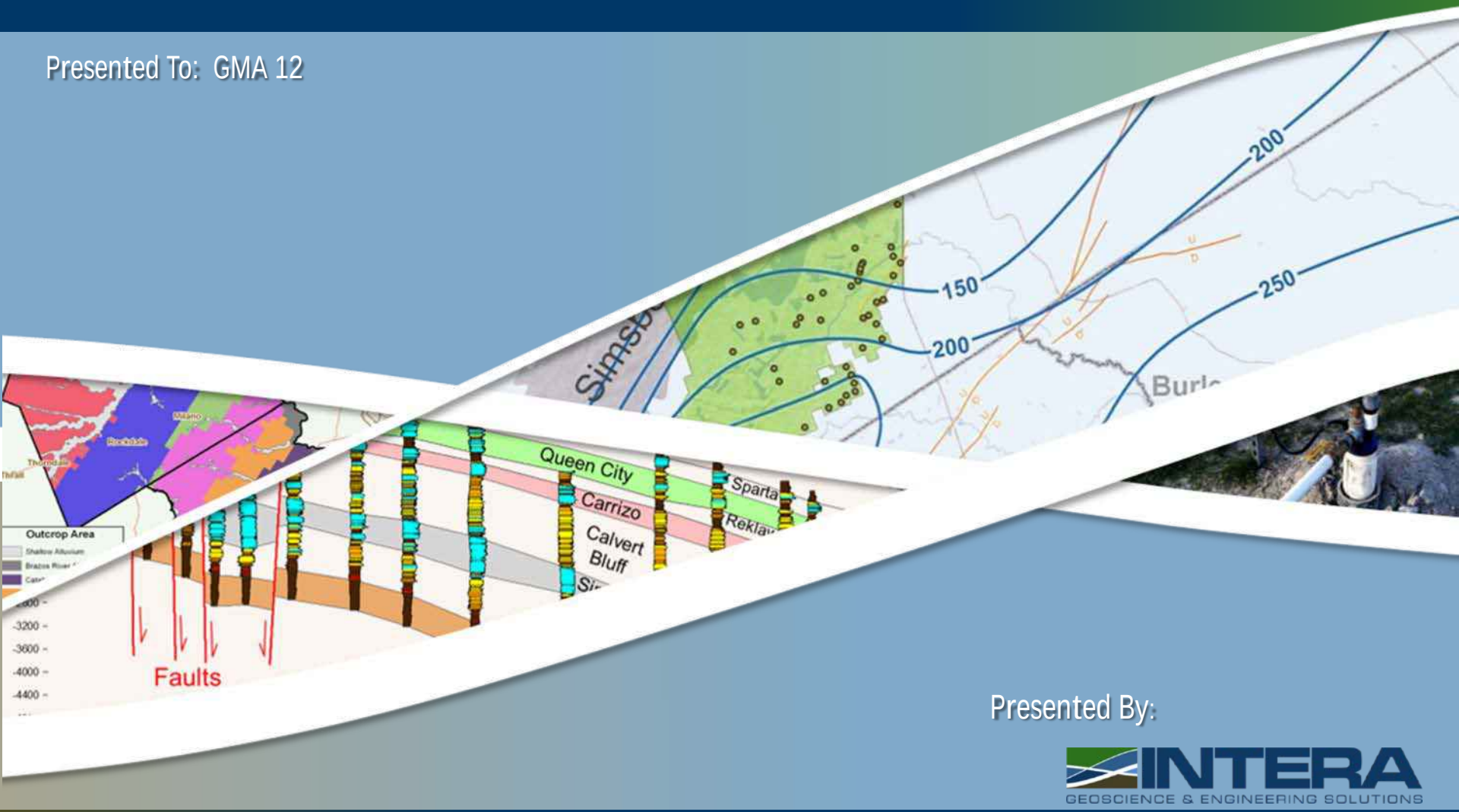
POSGCD Update: DFC Compliance

Presented To: GMA 12



Presented By:

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

January 29, 2019

Agenda

- Desired Future Conditions (DFC) Compliance Document
- Evaluating DFC Compliance
- Evaluating Protective Drawdown Limit (PDL) Compliance

DFC Compliance Document for POSGCD

TABLE OF CONTENTS

Post·Oak·Savannah·Guidance·Document·for·Evaluating· Compliance·with·Desired·Future·Conditions·and·Protective· Drawdown·Limits·¶

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Prepared·for:¶

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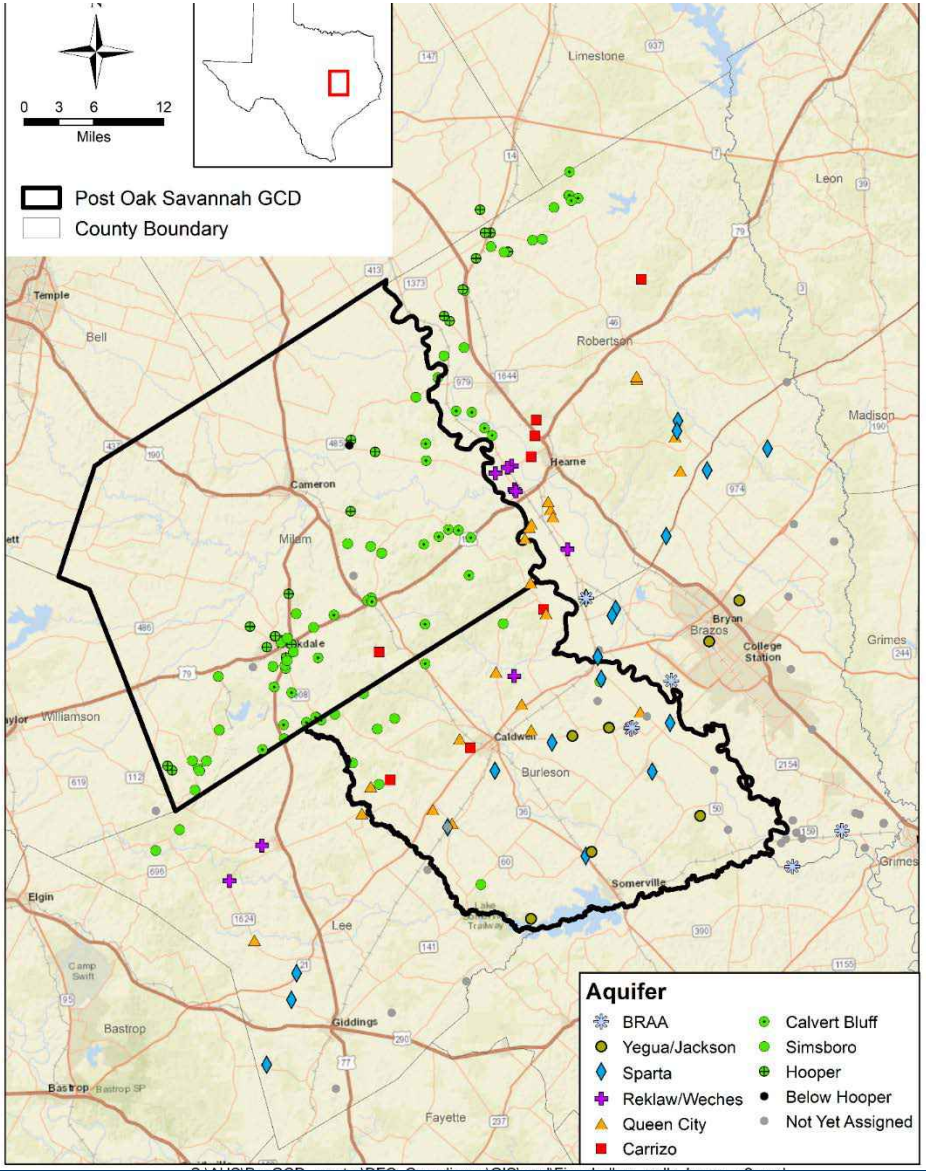
DFC Compliance Document for POSGCD

