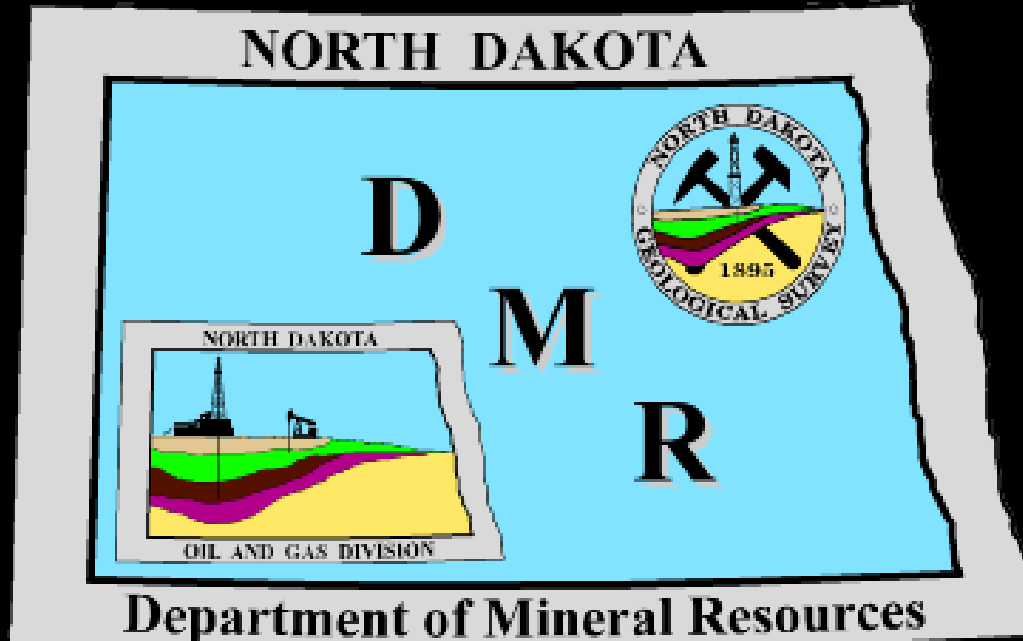


# North Dakota Department of Mineral Resources



*<http://www.oilgas.nd.gov>*

*<http://www.state.nd.us/ndgs>*

*600 East Boulevard Ave. - Dept 405*

*Bismarck, ND 58505-0840*

*(701) 328-8020*

*(701) 328-8000*

# North Dakota Update

- First barrel of oil produced in April 1951.
- 1 Billionth barrel of oil produced in October 1989.
- 2 Billionth barrel of oil produced in November 2011.
- 3 Billionth estimated in 2015-2016.

# North Dakota Update

- Became #3 Oil Producing state in March 2012.  
(January figures)
- Became #2 Oil Producing state in May 2012.  
(March Figures)
- May production 32.2 million or 1,039,635 barrels of oil or million barrels of oil per day.
- 36.9 Billion cubic feet of natural gas or 1.1 billion cubic feet per day.

# Water Use Throughout the Phases:

## Hydraulic Fracturing:

- High pressure injection of water, sand and chemicals into the rock (shale) in order to open the fractures and allow the oil to flow.
- 80.5% water (about 3 million gallons/well)
- 19% proppant (sand, ceramic, coil tubing)
- 0.5% chemical (guar gum, make-up remover, household cleaners.)

## Maintenance:

- Used to keep well bore open over the life of the well.
- Salty produced water can build up in the well.
- Fresh “maintenance” water is used to dissolve the salt from the tubing.
- The amount of maintenance water needed is dependent on geology.

# North Dakota Update

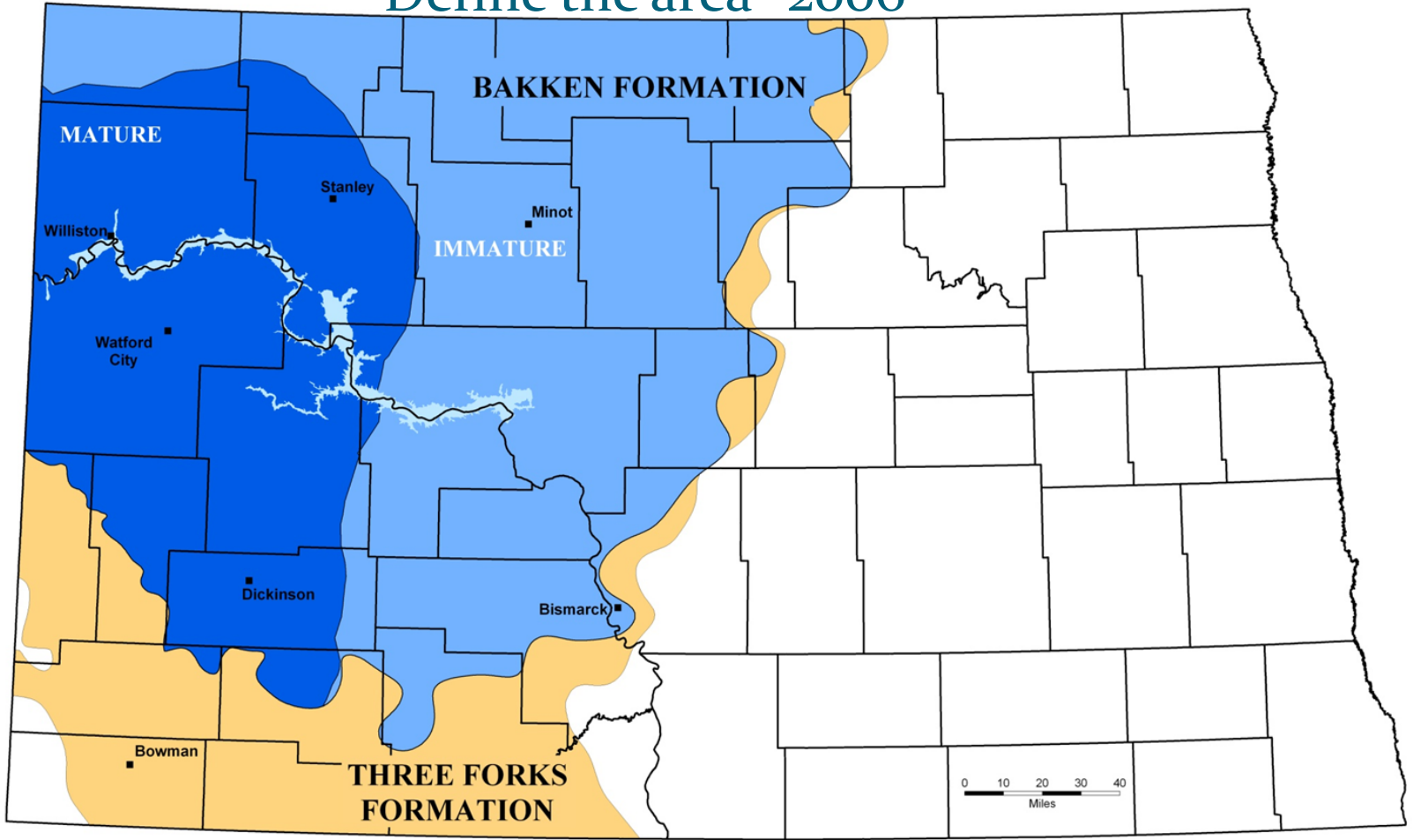
- 1,100 to 2,700 wells/year = 2,000 expected
  - 190 rigs = 2,280 wells per year
  - 40,000 / 60,000 / 70,000 new wells
- 2,000 new wells/year require 15-20 million gallons of frac water per day.
- 40,000-45,000 new wells are expected to require 17-28 million gallons of maintenance water per day.

