Texas Water Development Board Clarifications and Assumptions Request

Clarifications and assumptions for the Carrizo-Wilcox, Queen City, and Sparta aquifers:

1. **Our calculated drawdowns for the Simsboro and Hooper aquifers in Lost Pines Groundwater Conservation District exceed the variances specified for the desired future condition (see Table 1 below).**
   We calculated average water level drawdowns from 2000 through 2069 based on the well file submitted with the desired future condition package (PS10.wel). The drawdowns listed in Table 4-1 of the explanatory report for the Simsboro and Hooper aquifers in Lost Pines Groundwater Conservation District exceed the variances specified for the desired future condition. Our drawdown calculations agree within one foot of the average drawdown values presented in Table 4-1 of the explanatory report for the other groundwater conservation districts and counties (with the exception of Fayette County Groundwater Conservation District, discussed in item 2 below). Please either resubmit model files that produce drawdowns that are within the specified variances or increase the specified variances for the Simsboro and Hooper aquifers in Lost Pines Groundwater Conservation District. Otherwise, we will adjust pumping to match the desired future conditions.

Table 1

TWDB Calculated Drawdowns (feet)						
Row Labels	**Sparta**	**QC**	**Carrizo**	**Calvert**	**Simsboro**	**Hooper**
Brazos Valley GCD	13	13	61	126	296	209
Fayette County GCD	56	70	122	164	276	282
Lost Pines GCD	4	16	68	110	257	185
Mid-East Texas GCD	0	-3	81	90	138	126
ND Falls	np	np	np	np	-2	27
ND Limestone	np	np	np	11	51	53
ND Navarro	np	np	np	-1	3	3
ND Williamson	np	np	np	-11	47	69
Post Oak Savannah GCD	29	30	67	150	325	208
Grand Total	**16**	**16**	**75**	**115**	**231**	**171**

GMA 12 Response: *As indicated in the Explanatory Report, a new pumping scenario, called PS-12, has been developed which brings the Lost Pines GCD calculated water level drawdowns within the variances specified in the desired future conditions resolution.*

2. **Our calculated drawdowns for the Sparta and Carrizo aquifers in Fayette County Groundwater Conservation District exceed the variances specified for the desired future condition.**
   We calculated average water level drawdowns based only on aquifer areas within Groundwater Management Area 12. However, when we calculate average drawdowns for the model extent for all of Fayette County Groundwater Conservation District, including the area in Groundwater Management Area 15, our values are within one foot of the desired future conditions for Fayette County Groundwater Conservation District and within one foot of the values in Table 4-1 of the Explanatory Report. Please either resubmit model files that produce drawdowns within Groundwater Management Area 12 that are within the specified variances or increase the specified variances for the Sparta and Carrizo aquifers in Fayette County Groundwater Conservation District. Otherwise, we will adjust pumping to match the desired future conditions.

   GMA 12 Response: *Based on discussions with the Texas Water Development Board, the DFC Resolution for GMA 12 has been amended to indicate that all of Fayette County is to be used for the calculation of water level drawdowns for the DFCs, not just the portion of these aquifers within GMA 12. The reason for this is that these aquifers have been declared non-relevant by GMA 15 under the assumption that all management of these aquifers by the Fayette County GCD will be done through GMA 12.*

3. **Adjustments will be based on matching groundwater conservation district or county desired future conditions (per aquifer) rather than the GMA 12 overall desired future conditions (per aquifer).**
   If pumping adjustments are required to match the desired future conditions we will focus on matching groundwater conservation district or county-based desired future conditions rather than GMA 12 overall desired future conditions per county. Also, note that if we need to adjust pumping to match one groundwater conservation district's desired future conditions then drawdowns in adjacent groundwater conservation districts may move out of tolerance which would require pumping to be adjusted in multiple counties.

   GMA 12 Response: *GMA 12 agrees that any pumping adjustments required should be done to match GCD or county-based desired future conditions rather than overall GMA 12 conditions.*

4. **Use the model extent rather than official aquifer extent within Groundwater Management Area 12 to calculate the desired future condition and modeled available groundwater for all model layers.**
   This assumption was not mentioned in the explanatory report. When we make this assumption our results agree within one foot of the results presented in Table 4-1 of

the explanatory report, with the exception of Lost Pines Groundwater Conservation District and Fayette County Groundwater Conservation District as discussed in items 1 and 2 above. Please indicate whether or not this is an acceptable assumption.

