions.

The desired future condition provides a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater in GMA 6.

The policy in GMA 6 is to set the DFC for the slivers of aquifers to align with the DFC set in the GMA that contains the majority of the aquifers, or to declare the slivers non-relevant in areas with very little groundwater supply. In GMA 6, this includes the Ogallala and Dockum Aquifers in Motley County, which has an adopted DFC to match the rest of those aquifers in GMA 2; and the Ogallala Aquifer in Collingsworth County, which the Mesquite GCD does not believe is saturated, and is a very small area, which GMA 6 is declaring non-relevant for the purposes of joint planning.

In areas where there is an aquifer but no groundwater district, the policy in GMA 6 is to declare the aquifer non-relevant for the purposes of joint planning. GMA 6 recognizes that there is no groundwater conservation district with authority or funding to measure, monitor, or manage the aquifer to meet the DFC. GMA 6 also recognizes that Wilbarger County has previously failed to confirm a groundwater conservation district in an election and an existing groundwater conservation district in Kent County disbanded. In GMA 6 only all or parts of 12 of 27 counties have groundwater conservation districts. Also, large portions of GMA 6 have neither major nor minor aquifers present, and no representative from any area with an aquifer declared non-relevant ever attended a GMA 6 meeting. If a GCD were created in any of these areas, GMA 6 would recommend that District consider the values in the attached “GAM Run Values” excel file as their proposed DFC.

Technical Justifications

The models used to develop and check feasibility of the DFC in GMA 6 include GR 08-044 for the Seymour and Blaine Aquifers and the updated Seymour and Blaine model in Baylor, Haskell, and Knox Counties GR 14-009. The original model that covers most of GMA 6 is old, developed in 2008, and the pumping data in this model is even older, ending in 1999. GMA 6 wanted to stick as closely to the approved model as possible, but because of the age of the model data also took the member districts water level measurement data into consideration when proposing and adopting a DFC. This was especially the case in Collingsworth and Hall Counties because of increased irrigation development since 1999. The increase in pumping in Collingsworth and Hall Counties described in Aquifer Uses and Conditions led to more drawdown than predicted by the model in those counties according to an analysis of water level measurements. Because of this discrepancy between the modeled drawdown and actual measured drawdown, the GMA chose to use an analysis of actual measured drawdowns when setting the DFC values in those counties.

GMA 6 chose to mirror the DFC values of those small areas adjacent to a larger area in another GAM where larger scale modeling was used to adopt a DFC. The DFC for the Ogallala and Dockum Aquifers in Motley County follow the technical recommendations of GMA 2 as reported in Scenario 19, Technical Memorandum 20-01 (Hutchison). The DFC for the Dockum aquifer in Fisher county als0 follows the adopted DFC of GMA 2 to the west.

Section 3 - Factors Considered

GMA 6 considered the 9 factors listed in Chapter 36.108(d) before proposing a DFC. The DFC was evaluated for the effect it would have on each factor. Following is a description of the individual considerations:

Aquifer Uses and Conditions

GMA 6 aquifer uses and conditions were considered at several meetings during the last planning period. The aquifers in GMA 6 are used almost exclusively for agriculture and municipalities according to the five Regional Water Plans. In most areas in GMA 6, the pumping in the Blaine and Seymour aquifers has not increased since the development of the original model GR 08-044, nor since the refined model GR 14-009 in Baylor, Haskell, and Knox Counties in 2014. The exception to this in Collingsworth and Hall Counties. Both of these counties have had some increase in irrigation since the model was developed. This was referenced in Table 2-1 of the 2011 Region A water plan, which showed an increase of 14,793 irrigated acres in Collingsworth County, and 2,211 irrigated acres in Hall County. The older Region A Water Plan was used in this instance to show the increase in irrigated acres since the 1999 pumping information used in the model.

Other aquifers in this GMA, including the Dockum and Ogallala, are very localized, and used mostly for domestic and livestock, if at all. The exceptions to this is a small amount of irrigation in the Dockum Aquifer in Fisher County.