- Link between monitoring network & DFC compliance
- Field measurement protocols *(inter-District cooperation)*
- Detailed methodology for interpolating measured water levels and calculating drawdown
- Yearly time series that compares calculated District drawdown to DFCs
- Includes methodology for Shallow aquifer zones *(Protective Drawdown Limits or PDLs)*
- Living Document

Monitoring Network

- Link between monitoring network & DFC compliance
- Inter-District cooperation for field measurements



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Field Measurement Protocols

APPENDIX E

POSGCD Water Level Measurement Form

Draft: Post Oak Savannah Guidance Document for Evaluating Compliance with Desired Future Conditions and Protective Drawdown Limits

Aquifer(s) _____ State Well No. _____

Owner _____ Address: _____

Land Surface Elevation : _____ County: _____

Well Location: Lat: _____ Phone: _____
Long: _____

Pump: Type: _____ Depth: _____ ft.
Setting: _____ ft.

M.P. _____ ft. above land surface

Remarks:

Date of current measurement mm/dd/yyyy	Time since last pumped	Less than 24 hrs	Measuring Method	Measuring Point (MP) correction	Steel Tape Only		Depth to water from MP	Depth to water from Land Surface	Change in level since last static measurement	Field Observations	User I.D.
					HOLD	CUT					

Field Measurement Protocols

I. WATER LEVEL MEASUREMENT PROTOCOLS

A. Steel Tape (wetted-tape) method

Appropriate Wells for this method:

- ✓ water levels < 500 ft (< 200 ft for best results)
- ✓ an estimated water level is available
- X does NOT have angled casing
- X is NOT pumping
- X is NOT flowing
- X does NOT have water dripping into well or condensing on well casing

Required Materials:

- Graduated steel tape.
- Non-lead break-away weight (to attach to the end of the tape, if necessary)
- Non-toxic blue carpenter's chalk
- Clean rag.
- Pencil or pen.
- Water-level measurement field form.
- Two wrenches with adjustable jaws or other tools for removing well cap.
- Cleaning supplies for water-level tapes.

Steps:

1. If well is equipped with a submersible pump, confirm and record that the pump is not in operation. If the pump is operating, no water-level measurement should be taken or recorded. Obtain permission to collect measurement at a later time.
2. Record how long the pump has been off prior to taking the measurement. If the well has been pumped less than 24 hours prior to taking the water-level measurement, try to reschedule the measurement for another time when the pump can be shut down for the recommended 24 hours. If rescheduling is not possible, mark the ***Less than 24 hrs*** box on the field form. Estimate how long the well has been off and enter the time since pumping.
3. Identify a port or opening that provides access for the steel tape.
4. Measure and record the height of this opening above ground level. Record this as the measuring point correction value (***MP correction***). Describe the measuring point in the official record for the well, and use the same measuring point each time when measuring the water level. If not possible, record the height of the measuring point above land surface each time the static water level is measured.

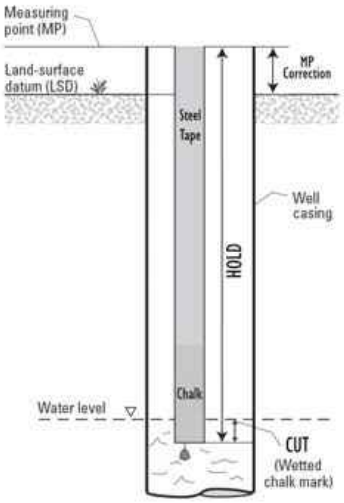
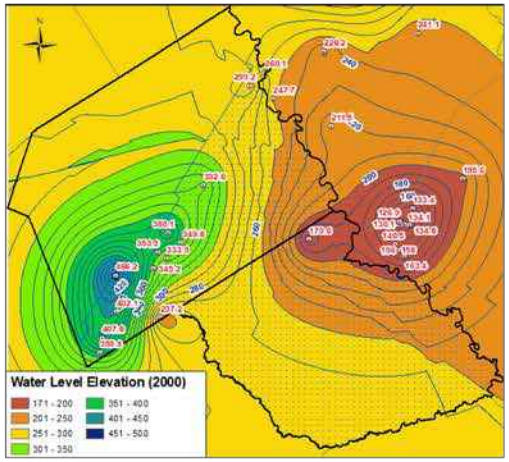


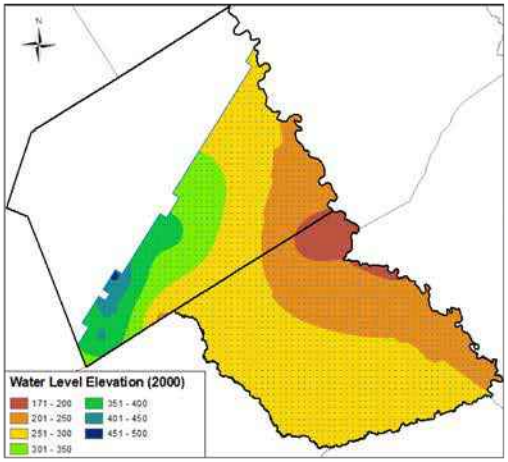
Figure 6-3 Steel tape diagram (modified from USGS, 2011)

