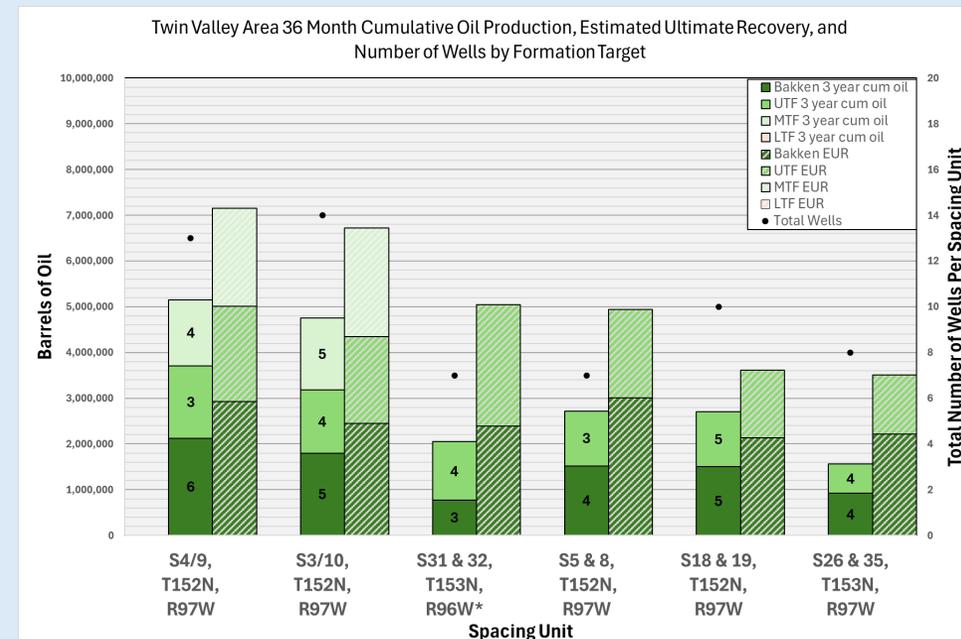
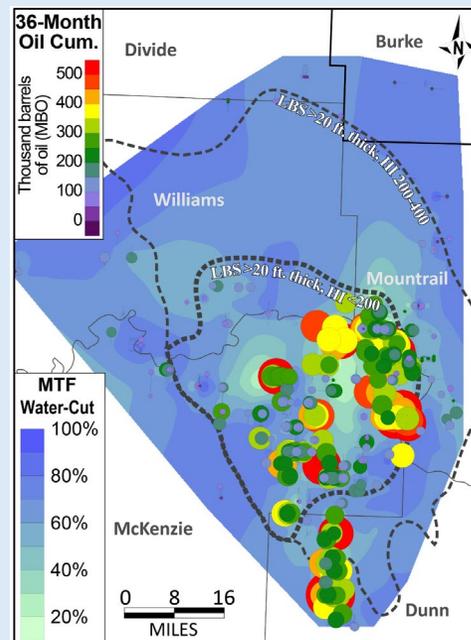
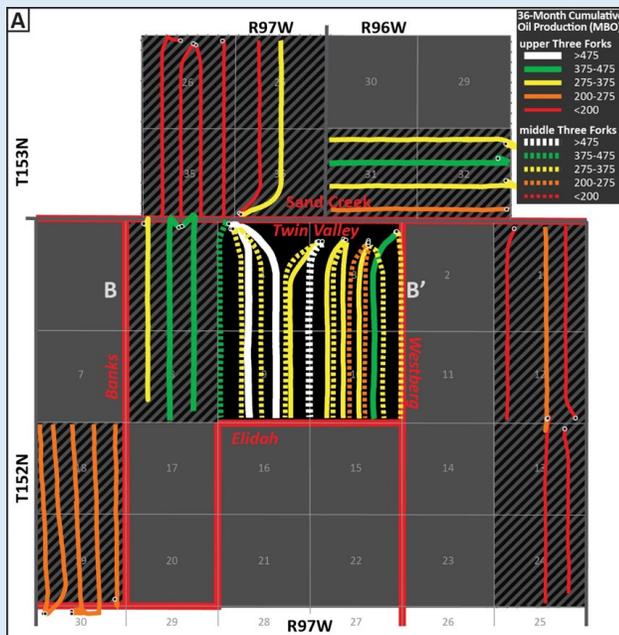
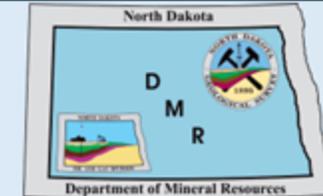


Underdeveloped Resources in the Middle Three Forks Formation



Timothy O. Nesheim* & Ted Starns*

SB-2397

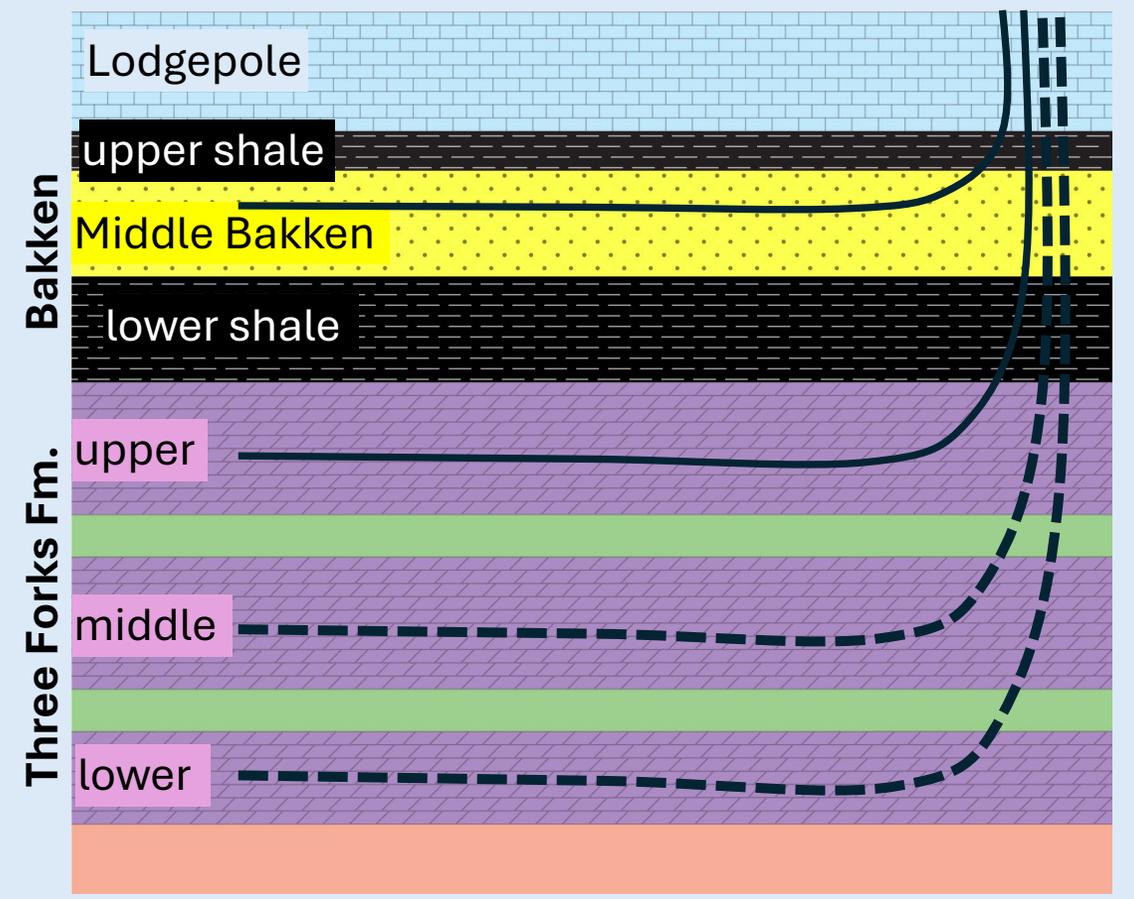
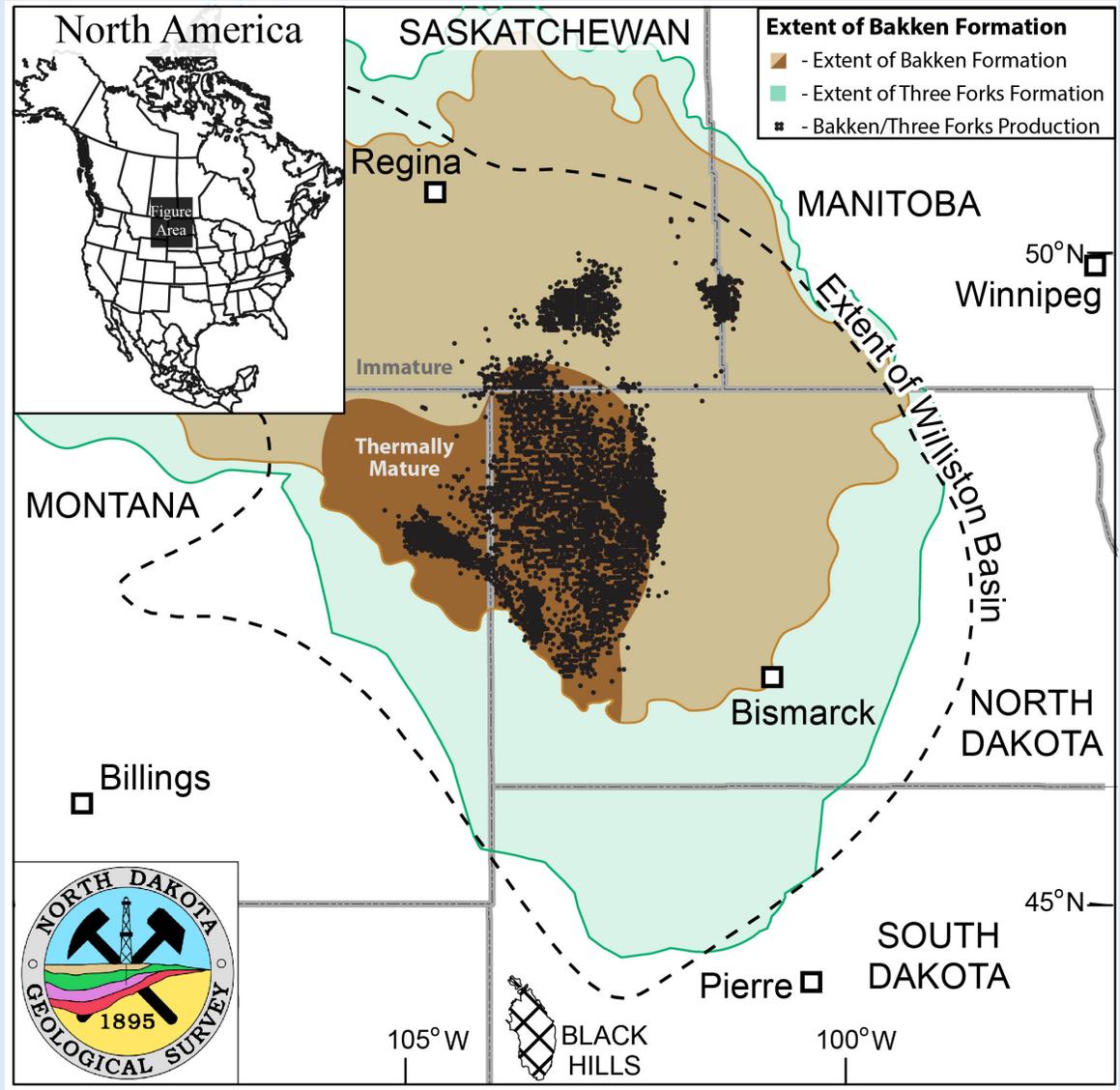
4/15/2025

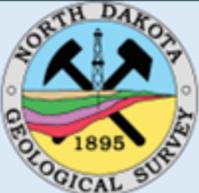
**North Dakota Geological Survey
Department of Mineral Resources*



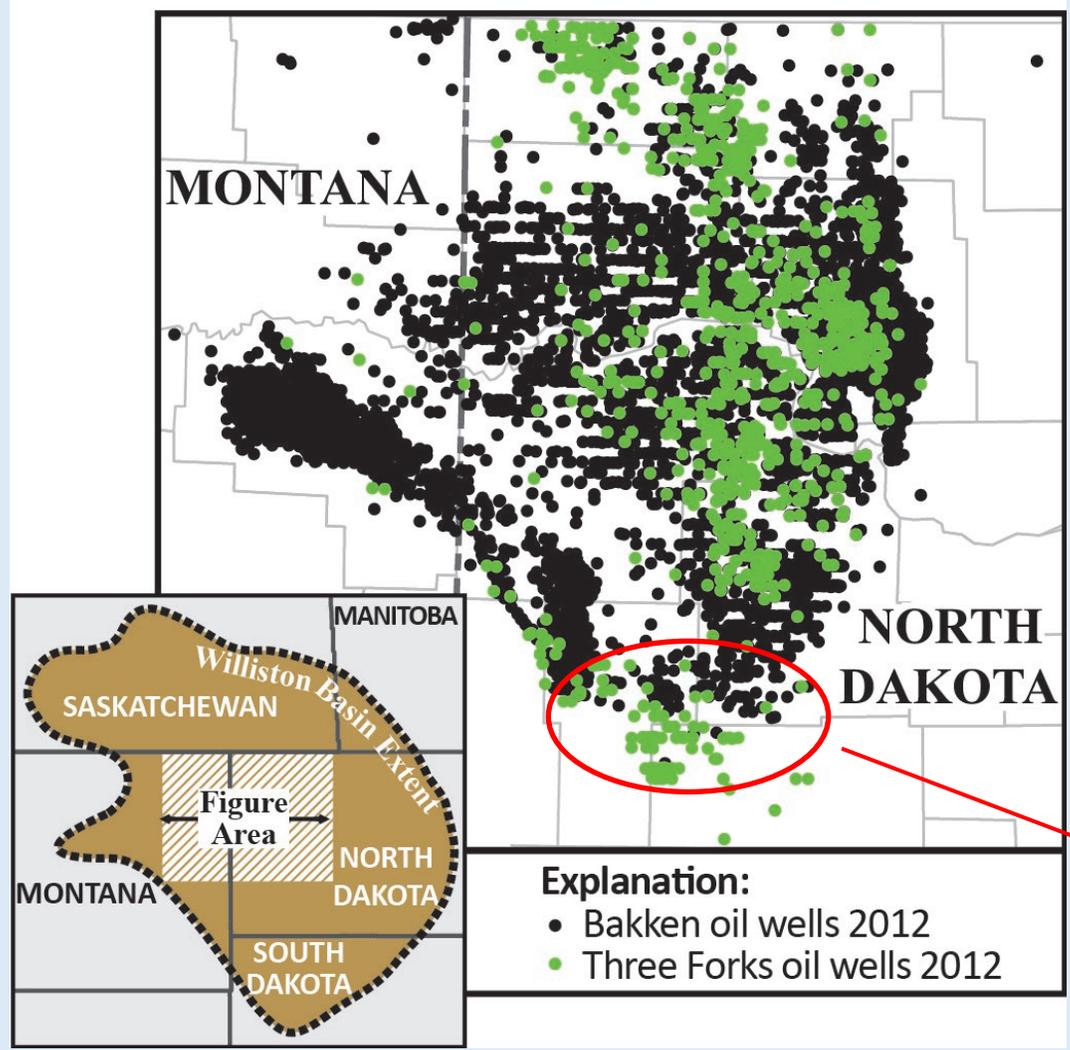


Bakken-Three Forks Play Overview

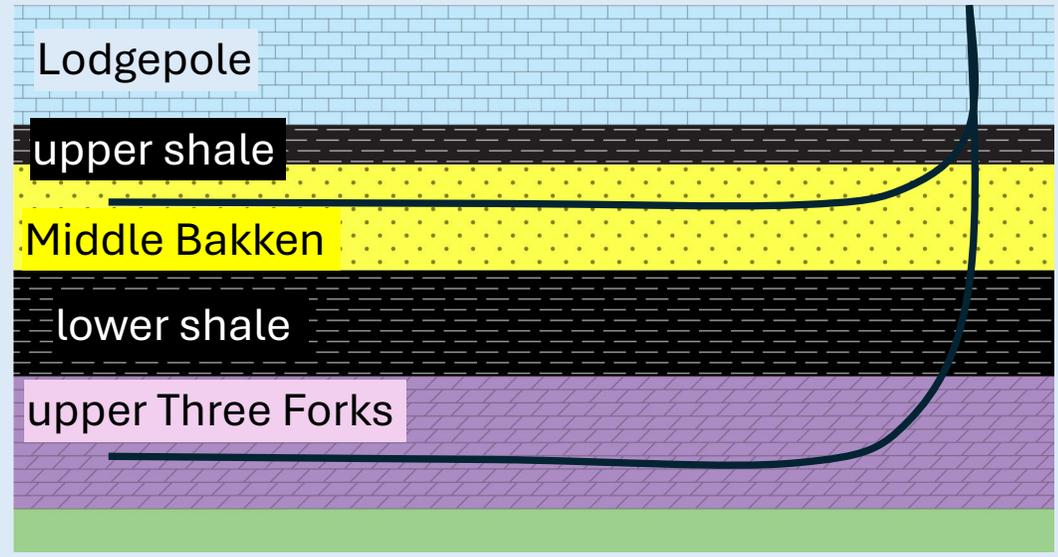




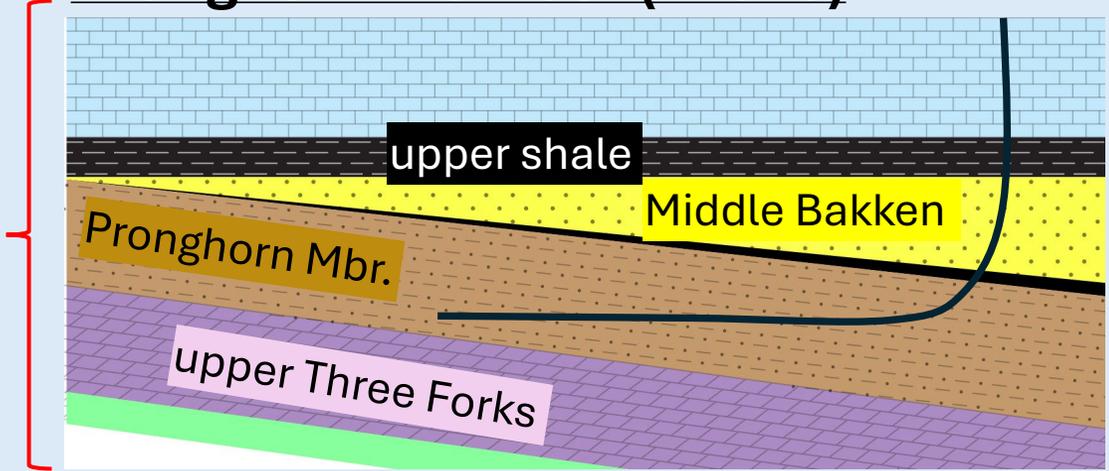
Bakken-Three Forks Play Evolution

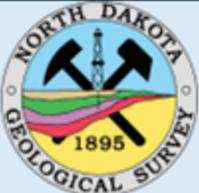


Middle Bakken & u. Three Forks(2000-08)

