



# **ND Oil and Gas Research Council Update**

**North Dakota Pipeline Authority**

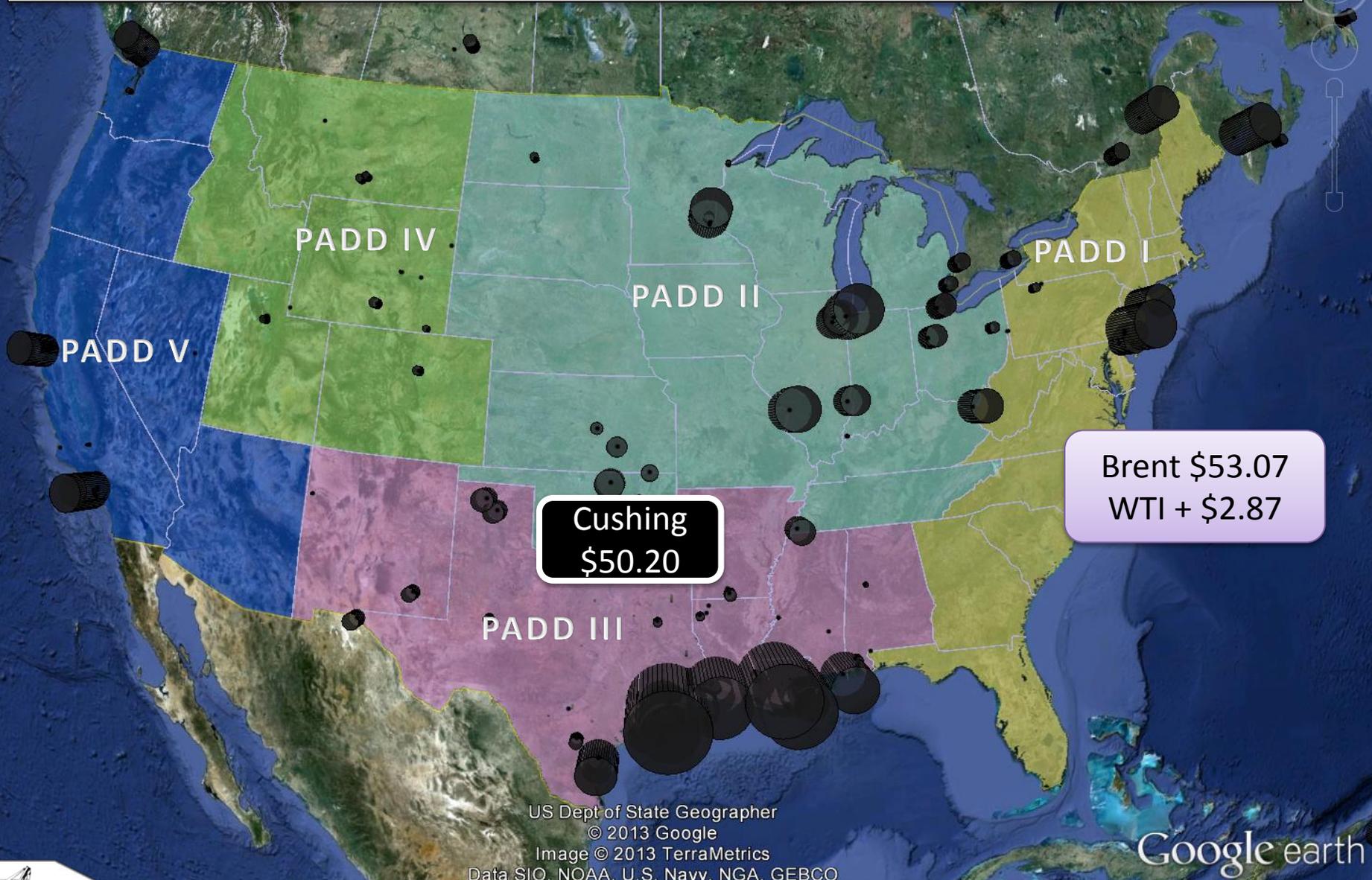
**Justin J. Kringstad**

**January 5, 2015 - Bismarck, ND**

# Rebuilding Oil & Gas Forecasts to Support Midstream Development



# Crude Oil Prices – Jan. 5, 2015



# ND Pipeline Authority Web Presentation

## Bakken Well Economics



**Justin J Kringstad**

*Geological Engineer*

*Director*

*North Dakota*

*Pipeline Authority*

*Please view replay video on the Pipeline Authority website for full commentary of the following slides*



## **Objective**

Define where the Bakken/Three Forks system is economic in a lower oil price environment.

## **Method**

Analyze past well performance across the region and estimate well economics for various production levels.

## **Disclaimer**

The goal of this work is not to imply individual company actions or intentions. All view expressed are strictly that of Justin J. Kringstad.

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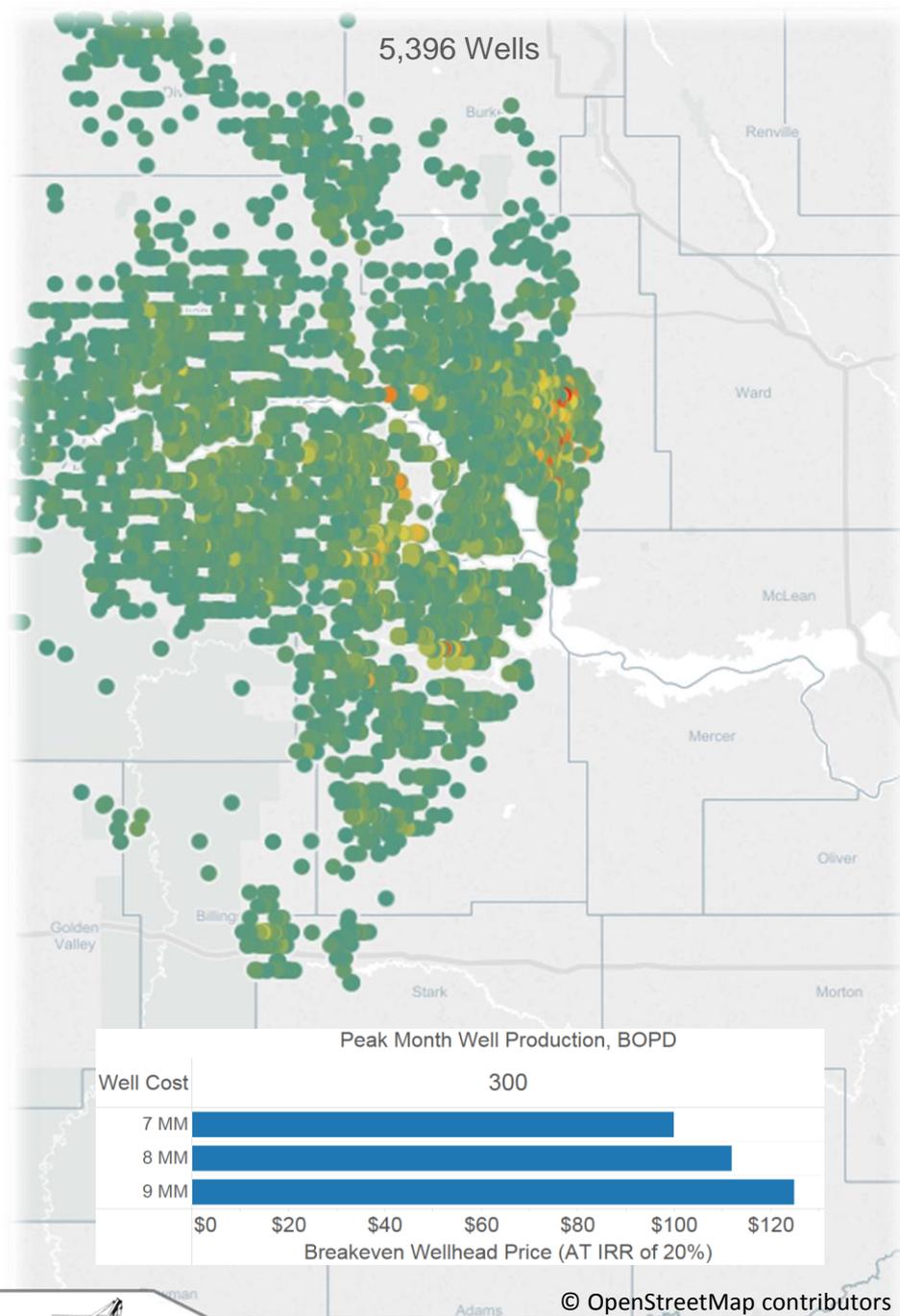


# Key Economic Assumptions

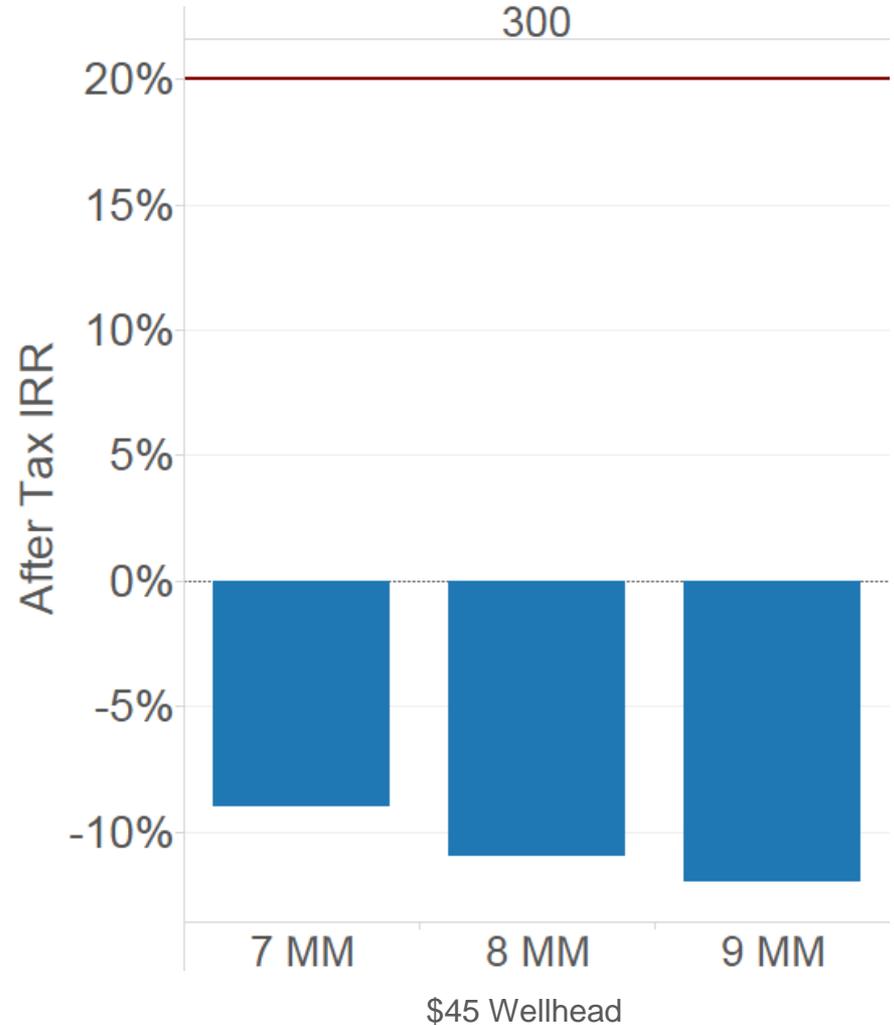
- \$7-\$9 Million Well Costs
- \$45/BBL Wellhead Pricing
- 1/6 Royalty
- Zero Flaring
- Minimum 20% IRR to drill (calculated after production taxes and royalties)
- No Tax Incentives Included
- Production rate is 30-day average
- All Bakken/Three Forks wells drilled in 2008+