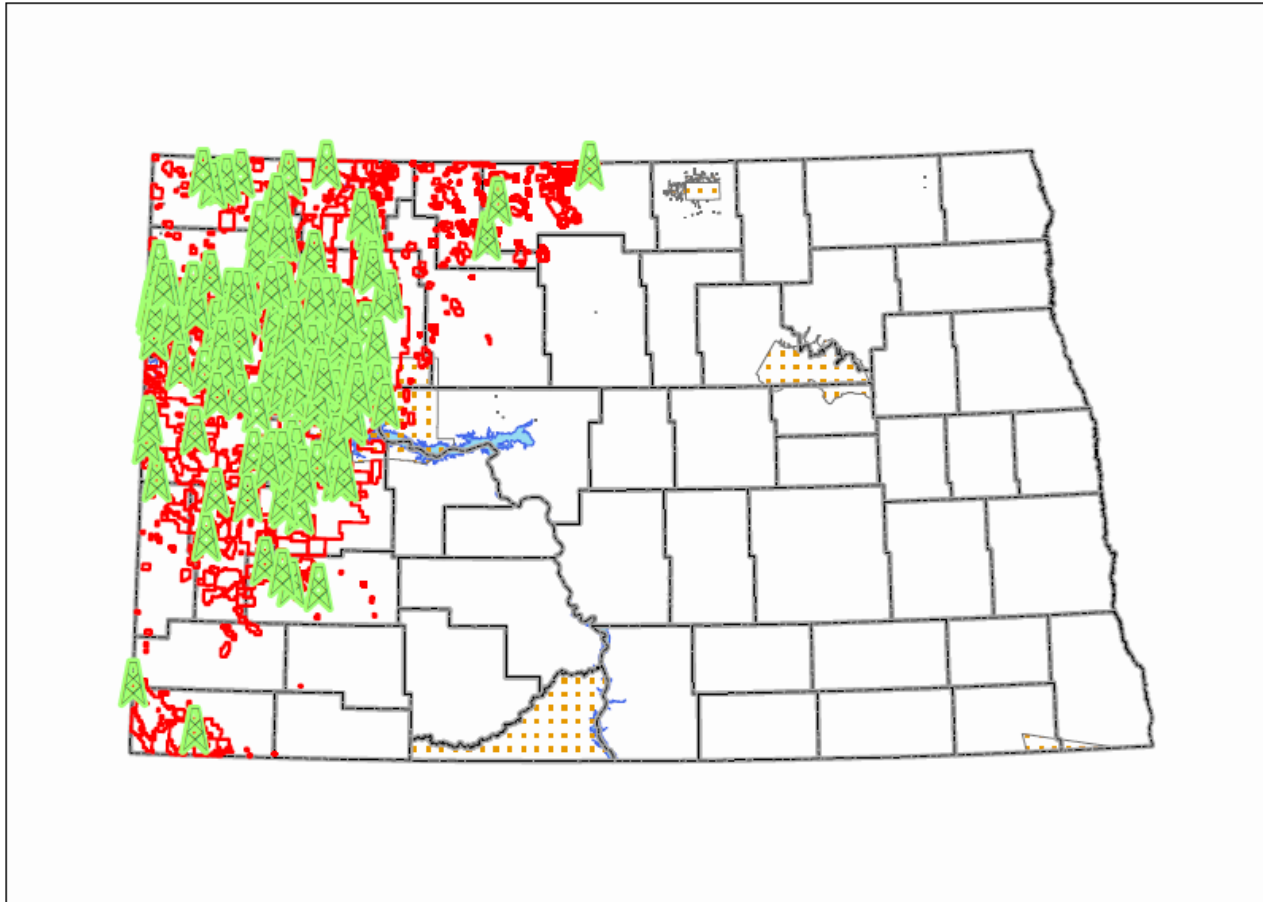
# Phase 1: "Discovery"

## Define the area- 2006

North Dakota Geological Survey  
Geologic Investigations No. 125 - Formations

Edward C. Maugh, State Geologist  
Lynn D. Helms, Director Dept. of Mineral Resources