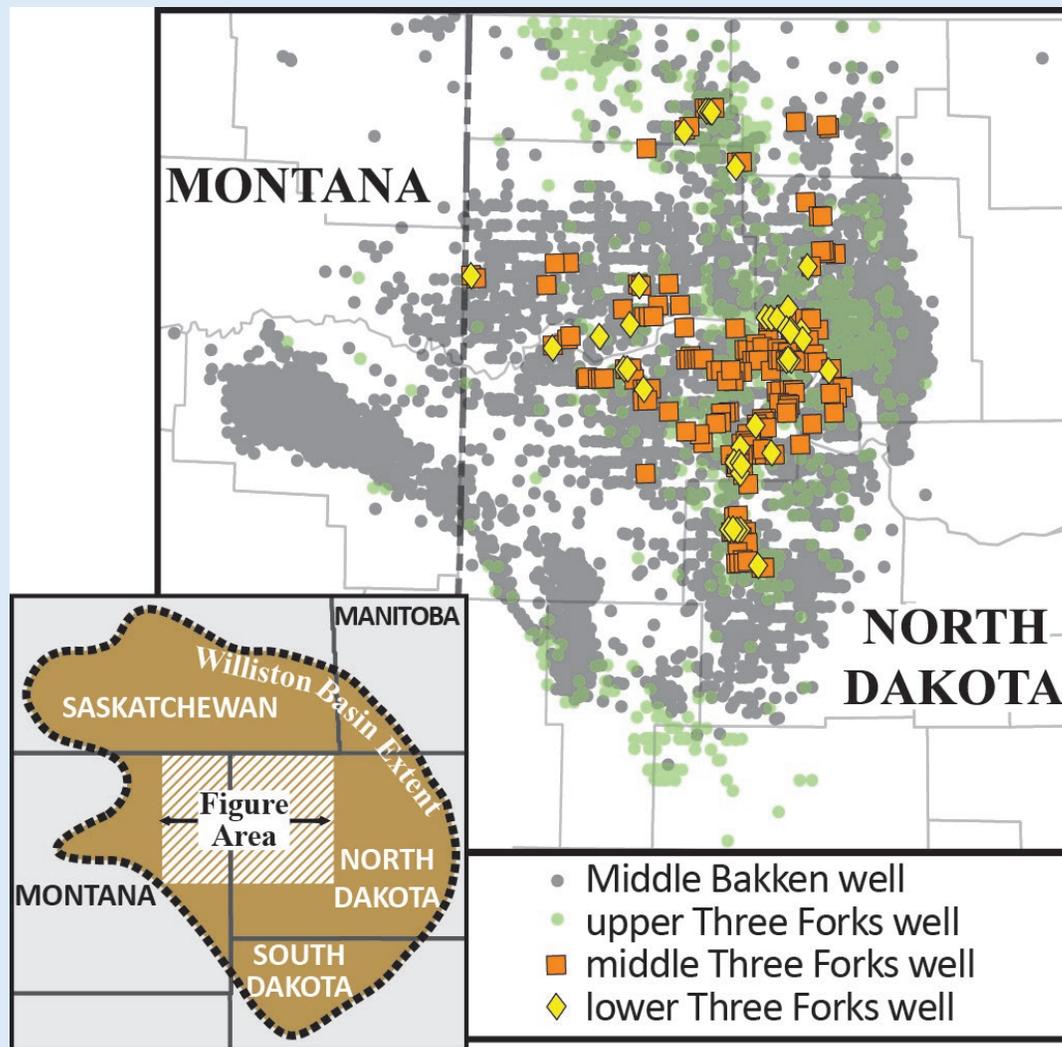
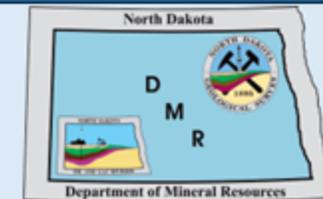


Pronghorn Member (~2010)

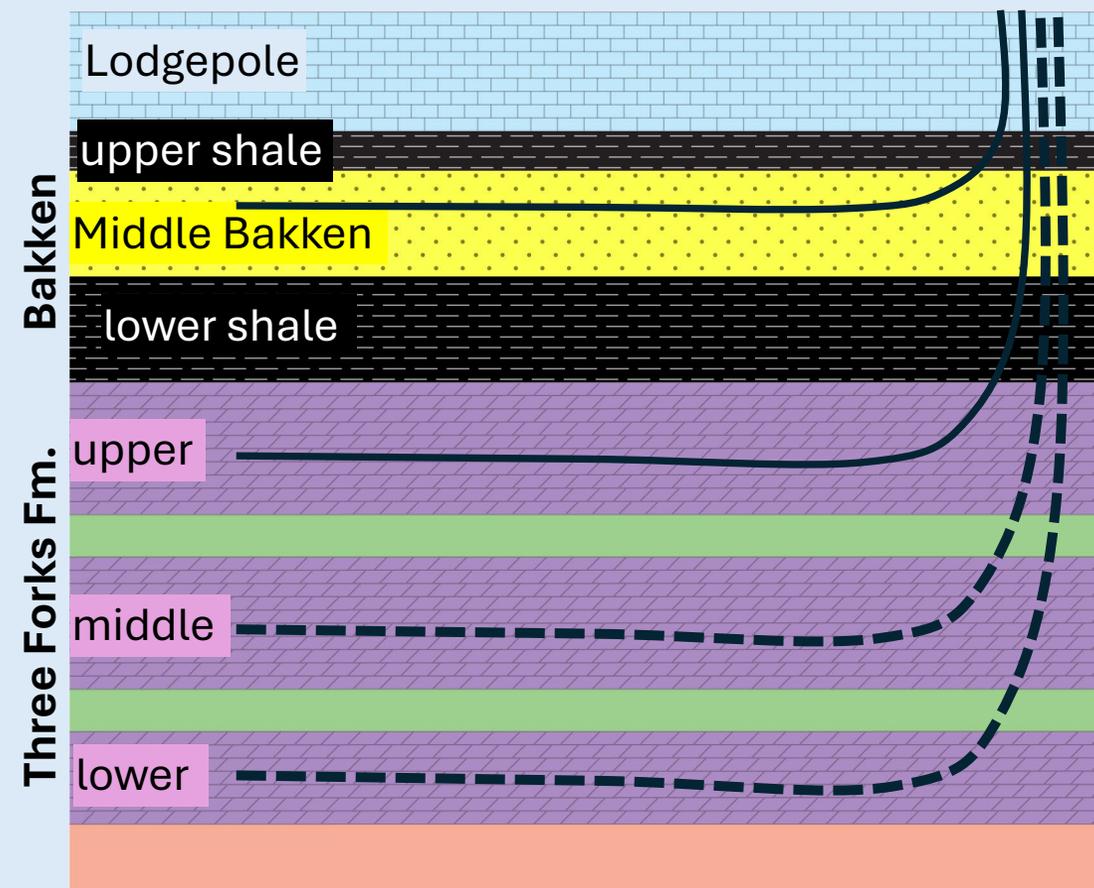




Bakken-Three Forks Play Evolution

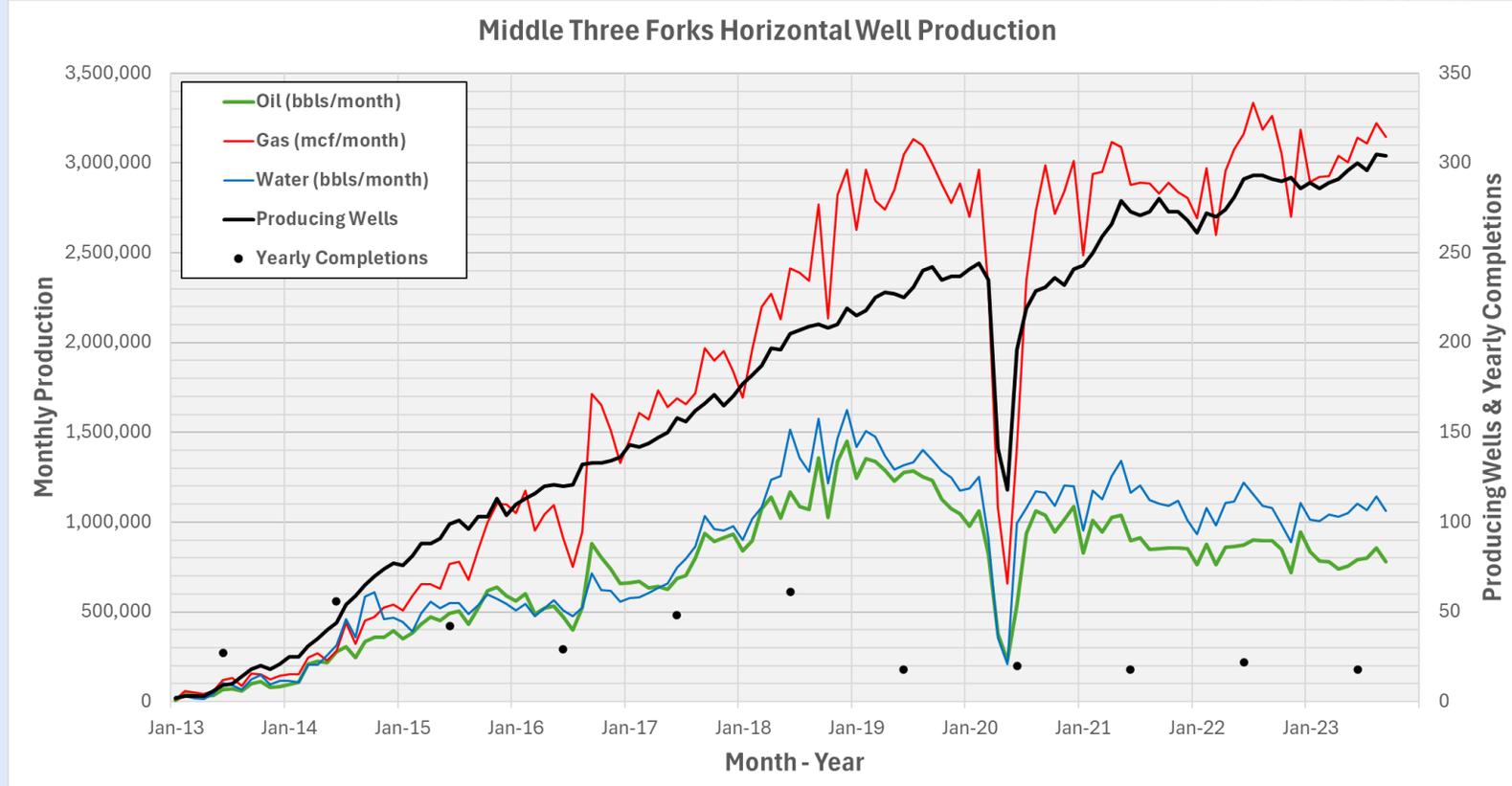
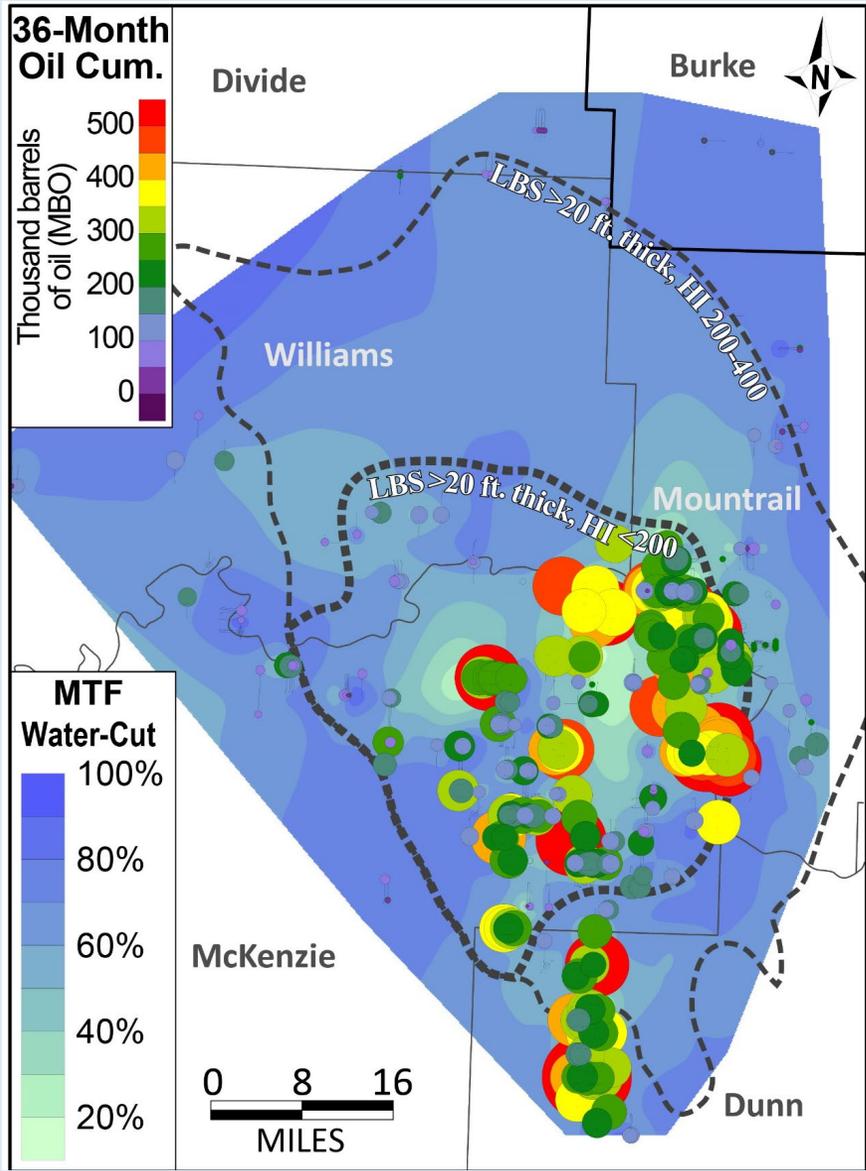


middle & lower Three Forks (~2013)





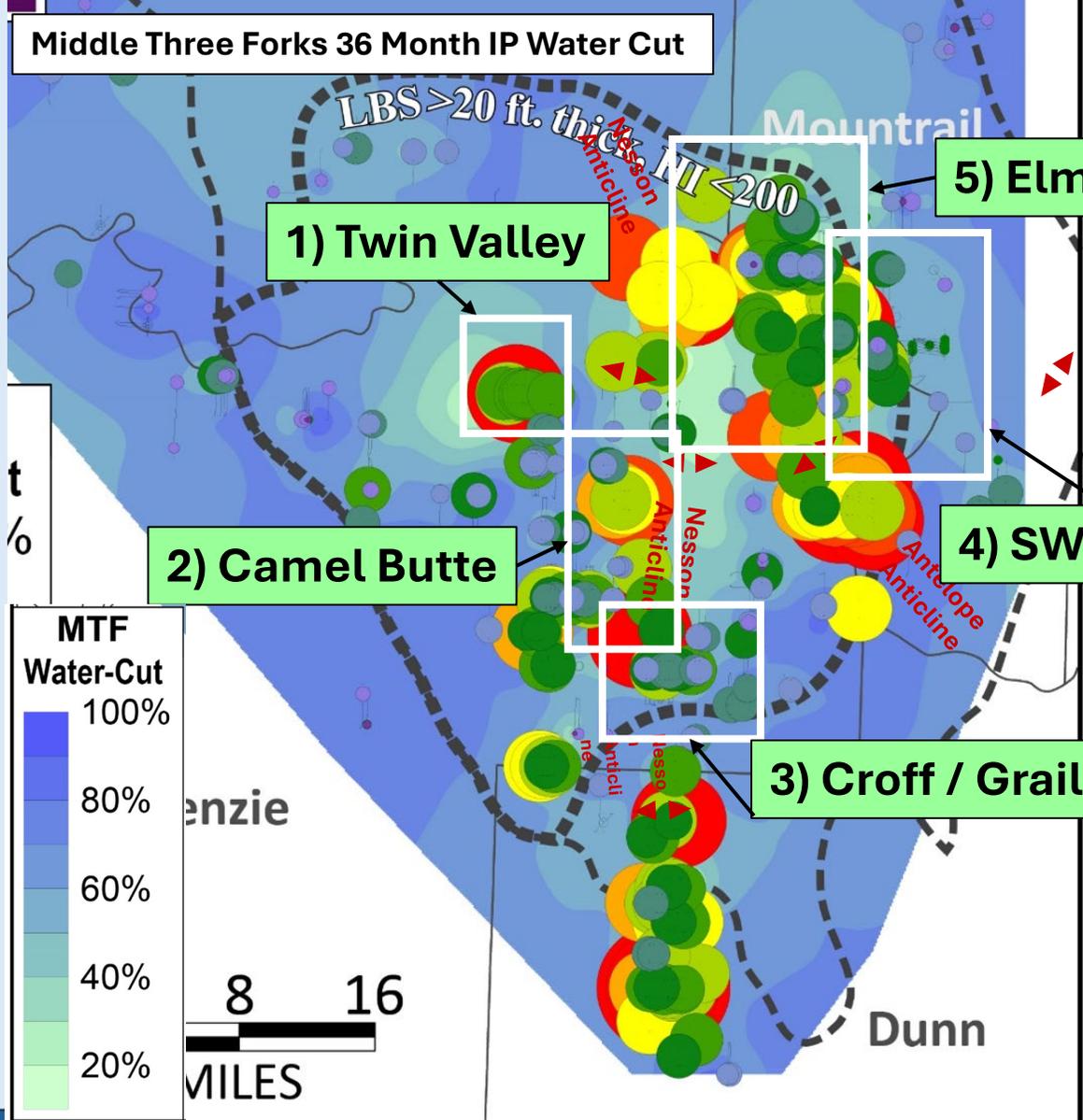
Middle Three Forks Development



- 373 horizontal producers
- 92.5 MMBO Cum. Oil
- 107.7 MMBW Cum. Water
- 238.2 BCF Cum. Gas



