Groundwater Management Area 12
Joint Planning Meeting

Presentation by Consultants

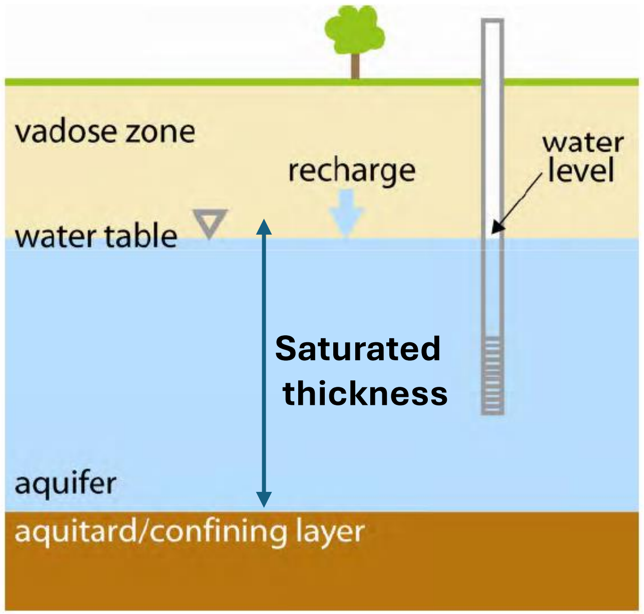
September 20, 2024

Agenda

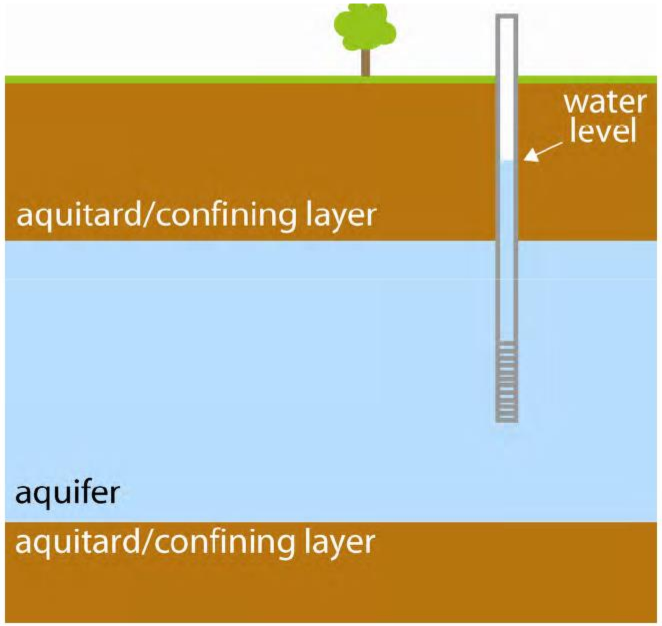
- Terminology & Concepts
- Desired Future Conditions
  - Previous Approach
  - Alternative Approaches
- Variance Discussion
  - Previous Approach
  - Alternative Approaches
- Review of LPGCD's DFC Code

