

# Powder River Basin

## Q4 Sample Report



PLS  **Derrick**



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## Activity Overview

1. Current Hz rig count has rebounded to Q1 2015 levels at ~22 from only one rig running in Q2 2016.
2. The Powder River Basin's rig count was hit hard by the downturn, but impressive well results and talks of stacked pay potential drove a massive influx of private equity backed E&P's into the basin.
3. Wells that came online in 2017 are reaching 200 Mboe in just 12 months, four times faster than wells that came online in 2014.
4. Like most unconventional-focused basins, longer laterals with larger frac treatments have greatly improved well performance. Different completion treatments have been utilized in each formation.
5. The hype around stacked-pay has yet to be realized, and fairways of single-zone delineation are still prevalent. A major transition from delineation to developmental mode appears to be a few years out for most operators.
6. There is a Tier 1 fairway along the Campbell and Converse county border.
7. The Turner stands out as the best formation in terms of well economics across the play, and it has been the most delineated formation across the Powder.
8. Over 80% of Hz spuds are focused in the Turner, Parkman, and Niobrara formations. Other sandstones in the Powder can have been proven viable but have sweet spots and can only be considered as localized targets.
9. The Mowry shale, another source rock below the Niobrara, has been tested for additional stacked pay potential by a few operators. EOG is leading the pack with Mowry delineation.

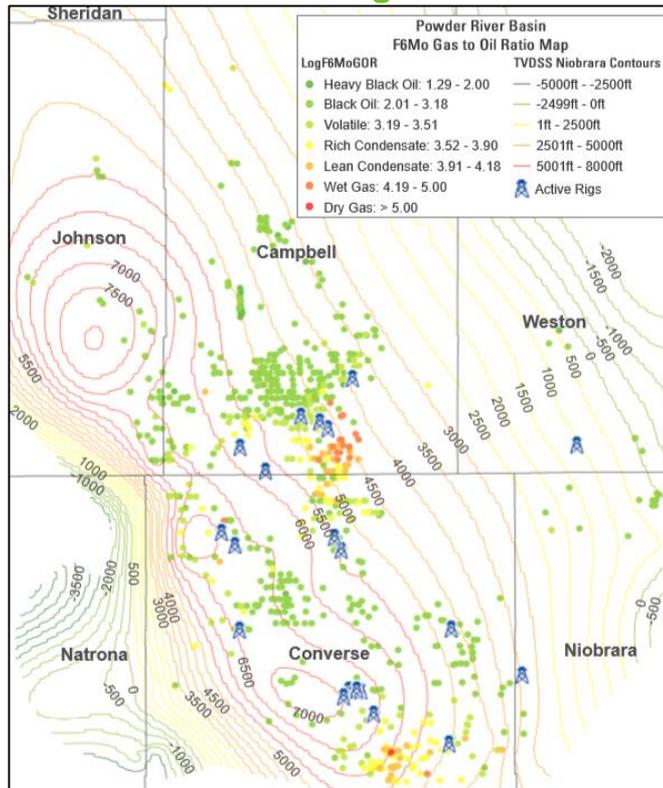
## Well Economics - Averages

- All DI Type Curve Averages:
  - 547 MBOE EUR at 77% Liquids
  - \$3.02 MM NPV10 with 55% IRR
  - \$43/bbl Breakeven
  - *Normalized to 7,500' Lateral*
- 3-Stream EURs used. Varied NGL Yield based on GOR, public disclosure and DI Estimates
- Area averages only included type curves with NPV10 >0

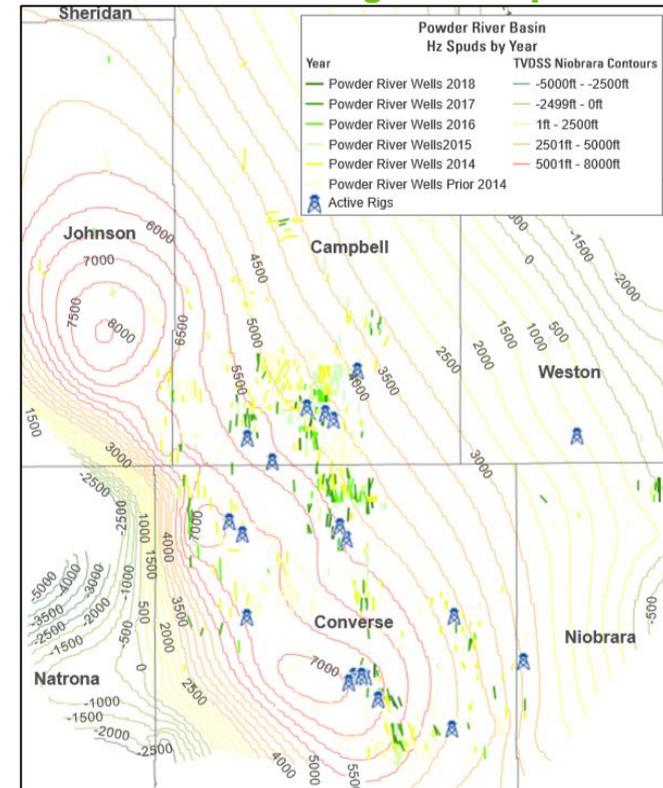
# Powder River Basin - Introduction

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## Powder River Rigs with GOR



## Powder River Rigs with Spuds



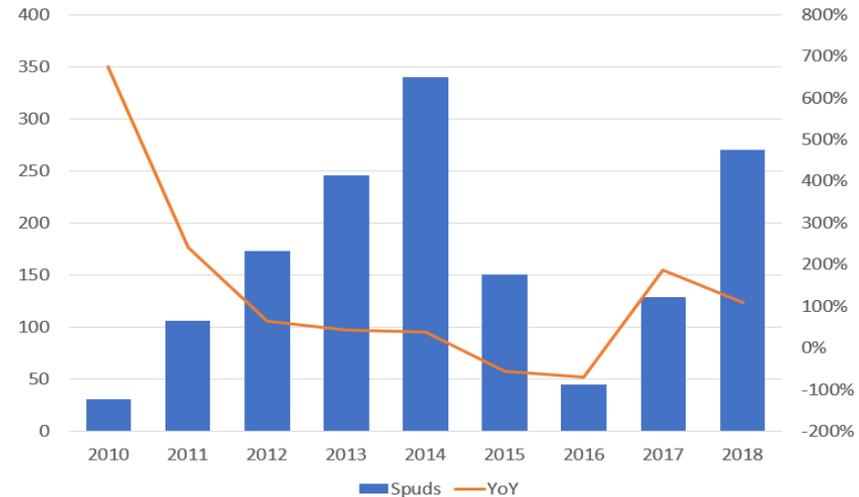
- The Powder River Basin's rig count was hit hard by the downturn, but high IP's combined with talks of stacked pay potential during the downturn drove a massive influx of private equity backed E&Ps into the basin.
- Meanwhile only a handful of large public E&P's have stayed active in the basin (APC, EOG, DVN, CHK), resulting in about five times as many PE-backed E&P's than public E&P's.
- Currently, the hype around stacked-pay has yet to be realized, meaning fairways of single-zone delineation are prevalent.
- The basin-wide transition from delineation to developmental mode appears to be a few years out.