Middle Three Forks Resource Potential – Project Update

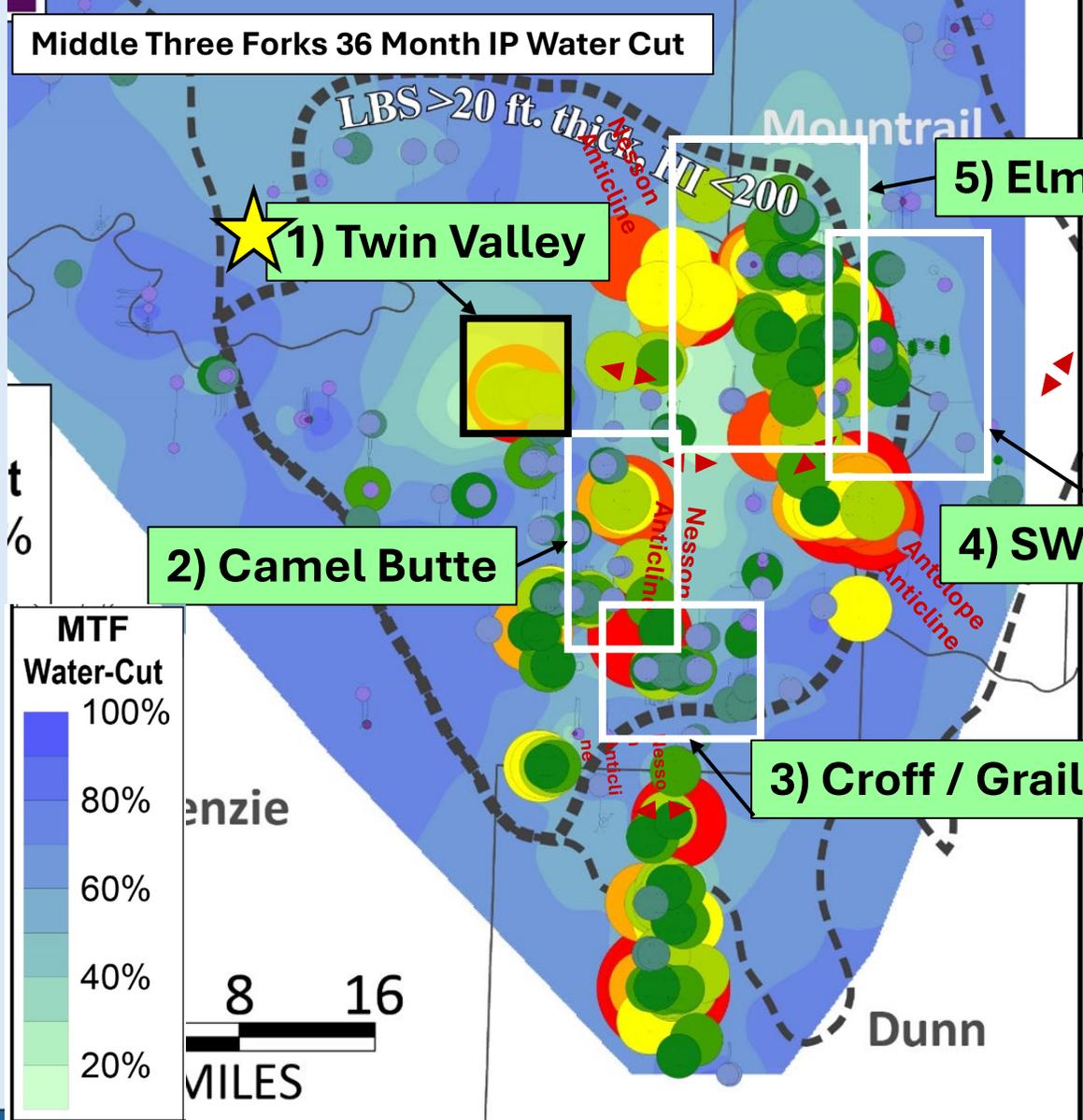


METHODS:

- Selected 1280-acre DSU's with MTF surrounded by DSU' w/o MTF development (avoided contiguous development areas)
- Confirm/determined lateral reservoir target
- Compiled production data, EUR forecasting methodology (e.g., cut off at 300 BBL/Month)
- Investigated cores in immediate area for reservoir quality of upper and middle Three Forks
- Isopach and structure mapping (geologic variations)
- Documented noteworthy interactions where discernible (i.e. existing production w/ later infill)
- Evaluated completions data
- Investigated 532 wells in 45 DSUs



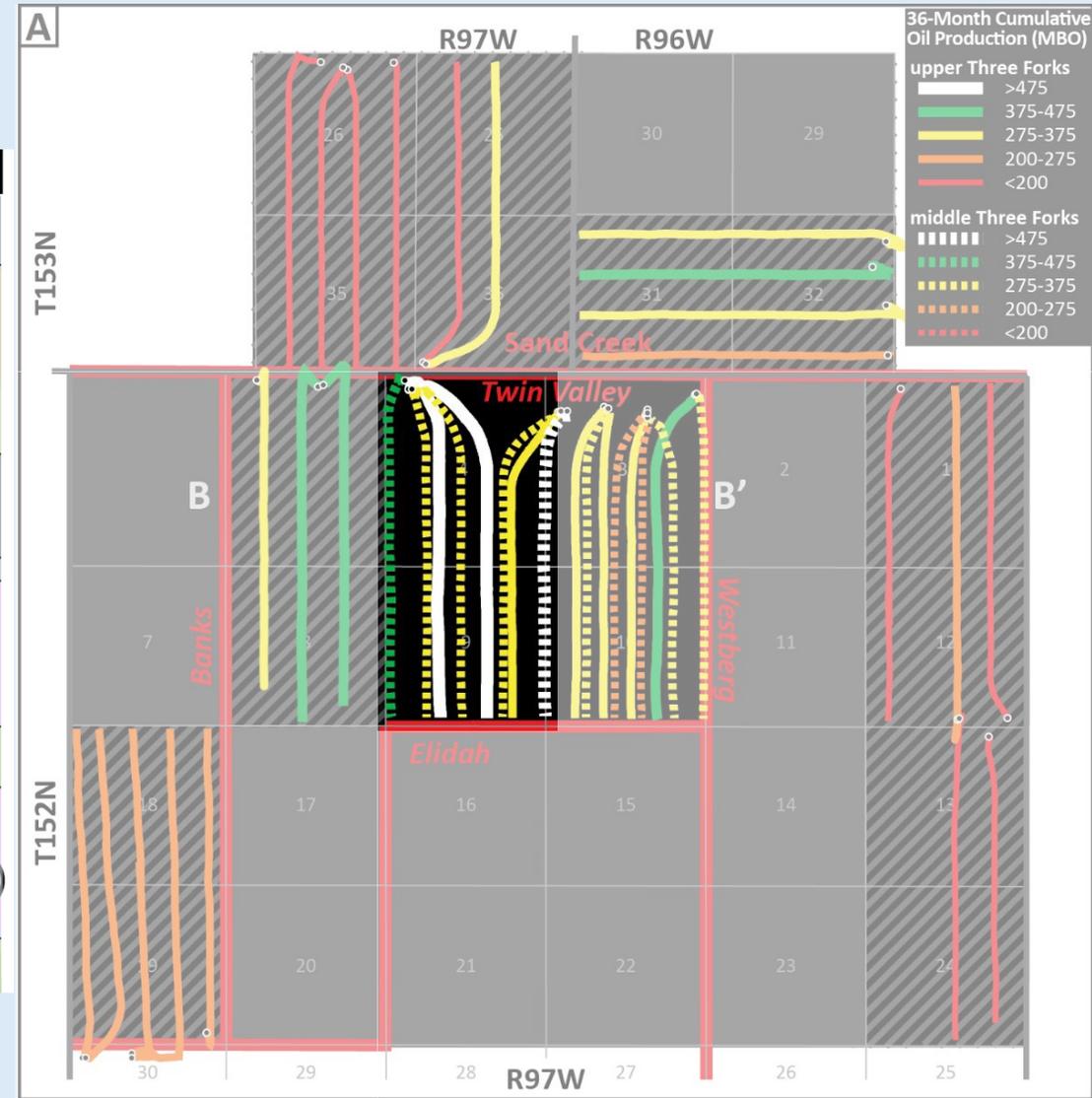
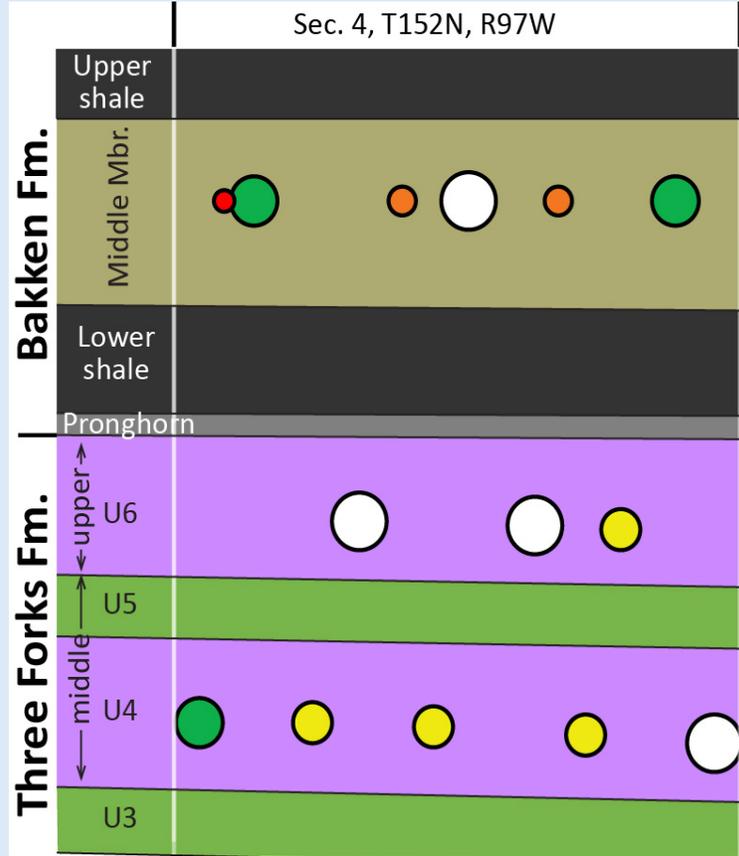
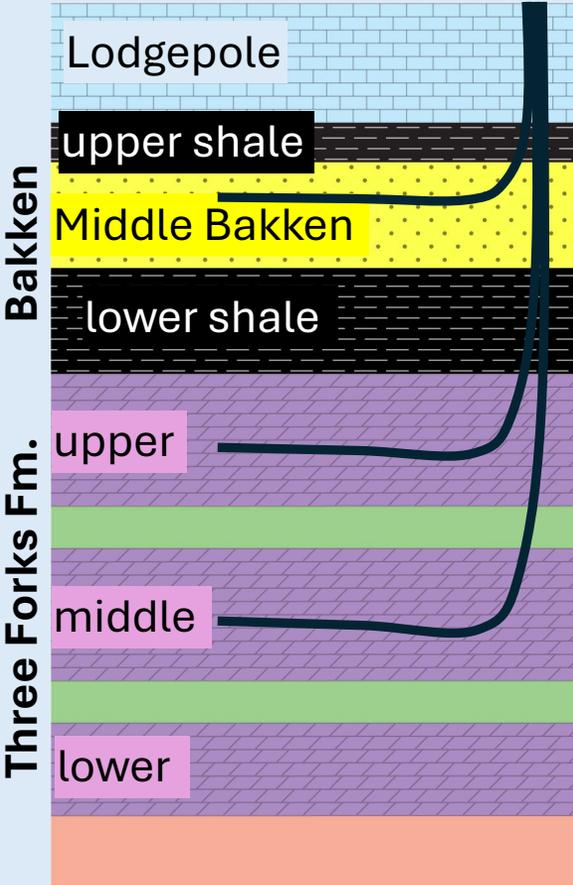
Middle Three Forks Resource Potential – Project Update

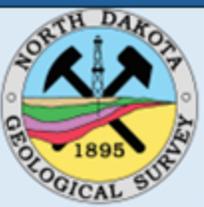


- METHODS:**
- Selected 1280-acre DSU's with MTF surrounded by DSU' w/o MTF development (avoided contiguous development areas)
 - Confirm/determined lateral reservoir target
 - Compiled production data, EUR forecasting methodology (e.g., cut off at 300 BBL/Month)
 - Investigated cores in immediate area for reservoir quality of upper and middle Three Forks
 - Isopach and structure mapping (geologic variations)
 - Documented noteworthy interactions where discernible (i.e. existing production w/ later infill)
 - Evaluated completions data
 - Investigated 532 wells in 45 DSUs

