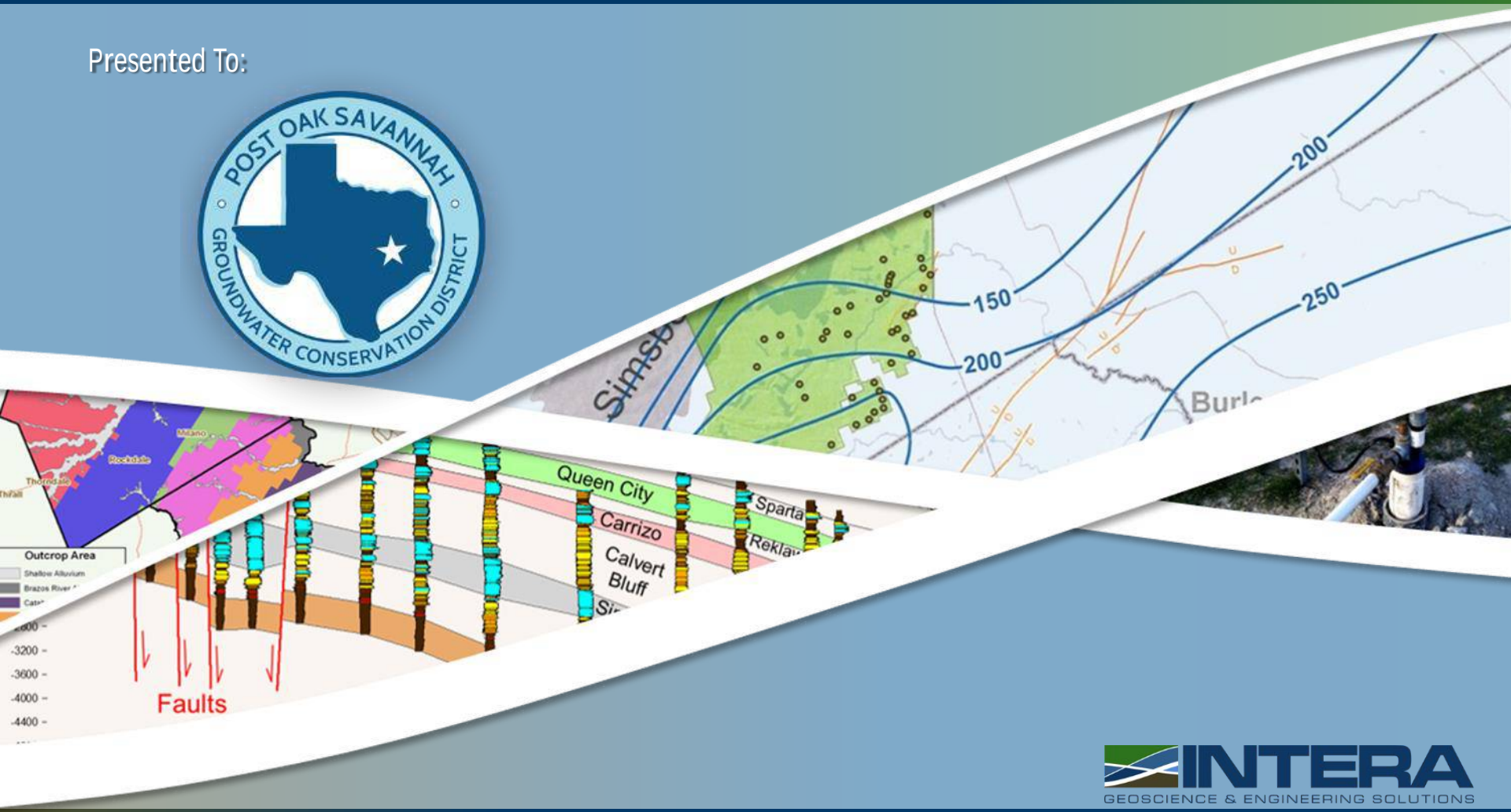
Application to Amend Vista Ridge Drilling and Operating Permit No. POS-D&O and Transport Permit No. POS-T-0001d

Presented To:

POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT



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February 13, 2020

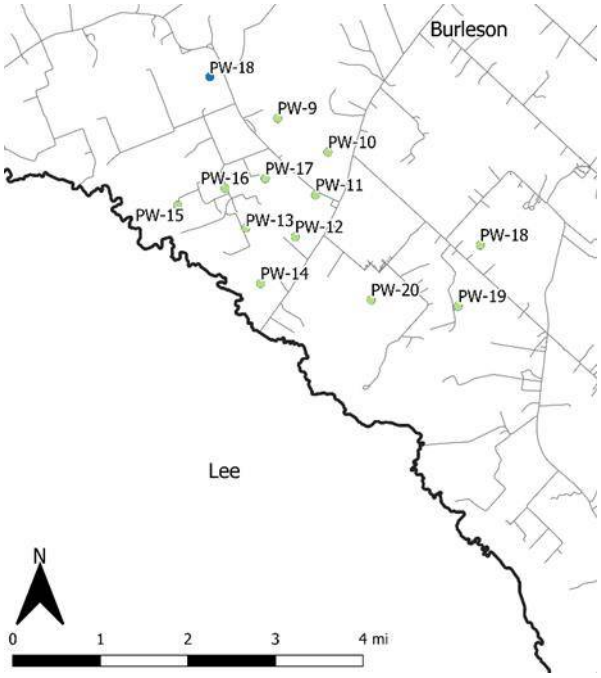
Outline

- Overview of Application
- Review POSGCD Rules
- Discussion of MODGAM
- Amendment #1
- Amendment #2
- Amendment #3
- Amendment #4
- Monitoring Requirement

Overview of Application

- Existing Vista Ridge Permit
  - 12 Simsboro wells producing 35,993 AFY
  - 21 Carrizo wells producing 15,000 AFY
- Application is to modify operation of 12 permitted Simsboro wells
- Amendments
  - #1: Relocation of PW-18
  - #2: Increase in Annual Simsboro Production by 4,842 AFY to 40,835 AFY
  - #3: Reinstatement of 3,000 gpm Production Rates for PW-12, PW-13, PW-16
  - #4: Alignment of Operating and Transport Permits

