

**STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION**

**APPLICATION OF APACHE CORPORATION FOR
APPROVAL OF A NON-STANDARD HORIZONTAL
WELL SPACING UNIT AND COMPULSORY POOLING,
LEA COUNTY, NEW MEXICO.**

Case No. 24141

**APPLICATION OF AVANT OPERATING, LLC
FOR COMPULSORY POOLING AND APPROVAL
OF NON-STANDARD SPACING UNIT,
LEA COUNTY, NEW MEXICO**

Case No. 24254

APACHE'S REBUTTAL EXHIBITS

Apache Corporation ("Apache") (OGRID No. 873) submits the following rebuttal exhibits that its witnesses may refer to during the contested hearing scheduled in these cases on May 29, 2024.

Rebuttal Land Exhibits

Slide 30 – Updated Development Plan Preparation Timeline

Slide 31 – Working Interest Control Rebuttal

Rebuttal Geology Exhibits

Slide 32 – Tight Spacing 1BSS: Apache v. Avant

Slide 33 – Tight Spacing 2BSS: Apache v. Avant

Slide 34 – Tight Spacing 3BSS: Apache v. Avant

Slide 35 – 4-String Capitan

Rebuttal Petroleum Engineering Exhibits

Slide 36 – Typical Development Well Spacing Over Time

Slide 37 – EUR Prediction Using Limited Production Data

Slide 38 – Performance Degradation at Tighter Spacing

Slide 39 – Golden Tee 3BSS Results

Slide 40 – Avant’s Full Bench Development Approach

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that on May 28, 2024, I served a copy of the foregoing document to the following counsel of record via Electronic Mail to:

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Adam G. Rankin

Apache Rebuttal Slide 30

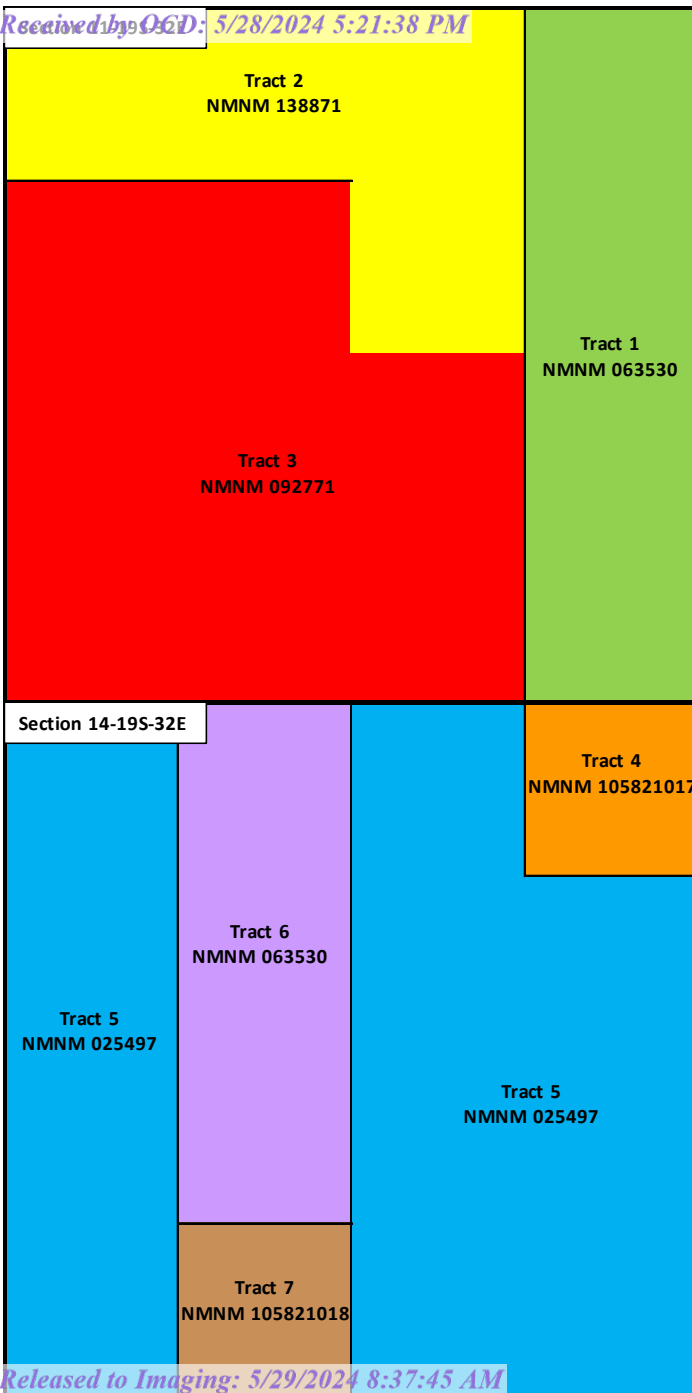
Development Plan Preparation Timeline

- **August 2022:** Apache nominated 80 open acres in tracts 4 and 7 in Section 14 for next available BLM sale. Auction held May 2023.
- **August 2023:** Begin discussions with BLM regarding Lesser Prairie Chicken.
- **September 2023:** Surveyors begin working on updated plats; brokers and Title Attorney begins title update. Detailed well proposal, AFEs and JOA sent to working interest owners for 1st BSS and 2nd BSS development.
- **October 2023- BLM APD's submitted 10.23.23 for all 8 Apache wells**
- **Earliest Avant permit submitted to BLM February 2024**
 - **Latest April 2024**
- **Late 2023:** Begin discussions with midstream companies; 4 proposals now in hand
- **January 2024- Apache files for compulsory pooling 1.2.24**
- **February 2024- Avant files for compulsory pooling 2.6.24**
- **December 2024:** Projected spud for Dustbowl wells; spud will be no later than March 2025 due to term assignment.
 - When permits issue and OCD pooling orders granted, Apache plans to accelerate this development

Received by OGD: 5/28/2024 5:21:38 PM

Rebuttal Working Interest

Avant misrepresented the actual ownership they own or control by 22.3%



Avant

- Avant et al current ownership- Represented by exhibit A-17 38.62%
- Avant et al actual Ownership without Northern Oil and Gas =22.91% (38.62% - 15.71%)
- Avant is representing to own 15.71% more interest than they actually do
- Avant represented controlled WI= 49.78%
- Sum of parties who have executed Avant’s JOA and not Apache= 4.57%
- Actual total controlled by Avant to date **27.48%**
 - (Avant WI + Parties executing only Avant JOA)

****CXA and SW Royalties executed Apache JOA- Avant can’t claim they only support Avant***

Apache

- Apache et al current WI based on Apache title= 46.01%
- Apache et al current WI based on Avant title= 48.85%
- Actual total WI controlled by Apache to date **46.31%** (Based on Apache title)
 - (APA WI + Parties executing only APA JOA)