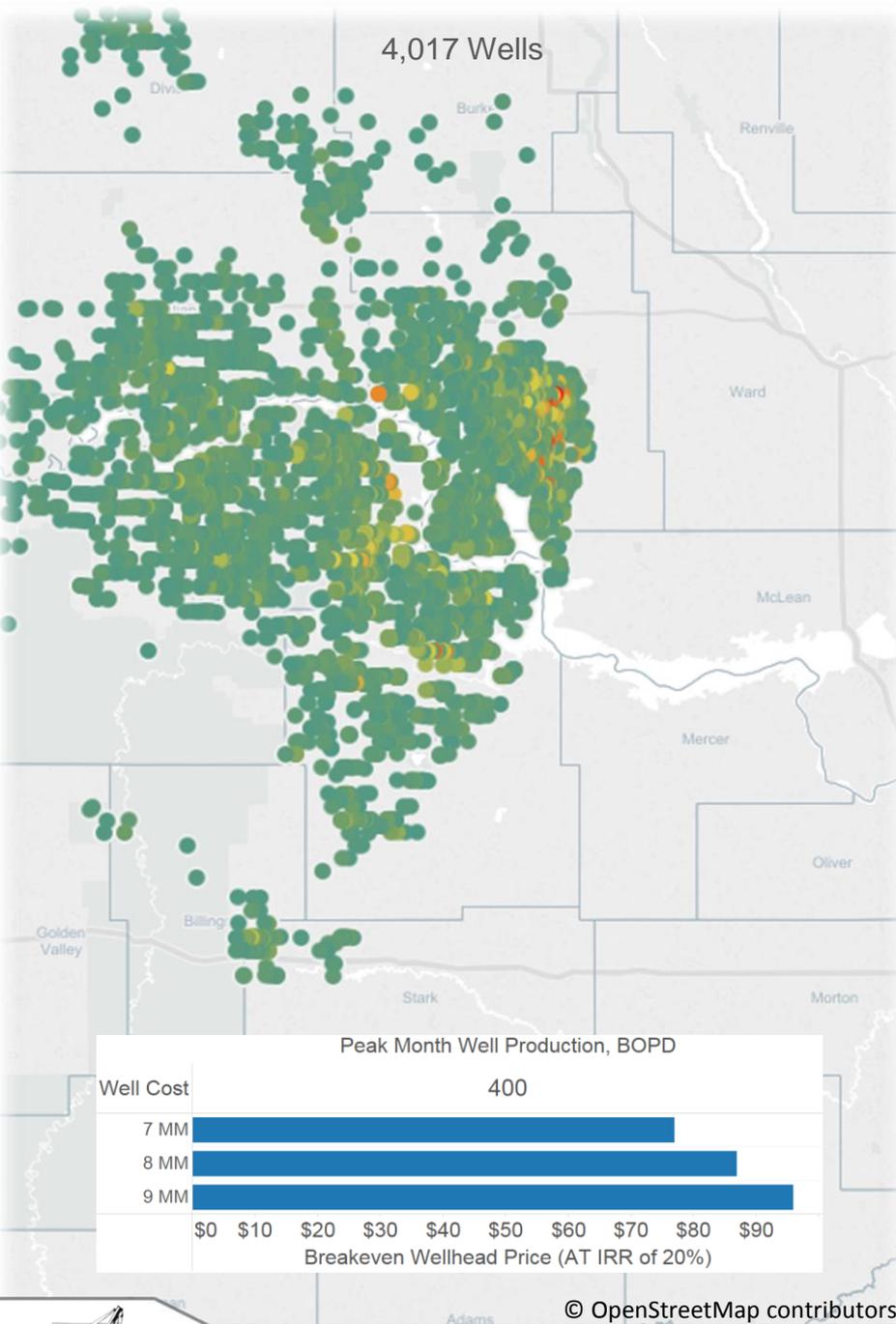
# Peak Month Minimum 300 BOPD



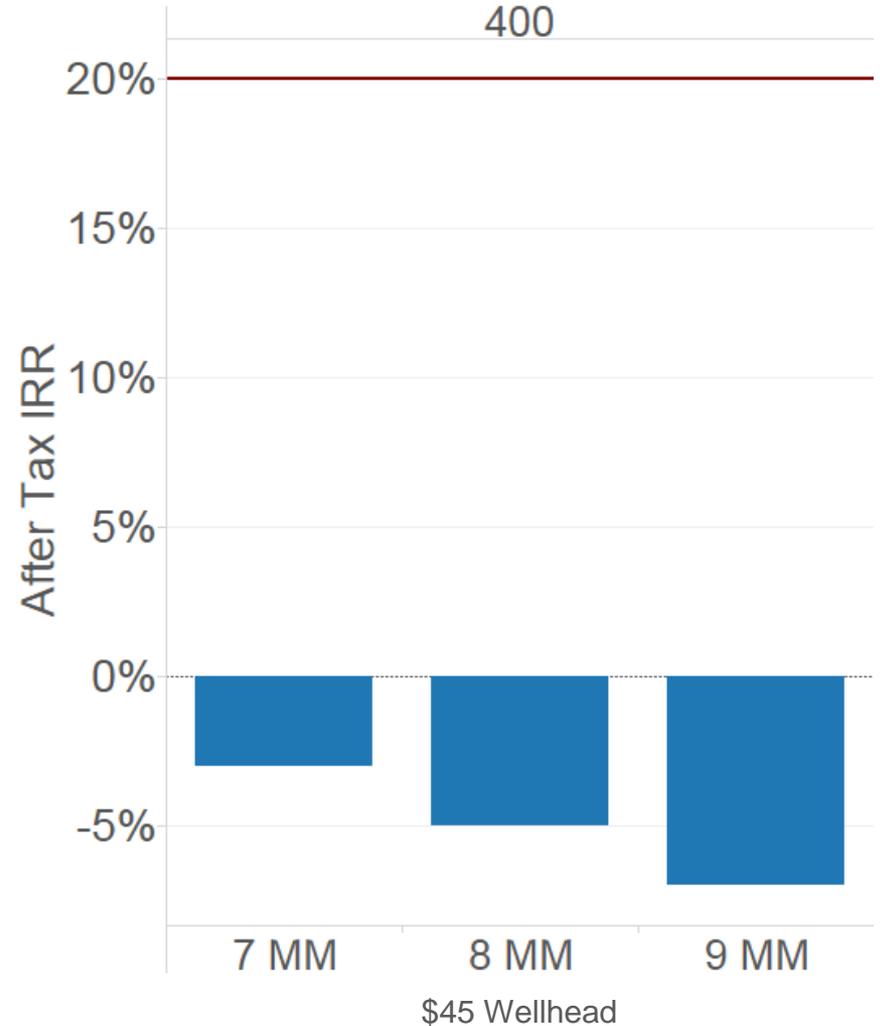
Peak Month BOPD / Well Cost  
300



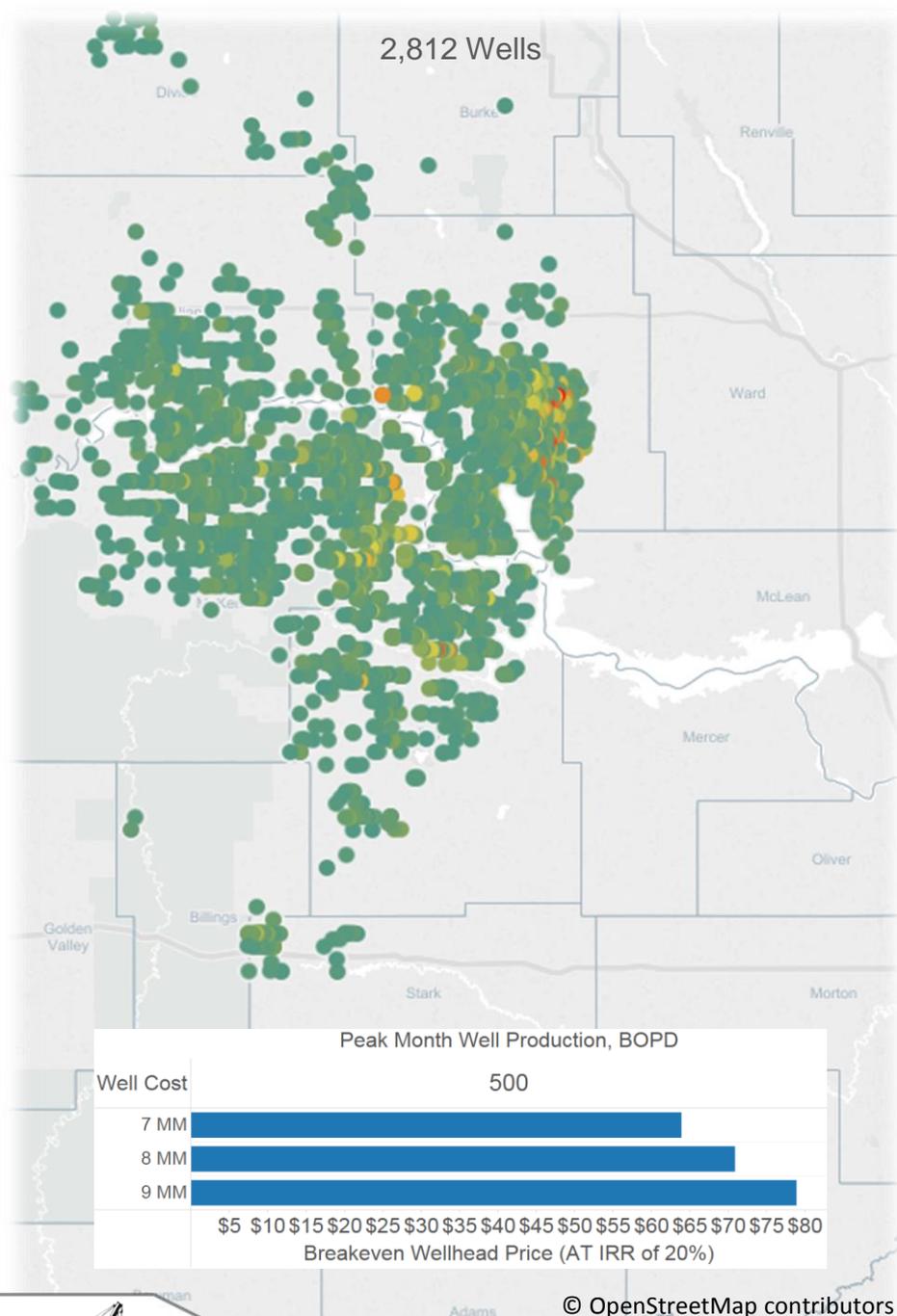
# Peak Month Minimum 400 BOPD



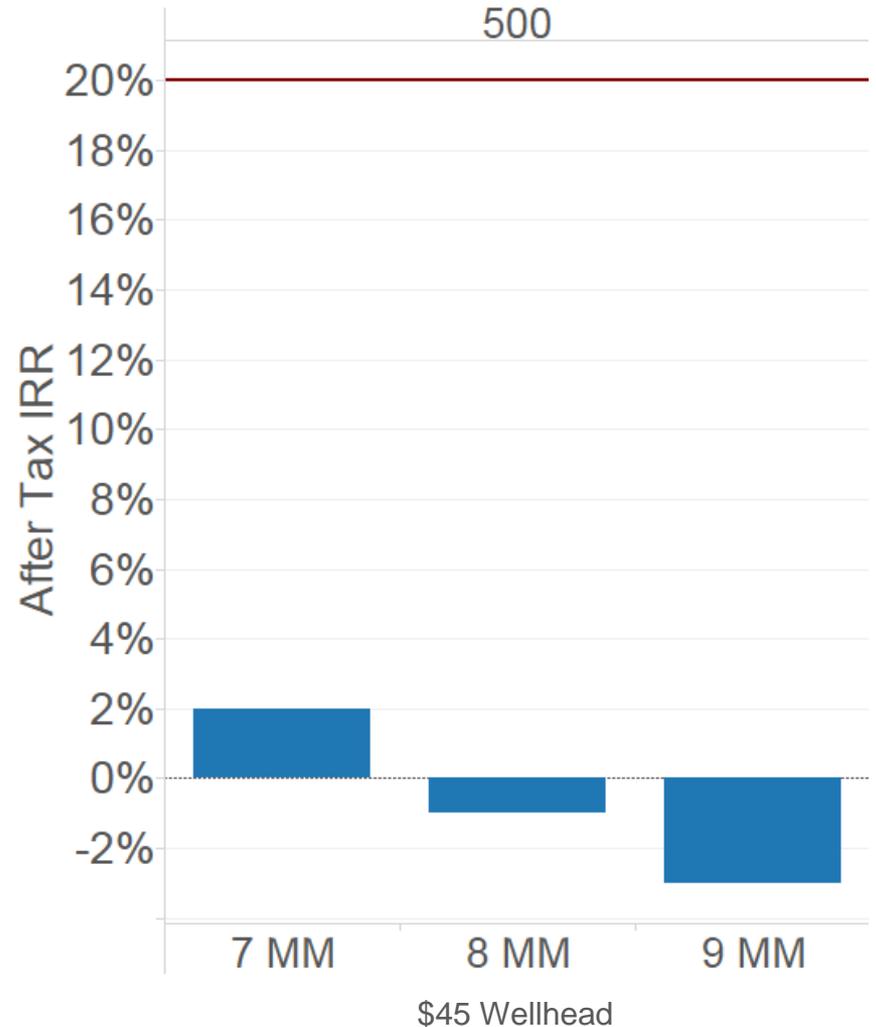
Peak Month BOPD / Well Cost  
400



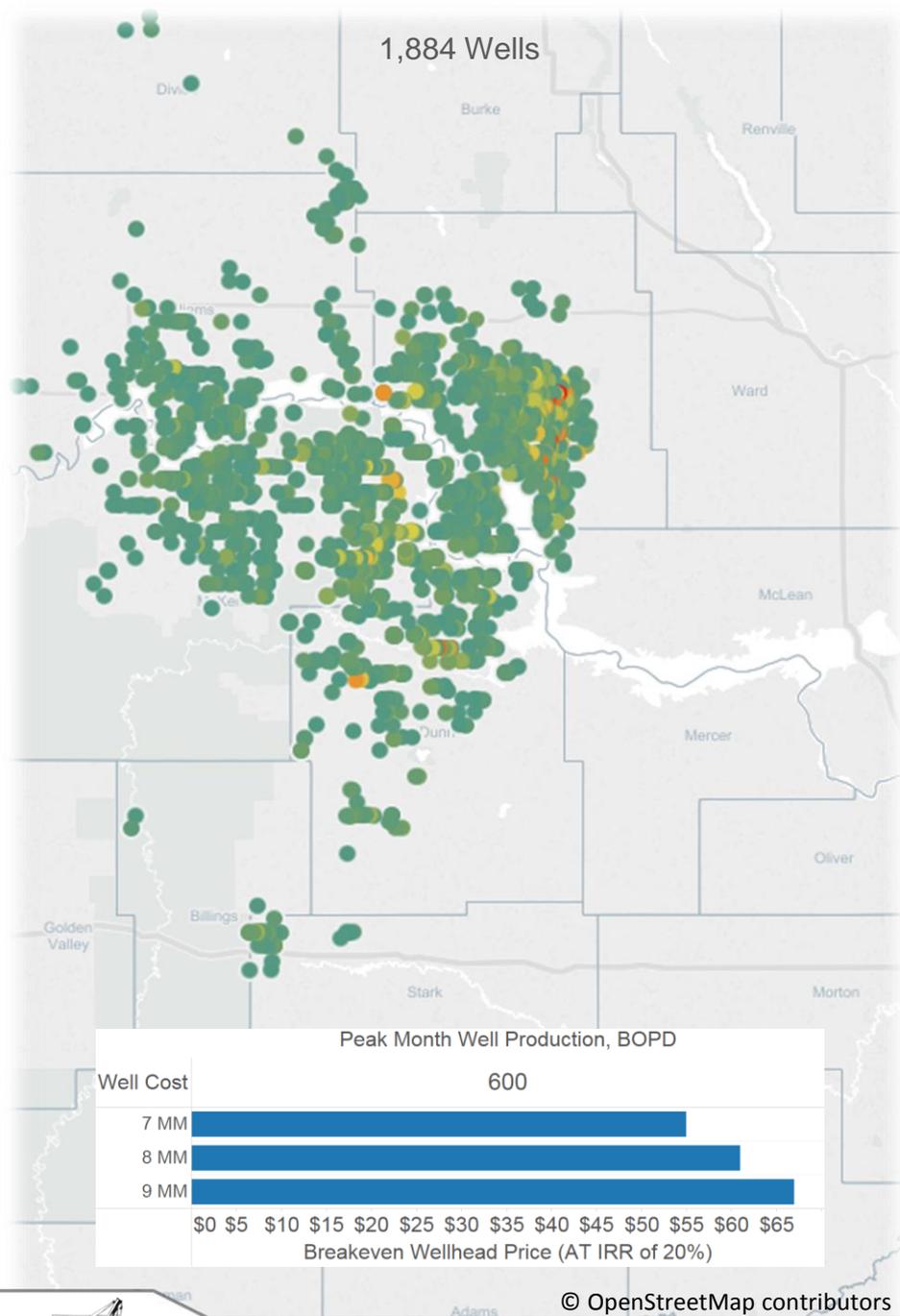
# Peak Month Minimum 500 BOPD



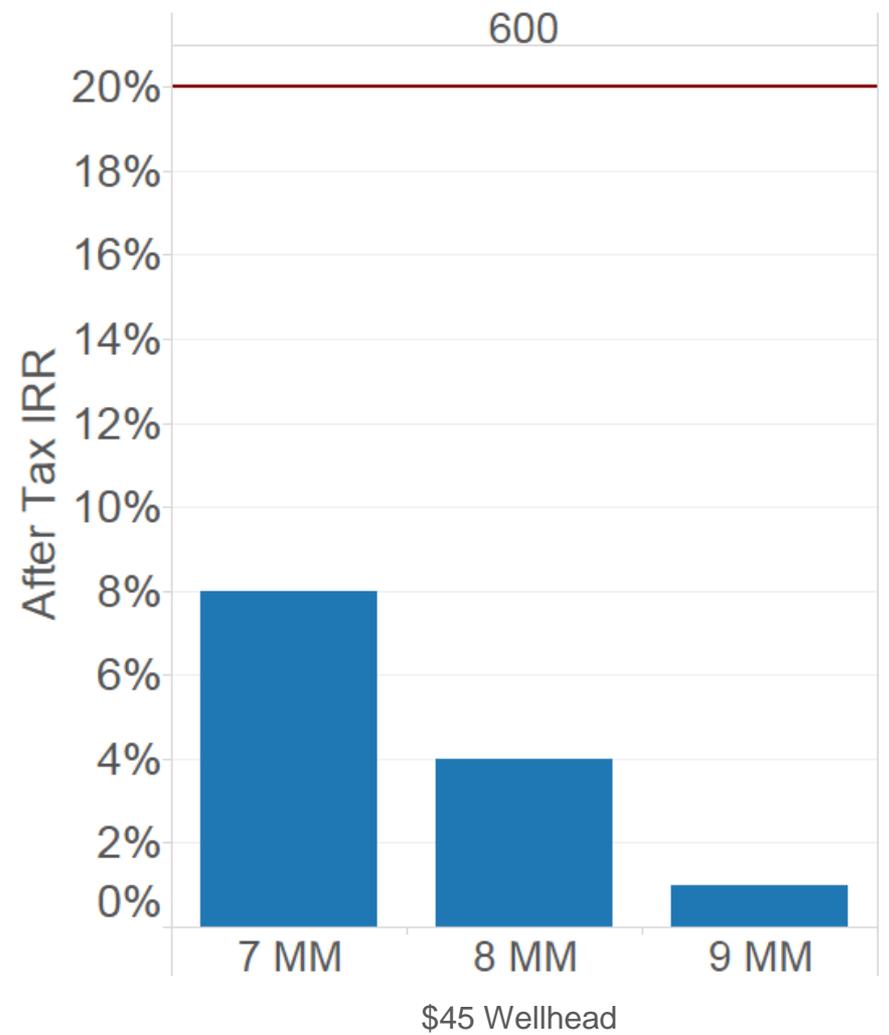
Peak Month BOPD / Well Cost  