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0 35 70 140 Miles

Prepared by N.D.I.C.  
Oil and Gas Division  
DATE: 10/8/2010  
Time: 7:20:05 AM

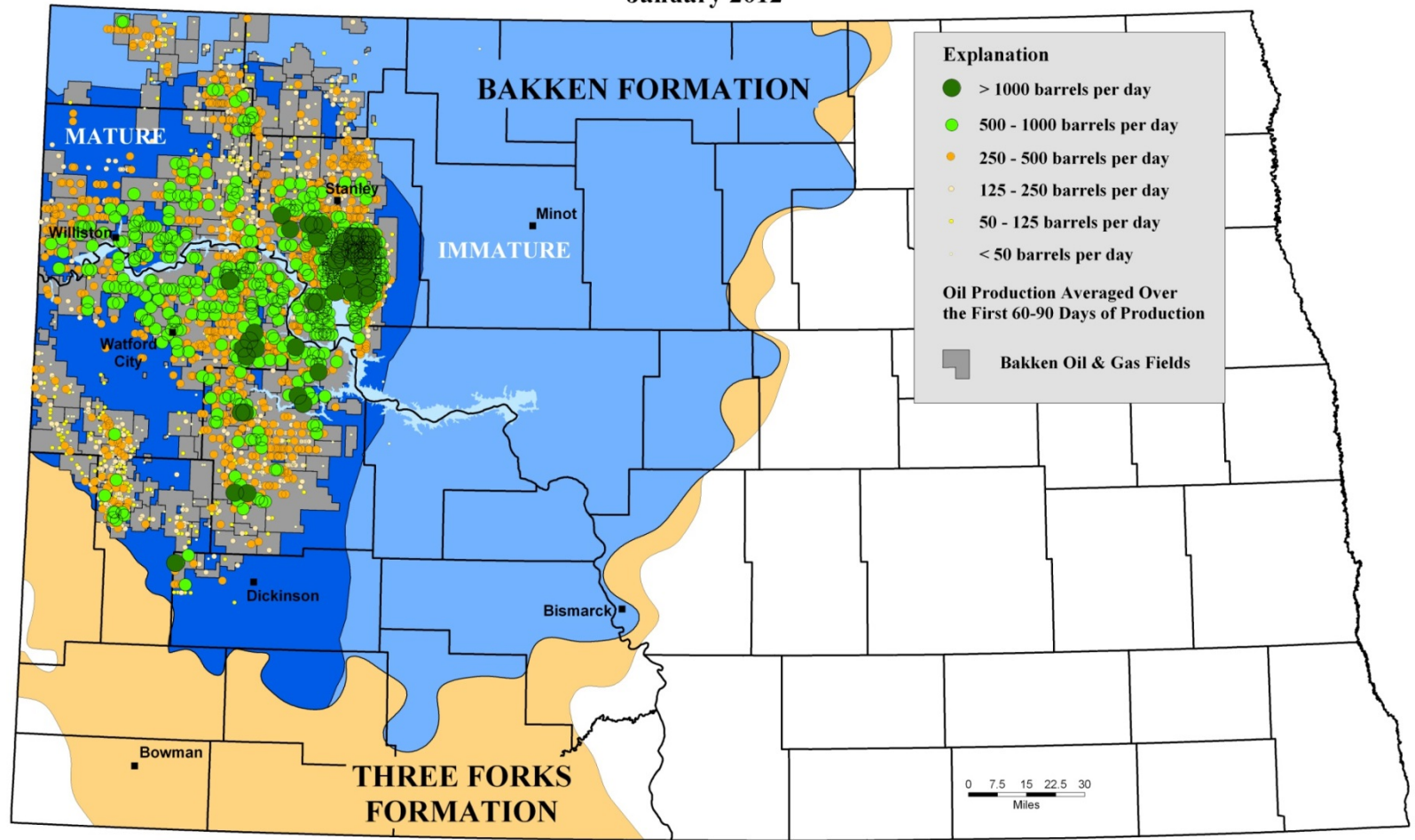


35 rigs in April 2006 to  
200 rigs in January 2012 completed first phase of  
drilling



# First 60 - 90 Day Average Bakken Pool Production by Well

## January 2012





# Est. Water Used in Phase 1

## Hydraulic Fracturing:

- 2006: 300 completed wells
- 2007: 300 completed wells
- 2008: 550 completed wells
- 2009: 520 completed wells
- 2010: 800 completed wells
- 2011: 1,220 completed wells
- January 2012: 145 completed wells
- 3,035\* wells in six years

## Maintenance:

- Takes about 1-3 years for a well to need maintenance.
- Depends on the area, and amount of water produced.
- Depth/pressure/content of water.
- Need started in 2011-2012.

Water used in '10-11: 5 million gal/day.

# Phase 2: "Homestead" De-risk leases

Wellbore Schematic  
Sec's 16 & 21, T148N, R95W  
Dunn County, ND

## Surface Location

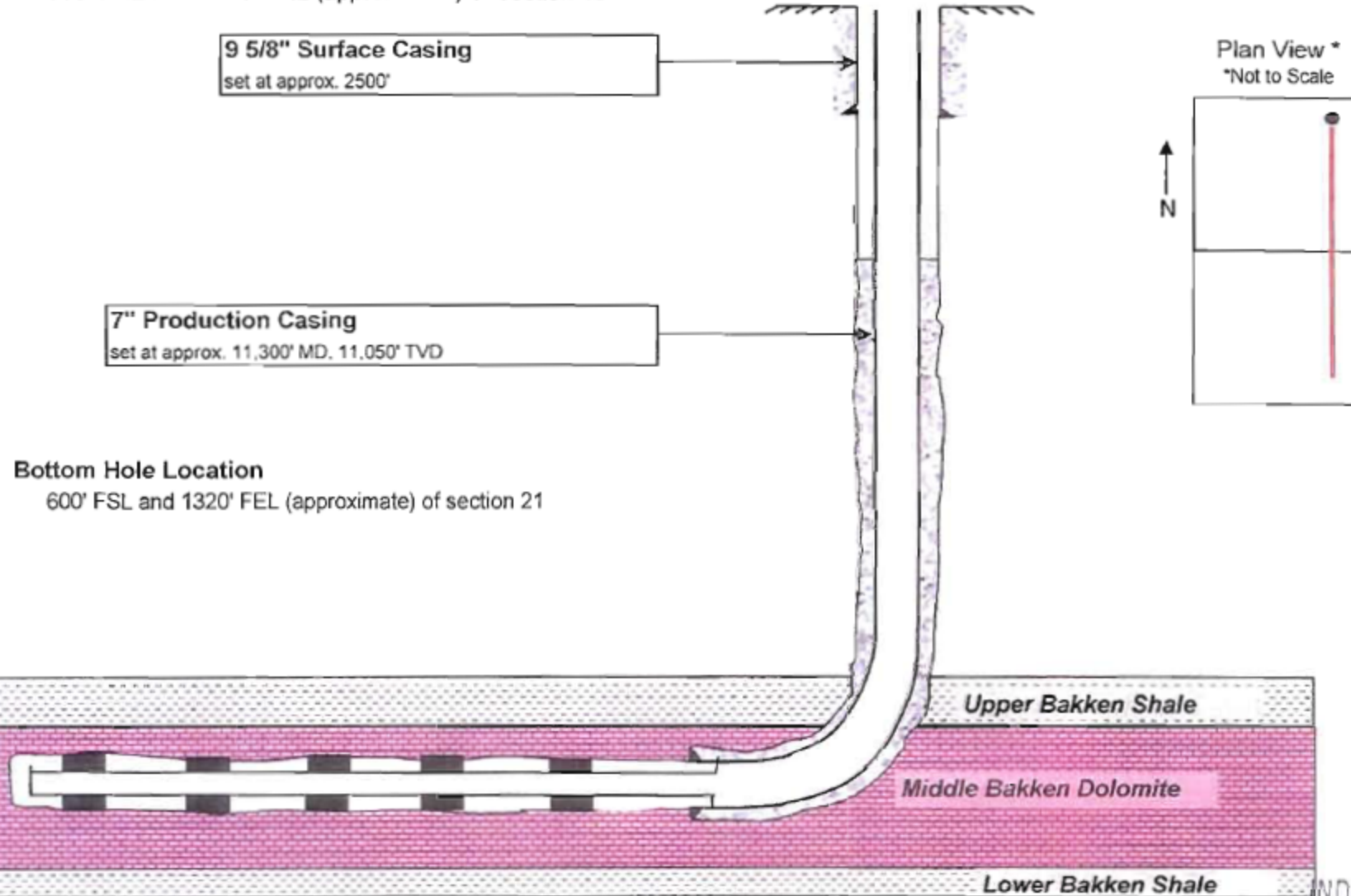
300' FNL and 1320' FEL (approximate) of section 16

9 5/8" Surface Casing  
set at approx. 2500'

