

North Dakota Department of Mineral Resources



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

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

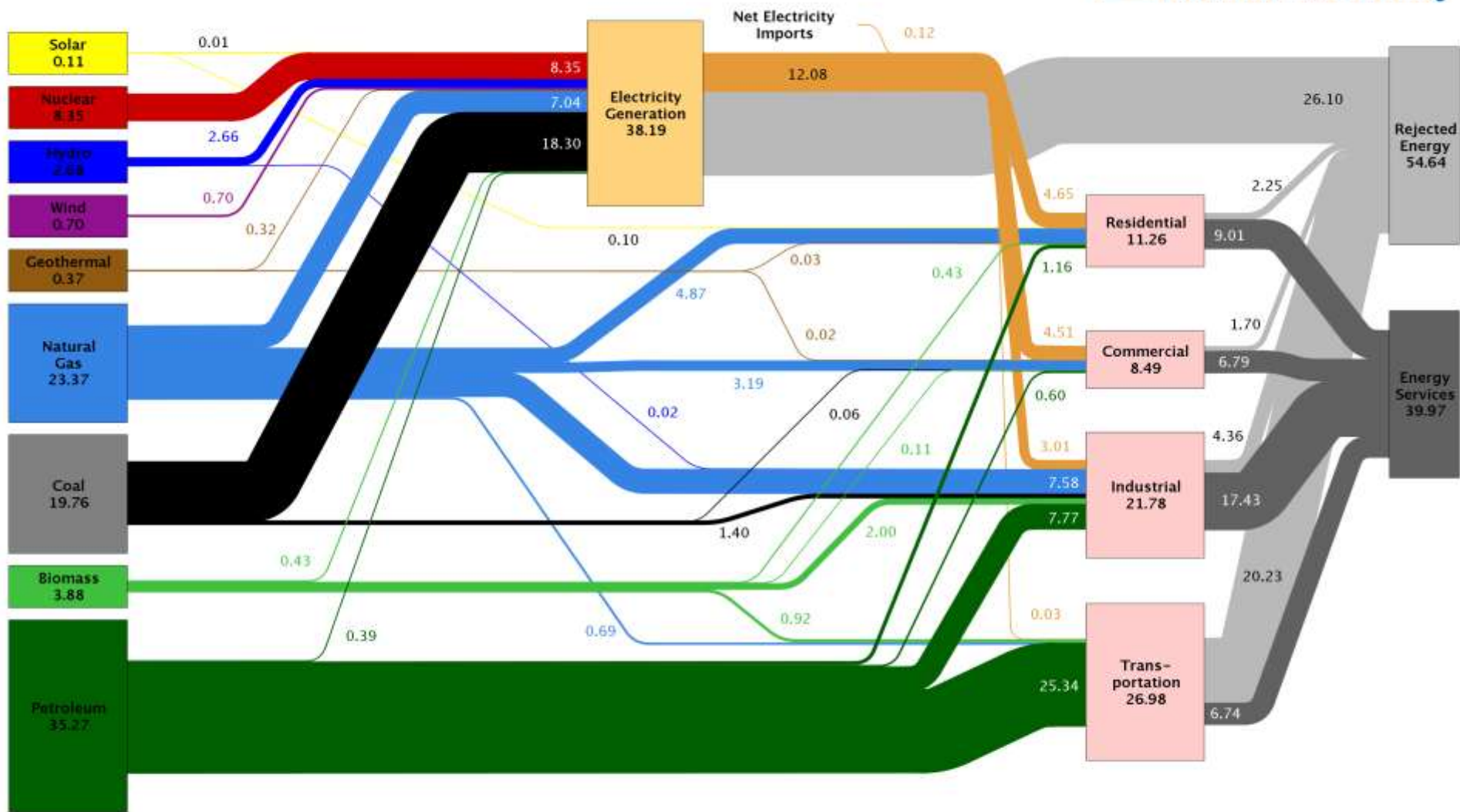
600 East Boulevard Ave. - Dept 405

Bismarck, ND 58505-0840

(701) 328-8020

(701) 328-8000

Estimated U.S. Energy Use in 2009: ~94.6 Quads



Source: LLNL 2010. Data is based on DOE/EIA-0384(2009), August 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 80% for the residential, commercial and industrial sectors, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

Petroleum 96% Biomass 3% Electricity 1%

From the Calgary Sun 3/24/12

Steven Chu, told a Congressional hearing last week that the government's mission is not to lower gas costs — but to get Americans off gas altogether.

Hey, great idea — when we invent that fantasy fuel of the future.