Water Supply Needs and Water Management Strategies

Water supply needs and management strategies were considered by the 5 regional planning groups with counties in GMA 6, which include Regions A, B, C, G, and O. Region C only covers Jack County, which concerns GMA 6 only because of a sliver of Trinity aquifer. The member districts of GMA 6 have a representative on the board of all other associated Regional Planning Groups. These districts have been very active and involved in developing the water supply needs and water management strategies for these plans. Many discussions of the water needs and strategies have taken place at GMA 6 meetings with the informed representatives on those Regional Planning Groups bringing information to the GMA meetings. Each of the Regional Water Plans is attached, and a brief summary of the needs and strategies from the counties in each of those plans is below.

Region A – Collingsworth and Hall Counties. Collingsworth County is showing an unmet municipal need for the City of Wellington, and Hall County is showing an unmet County-Other need for the city of Lakeview in Table 11-7 of Region A's plan. The strategies for addressing these needs are in Table 11-8, and include municipal conservation, expanded use of RO treatment of brackish groundwater, and developing new Seymour Aquifer wells.

Region B – Archer, Baylor, Clay, Cottle, Foard, Hardeman, King, Wichita, Wilbarger, and the City of Olney in Young County. This Region is primarily surface water based, although there is some irrigation using the Blaine or Seymour Aquifers in Baylor, Clay, Foard, Hardeman, Wichita and Wilbarger Counties. Wilbarger has the most groundwater availability at 4,600 acre-feet per year according to Table 3-5 in Region B's plan. Baylor, Hardeman, and Wilbarger Counties are projected to have unmet groundwater supplied irrigation needs for at least part of the plan's timeframe, and Wilbarger County shows an unmet groundwater supplied municipal need by 2040. The primary strategy to address these shortages is water conservation.

Region C – Jack County. This county is primarily supplied by surface water, and all their needs and strategies deal with surface water. In addition, there is no groundwater conservation district to monitor, evaluate, or manage the groundwater supplies in this county.

Region G – Fisher, Haskell, Jones, Kent, Knox, Palo Pinto, Shackelford, Stephens, Stonewall, Throckmorton, and Young (except the City of Olney) Counties. This Region is primarily surface water dependent, and shows many surface water needs. The groundwater supplied needs are as follows: Fisher County manufacturing, Haskell, Knox, Jones and Stephens Counties irrigation, and Kent County municipal. The strategies to meet these needs are conservation, and developing new supplies, whether they be groundwater or surface water. The City of Jayton in Kent County also has a strategy of developing a new water treatment facility, as their current facility has a low daily load limit and so is the bottleneck to their supply. There are also some needs that do not currently have groundwater supply, but one of the strategies for meeting these needs is to develop groundwater supply. The needs and strategies for all of these counties can be found in Chapter 5 of the Region G water plan.

Region O – Briscoe off of the caprock, Dickens, Floyd off of the caprock, and Motley Counties. Dickens and Motley Counties are showing unmet Ogallala or Dockum Aquifer supplied needs in Table 4-2 of the Region O plan. Table 5-2 contains the strategies to meet those needs. The strategies include conservation for irrigation and municipal shortages, and in addition, recommends a strategy of developing a new groundwater supply for the City of Dickens.

Hydrologic Conditions

GMA 6 considered the total estimated recoverable storage, average annual recharge, inflows, outflows, and discharge prior to proposing a DFC. This information is available from a variety of sources, including the TERS report 13-029 for GMA 6, GAM run 14-007 for the development of Clear Fork GCD's management plan, GAM run 13-017 for the development of Mesquite GCD's management plan, GAM run 10-21 for the development of Rolling Plains GCD's management plan, and GAM run 10-07 for the development of Gateway GCD's management plan. The information used is attached and compiled in the excel file named "Hydro Condition Chart."

Other Environmental Impacts

GMA 6 considered how spring flow might be affected by the DFC. Spring flow in Dickens and Motley Counties comes from the contact at the base of the Ogallala and Dockum Aquifers. The discharge in these springs will only be influenced by pumping outside of GMA 6, as the majority of the rest of those aquifers is in GMA 2. The springs that are fed by the Seymour and Blaine Aquifers tend to be seasonal and are affected by recharge and transpiration at least as much as they are by pumping.