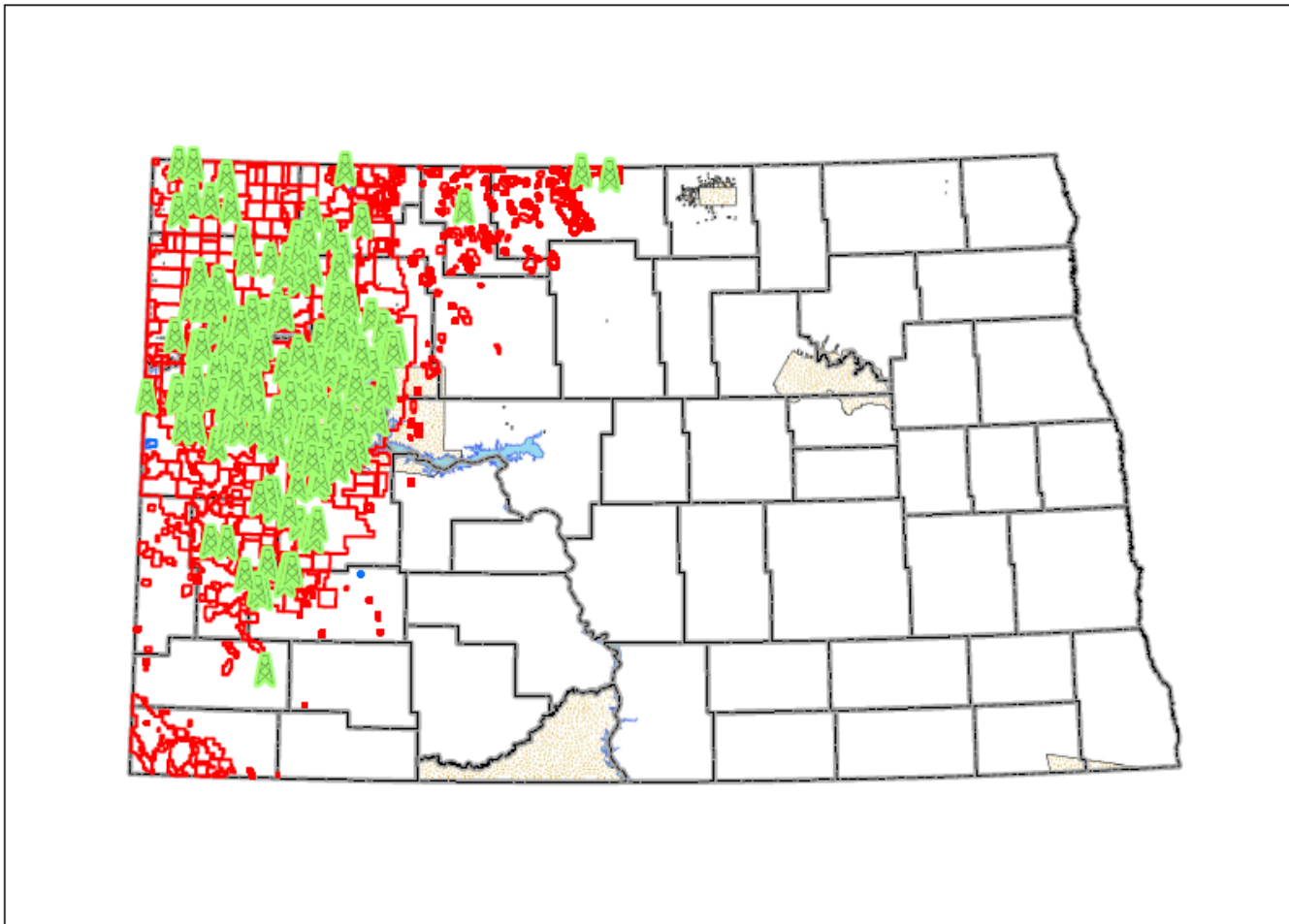
7" Production Casing  
set at approx. 11,300' MD, 11,050' TVD

## Bottom Hole Location

600' FSL and 1320' FEL (approximate) of section 21



INDUSTRIAL COMMISSION



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0 30 60 120 Miles

Prepared by N.D.I.C.  
Oil and Gas Division

1/17/2014  
4:08:20 PM



218 rigs in May 2012  
190 rigs through January 2015 complete phase 2 of drilling



Vern Whitten Photography

Parshall, ND

pizza near NYC

[Get Directions](#) [History](#)