500



# Peak Month Minimum 600 BOPD

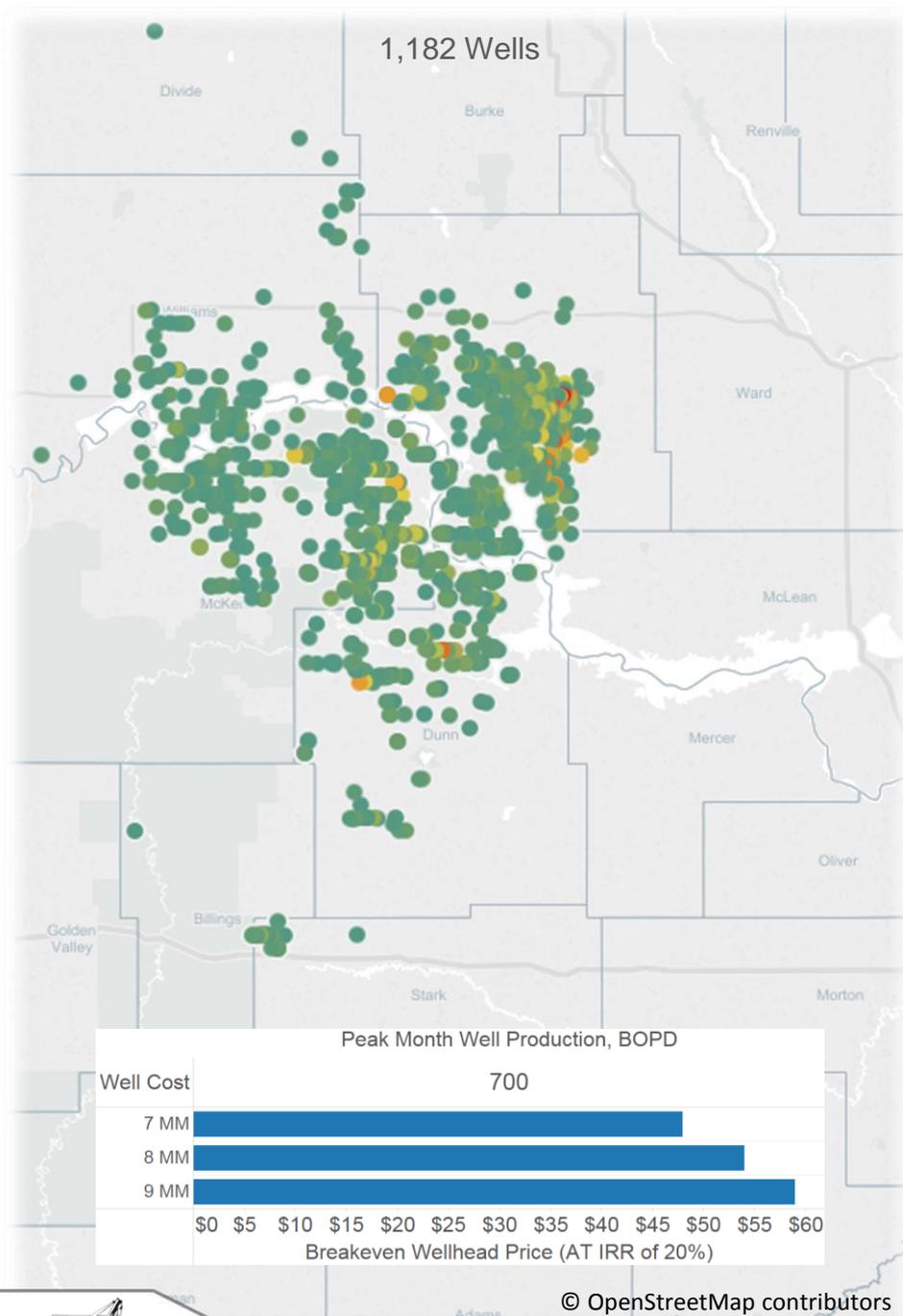
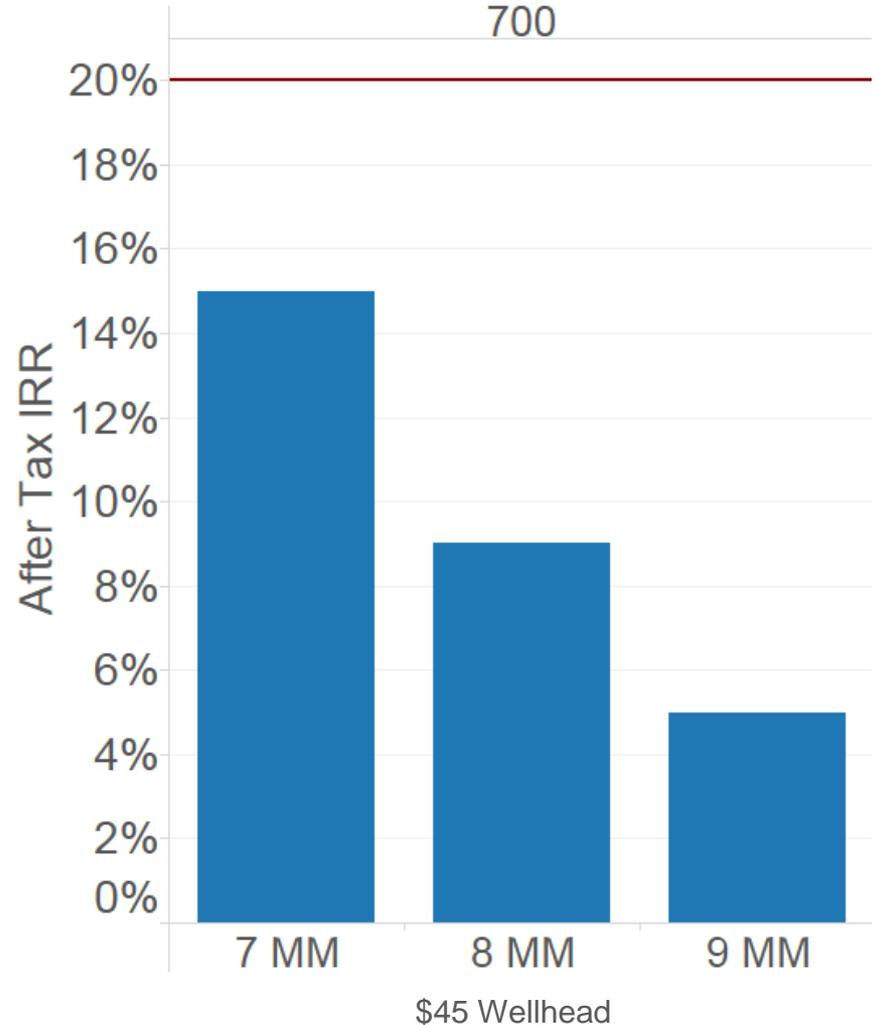


Peak Month BOPD / Well Cost



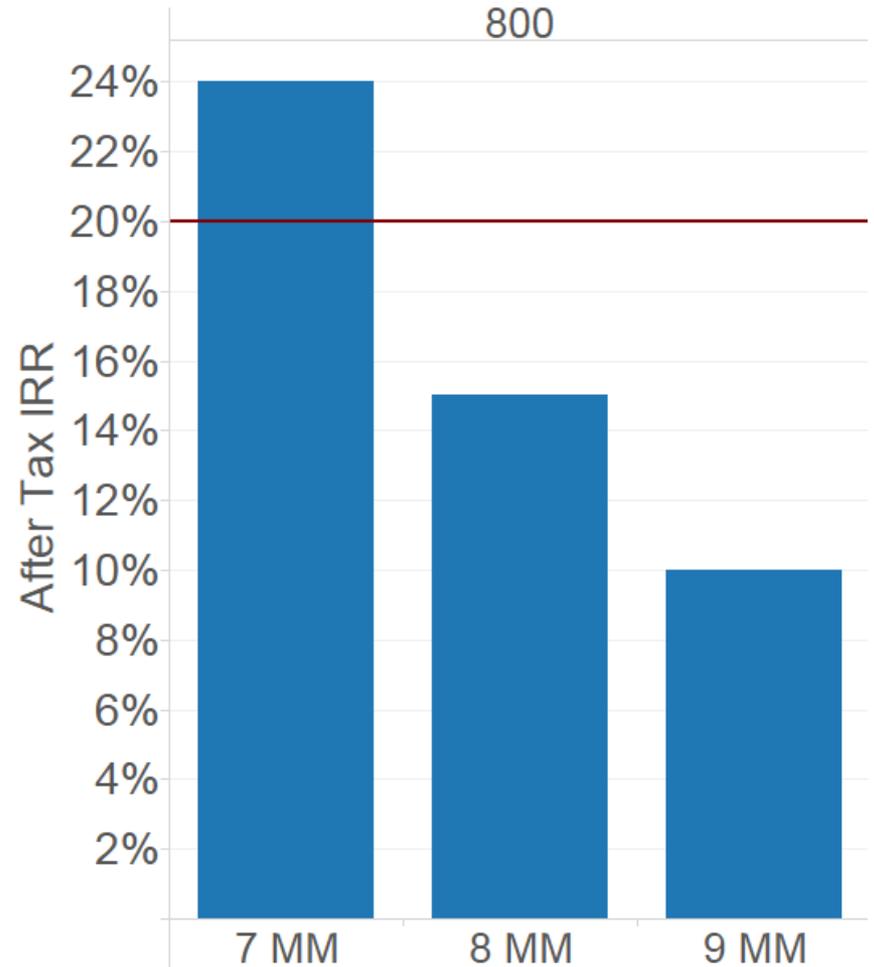
# Peak Month Minimum 700 BOPD

Peak Month BOPD / Well Cost  
700

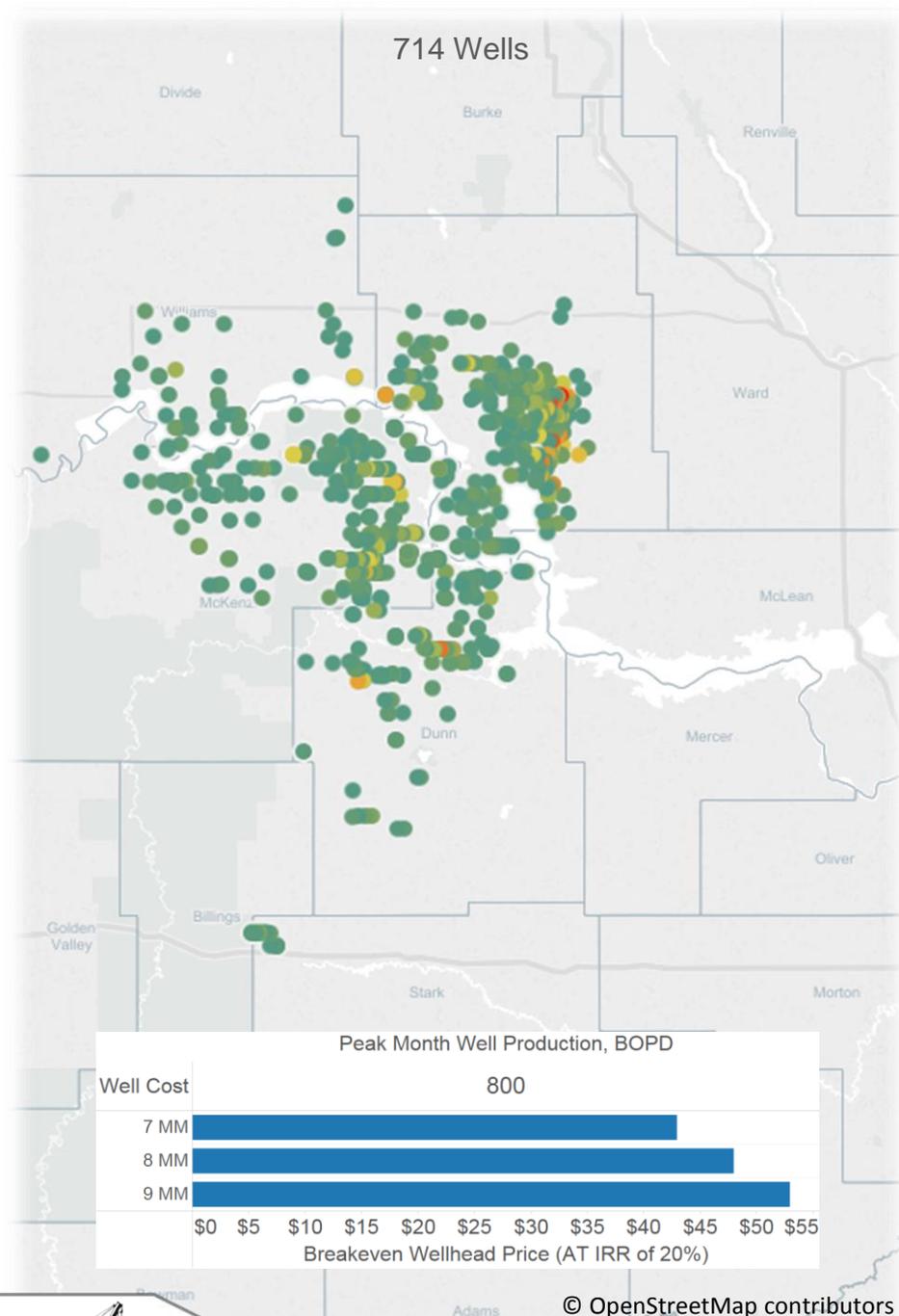


# Peak Month Minimum 800 BOPD

Peak Month BOPD / Well Cost  
800

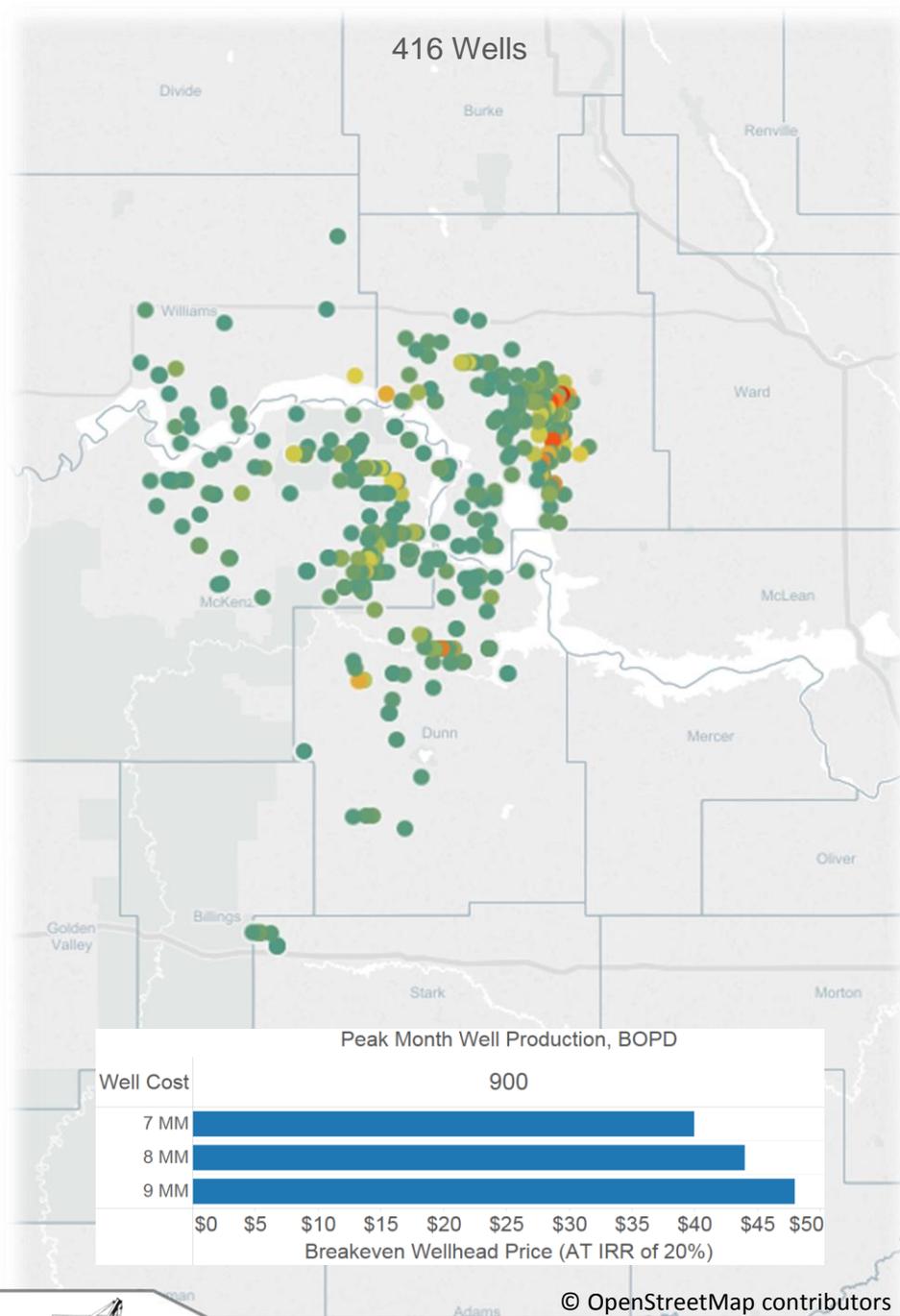
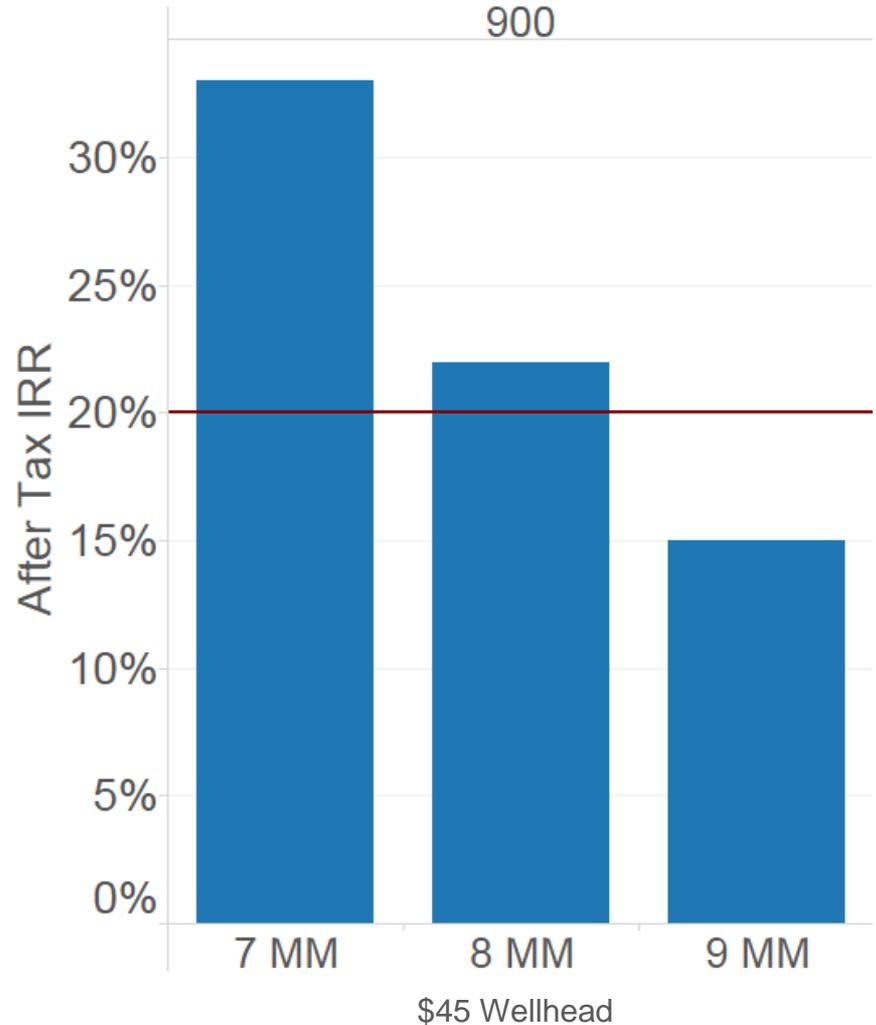