Interpolation Methodology

Interpolate Baseline (2000) Simsboro Water Level Surface



Clip Baseline (2000) Water Level Surface to Simsboro Zone

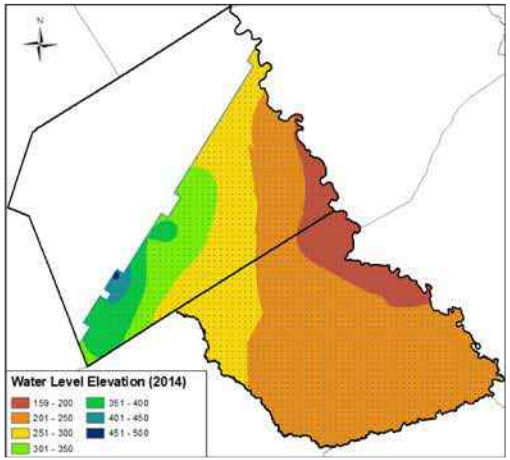


Calculate Average Baseline (2000) Water Level Elevation

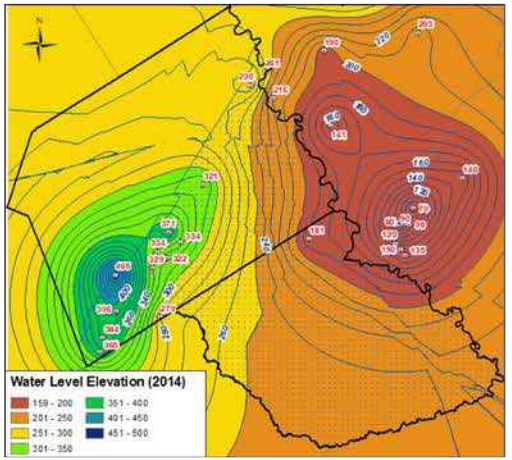
Average Drawdown = Baseline WL (2000) – Evaluation Year WL (2014)

Calculate Average Evaluation Year (2014) Water Level Elevation

Clip Evaluation Year (2014) Water Level Surface to Simsboro Zone



Interpolate Evaluation Year (2014) Simsboro Water Level Surface



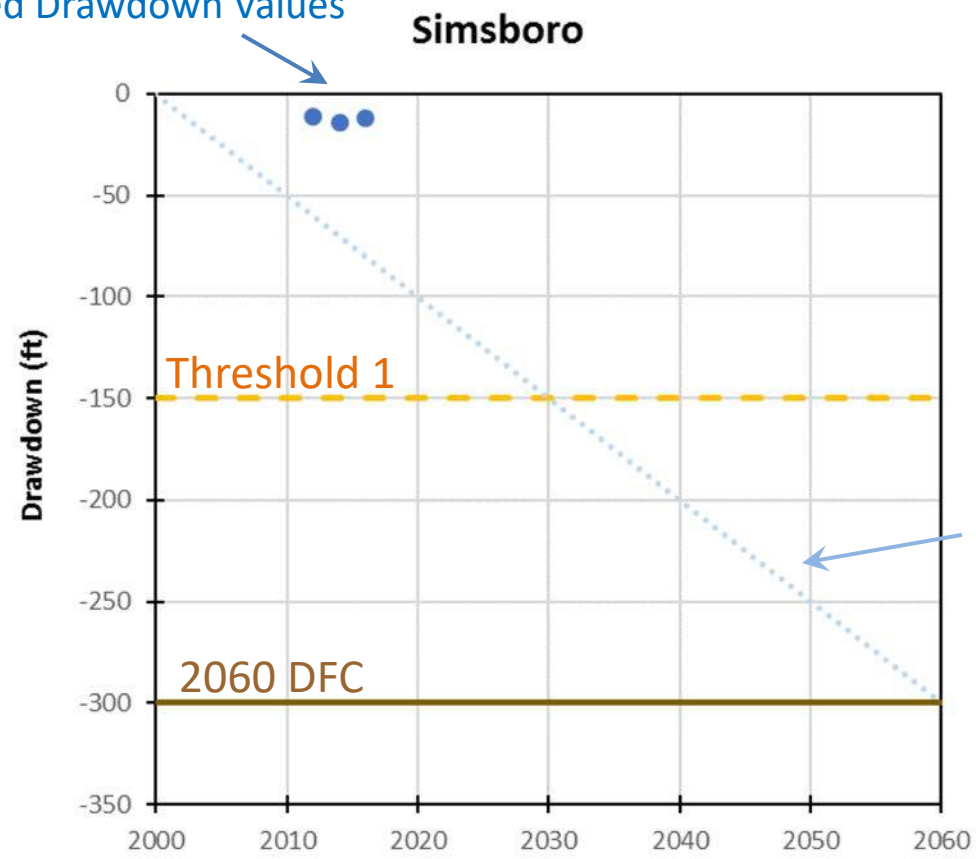
Evaluating DFC Compliance

Table 6-1 Status of DFC compliance by total aquifer management zone (green text indicates compliance; orange text indicates at or above Threshold 1).

Management Zone	DFC	Drawdown from 2000 to 2012	Drawdown from 2000 to 2013	Drawdown from 2000 to 2014	Drawdown from 2000 to 2015	Drawdown from 2000 to 2016	Drawdown from 2000 to 2017
		Calculated Drawdown (% of DFC)	Calculated Drawdown (% of DFC)	Calculated Drawdown (% of DFC)	Calculated Drawdown (% of DFC)	Calculated Drawdown (% of DFC)	Calculated Drawdown (% of DFC)
Yegua Jackson	100	31.8 (32%)	34.5 (34%)	35.7 (36%)	40.0 (40%)	47.0 (47%)	46.9 (47%)
Sparta	28	3.8 (14%)	3.9 (14%)	4.5 (16%)	6.0 (21%)	10.4 (37%)	14.9 (53%)
Queen City	30	2.2 (7%)	2.5 (8%)	3.0 (10%)	1.9 (6%)	1.1 (4%)	0.4 (1%)
Carrizo	67	6.7 (10%)	9.3 (14%)	--	10.2 (15%)	10.6 (16%)	11.4 (17%)
Calvert Bluff (Upper Wilcox)	149	-13.2 (-9%)	-11.2 (-8%)	-10.5 (-7%)	-9.4 (-6%)	-9.7 (-6%)	-10.7 (-7%)
Simsboro (Middle Wilcox)	318	9.4 (3%)	12.1 (4%)	11.8 (4%)	11.0 (3%)	9.5 (3%)	8.8 (3%)
Hooper (Lower Wilcox)	205	7.1 (3%)	7.3 (4%)	8.0 (4%)	9.1 (4%)	8.6 (4%)	6.0 (3%)

