June 14, 2016

DRAFT

Explanatory Report for the Proposed Desired Future Conditions of the Leona Gravel Aquifer Groundwater Management Area 10

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Abbreviations

DFC	Desired Future Conditions
GCD	Groundwater Conservation District
GMA	Groundwater Management Area
MAG	Modeled Available Groundwater
TWDB	Texas Water Development Board
UWCD	Underground Water Conservation District

1. Groundwater Management Area 10 and the Leona Gravel Aquifer

Groundwater Management Areas (GMAs) were created by the Texas Legislature to provide for the conservation, preservation, protection, recharging, and prevention of waste of the groundwater, and of groundwater reservoirs or their subdivisions, and to control subsidence caused by withdrawal of water from those groundwater reservoirs or their subdivisions. Each GMA is charged with facilitating joint planning efforts in the GMAs within its jurisdiction.

GMA 10 was created to oversee the Edwards (Balcones Fault Zone) and Trinity aquifers. Other aquifers include the Leona Gravel, Buda Limestone, Austin Chalk, and the saline Edwards (Balcones Fault Zone) Aquifers. The jurisdiction of GMA 10 includes all or parts of Bexar, Caldwell, Comal, Guadalupe, Hays, Kinney, Medina, Travis, and Uvalde counties (Figure 1). Groundwater Conservation Districts (GCD) in GMA 10 include Barton Springs/Edwards Aquifer Conservation District, Comal Trinity GCD, Edwards Aquifer Authority, Kinney County GCD, Medina County GCD, Plum Creek Conservation District, and Uvalde County Underground Water Conservation District (UWCD) (Figure 1).

As mandated in Texas Water Code § 36.108, districts are required to submit Desired Future Conditions (DFCs) of the groundwater resources in their GMA to the executive administrator of the Texas Water Development Board (TWDB), unless that aquifer is deemed to be non-relevant. According to Texas Water Code § 36.108 (d-3), the district representatives shall produce a DFC Explanatory Report for the management area and submit to the TWDB a copy of the Explanatory Report.

The Leona Gravel Aquifer is neither a major nor minor aquifer, but has been determined to be locally relevant in Uvalde County for joint planning purposes. The Leona Gravel Aquifer has been determined to be not relevant in Medina County for joint planning purposes. This document is the Explanatory Report for the Leona Gravel Aquifer where it is determined to be relevant within GMA 10.

2. Aquifer Description

For jurisdicational purposes, the Leona Gravel Aquifer is defined as Leona Gravels within Uvalde County. The geographic extent of the Leona Gravel Aquifer is presented in Figure 2 (Bradley, 2012). As illustrated, the jurisdiction is limited to Uvalde County. The Medina County GCD declared the Leona Gravel Aquifer to be non-relevant in Medina County.

3. Desired Future Conditions

The DFC for the Leona Gravel Aquifer in the Uvalde County part of GMA 10, as described in Resolution No. 2010-11 and adopted August 23, 2010 by the GCDs in GMA 10, is a regional average well drawdown of zero (0) feet (including exempt and non-exempt use) (Table 1). The second round DFC was adopted at the GMA 10 meeting on March 14, 2016. Resolution No. 2016-xx is attached in Appendix A.