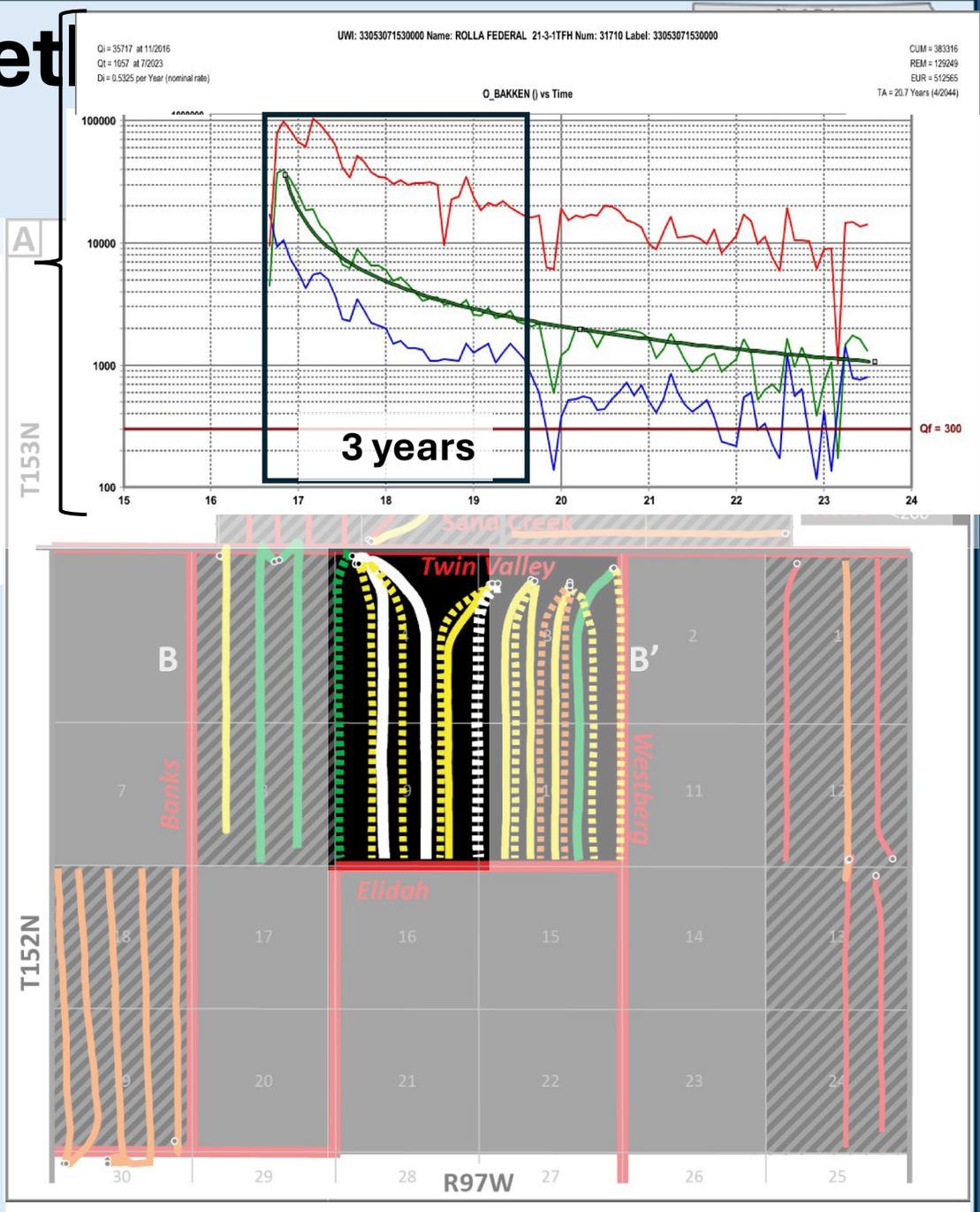
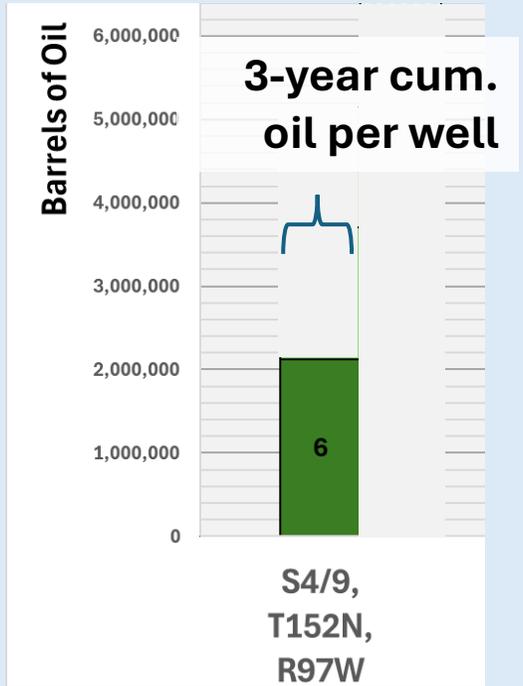
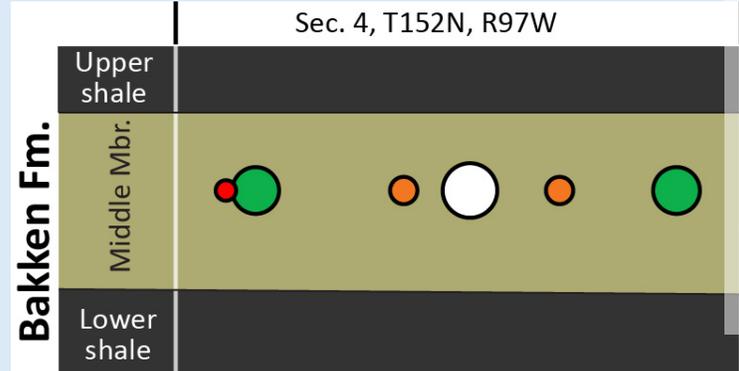
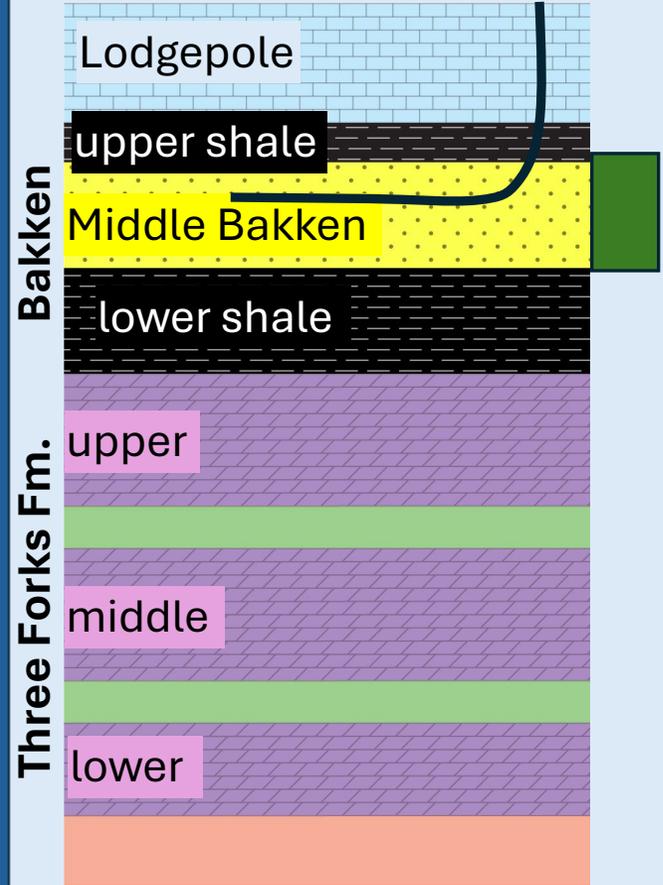


Evaluation Methods





Evaluation Met



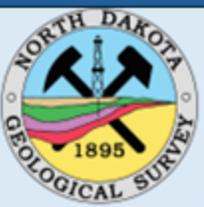
CUM = 383316
REM = 129249
EUR = 512565
TA = 20.7 Years (42944)

A

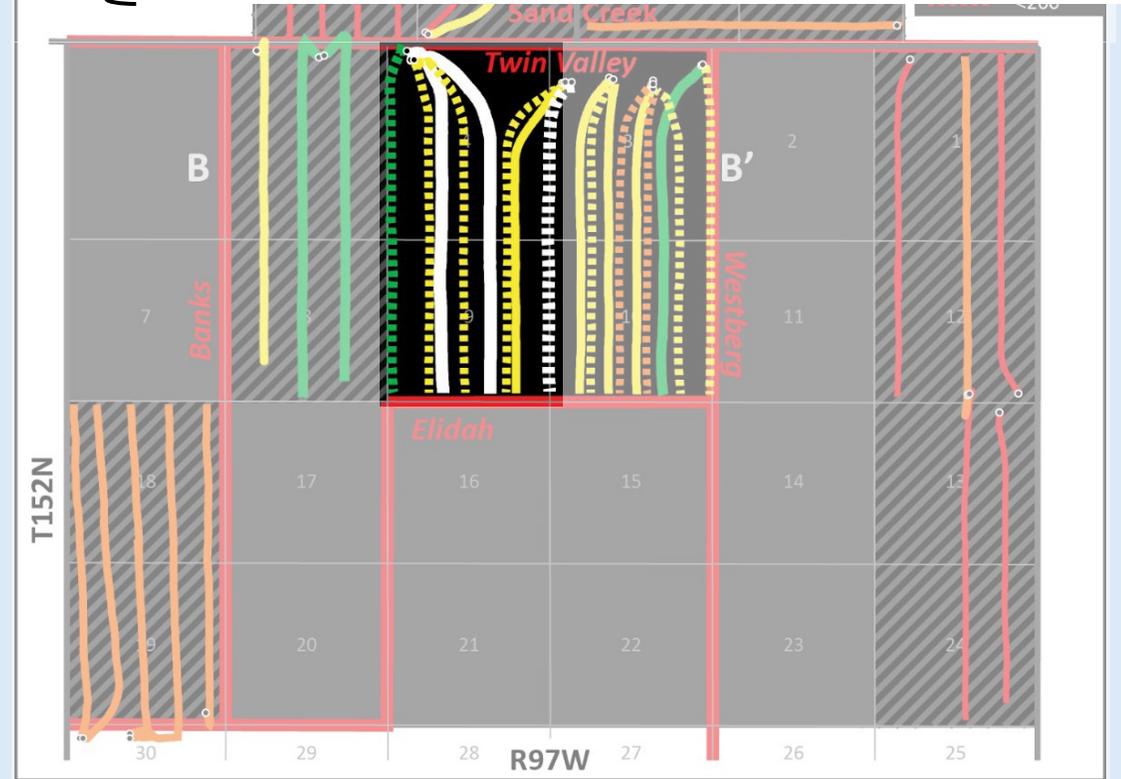
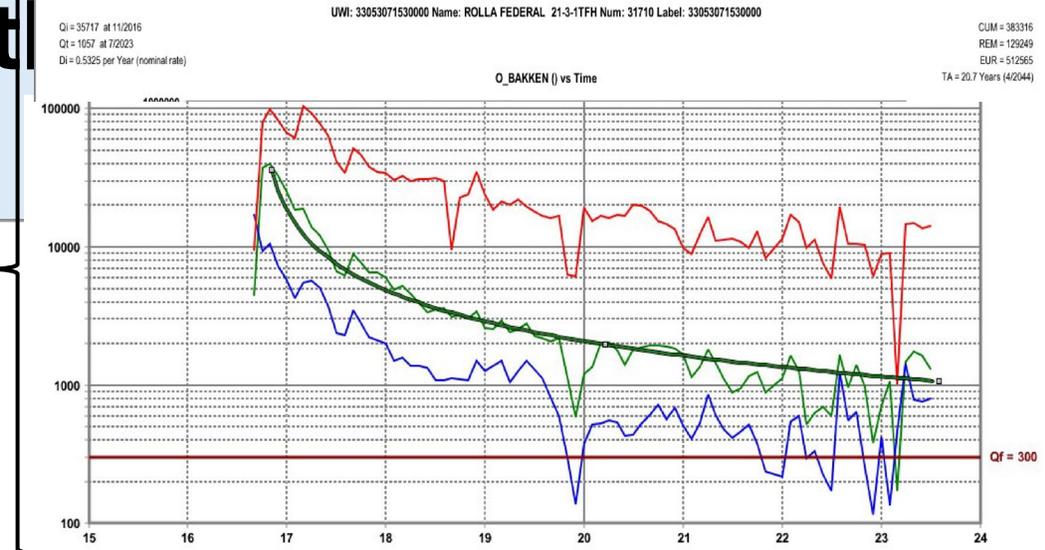
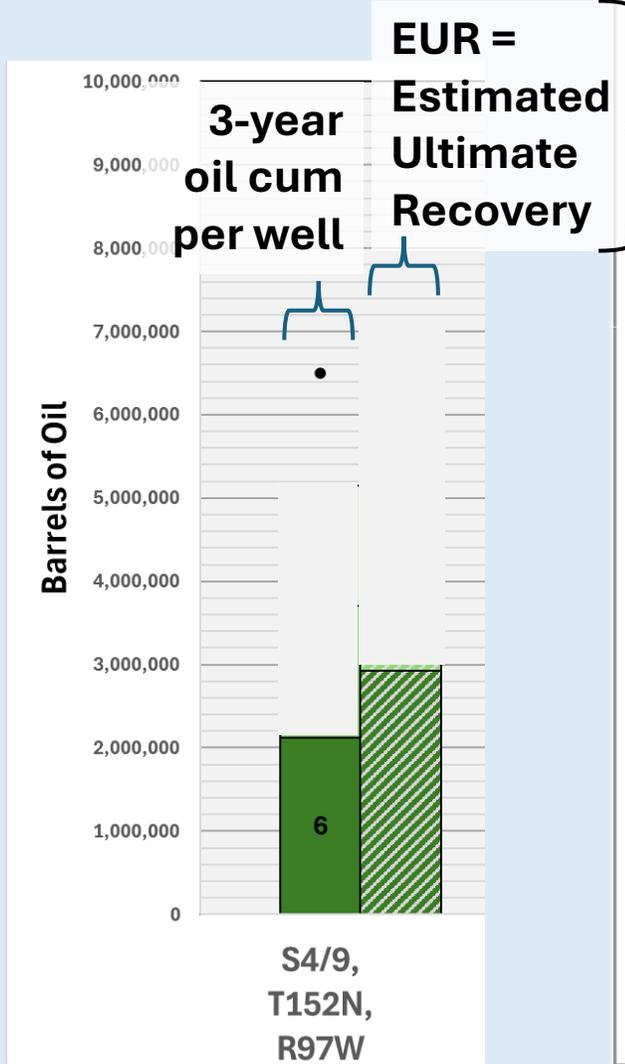
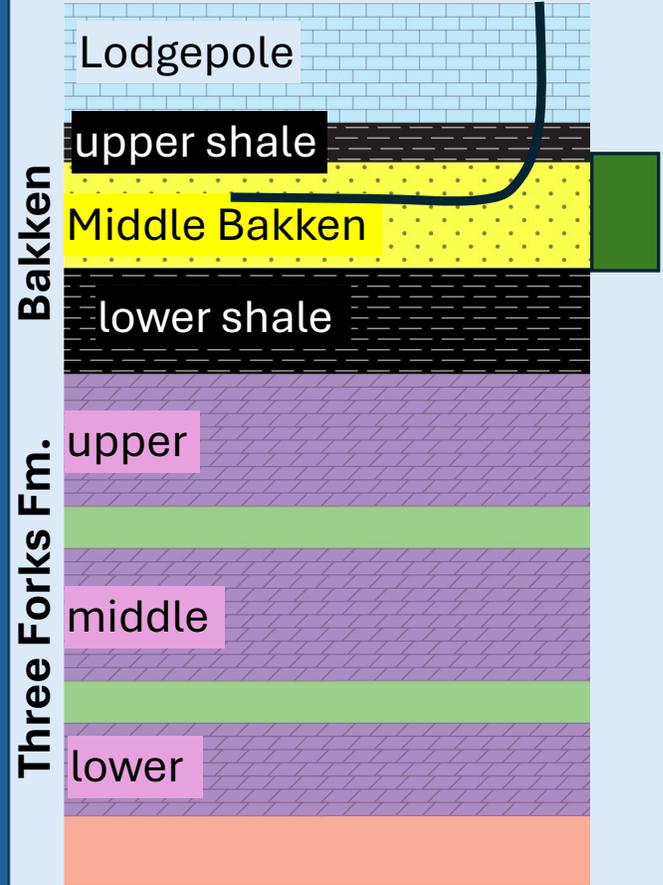
T153N

T152N

R97W



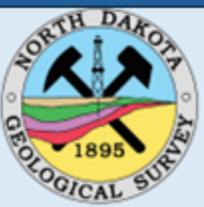
Evaluation Method



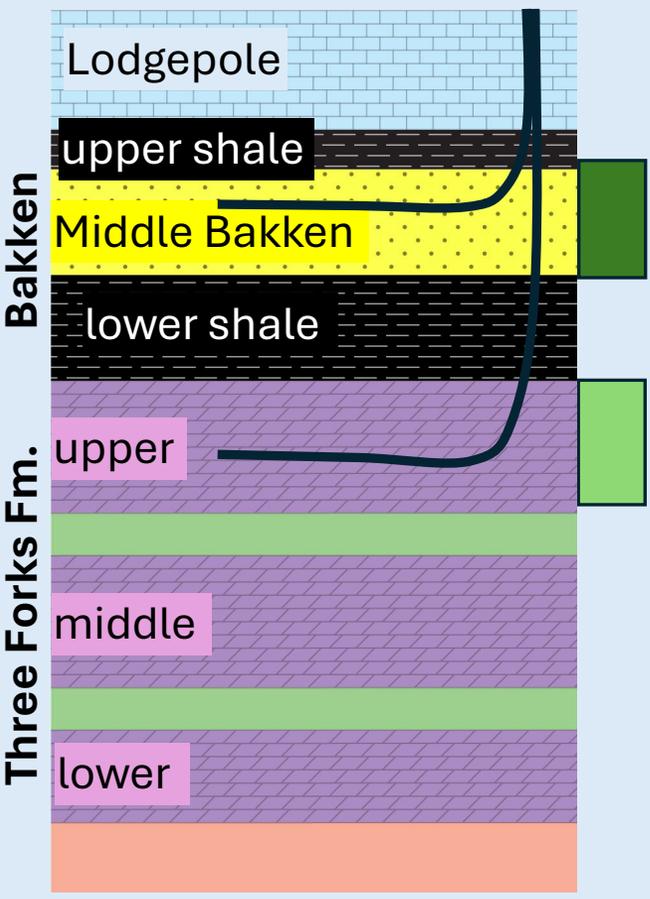
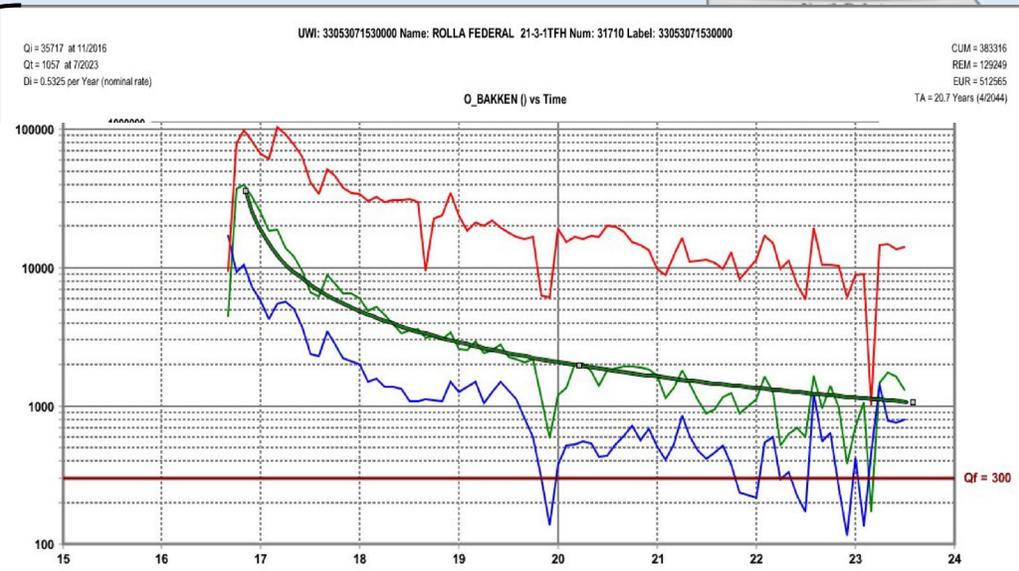
UWI: 33053071530000 Name: ROLLA FEDERAL 21-3-1TFH Num: 31710 Label: 33053071530000

QI = 35717 at 11/2016
 QI = 1657 at 7/2023
 DI = 0.5325 per Year (nominal rate)

CUM = 383316
 REM = 129249
 EUR = 512565
 TA = 20.7 Years (42044)