Simsboro Wells



Vista Ridge Permit: Vertical Cross-section Through Simsboro Well Field

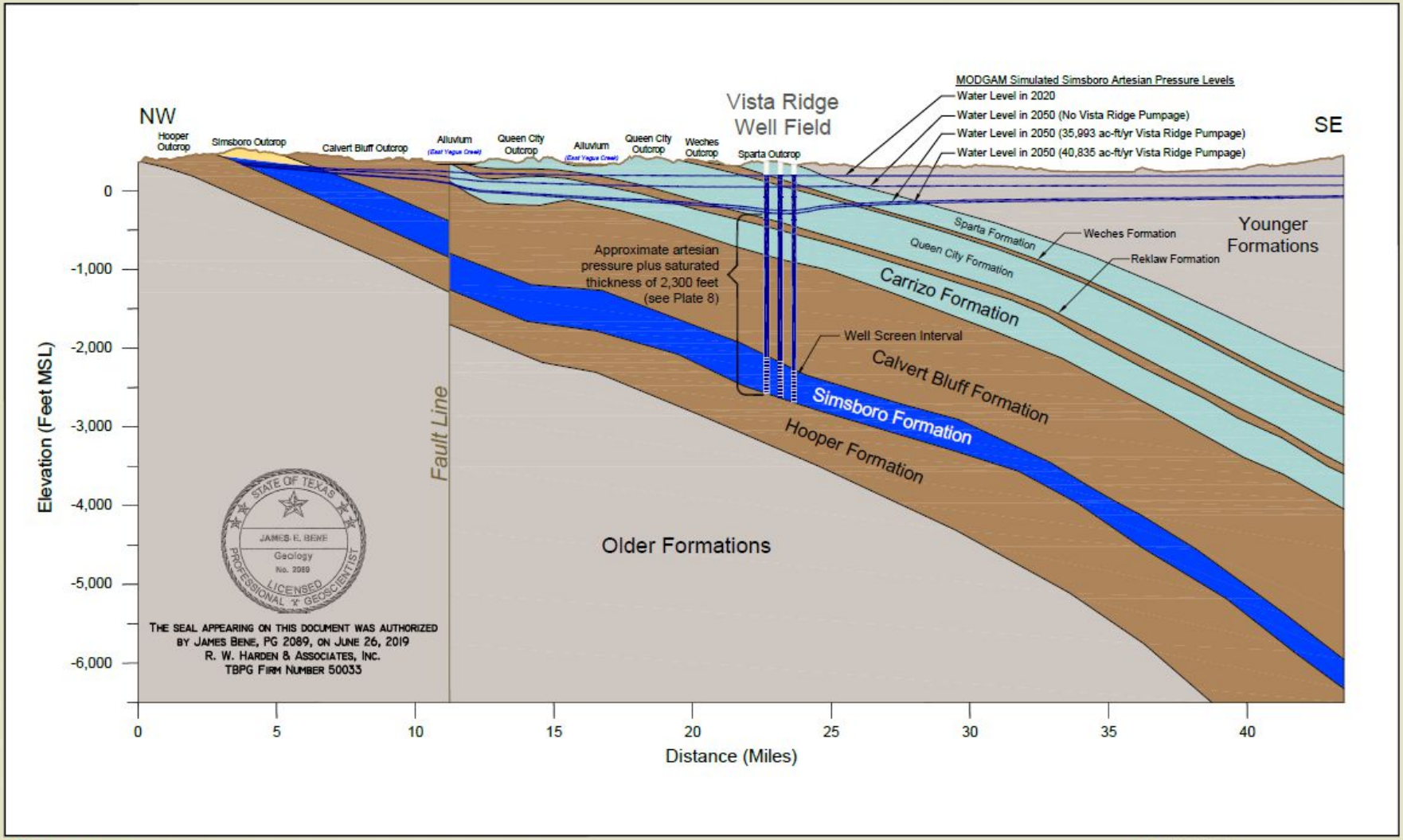


Plate 11 - Cross-Section Diagram (MODGAM Results)

Simsboro Well Locations Surveyed by POSGCD*

Well ID	POSGCD		Distance to Location in 2019 Application (ft)
	Latitude	Longitude	
PW-9	30.441895	-96.813345	2
PW-10	30.436059	-96.803873	7
PW-11	30.429055	-96.806497	6
PW-12	30.422234	-96.81063	3
PW-13	30.423939	-96.820052	4
PW-14	30.414692	-96.817523	1
PW-15	30.427986	-96.832996	5
PW-16	30.430597	-96.823848	21
PW-17	30.431988	-96.816059	7

Geo 7 Series Handheld

* surveyed on August 29 & 30

RULE 7.6 Consideration for Granting Permits

(1) management plan

(2) the quality, quantity, and availability of alternative water supplies

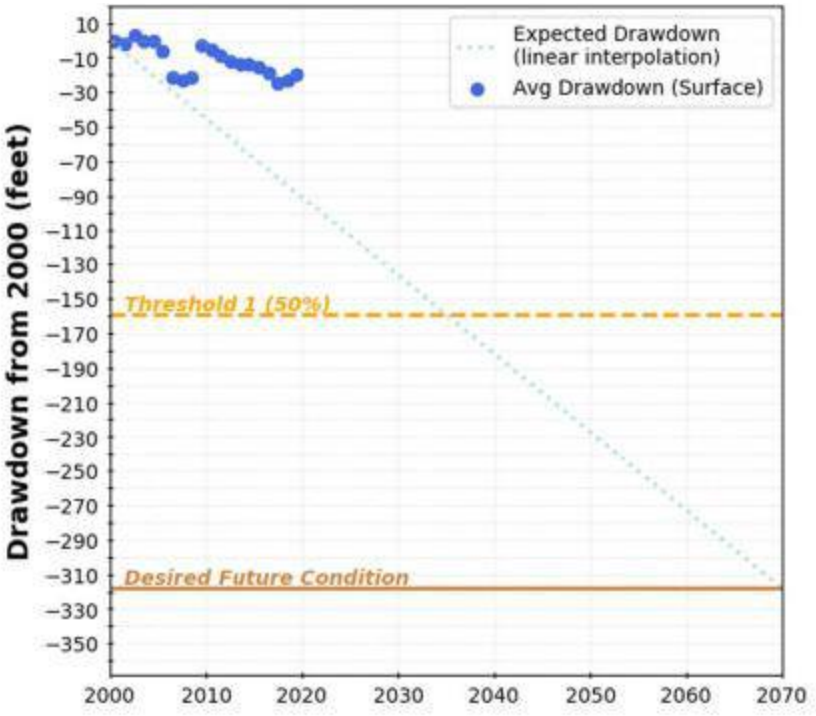
(3) the impact on other landowners and well owners from a grant or denial of the permit, or the terms prescribed by the permit including whether the well will interfere with the production of water from exempt, existing or previously permitted wells and surface water resources