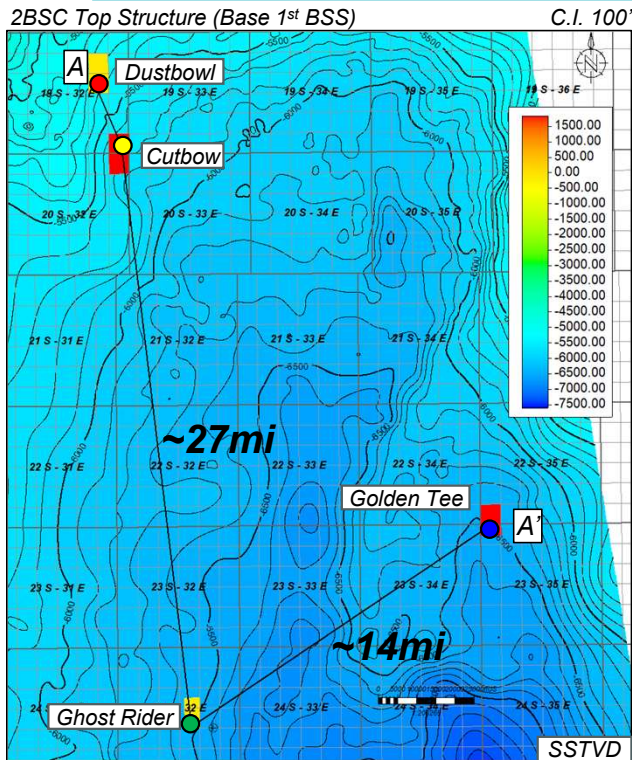
****CXA and SW Royalties executed Apache JOA- Avant can’t claim they only support Avant but for purposes of this discussion their interest was taken out of actual WI controlled by Apache***

Apache controlled WI **46.31%** vs Avant’s controlled WI **27.48%**

Apache controls 18.83% more working interest than Avant

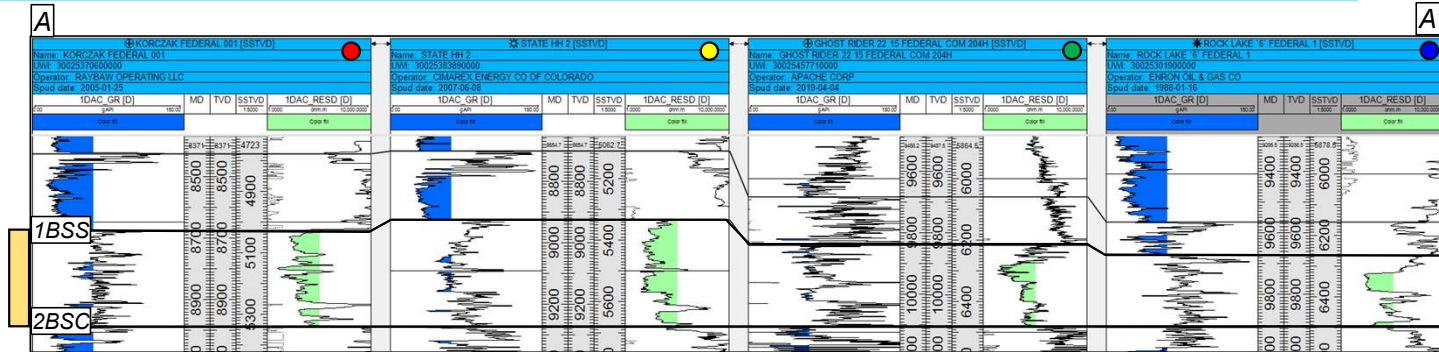
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REBUTTAL Tight Spacing 1st BSS: APA vs Avant

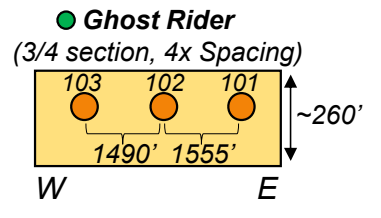
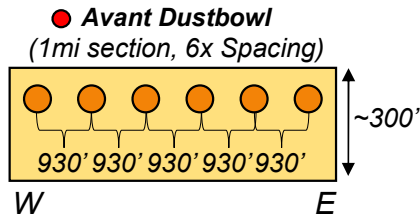
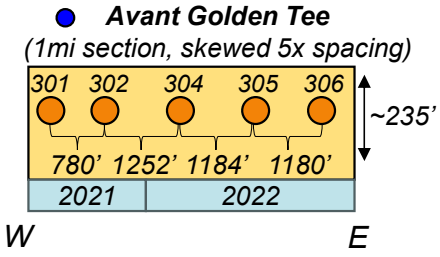
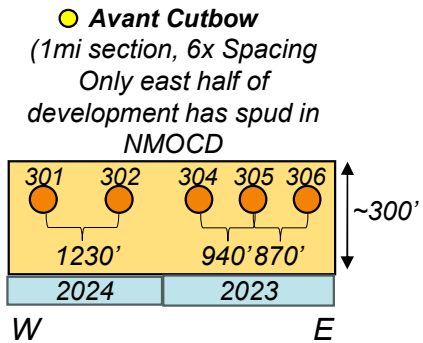
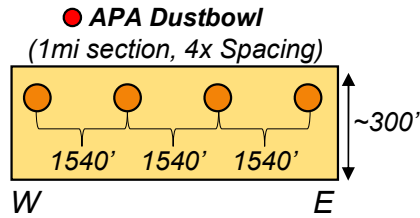


-APA developed Ghost Rider at 4x spacing
 -APA will develop Dustbowl at 4x spacing due to:

- Similar thickness and target quality



Flattened on Second Bone Spring Carbonate



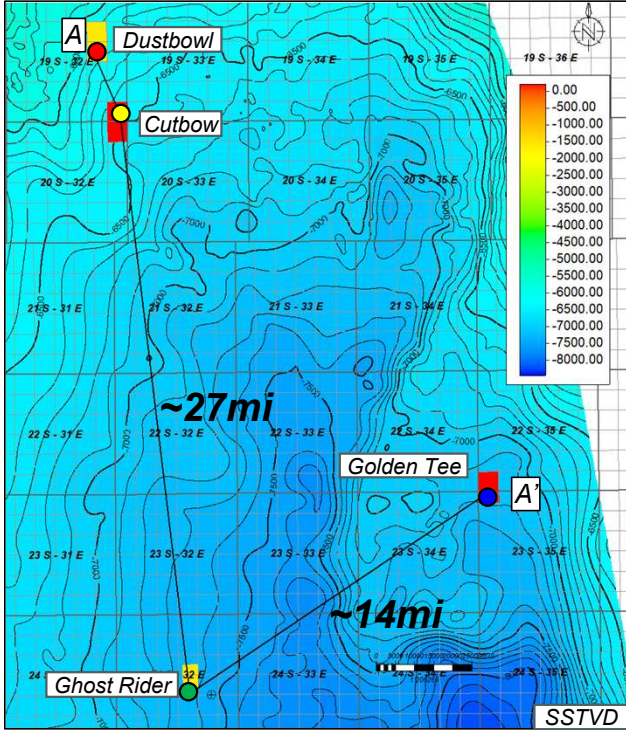
*According to NMOCD well search 5/24/24

Apache Rebuttal Slide 33

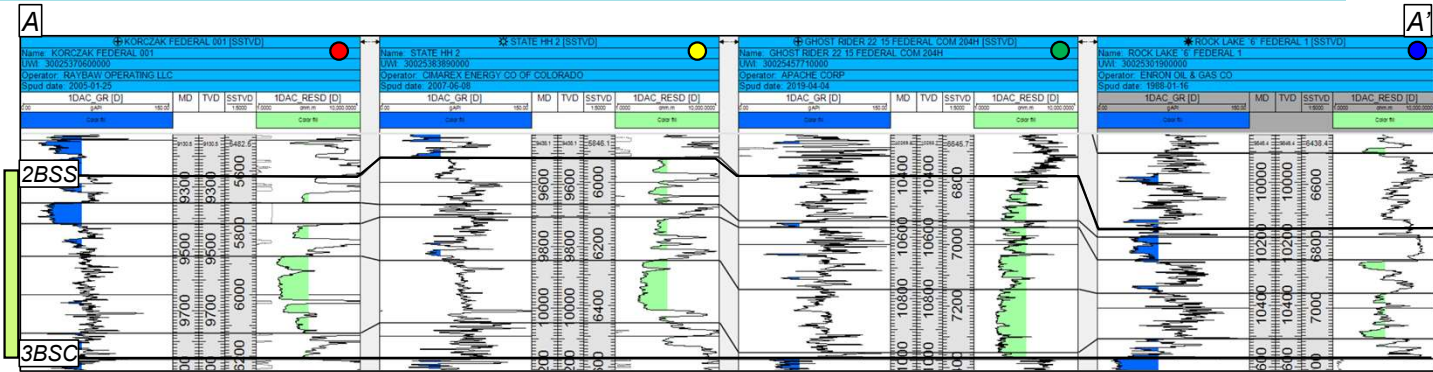
REBUTTAL Tight Spacing 2nd BSS: APA vs Avant

3BSC Top Structure (Base 2nd BSS)

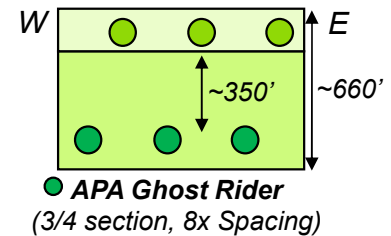
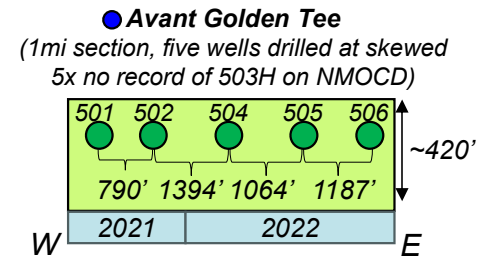
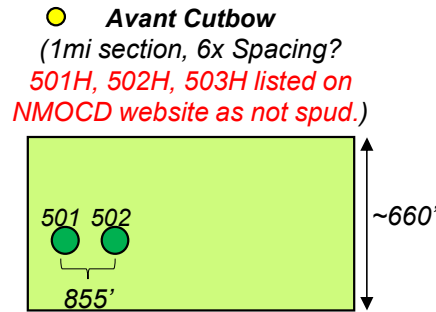
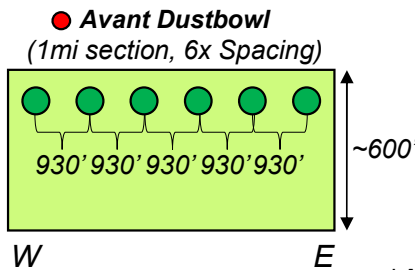
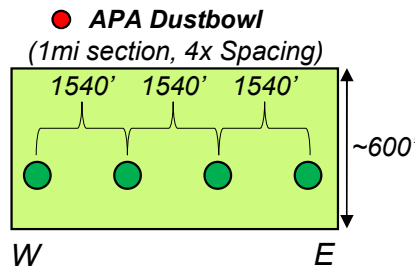
C.I. 100'



- APA developed Ghost Rider at 8x spacing (winerack)
- APA will develop Dustbowl at 4x spacing due to:
 - Shallower depth (1200' SSTVD)
 - Thinner Lower 2nd BSS sand package
 - Carbonate increase in 2nd BSS
 - Carbonate increase in 2BSC



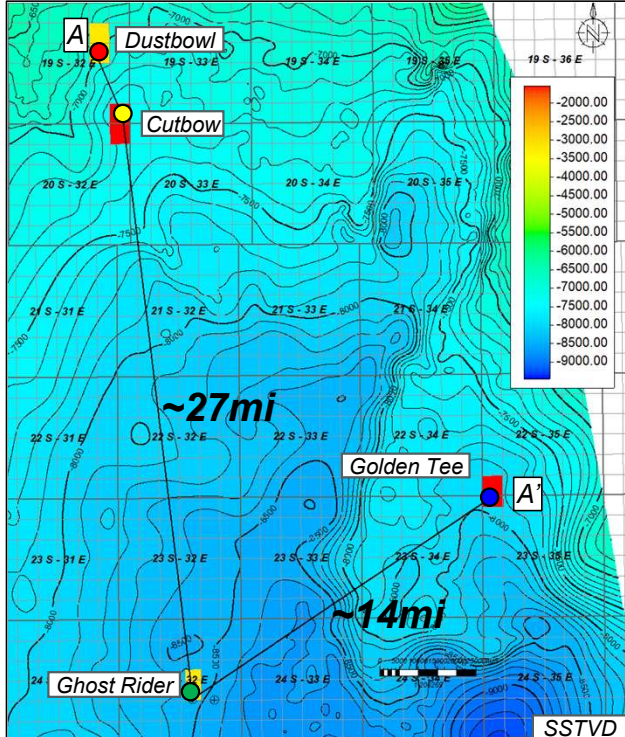
Flattened on Third Bone Spring Carbonate