Subsidence

Subsidence in GMA 6 only occurs in the form of dissolved gypsum, salt and limestone formations that can cause localized sinkholes, depressions, and subsurface cavities. Since the only way to control these sinkholes is to dewater that portion of the aquifer where the minerals are being dissolved, subsidence was not considered to be a relevant factor when proposing the DFC.

Socioeconomic Impacts

The GMA considered the five socioeconomic impact reports prepared by those regions located in the GMA. These include Regions A, B, C, G and O. A summary survey of socio-economic factors was prepared by the GMA and is attached in the file called "Socio-Economic Table". Factors considered included population, population density and population change, municipal water sources, wage and income data, property values, retail sales, agricultural value and economy base type. The survey indicated a declining population. Over half the GMA population is located in Wichita County. There is a low wage agricultural based economy in the west, and a mixed wage economy in the east. Municipal areas rely on groundwater in the west and surface water in the east. There is generally limited groundwater in the eastern part of the GMA.

Private Property Rights

GMA 6 considered private property rights repeatedly throughout the process of proposing a DFC. GMA 6 received several emails from Mr. James Adams expressing his concerns about private property right in the state of Texas, and they reviewed a presentation developed by Lawyer Keith Good addressing the same issue. GMA 6 also followed the Bragg v. EAA case closely and the member districts discussed at length the effect this might have on groundwater districts and private property rights. After much discussion the members of GMA 6 believe they have adopted a DFC that preserves private property rights while also allowing the Districts to conserve, preserve, and protect the natural groundwater supplies.

Feasibility

Both of the Seymour/Blaine models were used to evaluate feasibility of the proposed DFC. Results of GAM runs prepared by GMA 2 were considered when evaluating the limited Ogallala and Dockum areas. In all cases, the models predict achieving the DFC is feasible. The Districts and the TWDB measure water levels in all Districts in the GMA. Analysis of these water levels have also been evaluated to confirm the adopted DFC is feasible, and will be used to monitor the aquifers to ensure they meet the DFC through time.

Other

No other factors have been considered during the proposal of the DFC.

Section 4 – Other DFC Options Considered

GMA 6 considered many other DFC options, including percent decline, feet decline, springflow maintenance, and production based scenarios. The attached powerpoint titled “DFC options – revised” outlines all of these possible DFC options. These DFC options were not adopted because of the lack of data to evaluate them. All GCD’s in GMA 6 have historic and continuing water level measurements. These measurements will allow the GCD’s to evaluate feasibility of and compliance with the DFC.

Section 5 – Comments Considered

No GCD received any comment on the proposed DFC during the 90 day comment period from any stakeholder or TWDB. There was also no comment at any GMA 6 meeting, or received by the GMA 6 coordinator.

SECTION 6

Aquifers Declared Non-Relevant for Purposes of Joint Planning

The purpose of joint planning is for Districts to come together to consider DFC’s for their districts. Therefore, in areas where there are no districts, GMA 6 is declaring the aquifers non-relevant because there is no groundwater conservation district with authority or funding to measure, monitor, or manage the aquifer to meet the DFC.

The Seymour Aquifer in Clay, Kent, Jones, Stonewall, Throckmorton, Wichita, Wilbarger, and Young Counties (including all of pods 5, 9, 10, 12, 13, 14, and 15, and parts of pods 4, 7, 8, and 11, as shown in the attached pdf file named “Seymour Pod Numbers”) is totally excluded from any GCD. The aquifer characteristics have been discussed in this report in the prior aquifer characteristics section, and the demands, uses, and TERS volumes are included in the attached Excel file named “Hydro Conditions Chart.” Because there is no GCD to measure, monitor, or manage the aquifers in these counties, GMA 6 is declaring this aquifer in these counties non-relevant for the purposes of joint planning.