Parshall, ND 58770, USA

1000 miles of gravel  
road needed  
reduced 10 fold

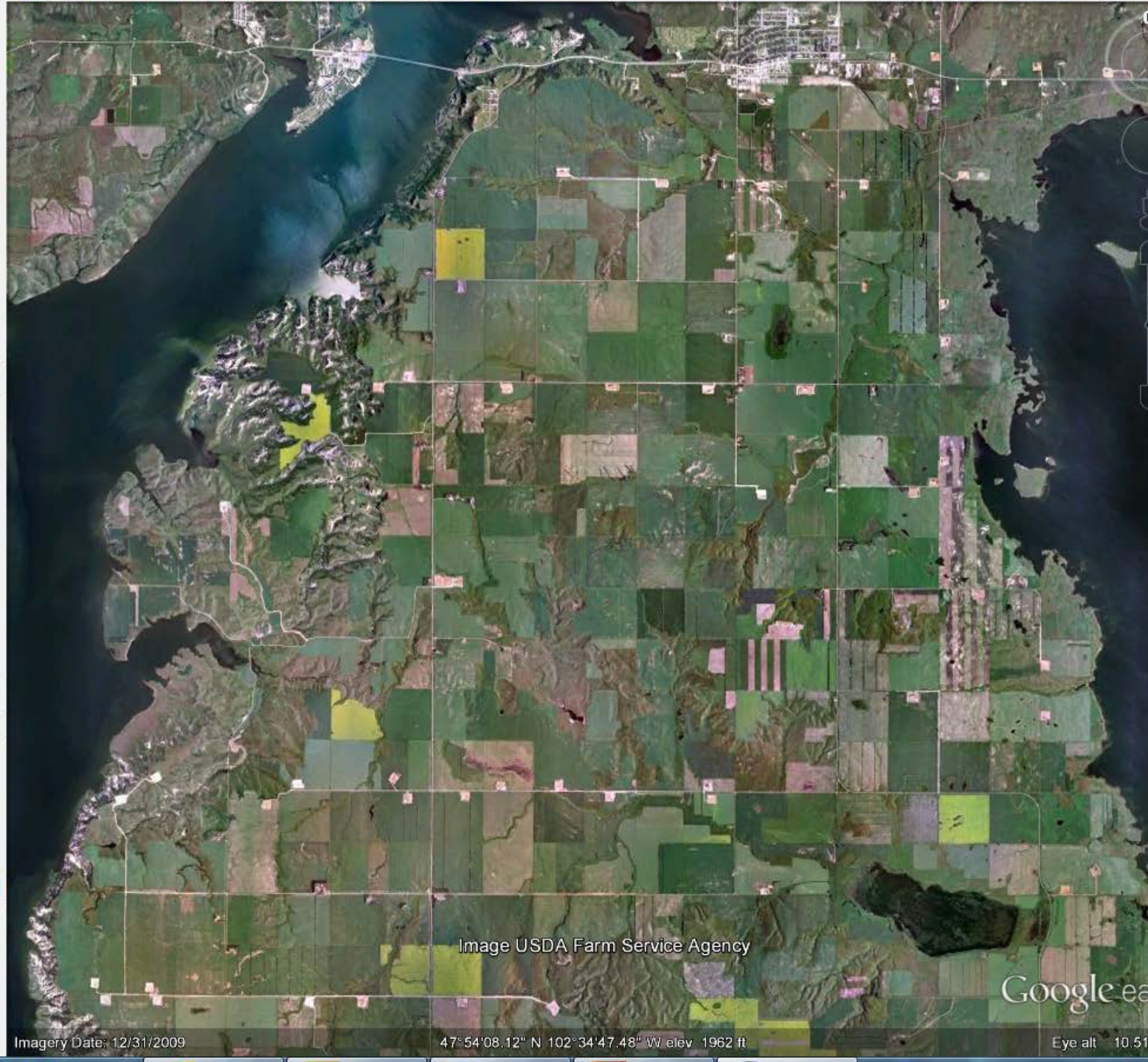
**Places**

- My Places
- [Sightseeing Tour](#)  
Make sure 3D Buildings layer is checked
- Temporary Places

1000 miles of pipeline  
needed reduced  
10 fold

**Layers**

- Primary Database
- Borders and Labels
- Places
- Photos
- Roads
- 3D Buildings
- Ocean
- Weather
- Gallery
- Global Awareness
- More



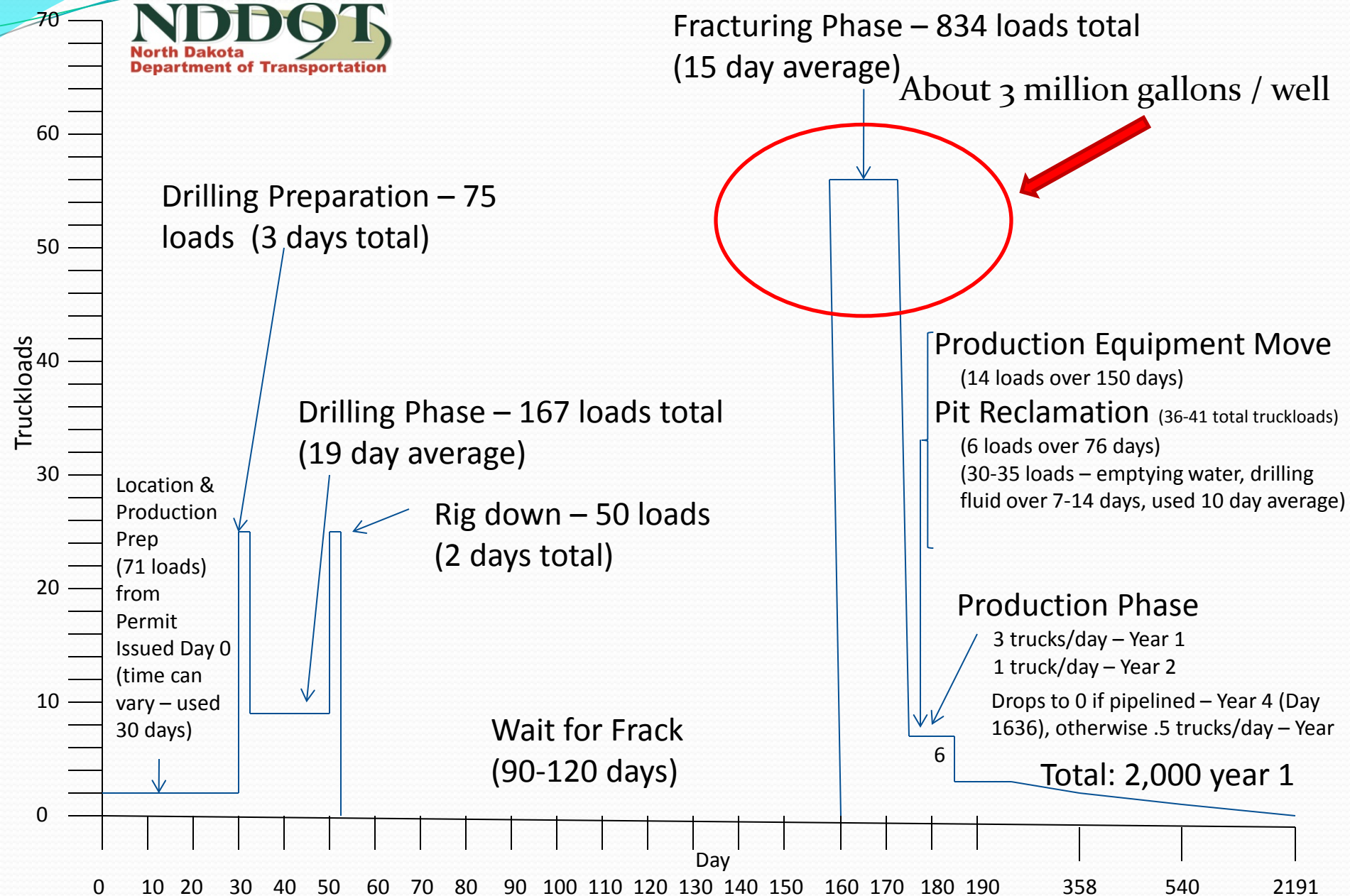
Imagery Date: 12/31/2009

47°54'08.12" N 102°34'47.48" W elev. 1962 ft

Google ea

Eye alt 10.51

# New Bakken Well – Truckload Timeline



Location & Production Prep (71 loads) from Permit Issued Day 0 (time can vary – used 30 days)

Fracturing Phase – 834 loads total (15 day average)  
About 3 million gallons / well

Production Equipment Move (14 loads over 150 days)  
Pit Reclamation (36-41 total truckloads) (6 loads over 76 days) (30-35 loads – emptying water, drilling fluid over 7-14 days, used 10 day average)

Production Phase  
3 trucks/day – Year 1  
1 truck/day – Year 2  
Drops to 0 if pipelined – Year 4 (Day 1636), otherwise .5 trucks/day – Year

