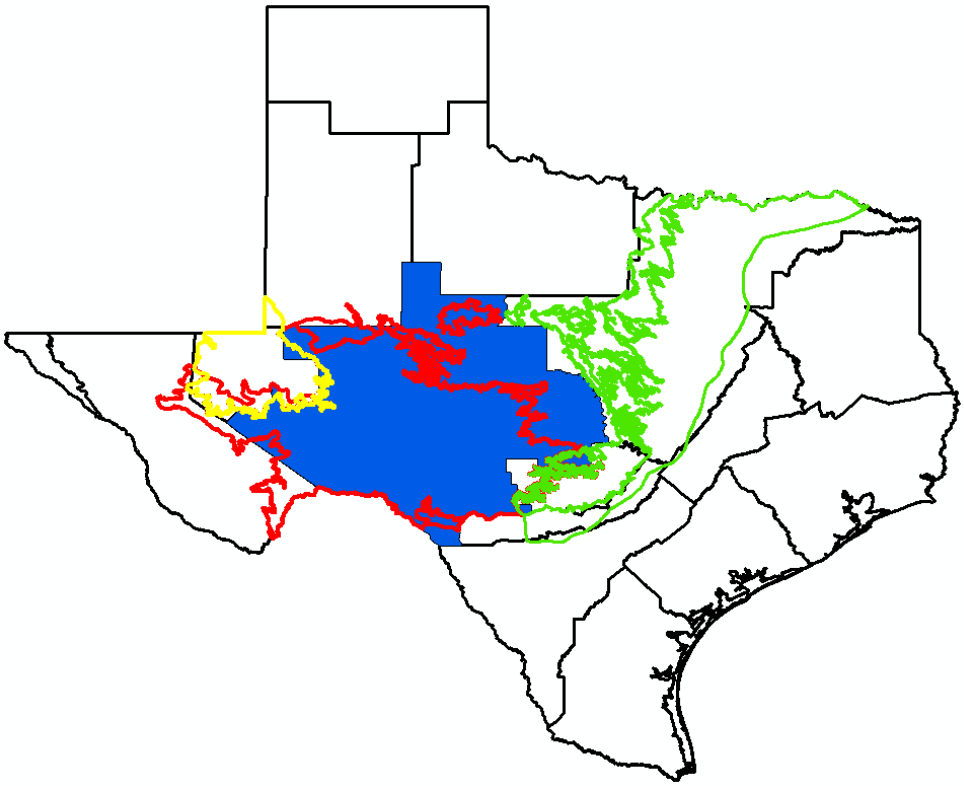
GMA 7 Technical Memorandum 18-01
Final

Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers: Update of Average Drawdown Calculations



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Groundwater Management Area 7

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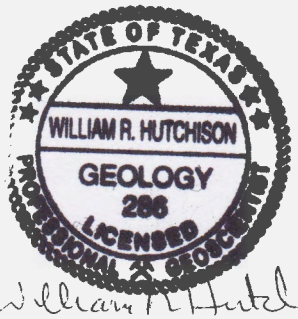

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1.0 Introduction

The desired future conditions for the Pecos Valley, Edwards-Trinity (Plateau), and Trinity Aquifers in GMA 7 were adopted on March 23, 2017. The basis for the desired future conditions was Scenario 2 as described in GMA 7 Technical Memorandum 15-06. During review of the materials for administrative completeness for the GMA 3 portion of the model area, the Texas Water Development Board could not reproduce the average drawdowns that were used as the desired future conditions with the model files that were submitted. After several meetings and emails, the differences seem to be centered on the use of different "grid files". The grid file contains data and information on the geographic location of each cell of the model, including:

- Geographic coordinates (x- and y-coordinates)
- County
- Groundwater Management Area
- Groundwater Conservation District (if applicable)
- River Basin
- Regional Planning Area
- Active or inactive cell in the model
- Inside or outside the official aquifer boundary (as defined by TWDB)

The groundwater model simulations that were completed in 2010 during the initial round of desired future conditions used a version of the grid file that was developed in 2009. Since then, a 2011 version, a 2014 version, and a 2015 version were developed.