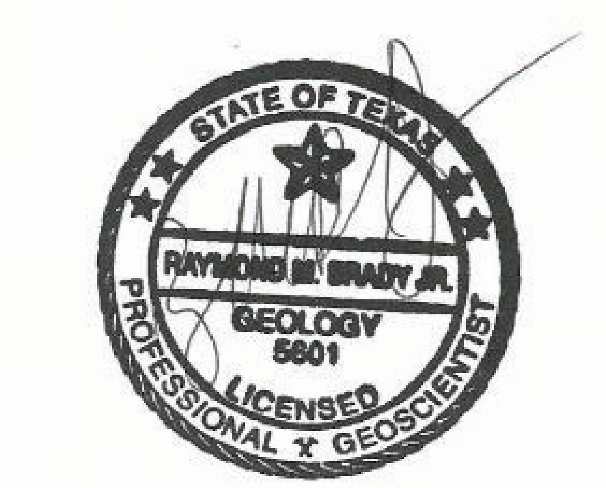
The Blaine Aquifer in King and Stonewall Counties is totally excluded from any GCD. The aquifer characteristics have been discussed in this report in the prior aquifer characteristics section, and the demands, uses, and TERS volumes are included in the attached Excel file named “Hydro Conditions Chart.” Because there is no GCD to measure, monitor, or manage the aquifers in these counties, GMA 6 is declaring this aquifer in these counties non-relevant for the purposes of joint planning.

The Cross Timbers Aquifer in 15 counties in GMA 6 does not have an existing groundwater availability model and only partly lies within a groundwater conservation district. The aquifer characteristics have been discussed in this report in the prior aquifer characteristics section but because there is no groundwater availability model and in most of the area no GCD to measure, monitor, or manage the aquifers in these counties, GMA 6 is declaring this aquifer in these counties non-relevant for the purposes of joint planning. During the next round of joint planning the GMA will consider any groundwater availability models and scientific information available at that time.

The Dockum Aquifer in Kent and Dickens Counties is totally excluded from any GCD. The aquifer characteristics have been discussed in this report in the prior aquifer characteristics section, and the demands, uses, and TERS volumes are included in the attached Excel file named “Hydro Conditions Chart.” Because there is no GCD to measure, monitor, or manage the aquifers in these counties, GMA 6 is declaring this aquifer in these counties non-relevant for the purposes of joint planning.

The Ogallala Aquifer in Dickens County is totally excluded from any GCD. The aquifer characteristics have been discussed in this report in the prior aquifer characteristics section, and the demands, uses, and TERS volumes are included in the attached Excel file named “Hydro Conditions Chart.” Also, GMA 6 examined pumping scenarios modeled in GMA 2 for this aquifer as attached in the file named “Ogallala Pumping Drawdown Motley and Dickens”. Because there is no GCD to measure, monitor, or manage the aquifers in these counties, GMA 6 is declaring this aquifer in these counties non-relevant for the purposes of joint planning.

The Ogallala Aquifer in Collingsworth County is in Mesquite Groundwater Conservation District. The aquifer characteristics have been discussed in this report in the prior aquifer characteristics section, and the demands, uses, and TERS volumes are included in the attached Excel file named “Hydro Conditions Chart.” MGCD is in the process of collecting information to verify whether any of the Ogallala Formation is saturated in their District. High Plains Aquifer System GAM numerical report August 2015 shows Ogallala pumping in Collingsworth County to be 1 acre-foot per year from 1998 to 2008. The rest of the years are 0 acre-feet. As you can see on the Major Aquifers map, there is such a small area of Ogallala formation mapped in Collingsworth County that it is not of consequence to regional-scale planning. Therefore, GMA 6 is declaring this aquifer in this county non-relevant for the purposes of joint planning.


STATE OF TEXAS
RAYMOND M. BRADY JR.
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5601
LICENSED
PROFESSIONAL GEOSCIENTIST

TERS report 13-029 for GMA 6.