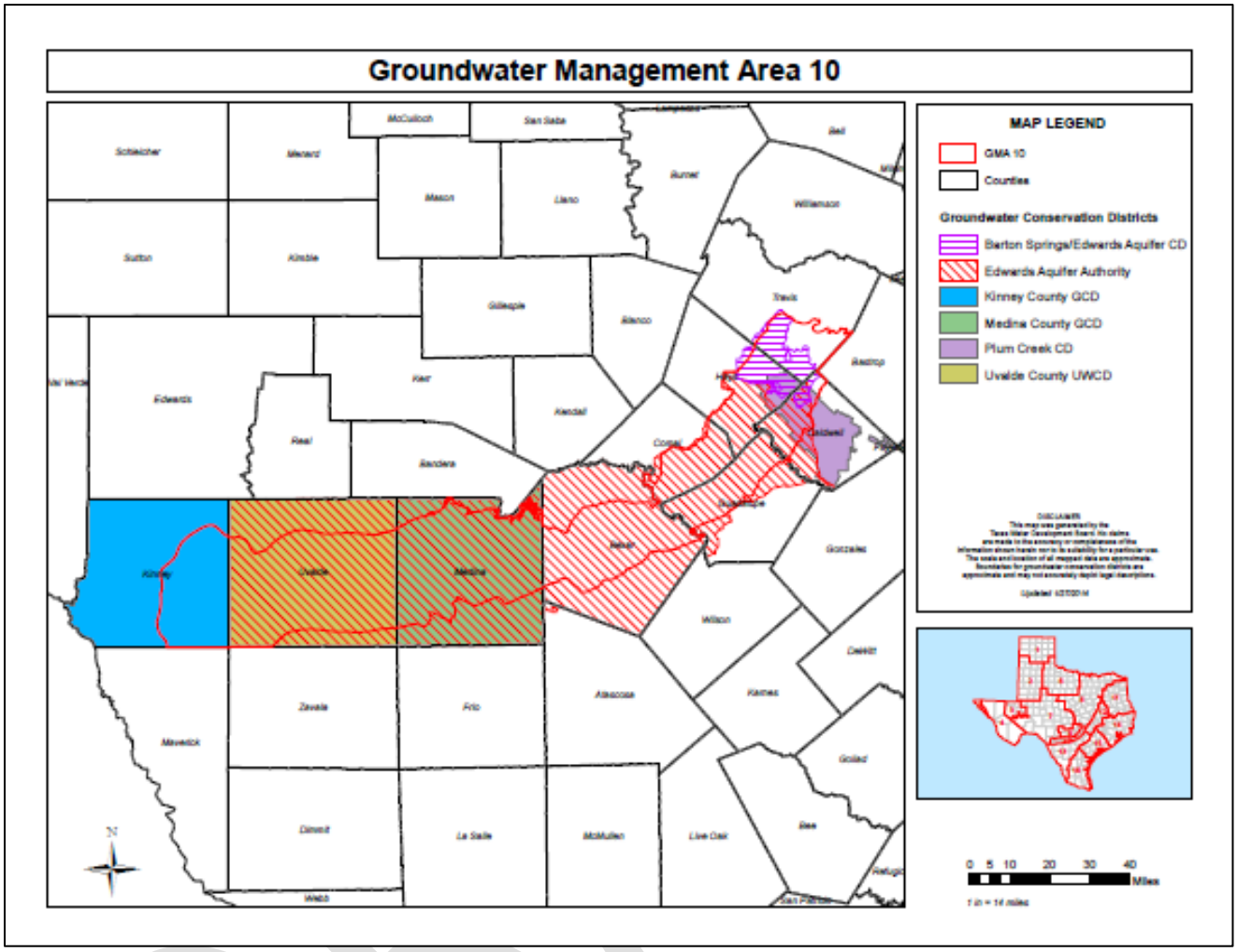

Figure 1. GCDs in GMA 10 (TWDB website)

4. Policy Justification

The DFC for the Leona Gravel Aquifer in Uvalde County was adopted after considering the following factors specified in Texas Water Code §36.108 (d):

1. Aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another;
   a. for each aquifer, subdivision of an aquifer, or geologic strata; and
   b. for each geographic area overlying an aquifer

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;

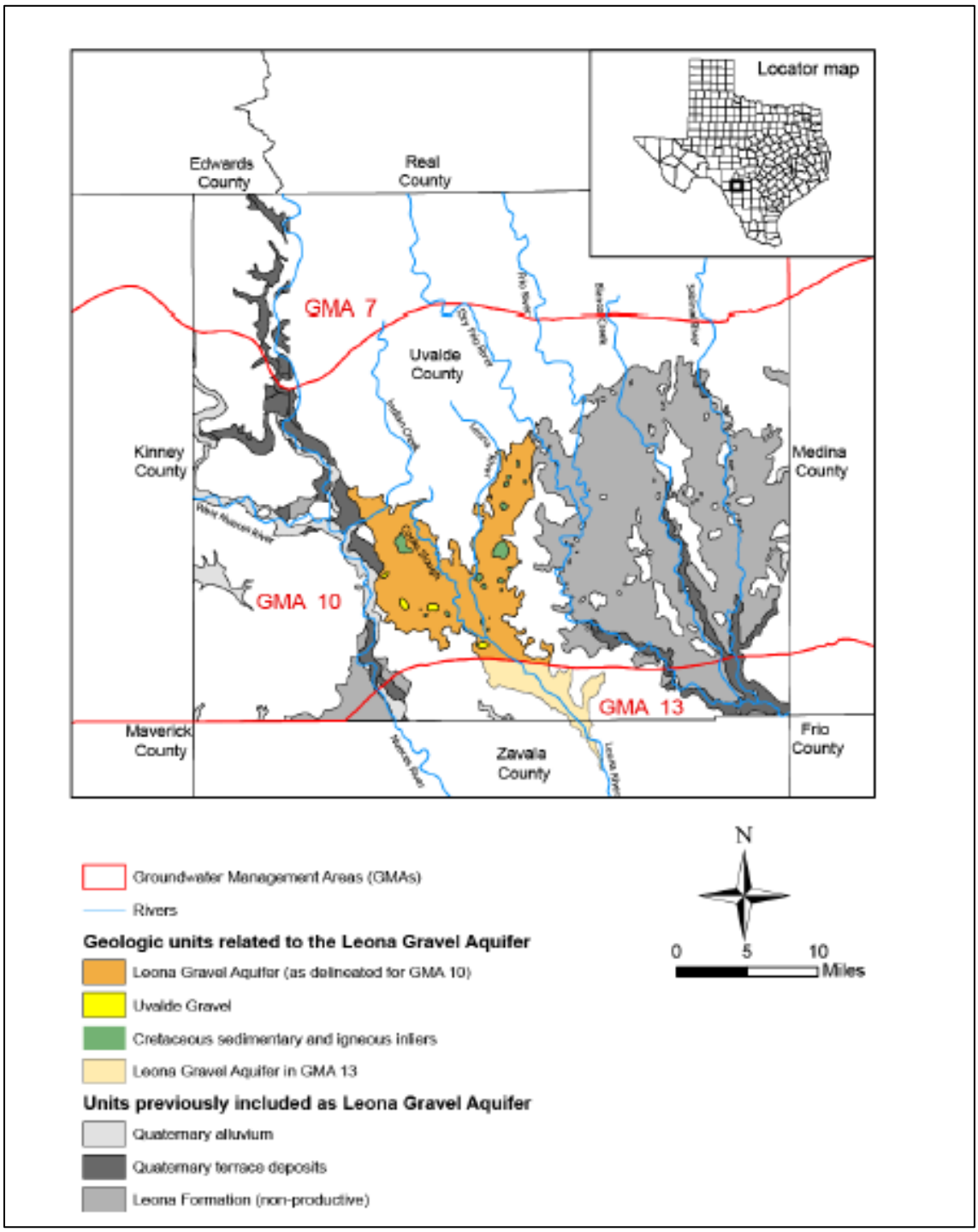

Figure 2. Map of Uvalde County showing the delineated Leona Grave Aquifer and the previously delineated extent of the aquifer, GMAs, and rivers (From Bradley, 2012)

Table 1. DFCs for the Leona Gravel Aquifer within Uvalde County in GMA 10

Aquifer	DFC Summary	Date DFC Adopted
Leona Gravel	No drawdown (including exempt and non-exempt use)	8/23/2010
Leona Gravel	No drawdown (including exempt and non-exempt use)	?/?/2015

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 DFC; and

9. Any other information relevant to the specific DFCs.

These factors are discussed in detail in appropriate sections in this Explanatory Report.