# Powder River Basin Activity

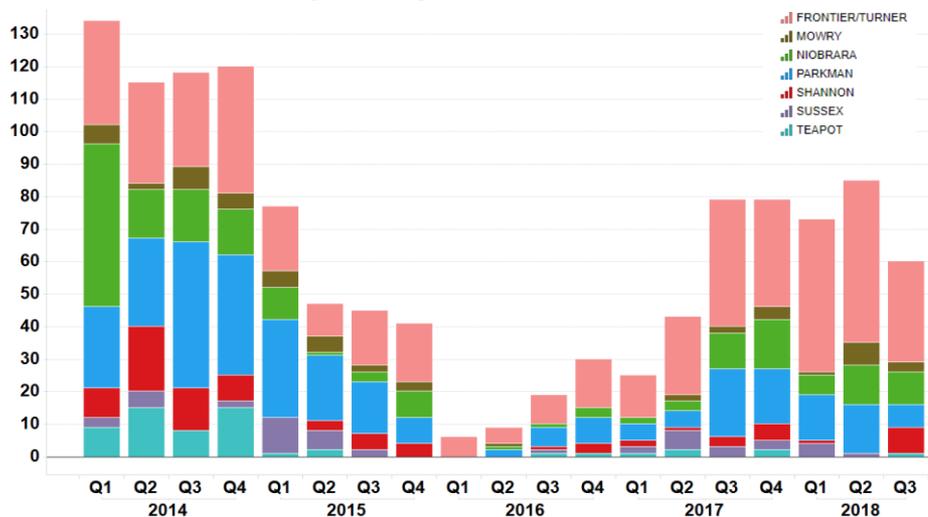
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- Activity in the basin grew exponentially before the downturn, then promptly collapsed, depicted on the graph to the right. 2018 is projected to be the second highest year ever at ~280 spuds.
- There was massive increase of well performance with low activity during the downturn.
- In 2015, well performance drastically improved, with wells turned online reaching 200 Mboe in 24 months compared to 48 months for wells turned online in 2014.
- Wells turned online in 2017 are reaching 200 Mboe in just 12 months.
- The influence of the \$26/bbl pricing in February 2016 is depicted in the graph below, with only five wells spudded in Q1 2016.
- ~80% of Hz drilling has consistently taken place in the Frontier/Turner, Niobrara, and Parkman since 2014.

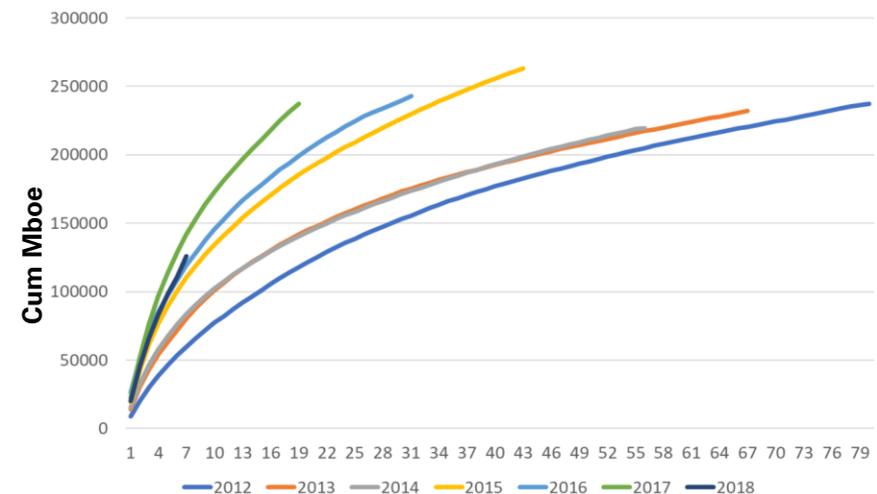
Spuds by Year



Spuds by Formation



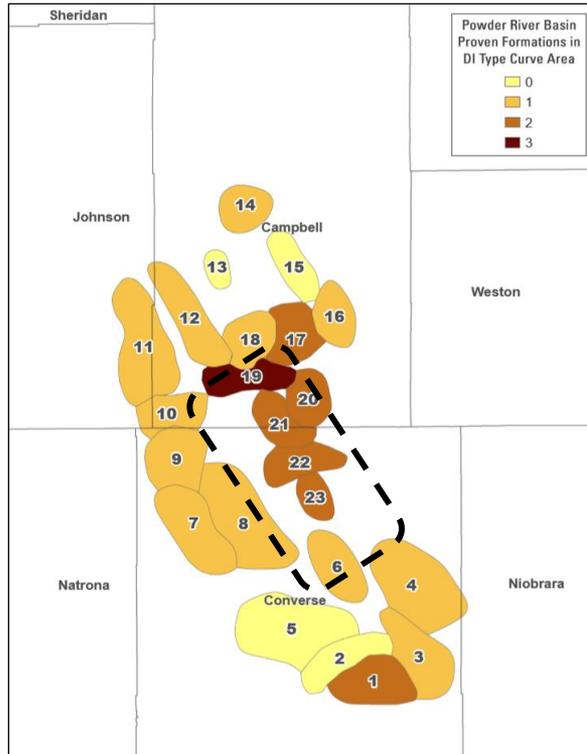
Vintage Type Curves



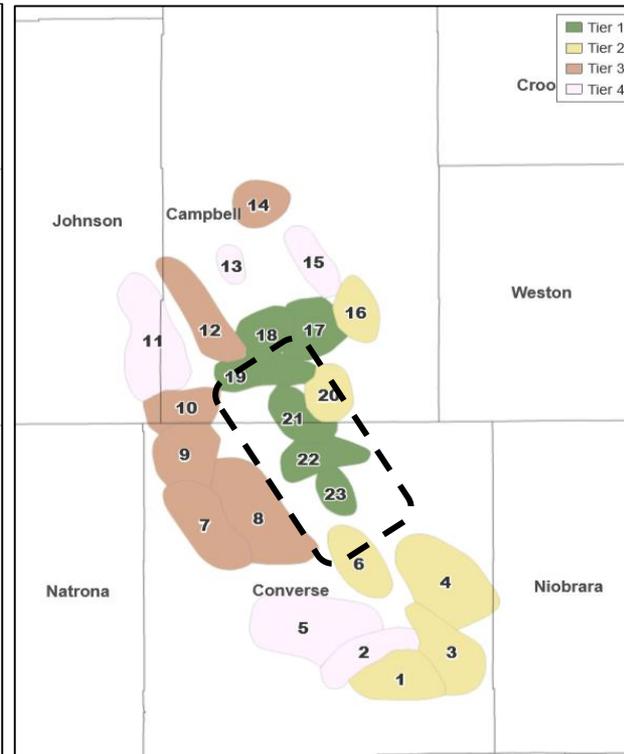
# Powder River Basin - Introduction

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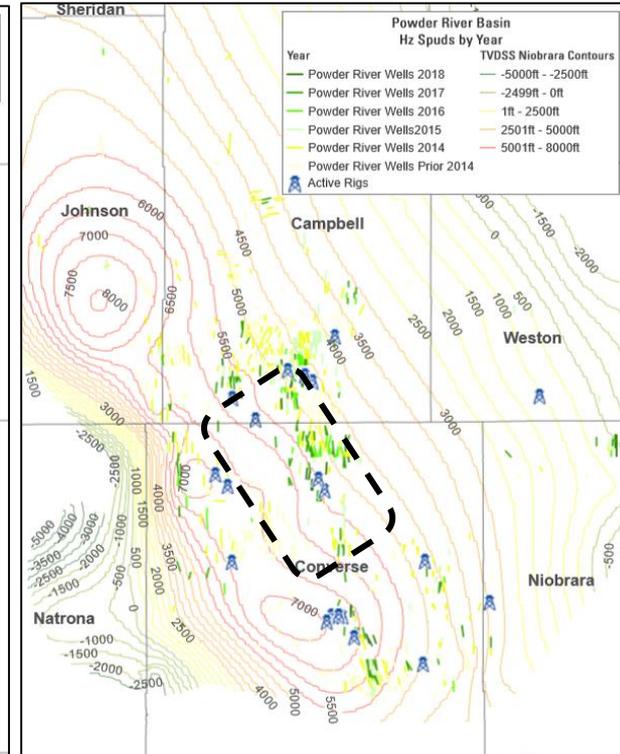
## Powder River Basin Proven Formations