Aquifer	County		TERS	
		Total Storage	25%	75%
Blaine	Childress	18,000,000	4,500,000	13,500,000
	Collingsworth	29,000,000	7,250,000	21,750,000
	Cottle	22,000,000	5,500,000	16,500,000
	Dickens	35,000	8,750	26,250
	Foard	5,900,000	1,475,000	4,425,000
	Hall	2,500,000	625,000	1,875,000
	Hardeman	10,000,000	2,500,000	7,500,000
	King	24,000,000	6,000,000	18,000,000
	Knox	810,000	202,500	607,500
	Motley	110,000	27,500	82,500
	Fisher	15,000,000	3,750,000	11,250,000
	Kent	490,000	122,500	367,500
	Stonewall	36,000,000	9,000,000	27,000,000
	Jones	880,000	220,000	660,000
	Wilbarger	1,400	350	1,050
	Total	164,726,400	41,181,600	123,544,800
Dockum	Dickens	3,400,000	850,000	2,550,000
	Fisher	1,300,000	325,000	975,000
	Kent	1,400,000	350,000	1,050,000
	Motley	1,800,000	450,000	1,350,000
	Total	7,900,000	1,975,000	5,925,000
Trinity (N	Jack	420,000	105,000	315,000
	Palo Pinto	51,000	12,750	38,250
	Total	471,000	117,750	353,250
Ogallala	Collingsworth	85,000	21,250	63,750
	Dickens	1,200,000	300,000	900,000
	Motley	1,000,000	250,000	750,000
	Total	2,285,000	571,250	1,713,750
Seymour	Archer	4,800	1,200	3,600
	Baylor	220,000	55,000	165,000
	Childress	100,000	25,000	75,000
	Clay	170,000	42,500	127,500
	Collingsworth	480,000	120,000	360,000
	Fisher	260,000	65,000	195,000
	Foard	220,000	55,000	165,000
	Hall	200,000	50,000	150,000
	Hardeman	450,000	112,500	337,500
	Haskell	570,000	142,500	427,500
	Jones	590,000	147,500	442,500
	Kent	94,000	23,500	70,500

Knox	400,000	100,000	300,000
Motley	72,000	18,000	54,000
Stonewall	44,000	11,000	33,000
Throckmorton	29,000	7,250	21,750
Wichita	270,000	67,500	202,500
Wilbarger	890,000	222,500	667,500
Young	6,300	1,575	4,725
Total	5,070,100	1,267,525	3,802,575

Aquifer	County	RECHARGE Acre-Feet
Blaine	Collingsworth, and Hall in Mesquite GCD	24209
	Childress, Cottle, Foard, Hardeman, and Motley in Gateway GCD	47067
	Collingsworth	
	Cottle	
	Dickens	No District
	Foard	
	Hall	
	Hardeman	
	King	not available
	Knox	642
	Motley	
	Fisher	No District
	Kent	No District
	Stonewall	No District
	Jones	No District
	Wilbarger	No District
	Total	
Dockum	Dickens	No District
	Fisher	2095
	Kent	No District
	Motley	619
	Total	
Trinity (No	Jack	No District
	Palo Pinto	No District
	Total	
Ogallala	Collingsworth	252
	Dickens	No District
	Motley	404
	Total	
Seymour	Archer	No District
	Baylor, Haskell, and Knox in Rolling Plains GCD	105272

Collingsworth, Hall, and Briscoe in Mesquite GCD	42904
Childress, Foard, Harc	48643
Clay	No District
Collingsworth	
Fisher	12261
Foard	
Hall	
Hardeman	
Haskell	
Jones	No District
Kent	No District
Knox	
Motley	
Stonewall	No District
Throckmorton	No District
Wichita	No District
Wilbarger	No District
Young	No District
Total	

Aquifer	County	Inflows	Outflows
Blaine	Childress, Collingsworth, and Hall in Mesquite GCD	12947	15637
	Childress, Cottle, Foard, Hardeman, and Motley in Gateway GCD	18811	13795
	Collingsworth		
	Cottle		
	Dickens	Not availab	No District
	Foard		
	Hall		
	Hardeman		
	King	No District	No District
	Knox	1467	261
	Motley		
	Fisher	No District	No District
	Kent	No District	No District
	Stonewall	No District	No District
	Jones	No District	No District
	Wilbarger	No District	No District
	Total		
Dockum	Dickens	No District	No District
	Fisher	65	98
	Kent	No District	No District
	Motley	1190	760
	Total		
Trinity (Not	Jack	No District	No District
	Palo Pinto	No District	No District
	Total		
Ogallala	Collingsworth	1390	0
	Dickens	No District	No District
	Motley	1895	2742
	Total		
Seymour	Archer	No District	No District