5. Technical Justification

Technical justification for selection of the DFC for the Leona Gravel Aquifer in Uvalde County was provided using a Groundwater Availability Model simulation and alternative analyses. The only Groundwater Availability Model simulation was an aquifer assessment to determine the effects of various levels of pumping in the Edwards (Balcones Fault Zone) Aquifer on discharge to the Leona Gravel Aquifer (Wade, 2008). Subsequent aquifer assessments were alternative analyses to estimate the Managed {modeled} Available Groundwater (MAG) (George, 2010; Wuerch and Backhouse, 2011; Bradley, 2012). The methodology used to estimate the Managed MAG in analyses by George (2010) and Wuerch and Backhouse (2011) was distinct from the methodology used by Bradley (2013).

Wade (2008) used the GWSWIM-IV (Klemt et al., 1979; Thorkildsen and McElhaney, 1992) version of the Groundwater Availability Model for the San Antonio Segment of the Edwards (Balcones Fault Zone) Aquifer to assess the effects of permitted pumping in the Edwards (Balcones Fault Zone) Aquifer on discharge from the Edwards (Balcones Fault Zone) Aquifer to the Leona Gravel Aquifer. Wade (2008) noted that Leona Springs was poorly understood and not well quantified; thus, model estimates of discharge to Leona Springs include uncertainty due to model estimation and uncertainty about the hydrogeology.

Wuerch and Backhouse (2011) used the approach by George (2010) to evaluate the Managed MAG associated with a DFC that specifies a regional average well drawdown in the Leona Gravel Aquifer of zero (0) ft. Wuerch and Backhouse (2011) defined effective recharge as the amount of water that enters an aquifer and is available for development (Muller and Price, 1979).

Because the DFC is zero, no water can be taken out of storage. Thus, the Managed MAG can be no greater than the effective recharge. Wuerch and Backhouse (2011) used the Atlas of Texas (US Geological Survey and Texas Water Development Board, 2006) to determine the boundary of the Leona Gravel Aquifer.

The Leona Gravel Aquifer is defined as having three hydrostratigraphic units, the Leona Formation (Qle), Quaternary alluvium (Qal), and terrace deposits (Qt) (Figure 2). Wuerch and Blackhouse (2011) calculated recharge by multiplying the outcrop area of each of the three units by the average precipitation (1971-2000) and an effective recharge rate of 5.5 percent. Wuerch and Blackhouse (2011) relied on an assessment by Lowry and Couch (2002) that included Qal and Qt with the Leona Gravel Aquifer when determining aquifer area. Using this methodology for the Leona Gravel Aquifer in Uvalde County, Wuerch and Blackhouse (2011) calculated the annual effective recharge at 30,772 acre-ft/yr, total pumping at 17,646 acre-ft/yr, and MAG at rates that vary from 17,485 to 17,552 acre-ft/yr.

Managed MAG in analyses performed by Bradley (2013) are the most current analyses available and are used as the basis for the Technical Justification. The following information is taken from the aquifer assessment for the Leona Gravel Aquifer within Uvalde County (Bradley, 2012). Limited data for both historic water levels and pumpage estimates hinder an estimate of the MAG. However, there are four wells within Uvalde County that have short to long-term measurements taken from the 1945s to 2001 (Figure 3). Based on historical water levels, the Leona Gravel Aquifer recharges in response to inflows from the Edwards (Balcones Fault Zone) Aquifer (Green et al., 2008) and behaves in a similar manner as the Edwards (Balcones Fault Zone) Aquifer. The hydrograph of Well 69-51-406 shows a highly variable water level trend that mimics changes in the Edwards (Balcones Fault Zone) Aquifer J-27 Index Well (Bradley, 2012), especially high and low water conditions. During the drought of the 1950s, extreme water-level declines showed up in the other historic well measurements (69-51-801, 69-51-701) that also mimic the J-27 water levels (Figure 3). Figure 4 shows annual minimum and maximum measurements for the same wells to highlight that the Leona Gravel Aquifer reflects water levels in the Edwards (Balcones Fault Zone) Aquifer.

Since exempt uses are not available for permitting, it is necessary to account for them when determining the MAG. To do this, the TWDB developed a standardized method for estimating exempt use for domestic and livestock purposes based on projected changes in population and the ratio of domestic and livestock wells in an area to the total number of wells. 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. If a district believes it has a more appropriate estimate of exempt pumping, they may submit it, along with a description of how it was developed, to the TWDB for consideration. Once established, the estimates of exempt pumping are subtracted from the total pumping calculation to yield the estimated MAG for permitting purposes. Exempt use of the Leona Gravel Aquifer in the Uvalde County UWCD has not yet been independently estimated by the TWDB. Estimates for total, domestic, and livestock use by aquifers other than the Trinity and Edwards Aquifers in Uvalde County are presented in Tables 2–4 (TWDB, 2015). There is negligible exempt use due to oil and gas exploration in Uvalde County.