Evaluating DFC Compliance

Calculated Drawdown Values



Expected Drawdown if DFC is achieved

Evaluating DFC Compliance

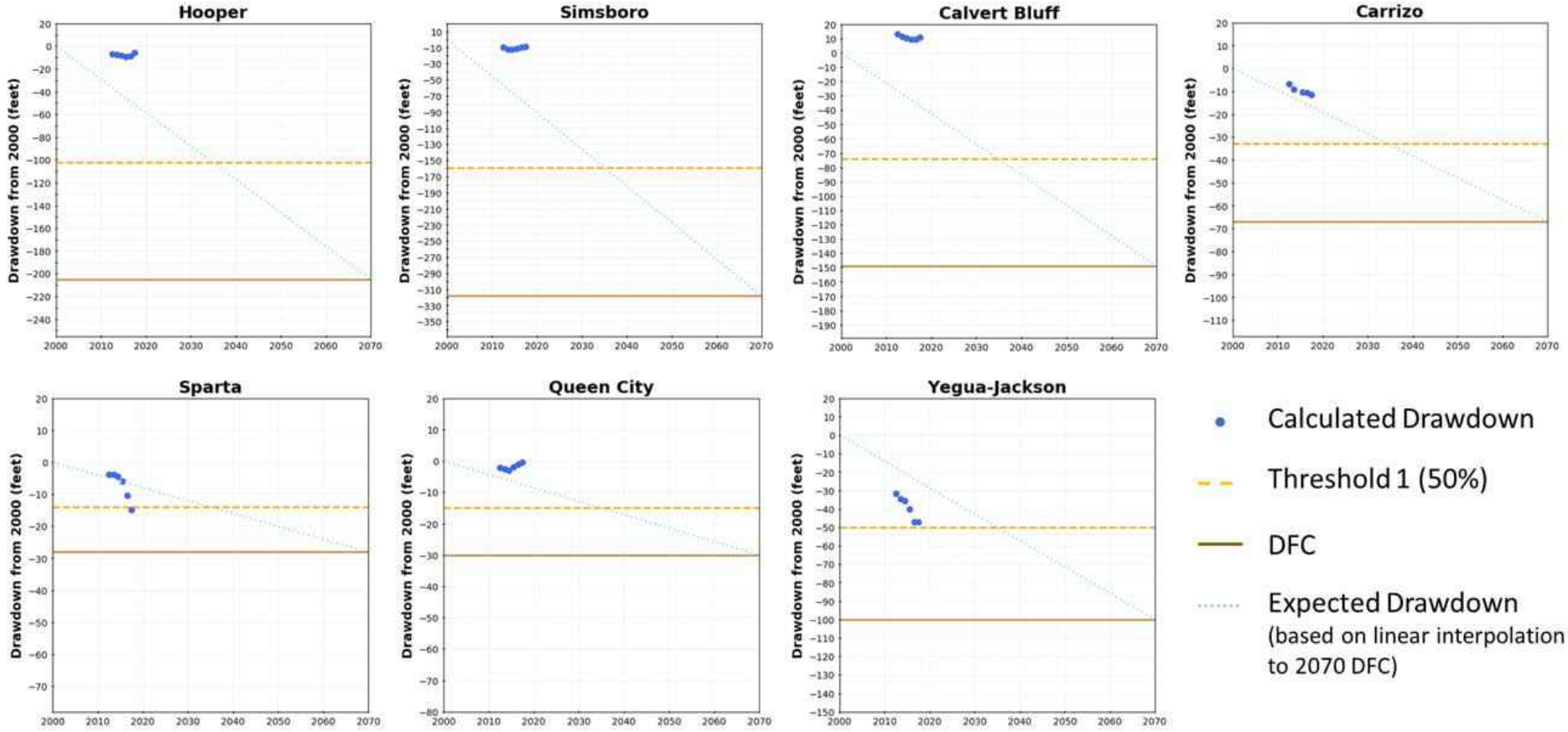
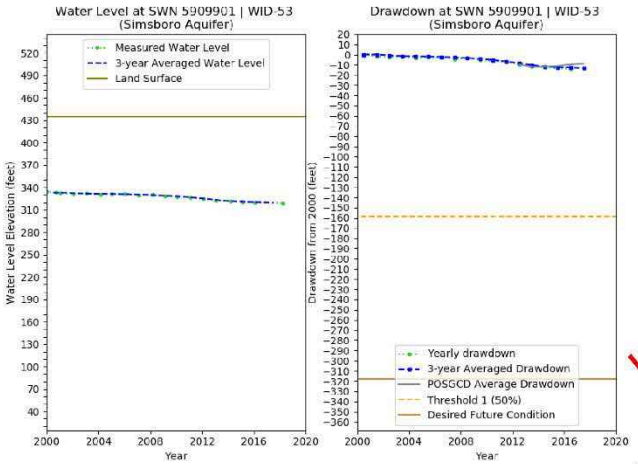
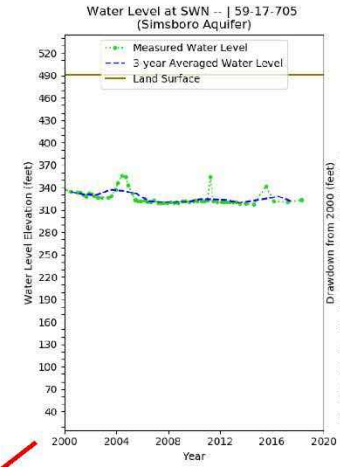
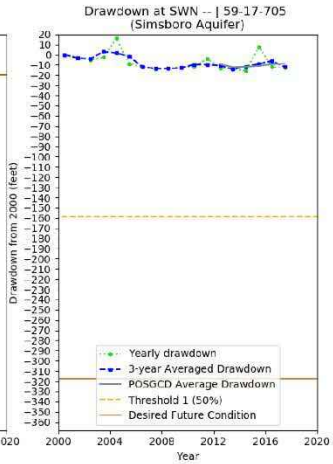


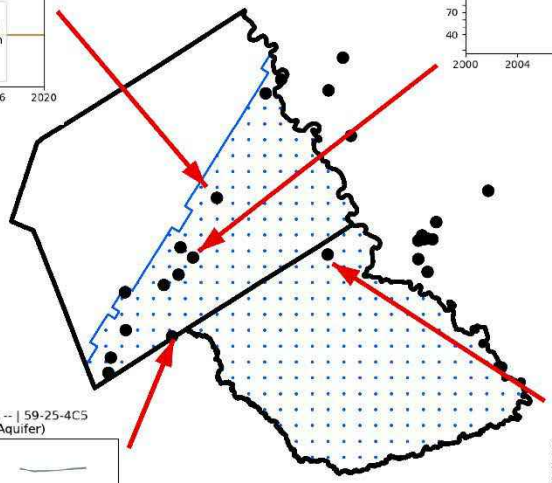
Figure 6-1 Status of DFC compliance by aquifer management zone