(4) whether the permit will result in a beneficial use and not cause or contribute to waste

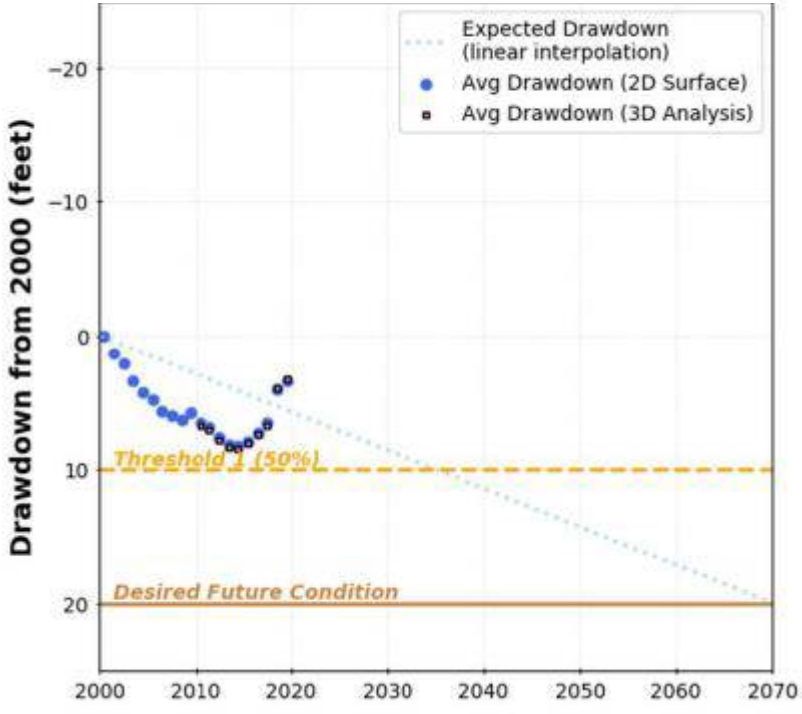
(5) if the applicant has existing production permits that are underutilized and fails to document a substantial need for additional permits to increase production.

Simsboro Monitoring Results

Simsboro DFC
318 ft Drawdown (2000 to 2070)*



Simsboro PDL
20 ft Drawdown (2000 to 2070)*



Simsboro MAG (AFY)

2020	2040	2060
38,468	40,041	48,501

Simsboro Reported Pumping (AFY)

2016	2017	2018
9,223	8,937	4,932

* Presented at POSGCD DFC committee in August 2019

RULE 7.4. APPLICATION REQUIREMENTS FOR ALL PERMITS

7.4.4

c. a statement of the nature and purpose of the proposed used and the amount of groundwater to be used for each purpose, including as applicable, any proposed conjunctive use;

d. a water conservation plan or a declaration that the applicant will comply with the management plan;

e. the maximum rate at which groundwater is proposed to be withdrawn from each well and a map showing the location of the well and the property owned or controlled by the applicant for the production of water;

i. a statement by the applicant that the groundwater withdrawn under the permit will be put to beneficial use at all times;

RULE 7.4. APPLICATION REQUIREMENTS FOR ALL PERMITS

7.4.5 Applications for permits for wells that will have a maximum pumping rate that equals or exceeds 500 gpm shall include:

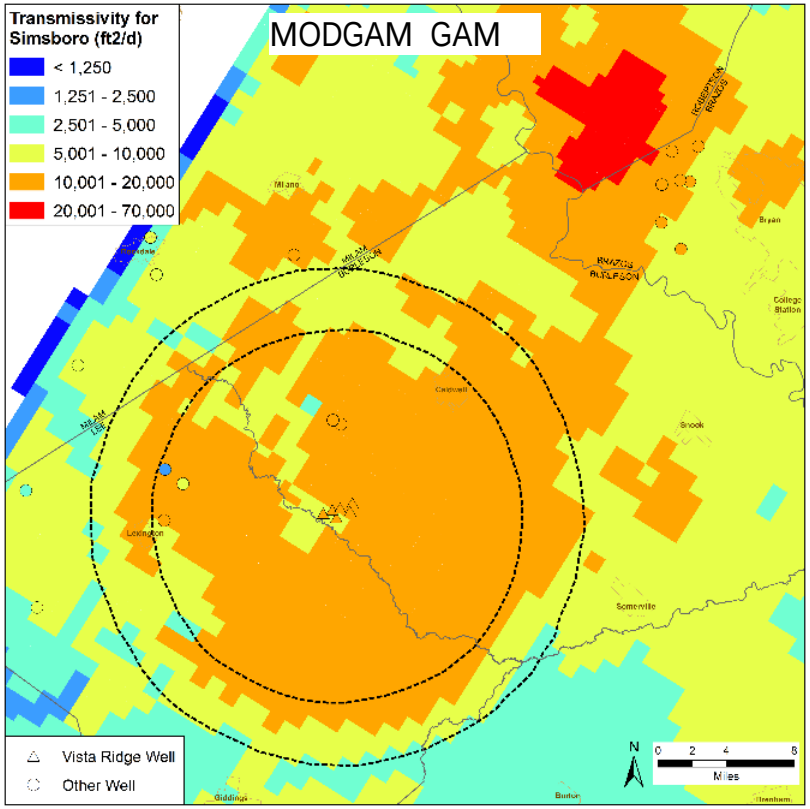
a. Predictions of pumping impacts on water levels over the next 30 years within a radial distance of 5 miles of the newly permitted well.