Unconfined and Confined Aquifers

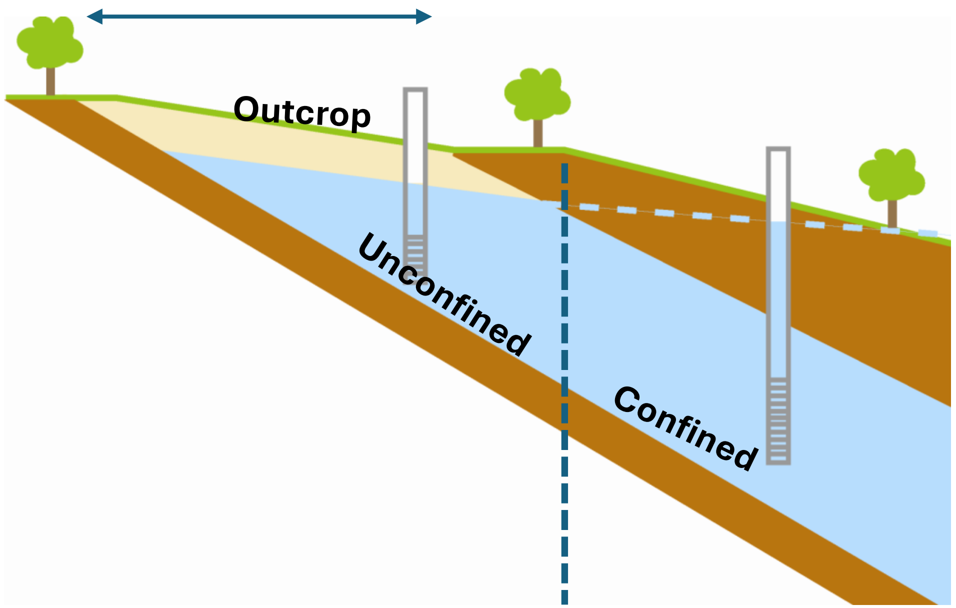
Unconfined Aquifer



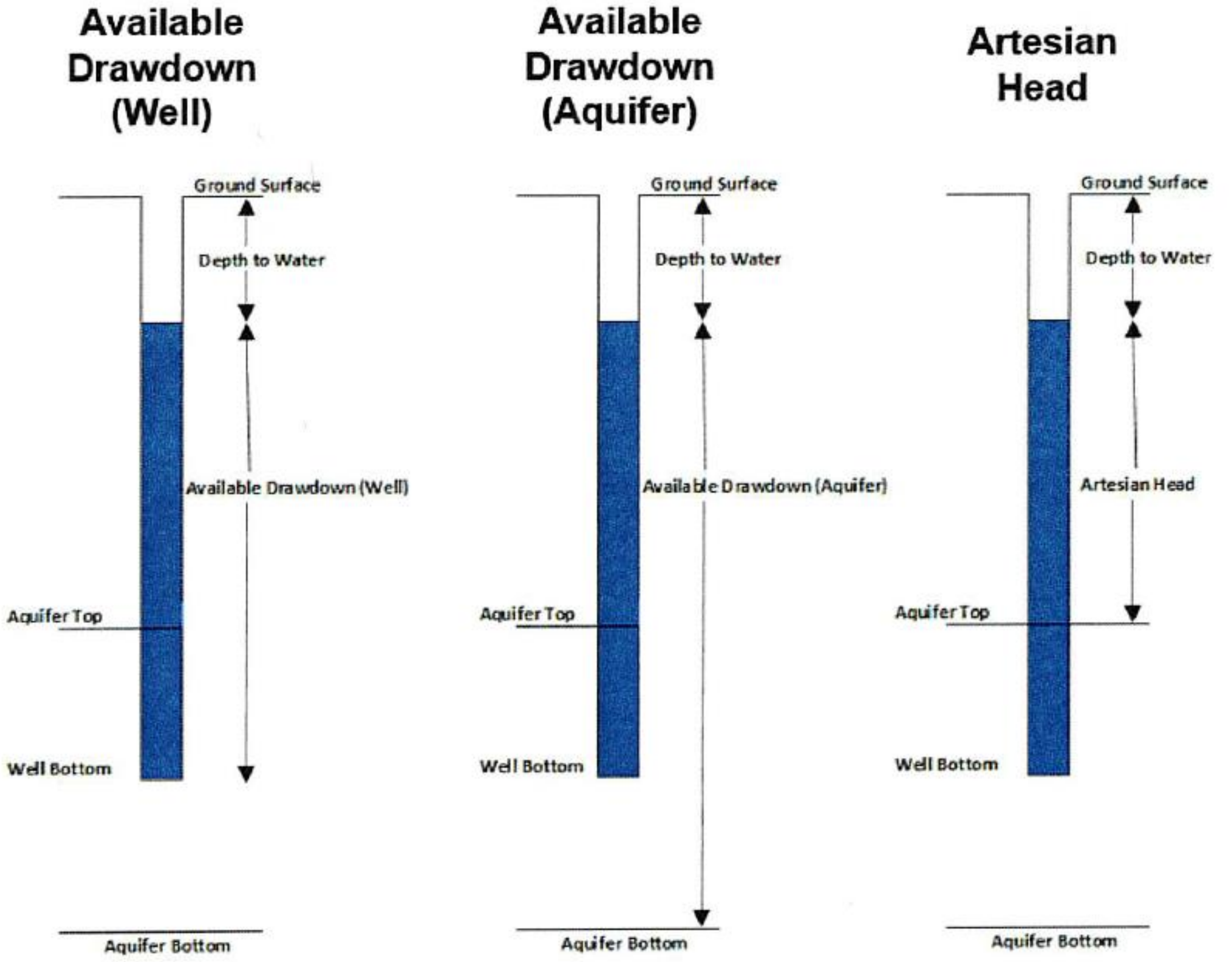
Confined Aquifer



Dipping Aquifer

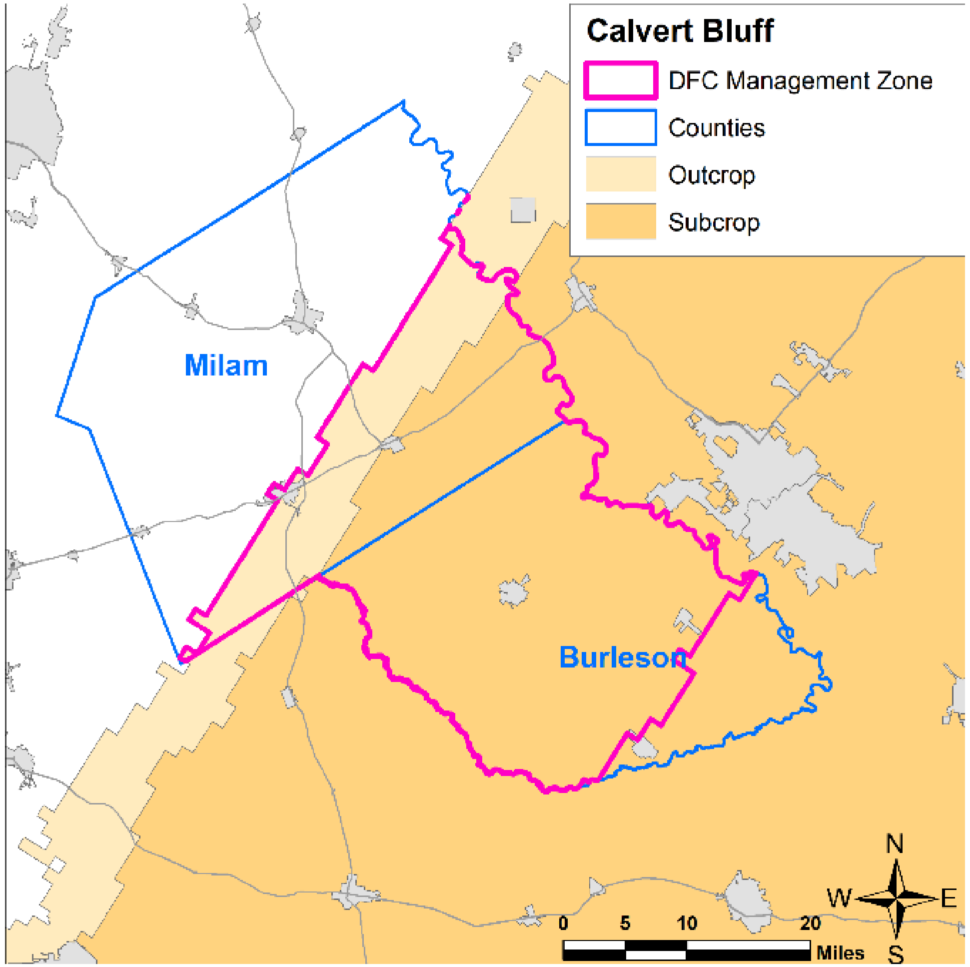


Water Level Metrics Besides Drawdown



Previous Approach for Defining a DFC Management Zone

- Management Zone(s)
  - Defined by Areal Footprint
  - County Boundaries
  - TWDB Downdip boundary for TDS = 3,000 mg/L
  - TWDB identifies the “active” cells in a grid file to define the “Official Aquifer Boundary”
  - Applied the last three planning cycles
- Example: POSGCD
  - Calvert Bluff
  - Downdip boundary sis same for all for all unit Carrizo-Wilcox units