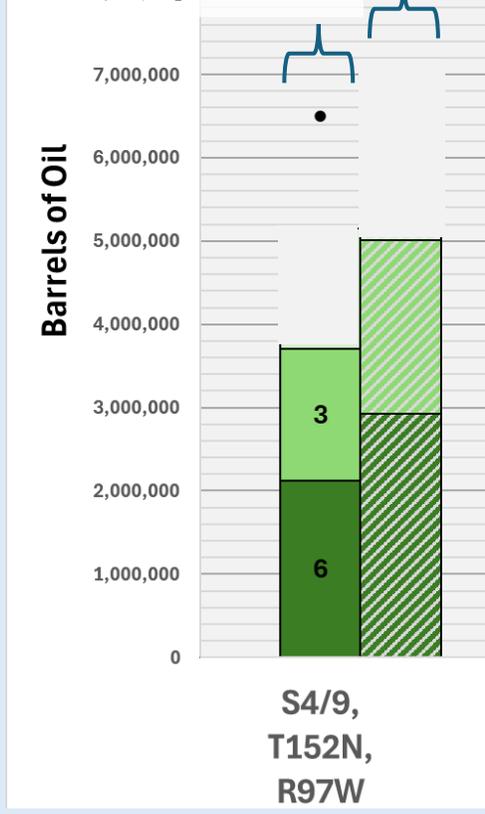


Evaluation Met



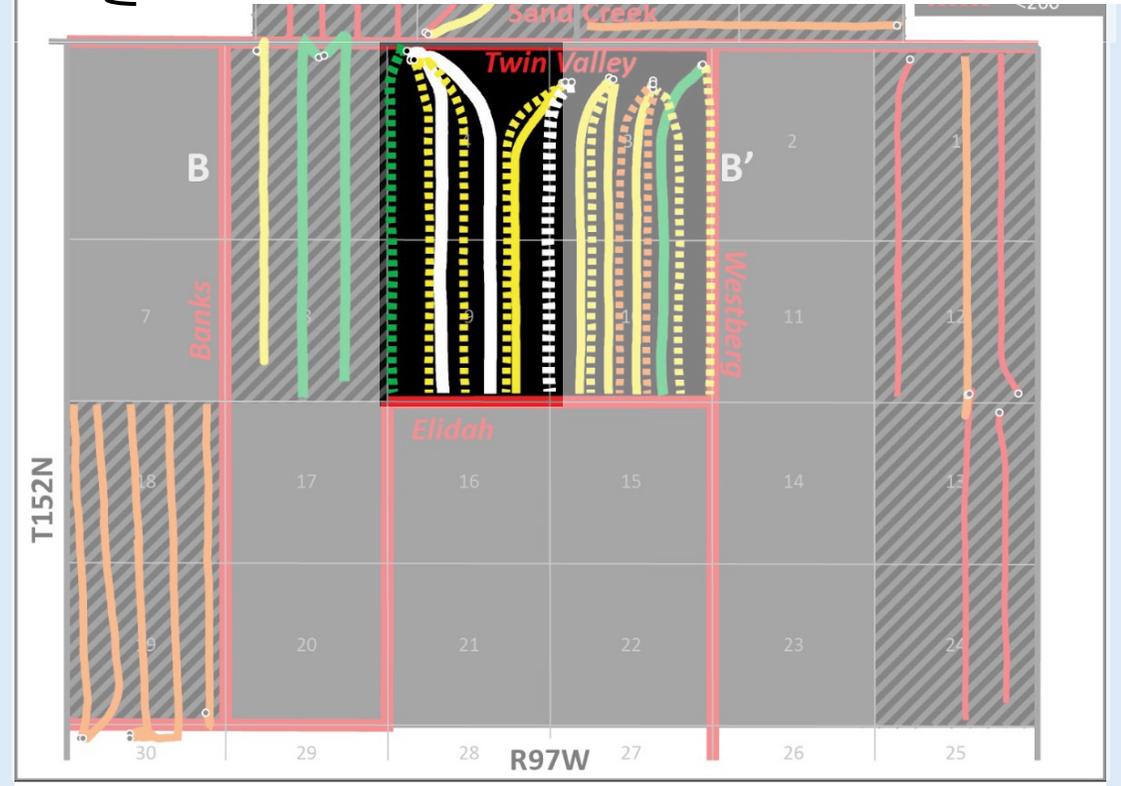
EUR = Estimated Ultimate Recovery

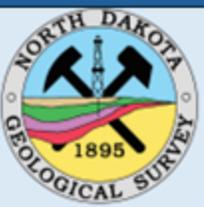
3-year oil cum per well



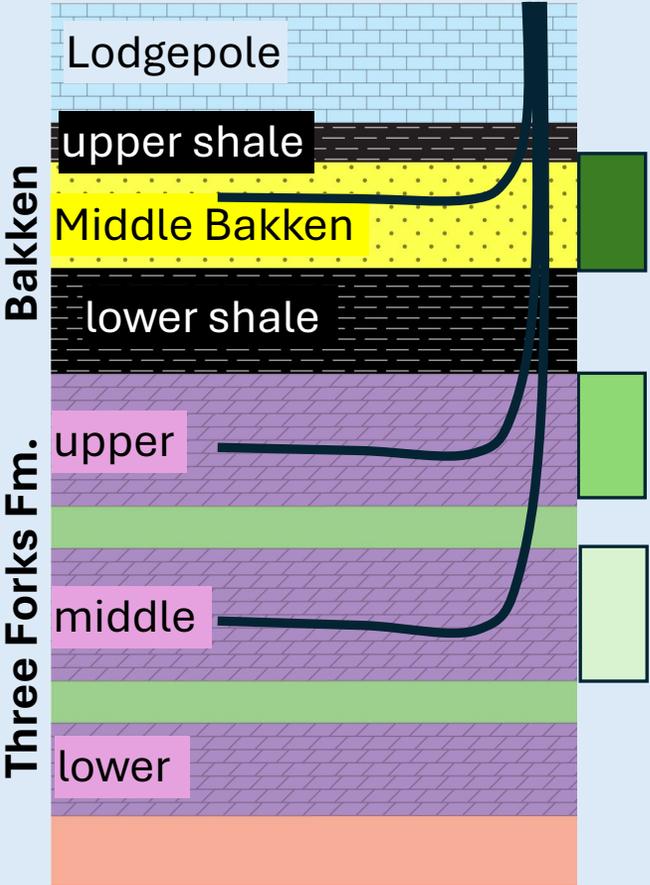
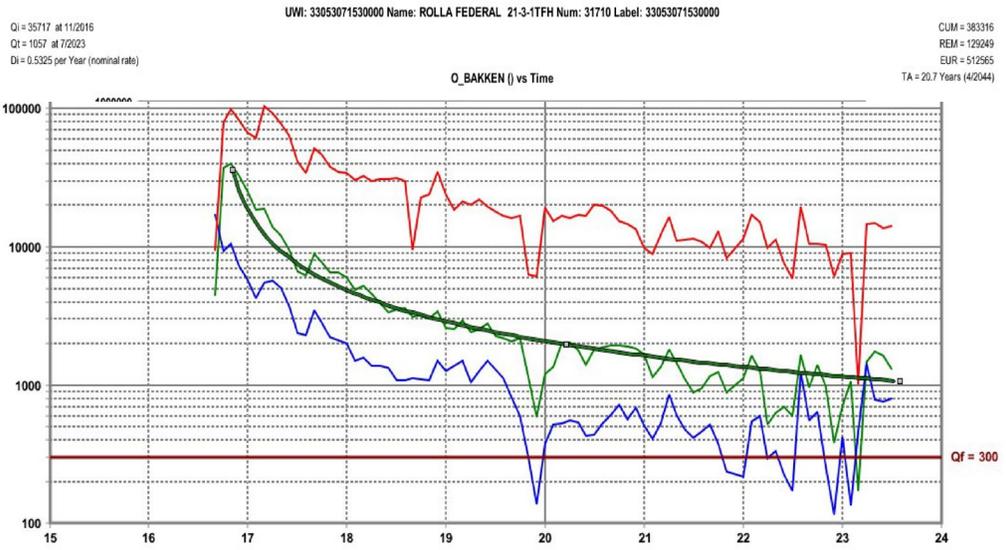
A

T153N



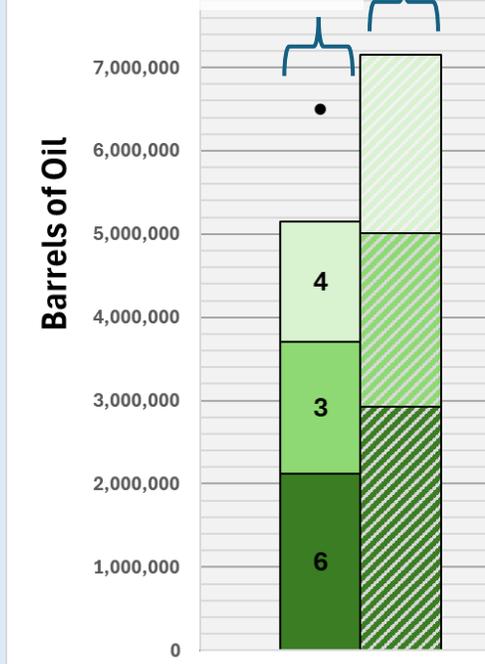


Evaluation Met

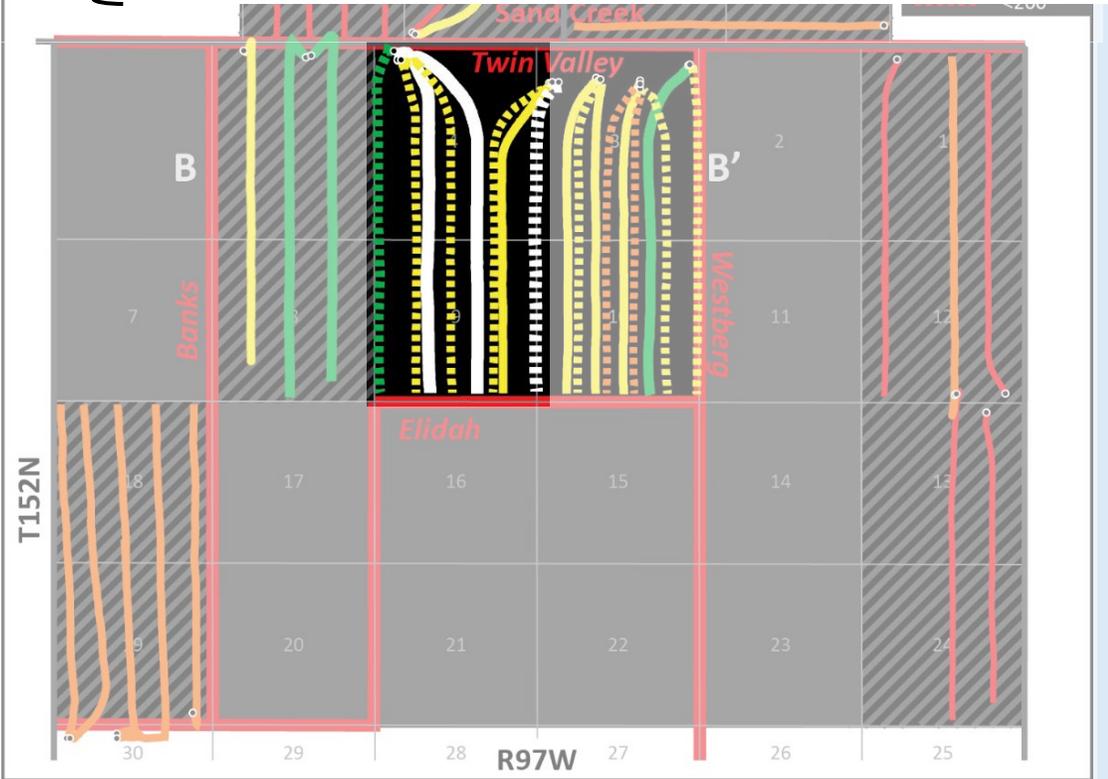


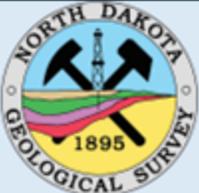
EUR = Estimated Ultimate Recovery

3-year oil cum per well

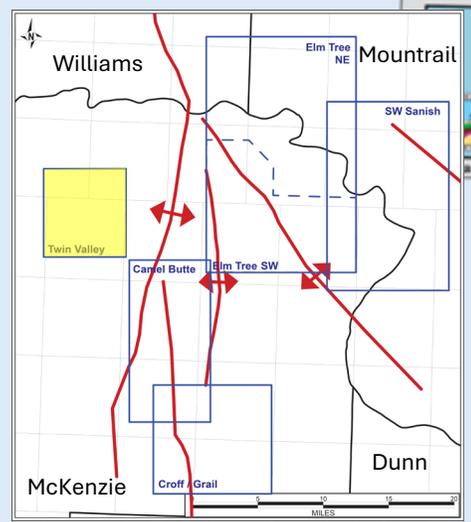


S4/9,
T152N,
R97W

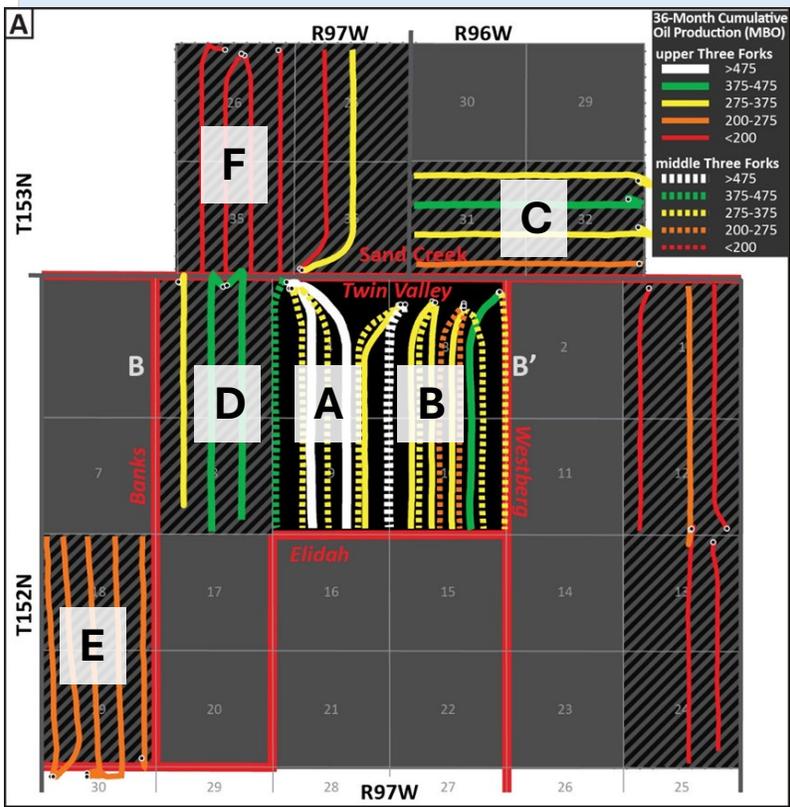
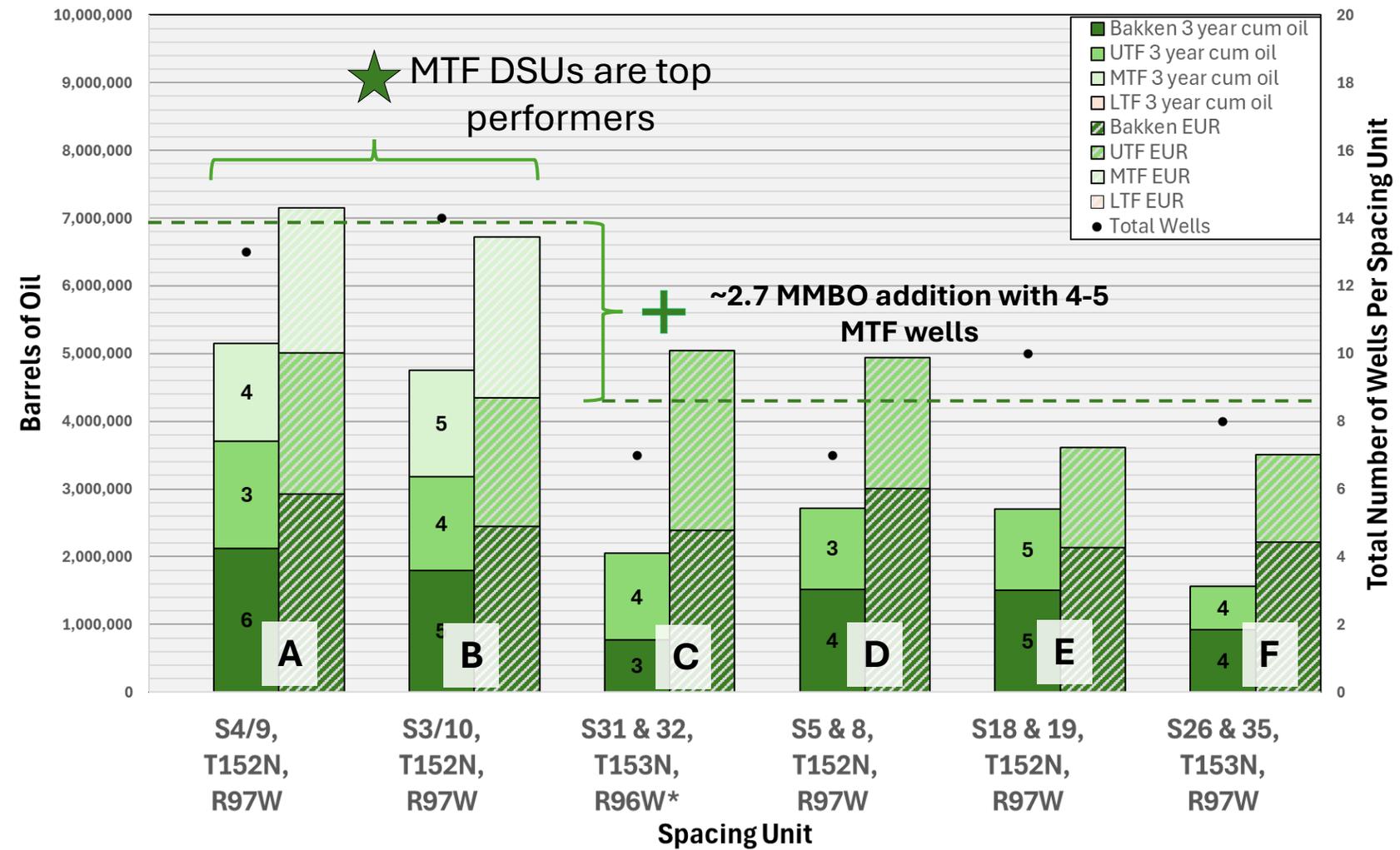