Due to an oversight, the groundwater model simulation that was the basis for the adopted desired future conditions in 2017 used the outdated grid file from 2009 to calculate average drawdowns in each of the counties that comprise GMA 7 instead of the most recent grid file developed by TWDB in 2015. Although the model files for GMA 7 had not been submitted to TWDB, the fact that the same underlying model run and assumptions for GMA 3 and GMA 7 are the same, and the problems with the grid files needed to be addressed prior to submittal.

This Technical Memorandum documents the updated average drawdown for each county within GMA 7 using the updated 2015 grid file. It is important to emphasize that the model run has not been changed, only the basis for calculating average drawdown.

In Pecos County, work has been completed recently to compare actual data, and model output from individual cells to develop proposed alternative regulatory thresholds. That work is not affected by these updated average drawdowns contained in this report since the underlying model run has not been changed, and drawdown in individual cells has not changed.

2.0 Grid File and Drawdown Comparison

2.1 Grid File Comparison

The average drawdown is calculated as the sum of all drawdowns within an area divided by the number of cells in the area. In this case, the area is defined by active model cells within a county. The calculation that was completed in 2010 and which was done in Technical Memorandum 15-06 was based on the 2009 grid file. The updated averages are based on the 2015 grid file. Table 1 summarizes the cell counts for each county in GMA 7 for the 2009 grid file and the 2015 grid file.

Table 1. Number of Active Cells Used in Average Drawdown Calculation

County	2009 Grid	2015 Grid
Coke	275	205
Concho	339	320
Crockett	2,801	2,791
Ector	771	469
Edwards	2,119	2,124
Gillespie	944	933
Glasscock	827	797
Irion	887	886
Kimble	1,228	1,222
Mason	137	257
Menard	892	884
Midland	890	889
Pecos	3,314	2,997
Reagan	1,176	1,176
Real	700	700
Schelicher	1,318	1,310
Sterling	615	615
Sutton	1,449	1,458
Taylor	174	102
Terrell	2,354	2,355
Tom Green	593	479
Upton	1,146	844
Uvalde	396	395

2.2 Average Drawdown Comparison

Table 2 summarizes the average drawdown reported in the GMA 7 resolution that adopted the desired future conditions and the average drawdown reported in GMA 7 Technical Memorandum 15-06. These average drawdown calculations were based on the 2009 grid file. Table 2 also shows the average drawdown calculated using the 2015 grid file. Please note that the two columns of average drawdown from 2010 to 2070 are presented: one based on the "ib" entry of the grid file (the active model cells within the county), and one based on the "aq" entry of the grid file (the active model cells within the county that are within the official boundary of the aquifer as defined by TWDB). In this case, the ib-based and aq-based drawdowns are the same.

Table 2. Summary of Average Drawdown (2010 to 2070) from 2009 and 2015 Grid Files

County	Average Drawdown in Resolution (ft) (Based on 2009 Grid File)	Average Drawdown in GMA 7 Technical Memorandum 15-06 (ft)	Average Drawdown in Using "IB" Cells in 2015 Grid File (ft)	Average Drawdown in Using "AQ" Cells in 2015 Grid File (ft)
Coke	0	0	0	0
Crockett	10	10	10	10
Ector	8	2	4	4
Edwards	2	2	2	2
Gillespie	5	5	5	5
Glasscock	40	40	42	42
Irion	10	10	10	10
Kimble	1	1	1	1
Menard	1	1	1	1
Midland	12	12	12	12
Pecos	12	12	14	14
Reagan	42	42	42	42
Real	4	4	4	4
Schelicher	8	8	8	8
Sterling	7	7	7	7
Sutton	6	6	6	6
Taylor	2	0	0	0
Terrell	2	2	2	2
Upton	16	15	20	20
Uvalde	2	2	2	2

Please note that there are differences in the resolution value and the value that was reported in GMA 7 Technical Memorandum 15-06 in Ector, Taylor, and Upton counties. It is assumed that TWDB would take the values in the resolution rather than the values from the Technical Memorandum as the desired future condition.