Total: 2,000 year 1

# Est. Water Used in Phase 2

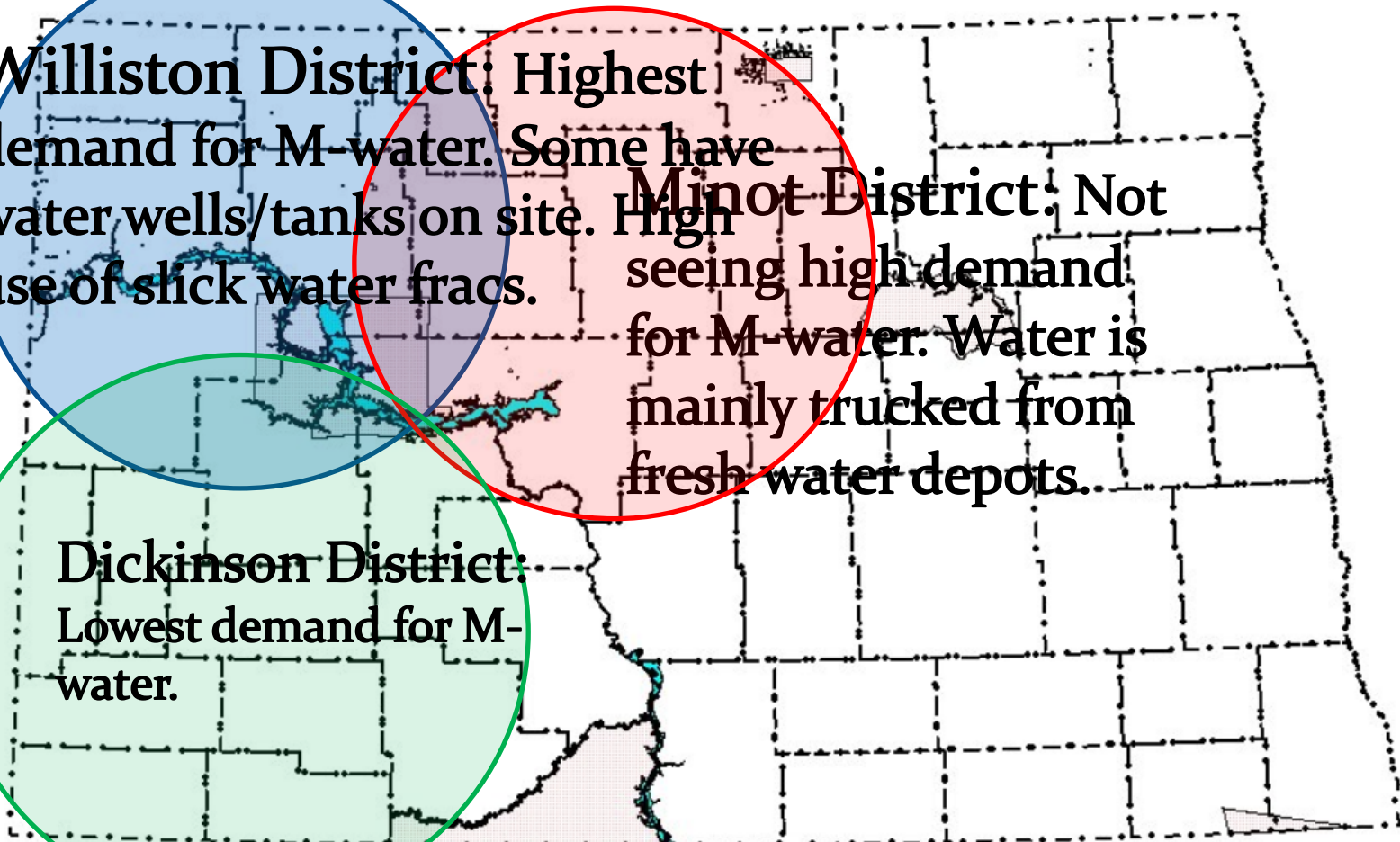
## Hydraulic Fracturing

- 2012: \*Feb-Dec. 1,680 wells completed.
- 2013: 2,040 wells completed.
- 2014: 420 wells completed through May 31, 2014
  - Est. 600 wells waiting on completion.
  - Nearly 15 million gal./day used 2012-2014.
- Increased use of high water fracs, known as slick water fracs.
  - 4% in 2012
  - 12% in 2014

## Maintenance

- Need will vary depending on geology/geography.
- Daily use vs. weekly or monthly.