Baylor, Haskell, and Knox in Rolling Plains GCD	98	1769
Childress, Collingsworth, Hall, and Briscoe in Mesquite GCD	1705	1041
Childress, Foard, Hardeman, and Motley in Gateway GCD	792	7145
Clay	No District	No District
Collingsworth		
Fisher	0	459
Foard		
Hall		
Hardeman		
Haskell		
Jones	No District	No District
Kent	No District	No District
Knox		
Motley		
Stonewall	No District	No District
Throckmorton	No District	No District
Wichita	No District	No District
Wilbarger	No District	No District
Young	No District	No District
Total		

Aquifer	County	DISCHARGE Acre-Feet
Blaine	Childress, Collingsworth, and Hall in Mesquite GCD	21605
	Childress, Cottle, Foard, Hardeman, and Motley in Gateway GCD	17164
	Collingsworth	
	Cottle	
	Dickens	No District
	Foard	
	Hall	
	Hardeman	
	King	not available
	Knox	0
	Motley	
	Fisher	No District
	Kent	No District
	Stonewall	No District
	Jones	No District
	Wilbarger	No District
	Total	
Dockum	Dickens	No District
	Fisher	319
	Kent	No District
	Motley	1160
	Total	
Trinity (Not	Jack	No District
	Palo Pinto	No District
	Total	
Ogallala	Collingsworth	1643
	Dickens	No District
	Motley	0
	Total	
Seymour	Archer	No District

Baylor, Haskell, and Knox in Rolling Plains GCD	16266
Childress, Collingsworth, Hall, and Briscoe in Mesquite GCD	4308
Childress, Foard, Hardeman, and Motley in Gateway GCD	5191
Clay	No District
Collingsworth	
Fisher	3011
Foard	
Hall	
Hardeman	
Haskell	
Jones	No District
Kent	No District
Knox	
Motley	
Stonewall	No District
Throckmorton	No District
Wichita	No District
Wilbarger	No District
Young	No District
Total	

FLOW BETWEEN AQUIFERS

Aquifer	County	Acre-Feet	Flow Direction
Blaine	Childress, Collingsworth, and Hall in Mesquite GCD	13371	from Seymour to Blaine
	Childress, Cottle, Foard, Hardeman, and Motley in Gateway GCD	21082	7056 from Blain to Seymour, 14026 from Blaine to Permi
	Collingsworth		
	Cottle		
	Dickens	No District	
	Foard		
	Hall		
	Hardeman		
	King	not available	
	Knox	4119	from Blaine to Permian
	Motley		
	Fisher	No District	
	Kent	No District	
	Stonewall	No District	
	Jones	No District	
	Wilbarger	No District	
	Total		
Dockum	Dickens	No District	
	Fisher	0	
	Kent	No District	
	Motley	133	from Ogallala to Dockum
	Total		
Trinity (No	Jack	No District	
	Palo Pinto	No District	
	Total		
Ogallala	Collingsworth	0	
	Dickens	No District	
	Motley	133	from Ogallala to Dockum
	Total		
Seymour	Archer	No District	