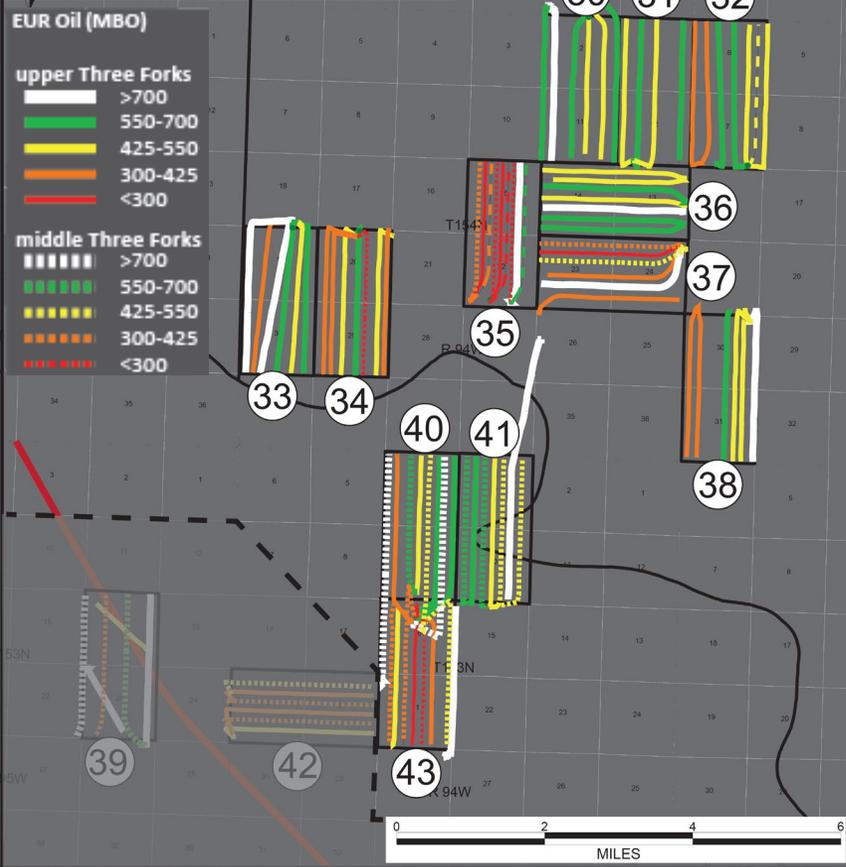
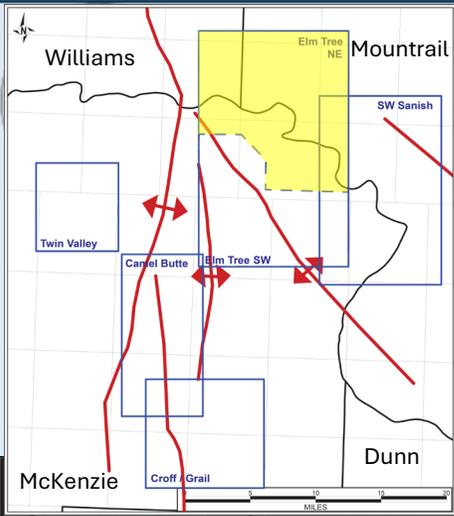
Results: Twin Valley



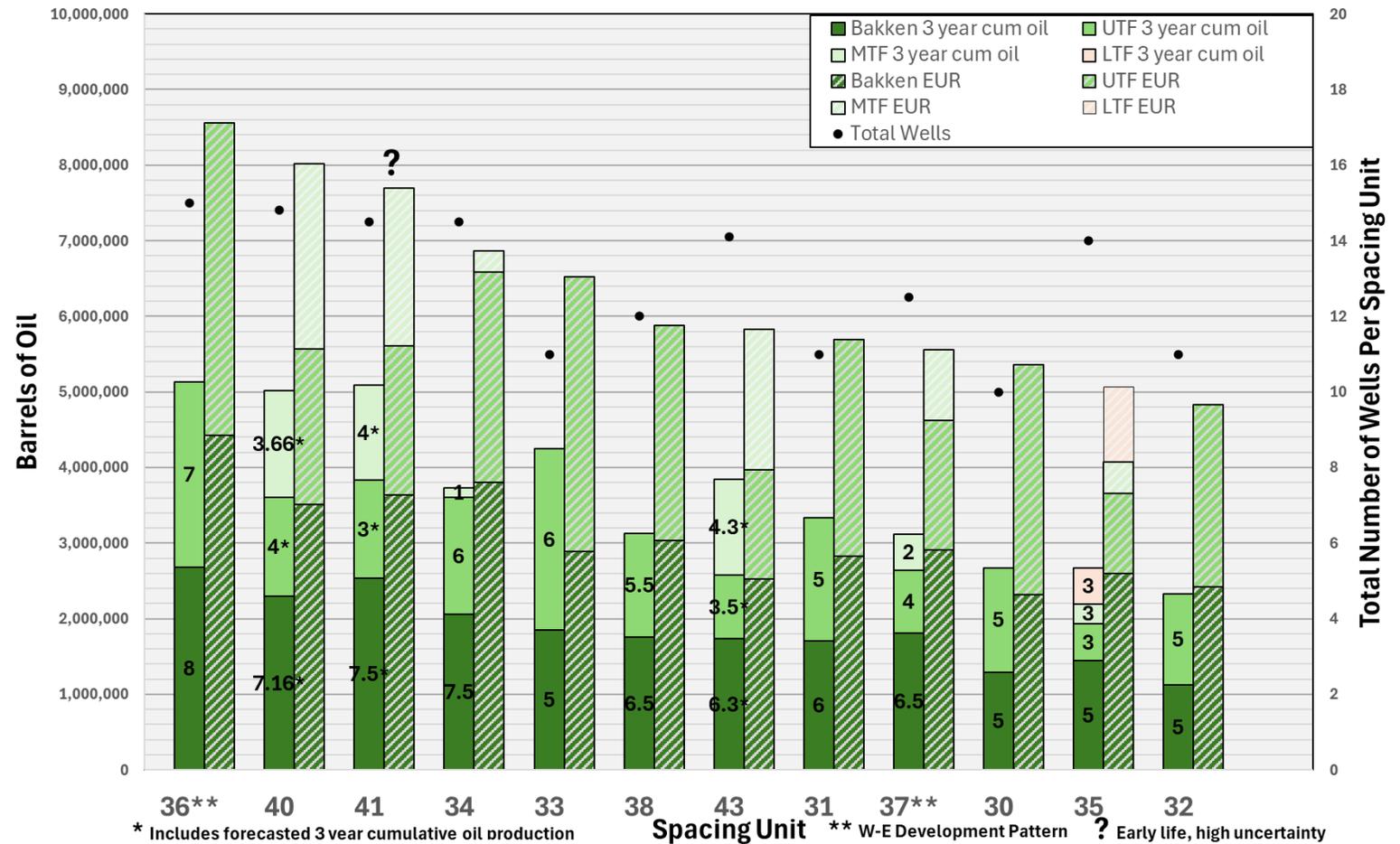
Twin Valley Area 36 Month Cumulative Oil Production, Estimated Ultimate Recovery, and Number of Wells by Formation Target



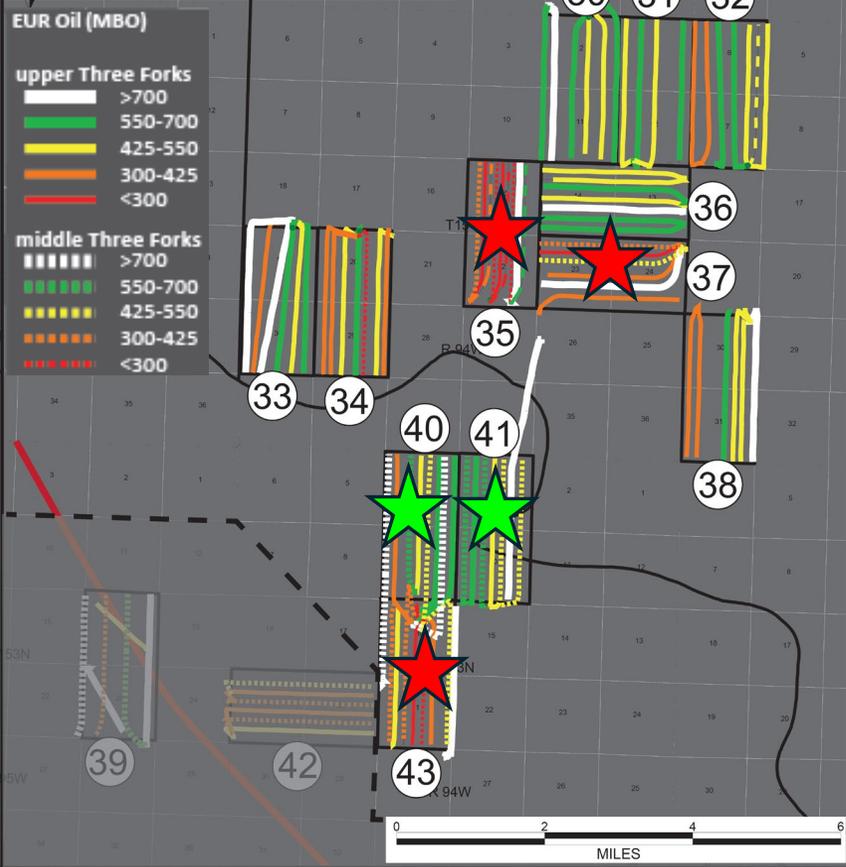
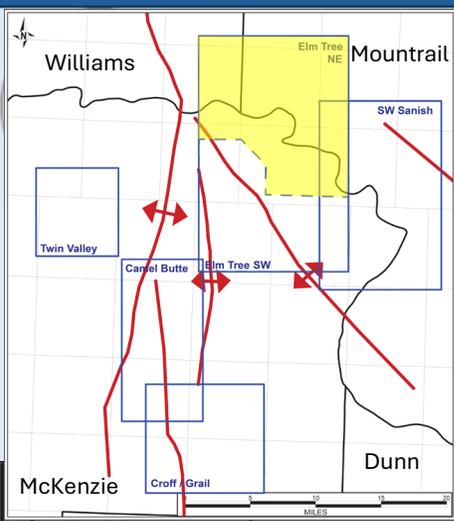
Results: NE Elm Tree



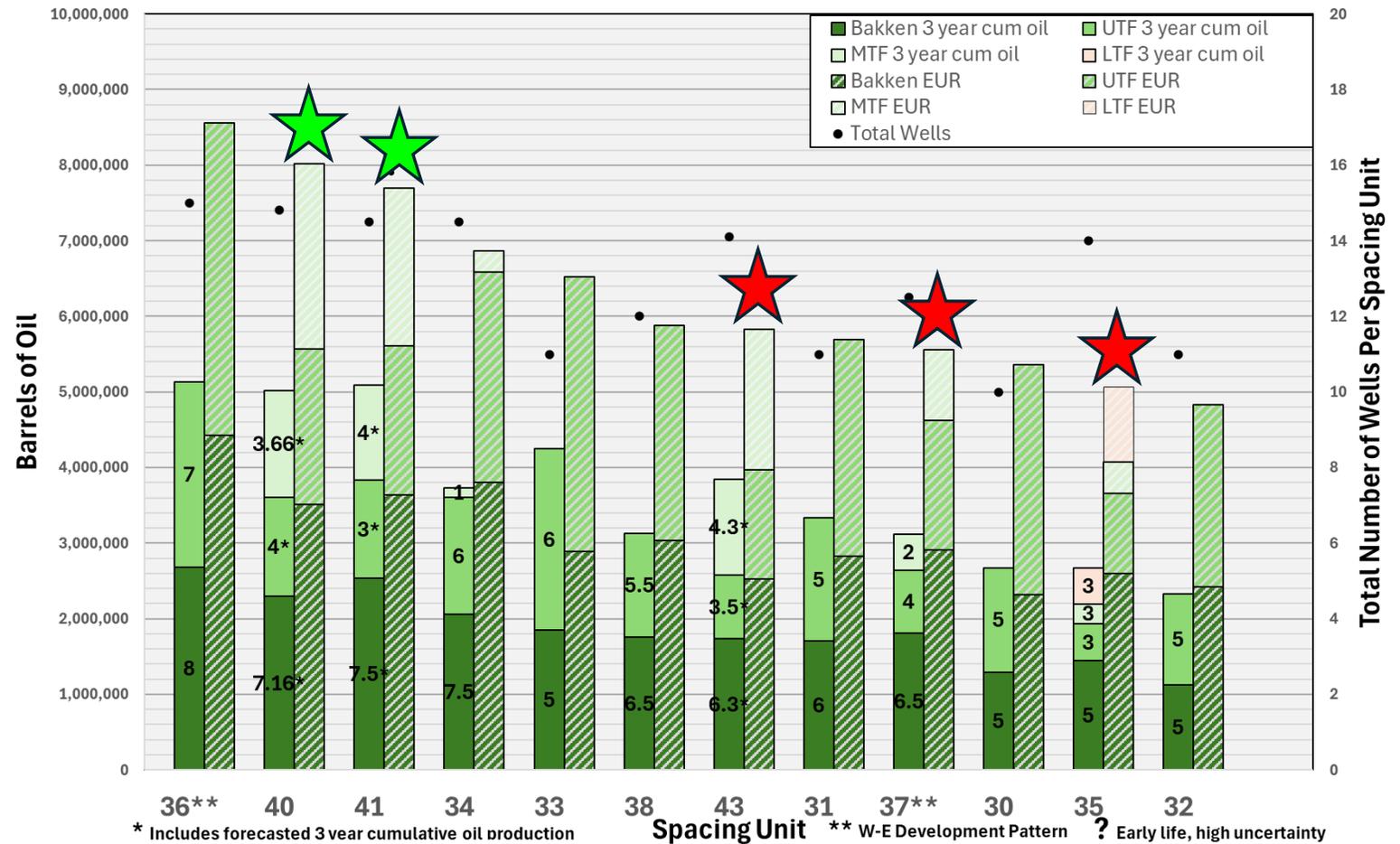
Elm Tree NE Area 36 Month Cumulative Oil Production, Estimated Ultimate Recovery, and Number of Wells by Formation Target

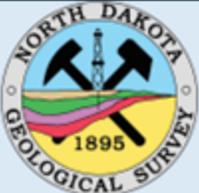


Results: NE Elm Tree



Elm Tree NE Area 36 Month Cumulative Oil Production, Estimated Ultimate Recovery, and Number of Wells by Formation Target

