

North Dakota Law Review

Energy Law Symposium

Justin J Kringstad

Geological Engineer

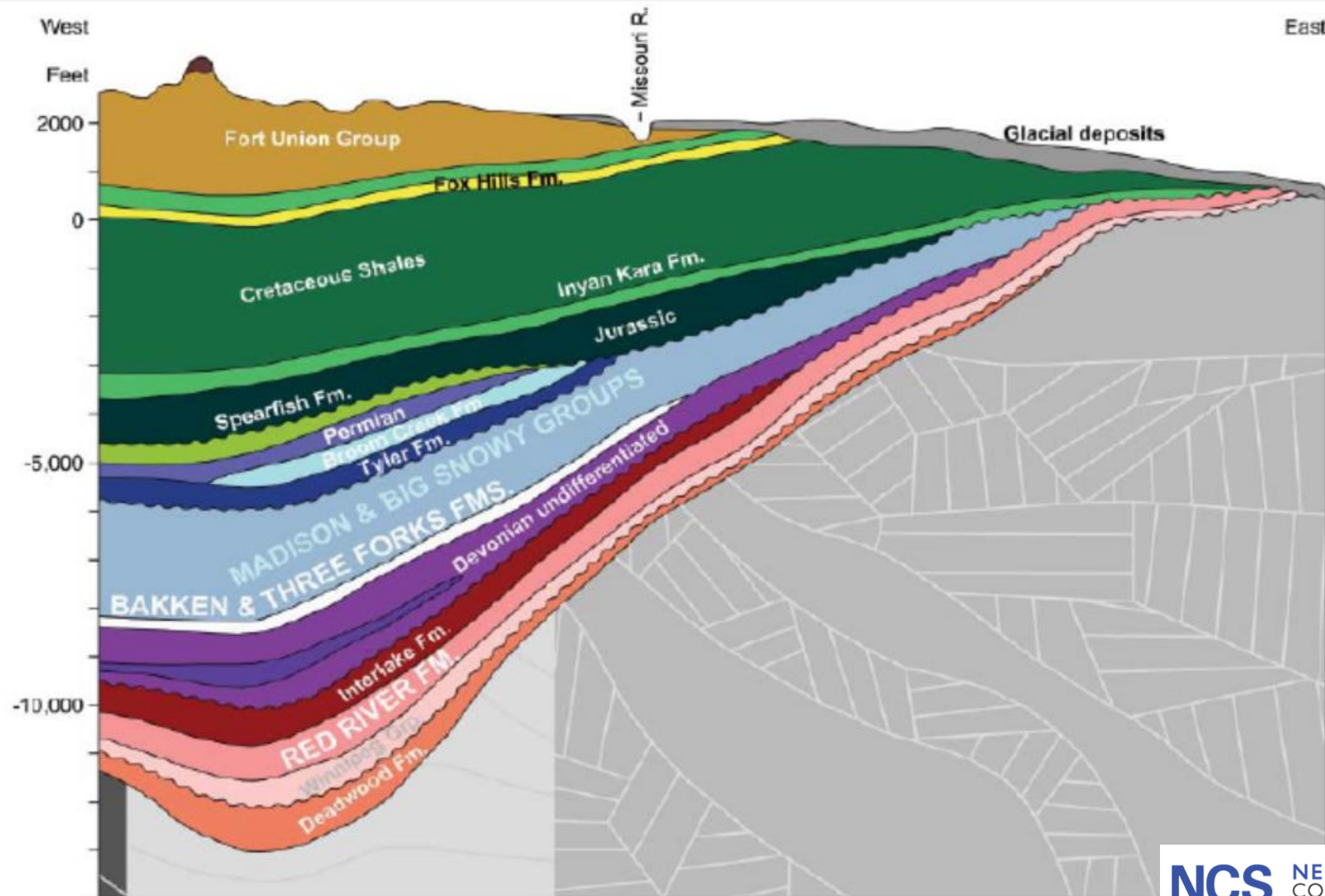
Director

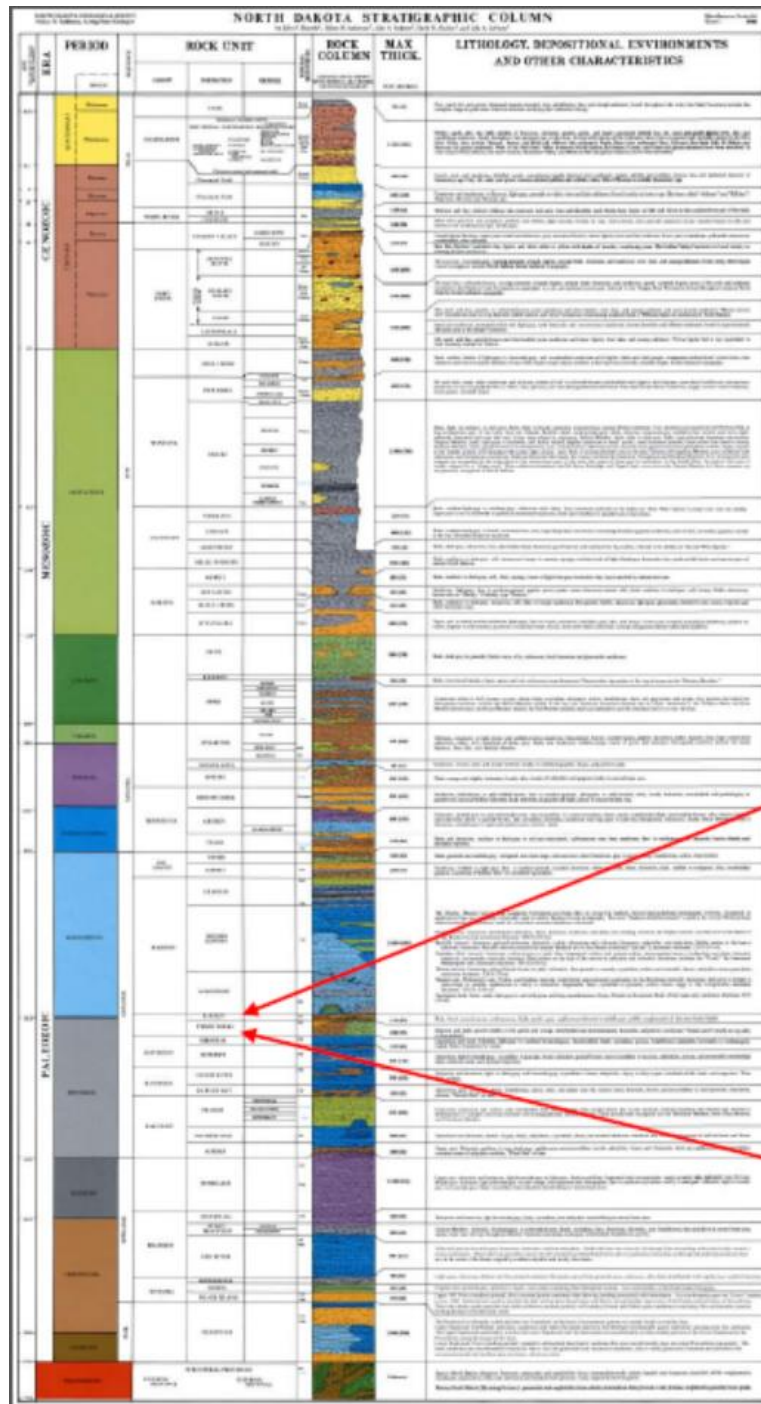
North Dakota Pipeline Authority

April 11, 2019



Williston Basin Deposition





Bakken

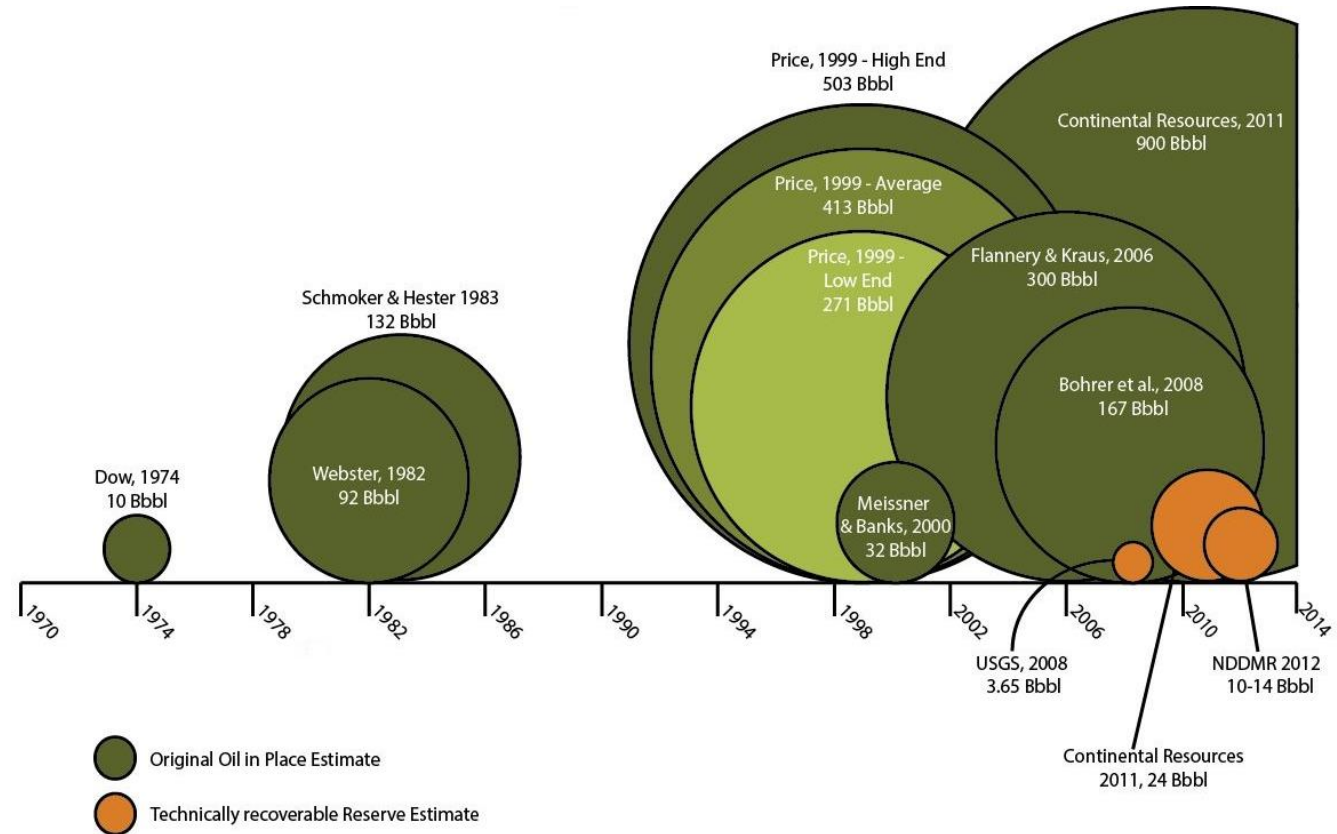
Three Forks

North Dakota Stratigraphic Column

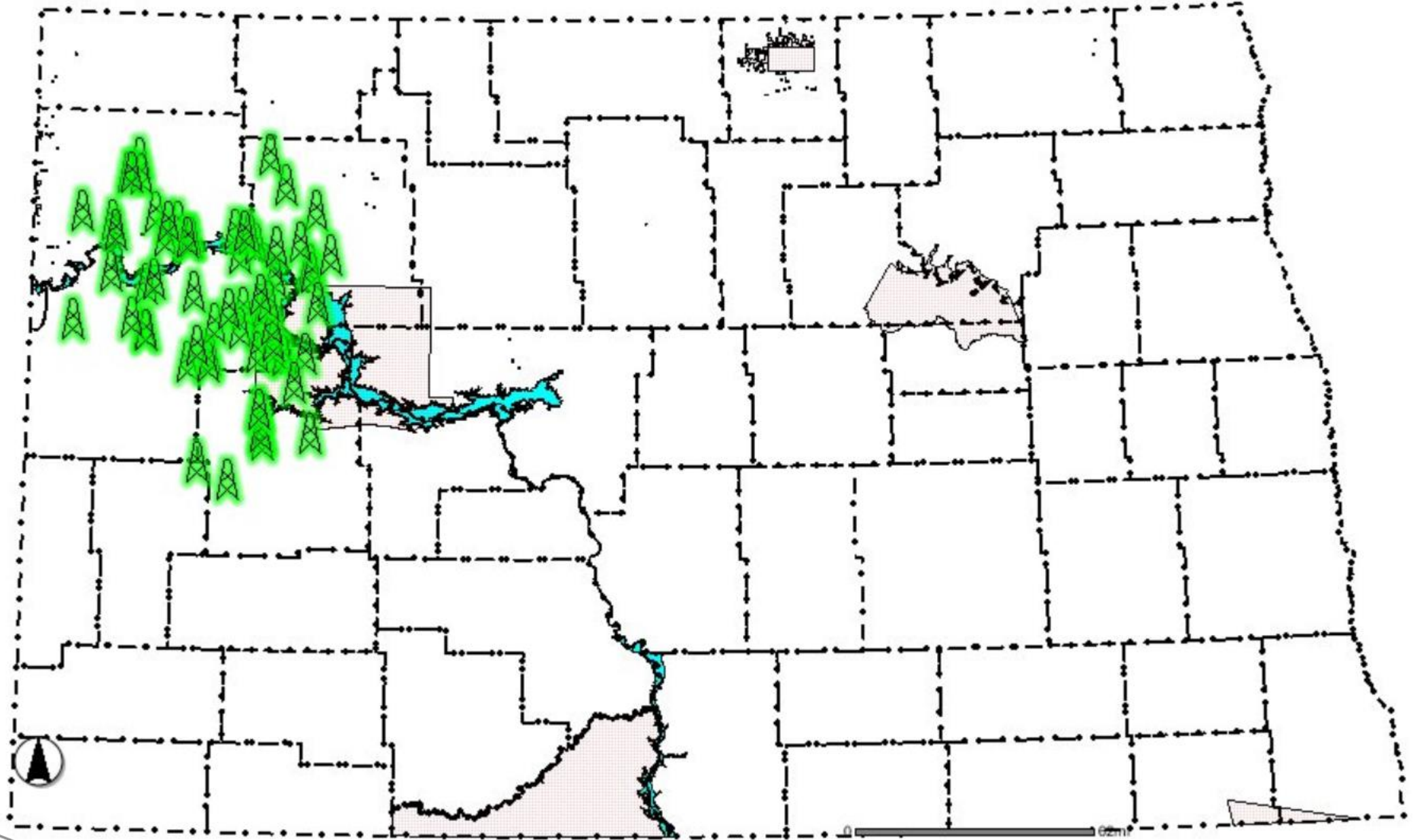
Bakken Formation
 ~360 Million Years Old
 Paleozoic Era
 Mississippian/Devonian Period
 ~110' thick

Three Forks/Sanish
 ~370 Million Years Old
 Paleozoic Era
 Devonian Period
 ~240' thick

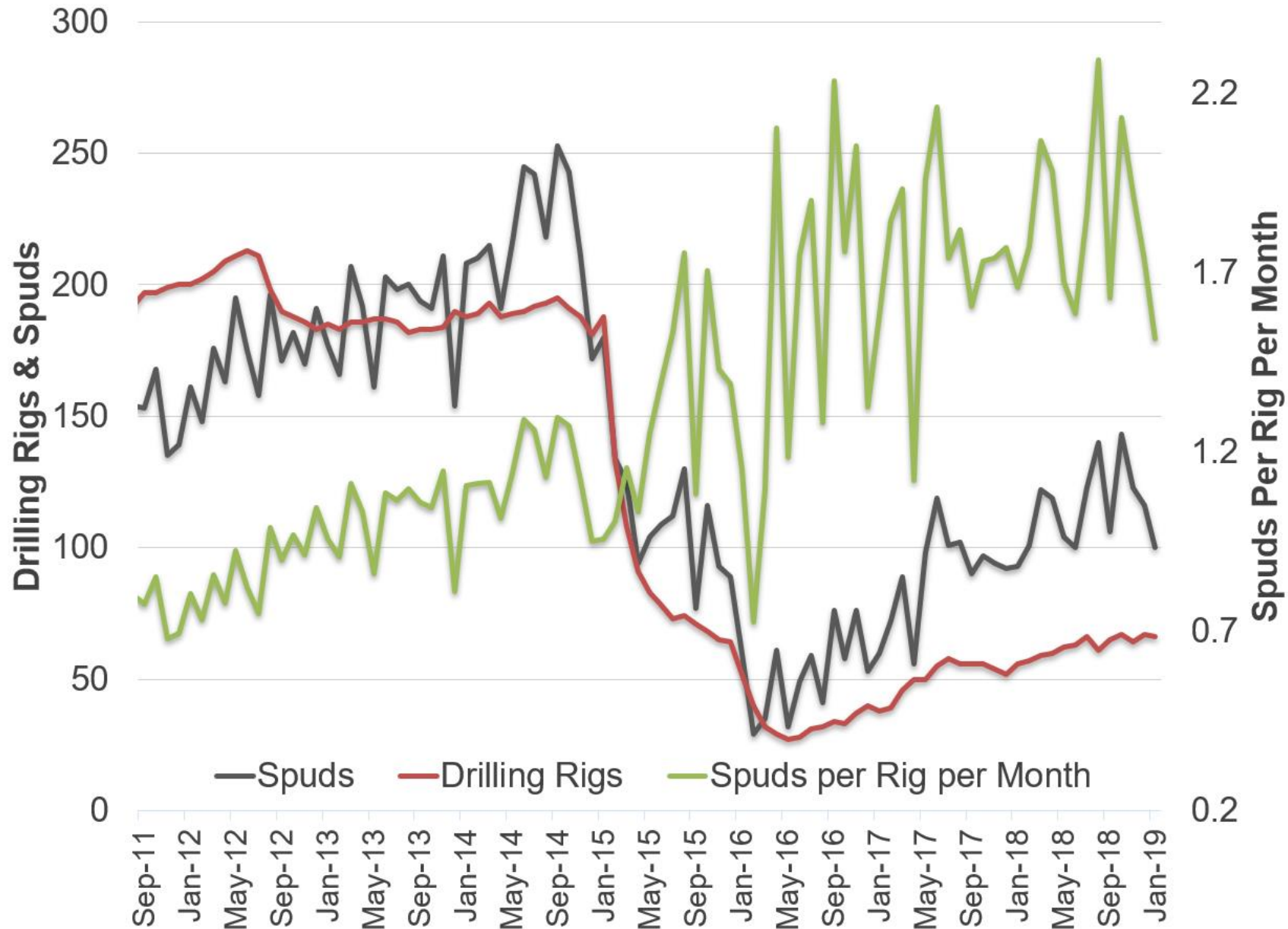
BAKKEN – THREE FORKS FORMATIONS



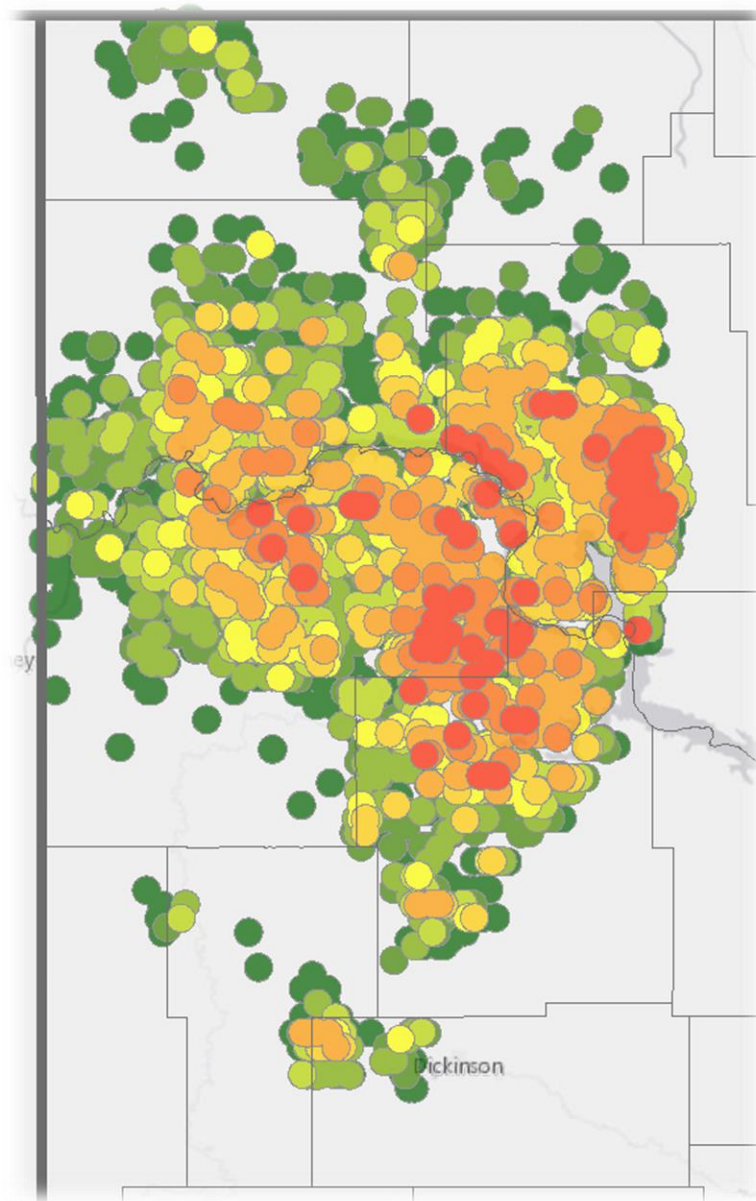
North Dakota Drilling Activity – 63 Rigs (April 9, 2019)



North Dakota Drilling Activity



Bakken Breakeven Price Range (20% IRR)