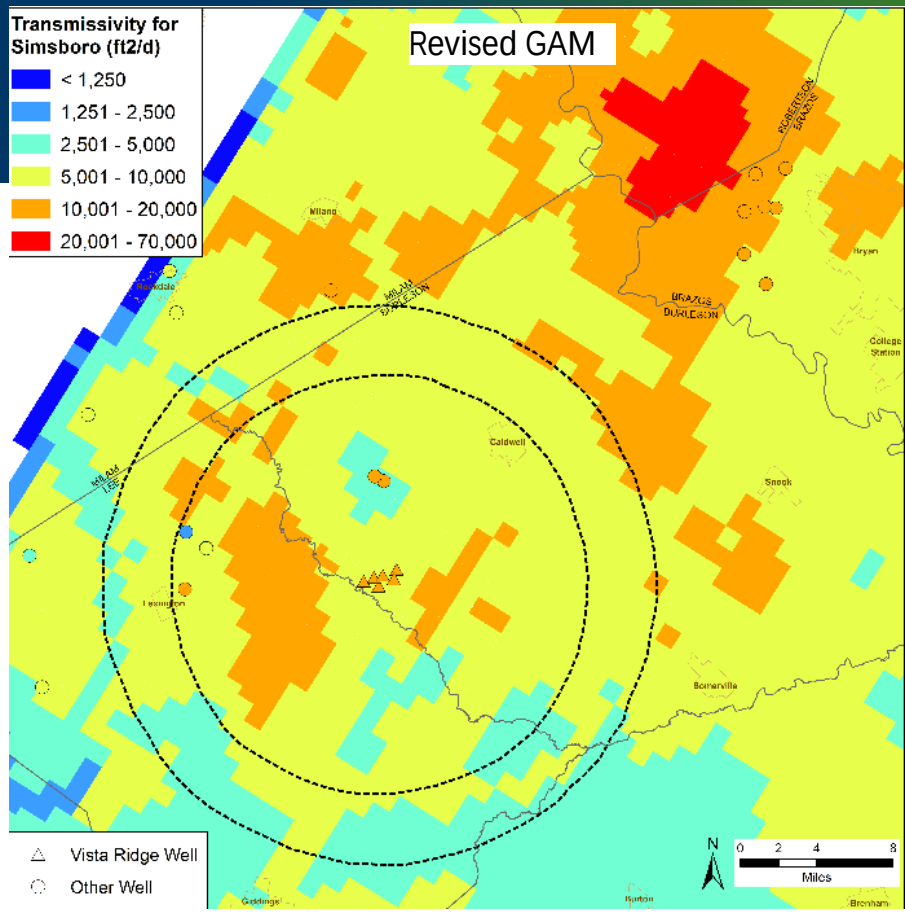
b. If a MAG exists for the aquifer from which water will be produced, then the predictions will include results based on using the Groundwater Availability Model run used to establish the MAG for the aquifer.

c. Predictions made using models other than the GAMs will be accepted by the district.

Development of MODGAM

- MODGAM adjustments based on transmissivity from Vista Ridge Wells
- Performed checks using
  - Simulated historical water levels
  - Simulated pumping tests