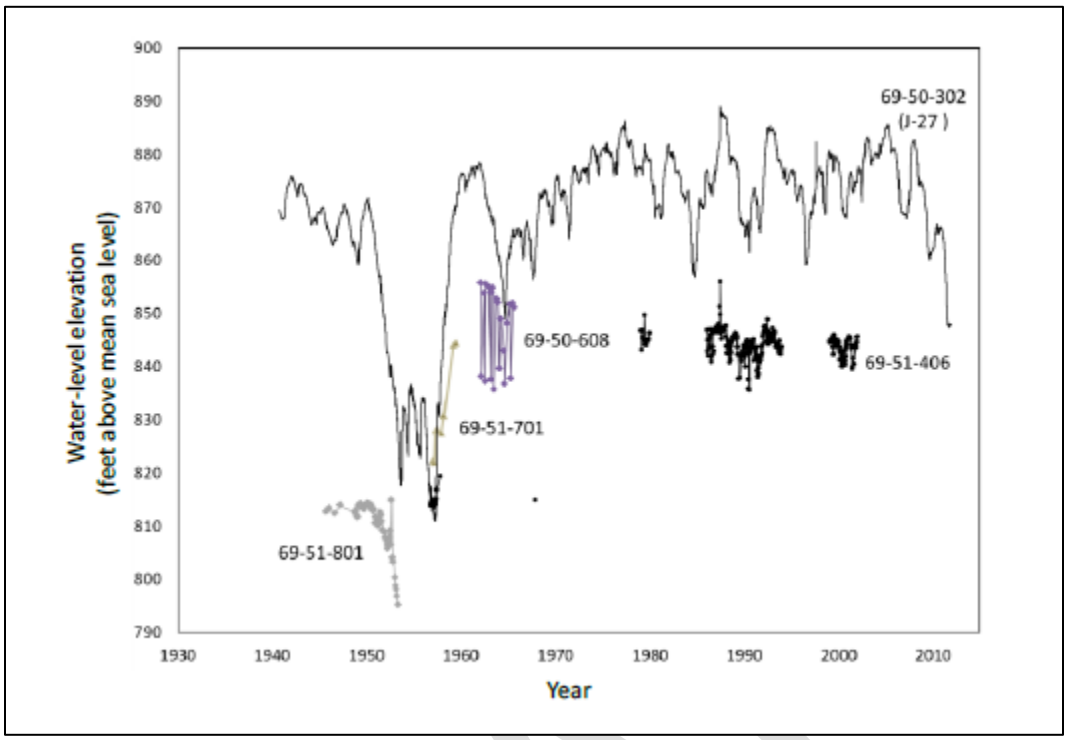

Figure 3. Hydrographs of the J-27 Edwards (Balcones Fault Zone) Aquifer index well and Leona Gravel Aquifer wells in Uvalde County (Bradley, 2012).

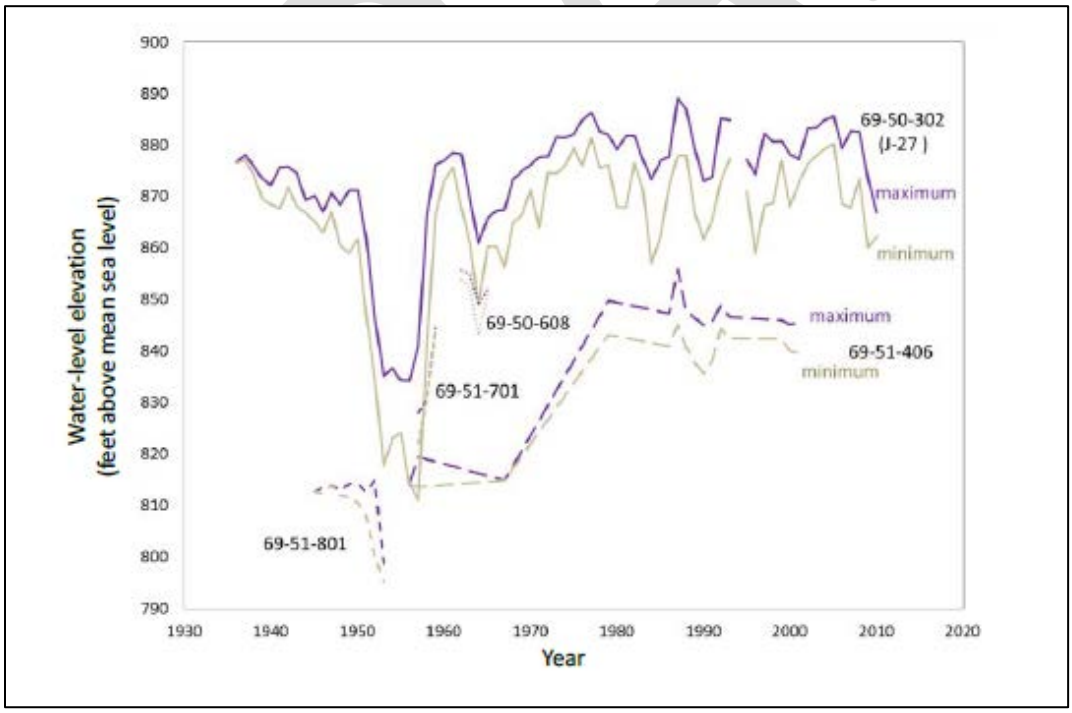

Figure 4. Hydrographs showing maximum and minimum annual water levels for the J-27 Edwards (Balcones Fault Zone) Aquifer index well and Leona Gravel Aquifer wells in Uvalde County (Bradley, 2012).