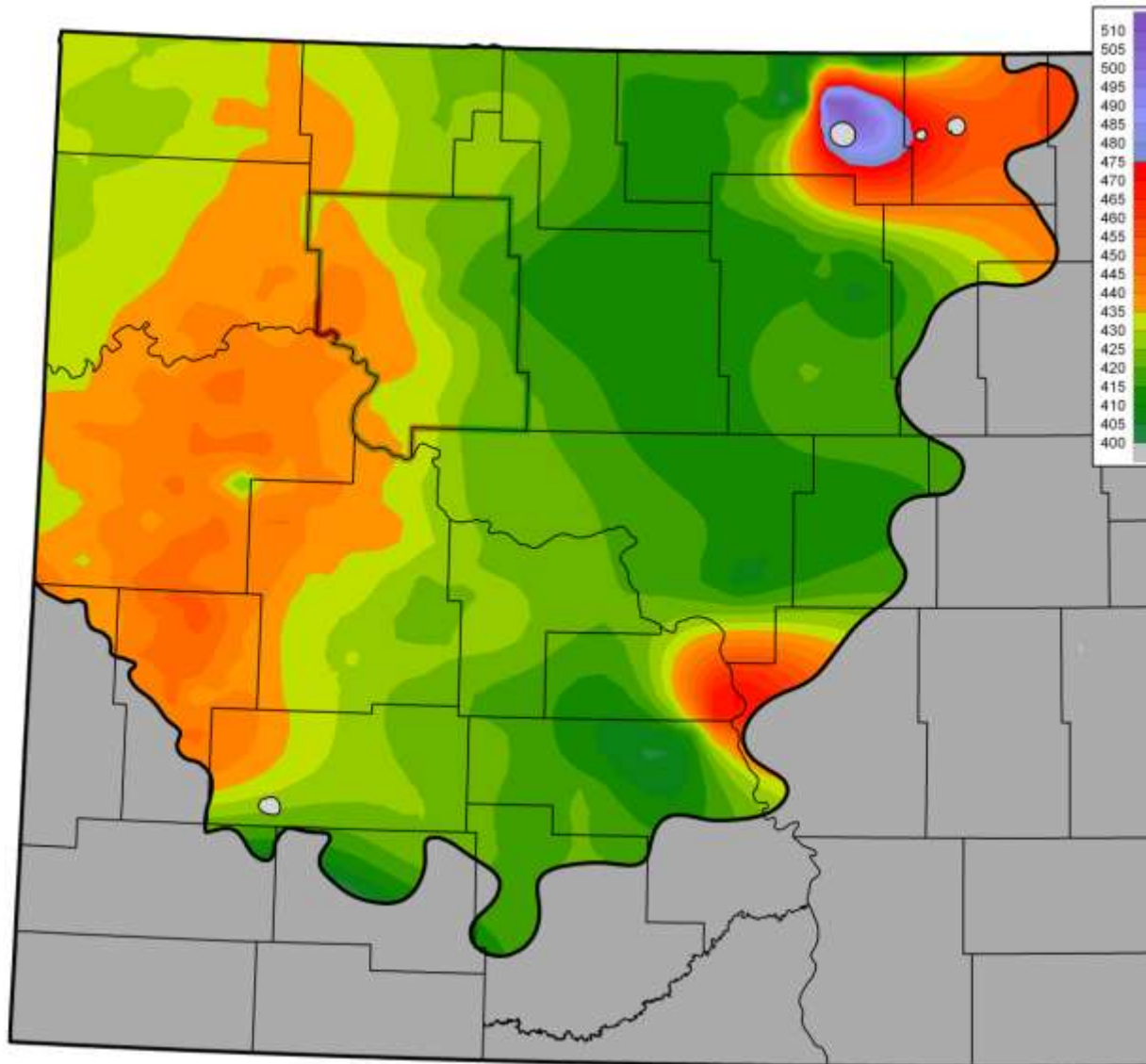
You can't get off oil until you know what you're getting on to. And right now, there is no practical replacement.

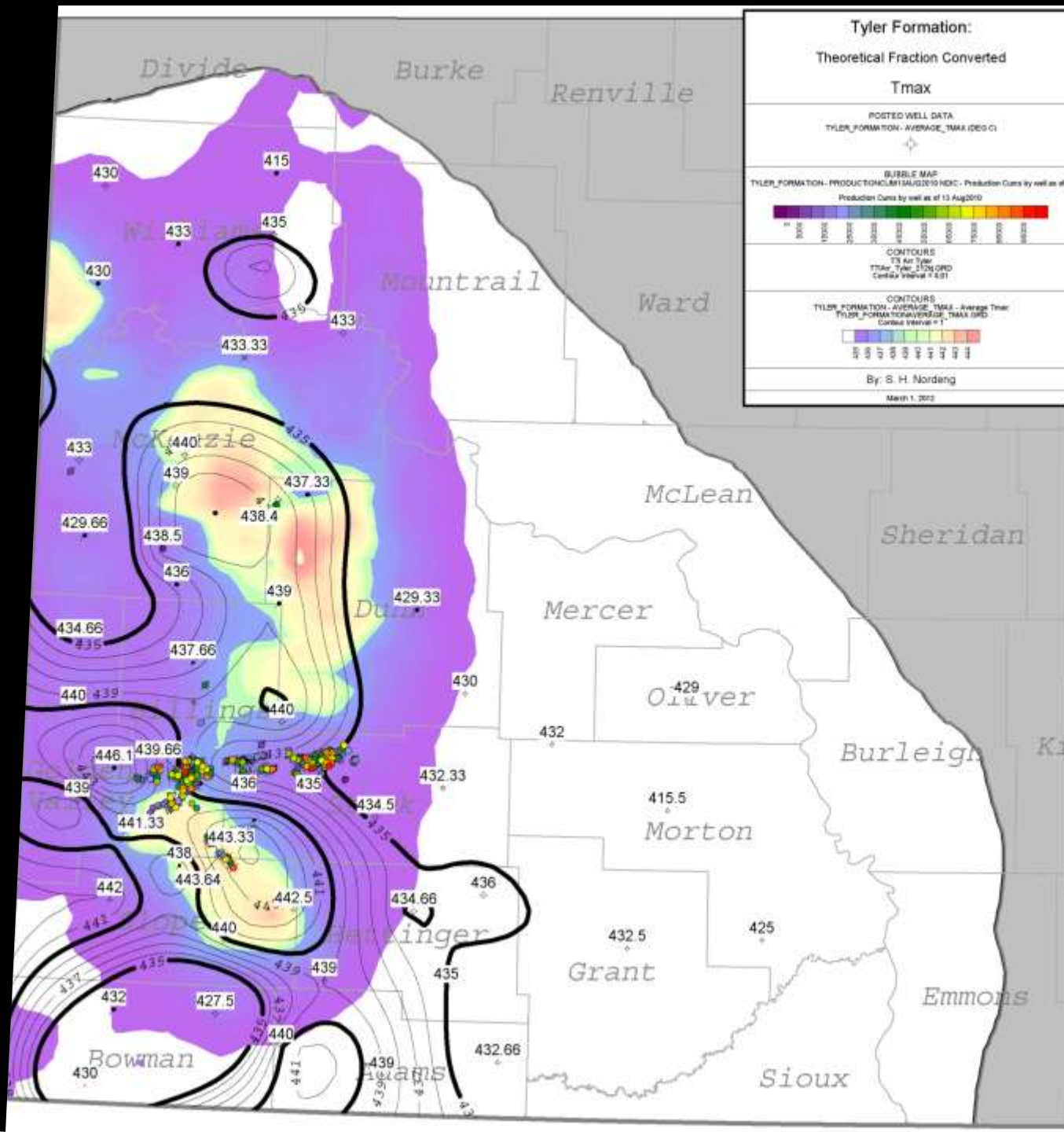
Dreamy alternatives work for unserious people like science fiction moviemakers. James Cameron's movie Avatar talked about a resource called "Unobtainium." Exactly — we haven't obtained it yet.