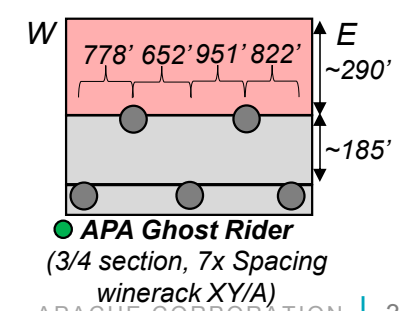
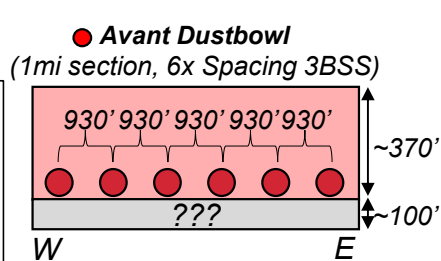
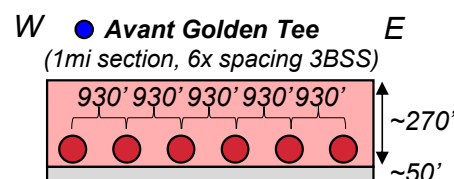
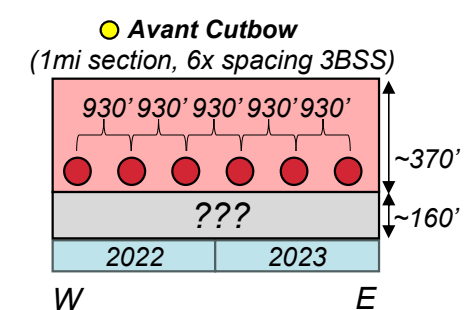
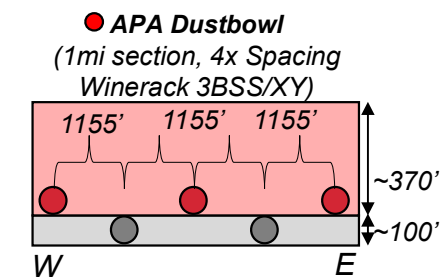
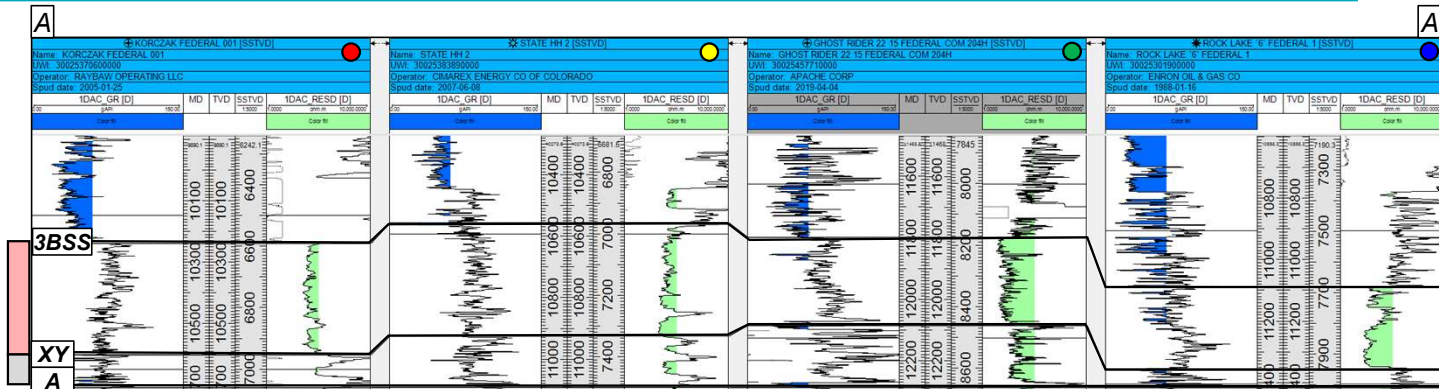
*According to NMOCD well search 5/24/24

REBUTTAL Tight Spacing 3rd BSS: APA vs Avant

Wolfcamp XY Top Structure (Base 3rd BSS) C.I. 100'



- APA developed Ghost Rider at 7x spacing Wolfcamp XY/A sands (winerack)
- APA will develop Dustbowl by wineracking 3BSS and XY at 5x spacing due to:
 - Thicker 3BSS package
 - Thinner WC Sands package



*According to NMOCD well search 5/24/24

Rebuttal 4-String Capitan

*June 21, 2023

From: Flores, Sorina
 Sent: Wednesday, June 21, 2023 11:33 AM
 To: Rutley, James S <jrutley@blm.gov>; Watland, Keely M <kwatland@blm.gov>
 Subject: RE: [EXTERNAL] New wells - Dustbowl

Great news!! Thank you!

SORINA FLORES
 APACHE CORPORATION
 US Onshore Operations
 3810 West 42nd Street, Suite 1000
 Midland, TX 79705

From: Rutley, James S <jrutley@blm.gov>
 Sent: Wednesday, June 21, 2023 11:32 AM
 To: Flores, Sorina <Sorina.Flores@apachecorp.com>; Watland, Keely M <kwatland@blm.gov>
 Subject: Re: [EXTERNAL] New wells - Dustbowl

Good Morning Sorina,

Hope you're doing fabulous!

Photos: No
 Capitan Reef: Yes
 4 String Design: No

Kind regards,
 Jim

From: Flores, Sorina <Sorina.Flores@apachecorp.com>
 Sent: Wednesday, June 21, 2023 10:05 AM
 To: Watland, Keely M <kwatland@blm.gov>; Rutley, James S <jrutley@blm.gov>
 Subject: [EXTERNAL] New wells - Dustbowl

This email has been received from outside of DOI. Use caution before clicking on links, opening attachments, or responding.

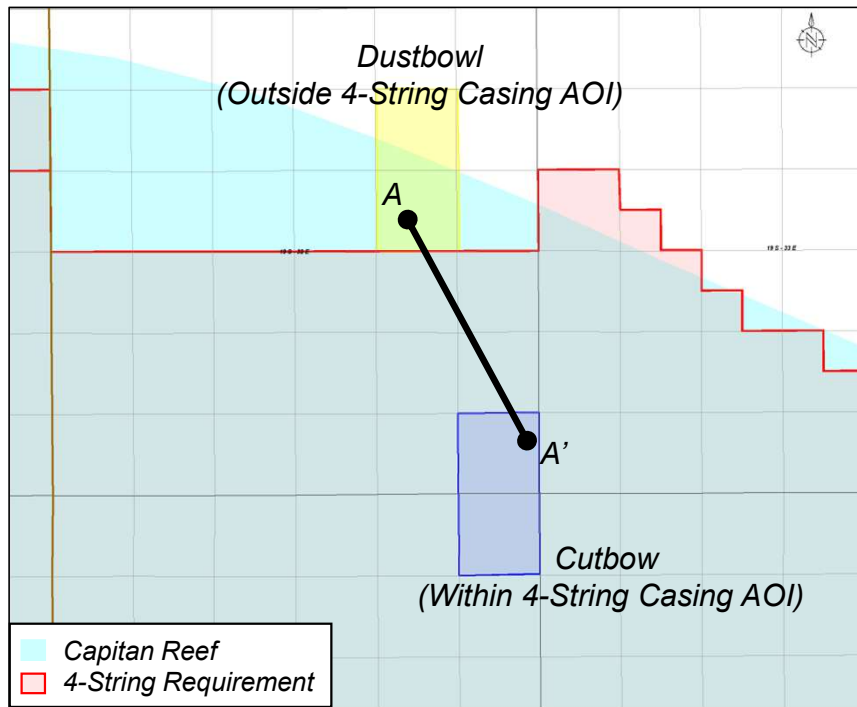
Apache is planning to drill wells at the Dustbowl lease in 2025. Wells are in the following:
 SHL Sec 14 T19S R32E
 BHL Sec 11 T19S R32E