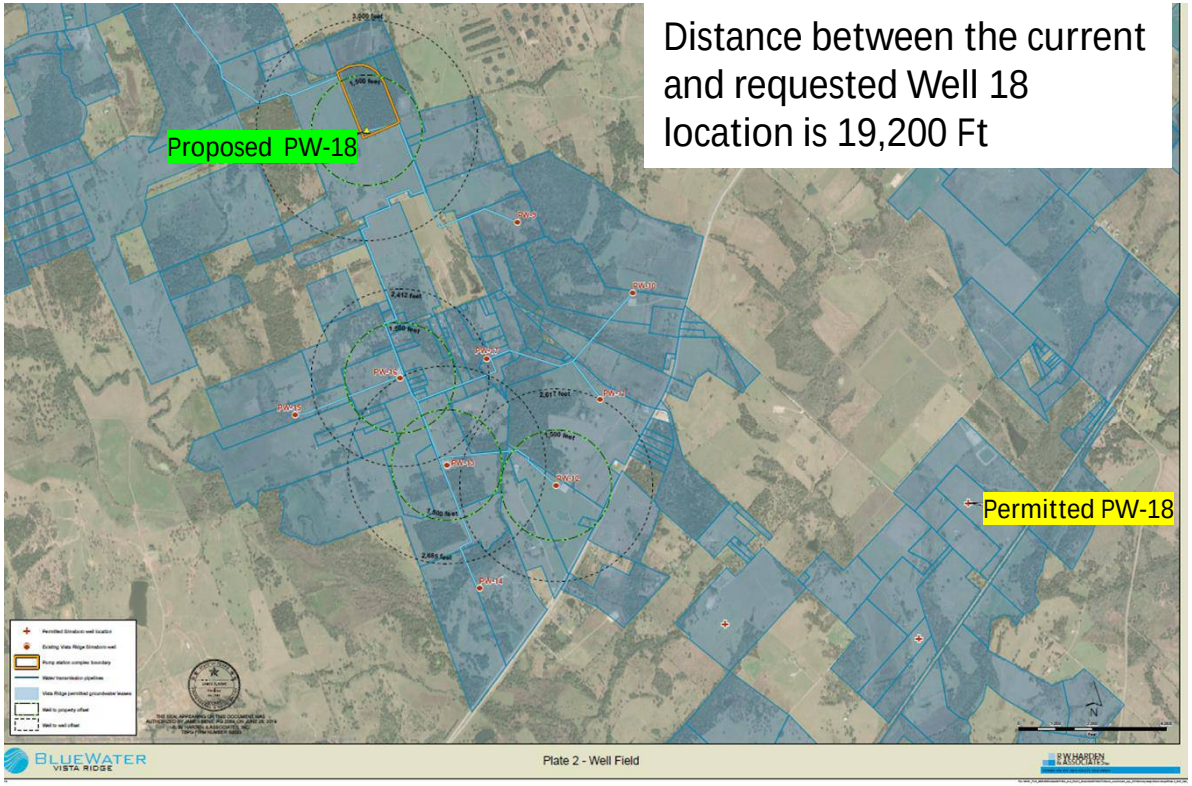




Amendment #1: Relocation of PW-18 Permitted Well Site

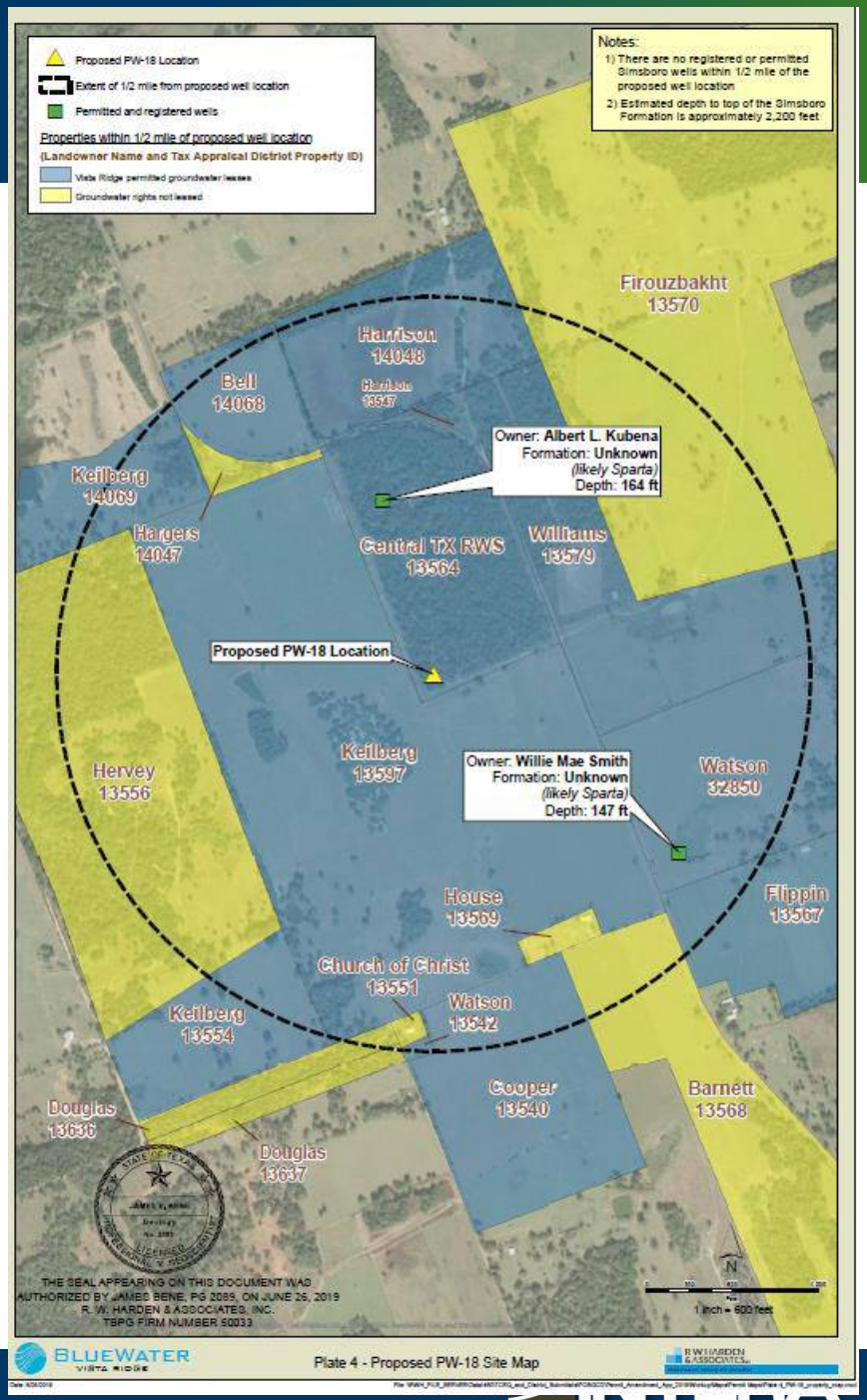
RULE 4.1. REQUIRED SPACING.

4.1.7 Upon application, and approval by the District, a well location established by permit may be modified on the request of both the permittee and the surface owner of land within the contiguous area included within the permit, or for the purpose of relocating the well to a site that is more secure from flooding, adverse drainage or any source of potential contamination.