Topics for Today

- Resource Plays
- History
- Activity
- Projections

2) Bakken T_{max} : Maturation Index





Tyler Formation:
Theoretical Fraction Converted
Tmax

POSTED WELL DATA
 TYLER_FORMATION - AVERAGE_TMAX (DEG C)

BURBLE MAP
 TYLER_FORMATION - PRODUCTION/13AUG2010 NDC - Production Cums by well as of
 Production Cums by well as of 13 Aug 2010

CONTOURS
 T3 Air Type
 T3Air_Tyler_2176.DPD
 Contour Interval = 0.51

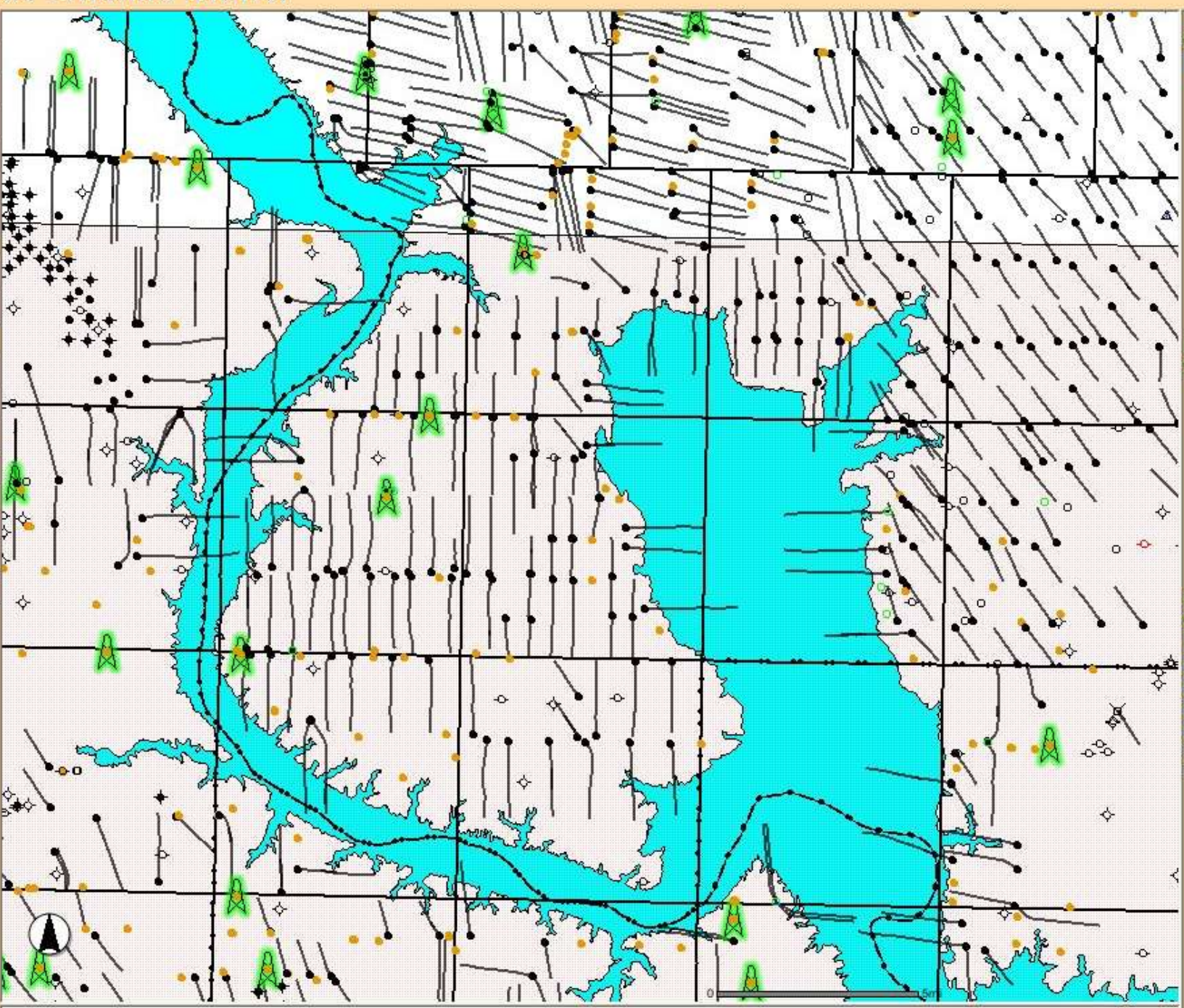
CONTOURS
 TYLER_FORMATION - AVERAGE_TMAX - Average Tmax
 TYLER_FORMATION/CONTOUR/TMAX.DPD
 Contour Interval = 1