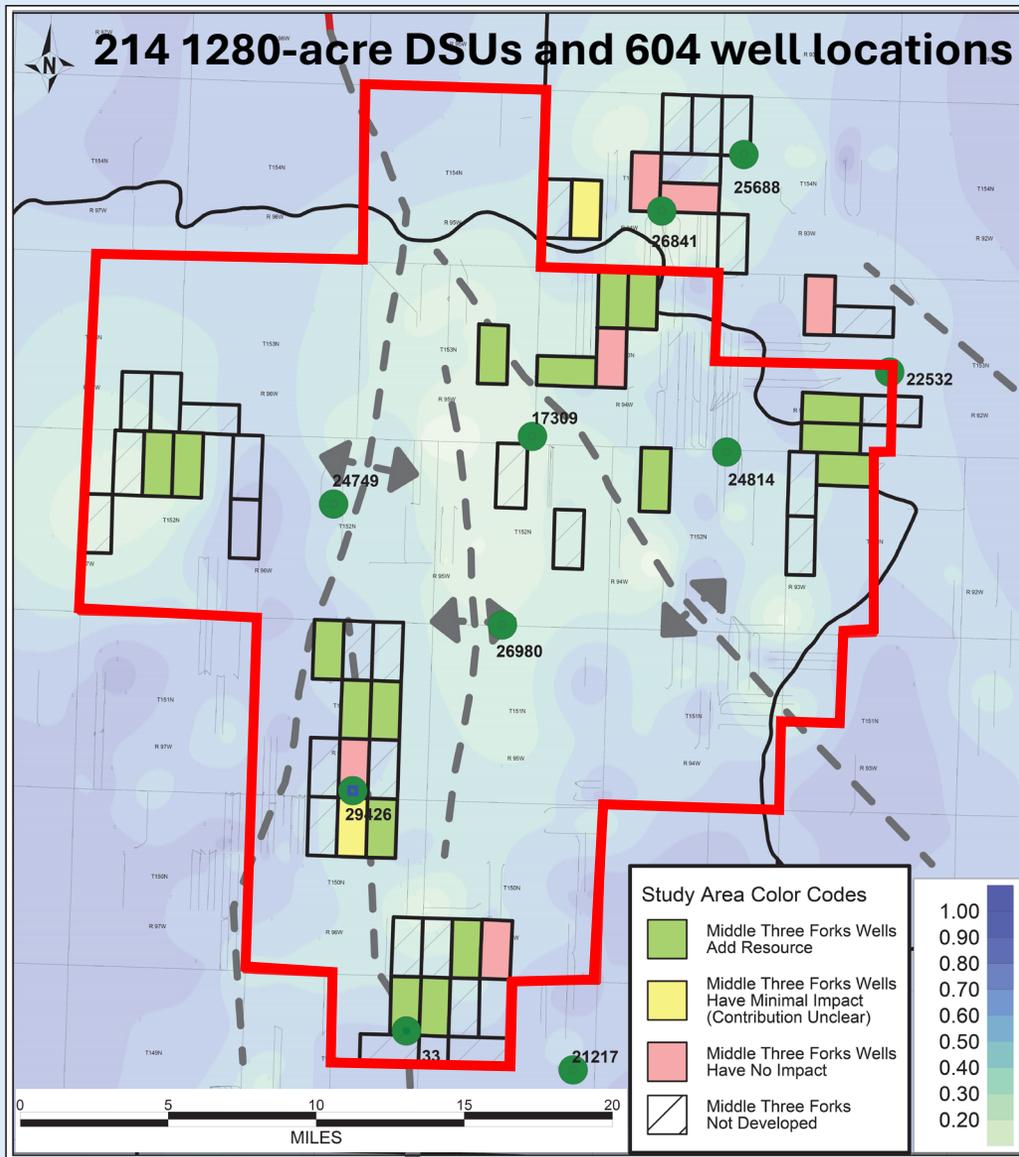




Middle Three Forks Remaining Resource Potential



~275,000 Contiguous Acres of Initial Development Potential



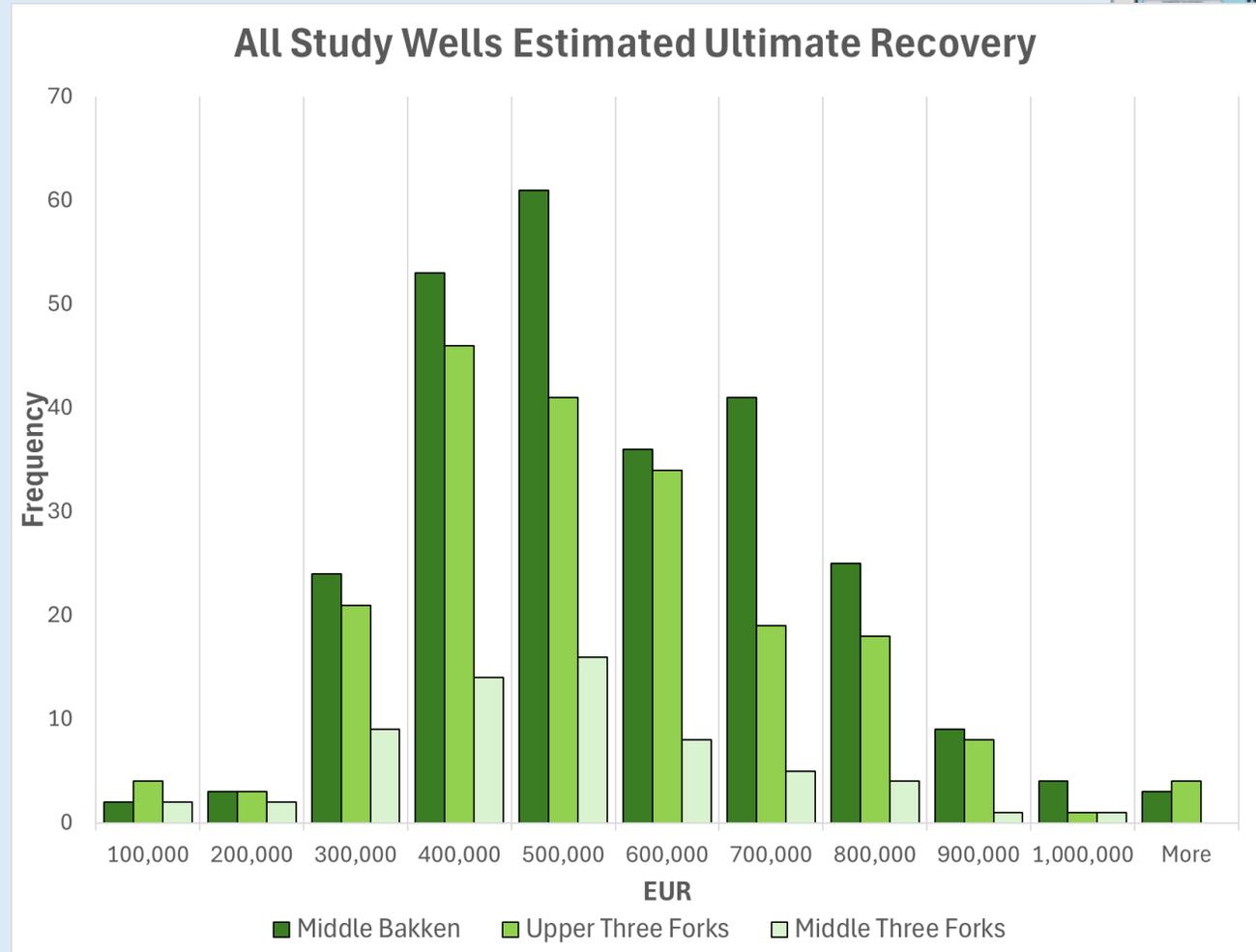
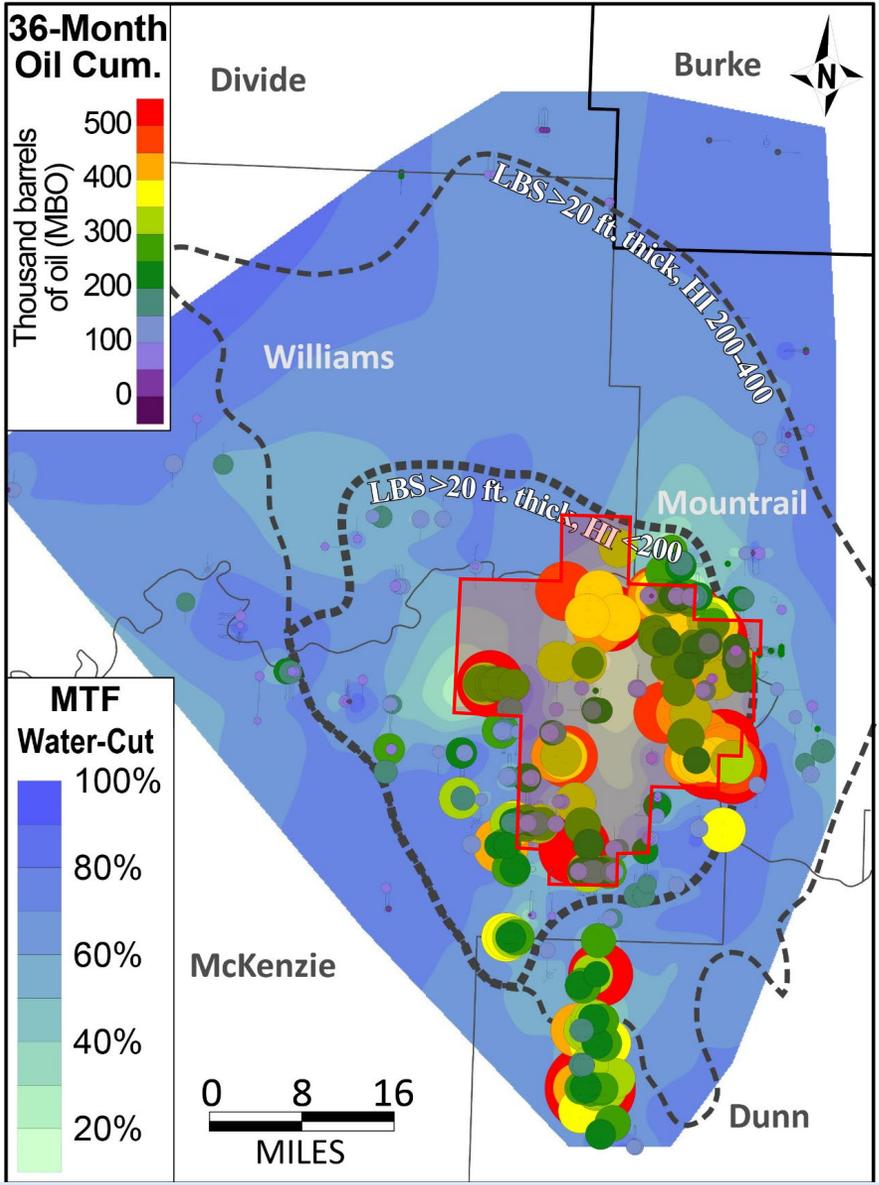
Number of Wells in Data Set	10th Percentile Middle Three Forks Well EUR (BO)	50th Percentile Middle Three Forks Well EUR (BO)	90th Percentile Middle Three Forks Well EUR (BO)
62	257,500	415,600	667,000
Number of Potential Drilling Locations	Prospective area 10th Percentile Middle Three Forks EUR (BO)	Prospective area 50th Percentile Middle Three Forks EUR (BO)	Prospective area 90th Percentile Middle Three Forks EUR (BO)
600	154,500,000	249,360,000	400,200,000

★ **~150 - 400 MMBO Recoverable Oil** ★

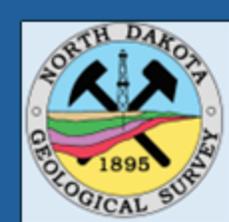
- Investigated 532 wells in 45 DSUs (25 DSU's with MTF development)
- 17 DSU's displayed volumetric addition by developing MTF, 6 DSU's did not, and 2 DSU's were unclear.
- Middle Three Forks wells investigated average ~415,000 barrels EUR



Middle Three Forks Remaining Resource Potential



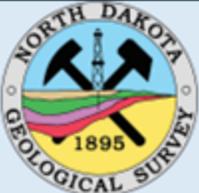
Percentile	10 th	50 th	90 th	sample set
Middle Bakken	296,525	479,337	766,702	261
upper Three Forks	273,795	470,303	755,192	199
middle Three Forks	257,498	415,594	667,007	62



Thank you for your Time!

Tim Nesheim: tonesheim@nd.gov

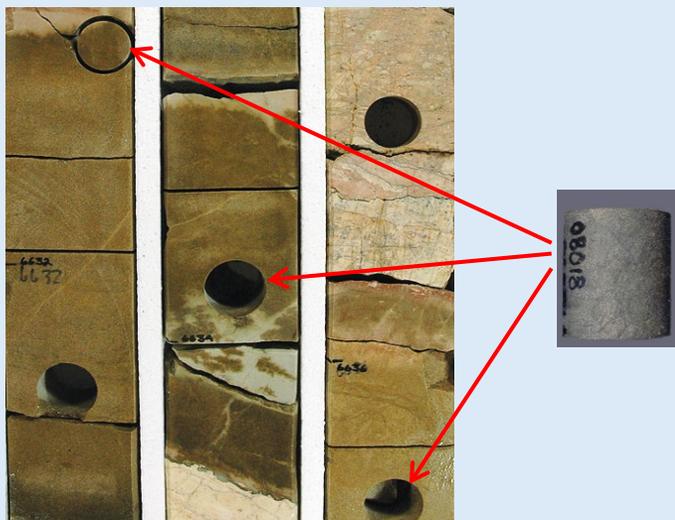
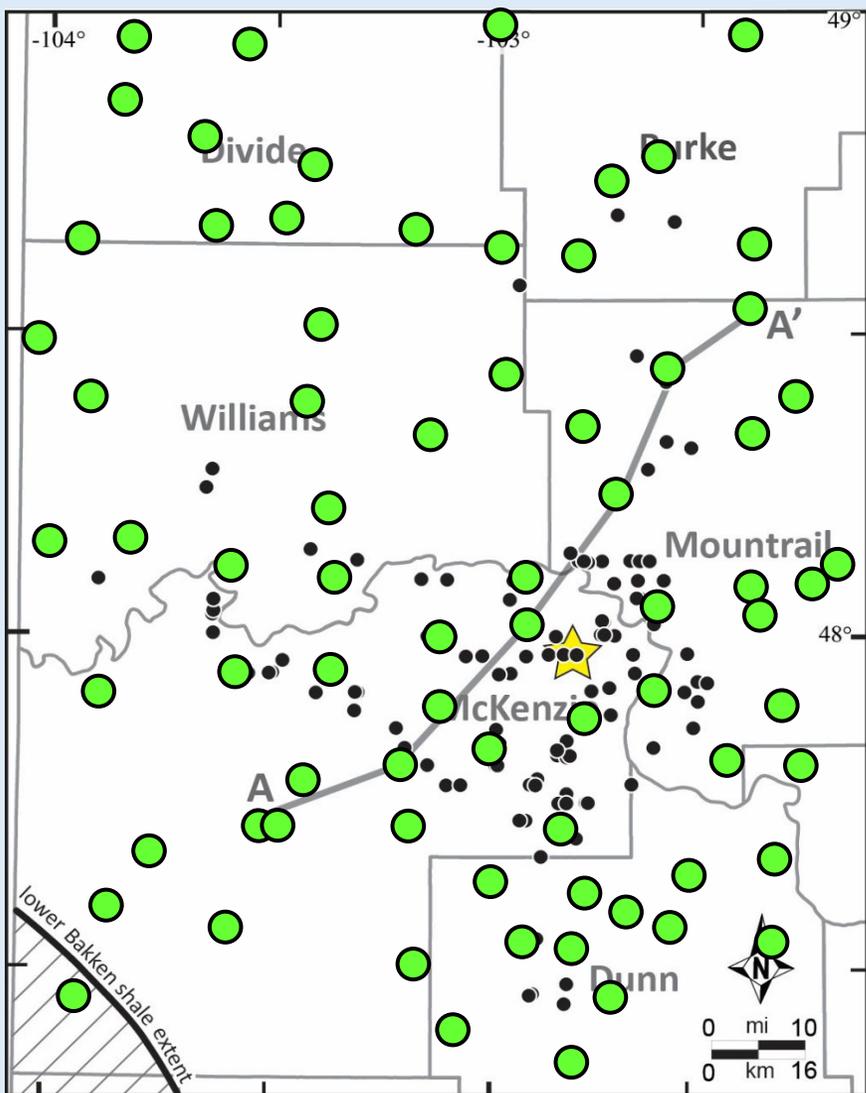
Ted Starns: ecstarns@nd.gov



Bakken-Three Forks Petroleum System: Core-Plug Fluid Saturation mapping

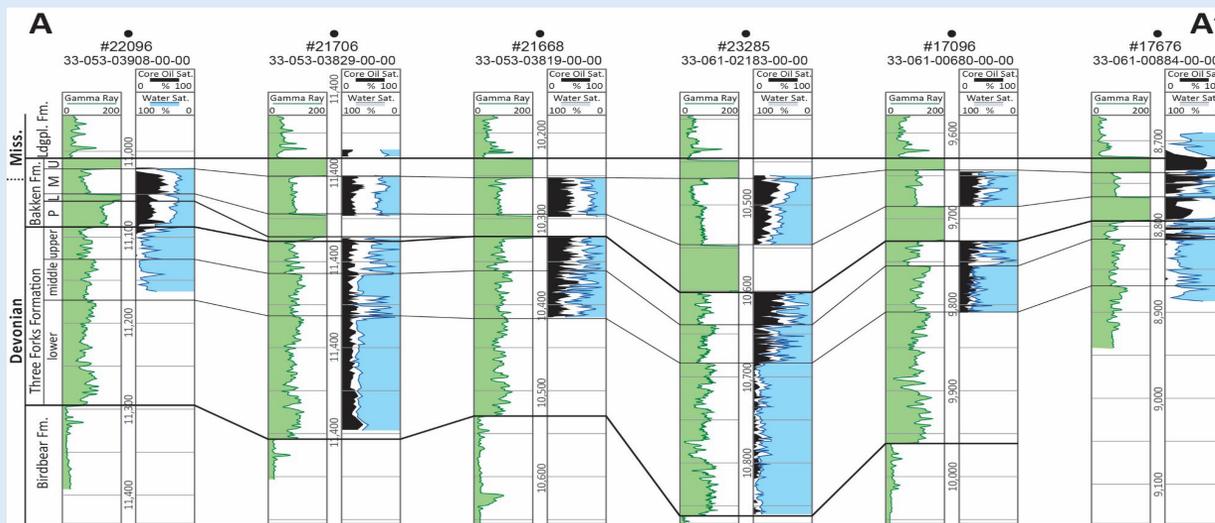


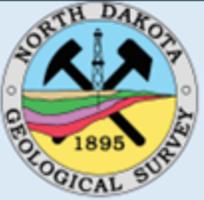
Three Forks cores with compiled core-plug fluid saturation and porosity data



● – core sample with oil saturations for the upper, middle, and/or lower Three Forks

60+ cores data sets compiled

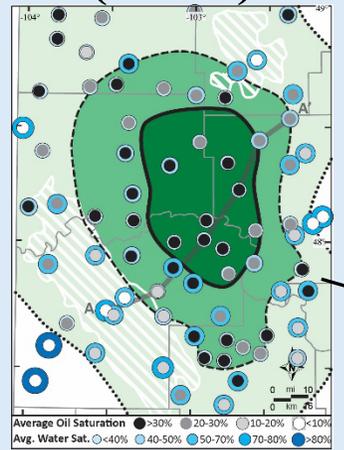




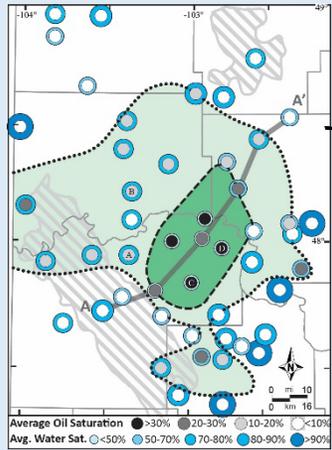
Bakken-Three Forks Petroleum System: Core-Plug Fluid Saturation mapping



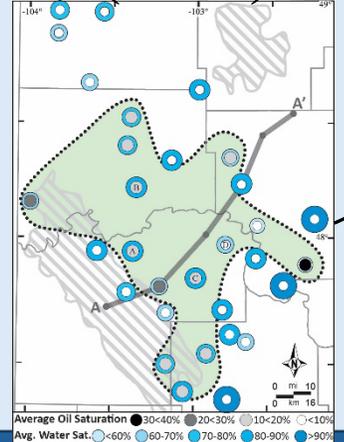
upper TF
(unit 6)