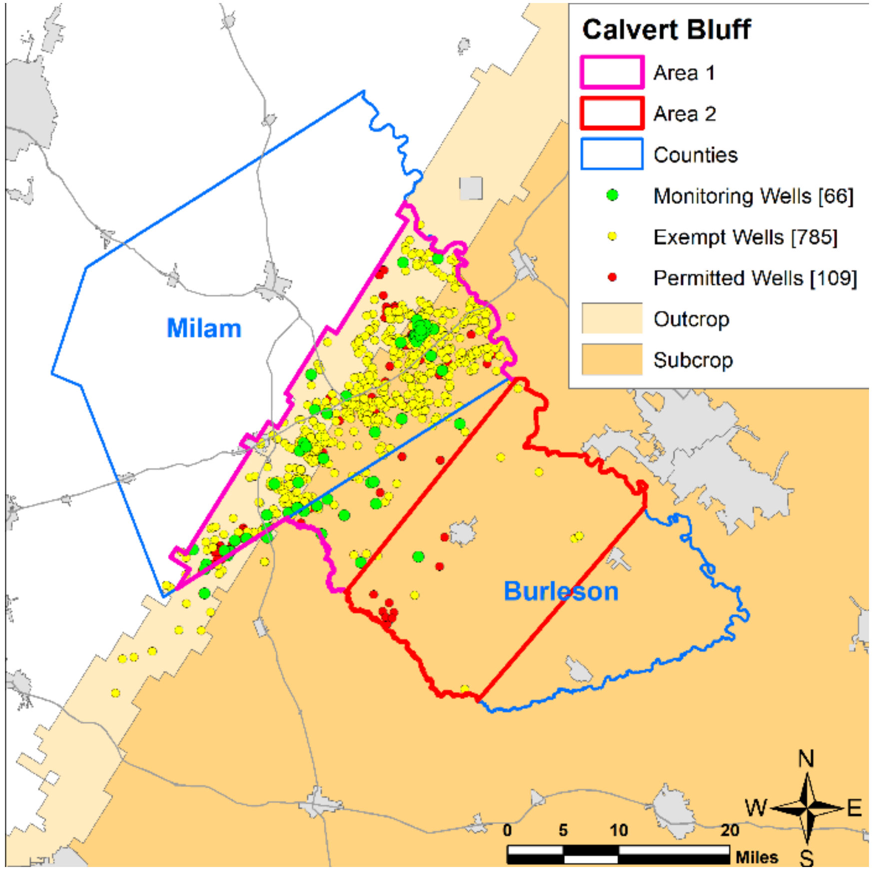


Note: TDS = Total Dissolved Solids Concentration

Options for Defining a DFC Management Zone

- Outcrop/Unconfined Area
  - Average water level (1 variable)
  - Water level drawdown (2 variables)
  - Average saturated thickness (2 variables)
  - Change in saturated thickness (3 variables)

- Confined Aquifer
  - Average
    - Hydraulic Head (1 variable)
    - Average Artesian Pressure (2 variables)
    - Average Available Drawdown (aq) (2 variables)
    - Average Available Drawdown (wl) (2 variables)
  - Change in Four Options Above



- Aquifer Areas Other than Entire Active Aquifer

Potential DFCs Discussion Topics

Sec. 36.108. JOINT PLANNING IN MANAGEMENT AREA.

d-1) After considering and documenting the factors described by Subsection (d) and other relevant scientific and hydrogeological data, the districts may establish different desired future conditions for:

(1) each aquifer, subdivision of an aquifer, or geologic strata located in whole or in part within the boundaries of the management area; or

(2) each geographic area overlying an aquifer in whole or in part or subdivision of an aquifer within the boundaries of the management area.