\$45 Wellhead

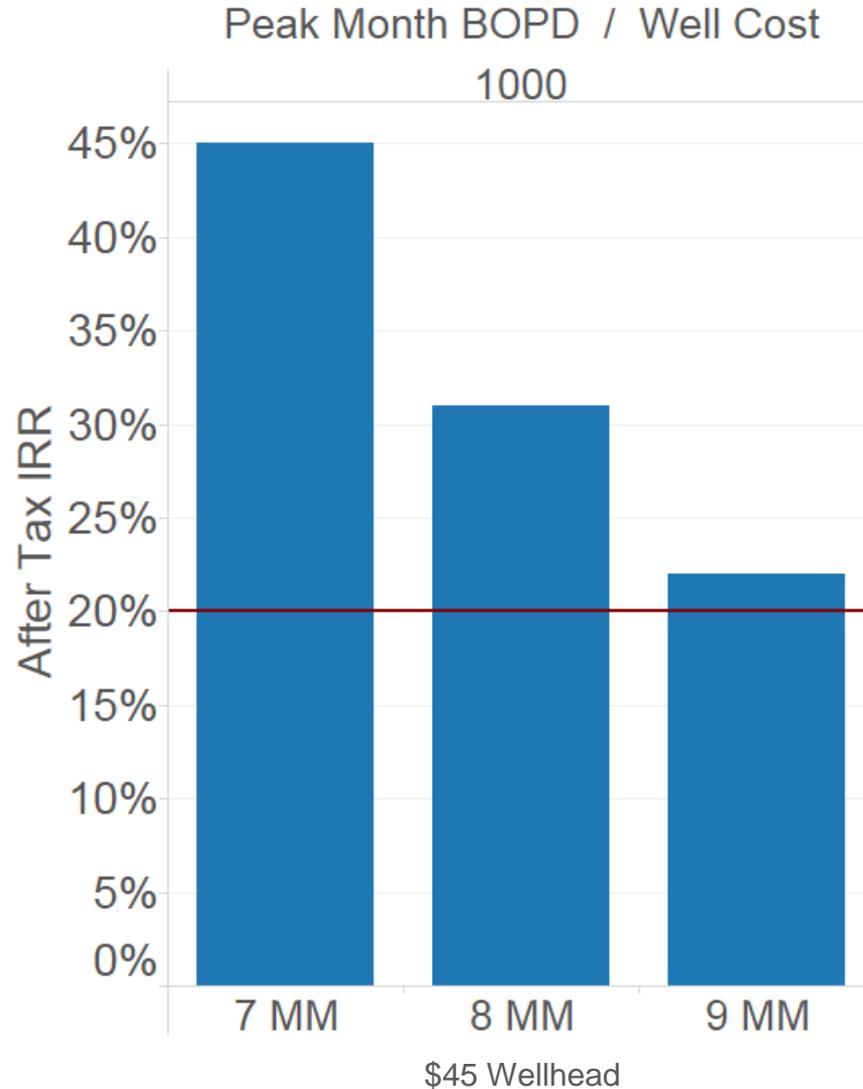
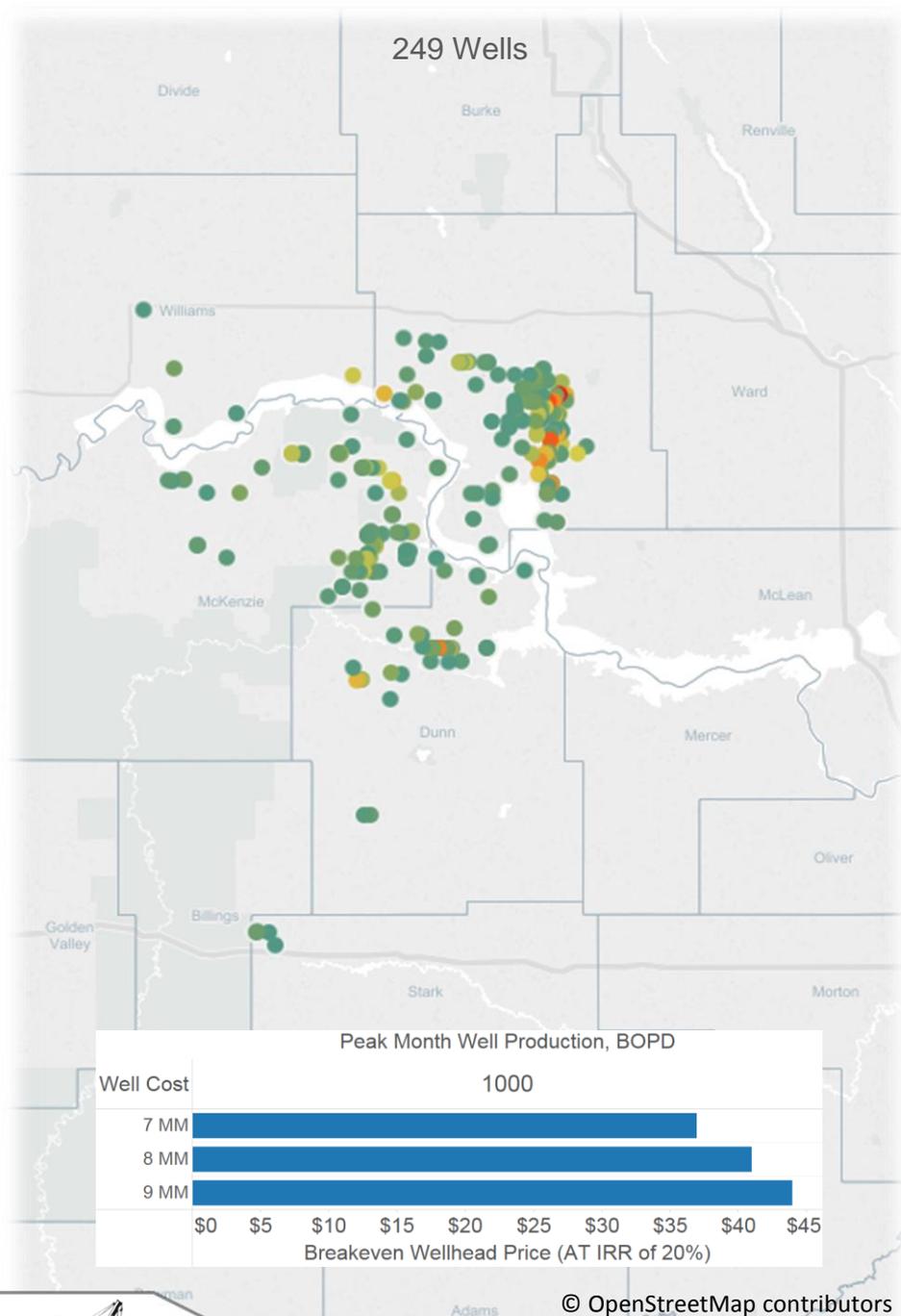