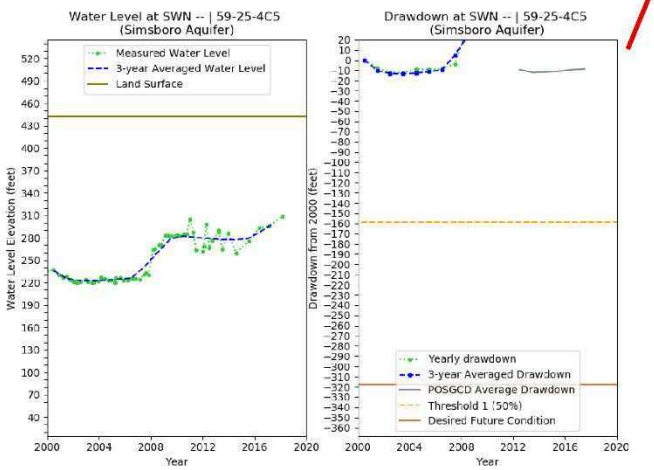
Creation of Individual hydrographs

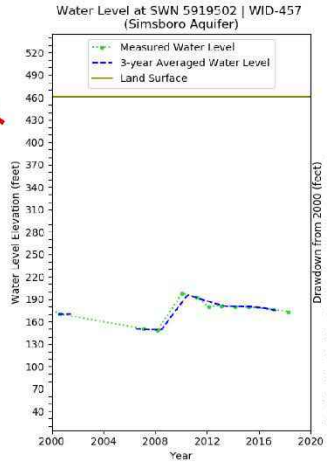


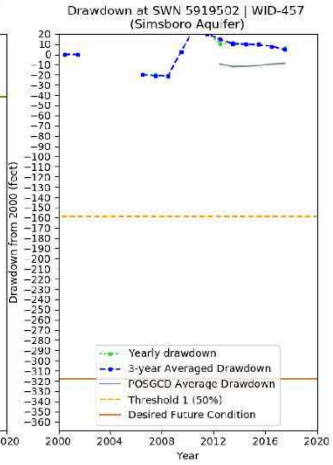




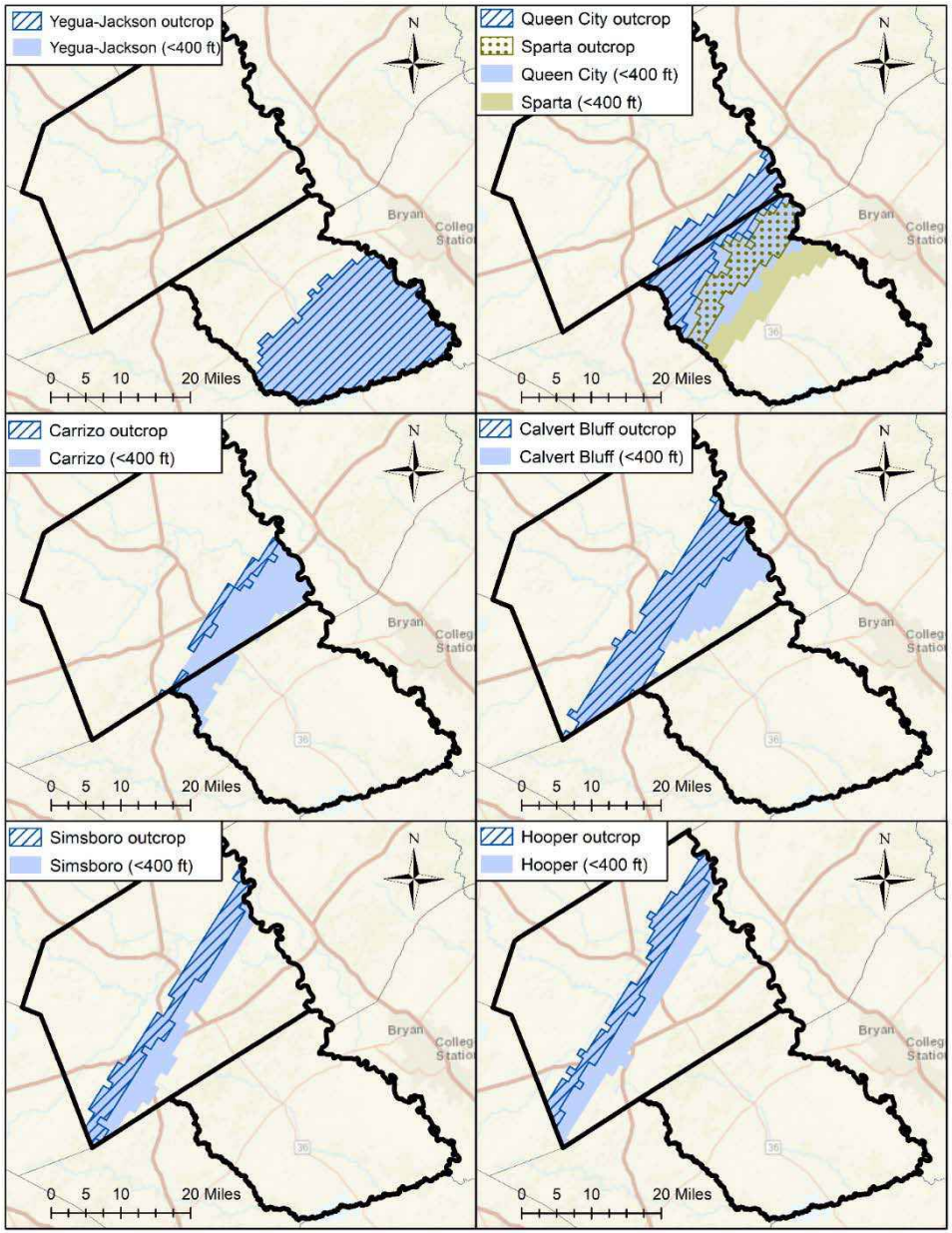








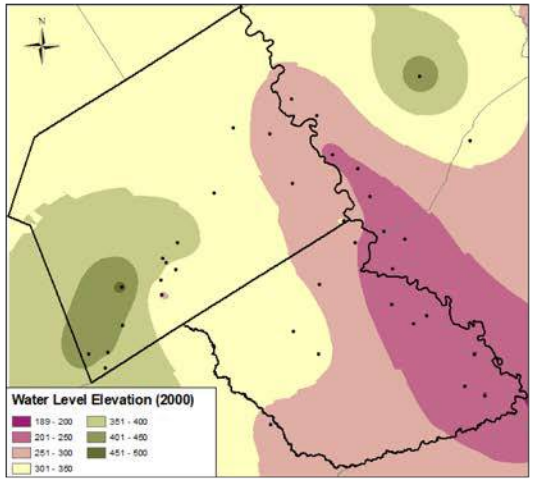
Protective Drawdown Limits (PDLs)