- GCD having different DFC Approaches
  - GCDs use same GAM Run
  - GCDs have option to use different DFC approaches
  - GMA 12 allowing a variance from the GAM predcitions

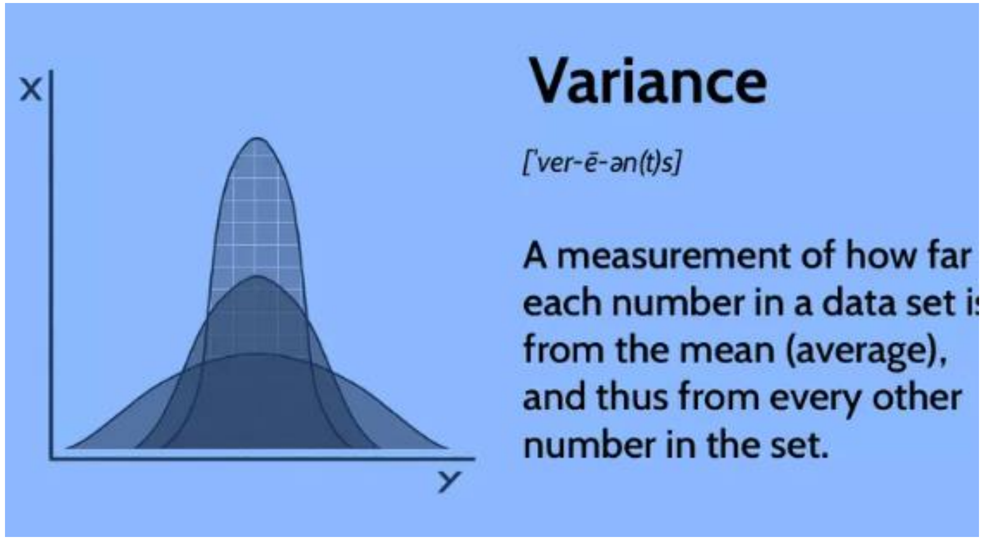
- Timing
  - 50 years plus
  - Decadal (or other interval)

Rational for GMA 12 Adoption of a Variance

- Working Definition - The difference allowed between an adopted DFC and the theoretical DFC calculated from a GAM

- Possible Reasons for a Variance
  - Account for possible differences between methods used to calculate DFCs from model results between TWDB and GMA
  - Acknowledge and account for the model is not a perfect predictor

- GMA 12's Use of a variance
  - The magnitude of the variance has varied
  - The rationale for the variance has not changed



Rational for GMA 12 Adoption of a Variance

- GAM 12 have used variance for all three joint planning cycles
  - Included in resolutions for adoption of DFCs
    - August 11, 2010
    - April 15, 2016
    - November 30, 2021
  - The allowed difference has varied
  - The rationale for the variance has not changed

Submission of a GAM Run for Validation of DFCs and Development of MAGs

- TWDB Document "How to Submit a Groundwater Availability Model Run or Aquifer Assessment for the Development of Modeled Available Groundwater"
  - provide the model files and supporting documentation to the TWDB Groundwater Availability Modeling manager
  - TWDB will review the MODFLOW model and determine if the model meets the Groundwater Availability Modeling Program standards
  - TWDB staff must be able to replicate the approach and assumptions used to develop the desired future conditions.
  - Requests for any clarifications required to develop modeled available groundwater estimates will come through your TWDB groundwater management area liaison. The most common items requiring clarification during the last round of joint planning include:
    - Whether to use the aquifer extent or the model extent for calculations
    - Dry cell assumptions
    - Variance assumptions. For example, if the variation of averaged drawdowns is within 5 percent of the desired future condition, the modeled desired future condition is deemed achieved.

Example for Variance* (11/30/2021)

Based on the principle of using the GAM as a joint planning tool and the fact that the GAM predictions contain uncertainty, GMA 12 considered the DFCs to be compatible and physically possible if the difference between modeled drawdown results and the DFC drawdown targets are within a 10 percent variance for all aquifers in the Queen City-Sparta/Carrizo-Wilcox GAM of the GAM simulation. Factors considered for determining tolerance criteria include:

- model calibration results and statistics;
- information used to calibrate the GAM;
- aquifer and recharge information collected since the GAM was developed;
- sensitivity of the GAM calibration and GAM predictions to change in the model parameters; and
- range of uncertainty in the model parameters including historical and future pumping, temporal variation in recharge distribution and magnitude.