By: S. H. Nordeng
 March 1, 2012

Topics for Today

- Resource Plays
- **History**
- Activity
- Projections

- Legend / Layers
- Overview Map
- View Entire State
- Previous View
- Clear Selection
- Search
- Generate PDF
- Zoom In
- Zoom Out
- Pan
- Rect Identify
- Select Object
- Buffer
- Distance
- Find Well
- Find Field/Unit
- Find Section





Vern Whitten Photography

Search

Fly To Find Businesses Directions

Fly to e.g., Hotels near JFK

dunn county nd

Dunn, North Dakota

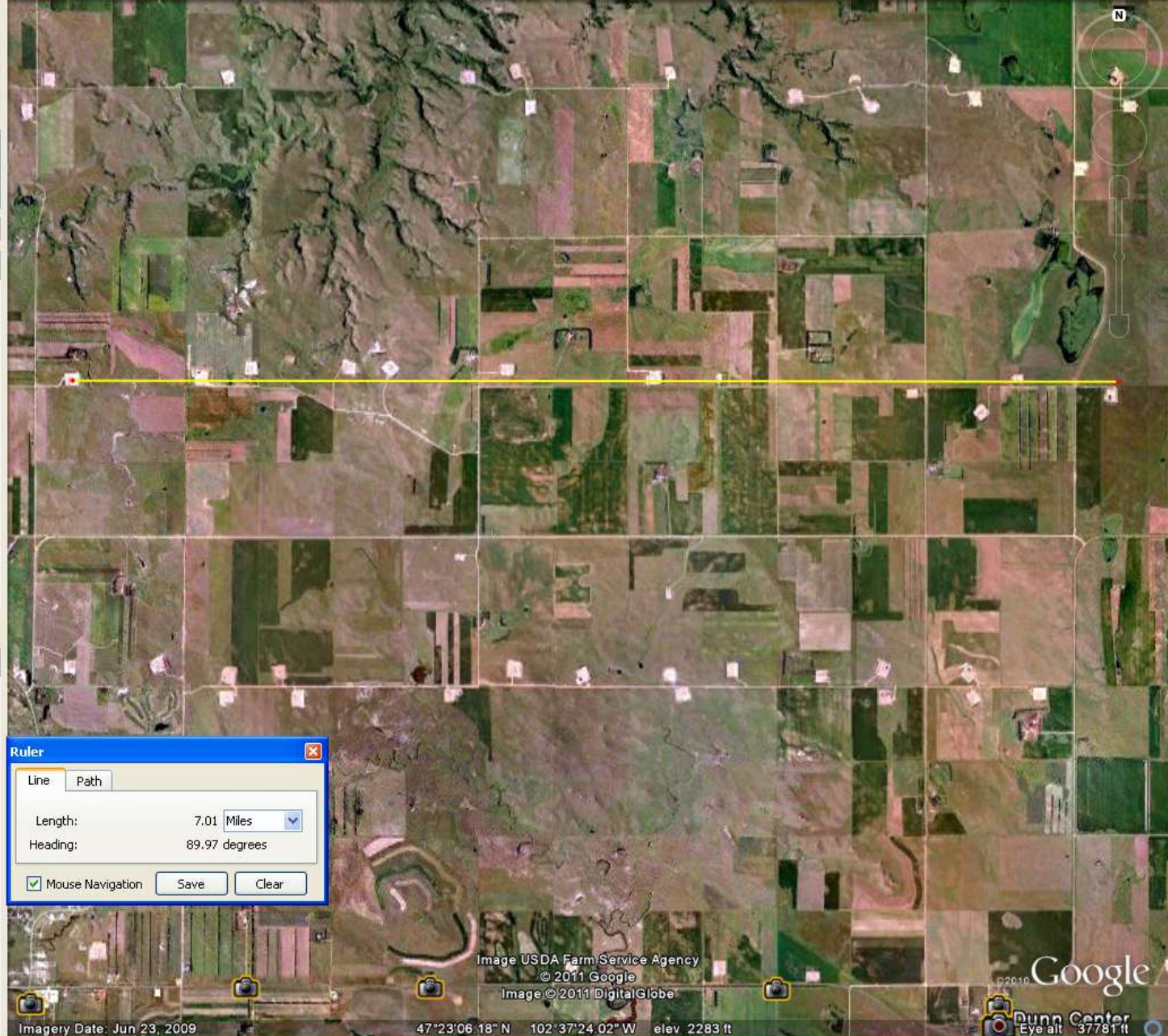
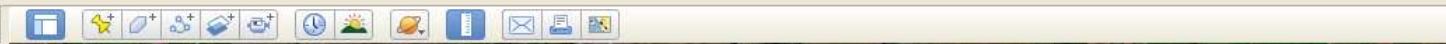
Sublette, Wyoming