# Water Demand by District



**Williston District:** Highest demand for M-water. Some have water wells/tanks on site. High use of slick water fracs.

**Minot District:** Not seeing high demand for M-water. Water is mainly trucked from fresh water depots.

**Dickinson District:** Lowest demand for M-water.



# Phase 3 : “Harvest” Increased well density

190 rigs will take  
20 years to  
complete phase 3  
of drilling

8–28 wells per 1,280 acres proposed

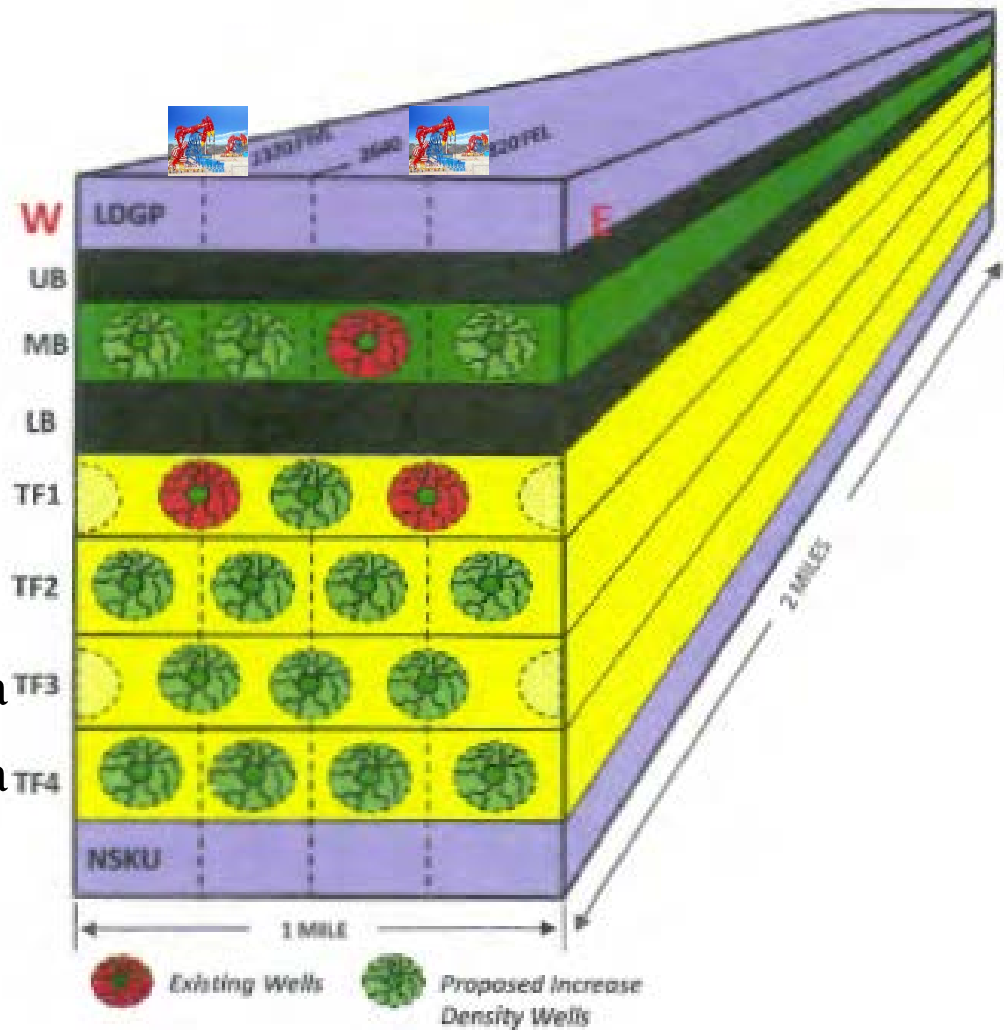
100% area

3/4 area

1/2 area

1/3 area

1/4 area



North Dakota Spacing Units and well pads are designed for multiple wells

# Bakken Wells 2-4 – Truckload Timeline

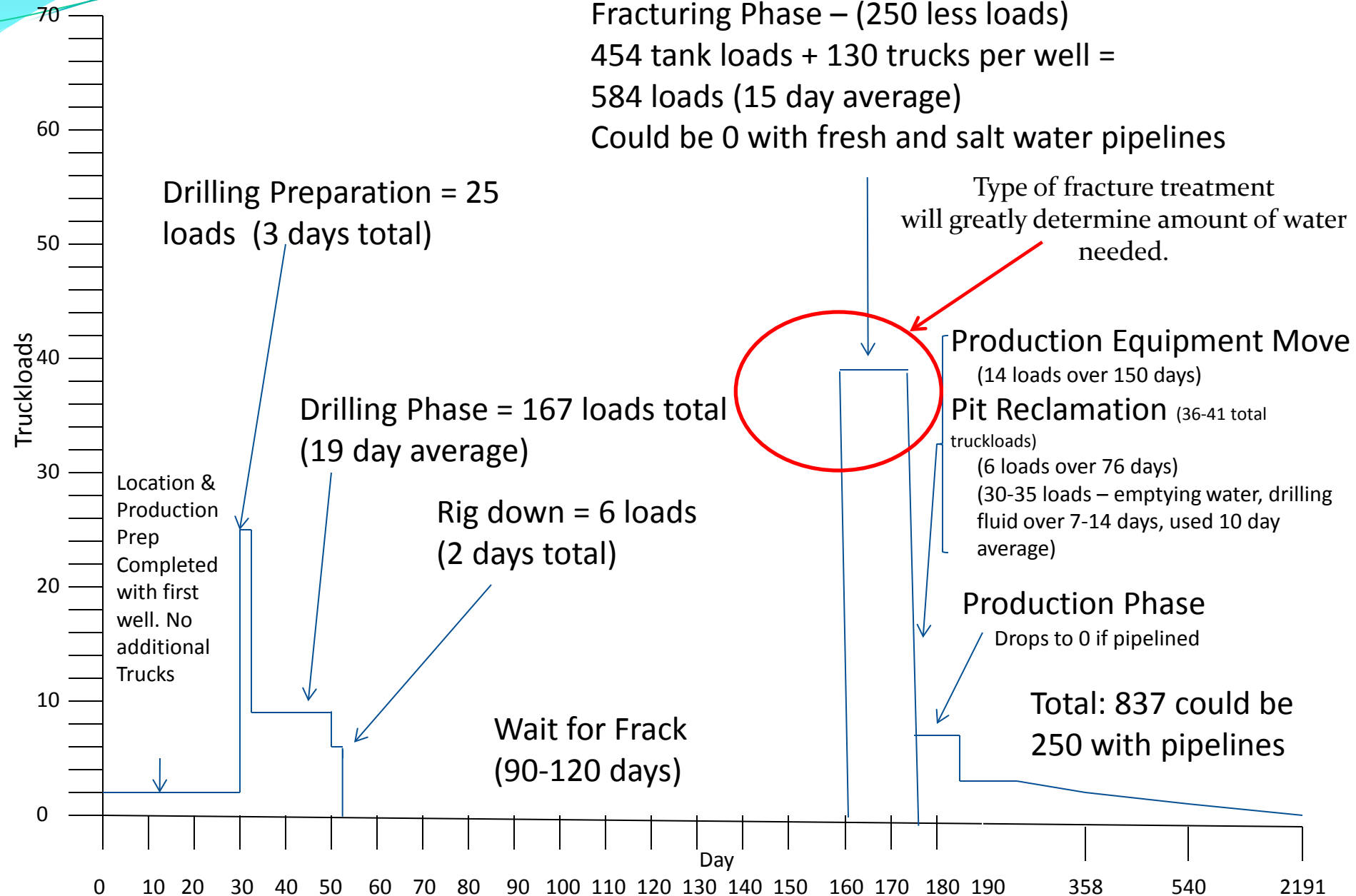
Fracturing Phase – (250 less loads)