Codes Used by GMA 12 in Third Planning Cycle

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Cc Ross Kushnereit

Intera.S-19 Drawdowns_for_andy.xlsx
18 KB

LPGCD S-19 Drawdowns in 2070

Aquifer Number	3	5	7	8	9	10
LPGCD	22.3	27.8	134.0	131.9	239.8	138.1
POSGCD	32.1	30.2	162.3	155.6	277.5	177.5
BVGCD	47.1	39.8	71.9	88.8	194.6	136.4
METGCD	24.8	20.5	47.5	56.9	76.1	69.3
FCGCD	42.7	72.6	140.1	141.3	207.4	119.7

INTERA PS-19

Aquifer	Sparta	Queen Cit	Carrizo	Calvert Bl	Simsboro	Hooper
LostPines	22.1	27.6	132.9	130.7	238.0	136.8
PostOak	31.8	30.0	161.8	154.8	275.1	175.6
BrazosValley	46.4	39.2	71.1	87.5	192.1	134.6
Mid-East	24.7	20.3	47.1	56.3	75.4	68.6
Fayette	42.4	72.0	139.1	140.0	205.8	118.4

LPGCD-INTERA

Aquifer Number	3	5	7	8	9	10
LPGCD	0.2	0.3	1.1	1.2	1.7	1.3
POSGCD	0.4	0.2	0.5	0.9	2.4	1.9
BVGCD	0.7	0.6	0.8	1.2	2.5	1.8
METGCD	0.1	0.2	0.4	0.5	0.7	0.7
FCGCD	0.3	0.5	1.1	1.3	1.6	1.3

Note: Not attempt to discover the reason for the difference

Codes Recently Develop by LPGCD

- Code DFC Calculations
  - Layer 2 (outcrop)
  - Confined layers

- LPGCD Code Calculations
  - Unchecked
  - Additional documentation and functionality are desired

	A	B	C	D	E	F	G	H	I
1						GCD Downdip			
2	ID	County Co	County Name	SP	QC	CZ	CB	SB	HP
3	1	51	FayetteCountyGCD	41	67	140	142	208	120
4	2	65	BrazosValleyGCD	44	38	74	89	175	114
5	3	68	LostPinesGCD	25	28	141	137	246	135
6	4	69	MidEastTexasGCD	19	19	99	81	79	67
7	5	71	PostOakSavannahGCD	35	28	135	162	287	166
8									
9						GCD Outcrop			
10	ID	GCD Code	GCD Name	SP	QC	CZ	CB	SB	HP
11	1	51	FayetteCountyGCD	555	-9999	-9999	-9999	-9999	-9999
12	2	65	BrazosValleyGCD	23	145	67	11	5	8
13	3	68	LostPinesGCD	18	117	61	20	13	14
14	4	69	MidEastTexasGCD	2	5	10	4	5	4
15	5	71	PostOakSavannahGCD	30	109	180	27	9	10
16									
17									
18									
19									
20									