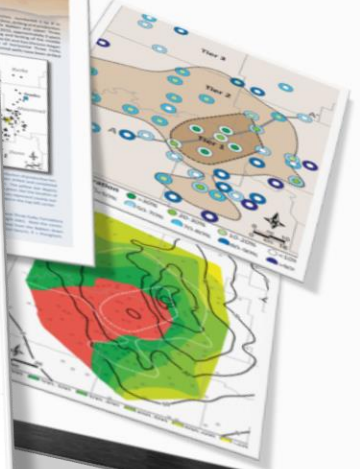
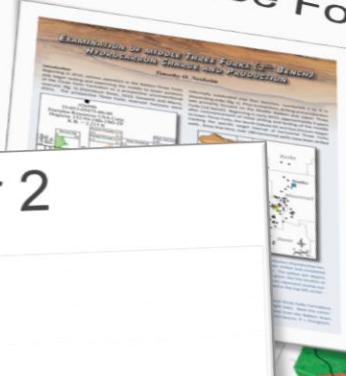
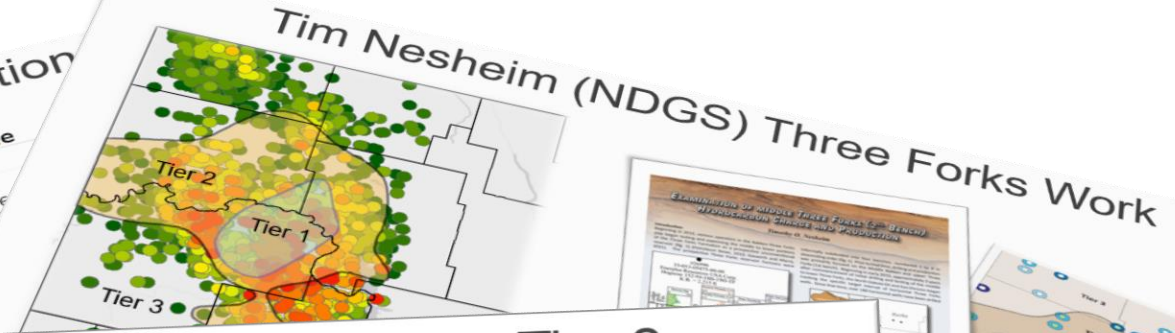
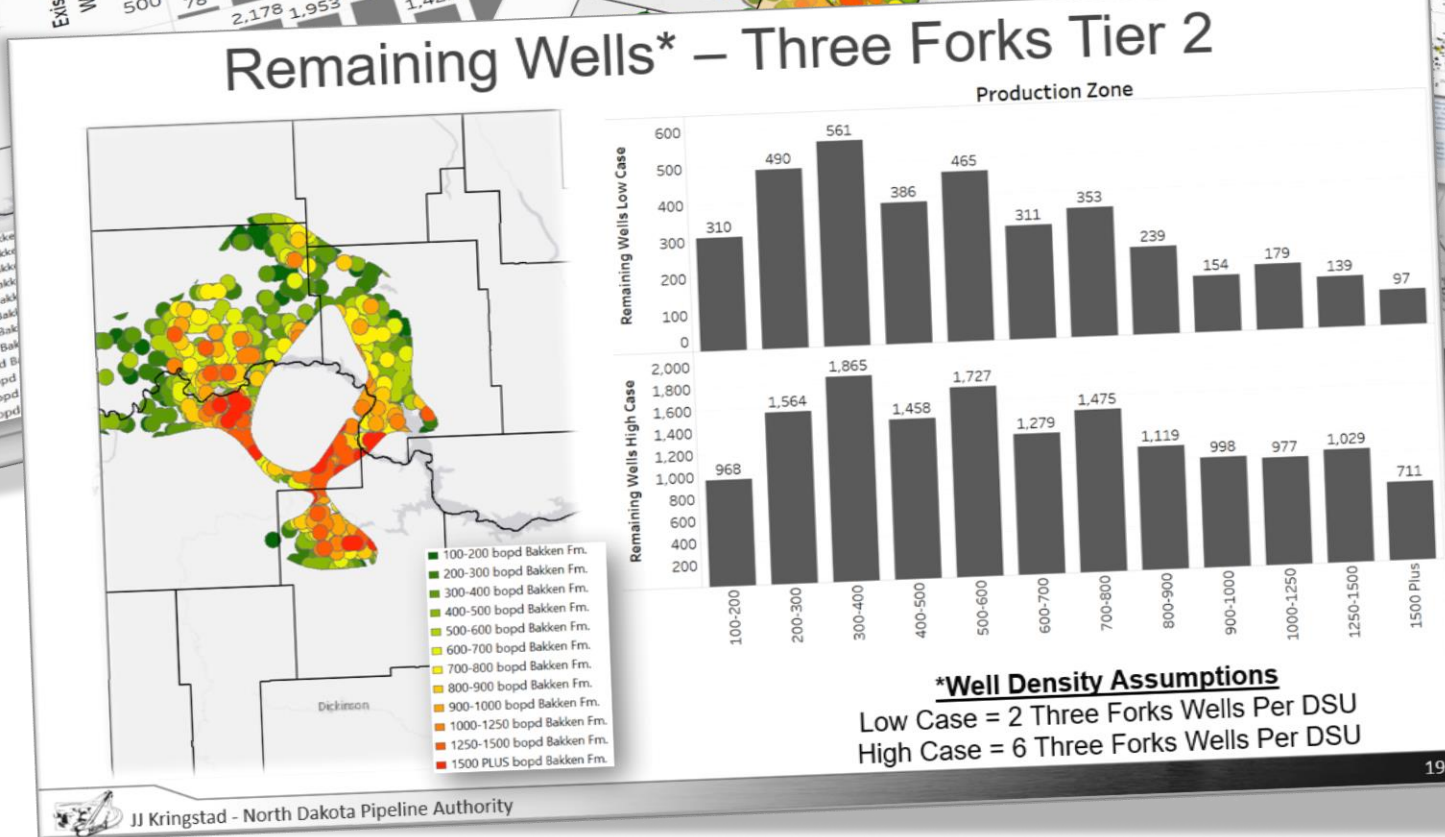
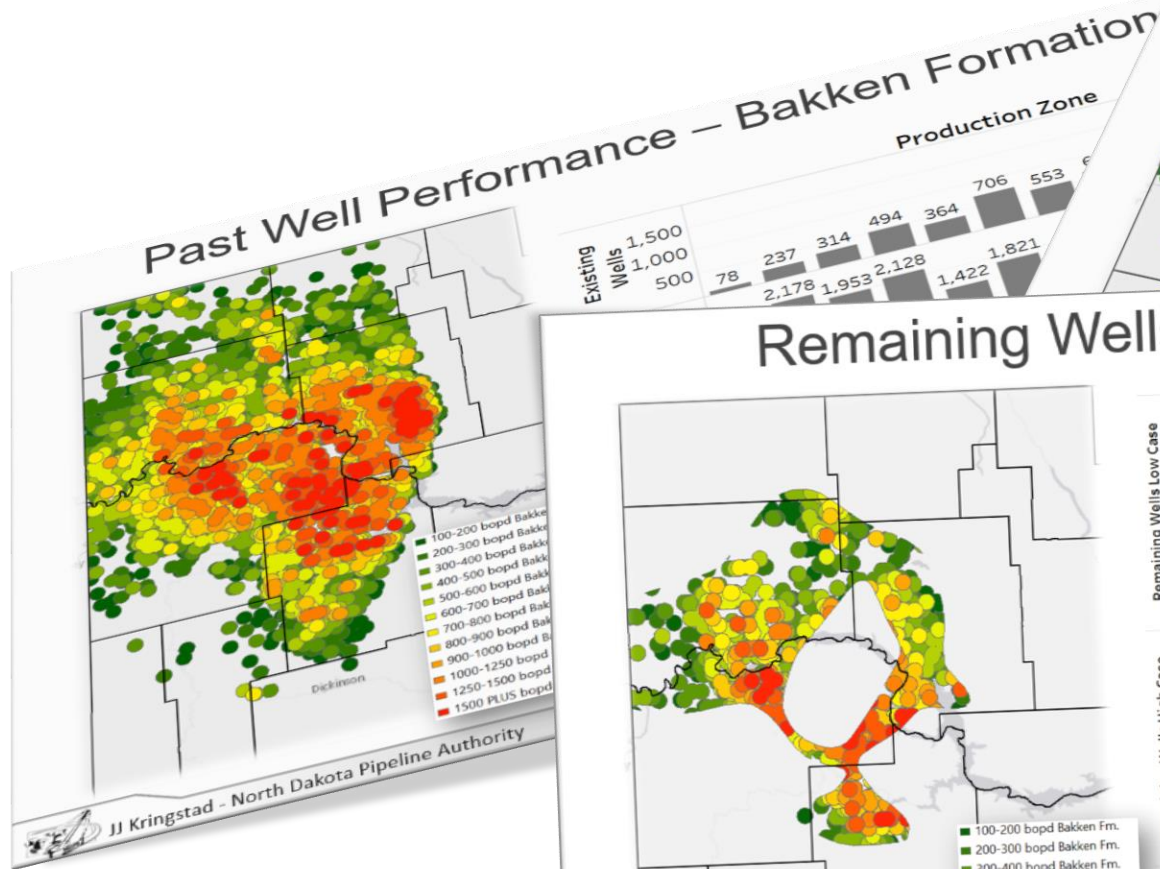
Bakken Breakeven Prices
\$6 - \$8 Million
Completed Wells Cost

- \$58-\$73
- \$49-\$61
- \$43-\$52
- \$39-\$48
- \$36-\$43
- \$34-\$40
- \$32-\$38
- \$28-\$33
- \$26-\$30

Background Map: Esri, HERE, DeLorme, MapmyIndia, ©
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Bakken-Three Forks Drilling Inventory Study

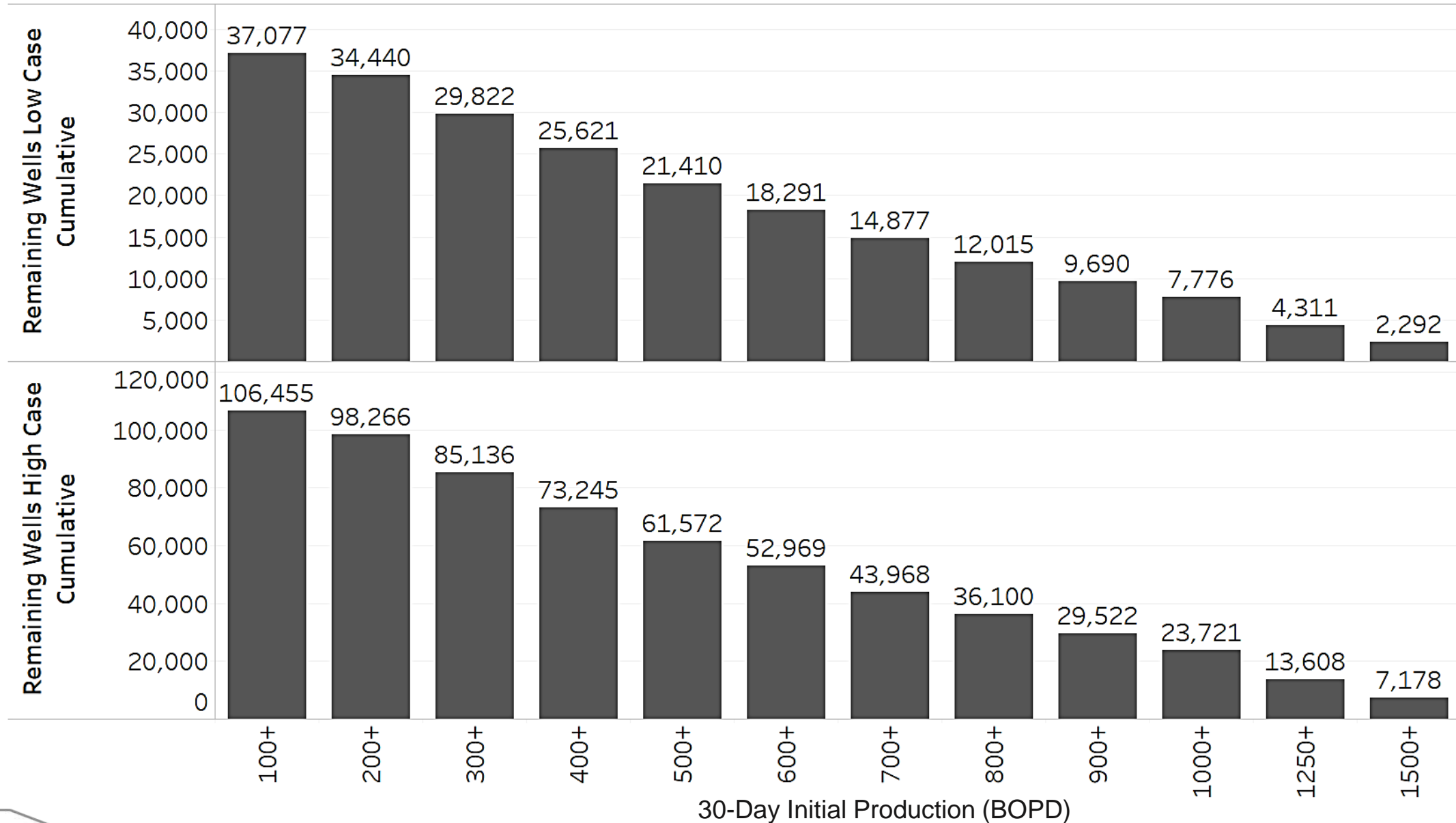


www.northdakotapipelines.com



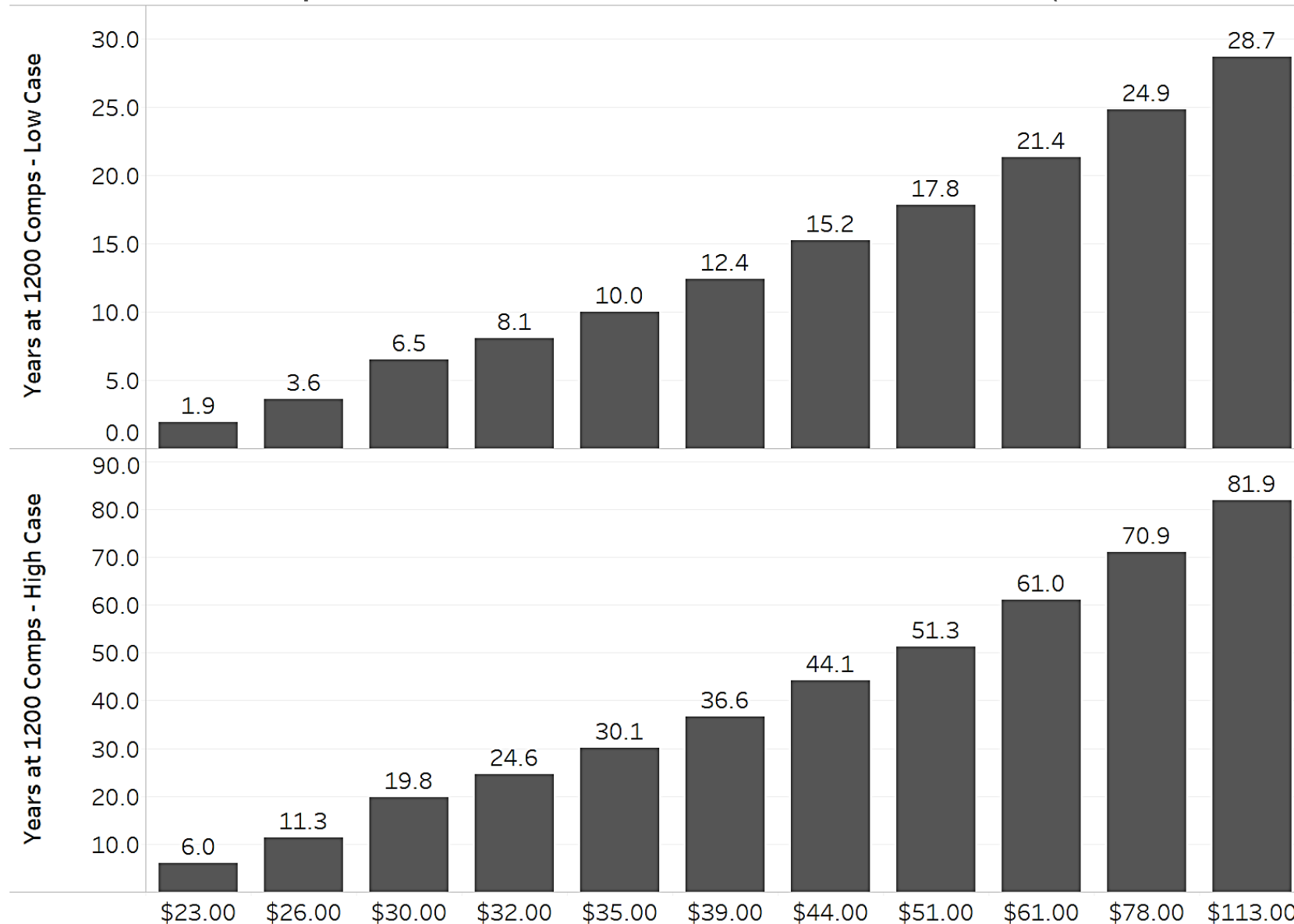
Cumulative Remaining Wells – Peak Month Minimum BOPD

Production Zone

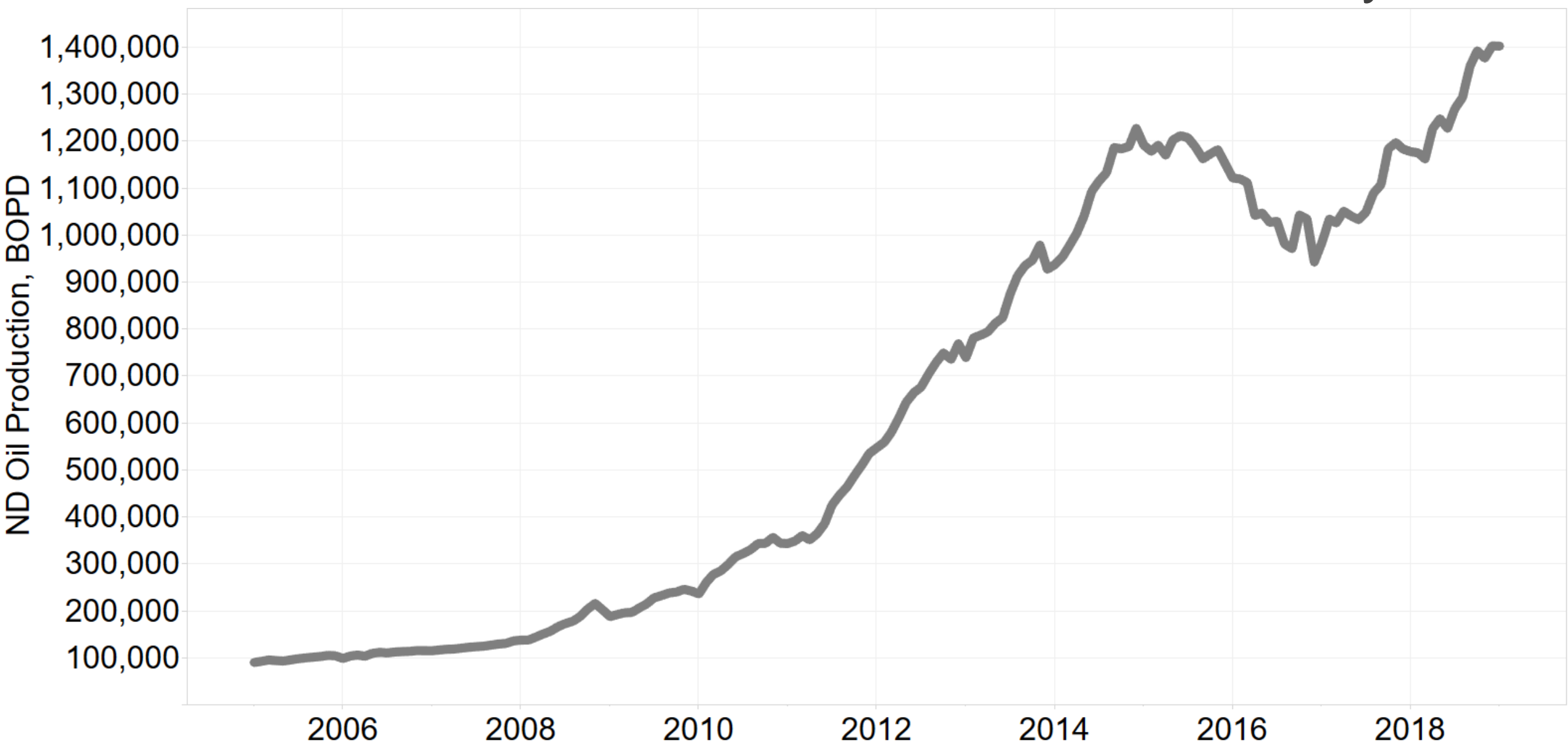


Years Remaining* / Minimum Wellhead Oil Price

*Assumes 1,200 Completions Per Year and \$7MM Well Costs (20% After Tax IRR)



North Dakota Oil Production – Barrels Per Day





CANADA'S OIL & NATURAL GAS PRODUCERS

For information contact: (403) 267-1141 / CAPP.ca

2017 CANADIAN CRUDE OIL PRODUCTION		
	000 m³/d	000 b/d
British Columbia	12	75
Alberta	534	3,363
Saskatchewan	77	486
Manitoba	6	39
Northwest Territories	0	0.3
Western Canada	630	3,963
Eastern Canada	36	224
Total Canada	665	4,187

COME BY CHANCE
Silverpeak.....130

Come by Chance
Hibernia
Hudson
Terra Nova

PIPELINE TOLLS FOR LIGHT OIL (US\$ per barrel)	
Edmonton to	
Burnaby (Trans Mountain)	1.95
Anacortes (Trans Mountain/Puget)	2.25
Samia (Enbridge)	4.80
Montréal (Enbridge)	6.10
Chicago (Enbridge)	4.15
Cushing (Enbridge)	5.35*-6.70
Wood River (Enbridge/Mustang/Capwood)	5.50
U.S. Gulf Coast (Enbridge/Seaway)	6.45†-9.55
Hardisty to	
Guemsey (Express/Platte)	3.30*
Wood River (Express/Platte)	5.05*
Wood River (Keystone)	4.50**,-7.95
U.S. Gulf Coast (Enbridge/Seaway)	6.20†-8.65\$
U.S. Gulf Coast (Keystone/TC Gulf Coast)	9.70\$-10.95
U.S. East Coast to Montréal (Portland/Montréal)	
	0.90
St. James to Wood River (Capline/Capwood)	
	1.35
PIPELINE TOLLS FOR HEAVY OIL (US\$ per barrel)	
Hardisty to:	
Chicago (Enbridge)	4.35
Cushing (Enbridge)	5.55*-6.90
Cushing (Keystone)	6.25**,-10.10
Wood River (Enbridge/Mustang/Capwood)	6.15
Wood River (Keystone)	5.15**,-9.05
Wood River (Express/Platte)	5.65*
U.S. Gulf Coast (Enbridge/Seaway)	7.30†-10.40
U.S. Gulf Coast (Keystone/TC Gulf Coast)	10.55\$-12.45