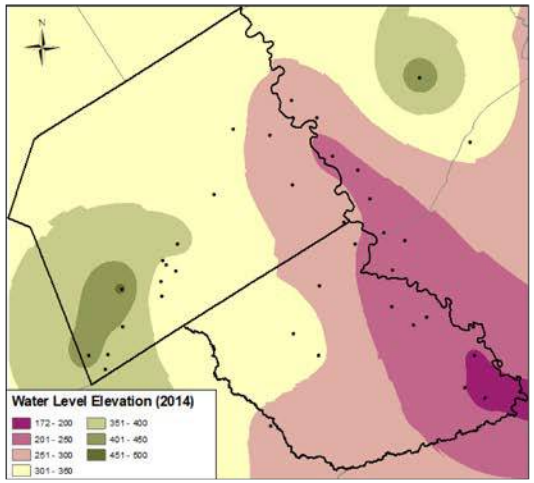
- Shallow Zone management
- Areas < 400 ft deep
- Potential to be adopted as future DFCs

Protective Drawdown Limits: Two-Dimensional Analysis (single layer)

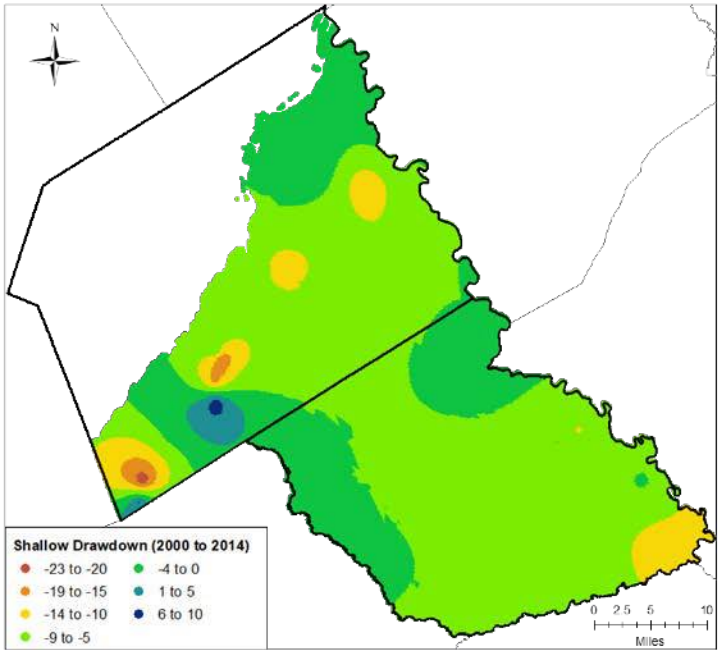
Interpolate Baseline (2000)
Shallow Water Level Surface



Interpolate Evaluation Year (2014)
Shallow Water Level Surface



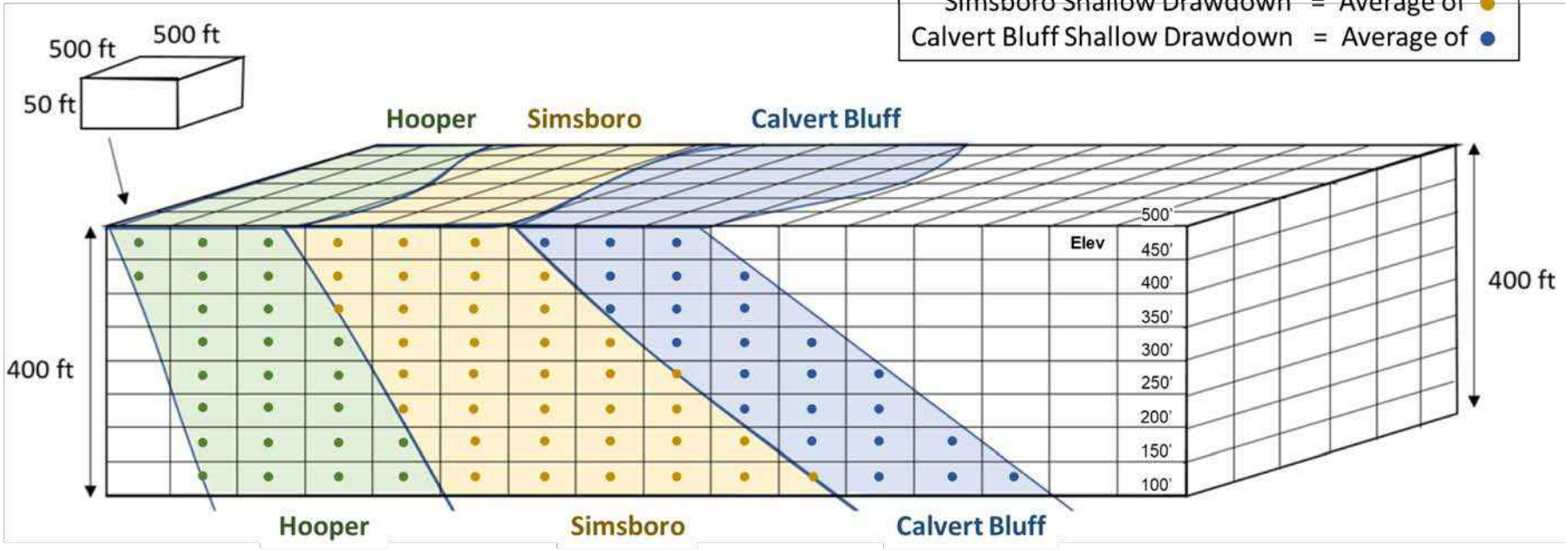
Calculate Shallow Drawdown Surface
(Evaluation Year – Baseline)