Baylor, Haskell, and Knox in Rolling Plains GCD	7259	from Seymour to underlying Permian
Childress, Collingsworth, Hall, and Briscoe in Mesquite GCD	13371	from Seymour to Blaine
Childress, Foard, Hardeman, and Motley in Gateway GCD	8046	from Blaine and Permain to Seymour
Clay	No District	
Collingsworth		
Fisher	0	
Foard		
Hall		
Hardeman		
Haskell		
Jones	No District	
Kent	No District	
Knox		
Motley		
Stonewall	No District	
Throckmorton	No District	
Wichita	No District	
Wilbarger	No District	
Young	No District	
Total		

an

COUNTY	GCD	POP	POP CHG	AREA	MUNI SOURCE	POP DENSITY	LABOR FORCE	UNEMP	WAGES	AVG WAGE	PER CAPITA $	CTY INCOME	PROP VALUE	RETAIL $	AG VALUE	AG % CTY $$	ECONOMY
SOURCE		TX AL	TX AL last census	TX AL		CALC AREA / POP	TX AL	TX AL	TX AL (quarter)	CALC WAGE x LABOR	TX AL	CALC PC x POP	TX AL	TX AL	TX AL	CALC AG VAL / CTY INC	TX AL
Fisher	CLEAR FORK	3844	-3.3	9901		2.6	1942	5.5%	$6,972,710	$14,362	34,088	$131,034,272	$745,917,285	$14,098,285	$50,500,000	39%	AG, GYP, REC,
Roby, Rotan					G												
Childress	GATEWAY	7000	-0.20%	639		11.0	2772	5.7%	$16,113,748	$23,251	22,754	$159,278,000	$463,683,579	$82,857,034	$20,720,000	13%	GOV, AG, RETAIL, REC
Childress					S												
Cottle	GATEWAY	1486	-1.30%	902		1.6	769	6.1%	$3,786,288	$19,695	35,709	$53,063,574	$422,802,420	$10,978,603	$17,500,000	33%	AG, GOV, REC
Paducah					G												
Foard	GATEWAY	1307	-2.20%	708		1.8	630	6.3%	$1,981,415	$12,580	33,685	$44,026,295	$460,258,790	$7,669,876	$17,800,000	40%	AG, GOV
Crowell					G												
Hardeman	GATEWAY	4082	-1.4%	697		5.9	1872	5.7%	$8,742,877	$18,681	31,356	$127,995,192	$657,235,820	$25,290,467	$24,000,000	19%	AG, GYP, O&G
Quanah					S												
Motley	GATEWAY	1202	-0.07%	990		1.2	494	6.3%	$1,952,465	$15,809	35,515	$42,689,030	$320,976,244	$6,731,227,336	$16,400,000	38%	AG, GOV,LT MANUF
Matador					G												
Briscoe	MESQUITE	500	-4.60%	455		1.1	242	8.1%	na	na	27,769	$13,884,500	na	na	$9,300,000	67%	AG, RETAIL, REC
Quitaque					G												
Childress	MESQUITE	29	na	71		0.4	145.9	5.7%	$848,092	$23,251	22,754	$659,866	$51,520,398	$0	$5,180,000	95%	AG
none					-												
Collingsworth	MESQUITE	3036	-0.70%	919		3.3	1271	5.0%	$6,434,222	$20,249	31,836	$96,654,096	$464,447,050	$13,362,509	$50,300,000	52%	AG, GOV, REC
Wellington					G												
Hall	MESQUITE	3293	-1.80%	904		3.6	1221	8.4%	$5,655,420	$18,527	23,662	$77,918,966	$472,406,000	$45,437,967	$43,500,000	56%	AG, RETAIL, REC
Memphis, Turkey					S , G												
BAYLOR	ROLLING PLAINS	3623	-2.8%	901		4.0	2386	4.6%	$9,729,202	$16,310	36,307	$131,540,261	$685,054,400	$25,118,643	$42,900,000	33%	AG, RETAIL, HEALTH SVC
Seymour					S												
KNOX	ROLLING PLAINS	3781	1.9%	855		4.4	1553	6.8%	$11,706,219	$30,151	32,652	$123,457,212	$421,502,664	$10,978,603	$38,400,000	31%	OIL, AG, GOV
Munday					S												
HASKELL	ROLLING PLAINS	5901	0.0%	910		6.5	2649	6.2%	$11,846,169	$17,888	27,118	$160,023,318	$606,751,801	$79,924,394	$67,700,000	42%	AG, OIL