Places

- My Places
- Sightseeing Tour
 - Make sure 3D Buildings layer is checked
- Temporary Places

Layers Earth Gallery >>

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



Ruler

Line Path

Length: 7.01 Miles

Heading: 89.97 degrees

Mouse Navigation Save Clear

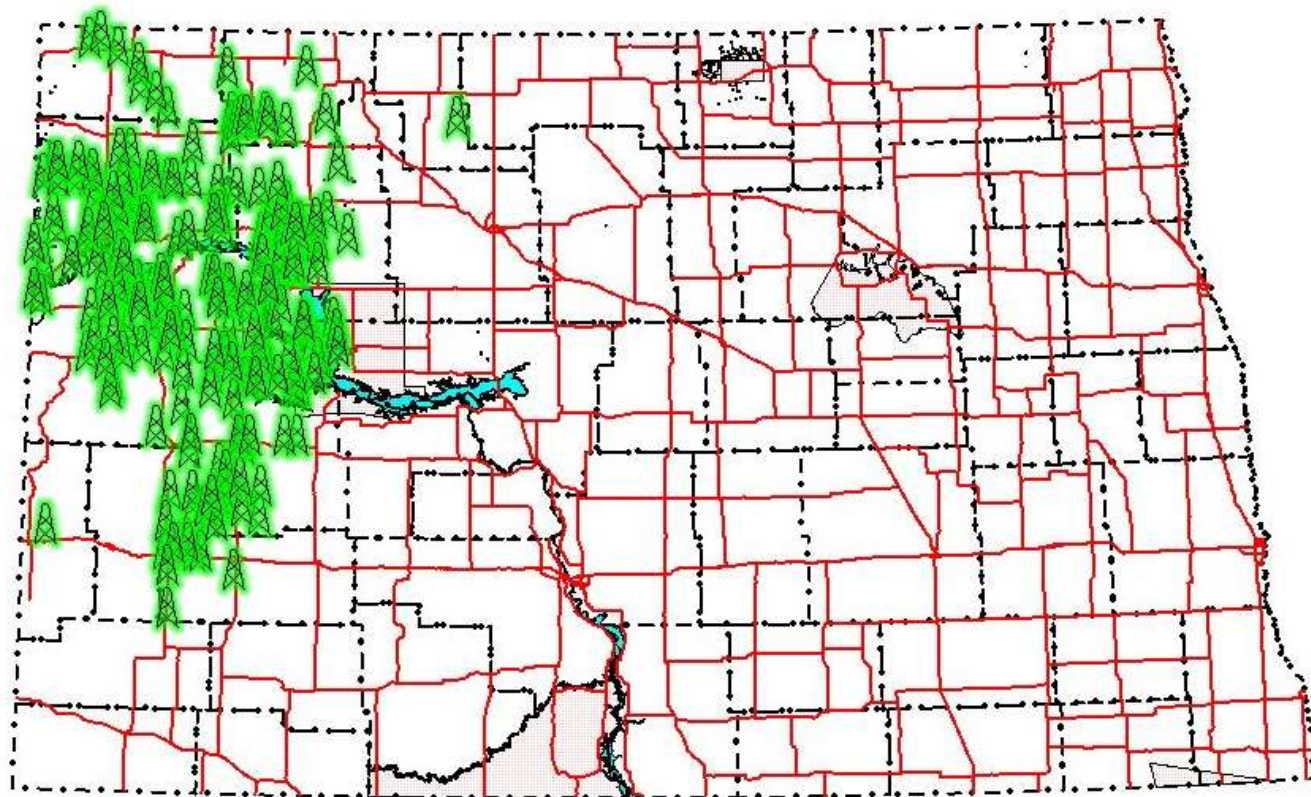
Topics for Today

- Resource Plays
- Development History
- **Activity**
- Projections

Oil and Gas : ArcIMS Viewer

206 Rigs

- Legend / Layers
- Overview Map
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0 91mi

What Does Every New Bakken Well Mean to North Dakota

A typical 2012 North Dakota Bakken well will produce for 29 years

If economic, enhanced oil recovery efforts can extend the life of the well

In those 29 years the average Bakken well:

Produces approximately 580,000 barrels of oil

Generates over \$22 million net profit

Pays approximately \$4,610,000 in taxes

\$2,200,000 gross production taxes

\$2,000,000 extraction tax

\$410,000 sales tax

Pays royalties of \$7,925,000 to mineral owners

Pays salaries and wages of \$1,500,000

Pays operating expenses of \$2,300,000

Cost \$8,500,000 to drill and complete

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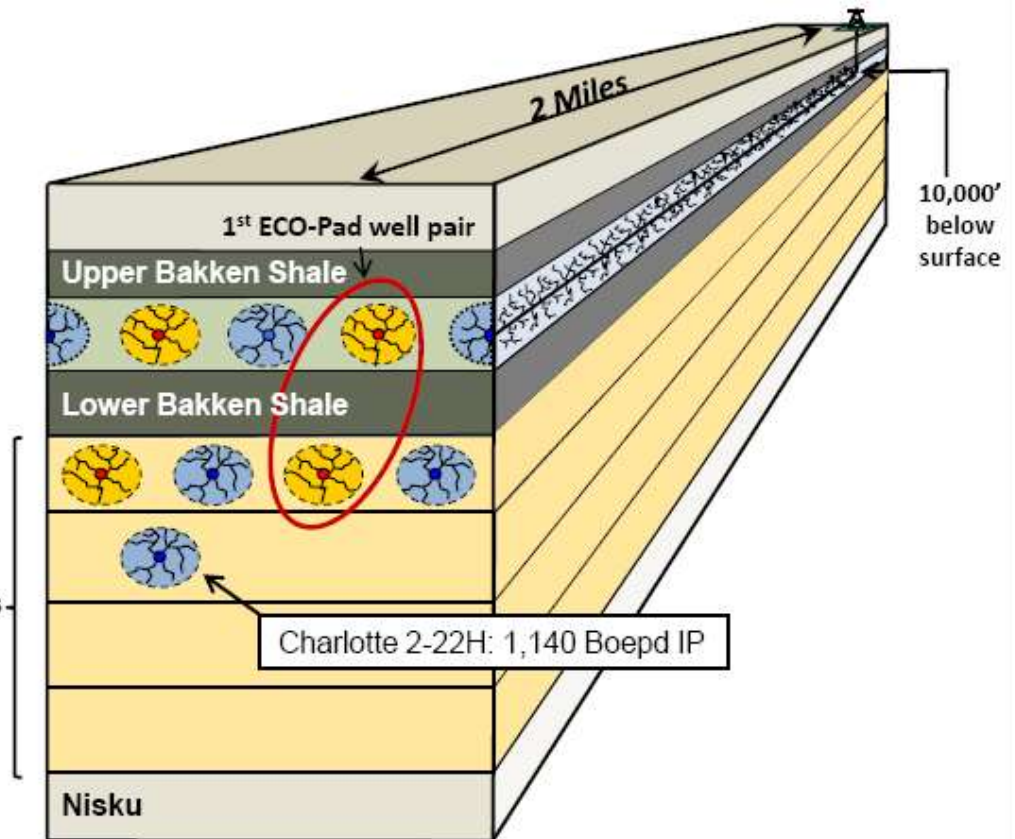
Western North Dakota

- 1,100 to 2,700 wells/year = 2,000 expected
 - 100-225 rigs = 12,000 – 27,000 jobs = 12,000 – 27,000 jobs
 - Another 10,000 jobs operating wells and building infrastructure
 - 225 rigs can drill the 4,500 wells needed to secure leases in 2 years
 - 225 rigs can drill the 27,500 wells needed to develop spacing units in 16 years
 - 32,000 new wells = 30,000-35,000 long term jobs

Bakken Development Plan

- Original dual-zone development plan
 - 8 wells per 1,280 acres – 4 MB, 4TF
 - 603,000 Boe EUR per well (avg. 24.5 stages/completion)
 - ECO-Pad® design: 2 wells south, 2 wells north