Wanted to double check on the following as I could not locate on any of the maps online:
 (I'm pretty sure all of these are yes)
 Potash - Y/N
 Capitan Reef - Y/N
 4 String Design - Y/N

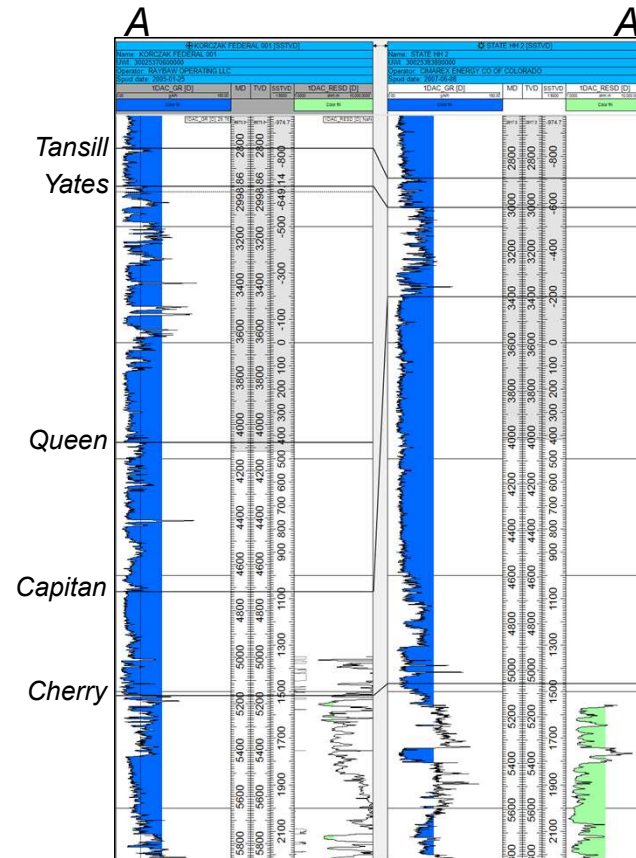
I did find we are LPC and sage brush areas. Are we subject to the LPC timing? Appreciate your help!

SORINA L. FLORES
 REGULATORY ANALYST
 US Onshore Operations
 4810 West 42nd Street, Suite 1000
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 APACHE CORPORATION
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 ReachOut@apache.com | LinkedIn | Facebook | Twitter | Instagram | YouTube

Dustbowl acreage relating to 4-string casing requirement boundary



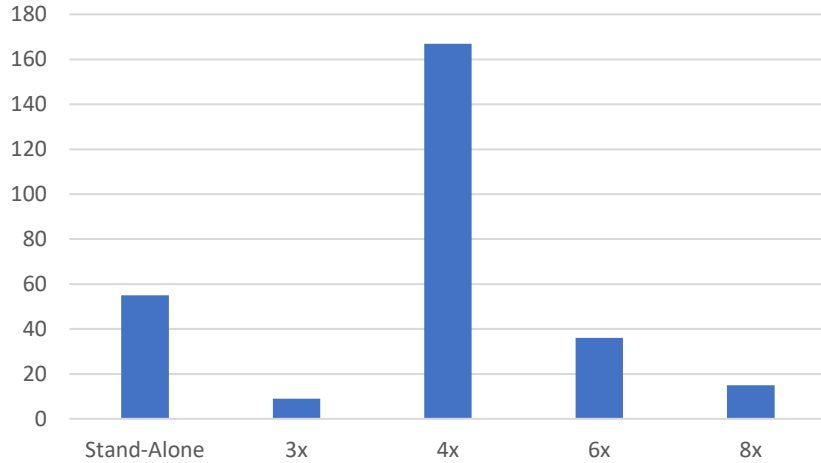
*4-string shapefile received from BLM on 4/10/24



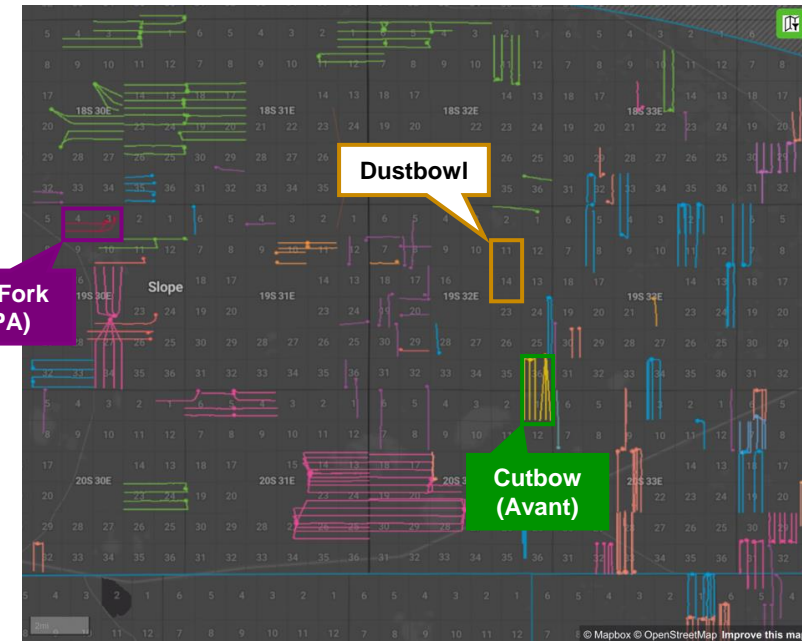
Typical Development Well Spacing

All Operators

Spacing by Well Count



Avant's Cutbow 3BSS Development



- Vast majority of operators are developing their respective pads at 4x spacing
- Stand-Alone wells are likely step out development tests
- The Well Per Section by Year plot in the middle shows a standard appraisal progression whereby operators test higher spacing densities (2019 & 2020), then adjust according to results
 - This demonstrates that almost all operators within the AOI agree that 4x spacing is ideal

Source: Enverus on 3/13/2024

*Data filtered to 1st, 2nd, & 3rd Bone Springs Landing Zone post 1/1/2015 First Production Date

Rebuttal – EUR Prediction Using Limited Production Data

Response to Avant’s practice of providing deterministic EUR values from wells producing <1 year shown in exhibits **C-3, C-4, C-15**, and suspected others.