## Powder River Basin Tiers



## Powder River Basin Rigs with Spuds

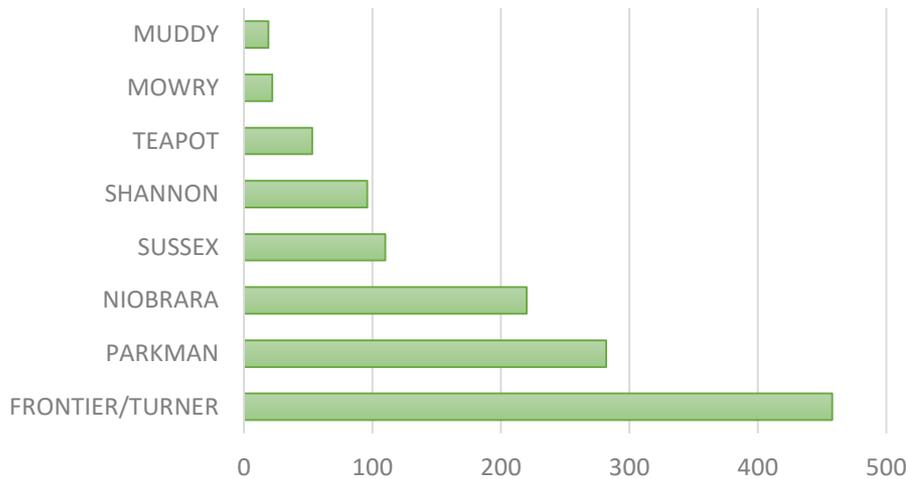


- Tiers are based on a weighted score using EURs, proven formations, and economics.
- Drilling and delineation is taking place across Tier 1 to Tier 3 areas in the basin.
- There is a clear fairway of Tier 1 acreage, depicted in the black box in the maps above.
- Most of the basin has only one or two proven formations (type curves by formation with > 10% IRR) in a given type curve area.
- Tales of stacked pay potential are yet to be realized.

# Powder River Basin – Formation Activity

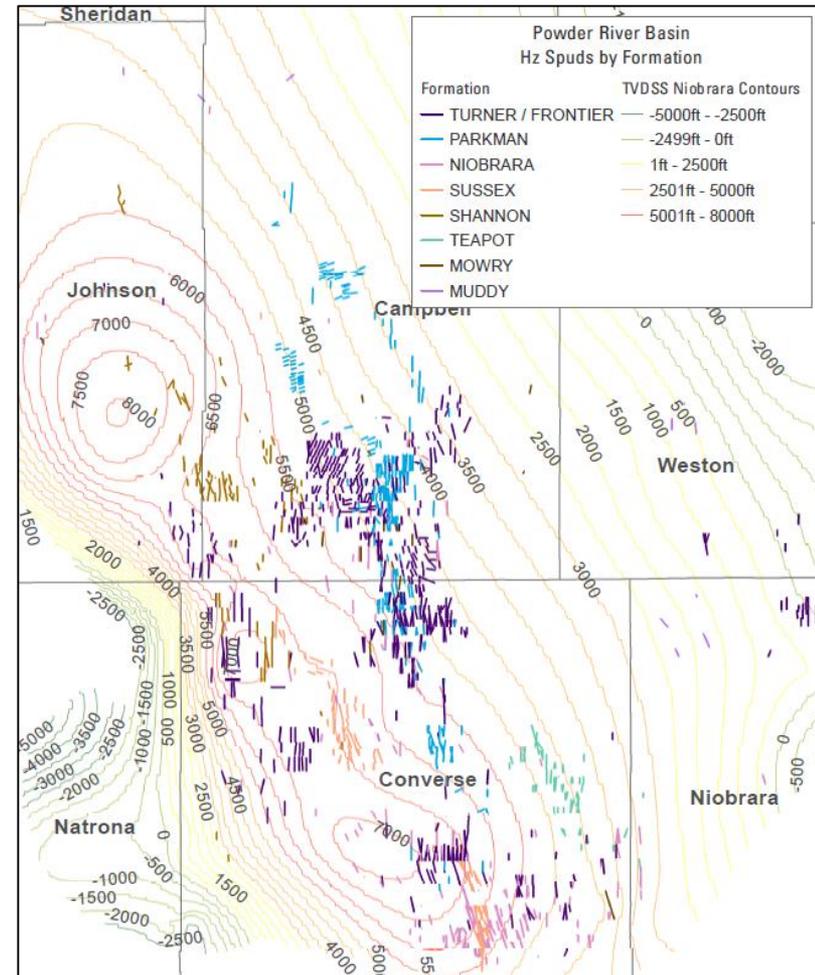
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## Key Formations Active Hz Well Count



- The Frontier/Turner formations are the most widely delineated and targeted zones in the basin. DI has looped them into the same group for most of our analysis due to a similar stratigraphic setting and order across the basin.
- The other sandstones (Parkman, Sussex, Shannon, Teapot, and Muddy) have only been regionally targeted. These sands have hot spots and are not proven widespread across the basin.
- The Niobrara has been drilled heavily in the south, mainly by Chesapeake. Additional delineation tests are ongoing further north.