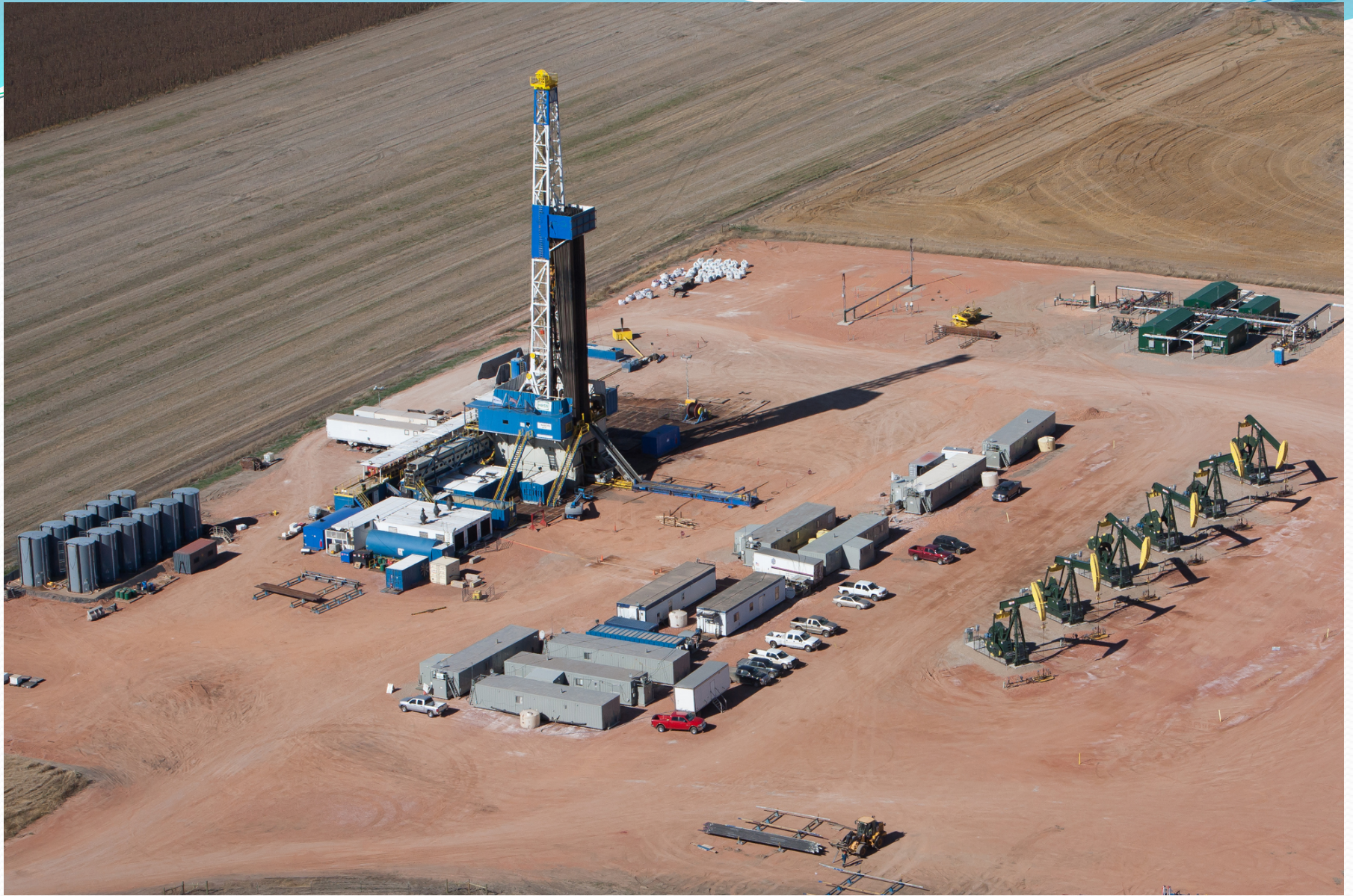
454 tank loads + 130 trucks per well =

584 loads (15 day average)

Could be 0 with fresh and salt water pipelines

Type of fracture treatment will greatly determine amount of water needed.



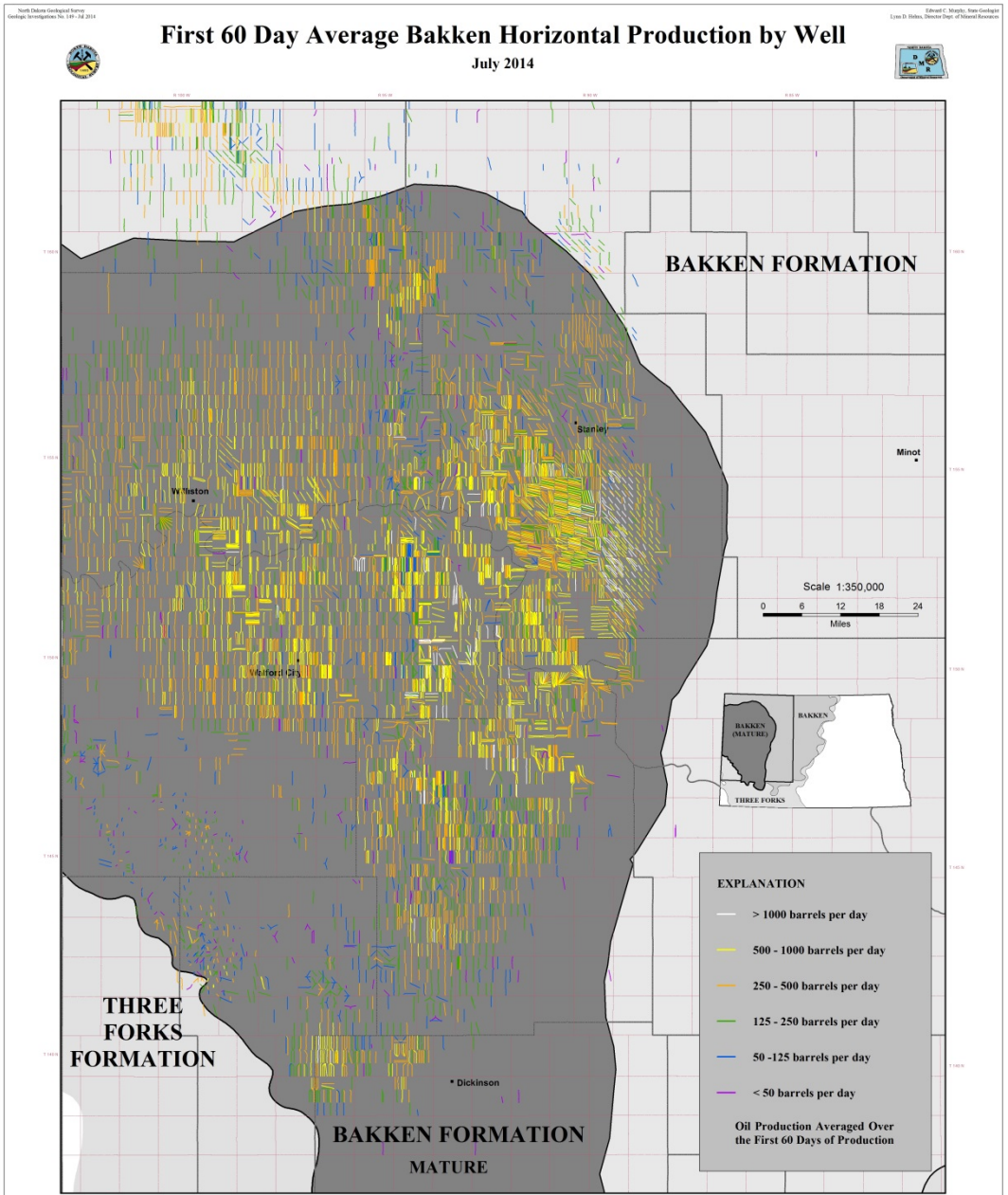


Vern Whitten Photography

6 wells producing - drilling 7-12 - and 11-18 coming soon

7,562 total Bakken/Three Forks wells

10,892 producing wells



# Est. Water needed for Phase 3

## Hydraulic Fracturing

- Continued need as technology evolves.
- Less demand for fresh water as recycling technology grows- provided incentives.
- Phase 4???

## Maintenance Water

- Geology will continue to drive demand.
- Type of water needed is important. Only fresh water can meet the need.
- Phase 4???

# Water Use Through the Phases:

## Conclusion

- There's a lot we understand about water needed.
- There's still more to learn about water needed.
- Geology, technology, incentives will all play a role in future water need.



# North Dakota Update

- **Spotlight on the Bakken: Media Coverage**
    - **National Geographic**
    - **New York Times**
    - **The Globe and Mail (Canada)**
    - **BBC**
    - **Al-Jazeera America**
    - **Time Magazine**
    - **Wall Street Journal**
    - **Daily: California, Florida, New York, Washington, D.C., Colorado, Alaska.**
    - **Inquiries from Australia, France, Germany, Japan, United Kingdom, Poland, Austria.**
- 

# Questions?

[amritter@nd.gov](mailto:amritter@nd.gov)

**701-328-8036**