Notes: 1) Assumed exchange rate = 0.78 US\$ / 1 C\$ (May 2018 average)
2) Tolls rounded to nearest 5 cents
3) Tolls in effect July 1, 2016

* 10-year committed toll
** 20-year committed toll
† First Open Season, 15-year, 50,000+ b/d committed volumes
\$ International Joint tariff

Crude Refining Capacities as at June 1, 2018
(thousand barrels per day)

PADD Petroleum Administration for Defense District

Major Existing Crude Oil Pipelines Carrying Canadian Crude Oil

Selected Other Crude Oil Pipelines

VANCOUVER TO:
Japan - 4,300 miles
Taiwan - 5,600 miles
S. Korea - 4,600 miles
China - 5,100 miles

San Francisco - 800 miles
Los Angeles - 1,100 miles

VANCOUVER
Parkland Fuel (Burnaby).....55

PUGET SOUND
BP (Cherry Point).....236
Shell (Anacortes).....137
Andeavor (Anacortes).....120
Phillips 66 (Ferndale).....105
TrailStone (Tacoma).....42

SAN FRANCISCO
Chevron (Richmond).....257
Andeavor (Martinez).....196
Shell (Martinez).....145
Phillips 66 (Berkeley).....145
Phillips 66 (Flood & Santa Maria).....120

San Francisco

Santa Maria

Los Angeles

LOS ANGELES
Andeavor (Carson/Wilmington).....390
Chevron (El Segundo).....289
PBF (Torrance).....155
Phillips 66 (Carson/Wilmington).....139
Valero (Wilmington).....85
Dekel (3-Paramount, LA, Bakersfield).....idled

SALT LAKE CITY
Andeavor.....63
Chevron.....53
HollyFrontier.....45
Big West Oil.....35

BAKERSFIELD
Kern Oil.....26
San Joaquin.....14

NEW MEXICO/W. TEXAS
Andeavor (El Paso).....135
HollyFrontier (Artesia).....100
Dekel (Big Spring).....73
Andeavor (Gallop).....25

SAN ANTONIO
Calumet.....21
THREE RIVERS
Valero.....89
CORPUS CHRISTI
Fint.....300
Valero.....275
QTG.....157

SWERNY
Phillips 66.....256

QTG.....157

PRINCE GEORGE
Husky.....12

Prince George

Burnaby

Ferndale

Anacortes

Sumas

Billings

Great Falls

Edmonton

Regina

Superior

Chicago

Montréal

Portland

Halifax

St. John's

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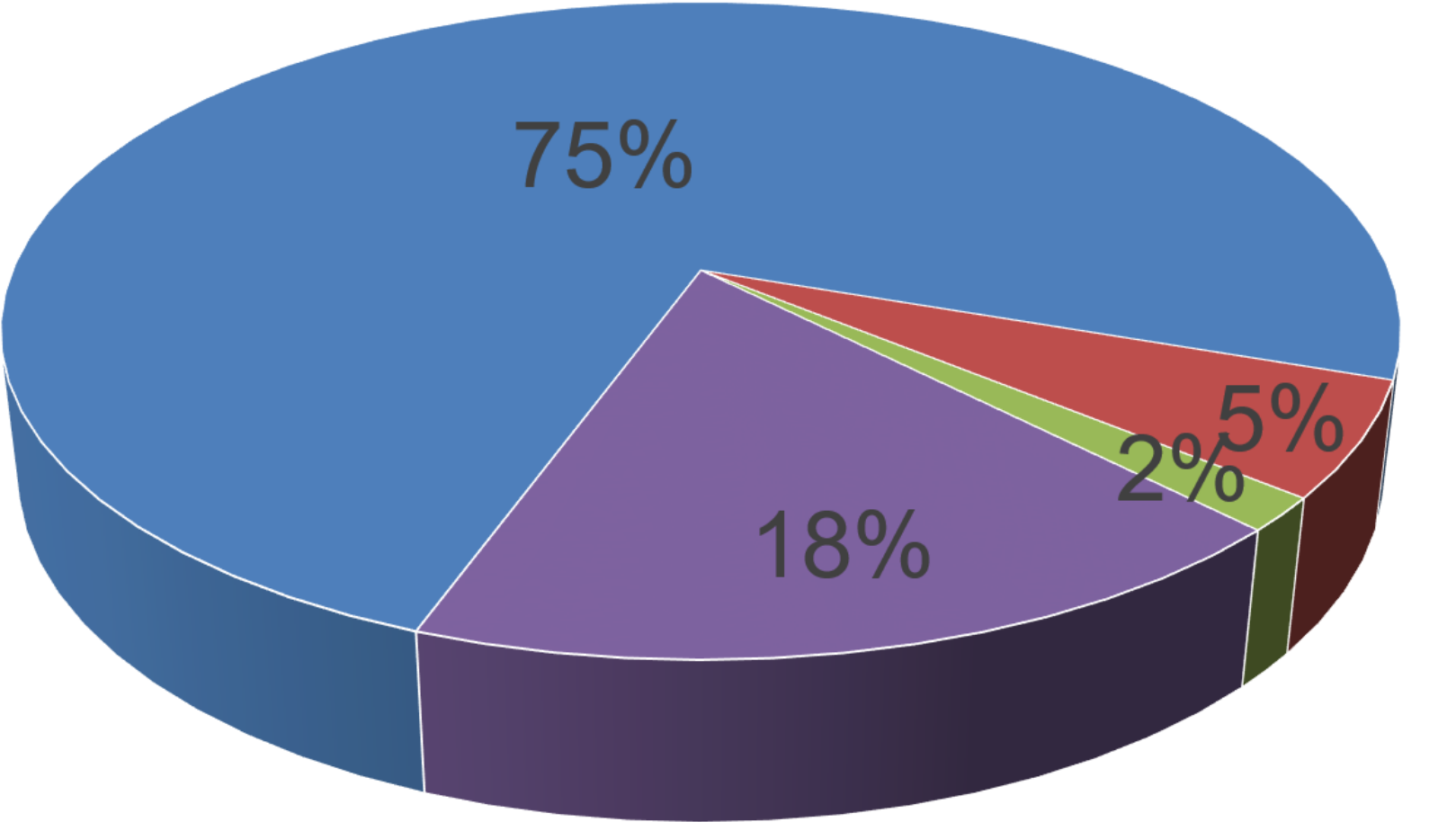
Portland

Halifax

St. John's

Quebec City

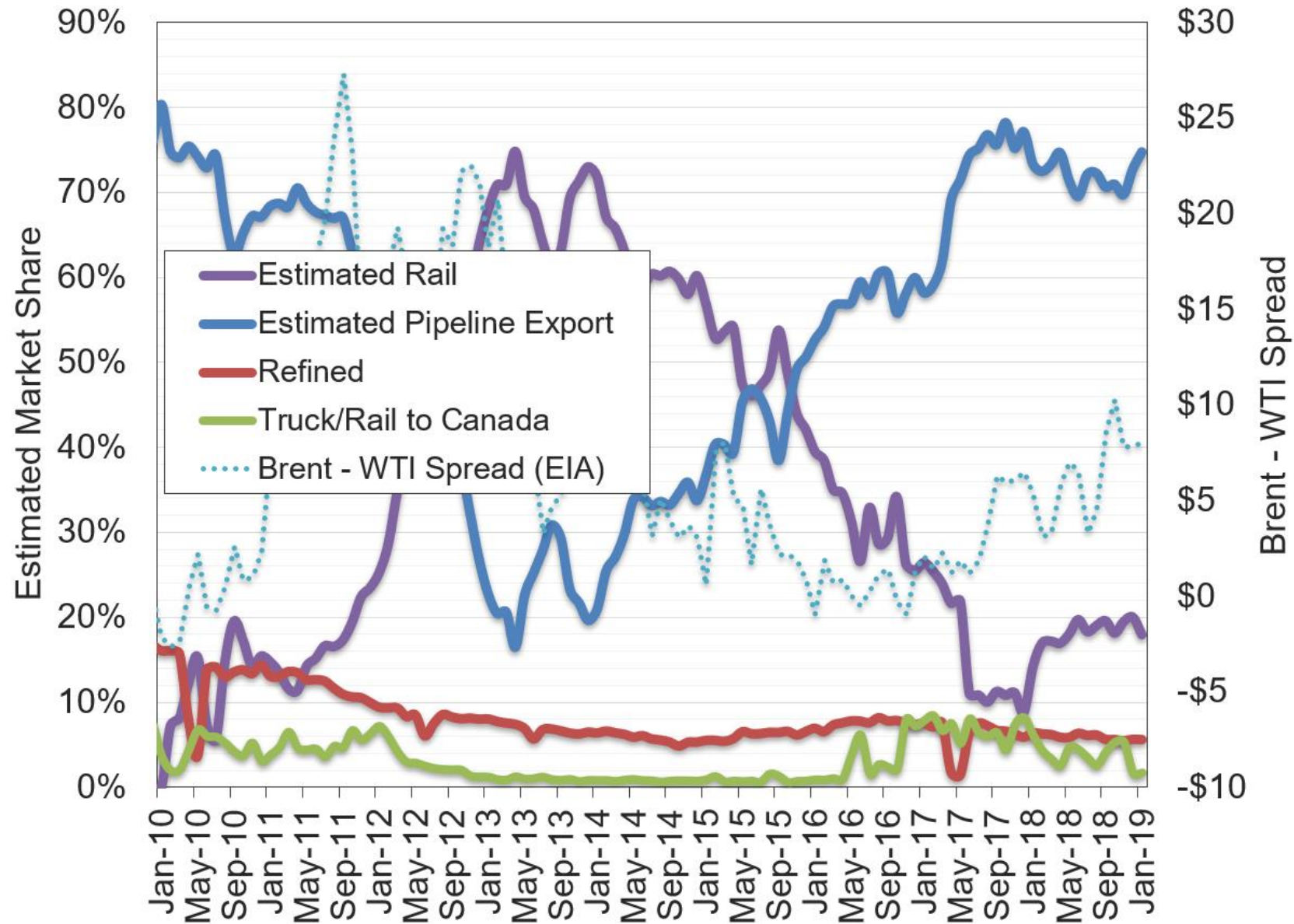
Estimated Williston Basin Oil Transportation – Jan. 2019



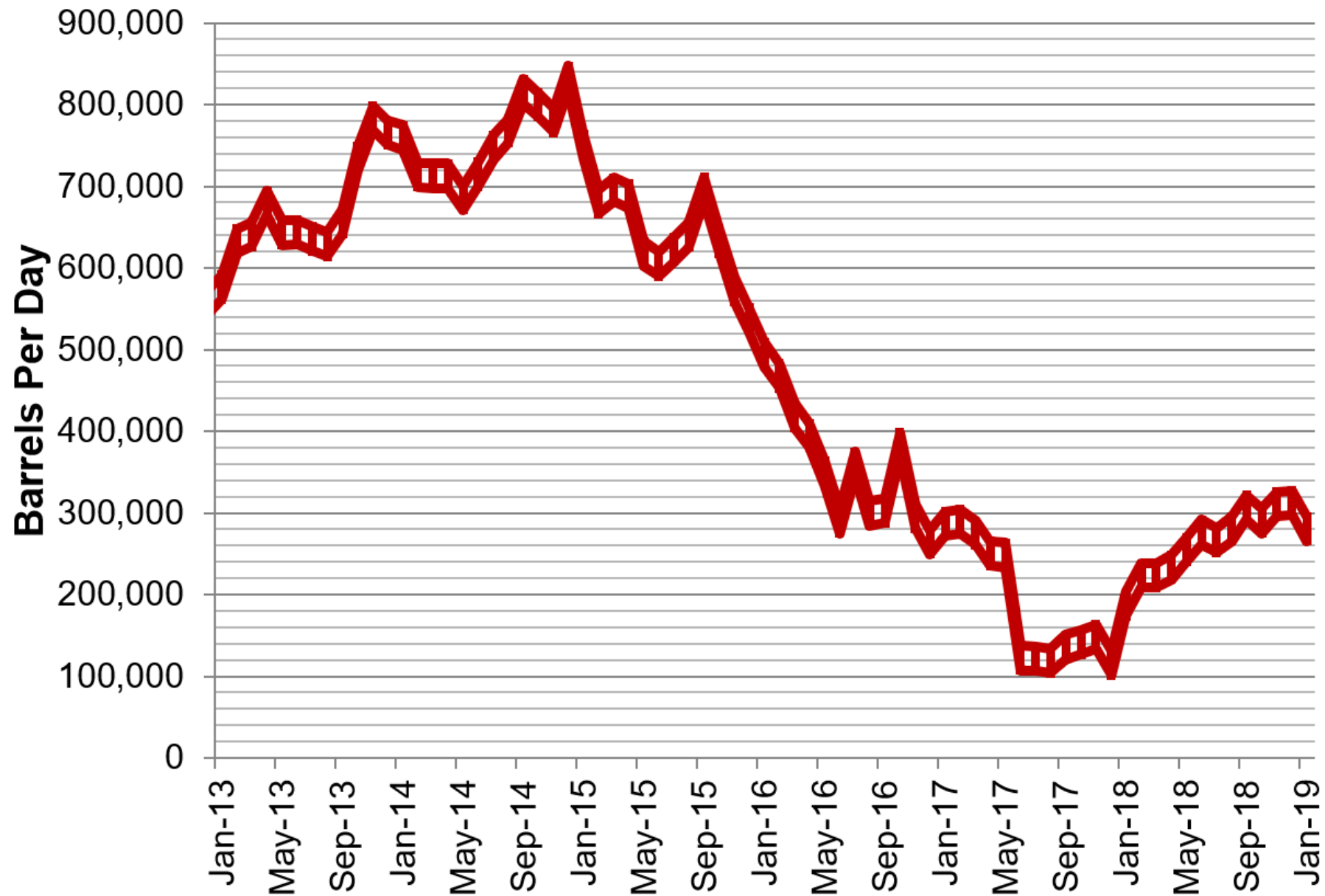
- Pipeline Export
- Refined
- Truck/Rail to Canada
- Estimated Rail



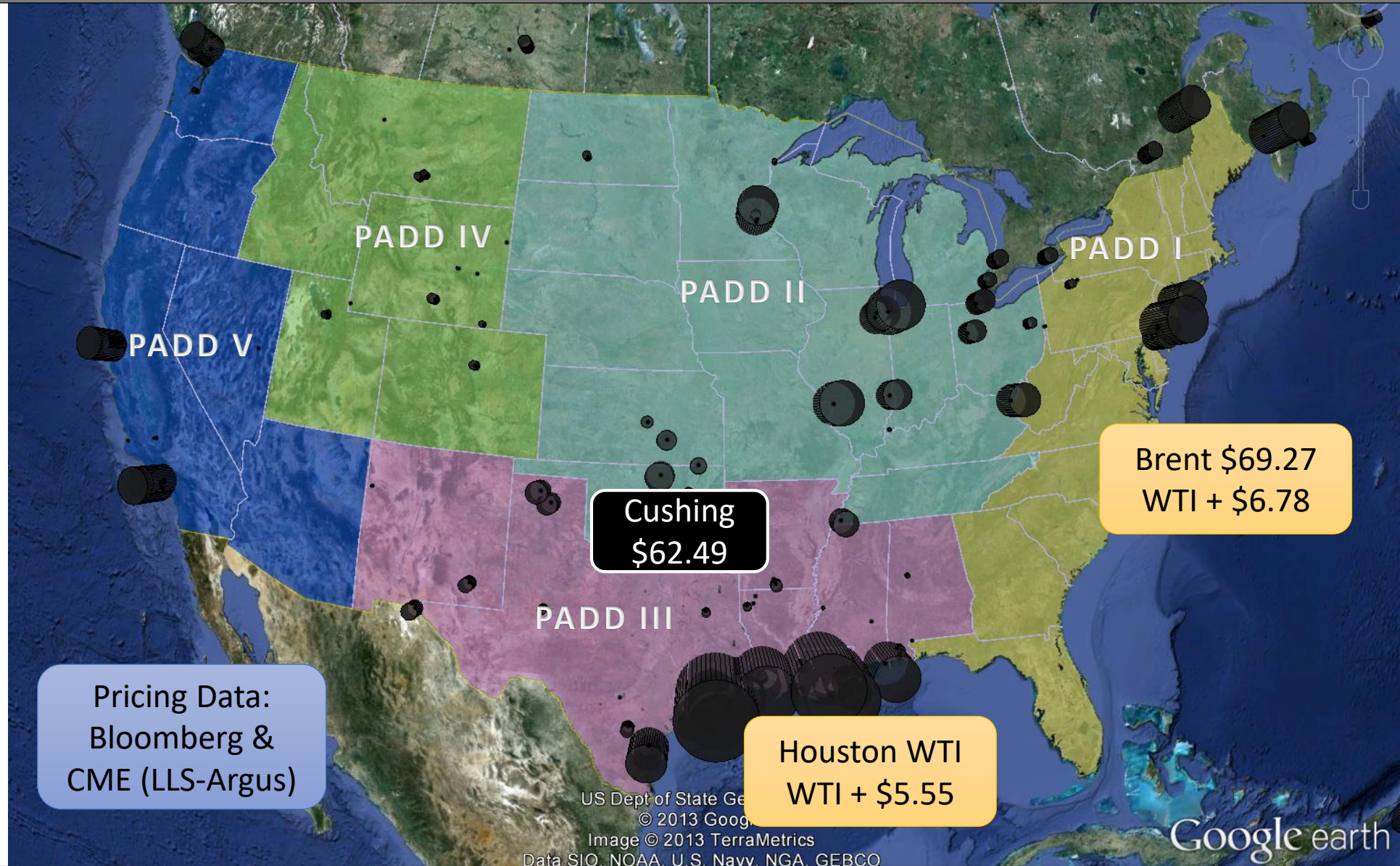
Estimated Williston Basin Oil Transportation