## Hz Spuds by Formation

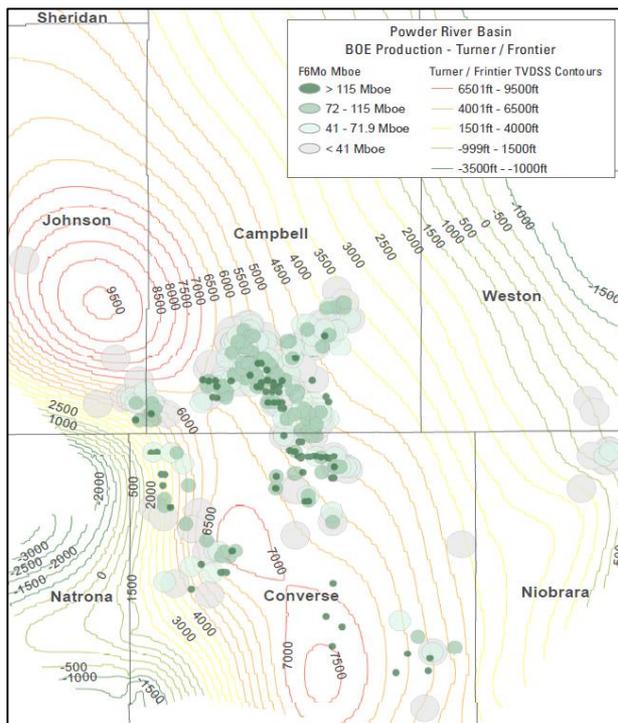


# Powder River Basin – Production Heat Maps

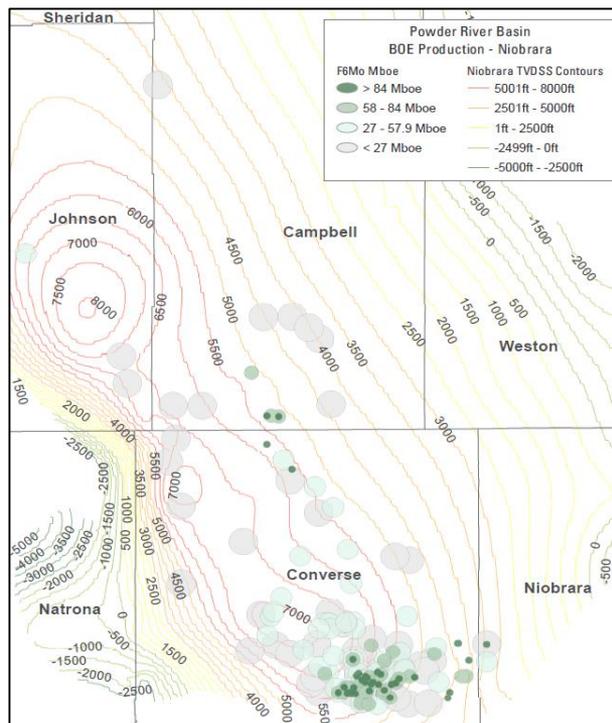
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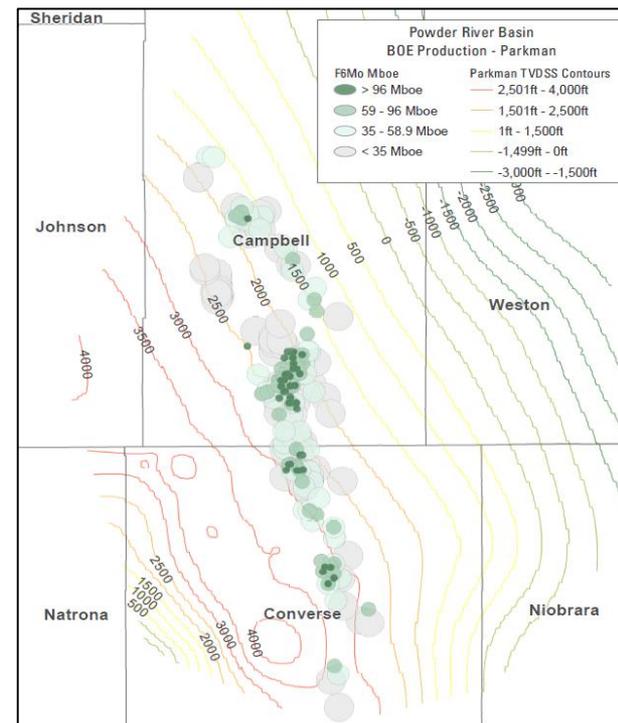
## Turner/Frontier



## Niobrara



## Parkman



- The Turner/Frontier has seen impressive results as it is over-pressured across most of the basin.
- Several pockets of high production are encouraging operators to transition from delineation to developmental mode.

- The Niobrara shale has had the most successful results in the southern end of the basin.
- There is small pocket of strong well results in the Converse/Campbell border.
- Productivity has been low to the west and north, a signal for a potential rock properties transition.

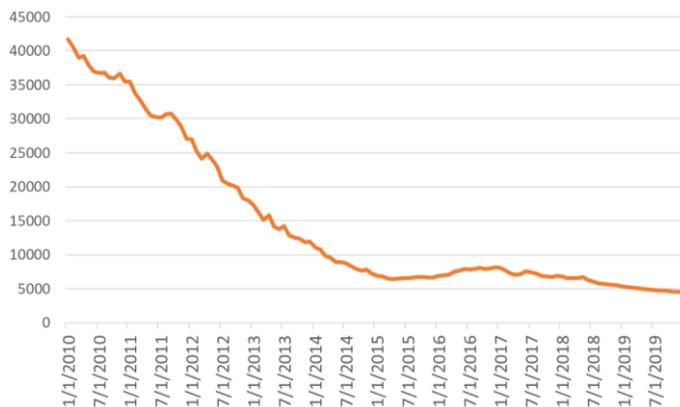
- The shallower, under-pressured Parkman sandstone has a relatively tight productivity window.
- Wells drilled outside the tight window have seen disappointing well results.

# Powder River Basin Production

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- Oil production peaked around 140 Mbb/d in Q2 2015. Oil volumes are set to break the previous high in early 2019.
- Conventional gas assets in the basin have had consistent declines, but the rise of associated gas will keep gas production flat for the short term.
- The basin-wide horizontal production has a GOR of 7,500 scf/bbl.
- The GOR is trending downward as operators focus on drilling more oil bearing targets.