# Peak Month Minimum 900 BOPD

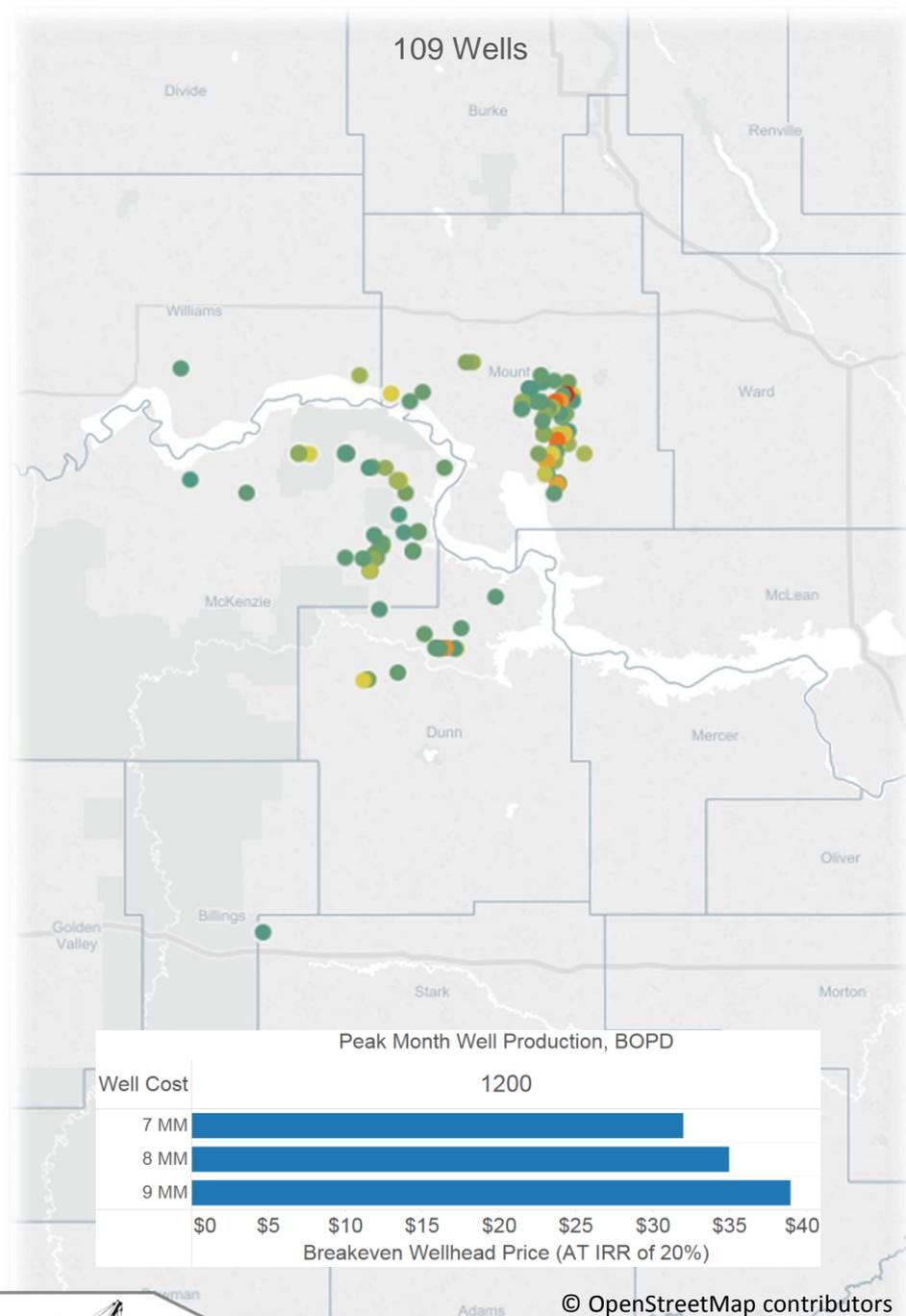
Peak Month BOPD / Well Cost  
900



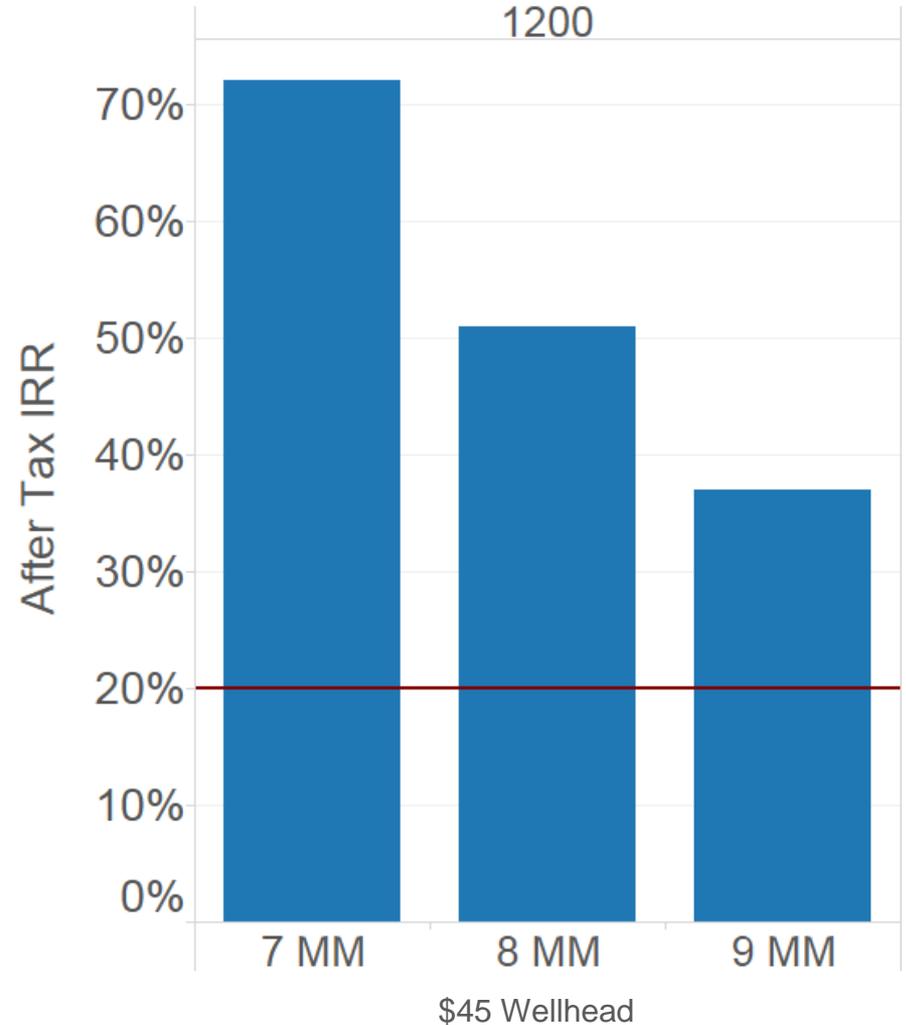
# Peak Month Minimum 1,000 BOPD

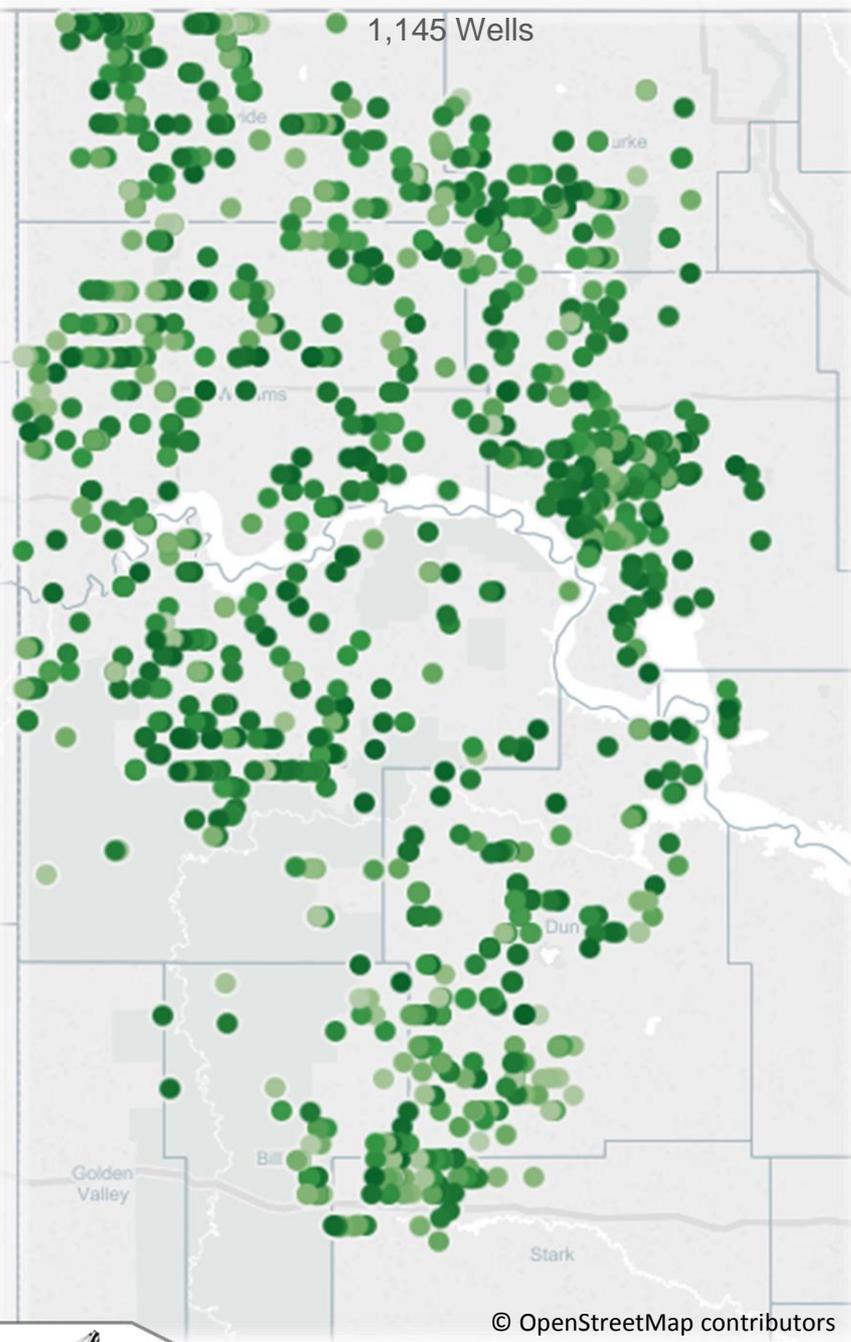


# Peak Month Minimum 1,200 BOPD



Peak Month BOPD / Well Cost  
1200





# Peak Month: 100-300 BOPD\*

\*Low production wells also occur in areas deemed “Core” or “Hot Spot”.

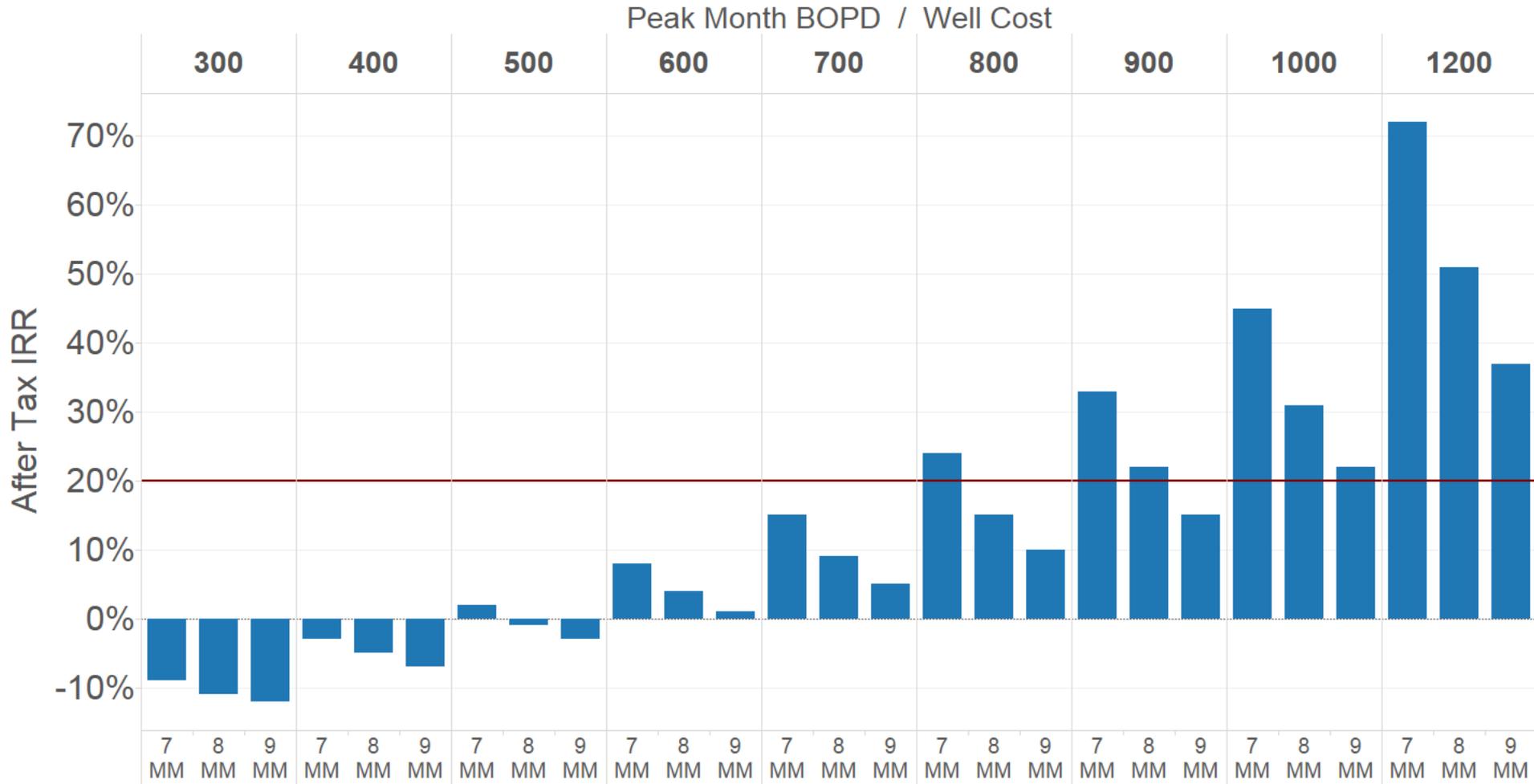
Risk is still present in most areas.

Mapped wells drilled 2012-2014

© OpenStreetMap contributors

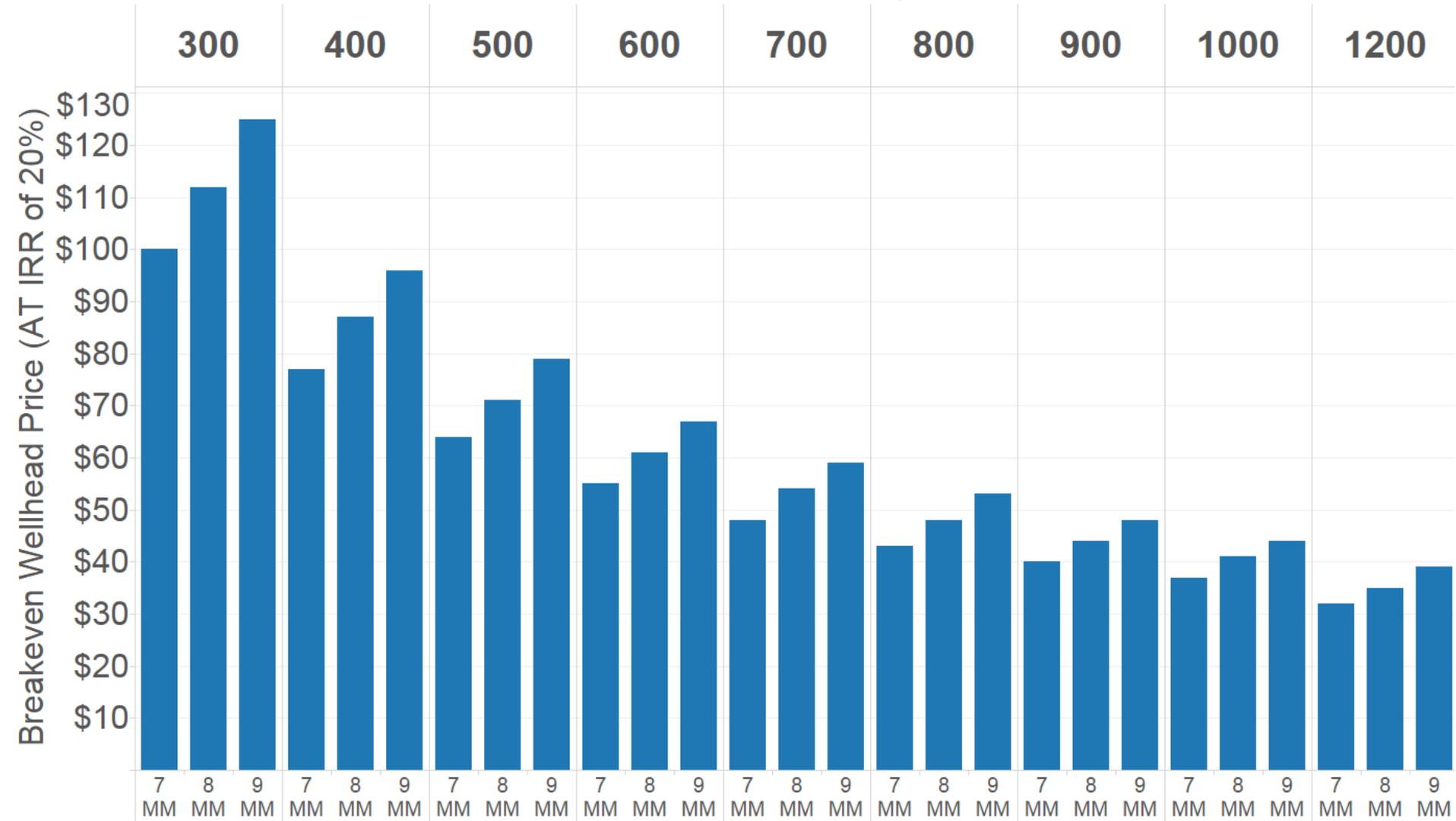


# Summary of \$45 Wellhead Oil



# Breakeven Summary

Peak Month Well Production, BOPD / Well Cost

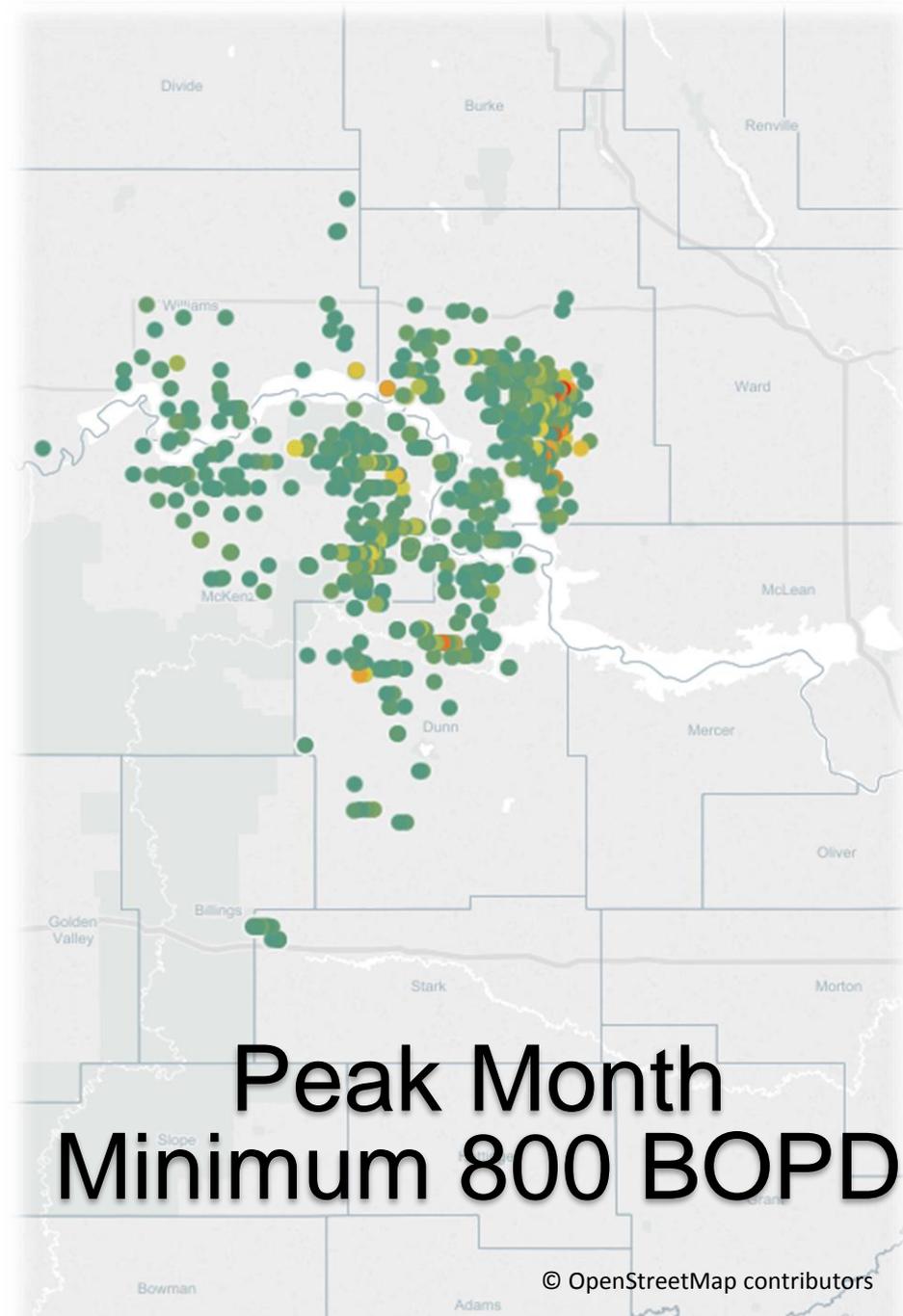


# Options for drilling outside 800 BOPD footprint:

1) Prove location is viable in low price environment (lower costs, improved IP, etc.)