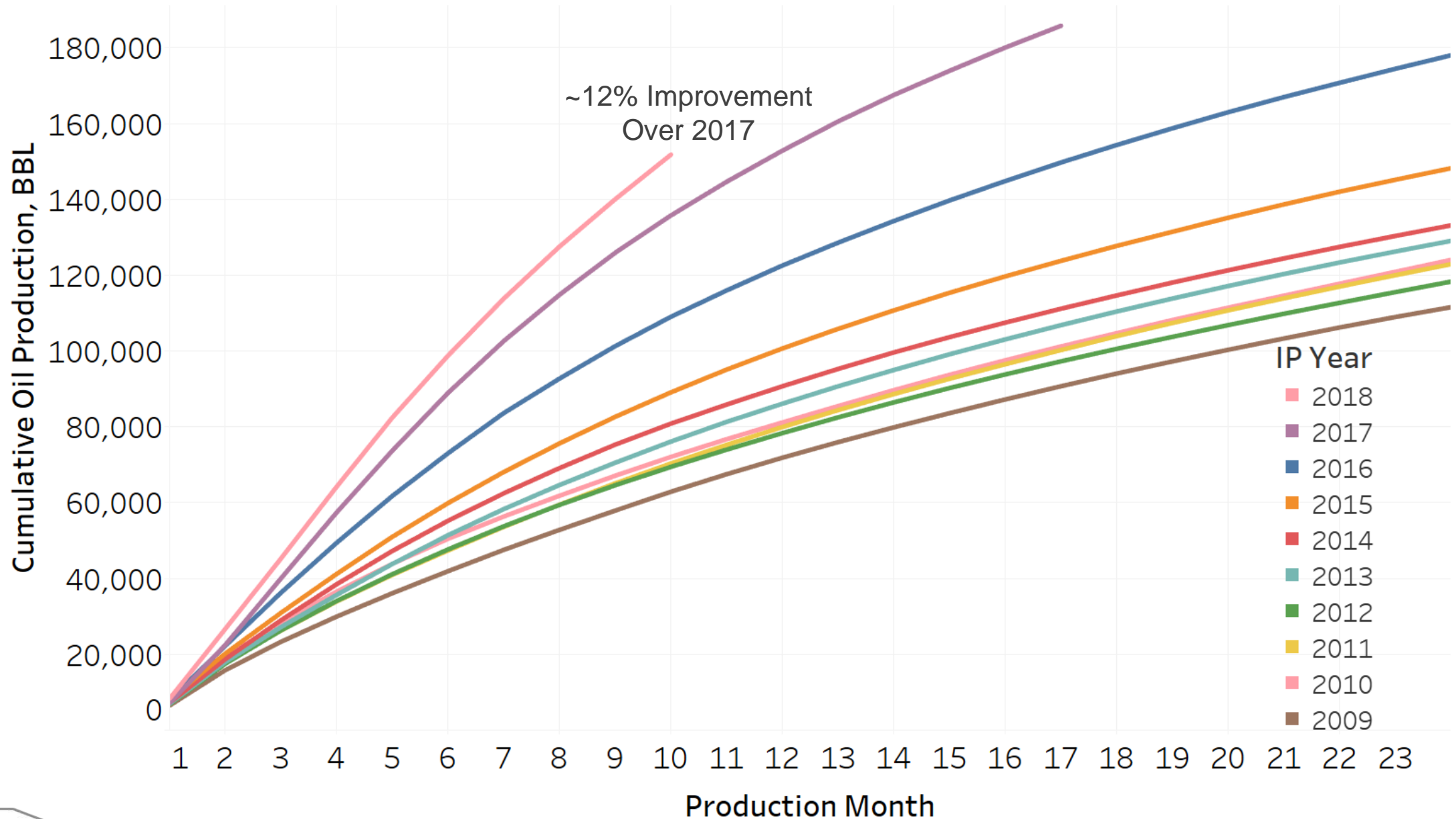
Estimated ND Rail Export Volumes



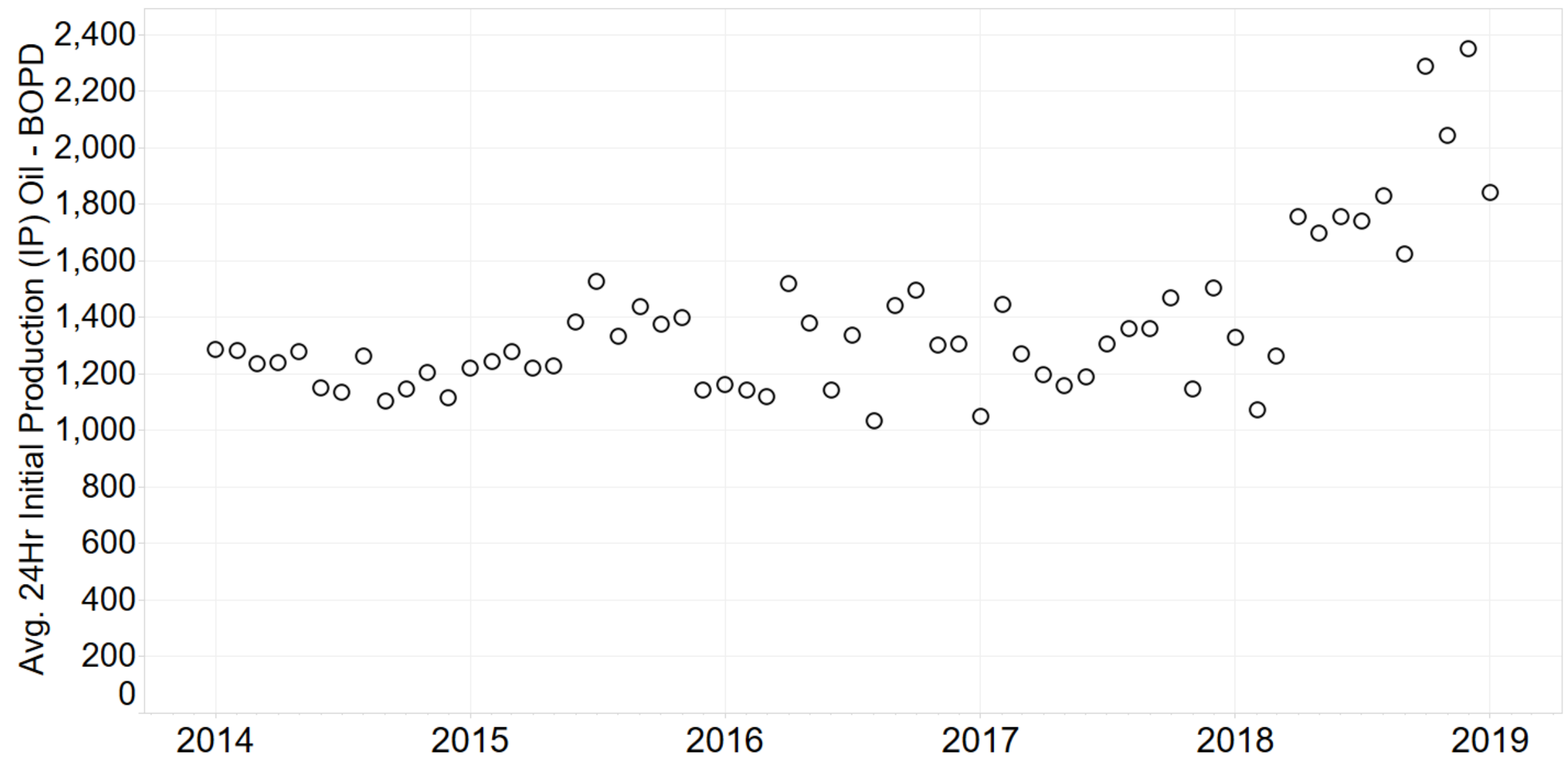
Crude Oil Prices – April 2, 2019



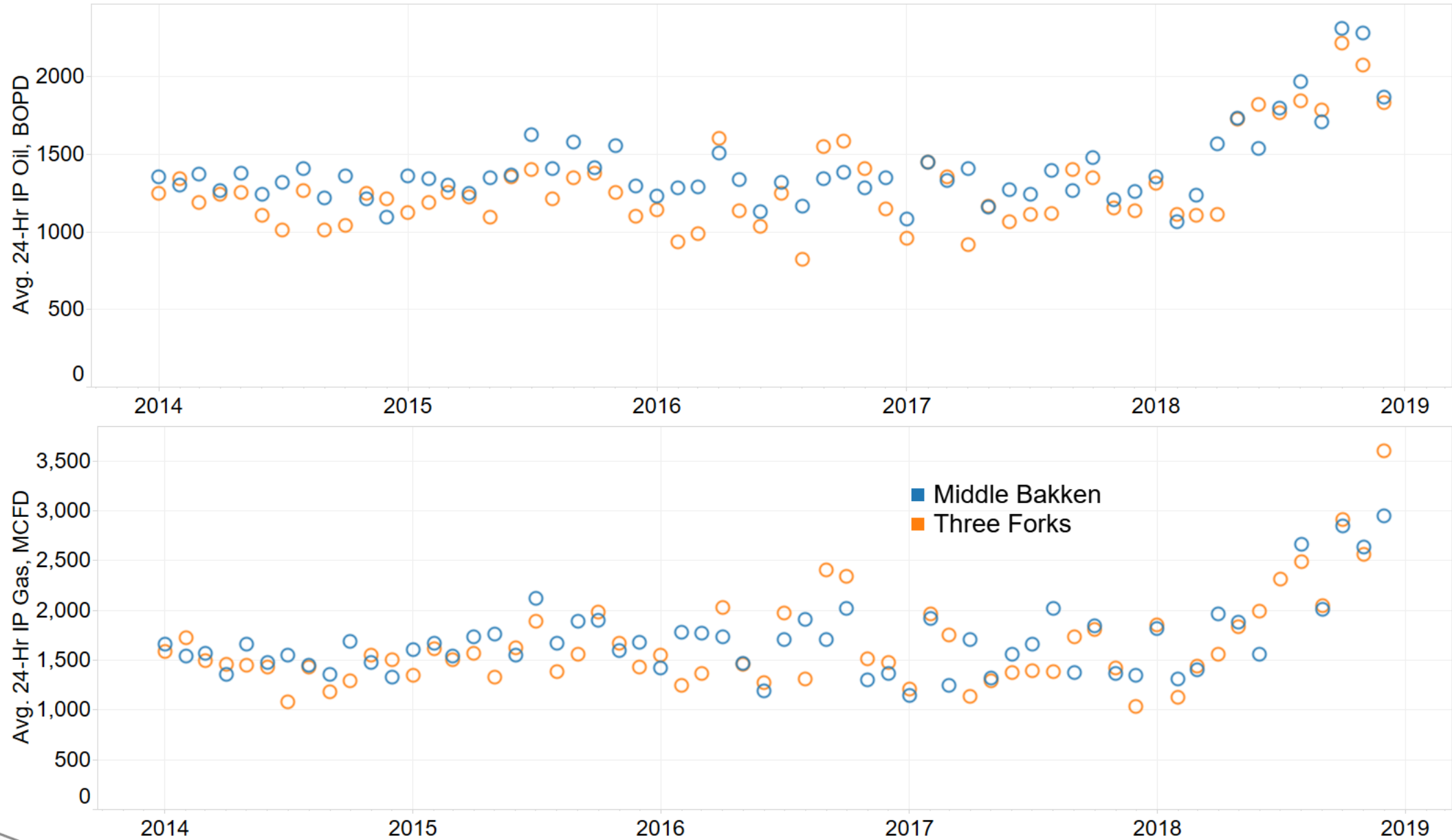
Statewide Oil Performance



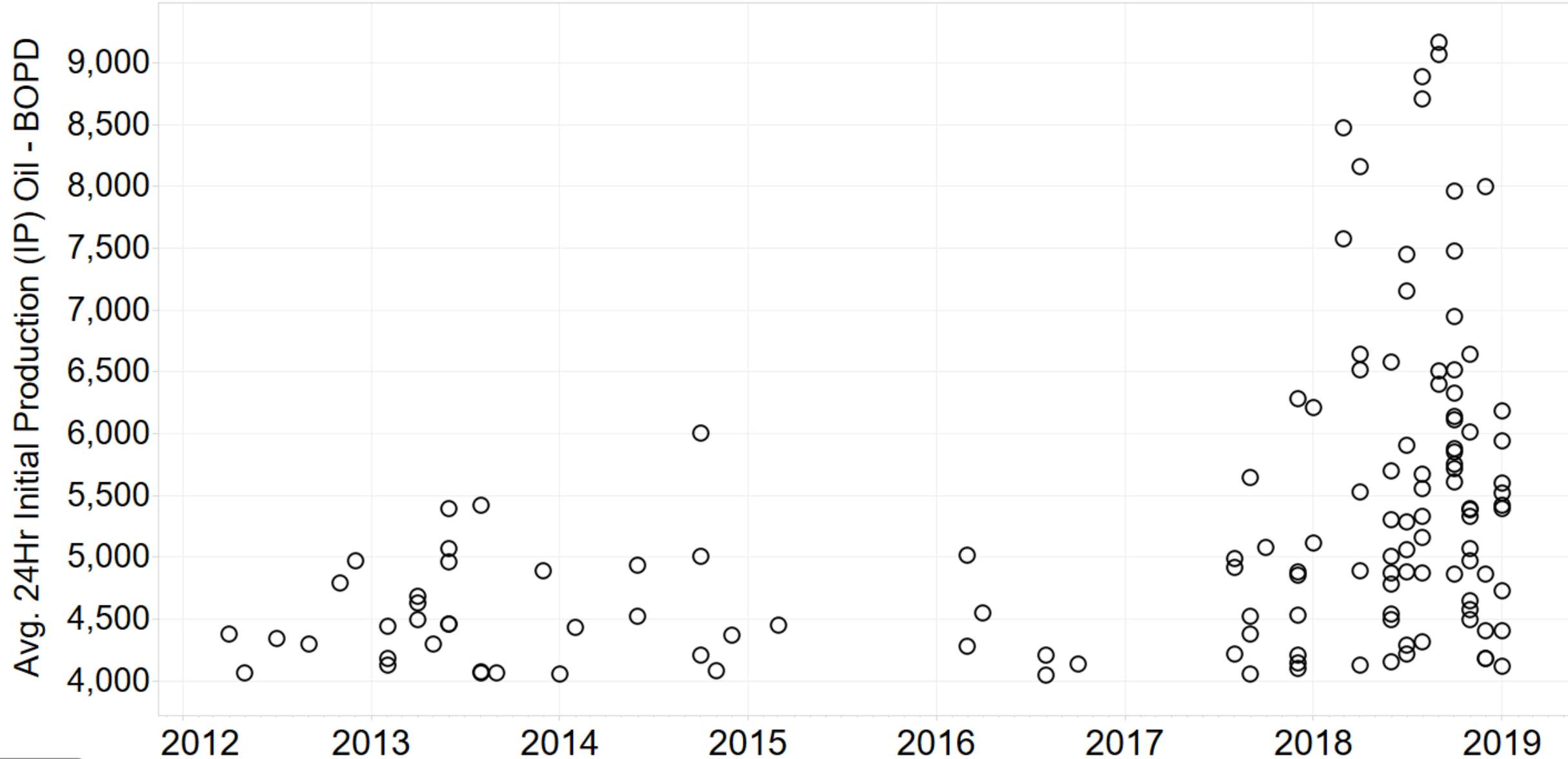
Statewide Initial Oil Production Rates – 24hr



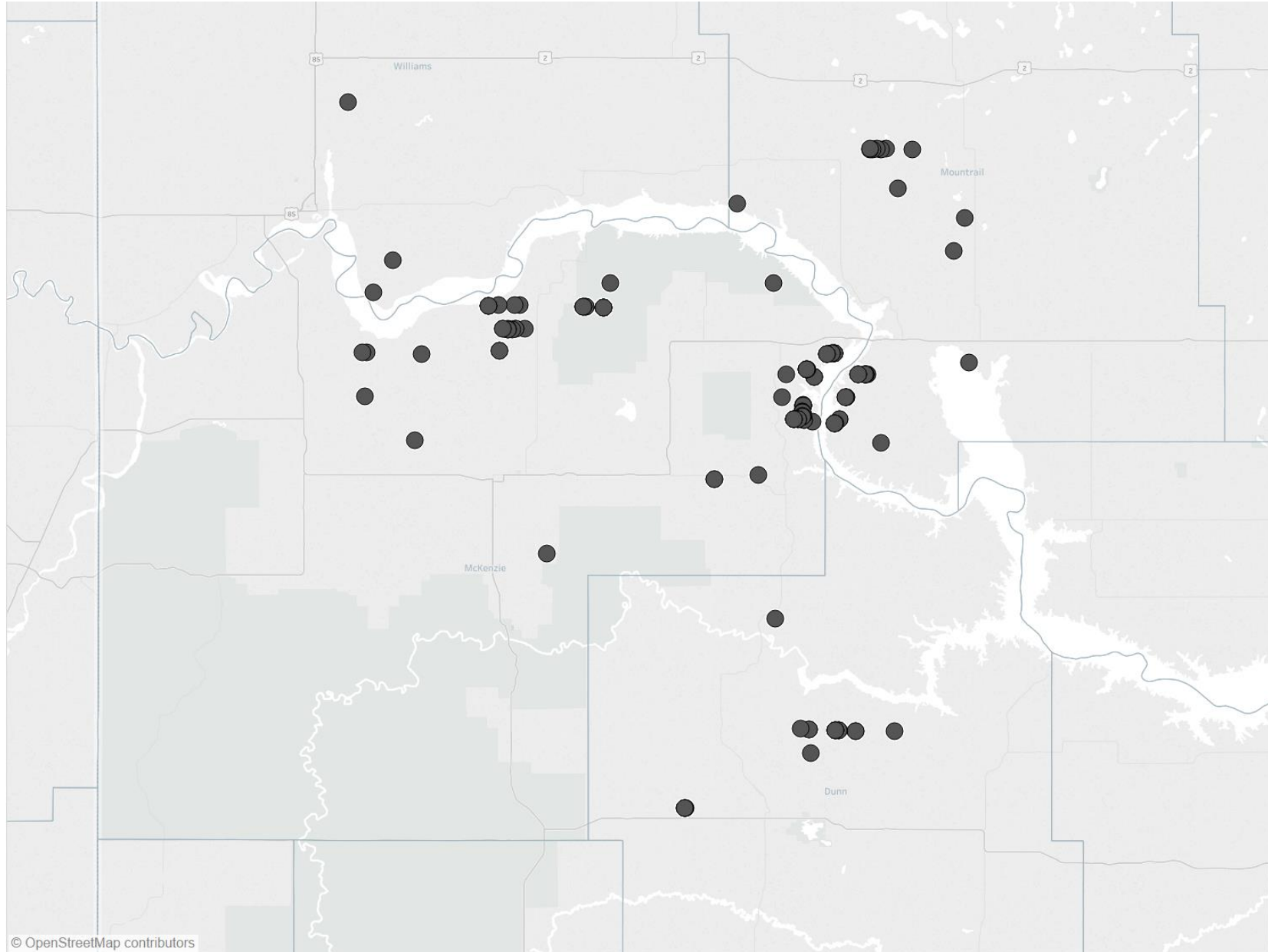
Statewide Initial Production Rate: 24hr



4,000+ BOPD 24hr Initial Production Rates



4,000+ BOPD 24hr Initial Production Rates

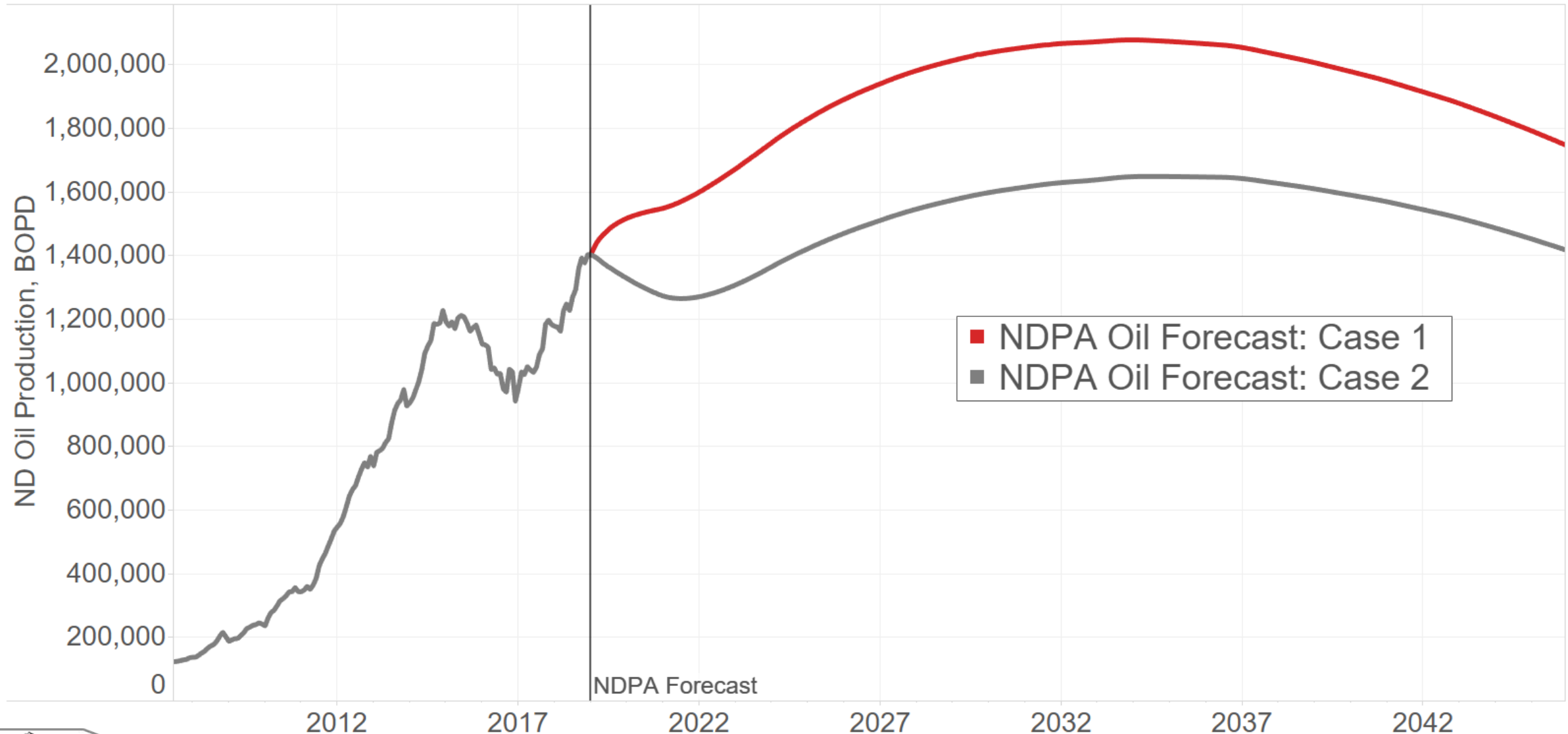


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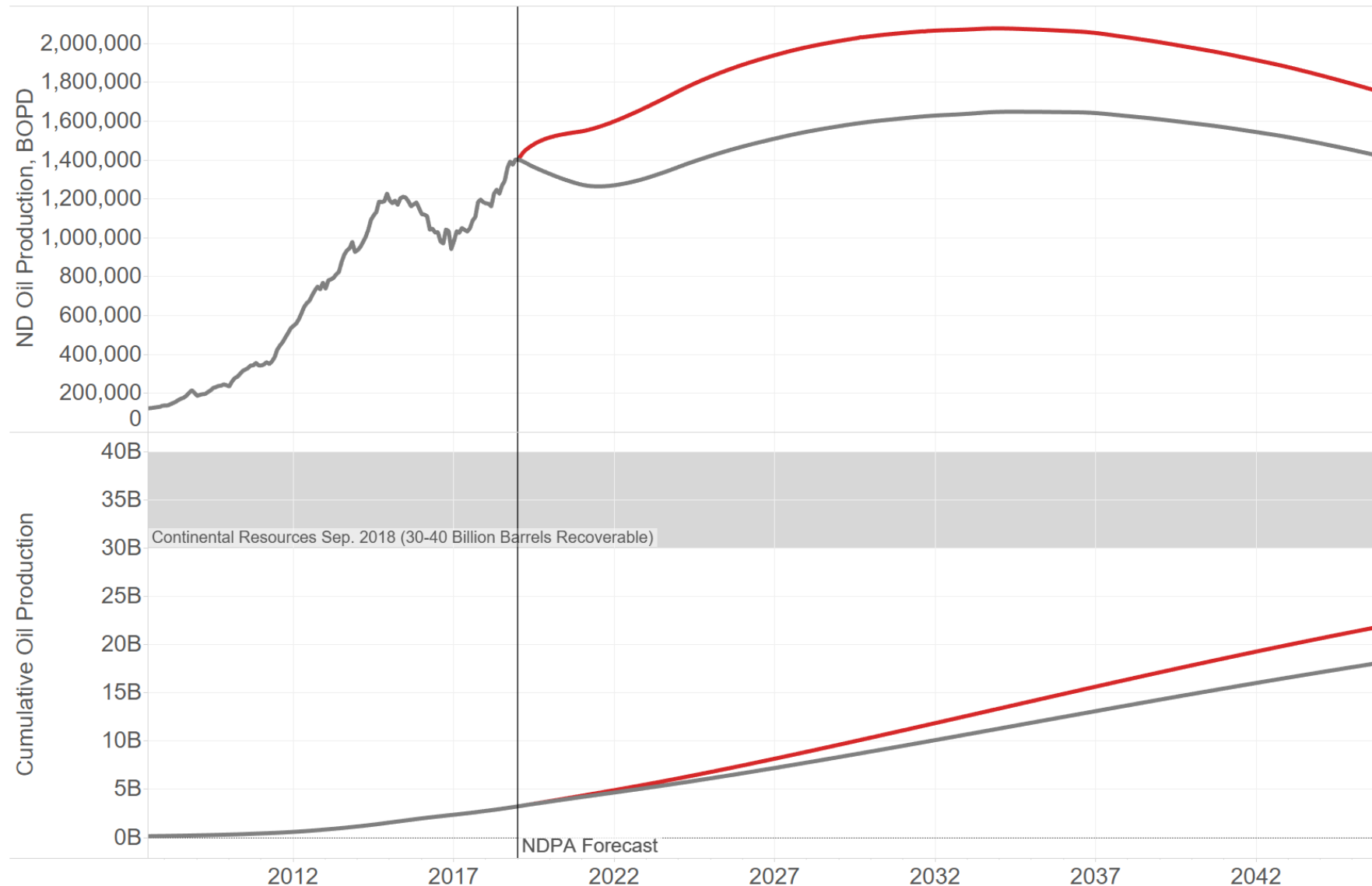
North Dakota Oil Production Forecast