## Powder River Gas to Oil Ratio

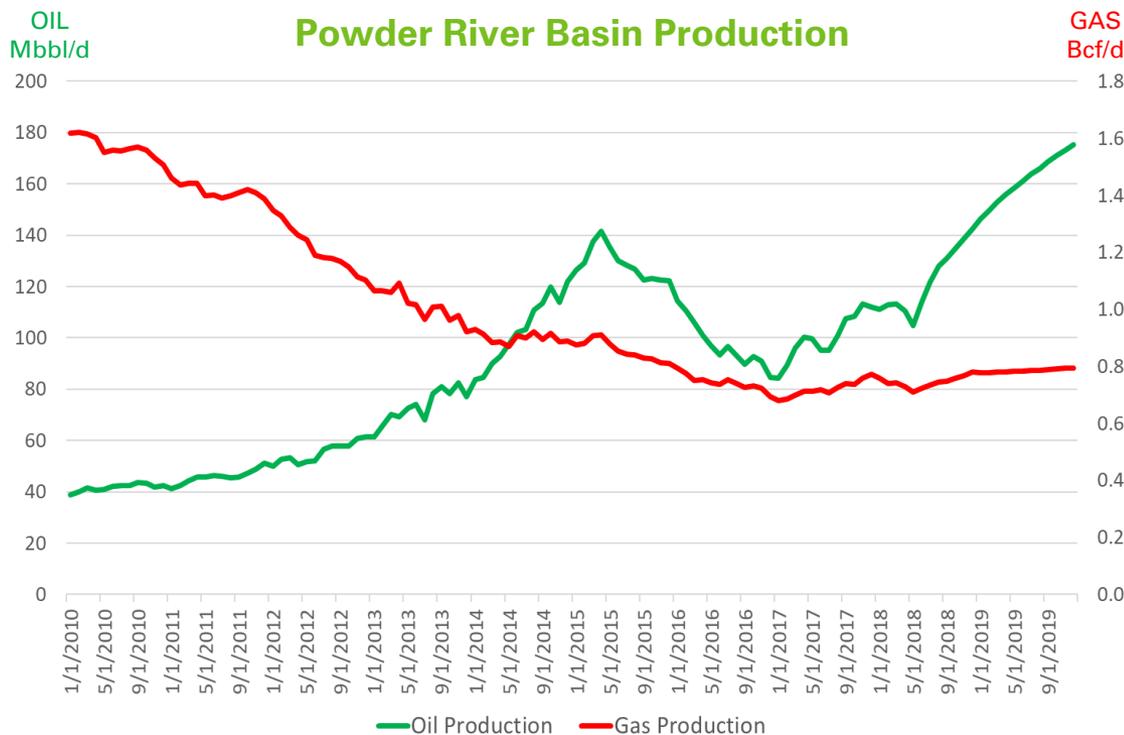


### Oil Q4 2018

- Powder River Basin: 140 Mbb/d
- 2019 YE: 177 Mbb/d

### Gas Q4 2018

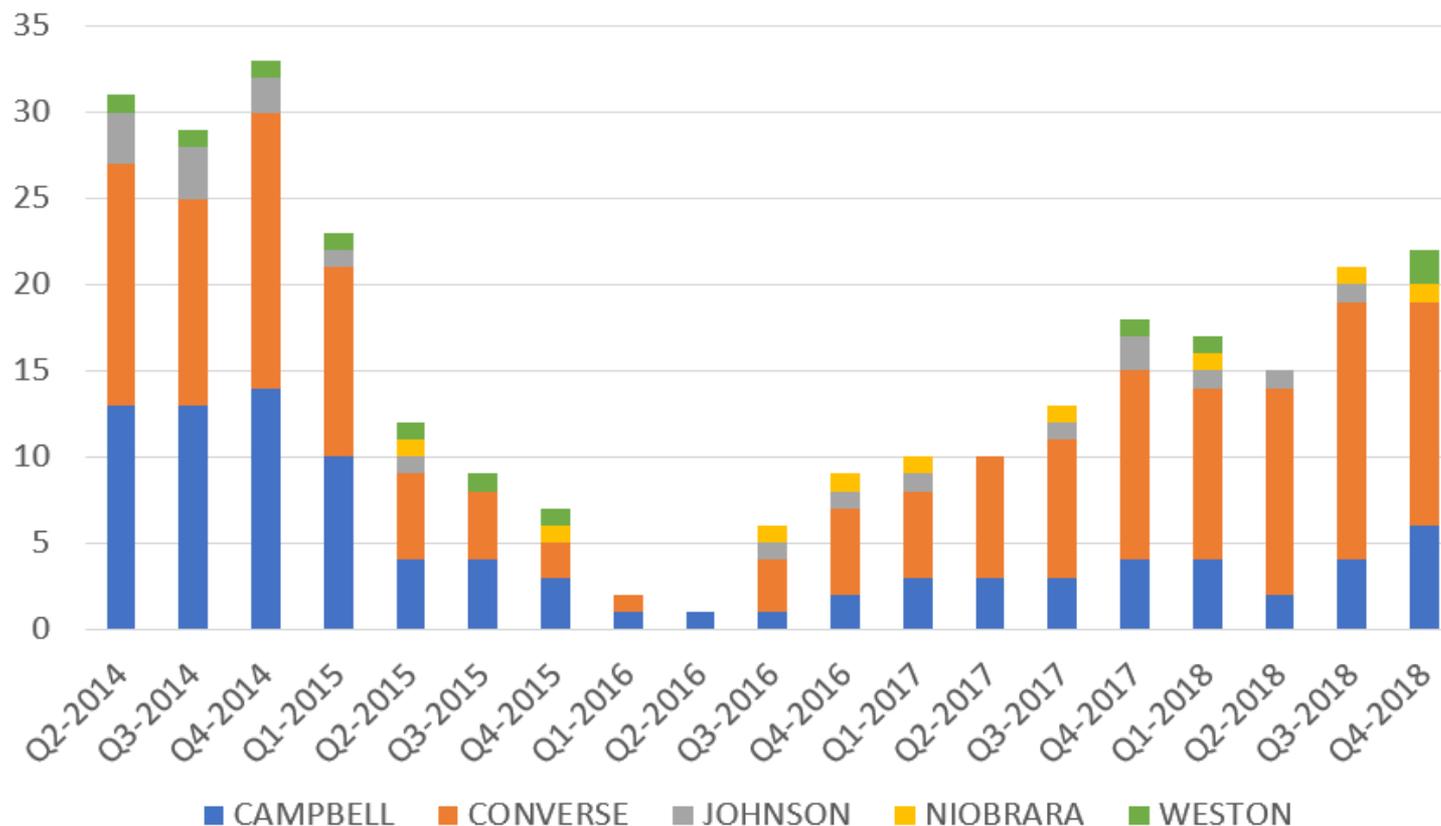
- Powder River Basin: 0.7 Bcf/d
- 2019 YE: 0.8 Bcf/d



# Powder River Basin – Historical Hz Rig Count

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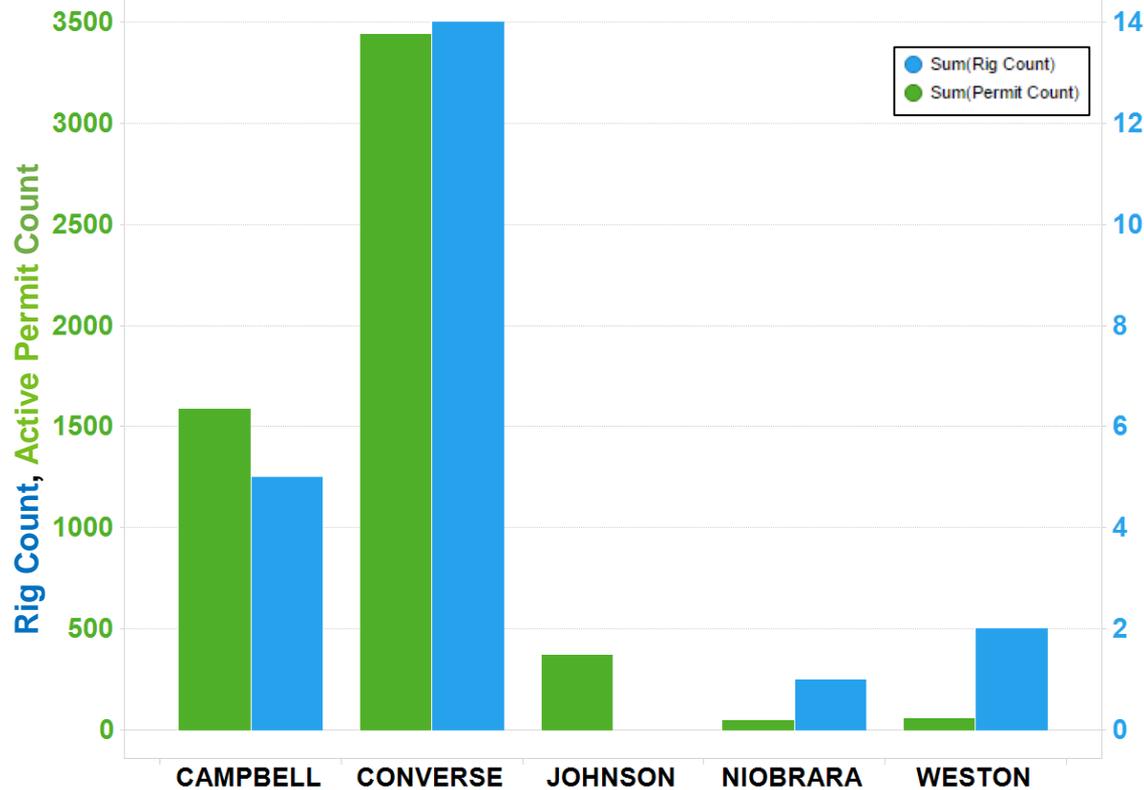
Quarterly Average Hz Rig Count by County



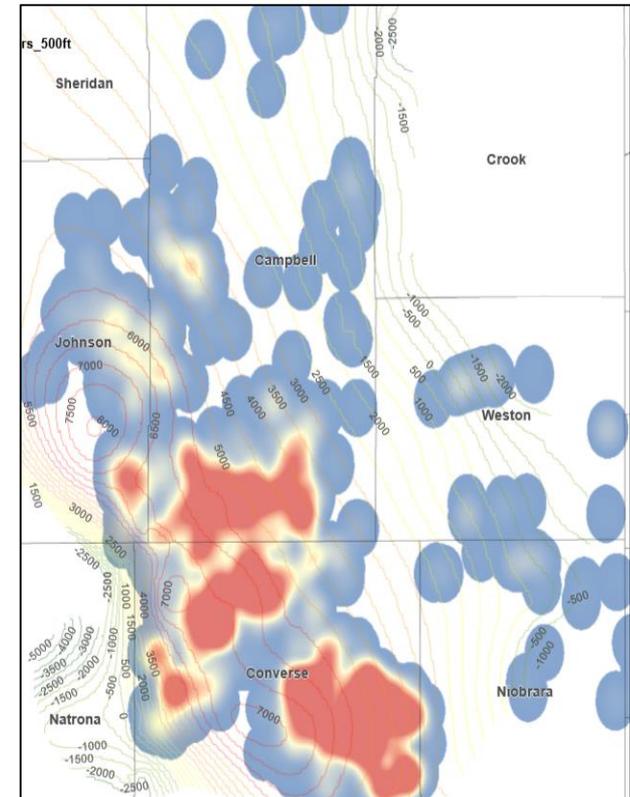
- Campbell and Converse counties have held the vast majority of the rig count in the basin since 2014.
- Converse has been more active than Campbell since the downturn.
- Horizontal rig count has grown from one to 22 from Q2 2016 to Q4 2018.
- Drilling outside of Campbell and Converse has yet to drastically expand.