Table 2. Total estimated exempt use for the other aquifers in the Uvalde County UWCD for decades from 2015 to 2070. Results are in acre-ft /yr. Estimated exempt use calculated by TWDB and accepted by the district (TWDB, 2015).

Year	2015	2020	2030	2040	2050	2060	2070
Acre-ft	537	473	522	544	566	587	607

Table 3. Estimated domestic exempt use for the other aquifers in the Uvalde County UWCD for decades from 2015 to 2070. Results are in acre-ft /yr. Estimated exempt use calculated by TWDB and accepted by the district (Thorkildsen and Backhouse, 2011; TWDB, 2015).

Year	2015	2020	2030	2040	2050	2060	2070
Acre-ft	171	233	282	304	326	347	367

Table 4. Estimated livestock exempt use for the other aquifers in the Uvalde County UWCD for decades from 2015 to 2070. Results are in acre-ft /yr. Estimated exempt use calculated by TWDB and accepted by the district (TWDB, 2015).

Year	2015	2020	2030	2040	2050	2060	2070
Acre-ft	366	240	240	240	240	240	240

Without current water-level data to match with current groundwater pumpage estimates from the Uvalde County UWCD, it is difficult to ascertain the MAG. However, J-27 hydrograph does indicate a possible correlation between water-level conditions in the Edwards (Balcones Fault Zone) Aquifer and water levels within the Leona Gravel Aquifer.

Analyses by Bradley (2013) relied on historical pumping to establish the MAG in response to a DFC of zero drawdown. In response to requests by the Uvalde County UWCD, the TWDB first reduced the extent of the Leona Gravel Aquifer to only include the Leona Formation. Secondly, the TWDB restricted the extent of the Leona Formation to only the Leona River floodplain and the Cooks Slough area. Bradley (2013) calculated that 84 percent of this area is in GMA 10 and that 16 percent of the area is in GMA 13. Thus 57,474 acres of the total Leona Gravel Aquifer acreage of 68,458 acres are in GMA 10. Bradley (2013) noted that if this restricted area were used in the George (2010) calculation, the MAG would be about 6,600 acre-ft/yr.

Bradley (2013) assumed that the Edwards (Balcones Fault Zone) Aquifer index well in Uvalde County, J-27, is an acceptable surrogate monitoring well for the Leona Gravel Aquifer. Using 2008 as a year in which no water was taken from storage, Bradley (2013) observed that 11,173 acre-ft were pumped from the Leona Gravel Aquifer without lowering the water table measured by J-27. Eighty-four percent of this is assumed to have been pumped from the Leona Gravel Aquifer in GMA 10. Using this reasoning, Bradley (2013) calculated the MAG from the Leona Gravel Aquifer in Uvalde County to be constant at 9,385 acre-ft/yr.

6. Consideration of Designated Factors

In accordance with Texas Water Code § 36.108 (d-3), the district representatives shall produce a DFC Explanatory Report. The report must include documentation of how nine factors identified in Texas Water Code §36.108 (d) were considered prior to proposing a DFC and how the

proposed DFC impacts each factor. The following sections of the Explanatory Report summarize the information that the GCDs used in its deliberations and discussions.

6.1 Aquifer Uses or Conditions

GMA 10 incorporated information from the Uvalde County UWCD Groundwater Management Plan and analyses from the TWDB during development of the proposed DFCs.

6.1.1 Description of Factors in the Leona Gravel Aquifer in Uvalde County

Surface water in Uvalde County comes primarily from the Nueces River and its tributaries. Groundwater is found in both major and local aquifers in Uvalde County. Major aquifers include the Edwards (Balcones Fault Zone), Edwards-Trinity (Plateau), Carrizo-Wilcox and Trinity Aquifers. Minor or local aquifers include the Leona Gravel, Buda Limestone, Anacacho, Austin Chalk, and Glen Rose Formations. There is significant production from the Buda Limestone, Austin Chalk, and Leona Formation Aquifers in areas of Uvalde County west of the Knippa Gap. A report completed for the Uvalde County UWCD in 2009 concludes that the Edwards (Balcones Fault Zone) Aquifer is in hydraulic communication with these minor aquifers and that index well J-27, although completed in the Edwards (Balcones Fault Zone) Aquifer, can indicate declines in groundwater levels in the Buda Limestone, Austin Chalk, and Leona Formation Aquifers that adversely impact the water resource (Green et al., 2009). When the level in index well J-27 drops below 860 feet msl, recharge to the Leona Formation gravels and discharge to Soldiers Camp Springs to the Nueces River decline measurably.

Use of the minor aquifers in Uvalde County for the years 2007–2010, in terms of pumping, is summarized in Table 5. The significant increase in pumping between 2007 and 2008 is attributed to improved reporting of pumping, not to a marked increase in aquifer use. Aquifer use in Uvalde County divided between surface water and groundwater and among industry sector for the years 2000–2004 is summarized in Table 6 (Uvalde County UWCD Groundwater Management Plan).