- Additional Three Forks potential



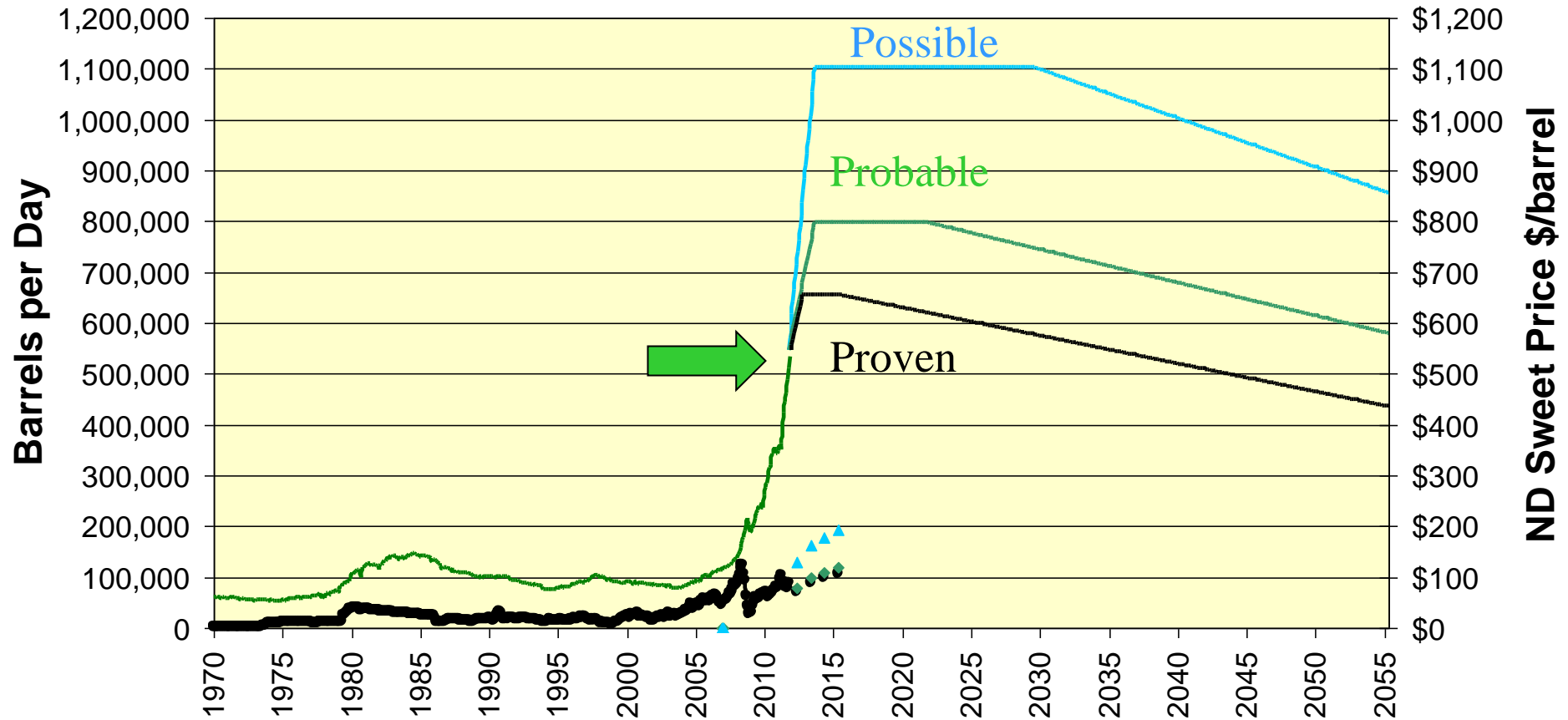
Six Wells on a Single Pad



Vern Whitten Photography



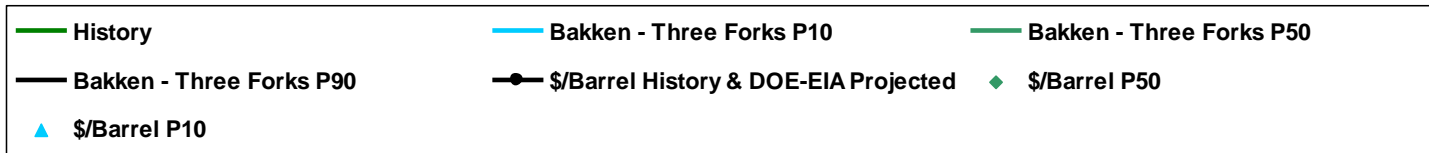
North Dakota Oil Production and Price



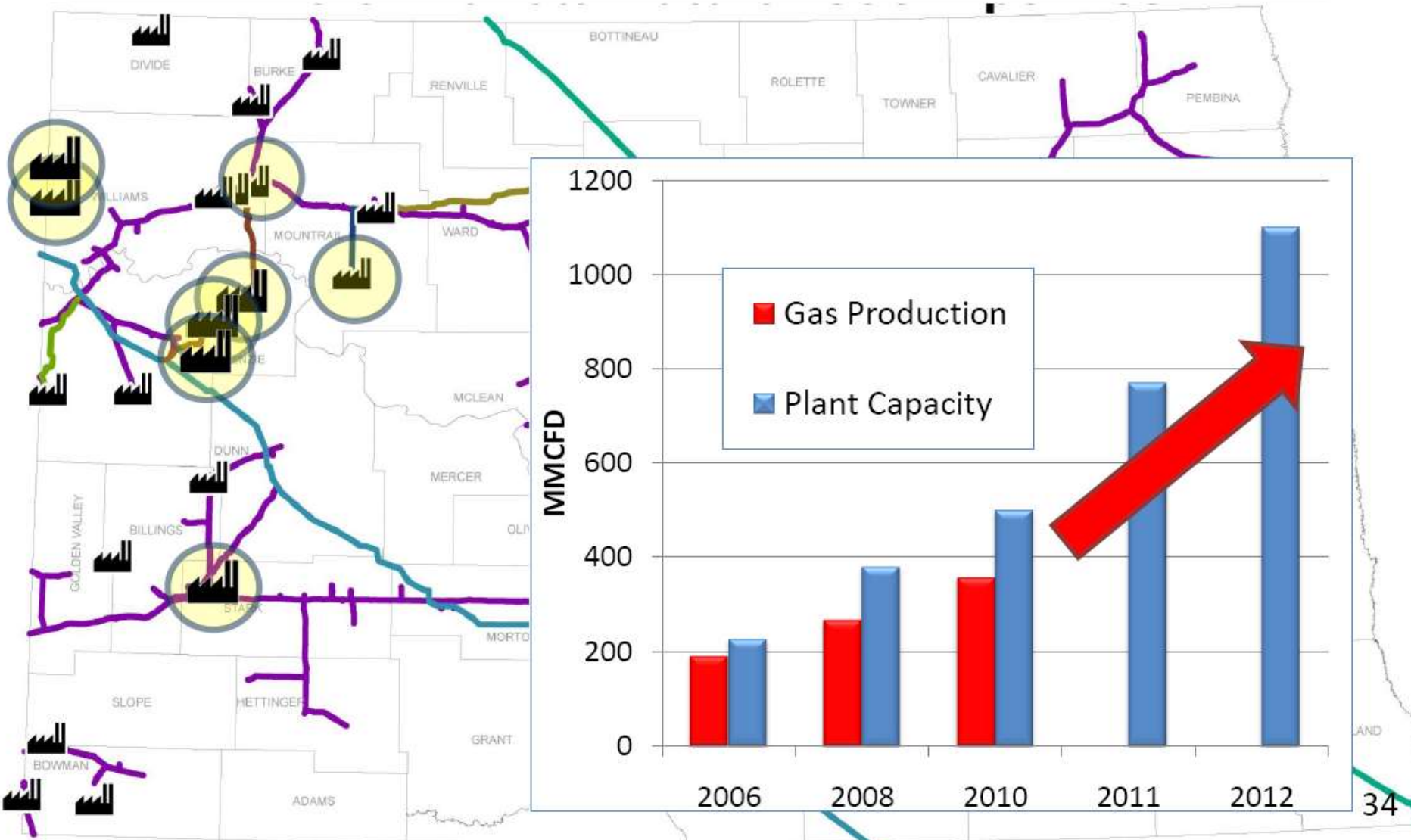
3,266 Bakken and Three Forks wells drilled and completed