Assumes Current Technology – Enhanced Oil Recovery Not Included

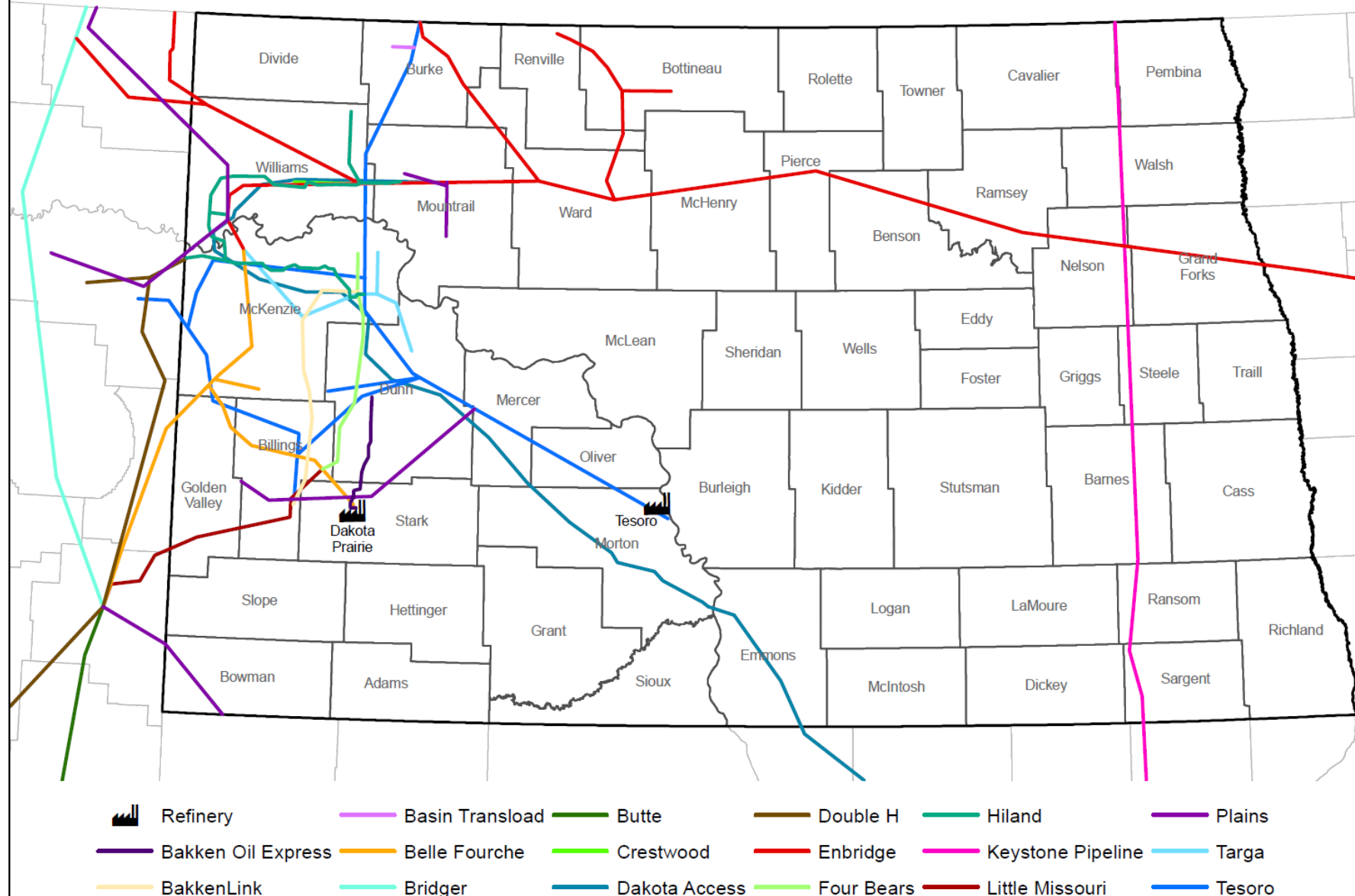


North Dakota Oil Production Forecast

Assumes Current Technology – Enhanced Oil Recovery Not Included



North Dakota Crude Oil Pipelines

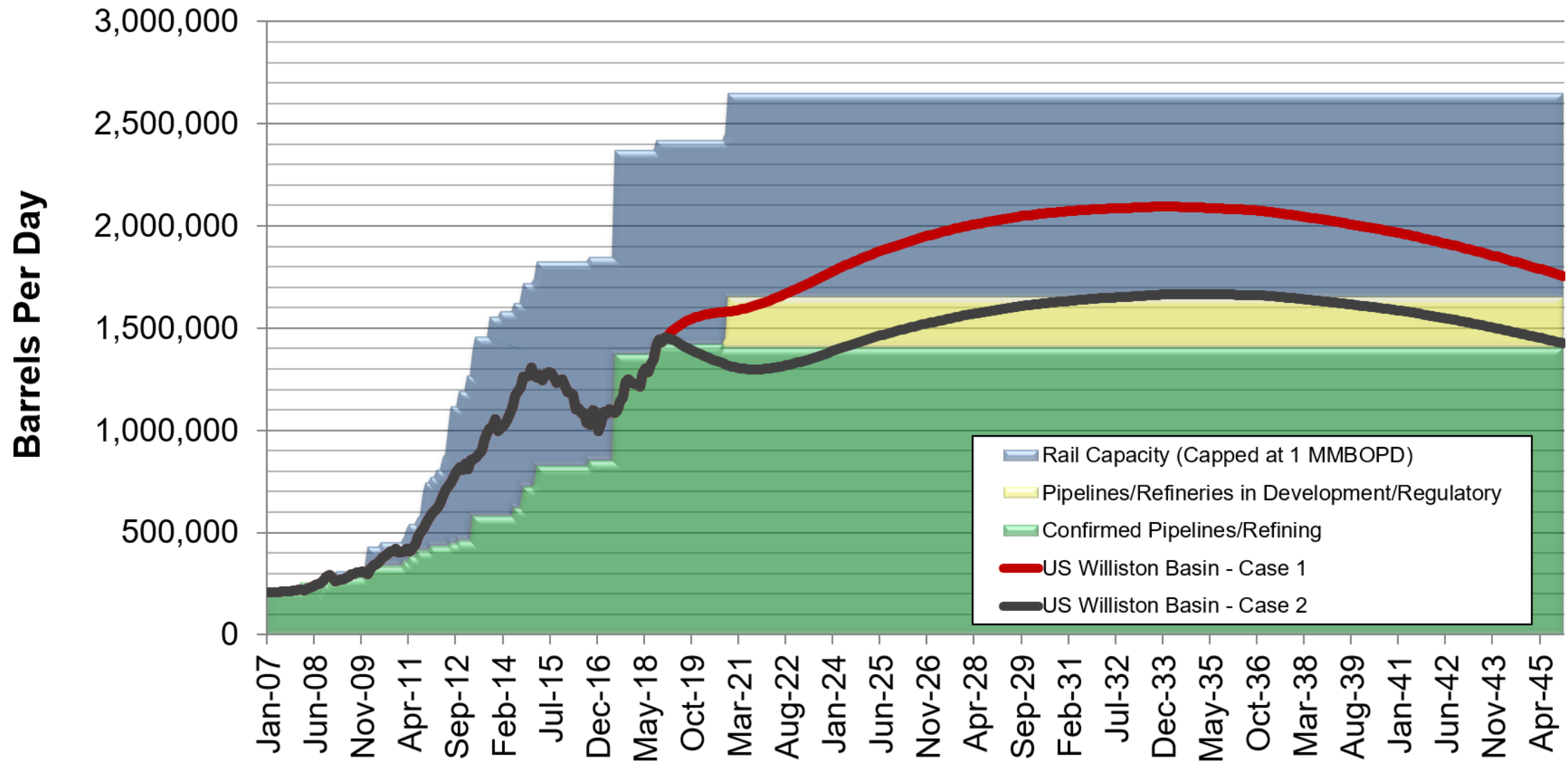


Date: 6/2/2017
 Disclaimer: Neither the State of North Dakota, nor any agency, officer, or employee of the State of North Dakota warrants the accuracy or reliability of this product and shall not be held responsible for any losses caused by reliance on this product. Portions of the information may be incorrect or out of date. Any person or entity that relies on any information obtained from this product does so at his or her own risk.



Williston Basin Oil Production & Export Capacity, BOPD

Assumes Current Technology – Enhanced Oil Recovery Not Included



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



Natural Gas Update



Production

- Technology
- Markets



Gathering

- Capacity
- Connections



Processing

- Capacity
- Location



Transmission

- Dry Gas
- Natural Gas Liquids



Natural Gas Update



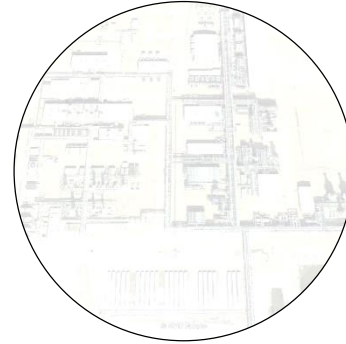
Production

- Technology
- Markets



Gathering

- Capacity
- Connections



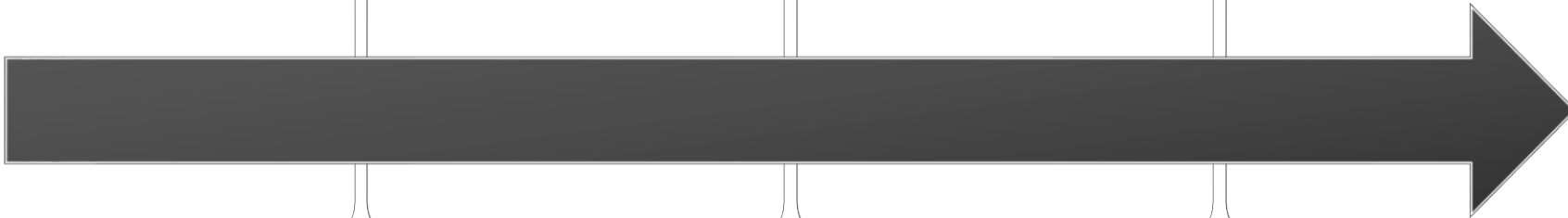
Processing

- Capacity
- Location



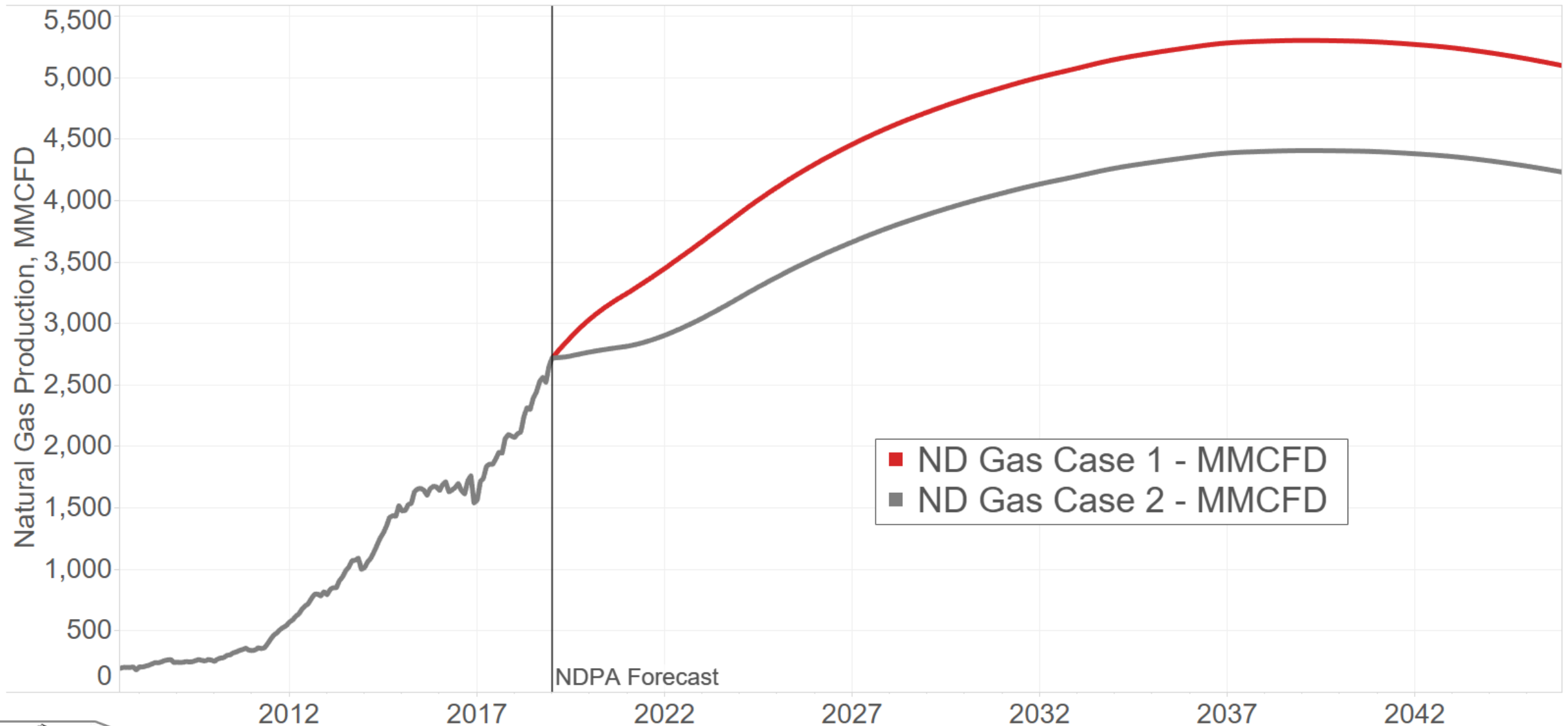
Transmission

- Dry Gas
- Natural Gas Liquids

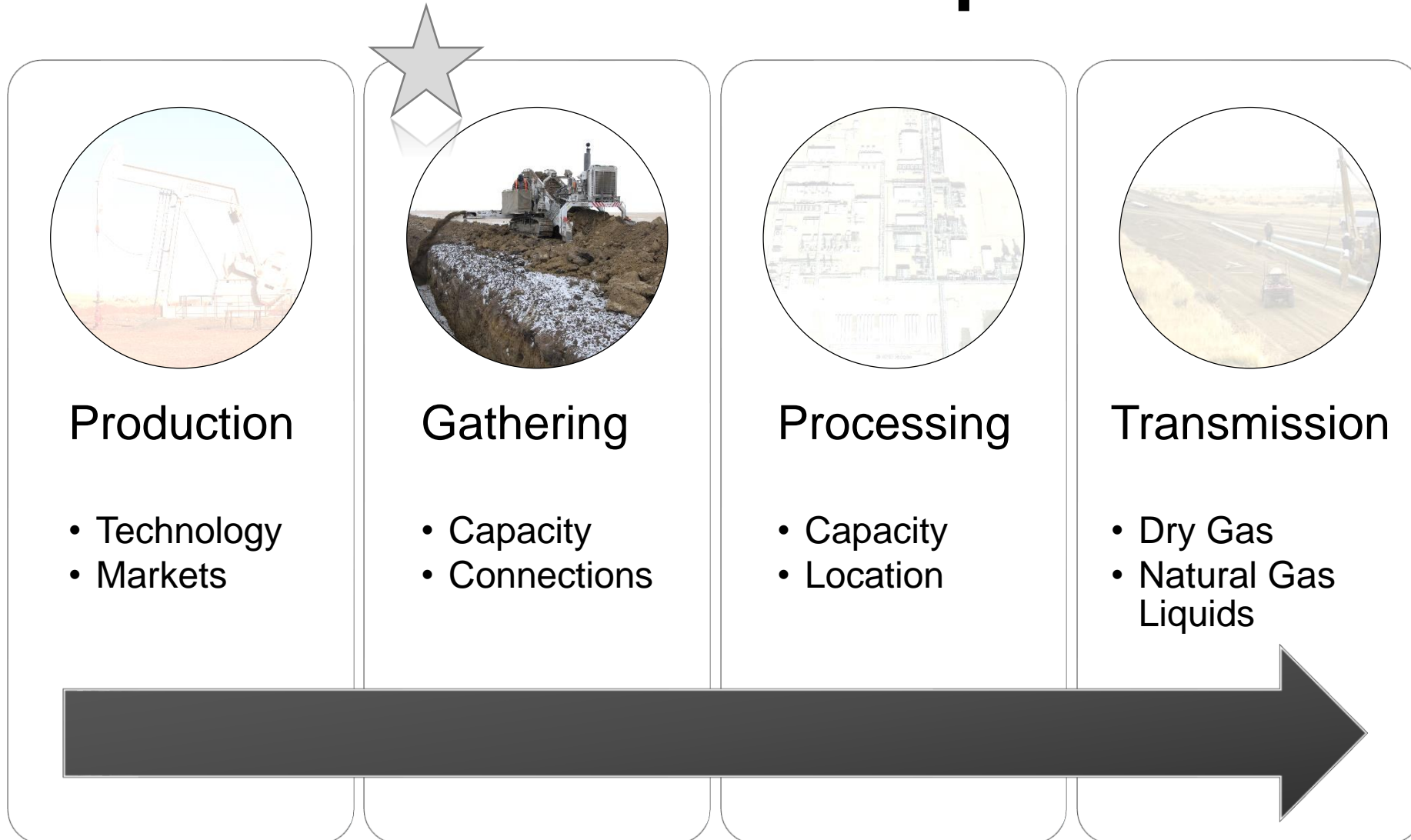


NDPA North Dakota Gas Production Forecast

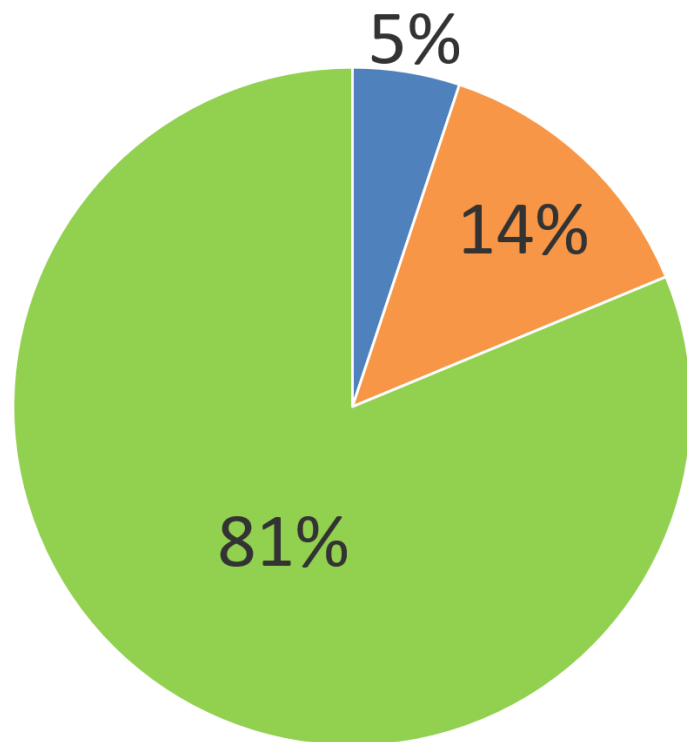
Assumes Current Technology – Enhanced Oil Recovery Not Included



Natural Gas Update



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.