The below chart shows a study conducted in 2020 which shows that using early production (<1yr) for predicting EUR is highly uncertain and unreliable.

$$\% \Delta EUR (tk - t24) = \frac{|EUR_{t24} - EUR_{tk}|}{EUR_{t24}} \times 100 \quad \text{with } k = 6, 12, 18 \text{ and } 24$$

t-step	Duong		Power Law		Stretched Exponential	
	Mean value	IQR value	Mean value	IQR value	Mean value	IQR value
6	78%	82%	66%	71%	64%	71%
12	20%	15%	16%	12%	15%	12%
13	18%	14%	15%	12%	15%	11%
14	18%	11%	15%	11%	14%	10%
15	17%	9%	14%	6%	13%	5%
16	14%	8%	12%	3%	11%	2%
17	13%	7%	10%	0%	9%	0%
18	12%	7%	8%	0%	7%	0%

Table 4. Oil wells results #3 (using Duong, Power Law and Stretched Exponential equations)

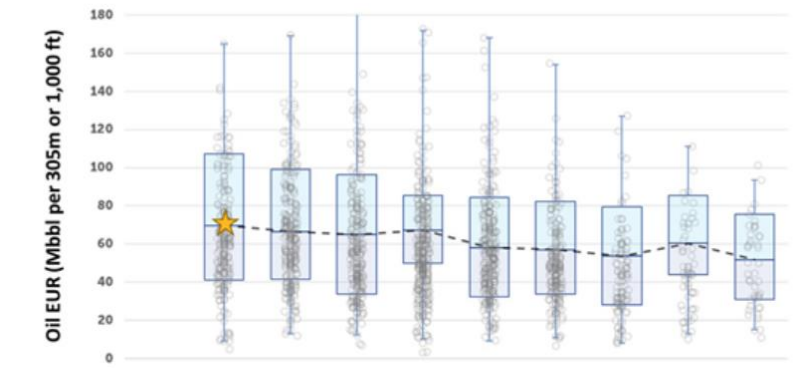
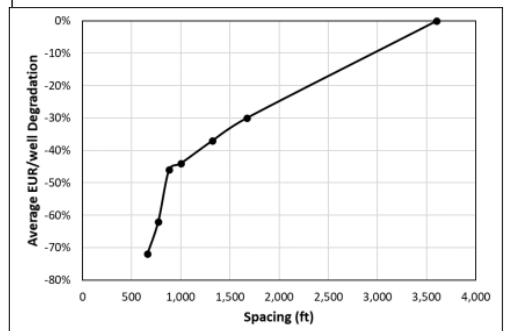
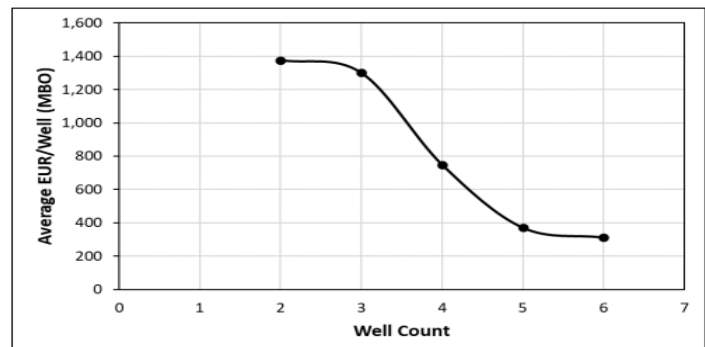
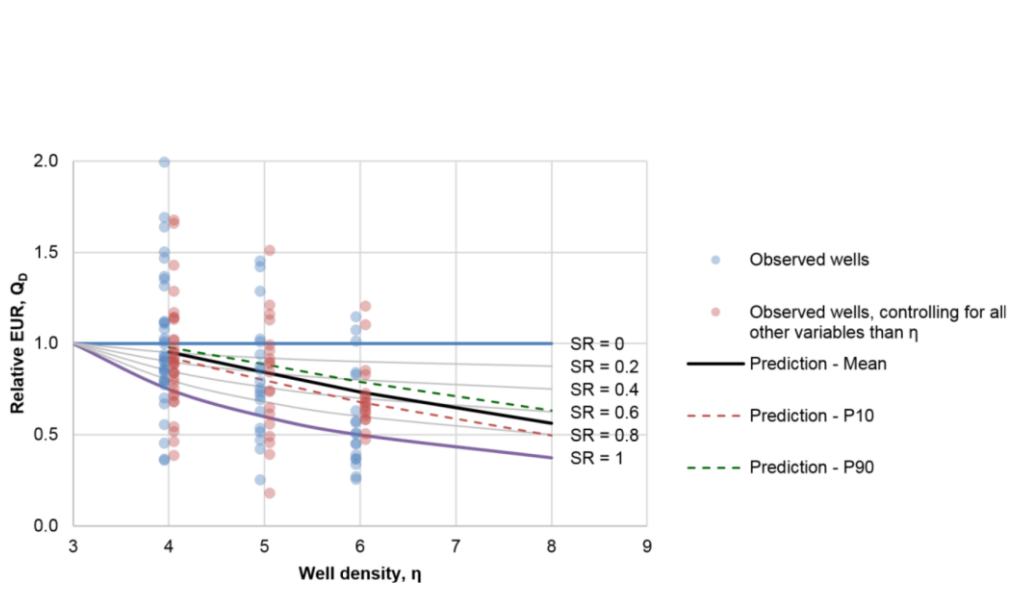
Sources:

- 1) Terminiello, Agustín, Crespo, Pablo, and Matías Nasca. "Evaluating the Performance of Decline Curve Analysis Equations During the Early Life of a Well Through the Quantification of the Uncertainty Associated With the Estimated Ultimate Recovery in a Shale Oil and Gas Formation." Paper presented at the SPE/AAPG/SEG Latin America Unconventional Resources Technology Conference, Virtual, November 2020. doi: <https://doi.org/10.15530/urtec-2020-1518>

Rebuttal – Well Performance Degradation at Tighter Spacing

Response to Avant’s attestation that 6x spacing wells will exhibit no deterioration compared to 4x spacing wells as shown in exhibits C-3, C-4, C-5, C-8, C-12, C-14 and C-15. Response to Avant’s practice of using loosely spaced wells (standalone & 2x spacing) as reasonable analogs for their 6x proposed development as shown in exhibits C-12, C-14, and C-15.

The images below are from three studies conducted over the past 6 years. They all make the same statement; as the number of wells in a section increases, the EUR per well decreases.