# Powder River Basin – County Activity

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Permitting Heat Map, Past 2 Years

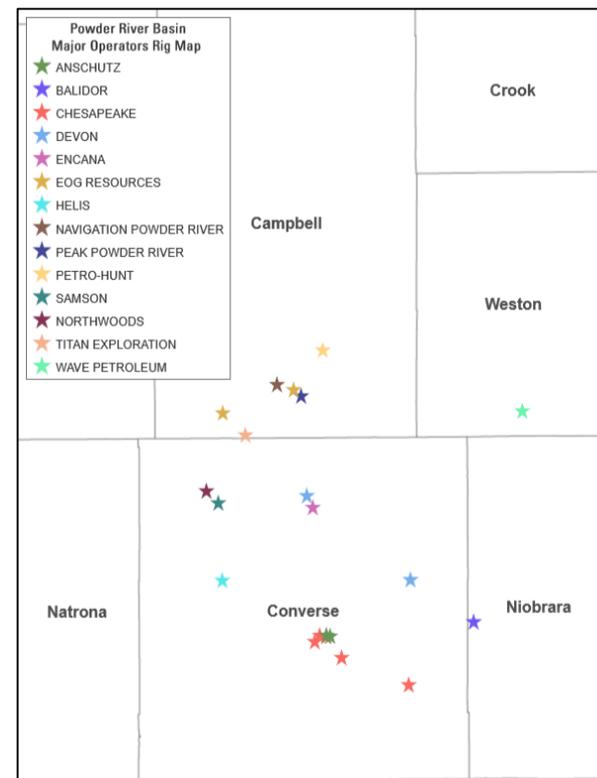
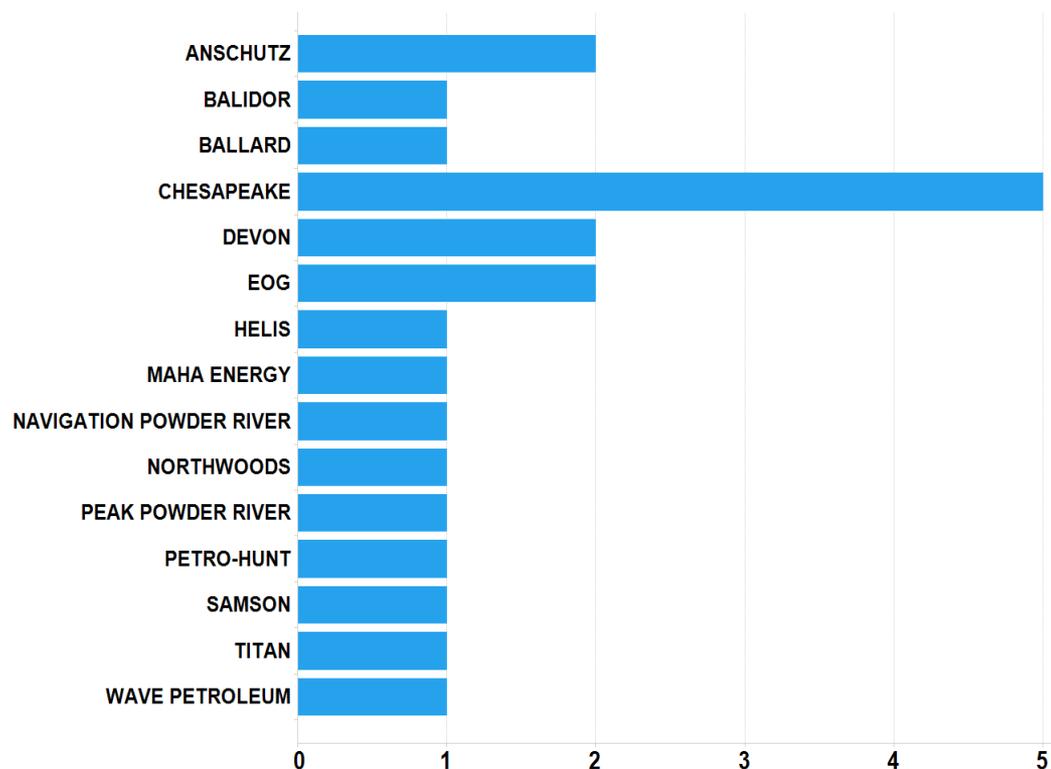


- Permitting activity is high in southern Converse county and along the Campbell/Converse border.

# Powder River Basin – Operator Activity

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## Major Operators' Hz Active Rig Count and Map

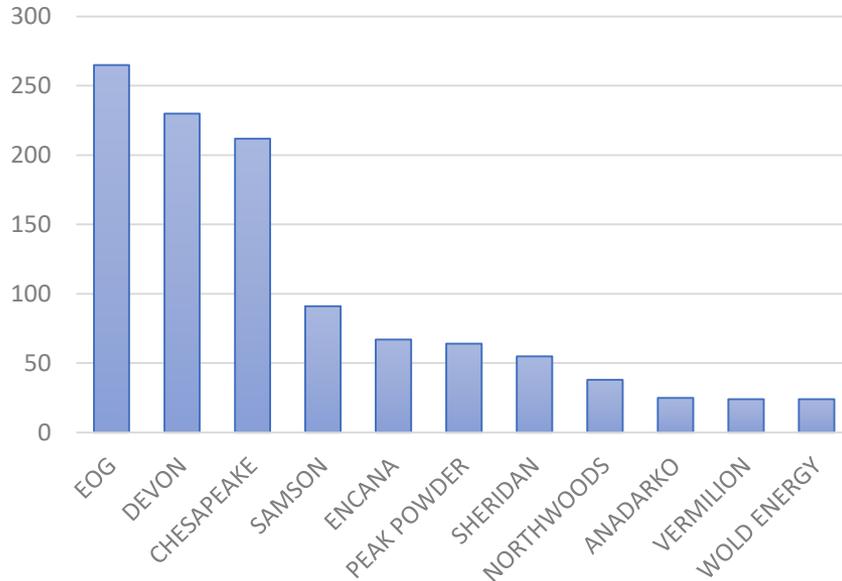


- Only four operators are running multiple rigs in the basin: Chesapeake, EOG, Devon, and Anschutz.
- About ten PE-backed operators are drilling in the basin.

# Powder River Basin – Operator Activity

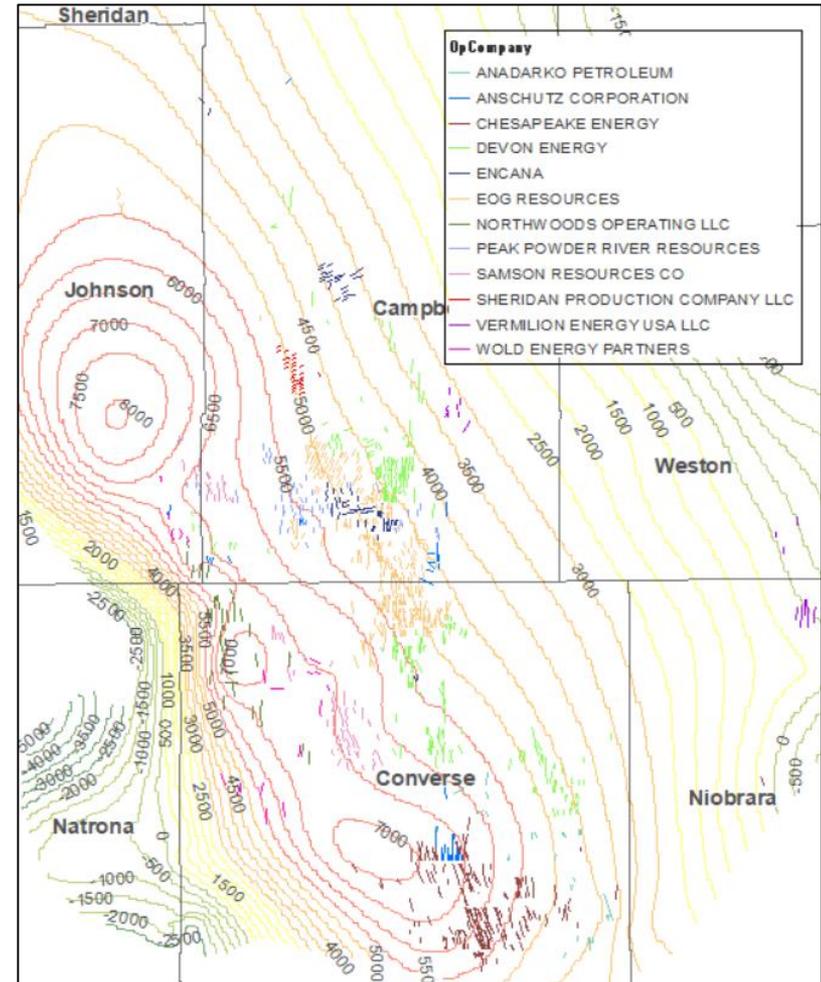
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## Key Operators' Hz Active Well Count