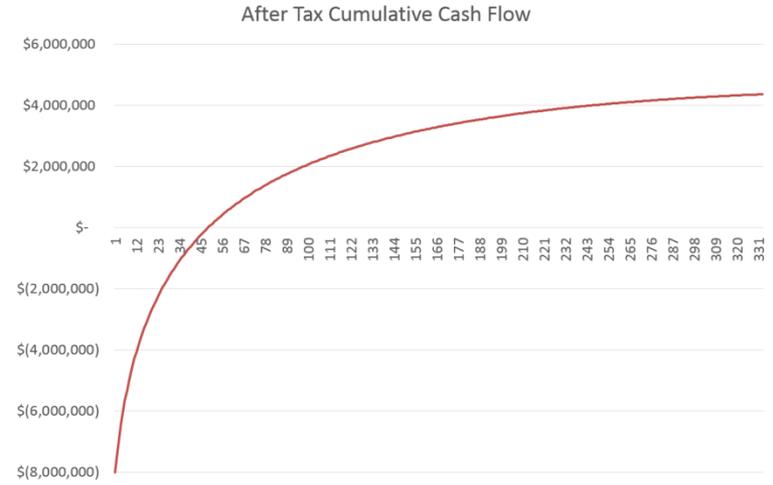
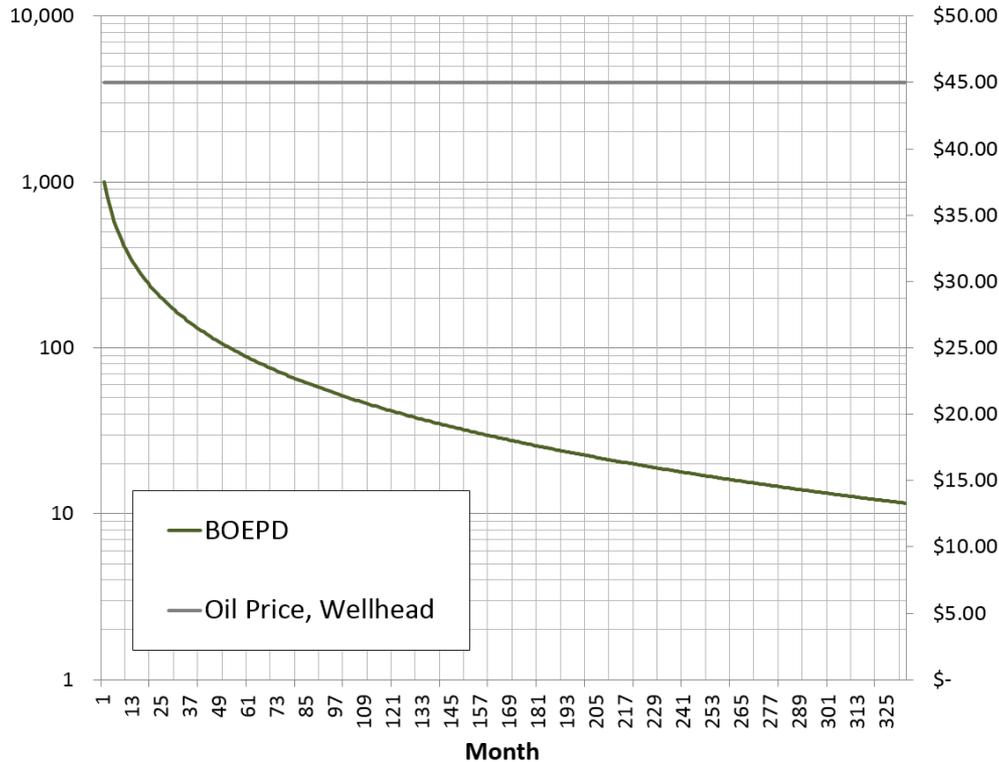
2) Move rig to better geology (inside or outside of basin)

3) Release rig



# 800 BOPD Well Example

- \$8 MM Well
- \$45/bbl oil and \$6/mcf gas
- AT IRR = 15%
- AT NPV (10) = \$0.93 MM
- Simple Payback = 4.0 Years



# Additional Considerations

- Can well costs come down further?
- Individual company budgets, cash flows, hedges, obligations, and management strategies
- Competition from other plays
- Completion technology continues to improve
  - Higher volumes of proppant and water
  - Higher density drilling success



# Arguments

- Well economic assumptions too optimistic or conservative
  - Jump to lower or higher well performance footprints
- Some rigs are not drilling Bakken/Three Forks wells
  - No economics were run on wells in other formations



# Next Steps

- Use the findings to refine crude oil and natural gas forecasts for the region
- Continue to monitor pricing, production, and technology to further enhance our understanding of well economics in North Dakota

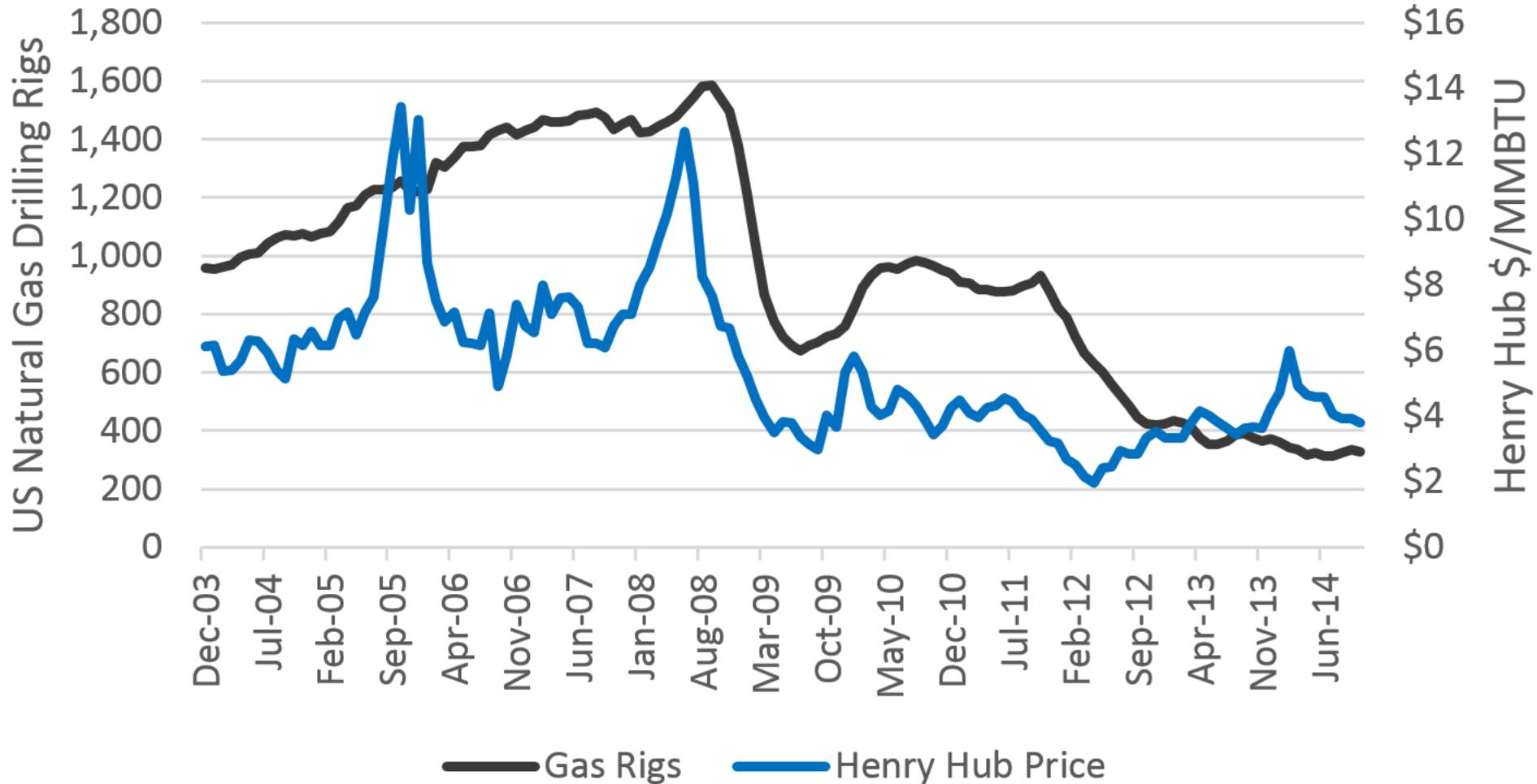


# Have I Seen This Episode Before?



# Can We Learn from Natural Gas?

## US Gas Drilling Rigs / Price

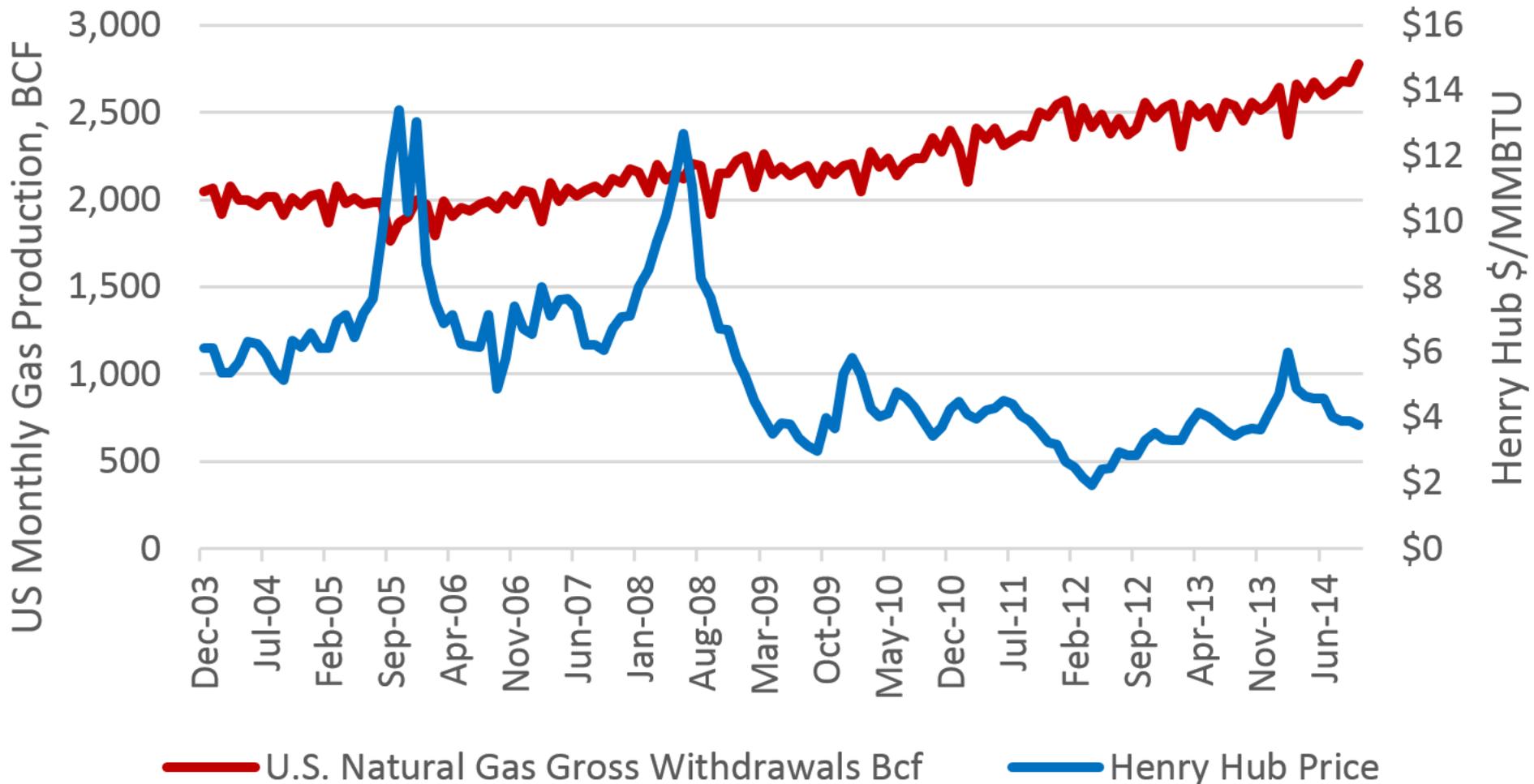


Source: EIA Data



# Can We Learn from Natural Gas?

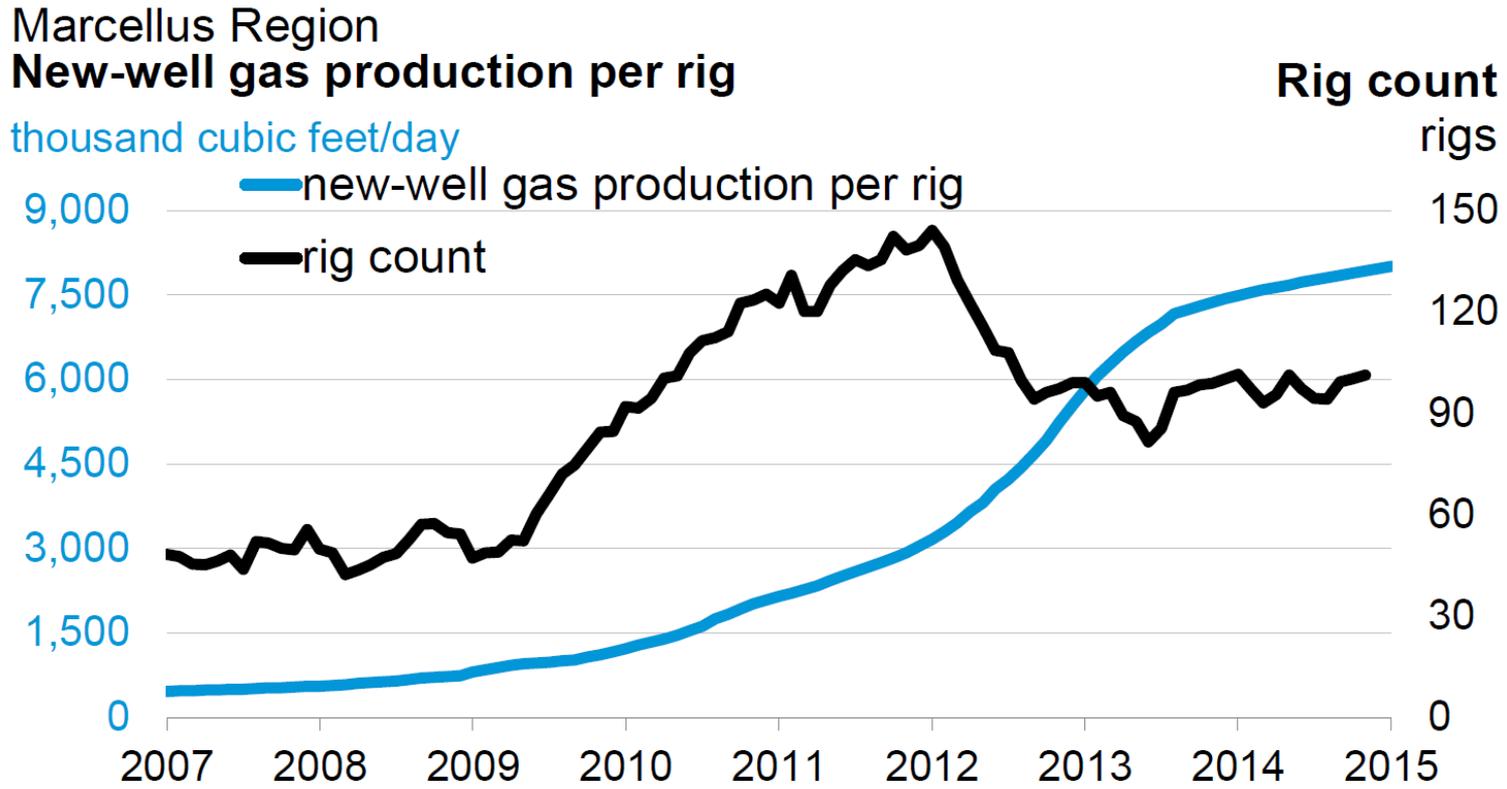
## US Gas Production / Price



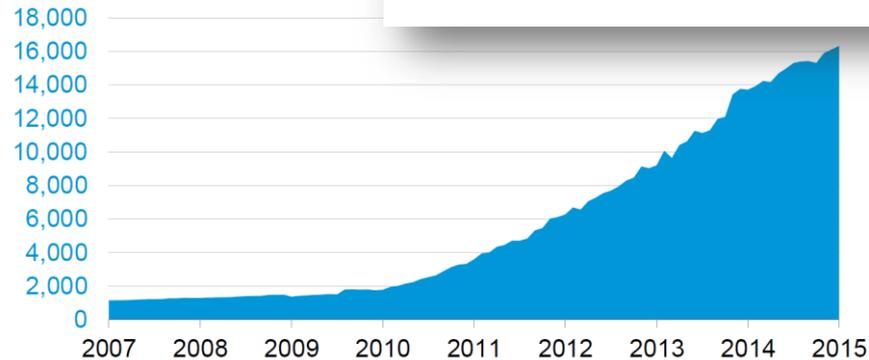
Source: EIA Data



# Marcellus Reaction to Low Prices



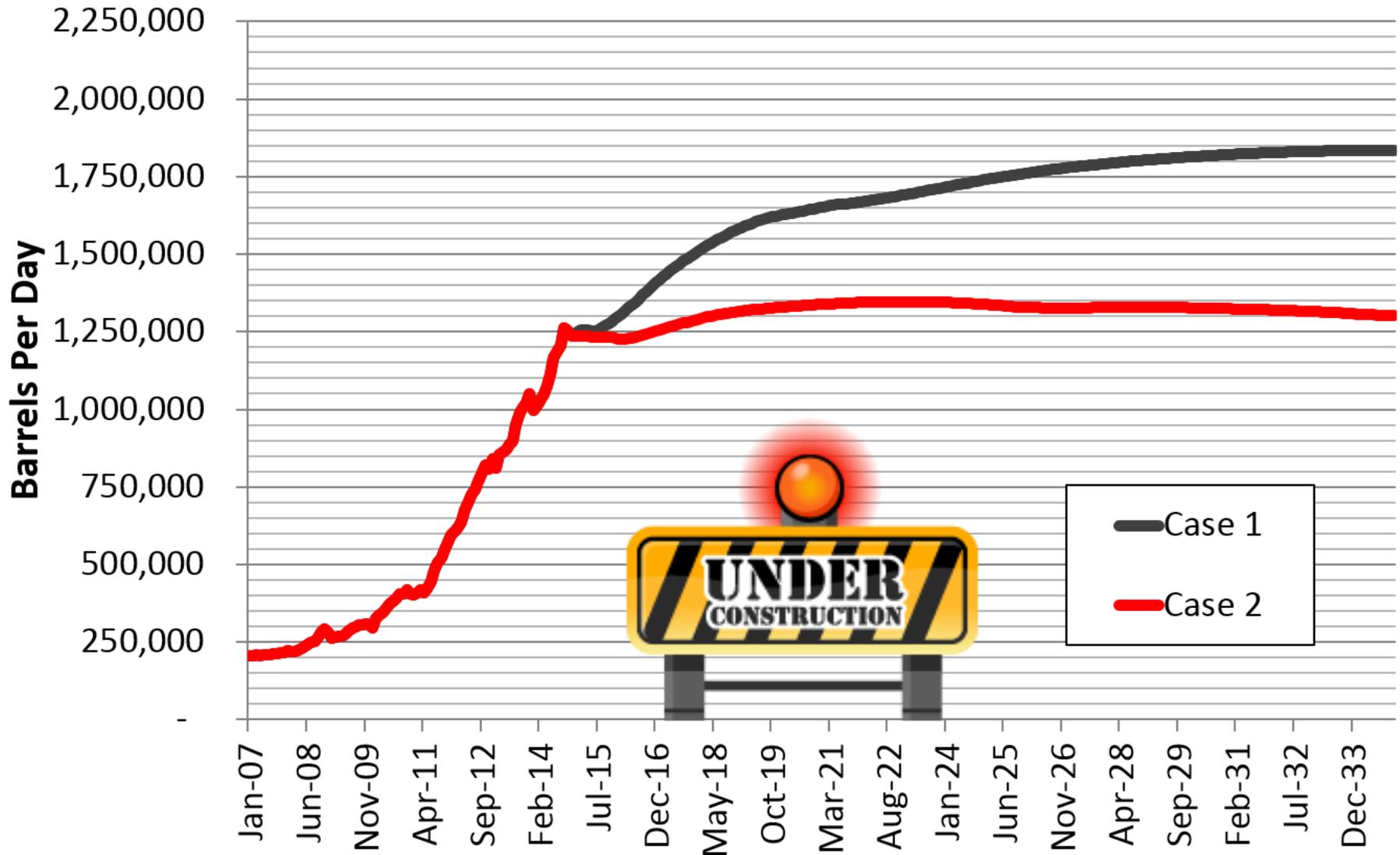
**Marcellus Region  
Natural gas production**  
million cubic feet/day