GCD Downdip&outcrop | GCD Downdip | GCD Outcrop | County Downdip

Ready Accessibility: Good to go

Potential Discussion Topics

- Pros and Cons for using a Variance

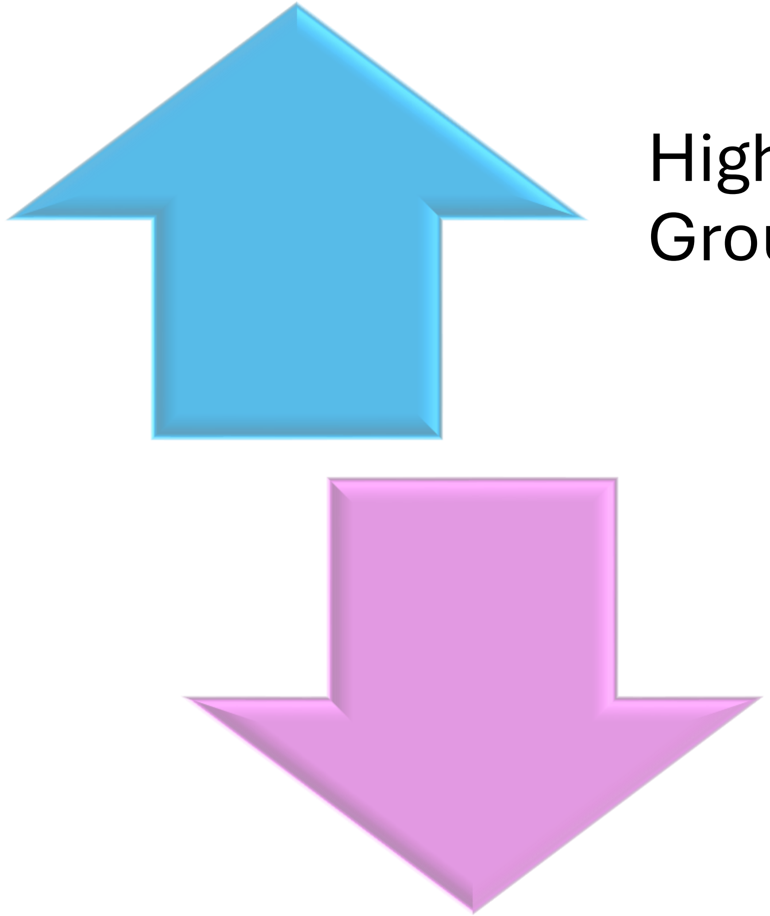
- Pros and Cons for Not using a Variance

- Advantages and Disadvantages for having an Official DFC Code

- Advantages and Disadvantages for having Several DFC codes and offering to submit the Code to TWDB that GMA used to calculate the DFCs reported in the Explanatory Report

Discussion of 3 factors

Balance test for Desired Future Conditions



Highest Practicable Level of Groundwater Production

Conservation, Preservation, Protection, Recharging, and Prevention of Waste of Groundwater, and Control of Subsidence

Balance between production and conservation/ protection

- Evaluation and discussion of nine factors
- The use of GAMs to simulate various pumping scenarios
- The blending of policy and science
- GCDs were able to set different DFCs within their boundaries
  - Aquifers production capability varies
  - Historic production varies
  - Importance of production varies
- Final DFCs will be adopted after public comment period and consideration the nine factors

TWC 36.108(d)

- (5) the impact of subsidence;
- (8) the feasibility of achieving the desired future condition;
- (9) any other information relevant to the specific desired future condition;

9 Factors to consider in determining DFCs

Aquifer Uses or Conditions	Supply Needs & Management Strategies	Hydrological Conditions
Environmental Impacts	Subsidence Impacts	Socioeconomic Impacts
Private Property Rights	DFC Feasibility	Other Relevant Information

The Impact of Subsidence

- Before voting on the proposed DFCs…GCDs shall consider:
  - the impact on subsidence
- Subsidence can be a significant issue related to large-scale groundwater pumping in certain geologic environments
- Potential for subsidence is related to the age of the sediments, depth of burial, and other factors (Gabrysch, 1984)
- Over 8 feet of subsidence has been observed in Harris and Galveston counties

The Impact of Subsidence

- The geologic environment in the Gulf Coast Aquifer System is different than the geologic environment in GMA 12
  - Gulf Coast sediments are younger (<5 my), unconsolidated, and still “inflated” with water
  - Claiborne/Wilcox clays are older (33-55 my), have already experienced considerable natural compaction, and are semi-consolidated
- TWDB subsidence tool indicates that the Brazos Valley Alluvium, Yegua-Jackson and Carrizo-Wilcox have high potential for subsidence; Queen City and Sparta have a medium risk
- Despite significant development and water-level declines in the Carrizo-Wilcox, no subsidence has been observed previously in the Carrizo-Wilcox (Huang and others, 2012)

The Impact of Subsidence

- BVGCD
  - Monitor changes in water levels with consideration for subsidence
  - At least every three years, the District will map and assess the potential for land subsidence where more than 100 feet of drawdown has occurred since 2000
  - Review sections in TWDB Subsidence Vulnerability report
- FCGCD
  - Management Goal (Not Applicable to the District)- The Control and Prevention of Subsidence
  - Review sections in TWDB Subsidence Vulnerability report
  - Continue to monitor water levels and respond to any potential subsidence issues reported to the District
- METGCD
  - Review sections in TWDB Subsidence Vulnerability report, no significant risk of subsidence
  - No reported cases of subsidence in the District