WPS, Same Zone	2	3	4	5	6	7	8	9	10
No. Wells	58	37	35	23	25	31	22	16	12
Avg T/m	2.8	2.8	2.9	2.7	2.9	2.9	3.0	2.9	2.9
Oil EUR (Mbbbl/305m)	70	66	65	67	58	57	54	60	52
P10/P90	2.6	2.4	2.8	1.7	2.6	2.4	2.8	2.0	2.4
% EUR Degradation*		-5%	-7%	-4%	-17%	-18%	-23%	-14%	-26%

Benchmark

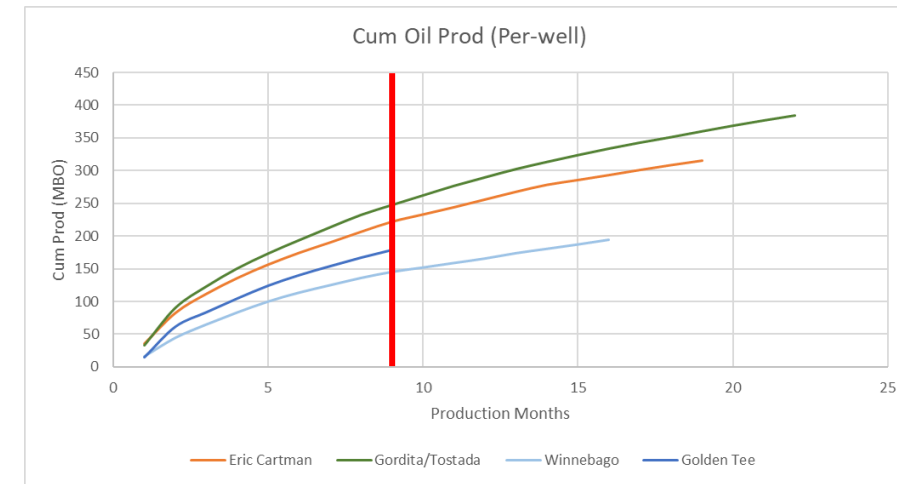
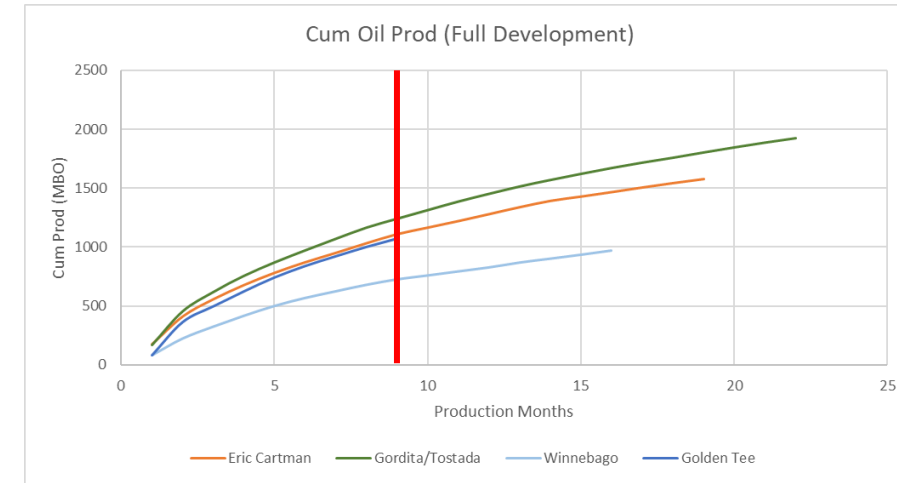
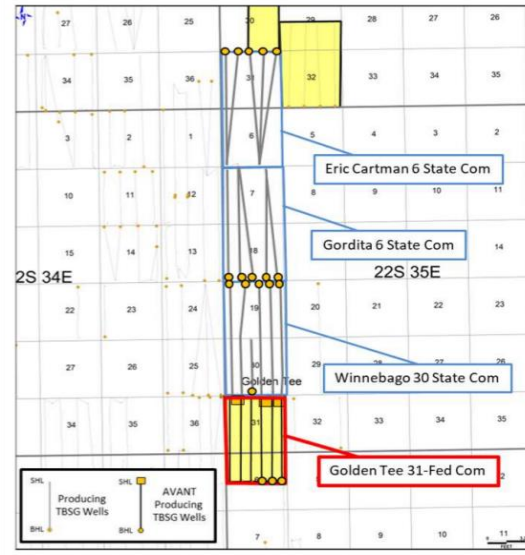
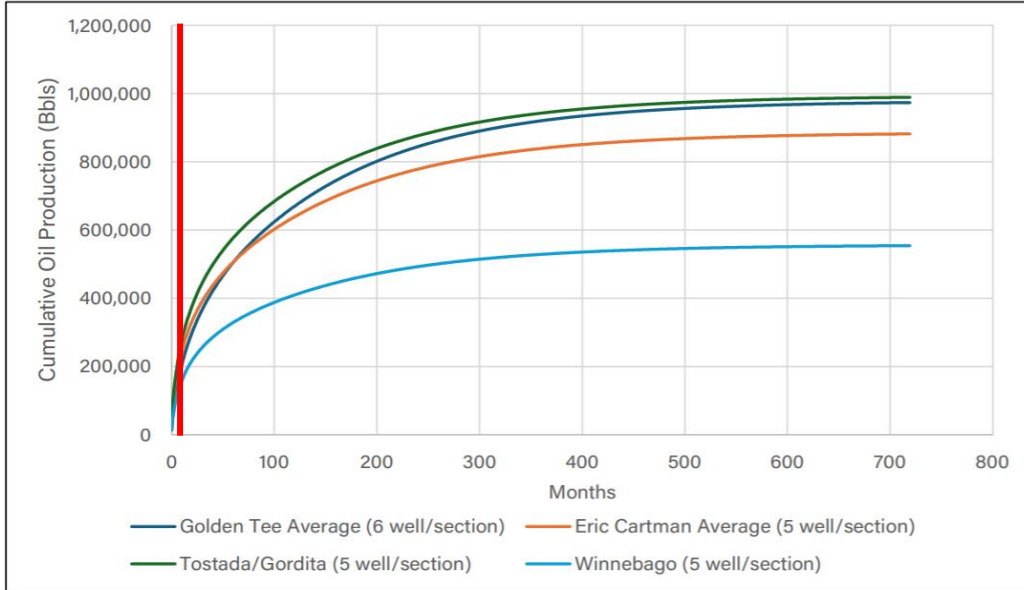
Fig. 23 – EUR degradation as function of well spacing for 2nd Bone Spring

Sources:

- 1) Hassen, Ryan A., Fulford, David S., Burrows, Clayton T., and Gregory P. Starley. "Decision-Focused Optimization: Asking the Right Questions About Well-Spacing." Paper presented at the SPE Liquids-Rich Basins Conference - North America, Midland, Texas, USA, September 2018. doi: <https://doi.org/10.2118/191783-MS>
- 2) Pradhan, Yogashri, Lee, W. John, Lam, Duc, Hanna, Kyle, Nguyen, Thuy, and Andrew (Quang) Tran. "Forecasting Well-to-Well Interference in the Permian Basin by Applying Neural Networks on Pre-Run Simulations." Paper presented at the SPE/AAPG/SEG Unconventional Resources Technology Conference, Houston, Texas, USA, June 2022. doi: <https://doi.org/10.15530/urtec-2022-3723394>
- 3) Miller, Patrick, Redpath, Darcy, and Keane Dauncey. "No Reservoir Model? No Problem. Unconventional Well Spacing Optimization With Simple Tools." Paper presented at the SPE Canadian Energy Technology Conference, Calgary, Alberta, Canada, March 2022. doi: <https://doi.org/10.2118/208882-MS>

Rebuttal – Golden Tee 3BSS Results

Response to Avant's statement that the Golden Tee 3BSS results indicate "significant outperformance ... relative to other nearby units" as shown in exhibit C-4.