- EOG, Devon, and Chesapeake have been the most active public operators in the basin. Each operator is focused in a different region in the basin and has targeted different formations in their drilling programs.
- Anadarko has a large undeveloped position, over 300k acres.
- The majority of PE-backed E&P's haven't entered into a developmental mode.

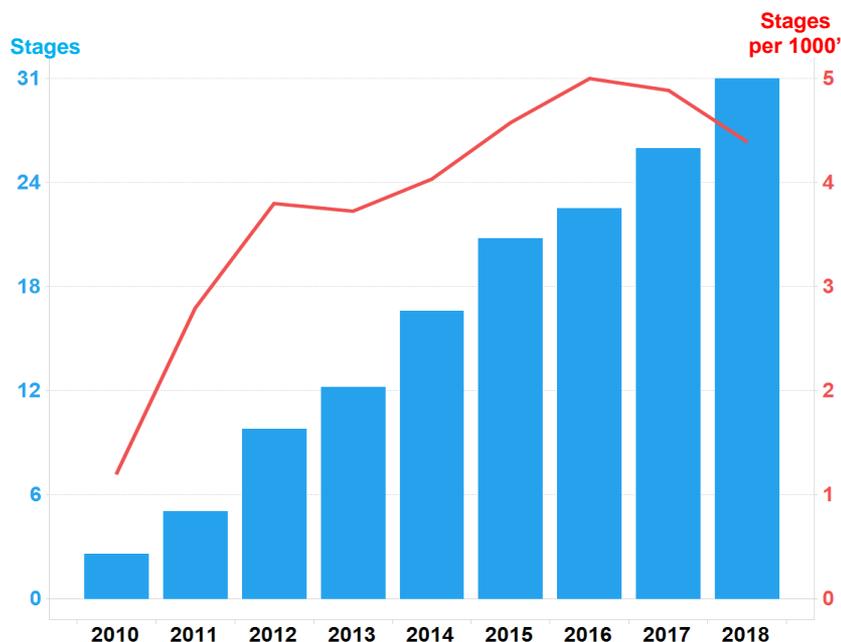
## Hz Spuds by Operator



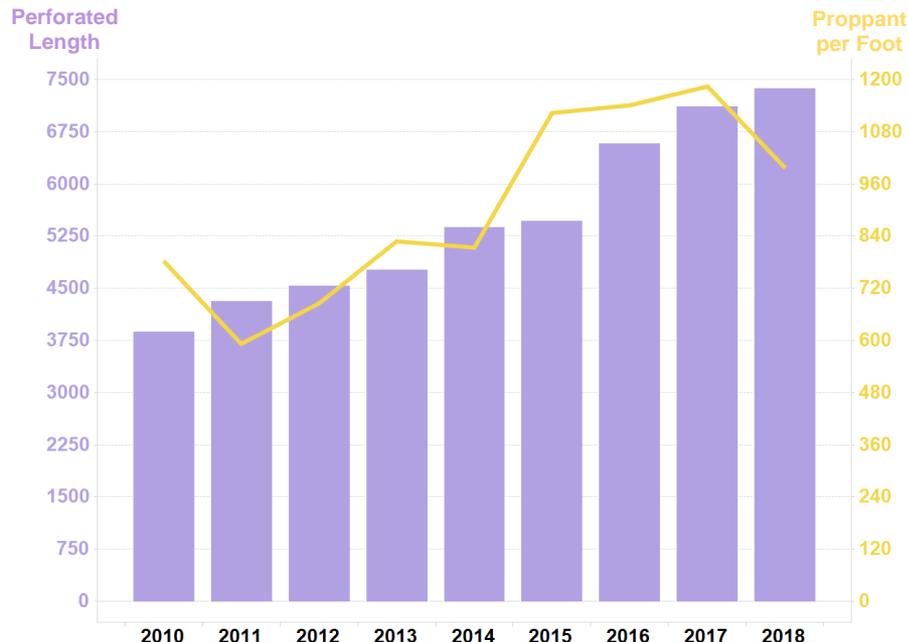
# Powder River Basin Completion Trends

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## Frac Stages Over Time



## Completion Practices Over Time

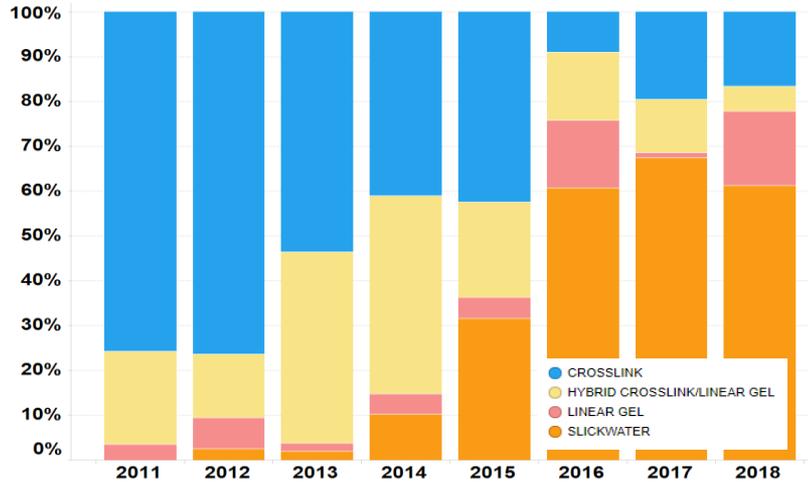


- There have been several consecutive years of IP growth, driven by longer and larger frac jobs with optimized designs.
- Different frac “recipes” are seen across the basin in each formation.
  - High intensity fracs do not make economic sense for some of the sandstones in the Powder.
  - There has been a rise of slickwater completions in the Niobrara and Turner/Frontier.
  - The Parkman is primarily treated in a linear gel styled completion.

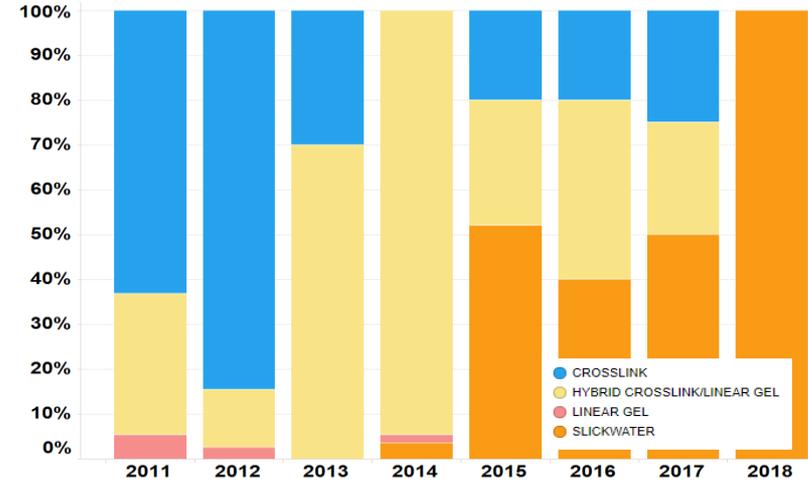
# Powder River Basin - Completion Trends