The Impact of Subsidence

- LPGCD
  - Monitor drawdowns to track subsidence
  - At least every five years, GM will investigate and report projected land subsidence for areas where more than 300 feet of drawdown is projected to occur based on GAM simulations used in joint groundwater planning and areas of high risk based on TWDB subsidence tool
  - If subsidence is suspected or confirmed, consider whether pumping curtailments are warranted in impacted areas or undertake any other action(s)

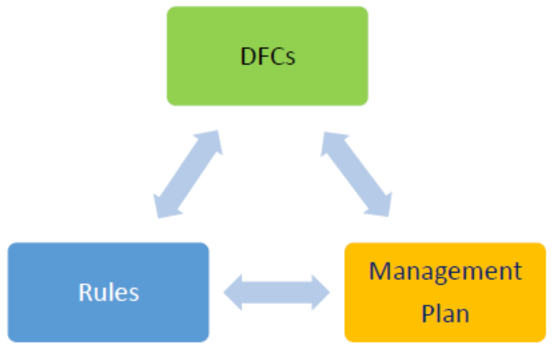
- POSGCD
  - Monitor changes in water levels with consideration for subsidence
  - At least every three years, the District will map and assess the potential for land subsidence where more than 100 feet of drawdown has occurred since 2000
  - Review sections in TWDB Subsidence Vulnerability report

The Impact of Subsidence

- Very minimal observed historic subsidence
- GCDs will continue to address subsidence management goals

The Feasibility of Achieving DFCs

- Before voting on the proposed DFCs…GCDs shall consider:
  - The feasibility of achieving the desired future conditions
- Considerations
  - TWC and TAC do not provide guidance on how GMAs and GCDs are to consider this factor.
- Is it feasible to achieve the DFC in the aquifer?
  - Groundwater Availability Models help ensure that DFCs are generally physically achievable in the aquifer and represent the best available science according to TWDB declaration.
  - DFCs compliance is determined by assessing actual aquifer conditions.
- Is it feasible to achieve the DFC from a regulatory standpoint ?
  - GCD Rules and Management Plans in each district help ensure
  - that DFCs can achieved.
  - DFCs may be less likely to be achieved in areas without GCDs.



The Feasibility of Achieving DFCs

- Chapter 36 Gives GCDs Authority to Manage Aquifers
- GCDs Continue to Collect Data and Improve Science and Understanding of the Aquifer
- GCDs Have Monitoring Plans and Well Networks to Track Status Of Aquifers Compared to DFCs
- GCDs set Goals and Objectives in TWDB-approved Management Plans
- Based on the best available science (the approved Groundwater Availability Model or other quantitative tools), the DFCs are physically possible

The Feasibility of Achieving DFCs

- Modeled Available Groundwater (MAGs) are estimated based on DFCs and the MAGs are considered maximum groundwater supply for region water planning groups
- GCDs have rule-making authority to meet DFCs
- GCDs have authority to limit production and implement well spacing
- GCDs have enforcement capabilities
- GCDs conduct joint groundwater planning with annual review of DFCs
- GCDs are voting members on RWPGs

Any Other Relevant Information

- Before voting on the proposed DFCs…GCDs shall consider:
  - any other information relevant to the specific desired future conditions

- Information, discussion, and presentations given during all GMA 12 joint groundwater planning meetings will be considered by the GMA prior to the adoption of DFCs.

Clarification / Disclaimer

- GCDs in GMA 12 will determine DFCs, not the hydrogeologic consultants.
- Chapter 36 of the Texas Water Code contains concepts that blend legal and technical issues. Any statements relating to regulatory or legal issues shall not be considered legal advice.
- Consultants may provide commentary based on our experience working with groundwater conservation districts, permitting, joint groundwater planning, GCD rules and management plans, water supply entities, and our general understanding of industry practices.