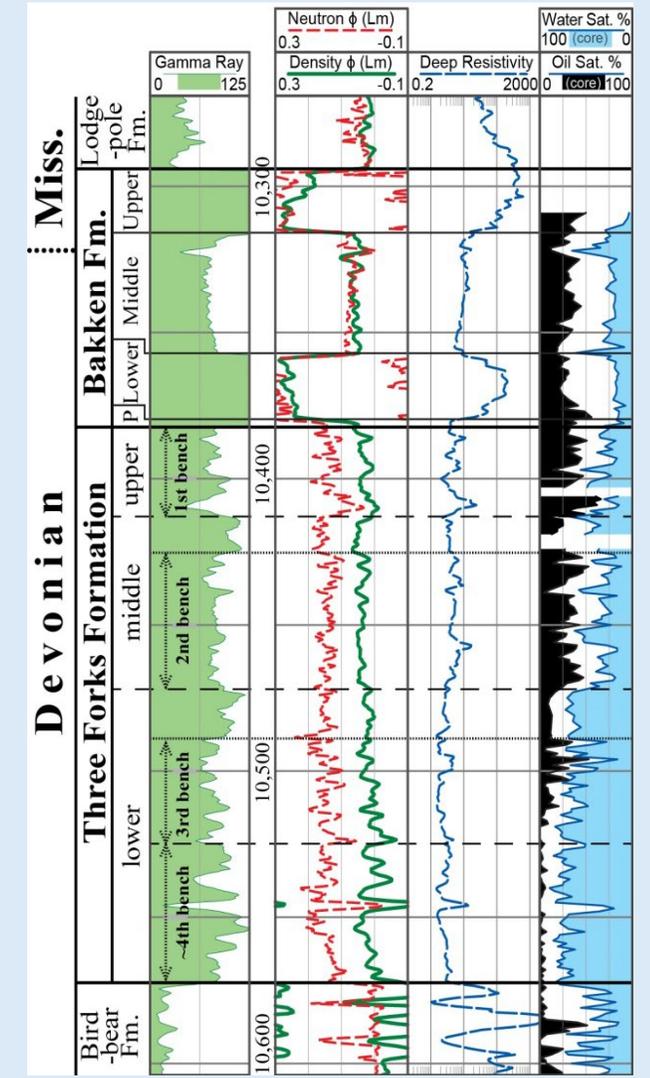
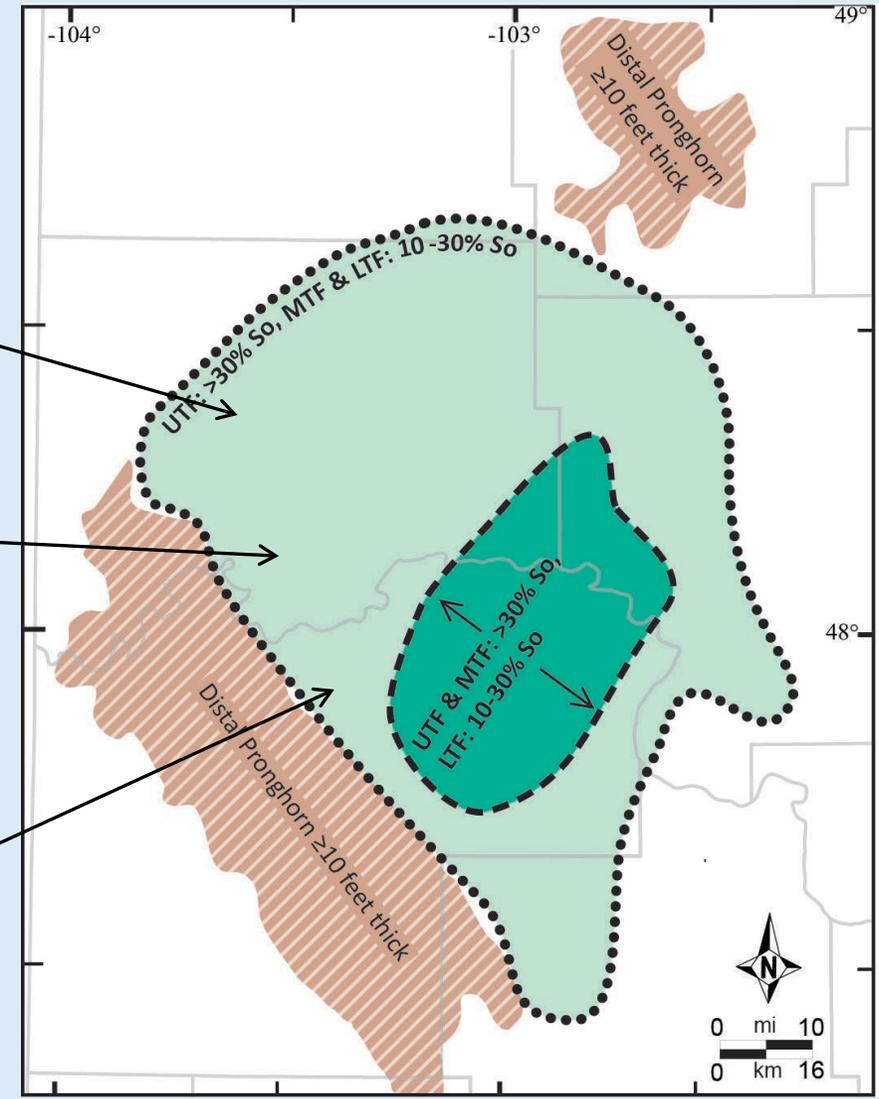
middle TF
(unit 4)



lower TF
(unit 2)



Three Forks Formation Oil Saturations



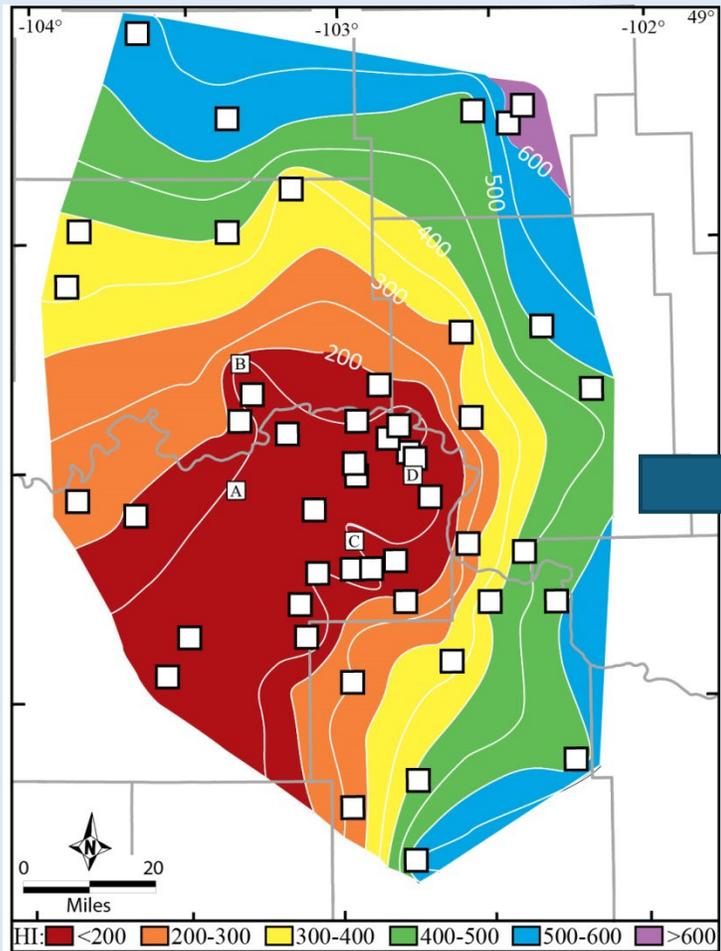


Bakken-Three Forks Petroleum System: Lower Bakken shale sourcing of Three Forks

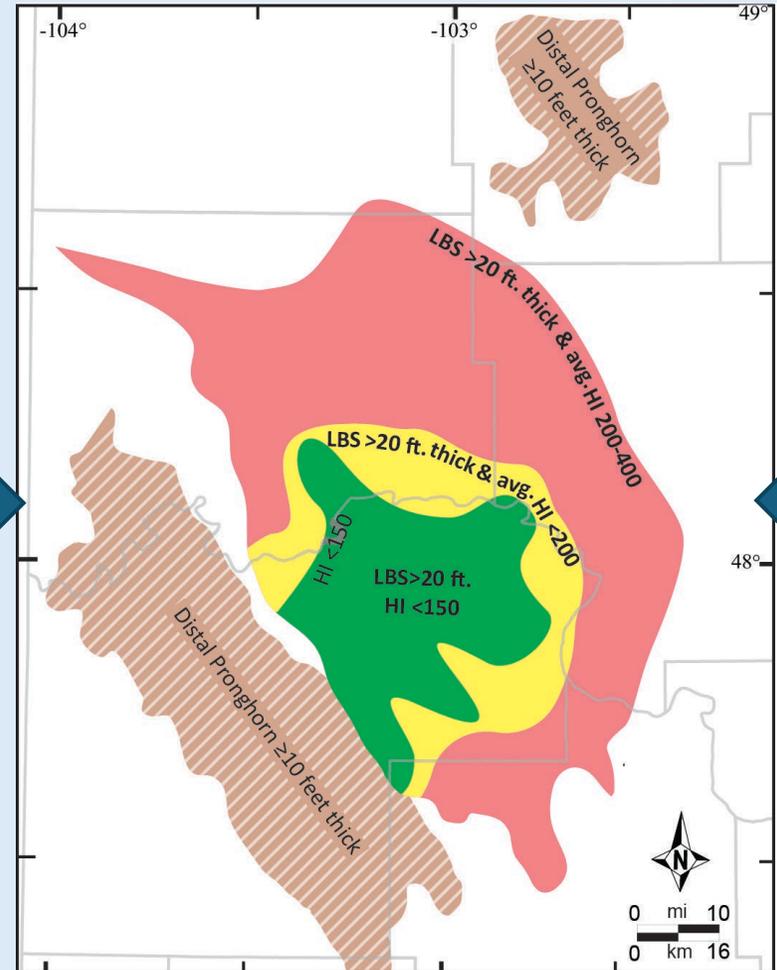
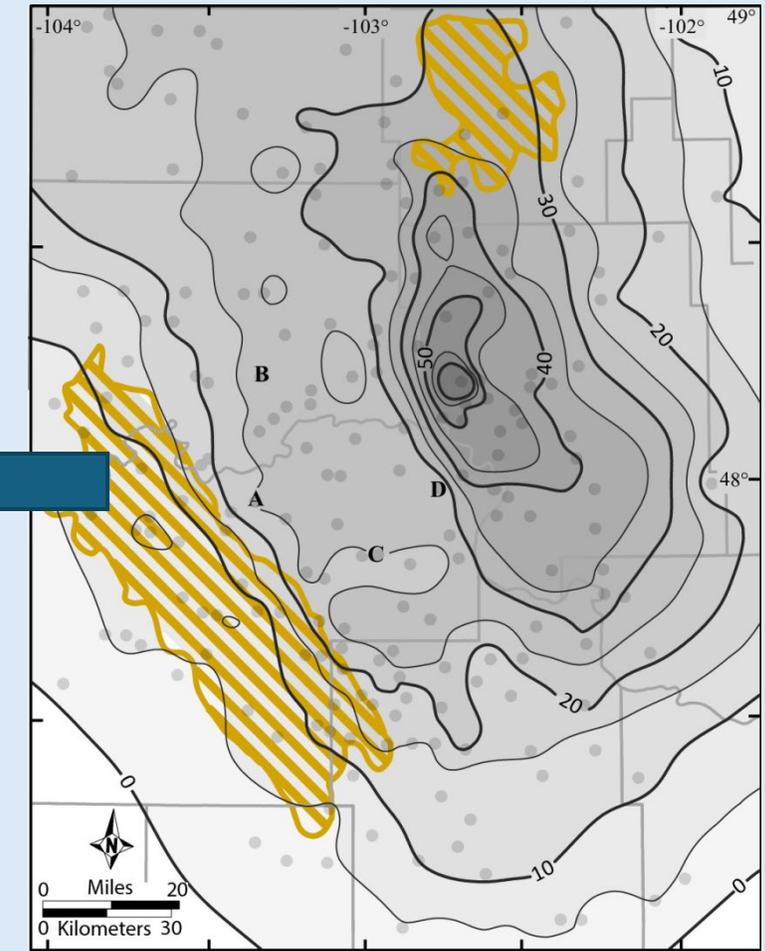


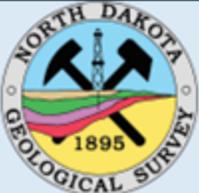
Lower Bakken Shale Thickness & Thermal Maturity (~Hydrocarbon Generation)

LBS average HI (thermal maturity)



LBS isopach (ft.)



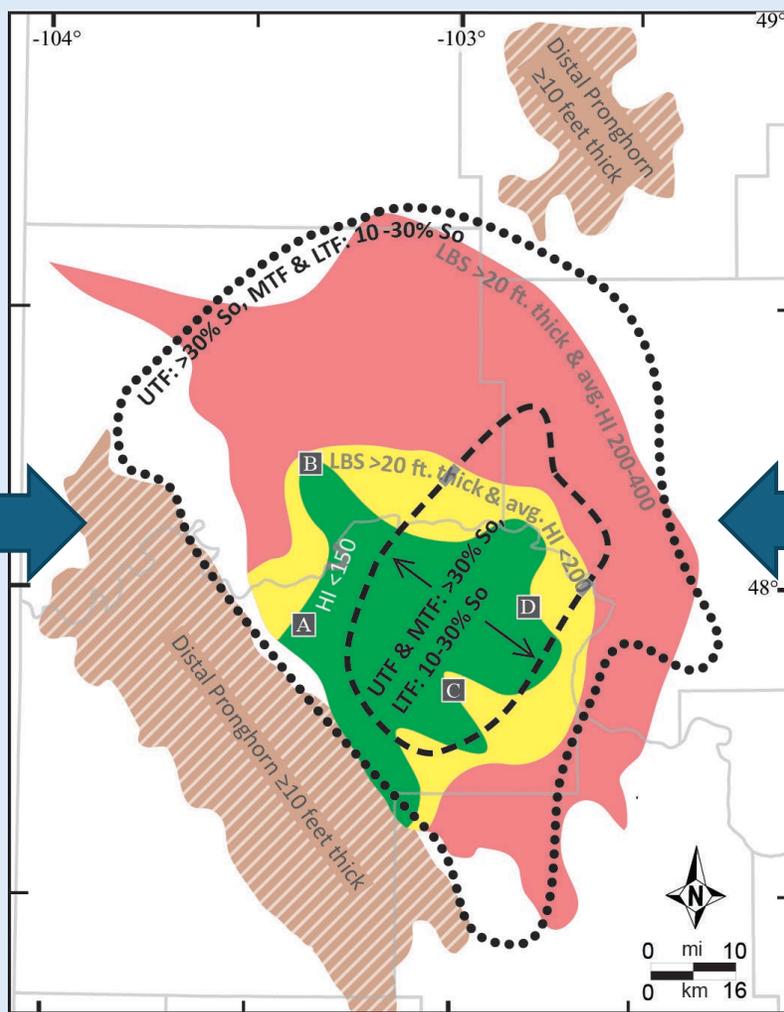
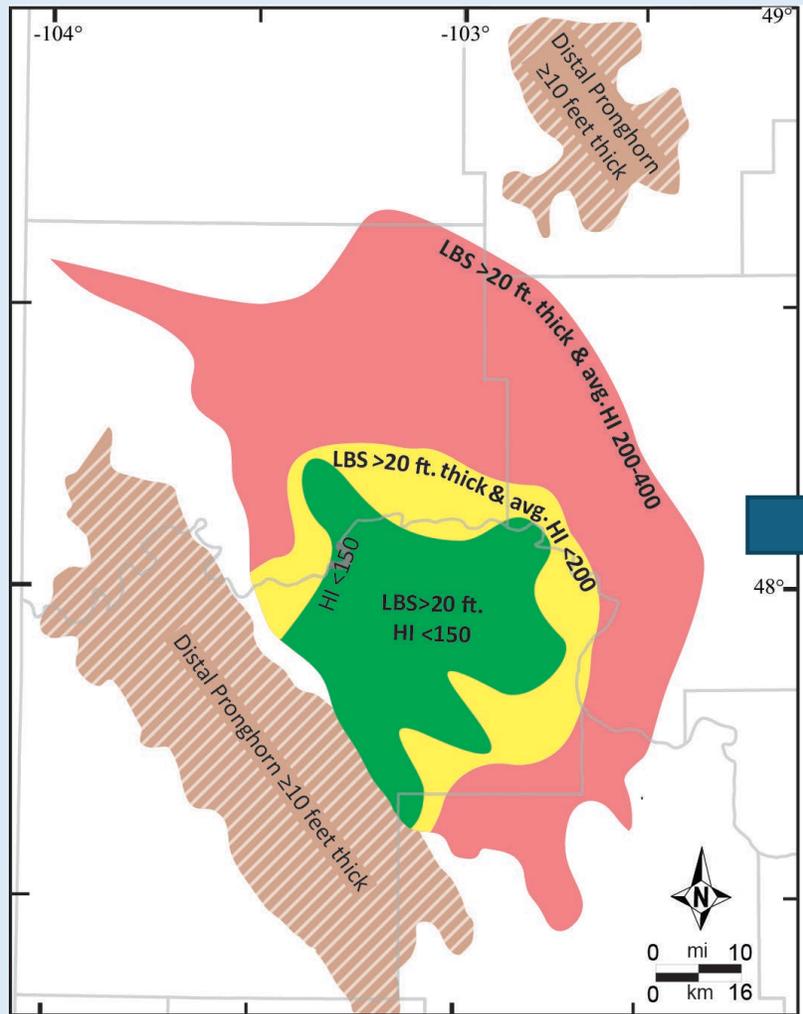


Bakken-Three Forks Petroleum System: Lower shale vs. Three Forks oil charge



Lower Bakken Shale Thickness & Thermal Maturity (~Hydrocarbon Generation)

Lower Shale Thickness + Thermal Maturity



Three Forks Oil Saturations