GMA 12 Response: *GMA 12 agrees that the model extent should be used instead of the official aquifer extent when calculating water level drawdowns.*

5. **Dry cells are excluded from the calculation of average drawdowns for the desired future conditions and are excluded when calculating the modeled available groundwater.**
   This assumption was not mentioned in the explanatory report. When we make this assumption our results agree within one foot of the results presented in Table 4-1 of the explanatory report, with the exception of Lost Pines Groundwater Conservation District and Fayette County Groundwater Conservation District as discussed in items 1 and 2 above. Please indicate whether or not this is an acceptable assumption.

   GMA 12 Response: *GMA 12 agrees that dry cells should be excluded from the calculation of average water level drawdowns for desired future conditions and excluded when calculating the modeled available groundwater.*

6. **Use Stress Period 95 from the groundwater availability model to calculate water level drawdowns and extract modeled available groundwater.**
   The desired future condition states that the drawdowns are based on January 2000 through December 2069. The stress period corresponding to December 2069 in the model run is stress period 95, which is the next to last stress period in the run rather than the final stress period. This will be the last stress period for which modeled available groundwater values will be extracted rather than the final stress period.

   GMA 12 Response: *GMA 12 agrees that stress period 95 should be used to calculate water level drawdowns and extract modeled available groundwater.*

Clarifications and assumptions for the Yegua-Jackson Aquifer:

7. **Our calculated drawdowns for the Yegua-Jackson Aquifer in Post Oak Savannah Groundwater Conservation District exceed the variances specified for the desired future condition (see Table 2 below).**
   We have calculated average water level drawdowns from 2010 through 2069 based on the well file submitted with the desired future condition package (ygjk_GMA12_PS1.wel). We calculated an average drawdown of 89 feet in Post Oak Savannah Groundwater Conservation District compared with a desired future condition of 100 feet, which is a difference of 11 percent. Please either resubmit model files that produce drawdowns are that within the specified variances or increase the specified variances for the Yegua-Jackson Aquifer in Post Oak Savannah Groundwater Conservation District. Otherwise, we will adjust pumping to match the desired future conditions within the specified variances.

Table 2

TWDB Calculated Drawdowns (feet)			
GCD	Yegua	Jackson	Yegua-Jackson
Brazos Valley GCD	63	110	
Fayette County GCD			71
Mid-East Texas GCD			7
Post Oak Savannah GCD			89
GMA 12			62

GMA 12 Response: *GMA 12 used the end of stress period 39 (year 2009) and stress period 99 (year 2069) to calculate the drawdowns for POSGCD. This information was emailed to Dr. Shirley Wade at TWDB on August 1, 2017. Dr. Shirley Wade confirmed on August 4, 2017 that GMA 12 could use stress period 39 for the calculation, and therefore no change in the DFC statement is required.*

8. **Adjustments will be based on matching groundwater conservation district or county desired future conditions (per aquifer) rather than the GMA 12 overall desired future conditions (per aquifer).**
   If pumping adjustments are required to match the desired future conditions we will focus on matching groundwater conservation district or county-based desired future conditions rather than GMA 12 overall desired future conditions per county. Also, note that if we need to adjust pumping to match one groundwater conservation district's desired future conditions then drawdowns in adjacent groundwater conservation districts may move out of tolerance which would require pumping to be adjusted in multiple counties.

GMA 12 Response: *GMA 12 agrees that any pumping adjustments required should be done to match GCD or county desired future conditions rather than overall GMA 12 conditions.*

9. **We excluded pass through layers in the average drawdown calculation.**
   Model layers two, three, and four have pass through layers. The drawdown in the pass through layer cells (ibound value = 6) were not included in the average for the Yegua-Jackson Aquifer. Please indicate whether or not this is an acceptable assumption.

   GMA 12 Response: *GMA 12 agrees that pass through layers should not be included in the calculation of water level drawdowns for the Yegua-Jackson Aquifer.*

10. **Use the model extent rather than official aquifer extent within Groundwater Management Area 12 to calculate the desired future condition and modeled available groundwater for all model layers.**
    This assumption was not mentioned in the explanatory report. When we make this assumption our results agree within the tolerance for all groundwater conservation districts except Post Oak Savannah discussed in item one above. Please indicate whether or not this is an acceptable assumption.

    GMA 12 Response: *GMA 12 agrees that the model extent should be used instead of the official aquifer extent when calculating water level drawdowns.*

11. **Dry cells are excluded from the calculation of average drawdowns for the desired future conditions and are excluded when calculating the modeled available groundwater.**
    This assumption was not mentioned in the explanatory report. When we make this assumption our results agree within the tolerance for all groundwater conservation districts except Post Oak Savannah discussed in item one above. Please indicate whether or not this is an acceptable assumption.