Also, there are differences between the average drawdown values between the 2009 grid file and the 2015 grid file in Ector, Glasscock, Pecos, and Upton counties. Because of these differences, TWDB would report modeled available groundwater values that based on the drawdowns listed in the resolution which would be different than the reported pumping values in GMA 7 Technical Memorandum 15-06. Details of these pumping differences are discussed in Section 3 of this report.

2.3 Maximum Drawdown Comparison

One way to test the assertion that the differences in average drawdown are not important for the application to cell by cell analyses of the model output from Scenario 2 is to compare the maximum drawdown in each county that is calculated from each of the grid files (i.e. 2009 and 2015). Table 3 presents the maximum drawdown for each county based on the two grid files.

Table 3. Maximum Drawdown from 2010 to 2070 (ft) in Each County

County	2009 Grid	2015 Grid
Coke	0.23	0.23
Crockett	22.48	22.48
Ector	64.75	64.75
Edwards	4.42	4.42
Gillespie	11.81	11.81
Glasscock	98.65	98.65
Irion	26.38	26.38
Kimble	5.41	5.41
Menard	4.75	4.75
Midland	75.38	75.38
Pecos	69.86	69.86
Reagan	97.67	97.67
Real	9.04	9.04
Schelicher	14.10	14.10
Sterling	33.54	33.54
Sutton	10.91	10.91
Taylor	0.38	0.38
Terrell	8.40	8.40
Upton	77.79	77.82
Uvalde	5.16	5.16

Please note that the maximum drawdown in each county is the same for each grid file. This suggests, along with the general similarities of average drawdowns in each county, that the differences in the grid files are in areas where the drawdown is in areas with relatively small drawdowns.

3.0 Modeled Available Groundwater Comparison

Modeled Available Groundwater is defined as the pumping that will achieve the desired future condition. Pumping is one of the inputs to the model. The pumping that was assumed for Scenario 2 is documented in GMA 7 Technical Memorandum 15-06. The output from Scenario 2 includes the drawdown in each cell of the model. As described above, the average drawdown was that is calculated using the 2009 grid file (the basis for the calculations in Technical Memorandum 15-06) is different than those calculated when the 2015 grid file is used. Consequently, the pumping that would achieve the average drawdowns associated with the 2015 grid files would be different than the pumping originally assumed in GMA 7 Technical Memorandum 15-06.

Table 4 summarizes the pumping reported in the GMA 7 Technical Memorandum 15-06 for Scenario 2 that would achieve the average drawdown based on the 2009 grid file. Table 4 also presents the pumping that would achieve the average drawdown based on the 2015 grid file. The pumping based on the 2015 grid file would be used by TWDB in calculating modeled available groundwater.

Table 4. Comparison of Pumping to Achieve Average Drawdowns (2009 Grid File and 2015 Grid File)

County	GMA 7 Technical Memorandum Pumping (AF/yr) Based on 2009 Grid	Pumping to Achieve GMA 7 Resolution Drawdowns (AF/yr) Based on 2015 Grid
Coke	1,000	997
Crockett	5,475	5,447
Ector	5,534	9,698
Edwards	5,659	5,676
Gillespie	5,000	4,979
Glasscock	65,177	61,926
Irion	3,300	3,289
Kimble	1,400	1,387
Menard	2,580	2,597
Midland	23,243	23,232
Pecos (GMA 7)	117,309	102,061
Reagan	68,243	68,233
Real	7,533	7,524
Schelicher	8,060	8,034
Sterling	2,500	2,495
Sutton	6,450	6,411
Taylor	490	3,462
Terrell	1,443	1,420
Upton	22,375	12,303
Uvalde	2,000	1,998

Please note that most counties have small differences that are the result of rounding. However, the pumping in Ector, Glasscock, the GMA 7 portion of Pecos, Taylor, and Upton counties are different in the two columns. As described in Section 2 and shown in Table 2 above, the differences are attributable to a combination of errors in the resolution DFCs as compared with the Technical Memorandum DFCs and the differences between the 2009 grid file and the 2015 grid file.