From Avant Exhibit C-4

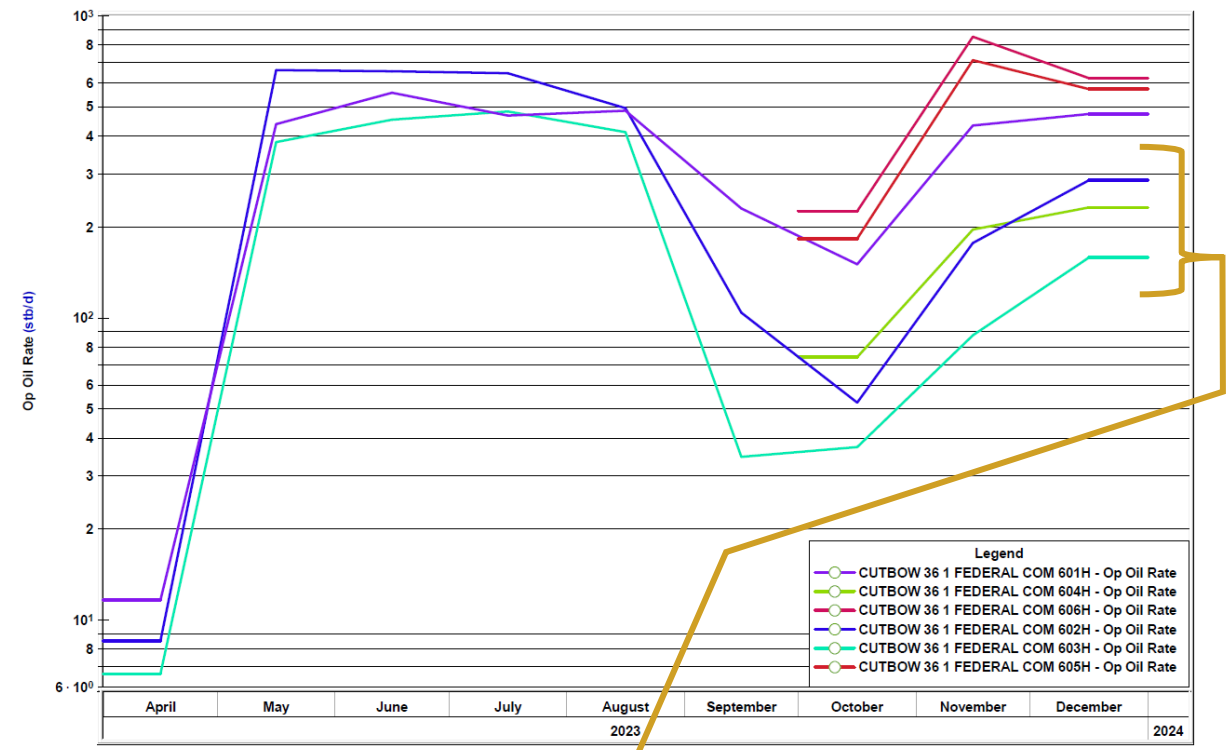
- The images in the center and left are from Avant's Exhibit C-4, attempting to show outperformance in their 3BSS Golden Tee wells compared to offsets
 - A red line is superimposed above last date of available public production data from Golden Tee on the left and right plots
- On the left, attempting to accurately predict well EUR based on 9 months of production history is not industry standard based on extreme uncertainty, as supported by Apache Rebuttal slide 31
- On the right, note that even after crediting Golden Tee production with a 1.33x factor (due to difference in lateral length), they clearly do not exhibit "significant outperformance" vs two out of three offset developments
 - The top right plot shows that when looking at the full development, Golden Tee performs below 2 out of 3 offset developments
 - The bottom right plot shows that when looking at per-well performance, the Golden Tee wells show notable degradation
 - This degradation is noted in academic papers (Rebuttal slide 32) and has NOT been incorporated into any of Avant's calculations

Rebuttal – Avant’s Full Bench Development Approach

- Initial 3 wells POP 2Q23, next 3 wells were POP 4Q23 after frac hitting their parent wells, causing damage
- No effort made by Avant at Cutbow from inception to date to develop a single bench in one program, destroying value

Well	Landing Zone	Spud Date	Completion Date	Program	Comments
CUTBOW 36 1 FEDERAL COM 601H	3rd Bone Spring	10/7/2022	3/28/2023	Development 1	Frac hit by development 2
CUTBOW 36 1 FEDERAL COM 602H	3rd Bone Spring	10/9/2022	3/28/2023	Development 1	Frac hit by development 2
CUTBOW 36 1 FEDERAL COM 603H	3rd Bone Spring	9/27/2022	3/28/2023	Development 1	Frac hit by development 2
CUTBOW 36 1 FEDERAL COM 604H	3rd Bone Spring	7/4/2023	9/26/2023	Development 2	Frac hit development 1
CUTBOW 36 1 FEDERAL COM 605H	3rd Bone Spring	7/5/2023	9/26/2023	Development 2	Frac hit development 1
CUTBOW 36 1 FEDERAL COM 606H	3rd Bone Spring	7/6/2023	9/26/2023	Development 2	Frac hit development 1
CUTBOW 36 1 FEDERAL COM 304H	1st Bone Spring	11/28/2023	2/4/2024	Development 3	Will be frac hit by development 4
CUTBOW 36 1 FEDERAL COM 305H	1st Bone Spring	11/29/2023	2/4/2024	Development 3	Will be frac hit by development 4
CUTBOW 36 1 FEDERAL COM 306H	1st Bone Spring	11/26/2023	2/4/2024	Development 3	Will be frac hit by development 4
CUTBOW 36 1 FEDERAL COM 301H	1st Bone Spring	3/7/2024		Development 4	Will frac hit development 3
CUTBOW 36 1 FEDERAL COM 302H	1st Bone Spring	3/28/2024		Development 4	Will frac hit development 3
CUTBOW 36 1 FEDERAL COM 501H	2nd Bone Spring	3/14/2024		Development 4	
CUTBOW 36 1 FEDERAL COM 502H	2nd Bone Spring	4/9/2024		Development 4	

Cutbow Daily Oil Rate (3rd Bone Spring)



Clear degradation of interior wells