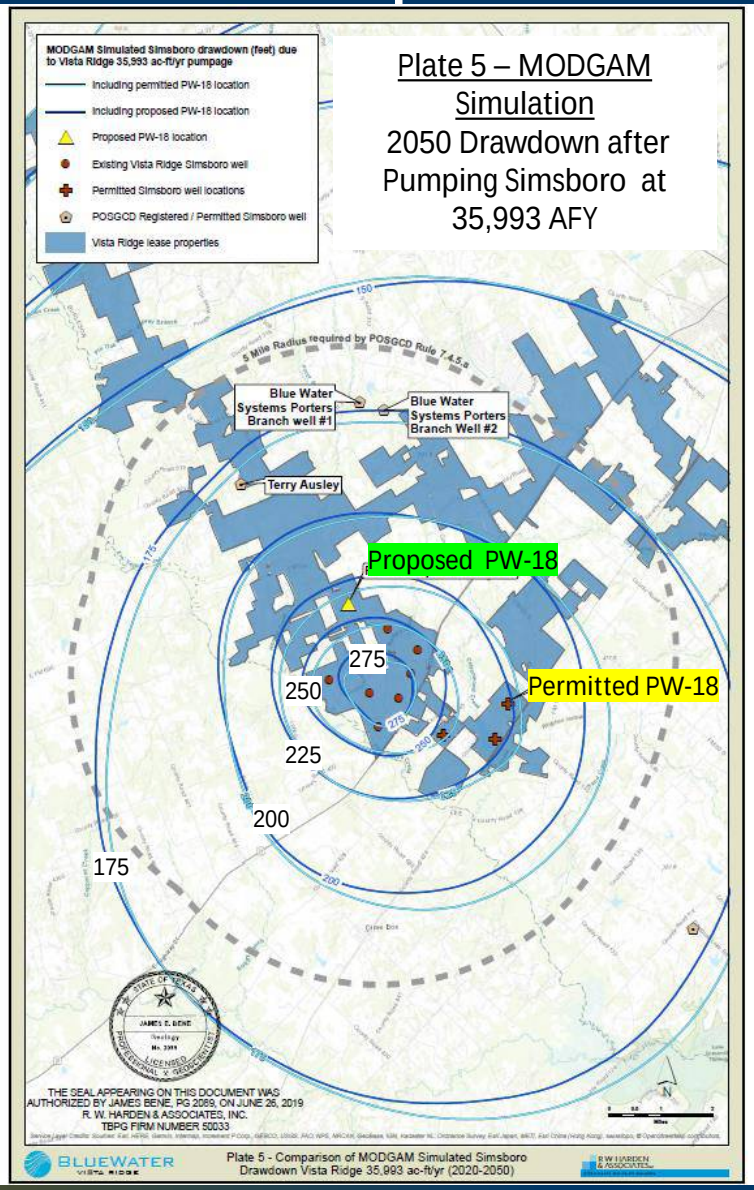


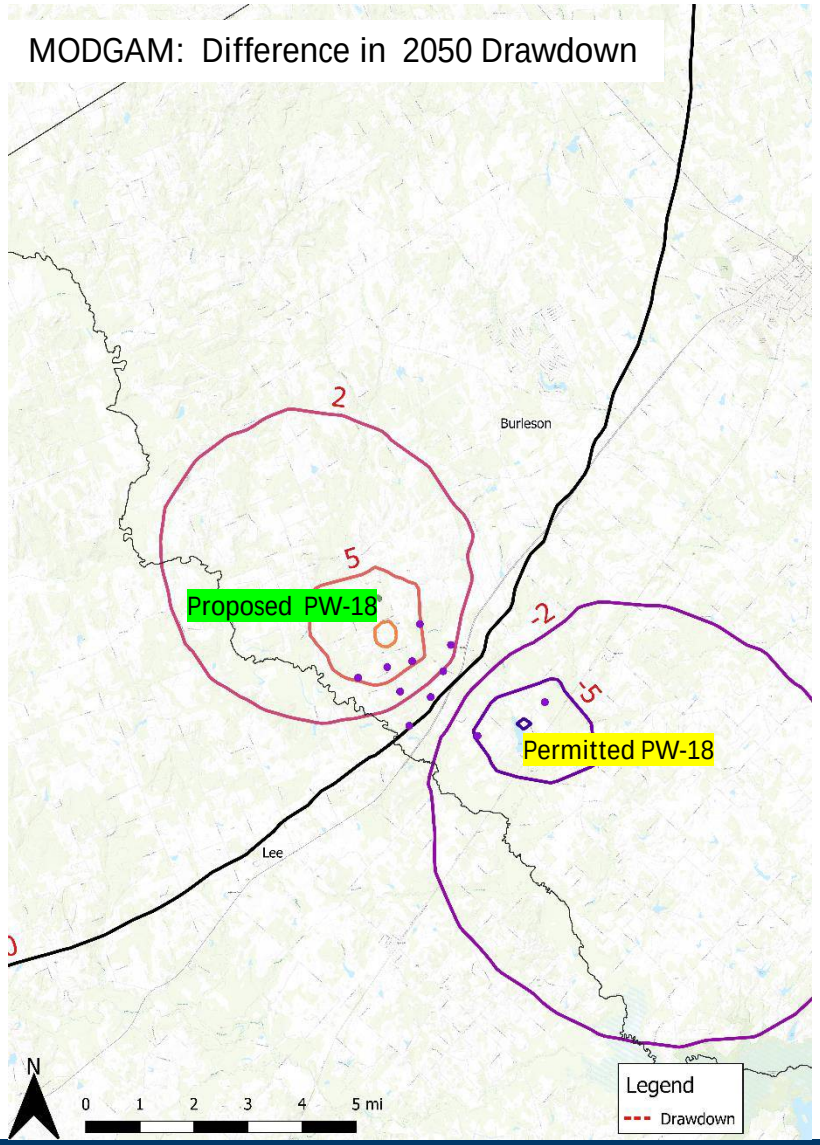
Amendment #1 Findings Regarding Drawdown

- Well spacing for proposed PW-18
  - achieved for property boundary
  - achieved for existing wells
- Maximum difference in simulated 2050 drawdown is less than 25 feet for GAM and MODGAM
- 25 feet is 1% change in available drawdown



Difference in 2050 Drawdown between Proposed and Permitted PW-18





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Amendment #2: Increase in Annual Simsboro Well Field Production

- Vista Ridge Operating Permit
  - 35,993 AFY from Simsboro Formation
  - 15,000 AFY from Carrizo Formation

- Requested Amendment
  - Increase Pumping Simsboro Formation by 4,842 AFY so total pumping is increased from 35,993 AFY to 40,835 AFY
  - "increase is requested to ensure full water production capacity with potential losses due to normal cooling tower operation and transmission system leakage"
  - No change in Carrizo Pumping

- Requested Amendment
  - Increase Pumping Simsboro Formation by 4,842 AFY so total pumping is increased from 35,993 AFY to 40,835 AFY
  - No change in Carrizo Pumping

Amendment #2 Findings Regarding Drawdown

- Information in application contains several minor errors that were easily resolved after talking with Harden & Associates

- Impact of additional 4,842 AFY Based on MODGAM
  - about 35 ft drawdown at 1 mile from center of wellfield
  - about 20 ft drawdown at 5 mile from center of wellfield

- 35 feet difference out of about 2,300 available drawdown is about 1.5% change in available drawdown

- Revised GAM and MODGAM predict less drawdown from 40,835 AFY than does the Former GAM for 35, 993 AFY

Amendment #3: Reinstatement of 3,000 gpm Instantaneous Well Production Rate

RULE 4.1. REQUIRED SPACING.

4.1.2 In the Simsboro formation the spacing of a new well shall be as provided in (a) or (b), at the election of the owner exercised when the application for a new well permit is filed:

(a) the spacing of a new well from any well existing in that formation shall be a distance of not less than one foot per one gallon per minute of production capacity and not less than one-half foot per gallon per minute from the property line of each adjoining landowner;

RULE 4.2. EXCEPTIONS TO SPACING REQUIREMENTS

4.2.1 The Board may, if good cause is shown by clear and convincing evidence, enter special orders or add special permit conditions increasing or decreasing spacing requirements

Amendment #3: Reinstatement of 3,000 gpm Instantaneous Well Production Rate

RULE 4.2. EXCEPTIONS TO SPACING REQUIREMENTS

4.2.3 If an exception to the spacing requirements is desired, a person shall submit an application to the Board at the district office. The application shall be on a form furnished by the District. The application must explain the circumstances justifying an exception to the spacing requirements and include a plat or sketch, drawn to scale, one inch equaling 600 feet. The plat or sketch must show the property lines of all land that abuts the land proposed for the well site within one-half mile of the proposed well, and all registered and permitted wells, within one- half mile of the proposed well site. The application must contain the names and addresses of all landowners and owners of registered and permitted wells within one-half mile of the proposed well site. The application and plat must be certified by some person actually acquainted with the facts who shall state that the facts contained in the application and plat are true and correct.

Well Spacing Based on Rule 4.1.2, POSGCD Surveyed Location, and Proposed Pumping

Well ID	Nearest well	Distance from nearest well (ft)	*Proposed* GPM	Distance required	Difference	Meets POSGCD Spacing Requirement
PW-9	PW-10	3,663	3,000	3,000	-663	Yes
PW-10	PW-11	2,678	3,000	3,000	**322**	**NO**
PW-11	PW-10	2,678	3,000	3,000	**322**	**NO**
PW-12	PW-11	2,802	3,000	3,000	**198**	**NO***
PW-13	PW-16	2,701	3,000	3,000	**299**	**NO***
PW-14	PW-13	3,456	2,500	2,500	-956	Yes
PW-15	PW-16	3,036	3,000	3,000	-36	Yes
PW-16	PW-17	2,507	3,000	3,000	**493**	**NO***
PW-17	PW-16	2,507	3,000	3,000	**493**	**NO**
PW-18*	PW-9	4,790	3,000	3,000	-1,790	Yes
PW-19⁺	PW-20	5,280	3,000	3,000	-2,280	Yes
PW-20⁺	PW-19	5,280	1,800	1,800	-3,480	Yes