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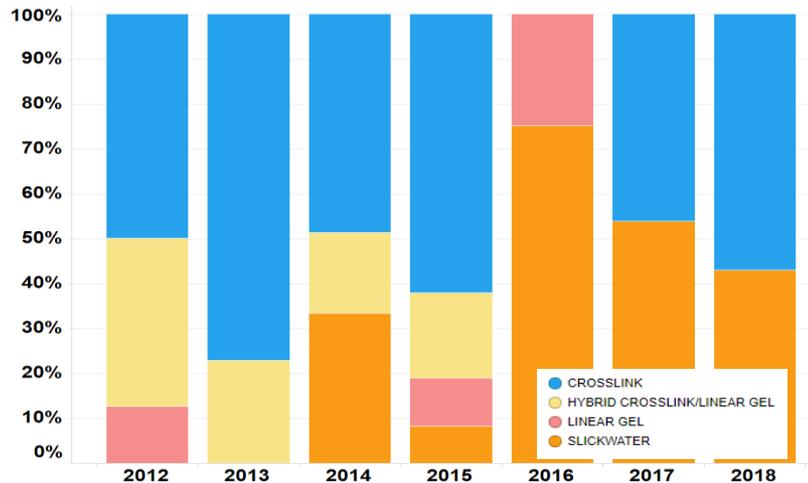
## All Formations Treatments Over Time



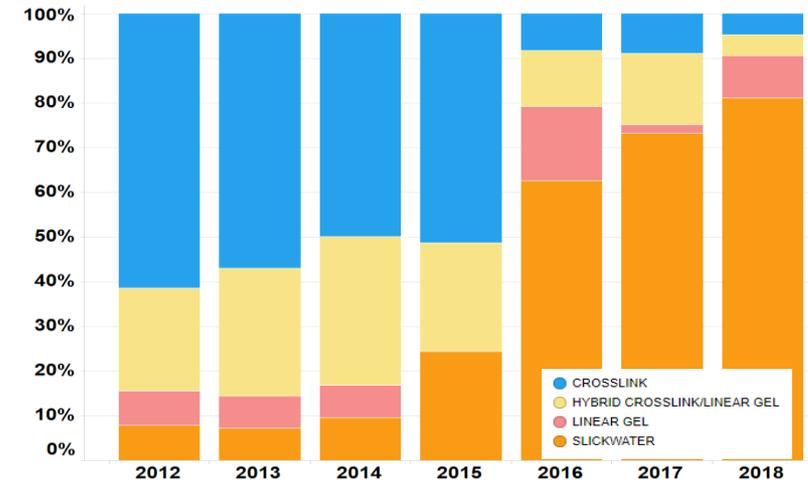
## Niobrara Treatments Over Time



## Parkman Treatments Over Time



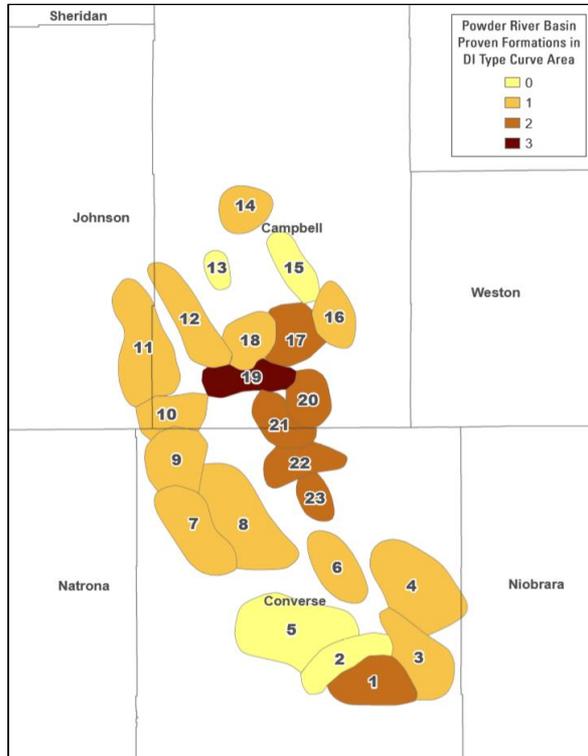
## Turner/Frontier Treatments Over Time



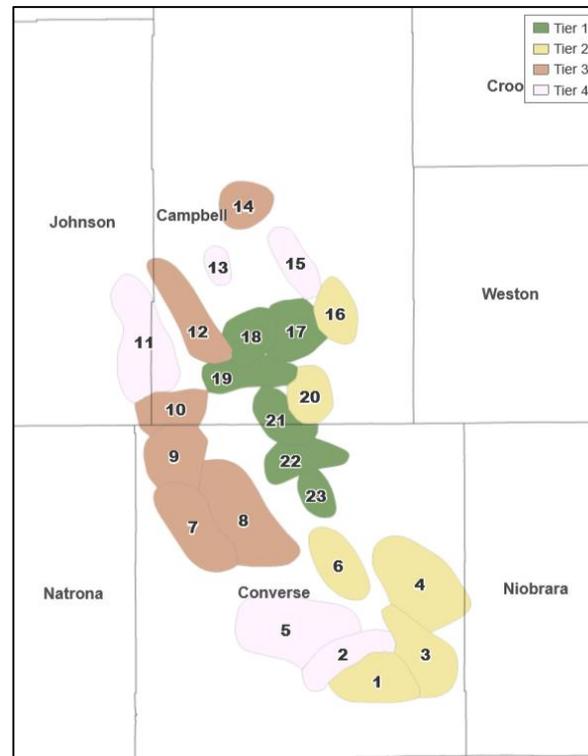
# Powder River Basin DI Area Type Curve Summary

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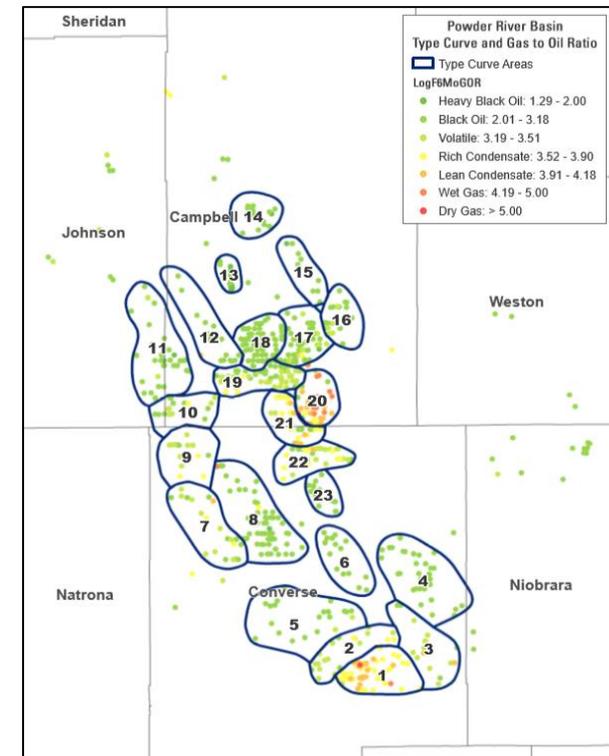
## Powder River Basin Proven Formations\*



## Powder River Basin Tiers



## Powder River Basin GOR & Type Curves



\*Proven formations have IRR > 10%

- 23 DI Type Curve Areas generated based on geological structure, thickness, and GOR.
- 32 individual type curves within the areas created, split up by geological formation.
- DI's Area Type Curve economic analysis follows the drilling activity and trends seen from the A&D market.
- Tiers are based on a weighted score using EURs, proven formations, and economics.
- Only DI Type Curve Area 19 has three horizons delineated across the area type curve.

# Want to See Full Report or Have A Question?

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