Table 5. Use of the minor aquifers in Uvalde County for the years 2007–2010 (the Uvalde County UWCD Groundwater Management Plan) (acre-ft)

Aquifer	2007	2008	2009	2010
Alluvium	190	199	669	143
Austin Chalk	1,443	2,816	3,238	1,626
Buda Limestone	110	1,637	2,059	734
Glen Rose	26	50	26	48
Leona Gravel	287	11,173	7,780	7,176
Serpentine	0	0	1	0
Trinity/Glen Rose	79	61	53	435
Trinity	228	267	1,667	908
Total	**2,362**	**16,236**	**15,508**	**11,070**
Source: Uvalde County UWCD Annual Water Use Report database				

Table 6. Aquifer use in Uvalde County divided by surface water and groundwater and among industry sector (Uvalde County UWCD Groundwater Management Plan) (acre-ft)

Year	Source	Municipal	Manufacturing	Steam Electric	Irrigation	Mining	Livestock	Total
2000	GW	7,846	378	0	56,967	250	642	66,083
	SW	0	0	0	1,094	0	642	1,736
Total		7,846	378	0	58,061	250	1,284	67,819
2001	GW	5,472	1,110	0	83,276	250	592	90,700
	SW	67	13	0	1,700	0	592	2,372
Total		5,539	1,123	0	84,976	250	1,184	93,072
2002	GW	4,777	751	0	88,392	717	579	95,216
	SW	59	9	0	1,804	0	579	2,451
Total		4,836	760	0	90,196	717	1,158	97,667
2003	GW	5,207	152	0	67,820	239	557	73,975
	SW	64	2	0	425	0	557	1,048
Total		5,271	154	0	68,245	239	1,114	75,023
2004	GW	4,083	3	0	66,399	239	522	71,246
	SW	50	0	0	377	0	522	949
Total		**4,133**	**3**	**0**	**66,776**	**239**	**1,044**	**72,195**
GW = groundwater; SW = surface water								
Source: Texas Water Development Board Water Use Survey Database 1/5/2010								

6.1.2 DFC Considerations

The dominant use of the Leona Gravel Aquifer in Uvalde County by pumping is domestic use and irrigation, and the sustainability of that supply, especially for users who have no alternative supply physically or economically available and/or who are in vulnerable locations, must be protected to the extent feasible (Texas Water Code §36). The primary concern with sustainability of this groundwater supply is drought, notably extreme drought that stresses the aquifer. The DFC supports and is, in fact, the linchpin of a drought management program to promote long-term sustainability of water supplies.

6.2 Water-Supply Needs

6.2.1 Description of Factors in the Leona Gravel Aquifer in Uvalde County

Water use in Uvalde County is divided between surface water and groundwater and among industry sector (Uvalde County UWCD Groundwater Management Plan). Water use is not delineated by aquifer in Table 5.

6.2.2 DFC Considerations

The population growth of Uvalde County is projected by the Office of the State Demographer for State of Texas, Texas State Data Center Texas A&M University System to grow from 28,616 in 2010 to 35,650 in 2040, an increase of 24.6 percent (http://txsdc.tamu.edu/tpepp/2001_txpopprj_method.php). The DFC maximizes the amount of water that can be provided during non-drought

periods that is consistent with the implementation of a drought management program that protects the supply for existing uses during drought, especially extreme drought. The drought program response to the DFC indexes the amount of aquifer water available to meet the needs with the severity of drought.

6.3 Water-Management Strategies

6.3.1 Description of Factors in the Leona Gravel Aquifer in Uvalde County

The following is from the 2011 Region L Water Planning Group Plan and the 2012 State Water Plan, which relies on the Water Planning Group Plans. The projected water supply and demand estimates for Uvalde County in the 2012 State Water Plan indicate that projected demands exceed projected supplies (Table 7). To meet the needs of water-user groups in the Uvalde County UWCD, Region L recommended water management strategies to address the identified shortages. Water management strategies are projects or procedures that if implemented will produce additional water to meet the identified needs of water-user groups. The total amount of groundwater and surface water resulting from implementation of the water-management strategies recommended for Uvalde County in the 2007 State Water Plan is anticipated to provide 4,487 acre-feet in 2010, increasing to 6,939 acre-feet in 2060. Transfers from the Edwards (Balcones Fault Zone) Aquifer and municipal water conservation are the primary strategies identified (Table 8). The Leona Gravel Aquifer is not identified as part of the water mitigation strategy.

6.3.2 DFC Considerations

The DFC under consideration here is specific to the Leona Gravel Aquifer in Uvalde County. The Edwards Aquifer in Uvalde County has a different DFC and is the subject of a separate groundwater management zone, designed to promote protection of the downgradient springs in the Edwards Aquifer and the endangered species impacted by spring discharge. The DFC for the Leona Gravel Aquifer, as described above, underpin an aquifer-responsive drought management program that encourages both full-time water conservation and further temporary curtailments in pumping during drought periods that increase with drought severity.

6.4 Hydrological Conditions

6.4.1 Description of Factors in the Leona Gravel Aquifer in Uvalde County

6.4.1.1 Total Estimated Recoverable Storage

Texas statute requires that the total estimated recoverable storage of relevant aquifers be determined. Total estimated recoverable storage is a calculation provided by the TWDB. Texas Administrative Code Rule §356.10 (Texas Administrative Code, 2011) defines the total estimated recoverable storage as the estimated amount of groundwater within an aquifer that accounts for recovery scenarios that range between 25 percent and 75 percent of the porosity-adjusted aquifer volume. As described in GAM Task 14-033 (Jones et al., 2013), the total recoverable storage was estimated for the portion of the aquifer within GMA 10 that lies within the official lateral aquifer boundaries as delineated by George et al. (2011). Total

Table 7. Projected water supply and demand estimates for Uvalde County in the 2012 State Water Plan

Water User Group	Supply/Shortage		Comment
	2010 (ac-ft/yr)	2060 (ac-ft/yr)	
City of Sabinal	-127	-109	Projected shortage (2010 through 2060)
City of Uvalde	-3,172	-3,263	Projected shortage (2010 through 2060)
Rural Area Residential and Commercial	1,277	317	No projected shortage
Industrial	943	837	No projected shortage
Steam-Electric Power	0	0	No projected shortage
Mining	105	0	No projected shortage
Irrigation	14,680	24,768	No projected shortage
Livestock	0	0	No projected shortage