-- default is distances measured by POSGCD

** Location of Proposed PW-18 from 2019 application*

⁺ Location from 2017 Permit

** Applied for maximum pumping rate of 3,000 gpm*

Amendment #3 Findings Regarding Well Spacing

- Six wells do not achieve Simsboro well spacing between new well and well existing in formation for proposed pumping

- Application requests variance for three of the six wells (PW-13, PW-12, PW-16).
  - Spacing deficit ranges from 198 ft to 493 ft
  - Increased drawdown at property boundary < 5 feet

- Applications does not request variance for three of the six wells (PW-17, PW-10, PW-11).
  - Spacing deficit ranges from 322 ft to 493 ft
  - Increased drawdown was not estimated in application

Approach For Evaluating Subsidence

- Application included a Subsidence Technical Memorandum cumulative pumping of entire permit and not incremental pumping for permit application
  - Model to generate drawdown
    - Former GAM
    - Revised GAM
    - MOD GAM
  - Pumping scenarios
    - DFC Pumping From PS 12
    - DFC Pumping From PS 12 plus cumulative Vista Ridge (15,000 AFY (Carrizo) + 40,835 AFY (Simsboro) = 55,835 AFY)
- Application uses TWDB tool for estimating land subsidence from Drawdown
  - Inputs for estimated drawdown and clay thickness are reasonable
  - Default values used for subsidence properties of clay (not reasonable, too high)

Findings Regarding Subsidence

- Applicant states that estimates are provided "in interest of completeness" of application because
  - Large-scale pumping has been occurring for by cities of Bryan and College Station for decades without observable subsidence for problems associated with subsidence
  - TWDB tool will overpredict subsidence because GAM will overestimate drawdown in Calvert Bluff and Hooper because it does not properly account for stratification of clays in thick clayey formation

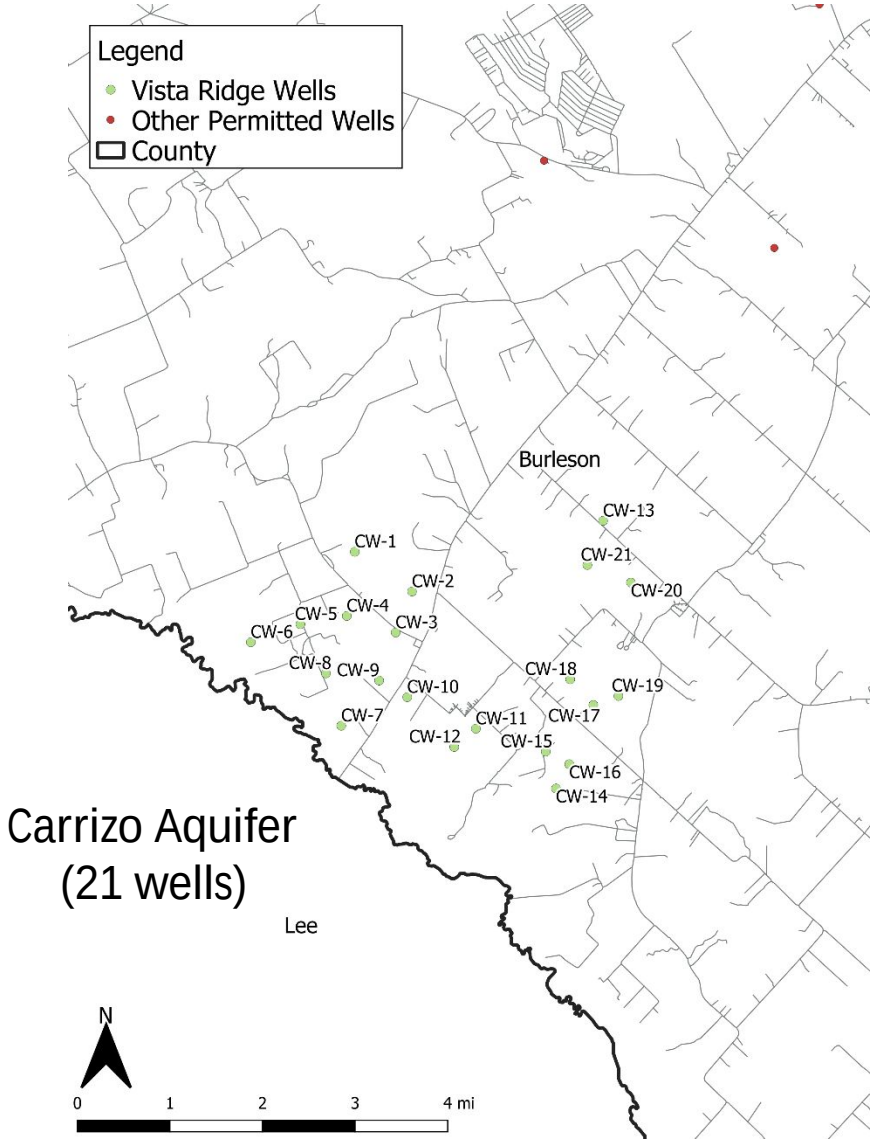
- Subsidence Predictions
  - Application provided estimate of land subsidence for cumulative Vista Ridge Pumping
  - Estimated Subsidence maximum cumulative for Vista Ridge pumping
    - Max 1.4 to 2.6 ft over 30 years
    - Over 50% compaction from Calvert Bluff
    - Need to estimate land subsidence for incremental permit amount of 4,842 AFY