    GMA 12 Response: *GMA 12 agrees that dry cells should be excluded from the calculation of average water level drawdowns for desired future conditions and excluded when calculating the modeled available groundwater.*

12. **Use Stress Period 99 from the groundwater availability model to calculate water level drawdowns and extract modeled available groundwater.**
    The desired future condition states that the drawdowns are based on January 2010 through December 2069. The stress period corresponding to December 2069 in the model run is stress period 99, which is the next to last stress period in the run rather than the final stress period. This will be the last stress period for which modeled available groundwater values will be extracted rather than the final stress period.

    GMA 12 Response: *GMA 12 agrees that the stress period 99 will be the last period for which modeled available groundwater values will be extracted.*

Methods and assumptions for the Brazos River Alluvium Aquifer:

1. **We have estimated preliminary modeled available groundwater values based on the Brazos River Alluvium Groundwater Availability Model (Table 1).**
   We calculated percent saturation and water level declines using the groundwater availability model for the Brazos River Alluvium. Pumping amounts in Burleson, Brazos, Milam, and Robertson counties were adjusted to match the desired future conditions for Brazos Valley and Post Oak Savannah Groundwater Conservation Districts. The desired future conditions were achieved within one foot or one percentage point with the exception that it was not possible to decrease percent saturation in the Brazos Valley Groundwater Conservation District south of Highway 21 below 45 percent, because the model would not converge with additional pumping. The estimated pumping to achieve the desired future conditions is listed in Table 1. Please note, using this method, the preliminary estimated modeled available groundwater for Milam County is almost twice the estimated total storage (Table 1).

Table 1 Preliminary Groundwater Availability Model Results

Area	Desired Future Condition	Model Results	Estimated total storage (acre-feet)	Model Estimated MAG (acre-feet per year)
Brazos Valley GCD North of Highway 21	> 30% saturation	30% saturation	270,000 (Robertson County)	71,750
Brazos Valley GCD South of Highway 21	> 40% saturation	45% saturation	290,000 (Brazos County)	65,602
Burleson County	6 feet decline	5.8 feet decline	450,000	28,413
Milam County	5 feet decline	4.6 feet decline	28,000	55,556

GMA 12 Response: *GMA 12 does not disagree that the model can perform in the manner described. GMA 12 agrees with the modeled available groundwater estimates provided in Table 1.*

2. **We used average recharge and streamflow for the predictive portion of the groundwater availability model of the Brazos River Alluvium Aquifer.**
   The historical groundwater availability model for the Brazos River Alluvium was extended from 2012 to 2070 by adding 58 annual stress periods to the model. The recharge package and streamflow routing package were extended to 2070 by using average recharge and average streamflow. The average recharge and streamflow were based on the historical model for the period from 2000 to 2012. These years were selected for averaging because the character of the modeled aquifer water budget seems to change in the year 2000.

GMA 12 Response: *GMA 12 agrees with the approach of using recharge and streamflow based on the historical model for the period from 2000 to 2012.*

3. **We used the average annual pumping for the last year of the historical model to create the initial pumping distribution for the predictive model.**
   We calculated annual average pumping using the last 12 months of the historical model. The pumping was then uniformly scaled to best match the desired future conditions for Brazos Valley and Post Oak Savannah Groundwater Conservation Districts. Deep flow due to pumping from underlying units was based on the modeled available groundwater runs for the underlying aquifers (central part of the Queen City and Sparta aquifers, Yegua-Jackson Aquifer, and northern part of the Gulf Coast Aquifer System). The deep flow portion of the pumping was not adjusted to match the desired future conditions of the Brazos River Alluvium and was based only on the model runs for the underlying aquifers.

   GMA 12 Response: *GMA 12 agrees with using the calculated annual average pumping for the last 12 months of the historical model to develop the initial pumping distribution for the predictive model.*

4. **Dry cells do not occur in the groundwater availability for the groundwater availability model for the Brazos River Alluvium Aquifer.**
   Pumping is reduced by the model code in some model cells to prevent cells from going dry. All reported pumping amounts are from the budget output files rather than the well file input package and reflect what was actually pumping in the model.

   GMA 12 Response: *GMA 12 agrees with the reduction in pumping by the model code to prevent the cells from going dry.*

5. **We will use a tolerance of up to one foot or 5 percent (whichever is greater) when comparing desired future conditions to average drawdown calculations or percent saturation values from the model files for the Brazos River Alluvium Aquifer.**

   GMA 12 Response: *GMA 12 agrees with using a tolerance of up to one foot or 5 percent (whichever is greater) when comparing desired future conditions to average water level drawdown calculations or percent saturation values from the model files.*