Table 8. Water-management strategies in Uvalde County in the 2012 State Water Plan (acre-ft/yr)

WUG	River Basin	Water-Management Strategy	Source Name	2010	2020	2030	2040	2050	2060
Sabinal	Nueces	Edwards Transfers	Edwards (Balcones Fault Zone) Aquifer	139	135	130	125	121	121
Sabinal	Nueces	Municipal Water Conservation	Conservation	34	65	92	116	139	145
Uvalde	Nueces	Edwards Transfers	Edwards (Balcones Fault Zone) Aquifer	3,793	3,830	3,850	3,854	3,856	3,884
County Other	Nueces	Municipal Water Conservation	Conservation	0	0	0	33	73	137
Uvalde	Nueces	Municipal Water Conservation	Conservation	521	1,017	1,471	1,882	2,269	2,652
TOTAL				**4,487**	**5,047**	**5,543**	**6,010**	**6,458**	**6,939**

estimated recoverable storage values may include a mixture of water quality types, including fresh, brackish, and saline groundwater, because the available data and the existing Groundwater Availability Models do not permit the differentiation between different water quality types. The total estimated recoverable storage values do not take into account the effects of land surface subsidence, degradation of water quality, or any changes to surface water-groundwater interaction that may occur due to pumping.

Per an email from Robert G. Bradley, TWDB, dated February 17, 2015 "We [TWDB] have not completed the [total estimated recoverable] report yet. We still have the Leona, Buda, and Austin Chalk report to do, as well as the GMA 10 saline Edwards (Balcones Fault Zone) Aquifer. Most of the Leona Gravel Aquifer is completed but we intend to write one report for Uvalde County. However, we have been struggling with the numbers for the Austin Chalk and Buda. Anyway some other projects had priority and we are now able to complete this report with some information." The TWDB Memorandum on Total Estimated Recoverable Storage in GMA 10 is attached in Appendix B. These data will be entered into Table 9 when available.

6.4.1.2 Average Annual Recharge

Using results from TWDB GAM Run 10-022 (Aschenbach, 2010), the estimated recharge from the Carrizo-Wilcox Aquifer in Uvalde County is 2,948 acre-ft/yr and the estimated recharge from the Edwards-Trinity Aquifer in Uvalde County is 28,213acre-ft/yr (Uvalde County UWCD Groundwater Management Plan). The Uvalde County UWCD Groundwater Management Plan does not include an estimate for average annual recharge from the Leona Gravel Aquifer.

6.4.1.3 Inflows

Analysis by Green et al. (2008) indicates that as much as 74,000 acre-ft/yr is recharged to the Leona Gravel Aquifer as inflow where the gravels abut with Austin Chalk, Buda Limestone, and possibly the Edwards (Balcones Fault Zone) Aquifer in the Leona River floodplain in the reach from Highway 90 in the north to Ft. Inge in the south. The quantity of recharge to the Leona Gravel Aquifer is highly variable and is greatly affected by aquifer stage as measured at J-27.

6.4.1.4 Discharge

The Uvalde County UWCD has no estimate of discharge from the Leona Gravel Aquifer. Discharge from the Leona Gravel Aquifer where it exits Uvalde County can be estimated by subtracting the pumpage from the Leona Gravel Aquifer from the inflow to the Leona Gravel Aquifer. The estimated inflow [74,000 acre-ft/yr] less the pumpage [7,176 acre-ft/yr reported in 2010 by permittees] is estimated to be 66,824 acre-ft/yr if exempt pumping is not taken under consideration. Discharge would be less than 66,824 acre-ft/yr if exempt pumping is included in the calculation.

Table 9. Total estimated recoverable storage for the Leona Gravel Aquifer within Uvalde County UWCD in GMA 10. Estimates are rounded within two significant numbers (Jones et al., 2013).

Total Storage (acre-ft)	25 percent of Total Storage (acre-ft)	75 percent of Total Storage (acre-ft)
Under development by the TWDB	Under development by the TWDB	Under development by the TWDB

6.4.1.5 Other Environmental Impacts Including Springflow and Groundwater/Surface Water Interaction

Named springs in Uvalde County include Soldiers Camp Spring on the Nueces River and Leona Springs on the Leona River. Leona Springs contributes to surface flow in the Leona River, but not to the Leona Gravel Aquifer (Green et al., 2008). The source for the Leona Springs appears to be the Uvalde Gravel and not the Leona Gravel Aquifer, thus discharge at the Leona Springs should not be impacted by the conditions of or impact to the Leona Gravel Aquifer.

An aquifer pump test conducted on the Leona Gravel Aquifer approximately 6 miles south of Highway 90 in the City of Uvalde indicated that the Leona Gravel Aquifer is not in hydraulic communication with the Leona River at that location (Green et al., 2008). The Leona Gravel Aquifer may be in hydraulic communication with the Leona River at other locations; however, this communication has not been established.

6.4.2 DFC Considerations

The DFC is proposed on the basis that the Leona Gravel Aquifer in Uvalde County is in direct hydrologic communication with the Edwards, Austin Chalk, and the Buda Limestone aquifers in the vicinity of the headwaters of the Leona Gravel Aquifer. This hydraulic communication is thought to occur along a reach of the paleo-stream channel that encompasses the Leona Gravel Aquifer starting from a point near Highway 90 in the City of Uvalde and continuing south to near Ft Inge. The four aquifers are well-integrated hydrologically along this reach and have a common potentiometric surface throughout this area. This hydrologic condition denotes that all four aquifers are jointly vulnerable to drought. The Leona Gravel Aquifer in Uvalde County is more vulnerable to drought than the Edwards Aquifer because it is above and has less saturated thickness than the Edwards Aquifer.