Monitoring Considerations

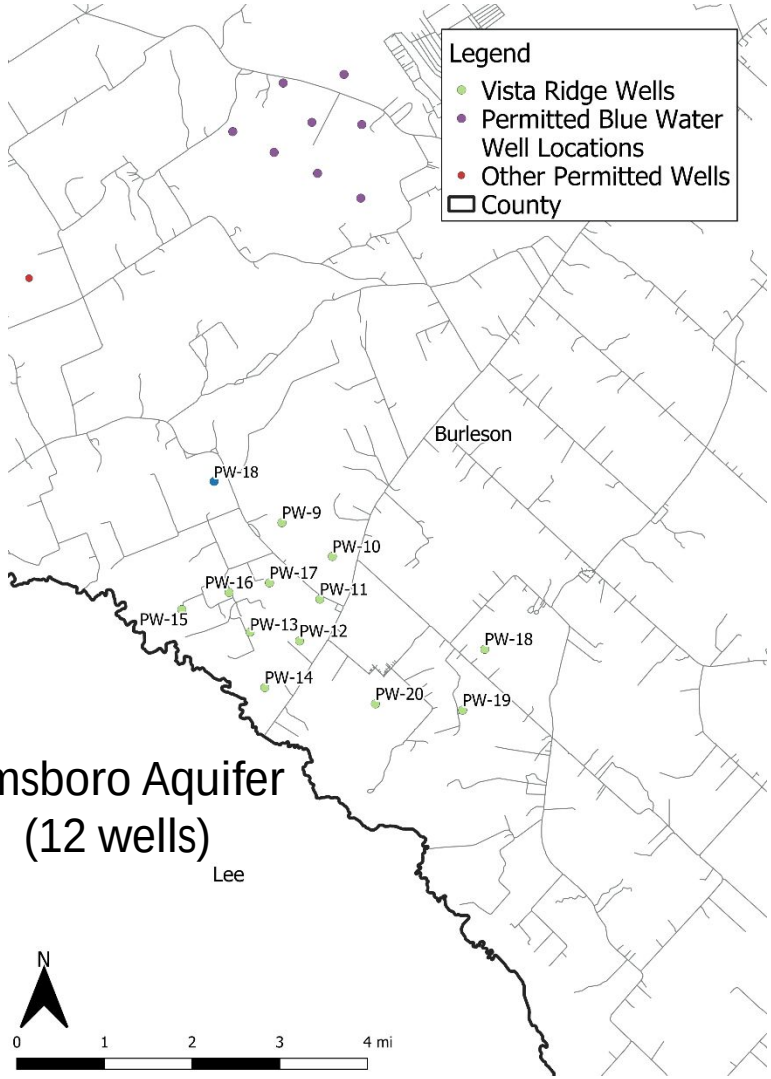
- RULE 5.1. MAXIMUM ALLOWABLE PRODUCTION.

5.1.1 A non-exempt well or well system may not be drilled and equipped for the production of a cumulative total of more than 10 gallons per minute (GPM) per contiguous acre owned or controlled by the well owner or operator, and each well having a production capacity of 1000 gpm, or more, shall have monitoring equipment reasonably required by the District and be capable for use as a monitoring well. [Amended July 12. 2005]

Monitoring Considerations



Carrizo Aquifer
(21 wells)



Simsboro Aquifer
(12 wells)

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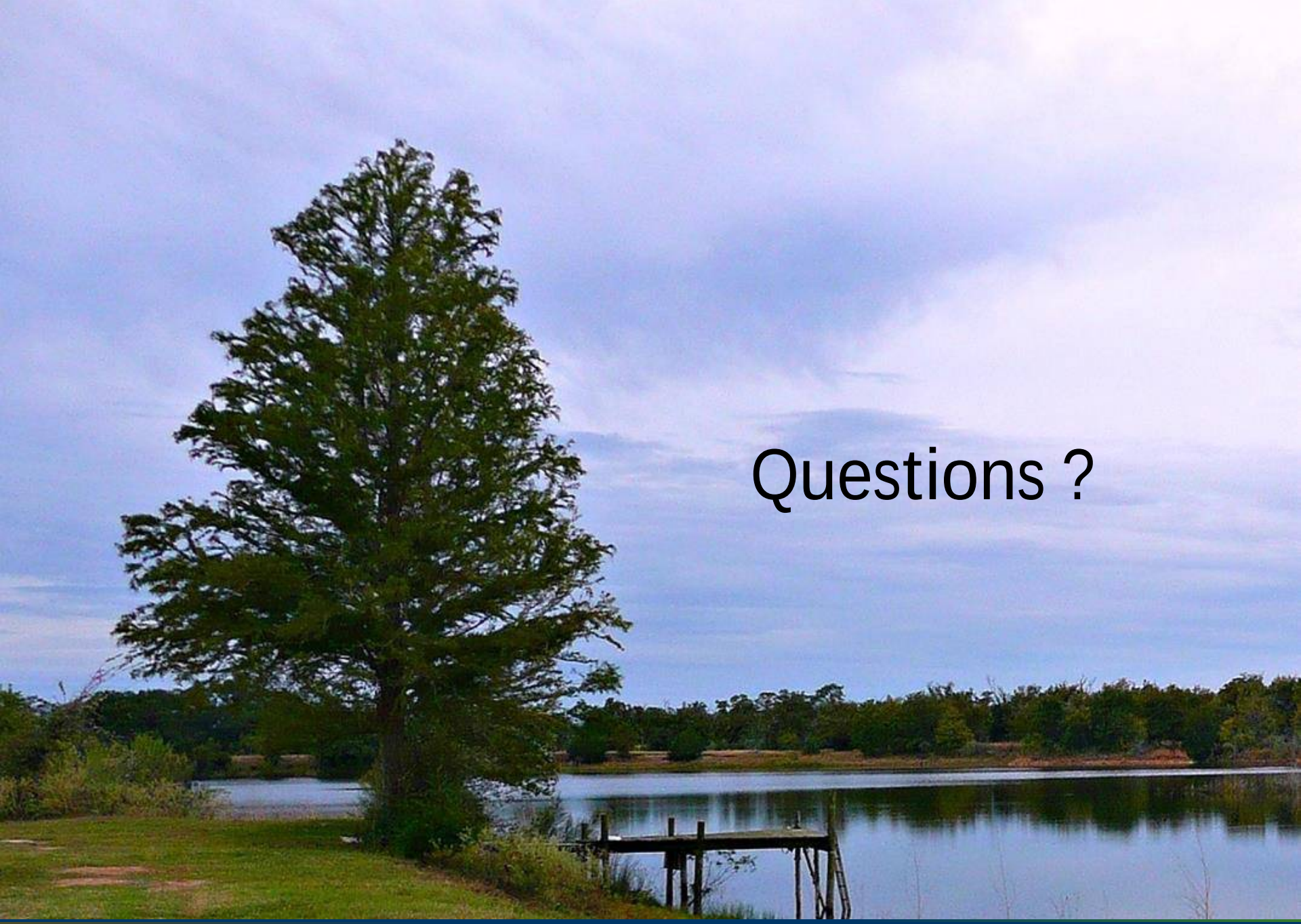
Status of Monitoring Data

- Discussions with Vista Ridge/Blue Water regarding their submission of monitoring data began in August 2019
- Vista Ridge/Blue Water has not yet provided any monitoring data nor a plan to submit monitoring data to POSGCD


Questions ?