Source: U. S. Energy Information Administration | Drilling Productivity Report



# Forecasting Williston Basin Oil Production, BOPD



*Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.*



# Forecasting Challenges

## Current Model (Case 1)

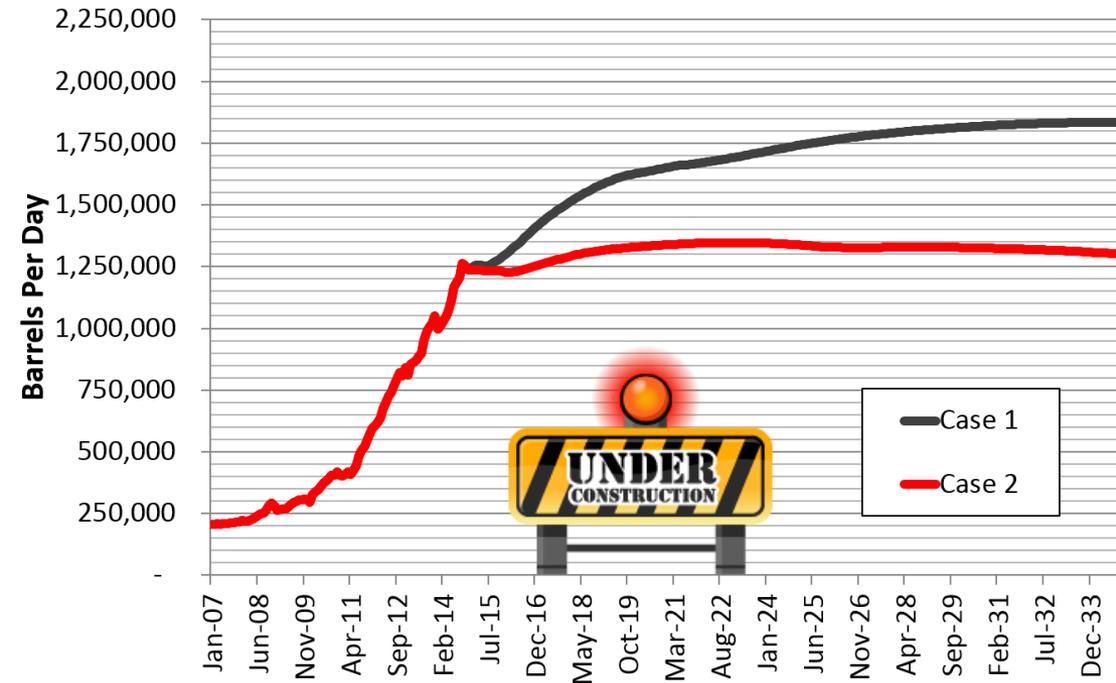
- Approx. 46,000 New Wells Out to Dec 2034
- Average EUR Roughly 342,000 BBLS
- Average First Month Production of 349 BOPD

## Ongoing Considerations

- Increased Density Drilling
- Drilling Efficiencies
- Improving Completion Techniques
- Productivity of the Lower Three Forks
- Eastern Montana Success
- Flaring production Restrictions

## Long Term Considerations

- EOR Opportunities
- Pricing
- Competition
- Additional Williston Basin Plays



# Forecasting Challenges

## Current Model (Case 1)

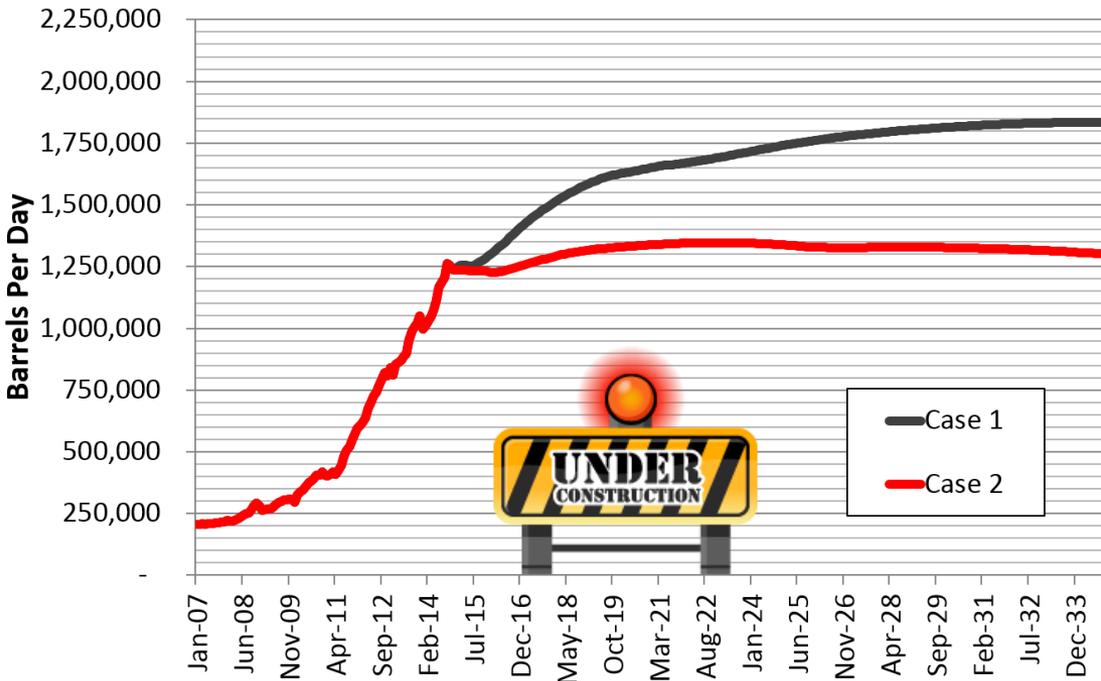
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## Ongoing Considerations

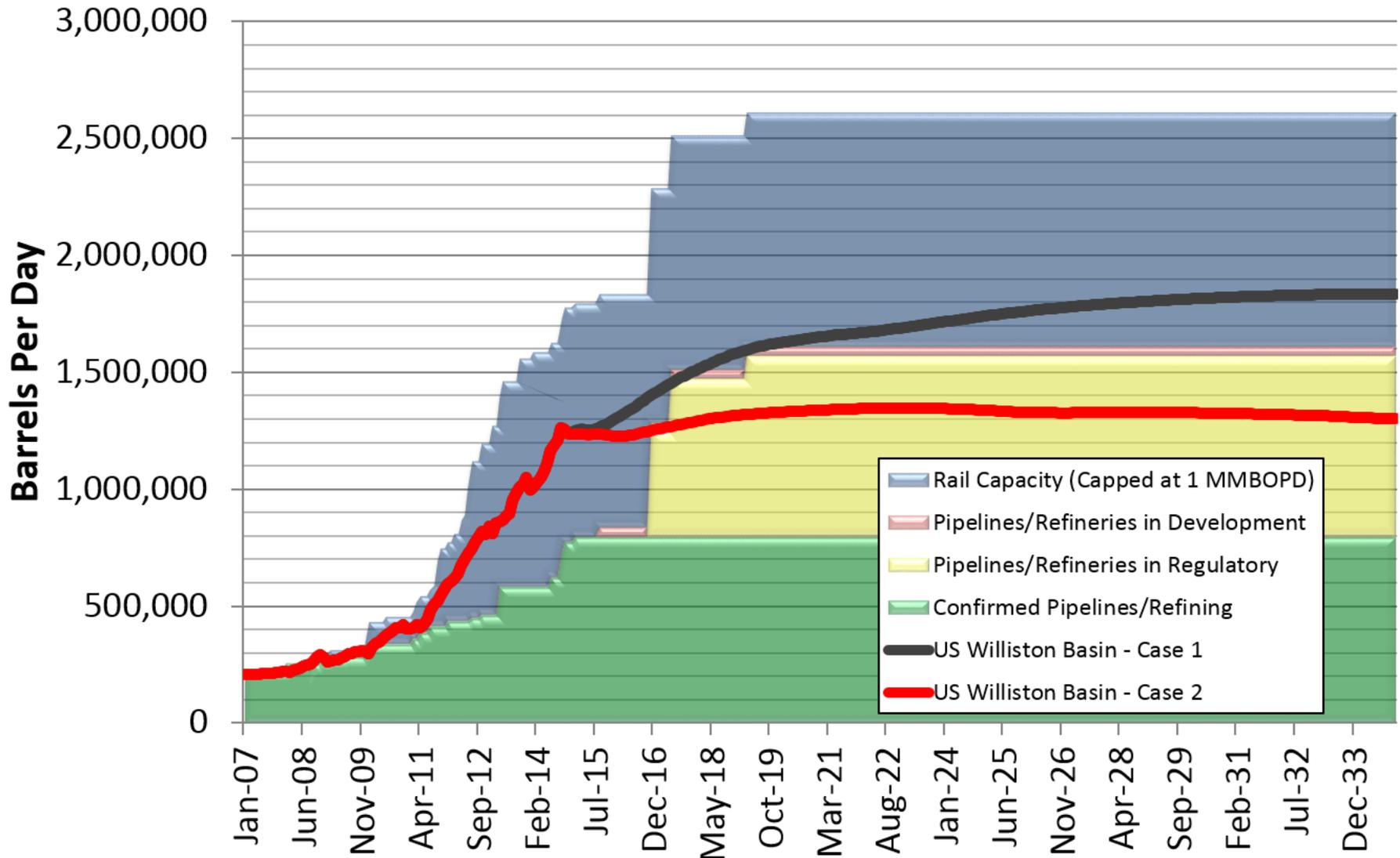
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## Long Term Considerations

- EOR Opportunities
- Pricing**
- Competition**
- Additional Williston Basin Plays



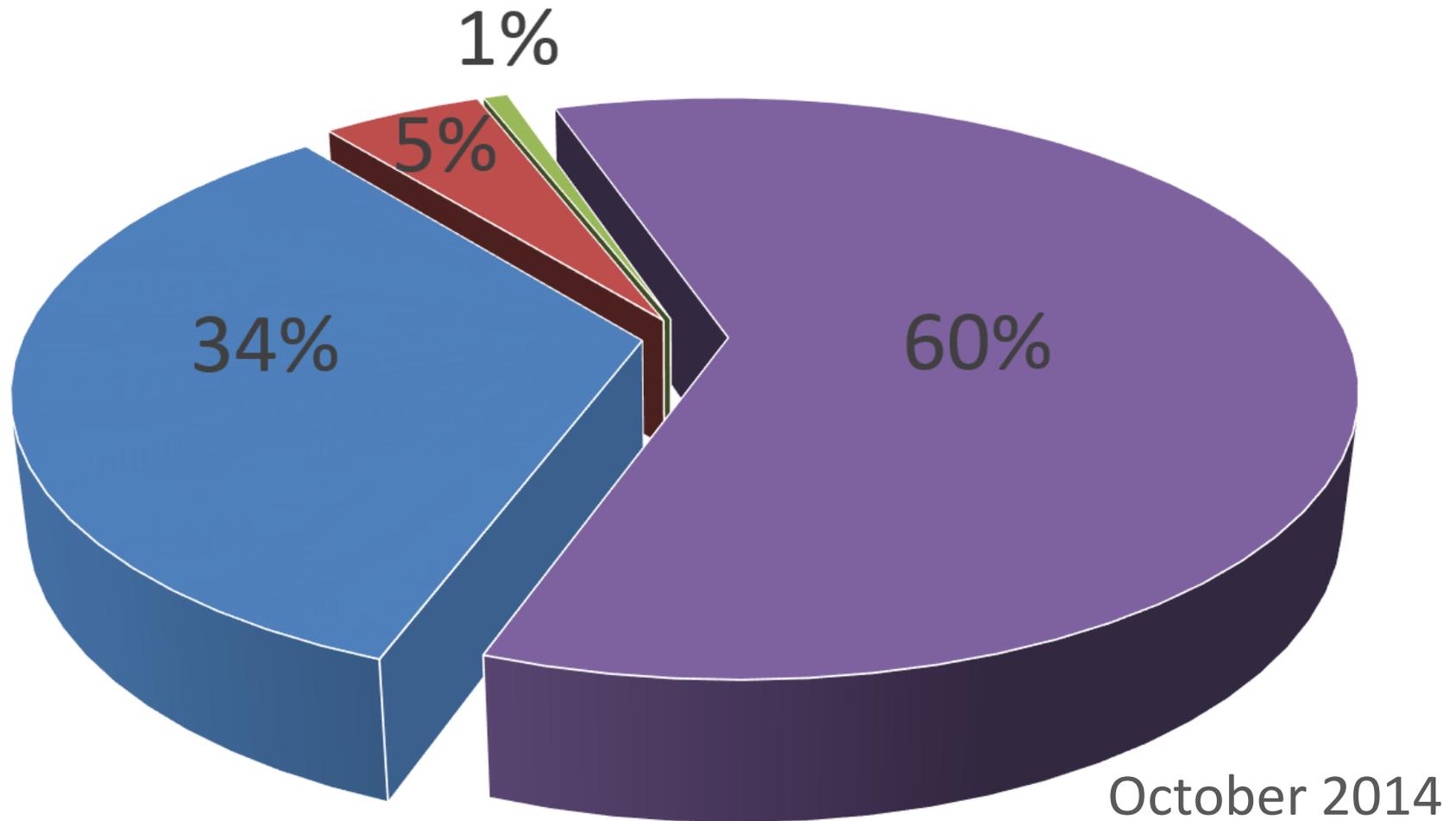
# Williston Basin Oil Production & Export Capacity, BOPD



Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.