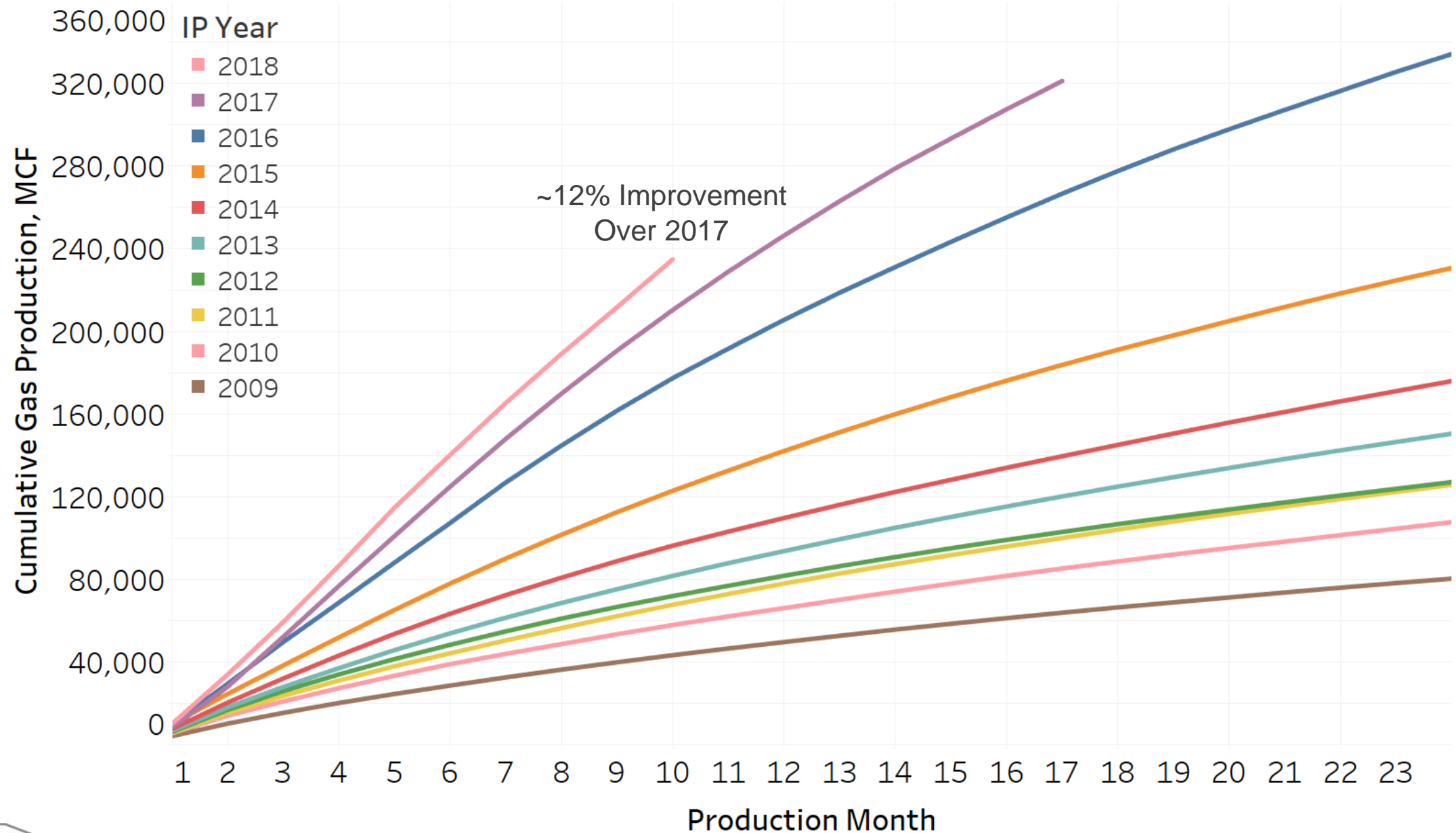
Simple Terms

Blue – Lack of pipelines
Orange – Challenges on existing infrastructure

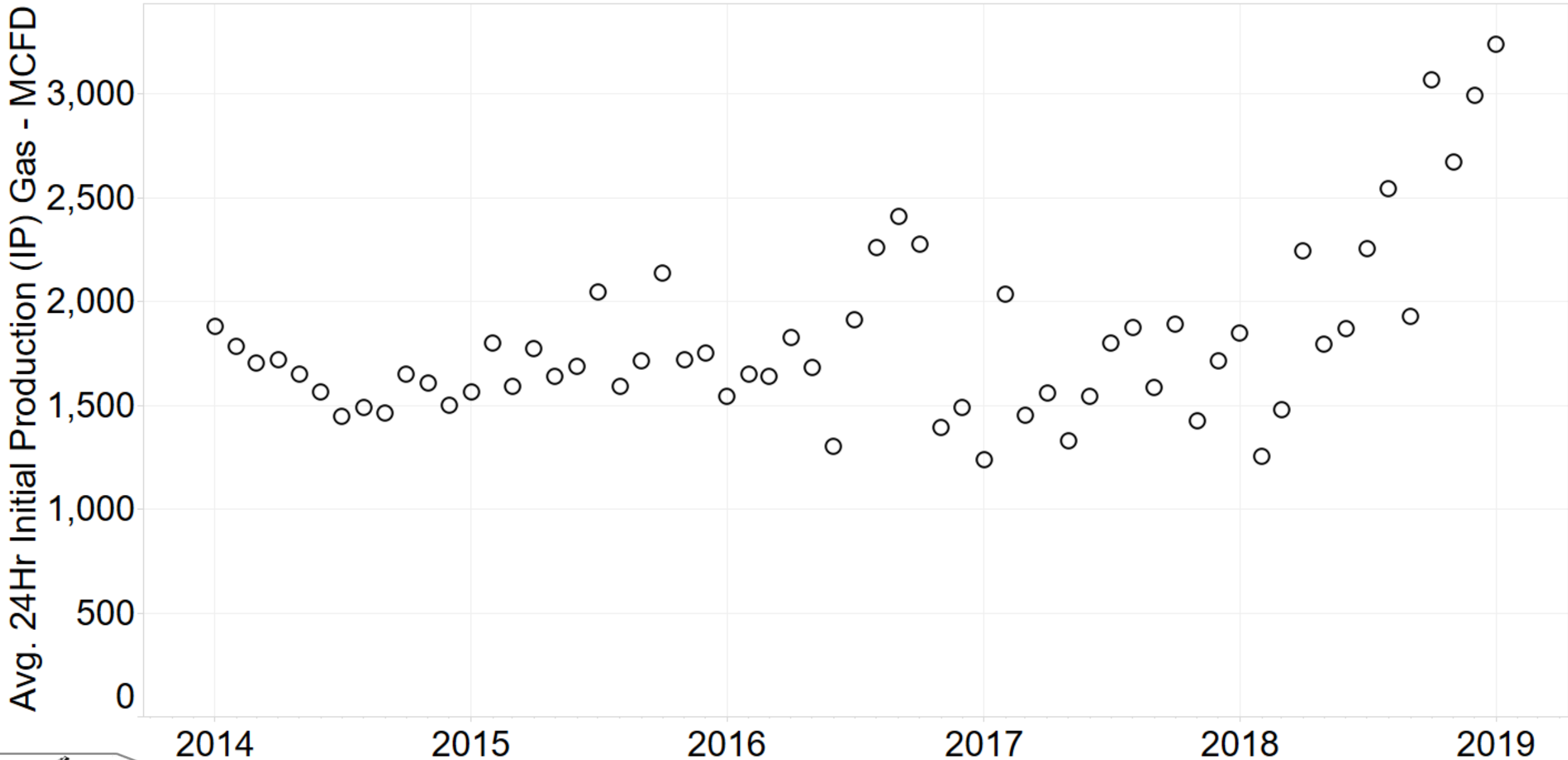
Dec. 2018 Data – Non-Confidential Wells



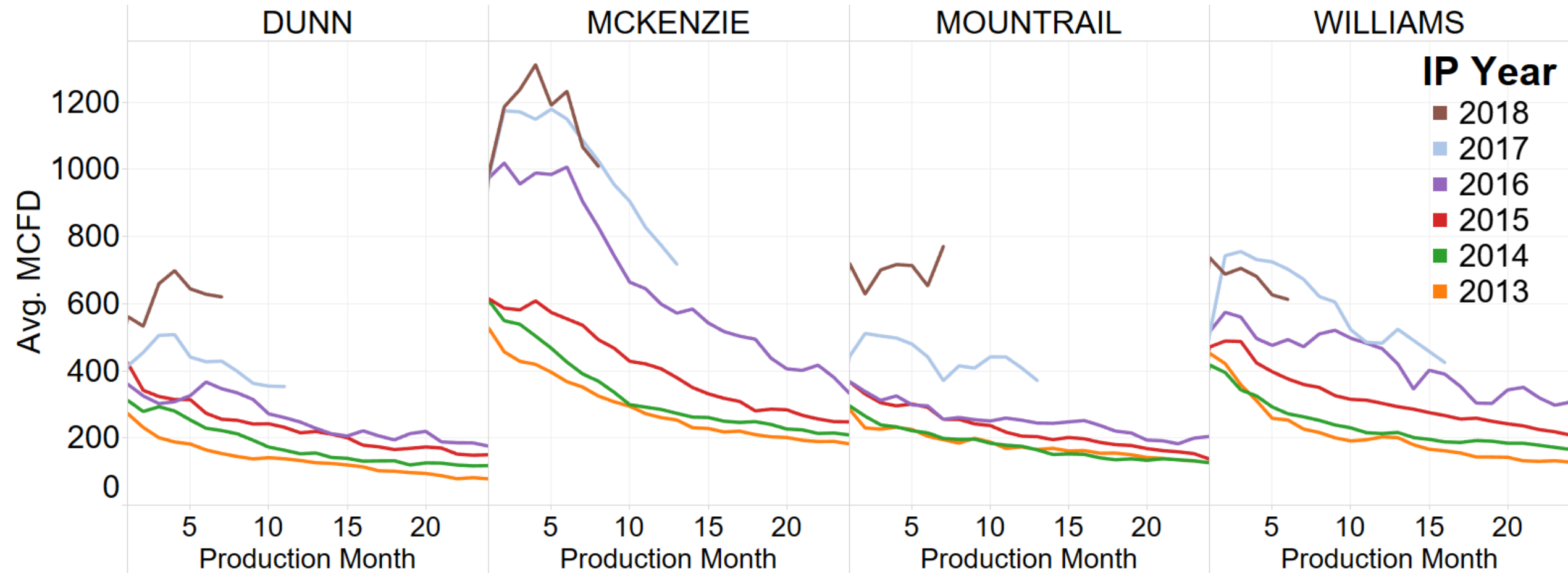
Statewide Gas Performance



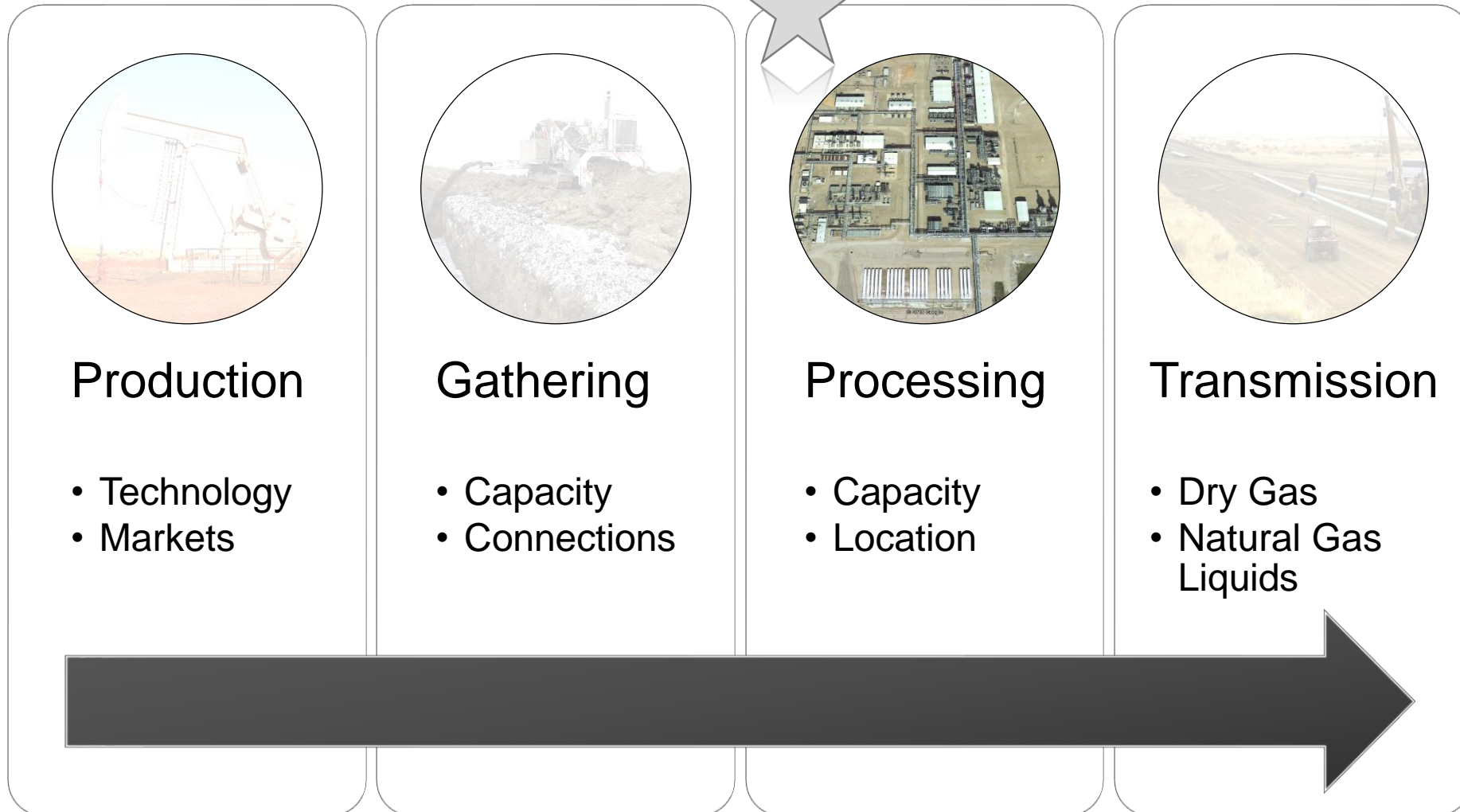
Statewide Initial Gas Production Rate: 24hr