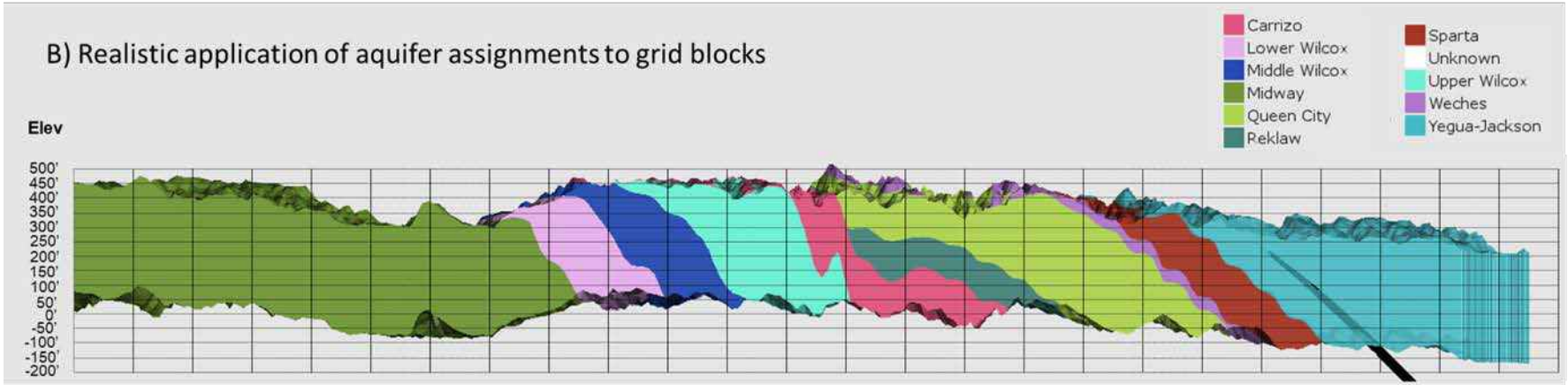
Protective Drawdown Limits: Three-dimensional analysis (multiple layers)

A) Idealized schematic of aquifer assignments to grid blocks

Hooper Shallow Drawdown = Average of
Simsboro Shallow Drawdown = Average of
Calvert Bluff Shallow Drawdown = Average of



B) Realistic application of aquifer assignments to grid blocks



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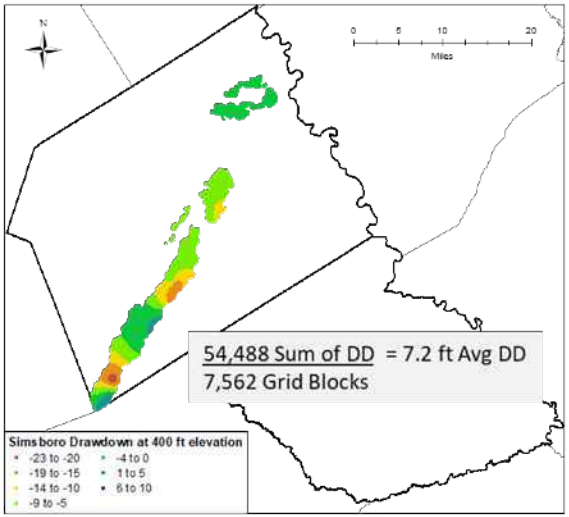
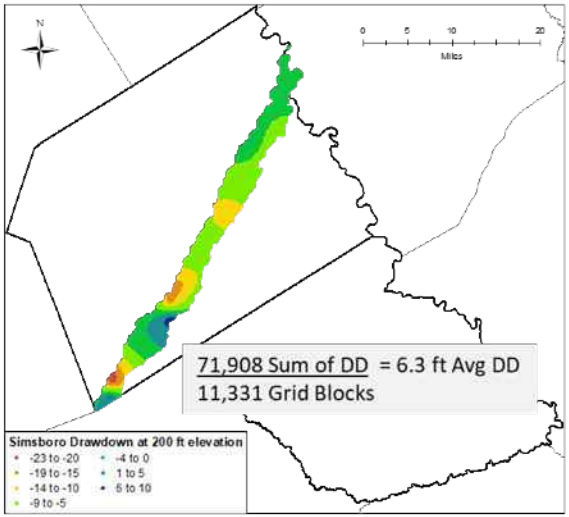
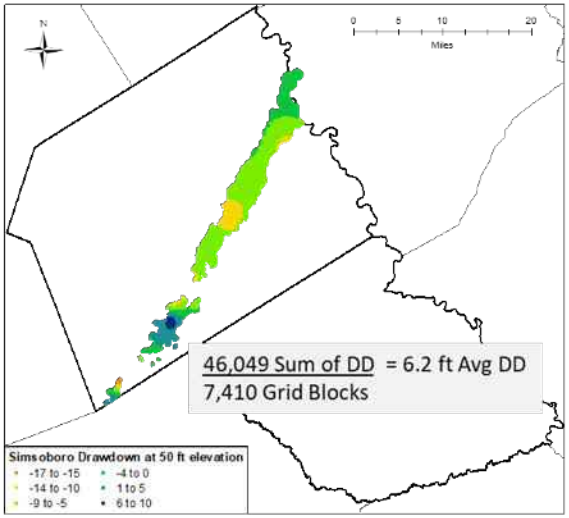
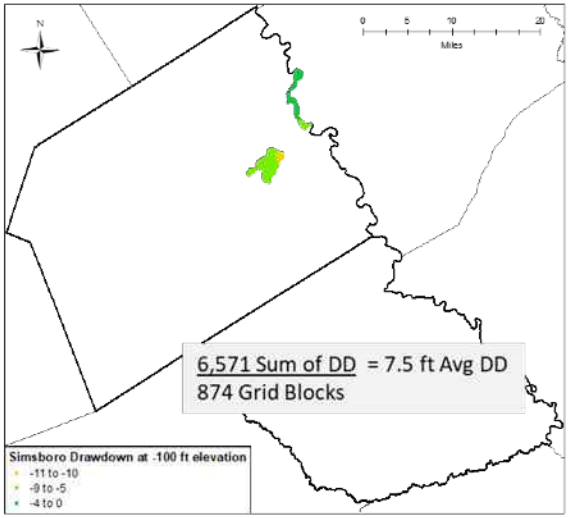
Protective Drawdown Limits (PDLs)









$$\frac{\text{Total Sum of Simsboro DD}}{\text{Total \# Simsboro Grid Blocks}} =$$