# Estimated Williston Basin Oil Transportation



■ Estimated Pipeline Export

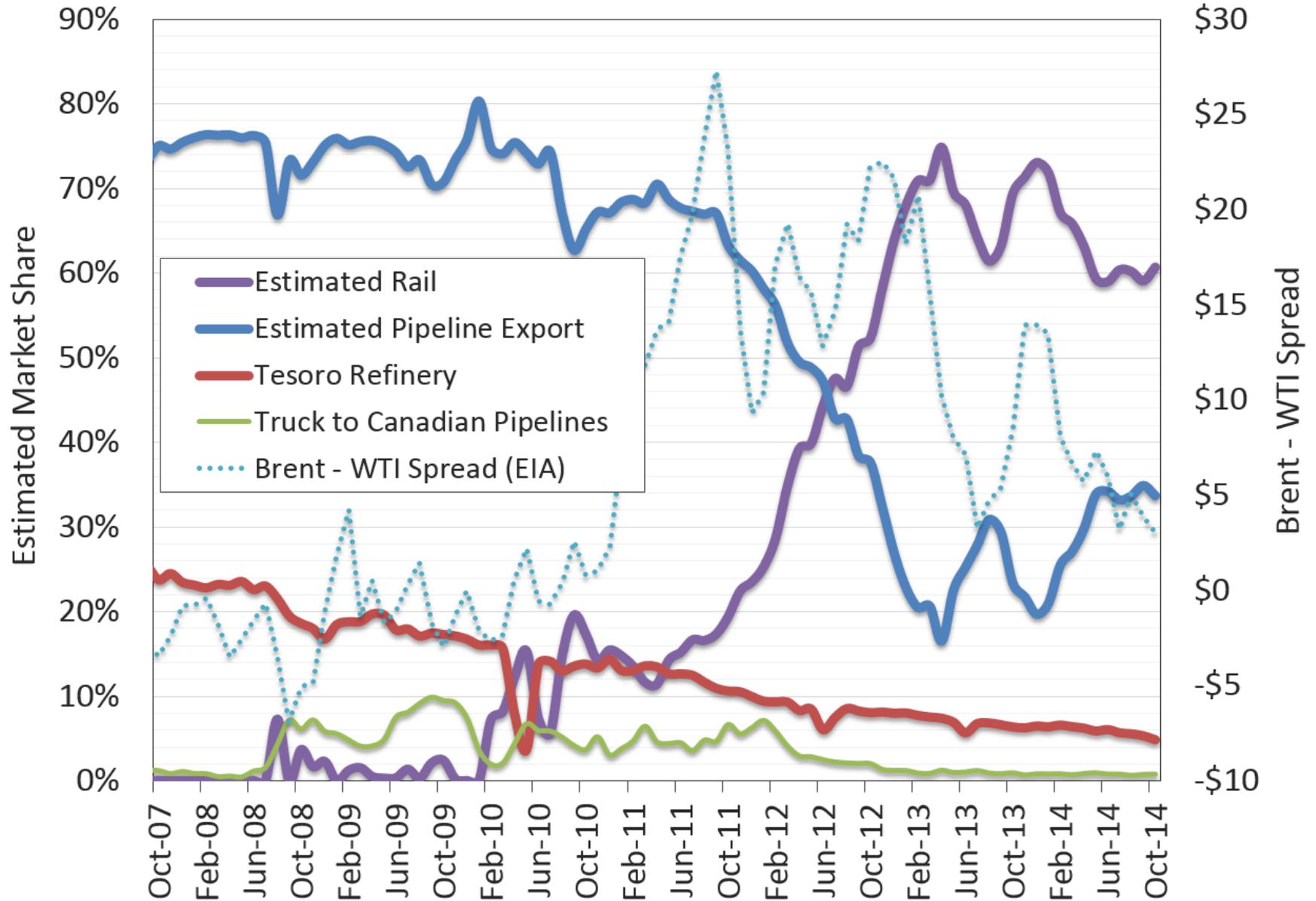
■ Tesoro Refinery

■ Truck to Canadian Pipelines

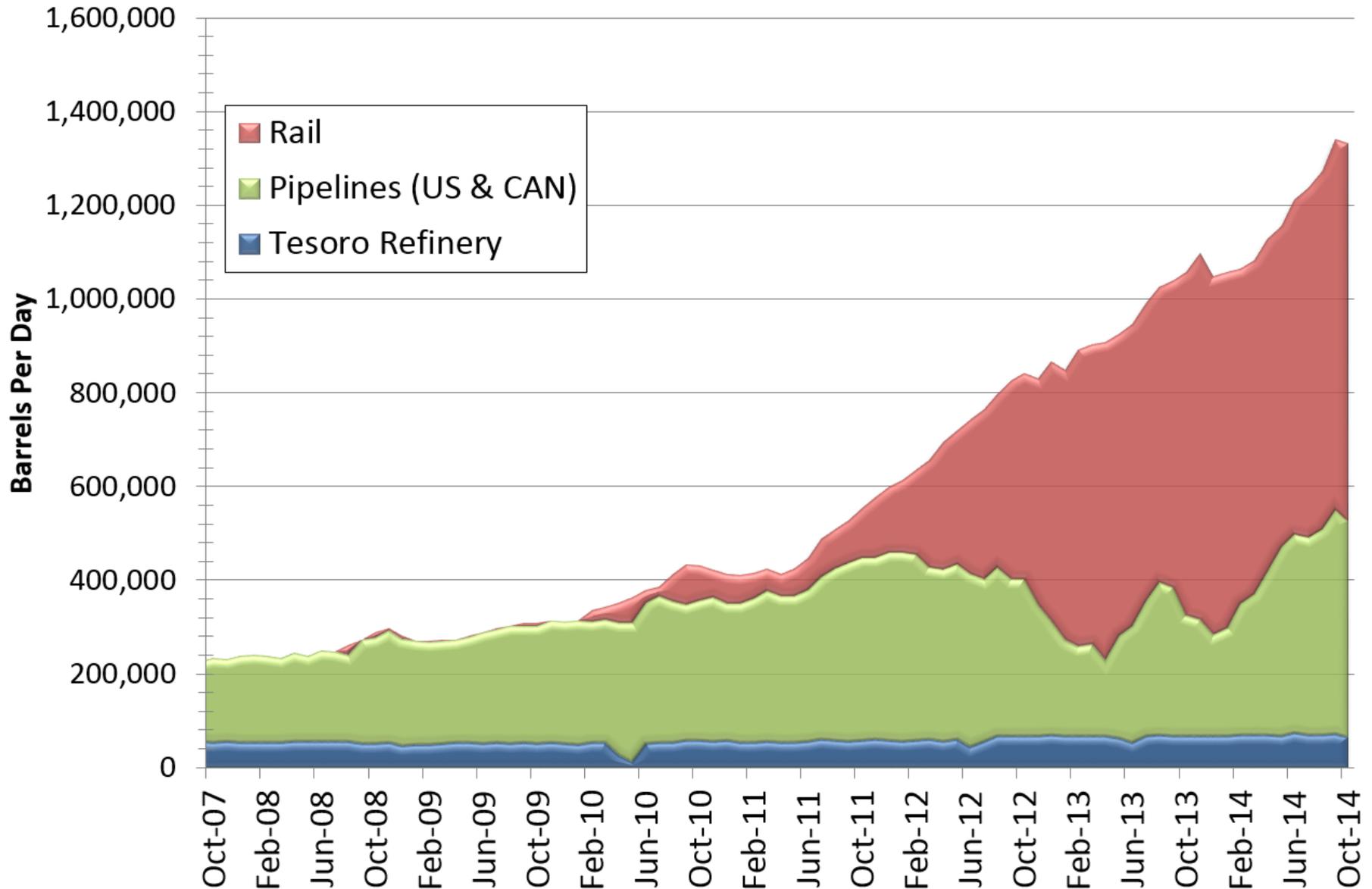
■ Estimated Rail



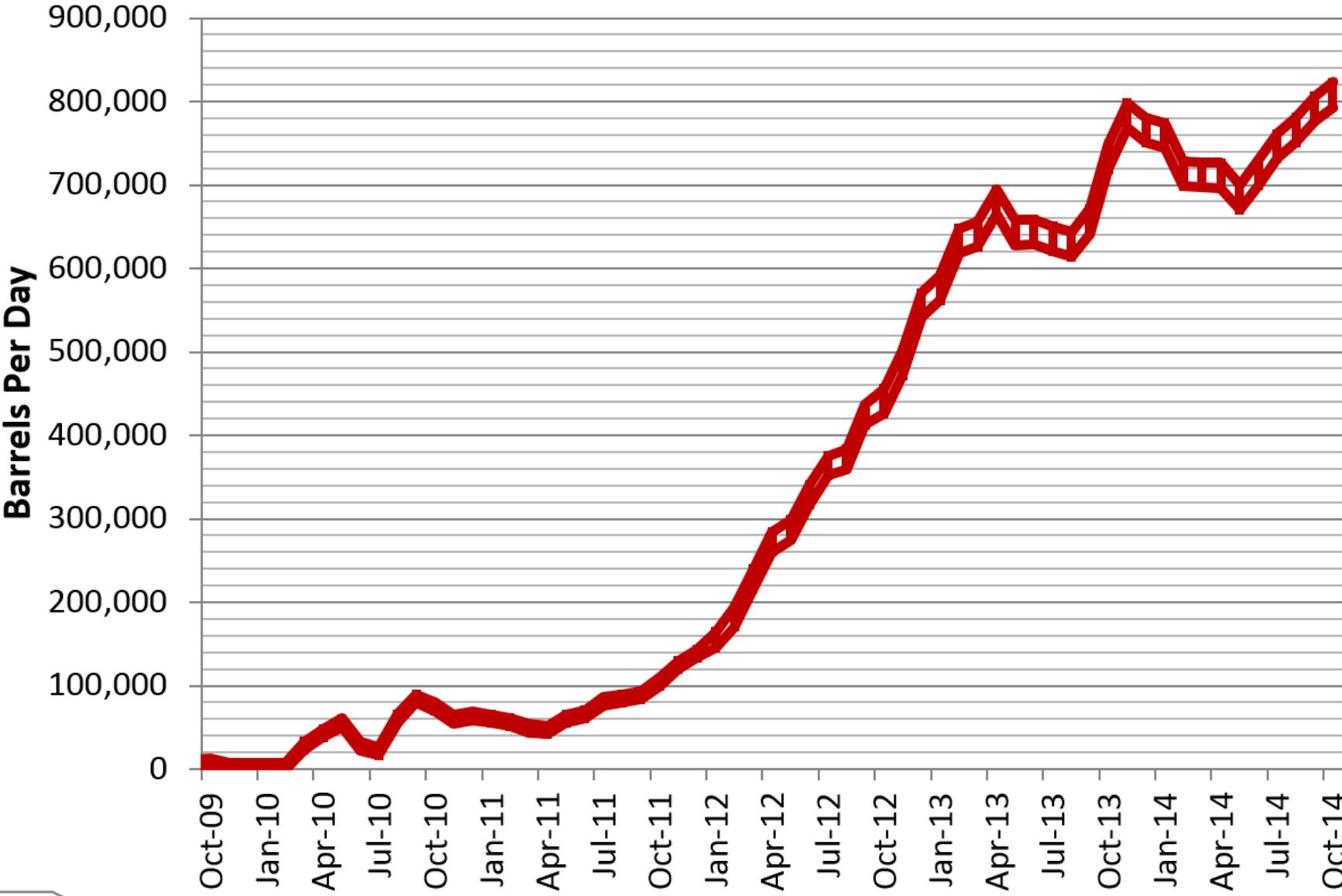
# Estimated Williston Basin Oil Transportation



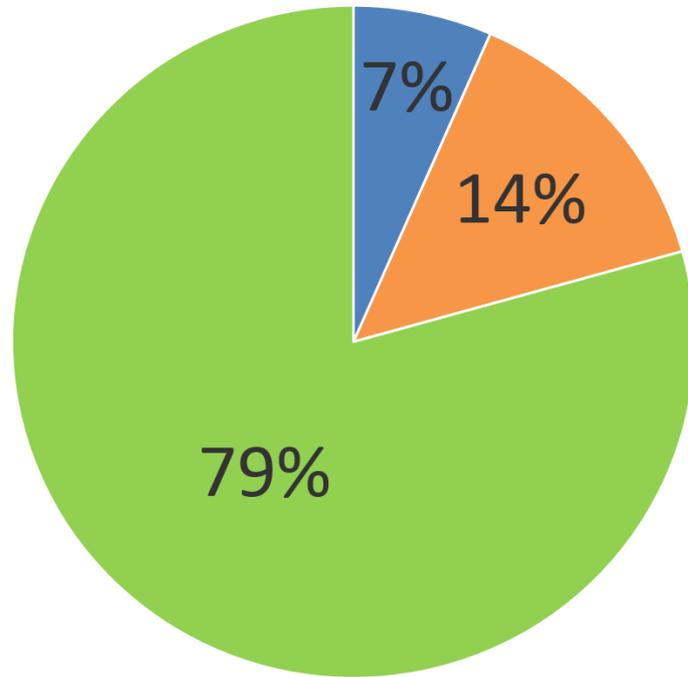
# Estimated Williston Basin Oil Transportation



# Estimated ND Rail Export Volumes



# Solving the Flaring Challenge



Statewide

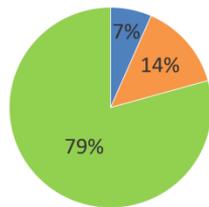
**GREEN** – % of gas captured and sold  
**Blue** – % flared from zero sales wells  
**Orange** – % flared from wells with at least one mcf sold.

## Simple Terms

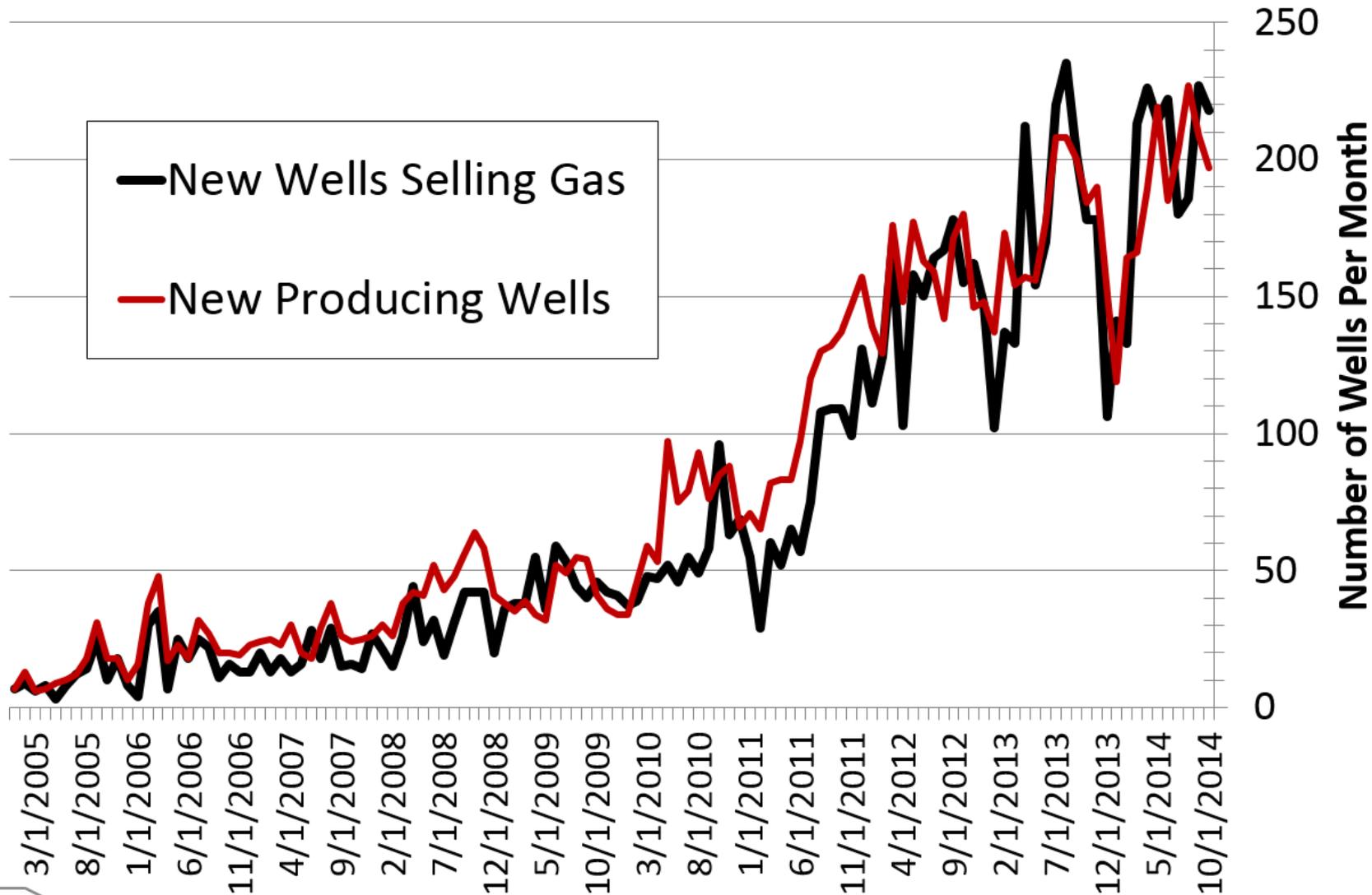
**Blue** – Lack of pipelines  
**Orange** – Challenges on existing infrastructure

Oct 2014 Data – Non-Confidential Wells





# Capturing the 7% Faster Well Connections



# Contact Information

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[www.pipeline.nd.gov](http://www.pipeline.nd.gov)

[www.northdakotapipelines.com](http://www.northdakotapipelines.com)



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