Bakken and Three Forks Gas Performance

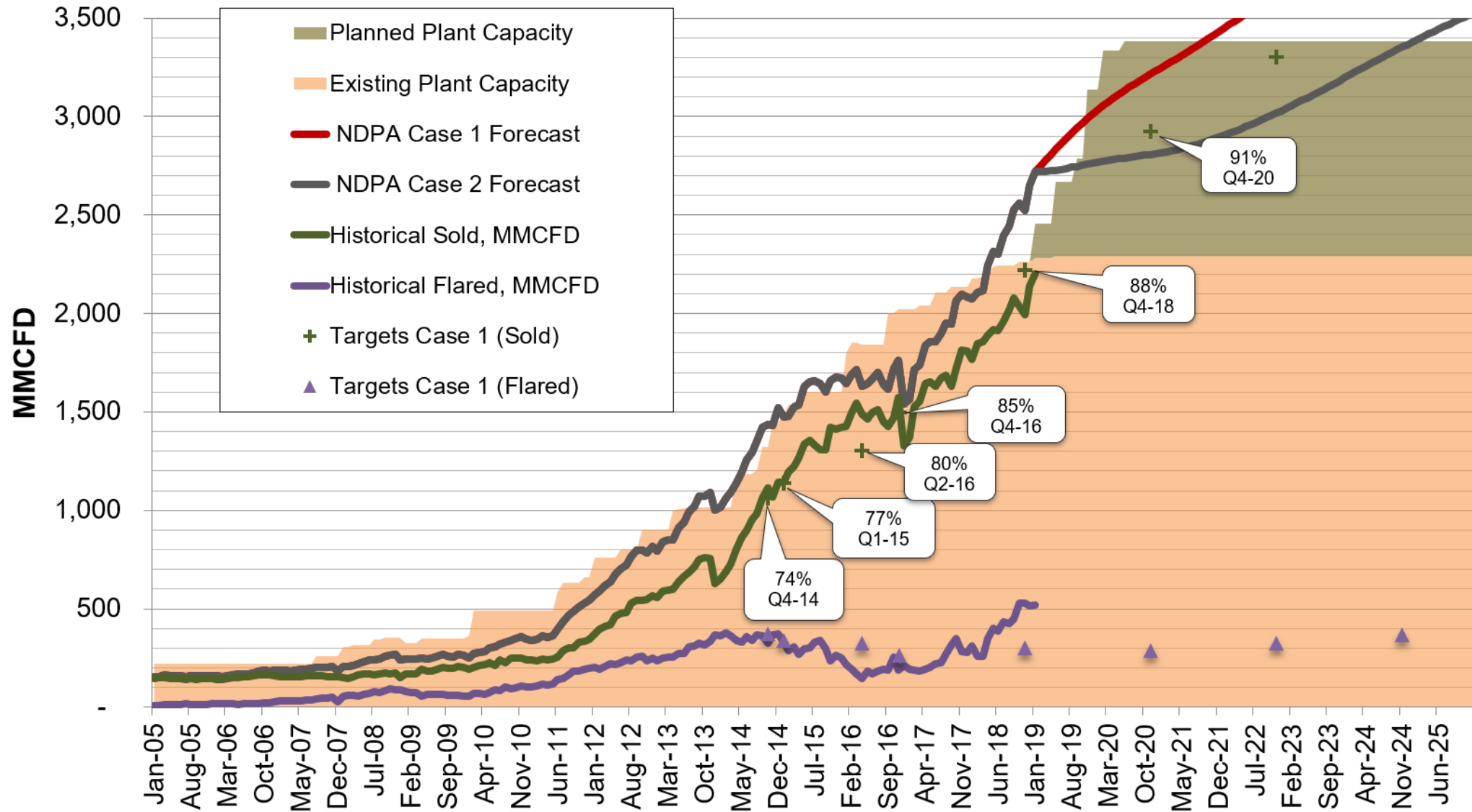


Natural Gas Update



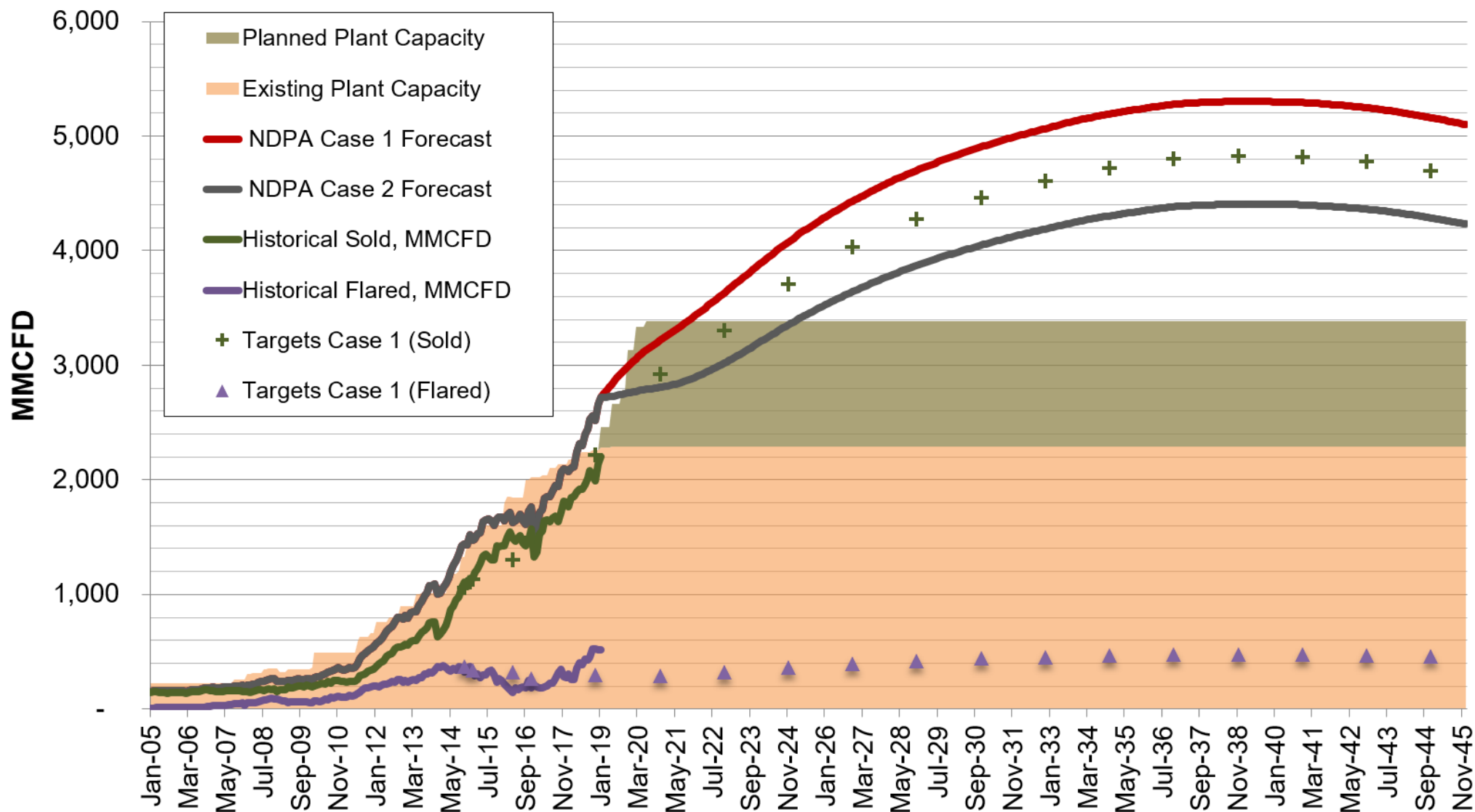
Solving the Flaring Challenge

Assumes Current Technology – Enhanced Oil Recovery Not Included

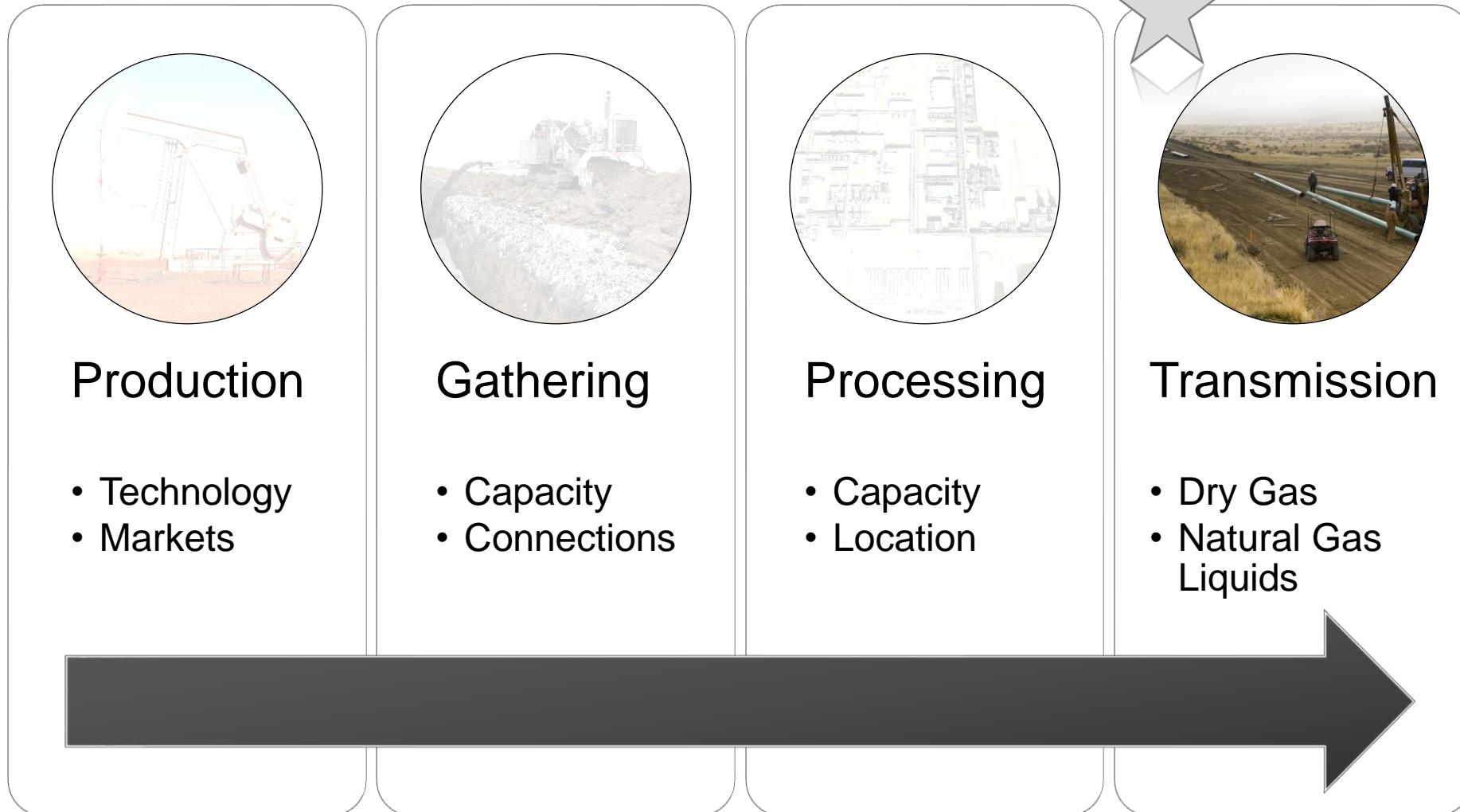


Solving the Flaring Challenge

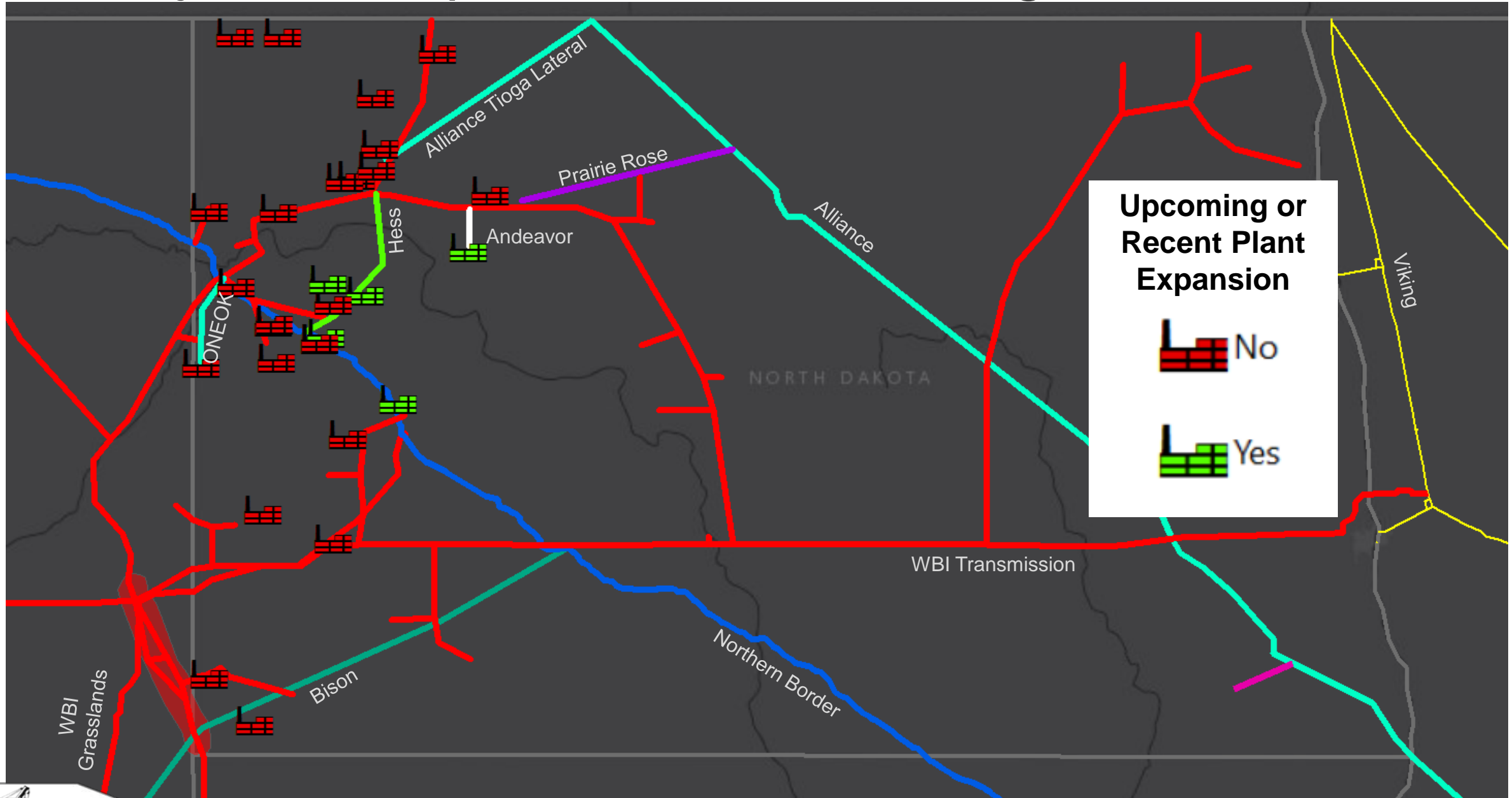
Assumes Current Technology – Enhanced Oil Recovery Not Included



Natural Gas Update

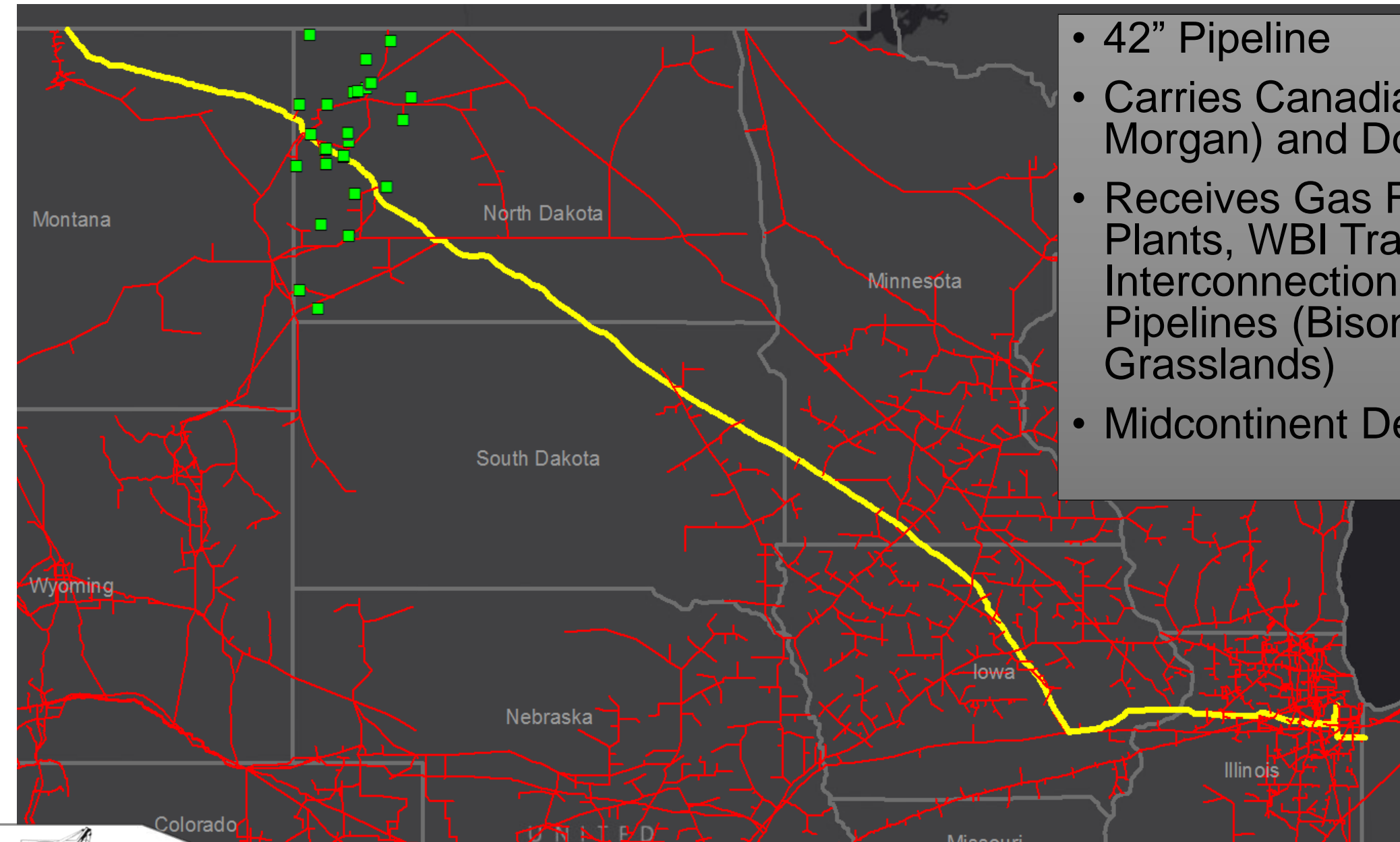


Major Gas Pipeline and Processing Infrastructure



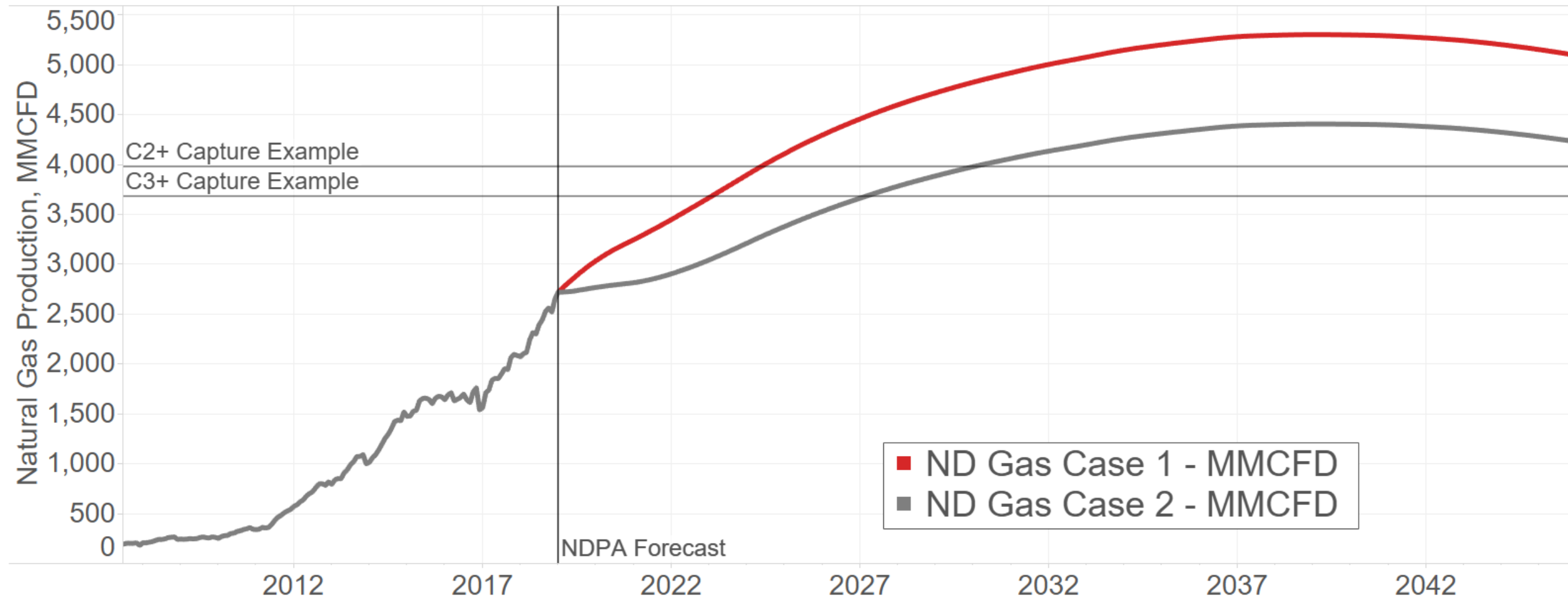
Northern Border Pipeline

- 42" Pipeline
- Carries Canadian (Port of Morgan) and Domestic Gas
- Receives Gas From ND Plants, WBI Transmission Interconnections, and WY Pipelines (Bison & Grasslands)
- Midcontinent Deliveries

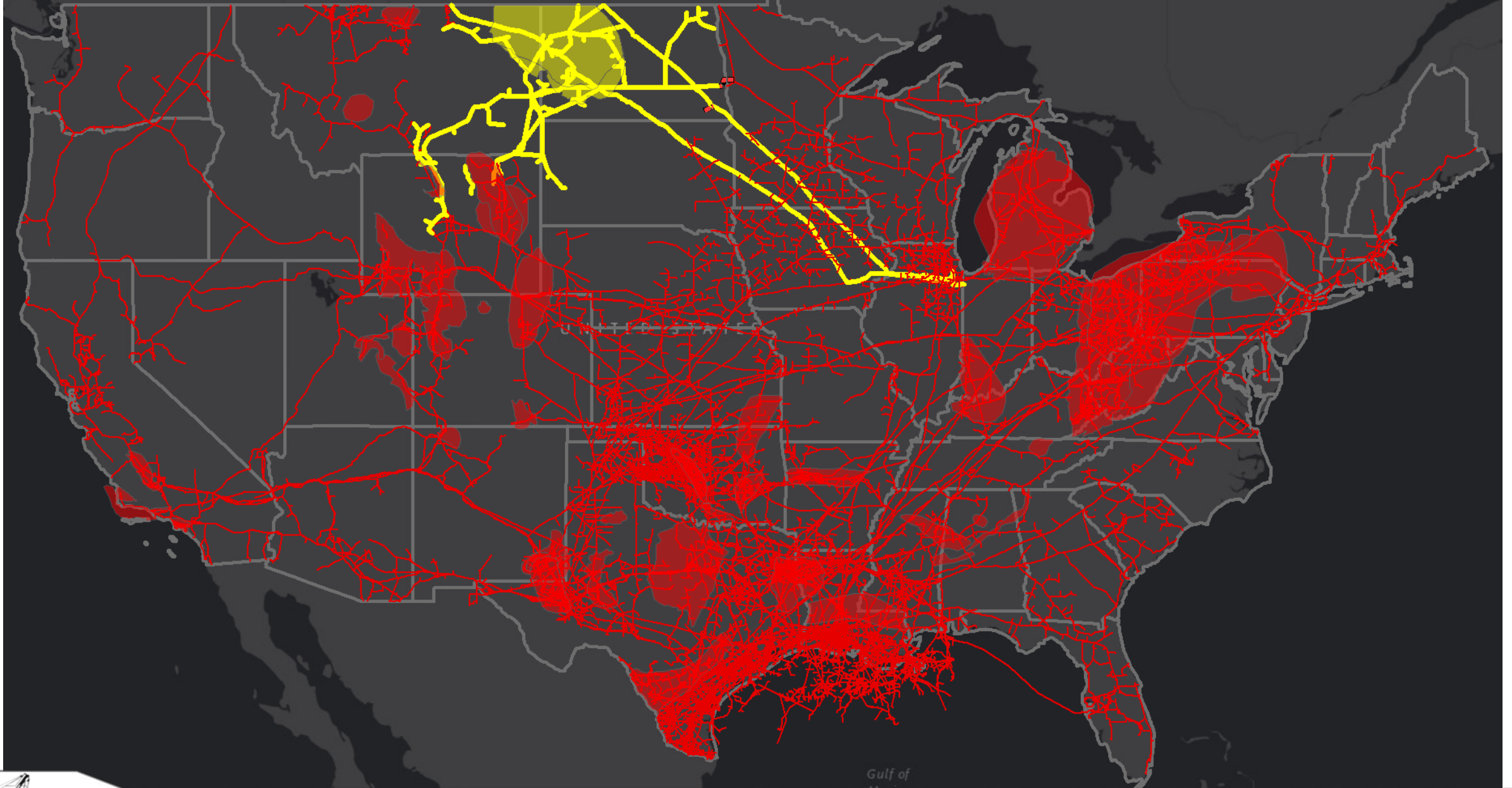


Simplified Example NB Calculations

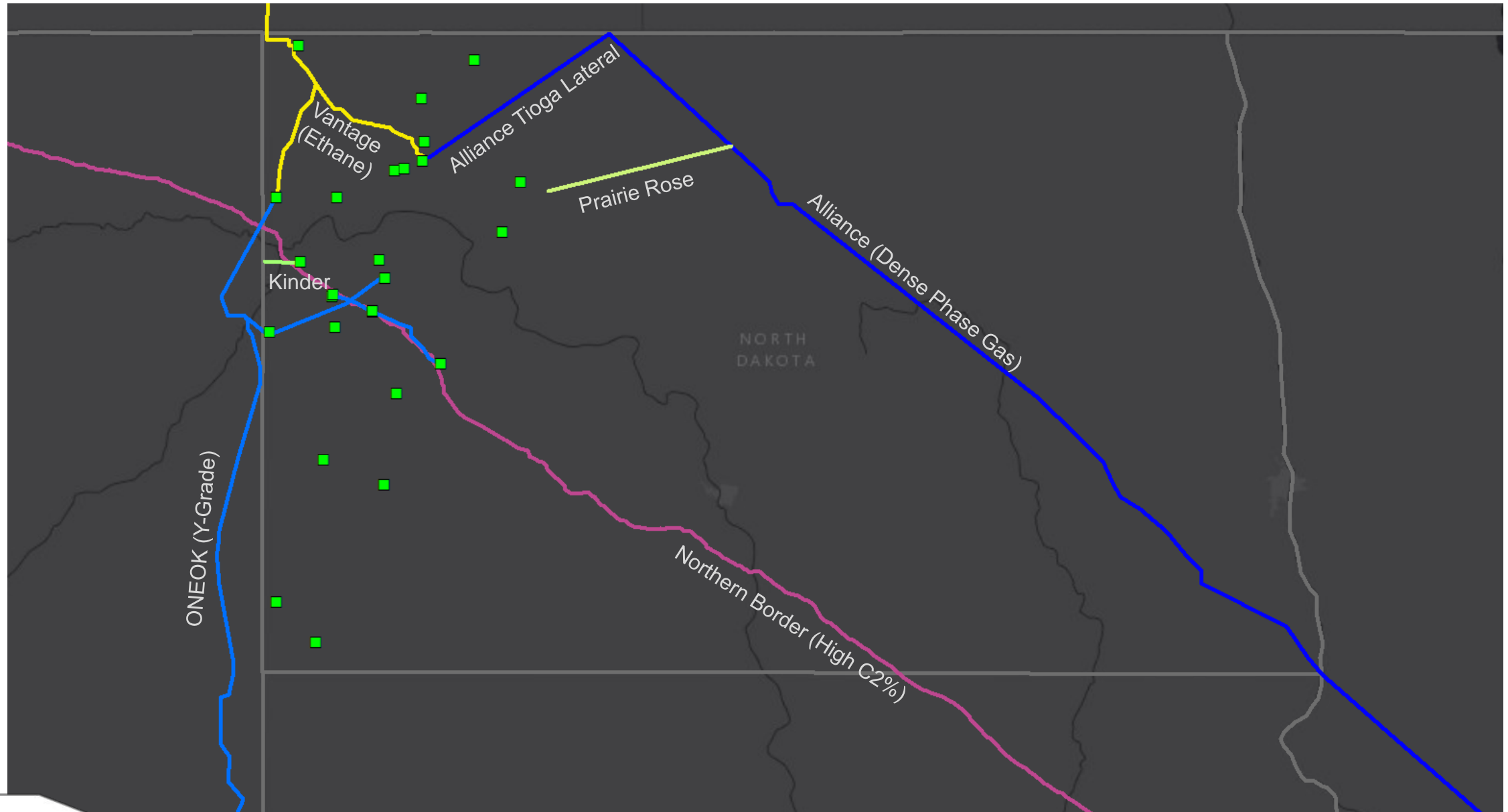
Conclusion: **IF** no other gas export options open and all other deliveries on other pipelines stay static, ND gas production could increase 0.96-1.26 BCFD (from Jan-19) before Northern Border is 100% Bakken production. **BTU management becomes increasingly important for Bakken residue gas.**