TWDB would report the right-hand column of Table 4 as the modeled available groundwater absent any additional action by GMA 7 (i.e. the pumping to achieve the drawdowns listed in the resolution from March 23, 2017. This would result in a MAG increase of over 4,000 AF/yr in Ector County and about 3,000 AF/yr in Taylor County over what was expected from the Technical Memorandum. It would also result in a MAG decrease of over 3,000 AF/yr in Glasscock County, about 15,000 AF/yr decrease in the GMA 7 portion of Pecos County, and a decrease of about 10,000 AF/yr in Upton County from what was expected for the Technical Memorandum.

5.0 Recalculated Average Drawdown and "Proposed" MAGs

It is recommended that GMA 7 readopt the desired future conditions based on Scenario 2 that uses the 2015 grid file as the basis for the average drawdown calculation. The values presented in Table 5 are the correct drawdown values that are based on the 2015 grid file that TWDB uses for the MAG calculation using the model run that was the underlying basis for the desired future conditions that were adopted on March 23, 2017.

Table 5. Recommended Corrected Desired Future Conditions: Average Drawdowns from 2010 to 2070 Calculated with 2015 Grid File

County	Recommended Corrected Average Drawdowns from 2010 to 2070 (ft)
Coke	0
Crockett	10
Ector	4
Edwards	2
Gillespie	5
Glasscock	42
Irion	10
Kimble	1
Menard	1
Midland	12
Pecos	14
Reagan	42
Real	4
Schelicher	8
Sterling	7
Sutton	6
Taylor	0
Terrell	2
Upton	20
Uvalde	2

Table 6 summarizes the pumping that will achieve the drawdowns in Table 5 organized by county and decade. Please note that these values were obtained from the cell-by-cell output file from Scenario 11.

Table 6. Pumping to Achieve the Drawdown (Proposed MAGs)

County	Pumping (AF/yr) by Decade						
	2010	2020	2030	2040	2050	2060	2070
Coke	997	997	997	997	997	997	997
Crockett	5,447	5,447	5,447	5,447	5,447	5,447	5,447
Ector	5,542	5,542	5,542	5,542	5,542	5,542	5,542
Edwards	5,676	5,676	5,676	5,676	5,676	5,676	5,676
Gillespie	4,979	4,979	4,979	4,979	4,979	4,979	4,979
Glasscock	65,186	65,186	65,186	65,186	65,186	65,186	65,186
Irion	3,289	3,289	3,289	3,289	3,289	3,289	3,289
Kimble	1,387	1,387	1,387	1,387	1,387	1,387	1,387
Menard	2,597	2,597	2,597	2,597	2,597	2,597	2,597
Midland	23,232	23,232	23,232	23,232	23,232	23,232	23,232
Pecos (GMA 7)	117,309	117,309	117,309	117,309	117,309	117,309	117,309
Reagan	68,233	68,233	68,233	68,233	68,233	68,233	68,233
Real	7,524	7,524	7,524	7,524	7,524	7,524	7,524
Schelicher	8,034	8,034	8,034	8,034	8,034	8,034	8,034
Sterling	2,495	2,495	2,495	2,495	2,495	2,495	2,495
Sutton	6,411	6,411	6,411	6,411	6,411	6,411	6,411
Taylor	489	489	489	489	489	489	489
Terrell	1,420	1,420	1,420	1,420	1,420	1,420	1,420
Upton	22,369	22,369	22,369	22,369	22,369	22,369	22,369
Uvalde	1,998	1,998	1,998	1,998	1,998	1,998	1,998