7. Subsidence Impacts

Subsidence has historically not been an issue with the Leona Gravel Aquifer in Uvalde County in GMA 10.

8. Socioeconomic Impacts Reasonably Expected to Occur

8.1 Description of Factors in the Leona Gravel Aquifer in Uvalde County

Administrative rules require that regional water planning groups evaluate the impacts of not meeting water needs as part of the regional water planning process, and rules direct TWDB staff to provide technical assistance [§357.7 (4)(A)]. Staff of the TWDB's Water Resources Planning Division designed and conducted a report in support of the South Central Texas Regional Water Planning Group (Region L). The report "Socioeconomic Impacts of Projected Water Shortages for the South Central Texas Regional Water Planning Area (Region L)" was prepared by the TWDB in support of the 2011 South Central Texas Regional Water Plan.

The report on socioeconomic impacts summarizes the results of the TWDB analysis and discusses the methodology used to generate the results for Region L. The report does not include the socioeconomic impact associated with only the Leona Gravel Aquifer. The socioeconomic impact report for Water Planning Group L is included in Appendix C.

8.2 DFC Considerations

Because none of the water management strategies involve changes in the current use of the Leona Gravel Aquifer in Uvalde County, as described in Section 6.3, the proposed DFC does not have a differential socioeconomic impact. They are supportive of the status quo in this regard, which is considered positive.

9. Private Property Impacts

9.1 Description of Factors in the Leona Gravel Aquifer in Uvalde County

The impact on the interests and rights in private property, including ownership and the rights of GMA landowners and their lessees and assigns in groundwater is recognized under Texas Water Code Section 36.002. The legislature recognizes that a landowner owns the groundwater below the surface of the landowner's land as real property. Nothing in this code shall be construed as granting the authority to deprive or divest a landowner, including a landowner's lessees, heirs, or assigns, of the groundwater ownership and rights described by this section.

Texas Water Code Section 36.002 does not: (1) prohibit a district from limiting or prohibiting the drilling of a well by a landowner for failure or inability to comply with minimum well spacing or tract size requirements adopted by the district; (2) affect the ability of a district to regulate groundwater production as authorized under Sections 36.113, 36.116, or 36.122 or otherwise under this chapter or a special law governing a district; or (3) require that a rule adopted by a district allocate to each landowner a proportionate share of available groundwater for production from the aquifer based on the number of acres owned by the landowner.

9.2 DFC Considerations

The DFC is designed to protect the sustained use of the aquifer as a water supply for all users in aggregate. The DFC does not prevent use of the groundwater by landowners either now or in the future, although ultimately total use of the groundwater in the aquifer is restricted by the aquifer condition, and that may affect the amount of water that any one landowner could use, either at particular times or all of the time.

10. Feasibility of Achieving the DFCs

The feasibility of achieving a DFC directly relates to the ability of the Uvalde County UWCD to manage the Leona Gravel Aquifer toward that goal. The Uvalde County UWCD is limited by the hydrogeology of the resource (e.g. how it responds to drought) and the authority of the Uvalde County UWCD to regulate pumping (e.g. uses exempt from permitting and by virtue of the fact that the Edwards (Balcones Fault Zone) Aquifer, the principal aquifer within its jurisdictional

boundaries, is regulated by the Edwards Aquifer Authority, not the Uvalde County UWCD). Because the Edwards (Balcones Fault Zone) Aquifer is the ultimate source of recharge to the Leona Gravel Aquifer, the feasibility of achieving the DFC of the Leona Gravel Aquifer is dependent on the management and hydraulic condition of the Edwards (Balcones Fault Zone) Aquifer.

11. Discussion of Other DFCs Considered

No other DFC of the Leona Gravel Aquifer in Uvalde County was considered.

12. Discussion of Other Recommendations

12.1 Advisory Committees

An Advisory Committee for GMA 10 has not been established.

12.2 Public Comments

Each GCD must hold a public meeting within 90 days after the GMA approves its DFCs. During this meeting, the GCD needs to document stakeholder input. This input is to be submitted by a report from the GCD to the GMA within 90 days after the GMA approves its DFC.

The GCDs have not yet approved their DFCs. The GCDs have not yet held public meetings to gather public comment on the DFCs. No public comments have yet been offered regarding the DFC for the Leona Gravel Aquifer in Uvalde County.

A draft of the Explanatory Report may be used as supporting documents to inform the public before such hearings and meetings are held.

13. Any Other Information Relevant to the Specific DFCs

No additional information relevant to the specific DFCs has been identified.

14. Provide a Balance Between the Highest Practicable Level of Groundwater Production and the Conservation, Preservation, Protection, Recharging, and Prevention of Waste of Groundwater and Control of Subsidence in the Management Area

TWDB has not developed guidance on how to approach this factor. It is up to the wishes of the GCDs on how they wish to approach it, whether in a qualitative, quantitative, or combination manner. But, the GCDs need to include stakeholder input so that this factor can be satisfactorily addressed. Participation by the project team at town hall meetings or with individual GCDs is not included in the scope of this work. GCD management plans will be used to complete this requirement.

Each GCD must hold a public meeting within 90 days after the GMA approves its DFCs. During this meeting, the GCD needs to document stakeholder input regarding whether the DFCs provide

a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater and control of subsidence in the management area. This input is to be submitted by a report from the GCD to the GMA within 90 days after the GMA approves its DFCs.

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