Haskell					S												
ARCHER	no district	8735	-3.50%	926		9.4	4867	5.1%	$14,701,222	$12,082	45,689	$399,093,415	$957,060,524	$58,748,446	$61,000,000	15%	AG, DAIRY,PET, REC
Archer City					S												
CLAY	no district	10535	-2.00%	1116		9.4	5826	5.5%	$11,567,011	$7,942	43,795	$461,380,325	$1,411,896,910	$75,490,712	$56,900,000	12%	PET, AG
Henrietta					S												
DICKENS	no district	2323	-5.00%	905		2.6	909	9.5%	$3,438,338	$15,130	27,118	$62,995,114	$805,238,480	$14,286,425	$21,100,000	33%	AG, GOV,REC, WIND
Spur					S												
JACK	no district	8983	-0.70%	920		9.8	5510	4.9%	$33,601,882	$24,393	37,903	$340,482,649	$2,395,946,280	$48,286,426	$18,300,000	5%	PET, LS, LT MANUF, REC
Jacksboro					S												
JONES	no district	19973	-1.10%	937		21.3	8074	6.5%	$30,698,438	$15,209	26,734	$533,958,182	$984,867,660	$167,700,282	$59,200,000	11%	AG, GOV, MANUF
Anson					S												
KENT	no district	831	3.80%	903		0.9	409	4.6%	$2,102,198	$20,559	31,367	$26,065,977	$1,077,775,240	$11,898,097	$6,800,000	26%	AG, PET, GOV, REC
Jayton					G												
KING	no district	276	-3.50%	913		0.3	145	7.6%	$1,272,141	$35,094	62,071	$17,131,596	$669,217,340	na	$17,900,000	90%	PET, LS, GOV, REC
Guthrie					G												
PALO PINTO	no district	27856	-0.90%	986		28.3	14232	6.5%	$80,307,254	$22,571	33,497	$933,092,432	$3,814,368,050	$333,654,743	$23,500,000	3%	MANUF, REC, PET
Mineral Wells					S												
SHACKELFORD	no district	3356	-0.70%	916		3.7	2806	3.0%	$17,116,822	$24,400	51,496	$172,820,576	$1,502,526,148	$16,182,353	$16,100,000	9%	PET, LS,MANUF, REC
Albany					S												
STEPHENS	no district	9630	-0.46%	921		10.5	4669	8.7%	$29,552,074	$25,318	na	na	$1,421,988,215	$116,972,911	$12,400,000	na	PET, MANUF, REC
Breckenridge					S												
STONEWALL	no district	1475	-1.00%	920		1.6	787	4.1%	$4,090,700	$20,791	40,298	$59,439,550	$649,293,960	$7,375,550	$13,700,000	23%	AG, LT MANUF, GOV
Aspermont																	
THROCKMORTON	no district	1601	-2.40%	915		1.7	885	5.0%	$3,331,066	$15,056	48,144	$77,078,544	$710,705,924	$10,878,006	$21,900,000	28%	PET, AG, REC
Throckmorton					S & G												
WICHITA	no district	131559	0.00%	633		207.8	61514	6.5%	$471,176,632	$30,639	35,477	$4,667,318,643	$6,700,665,983	$1,675,651,663	$27,200,000	1%	MANF, RETAIL, GOV, MIL
Wichita Falls					S												
WILBARGER	no district	13258	-2.00%	978		13.6	7594	4.8%	$54,940,088	$28,939	34,571	$458,342,318	$1,432,891,630	$116,894,290	$42,900,000	9%	AG, PWR GEN, GOV
Vernon					G												
YOUNG	no district	18339	-1.10%	931		19.7	9609	5.2%	$66,466,762	$27,669	39,998	$733,523,322	$1,744,140,480	$219,529,972	$21,200,000	3%	PET, AG, REC
Graham					S												
			Average			Average		Average									
26 official Counties	Total	297814	-1.10%			13.9		6.0%		$20,613	$35,310	$374,257,305	$1,187,079,232	$381,557,446	$29,439,286	31%	
plus Briscoe	less Wichita	166255	2 up, 2 nc			6.7											
	(56% of GMA POP)		rest down														