Bakken Natural Gas Infrastructure

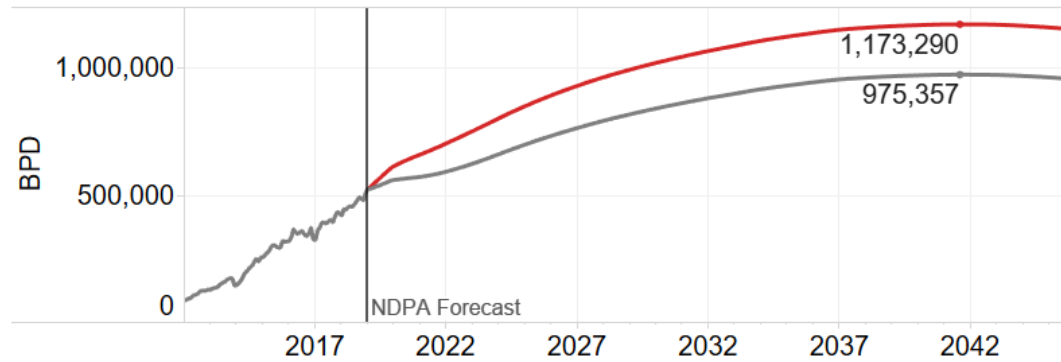


Regional NGL Infrastructure

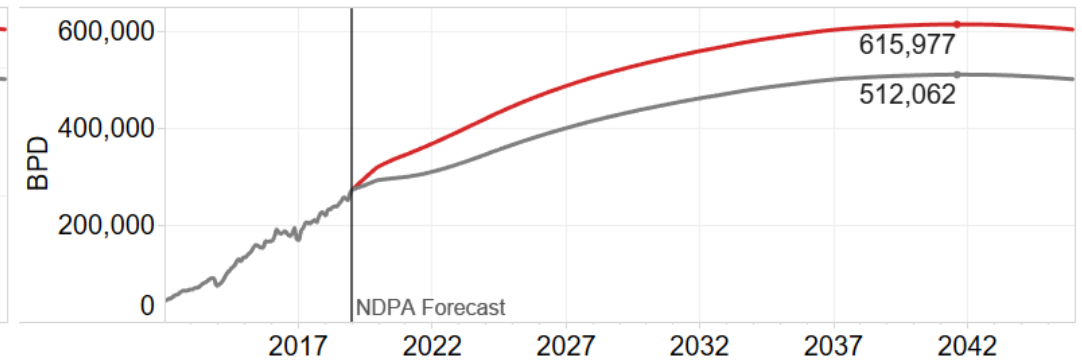


North Dakota Captured* NGL's

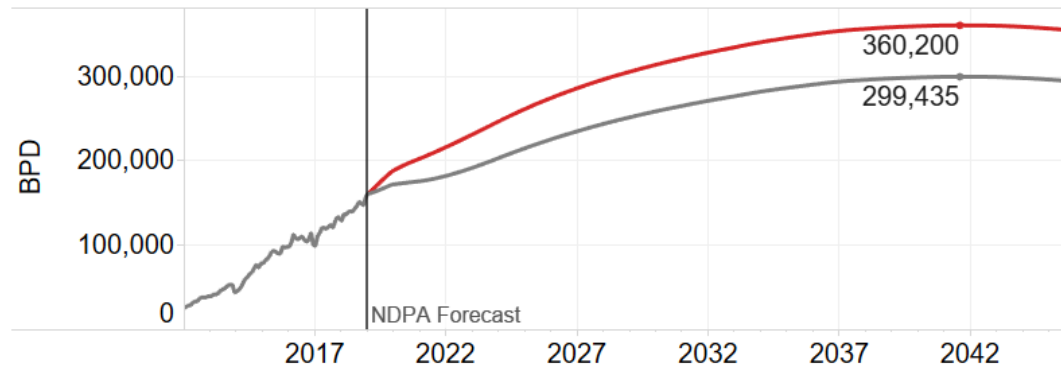
All Natural Gas Liquids



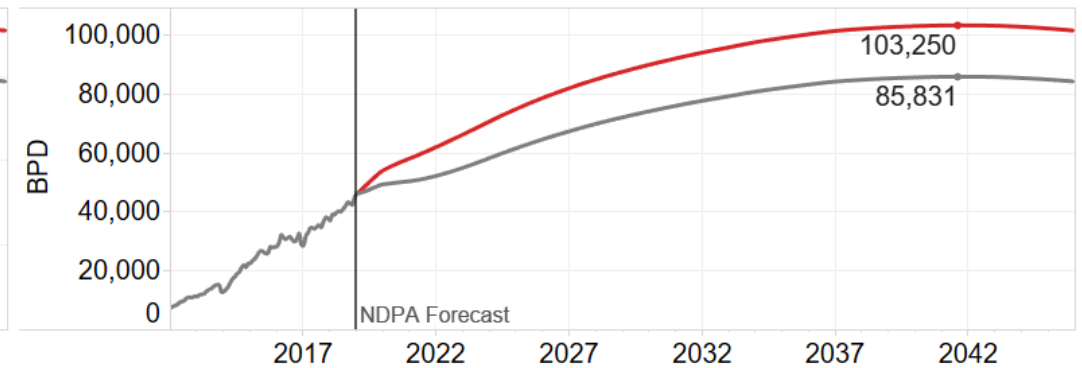
Ethane



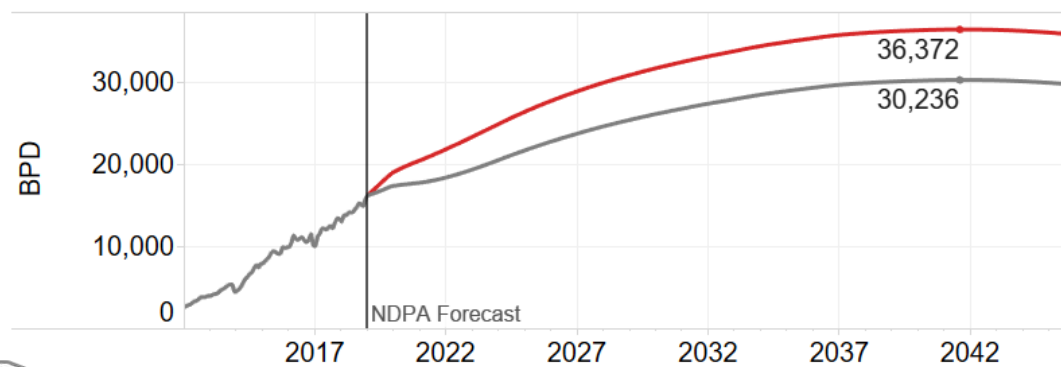
Propane



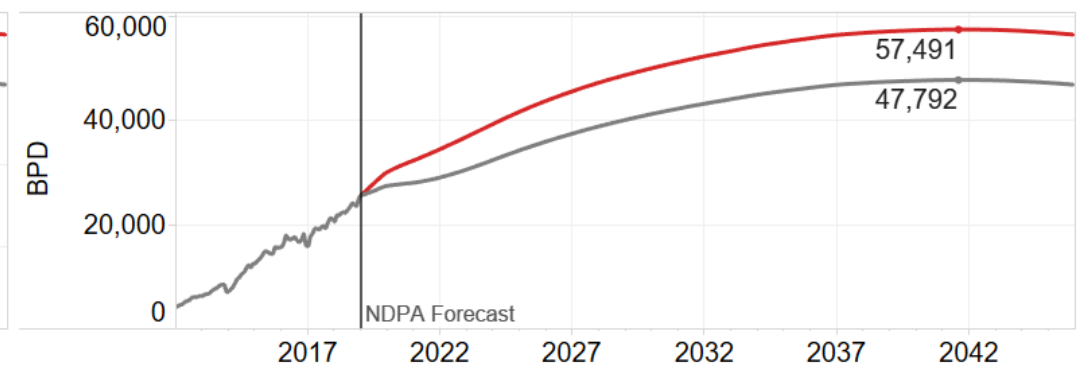
Butane



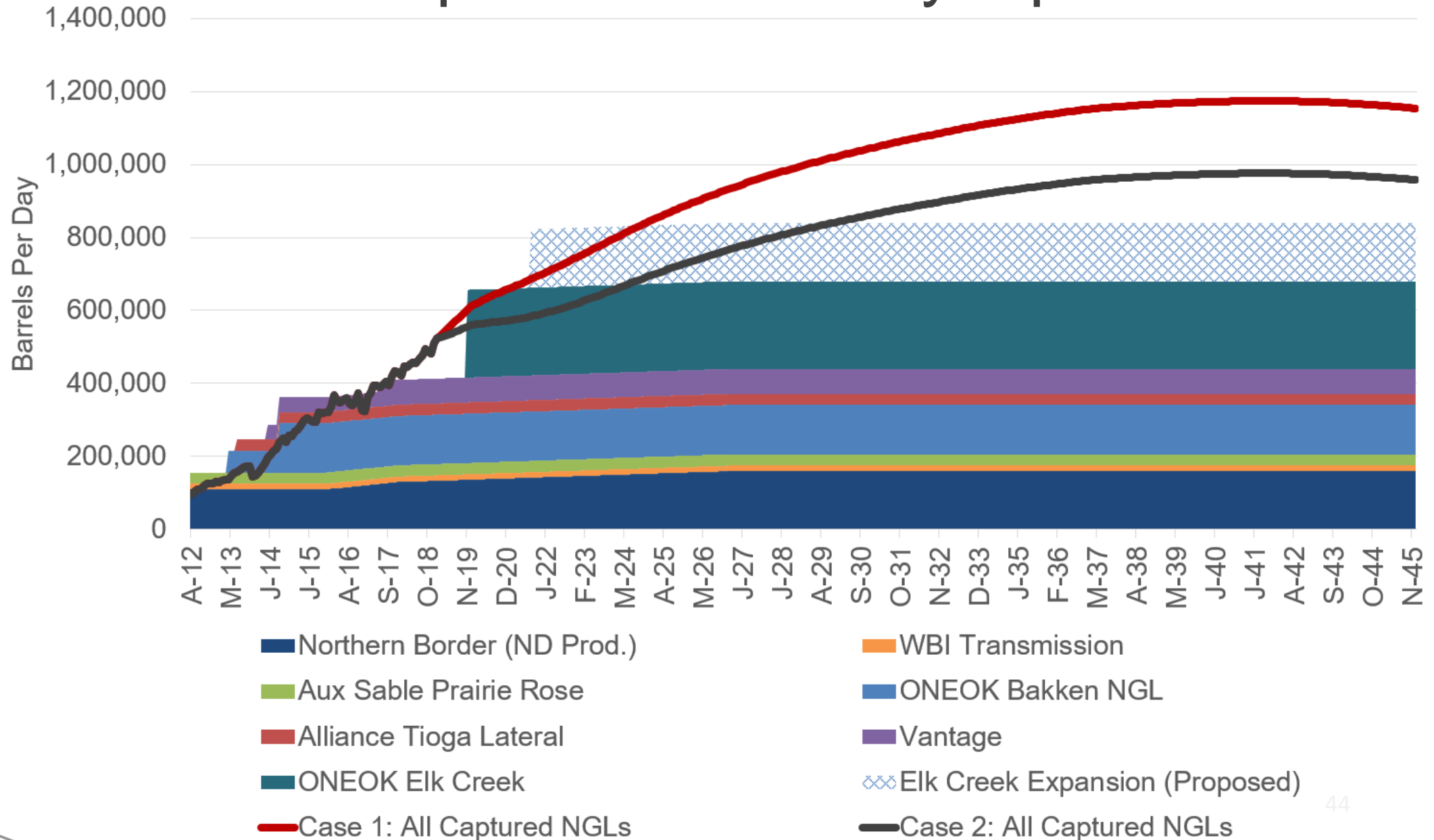
Isobutane



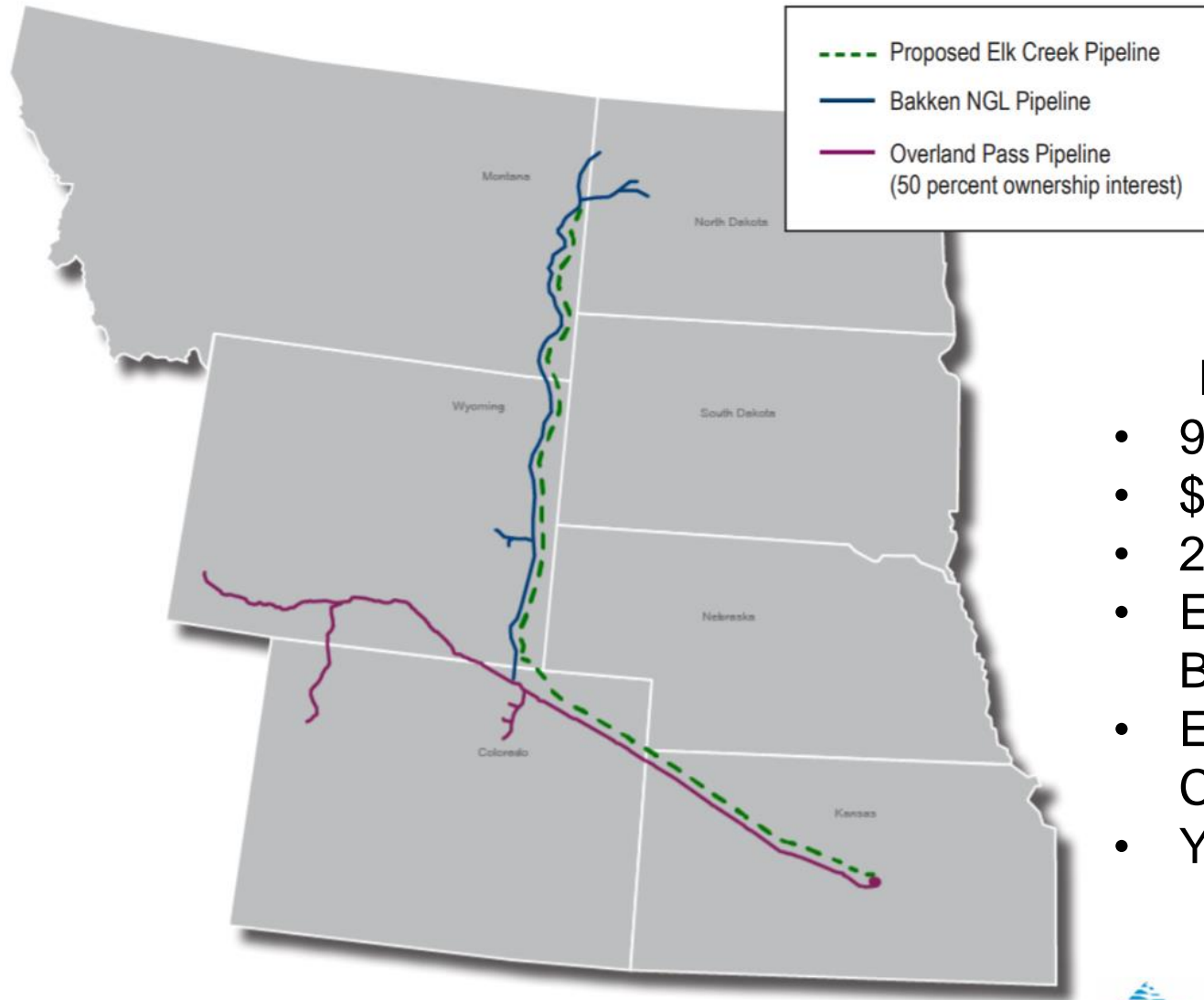
Natural Gasoline



NGL Pipeline Takeaway Options



ONEOK Elk Creek NGL Pipeline

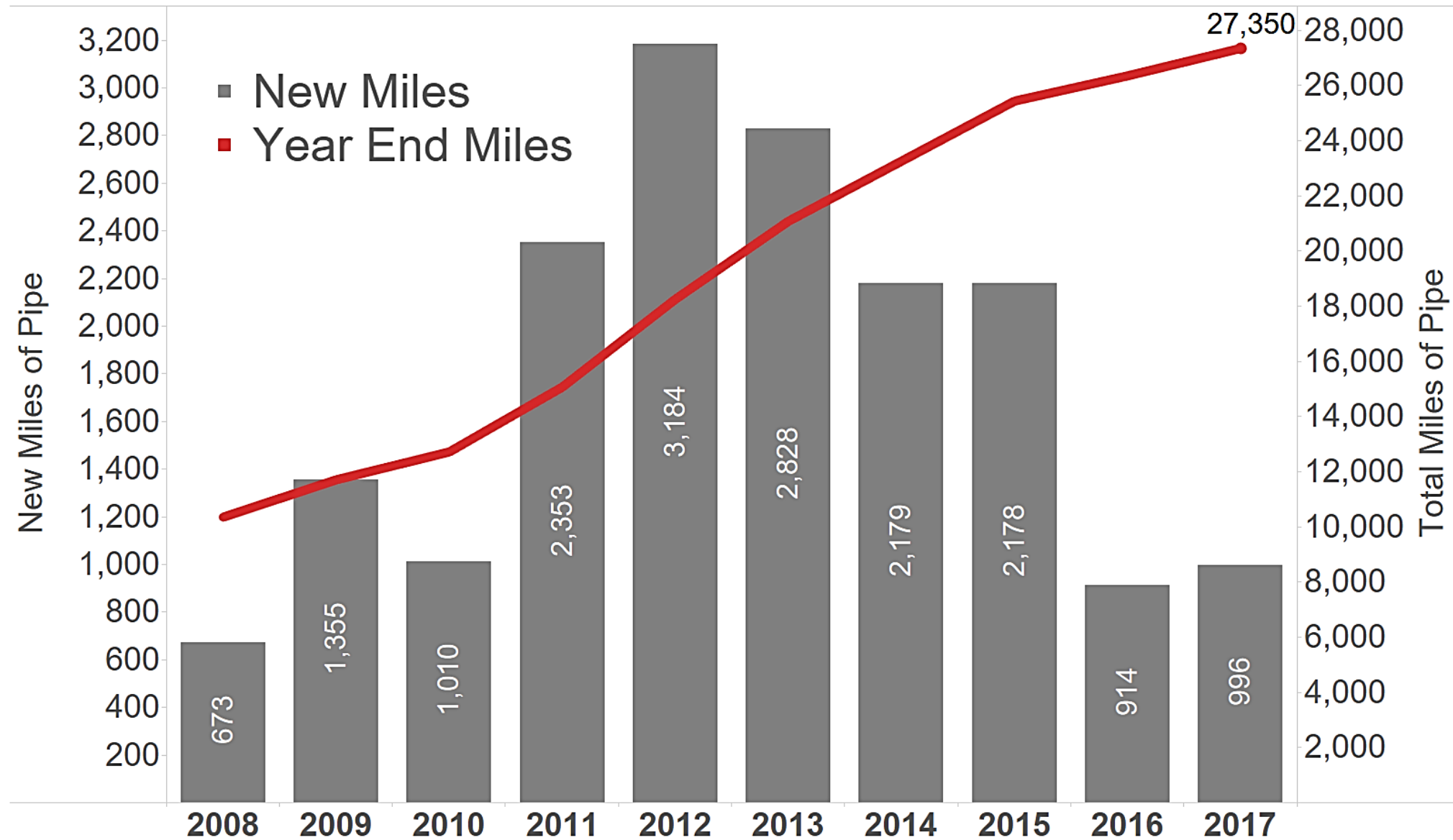


Project Highlights

- 900 Miles - 20" Pipeline
- \$1.4 Billion
- 240,000 BPD Capacity
- Expandable to 400,000 BPD
- End of 2019 Proposed Completion
- Y-Grade Transportation



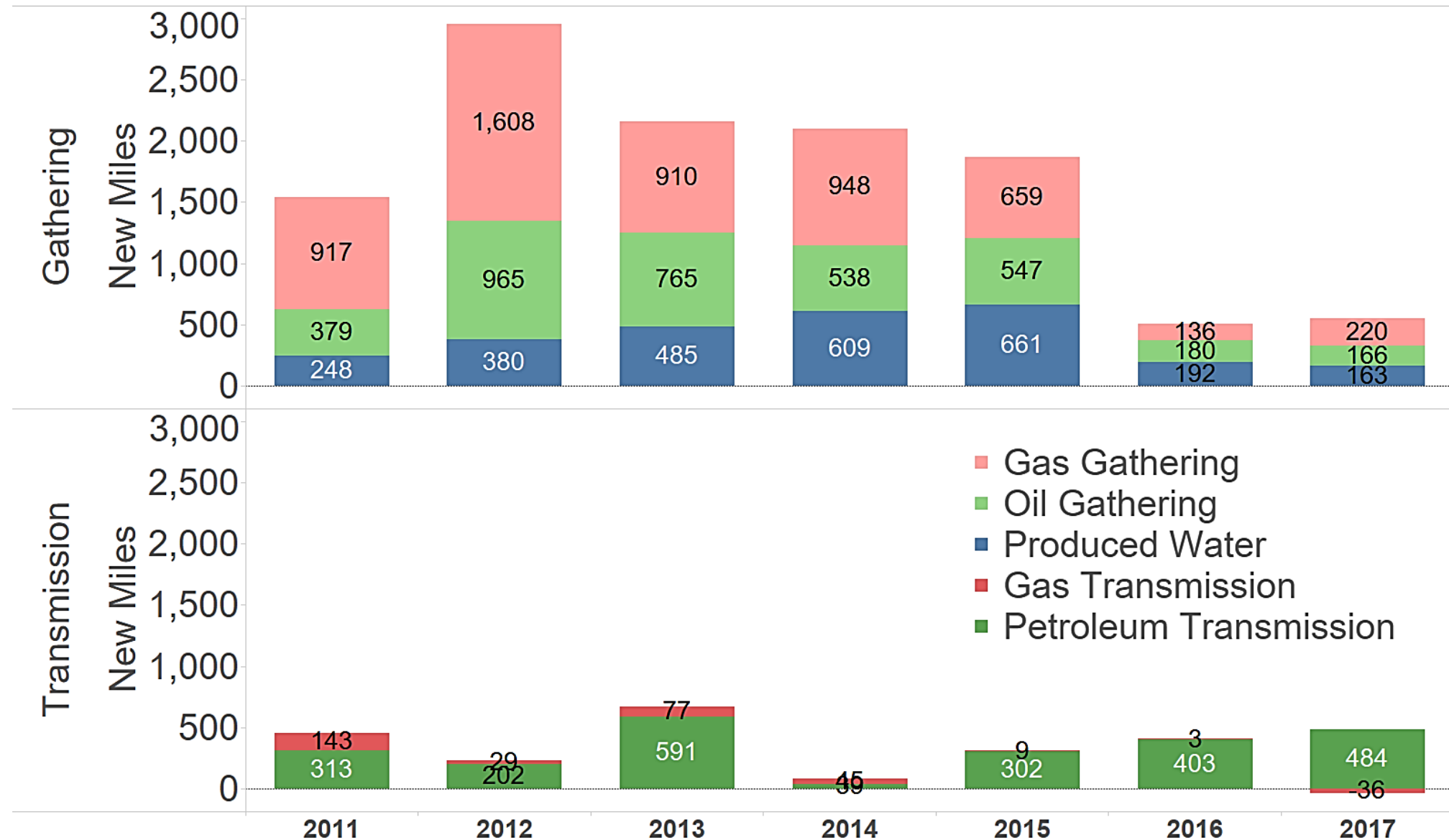
North Dakota Pipeline Construction



Sources: NDIC & PHMSA



North Dakota Pipeline Construction



Sources: NDIC & PHMSA



Contact Information

Justin J. Kringstad, Director
North Dakota Pipeline Authority

600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

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