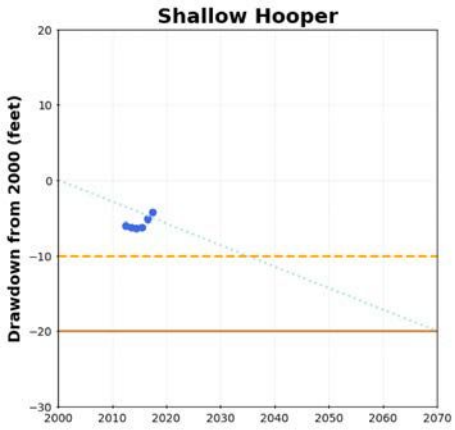
$$\frac{630{,}462}{94{,}110} = \textbf{6.7 ft Avg DD}$$

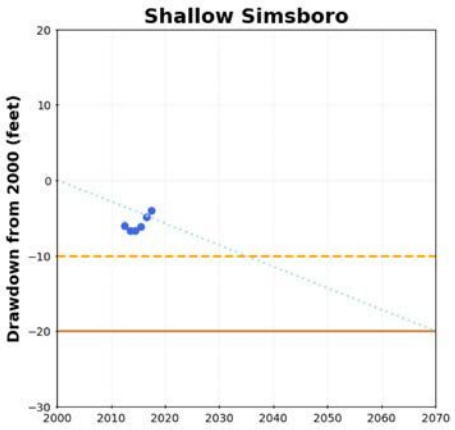
Evaluating PDL Compliance

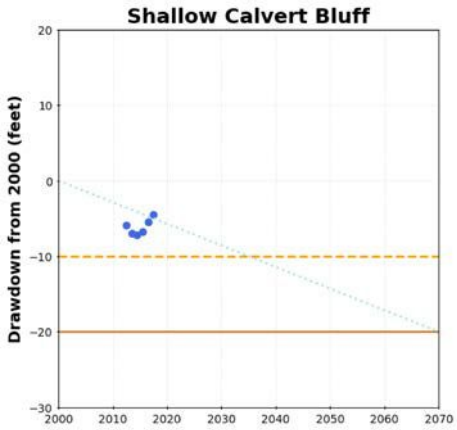
Table 6-2 Status of PDL compliance by shallow aquifer management zone (green text indicates compliance).

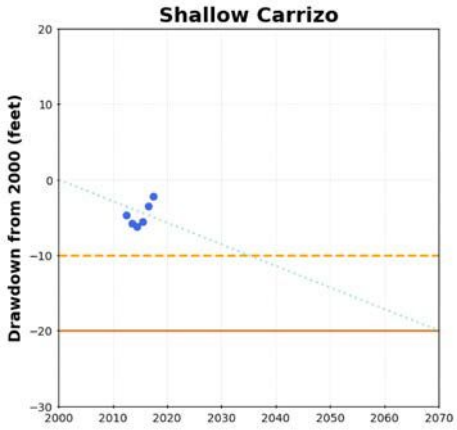
Management Zone	PDL	Drawdown from 2000 to 2012	Drawdown from 2000 to 2013	Drawdown from 2000 to 2014	Drawdown from 2000 to 2015	Drawdown from 2000 to 2016	Drawdown from 2000 to 2017
		Calculated Drawdown (% of DFC)	Calculated Drawdown (% of DFC)	Calculated Drawdown (% of DFC)	Calculated Drawdown (% of DFC)	Calculated Drawdown (% of DFC)	Calculated Drawdown (% of DFC)
Yegua Jackson	20	5.7 (29%)	6.4 (32%)	6.8 (34%)	7.3 (36%)	4.1 (21%)	3.1 (15%)
Sparta	20	4 (20%)	4.5 (22%)	4.9 (25%)	4.5 (22%)	3.1 (15%)	2.4 (12%)
Queen City	20	3.4 (17%)	4.1 (20%)	4.6 (23%)	4.1 (20%)	2.2 (11%)	1.2 (6%)
Carrizo	20	4.7 (23%)	5.8 (29%)	6.2 (31%)	5.6 (28%)	3.5 (18%)	2.2 (11%)
Calvert Bluff (Upper Wilcox)	20	5.9 (29%)	7 (35%)	7.2 (36%)	6.7 (34%)	5.5 (27%)	4.5 (22%)
Simsboro (Middle Wilcox)	20	6 (30%)	6.6 (33%)	6.7 (33%)	6.1 (31%)	5 (25%)	4 (20%)
Hooper (Lower Wilcox)	20	6 (30%)	6.2 (31%)	6.3 (32%)	6.2 (31%)	5.1 (26%)	4.3 (22%)

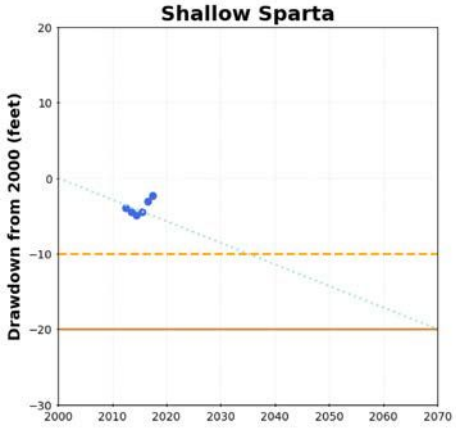
Evaluating PDL Compliance

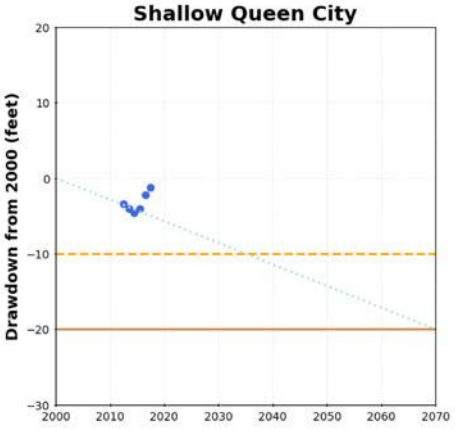


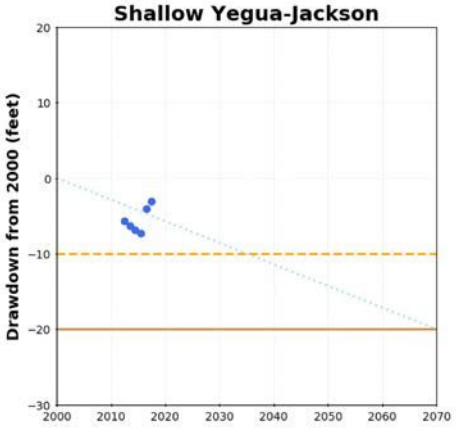












- Calculated Drawdown
- Threshold 1 (50%)
- PDL
- Expected Drawdown (based on linear interpolation to 2070 PDL)