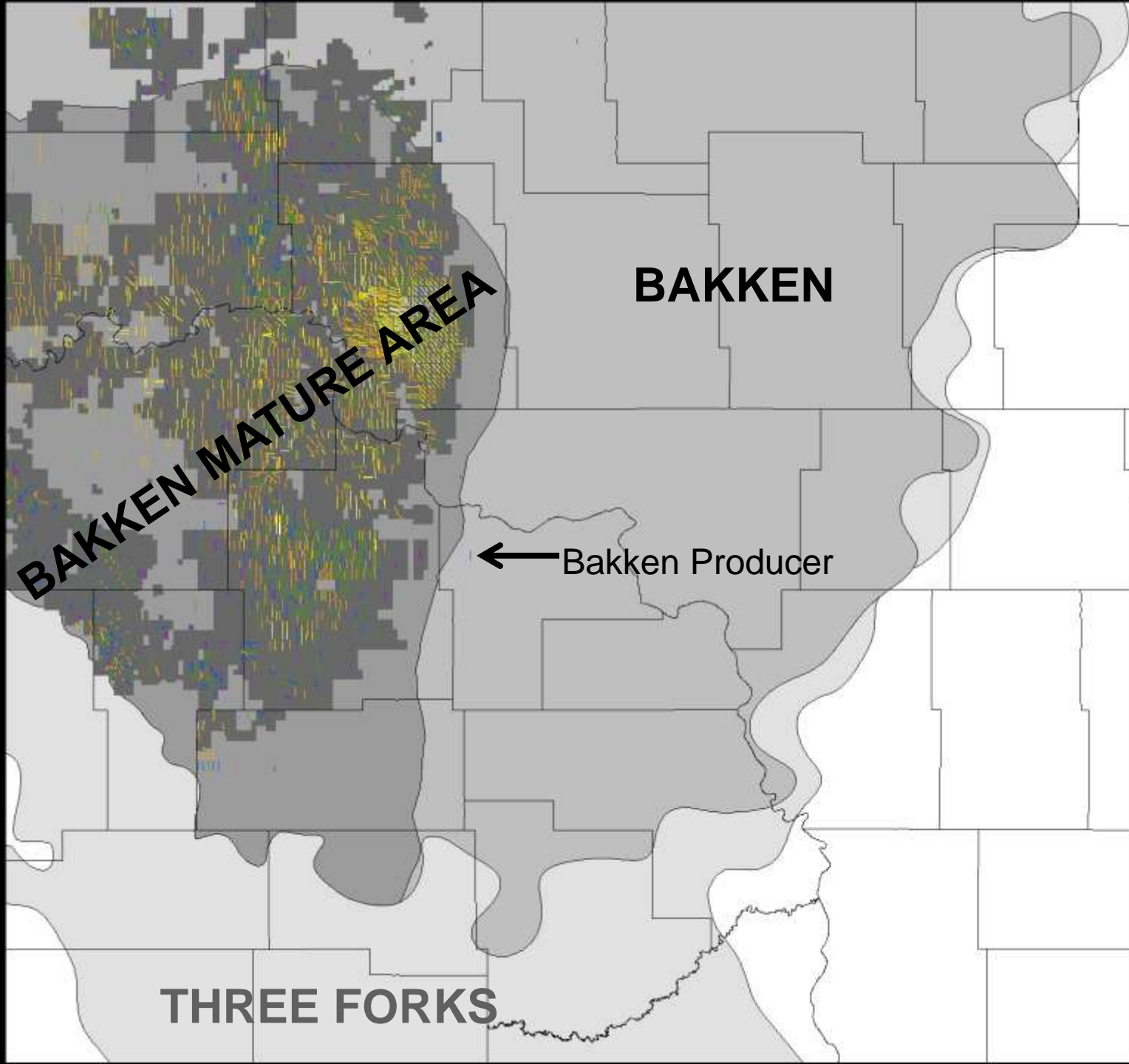
32,000 more new wells possible in thermal mature area

Proven=7 BBO – Probable=10 BBO – Possible=14 BBO (billion barrels of oil)



New or Expanding Gas Plants





BAKKEN

BAKKEN MATURE AREA

← Bakken Producer

THREE FORKS

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[Sublette, Wyoming](#)

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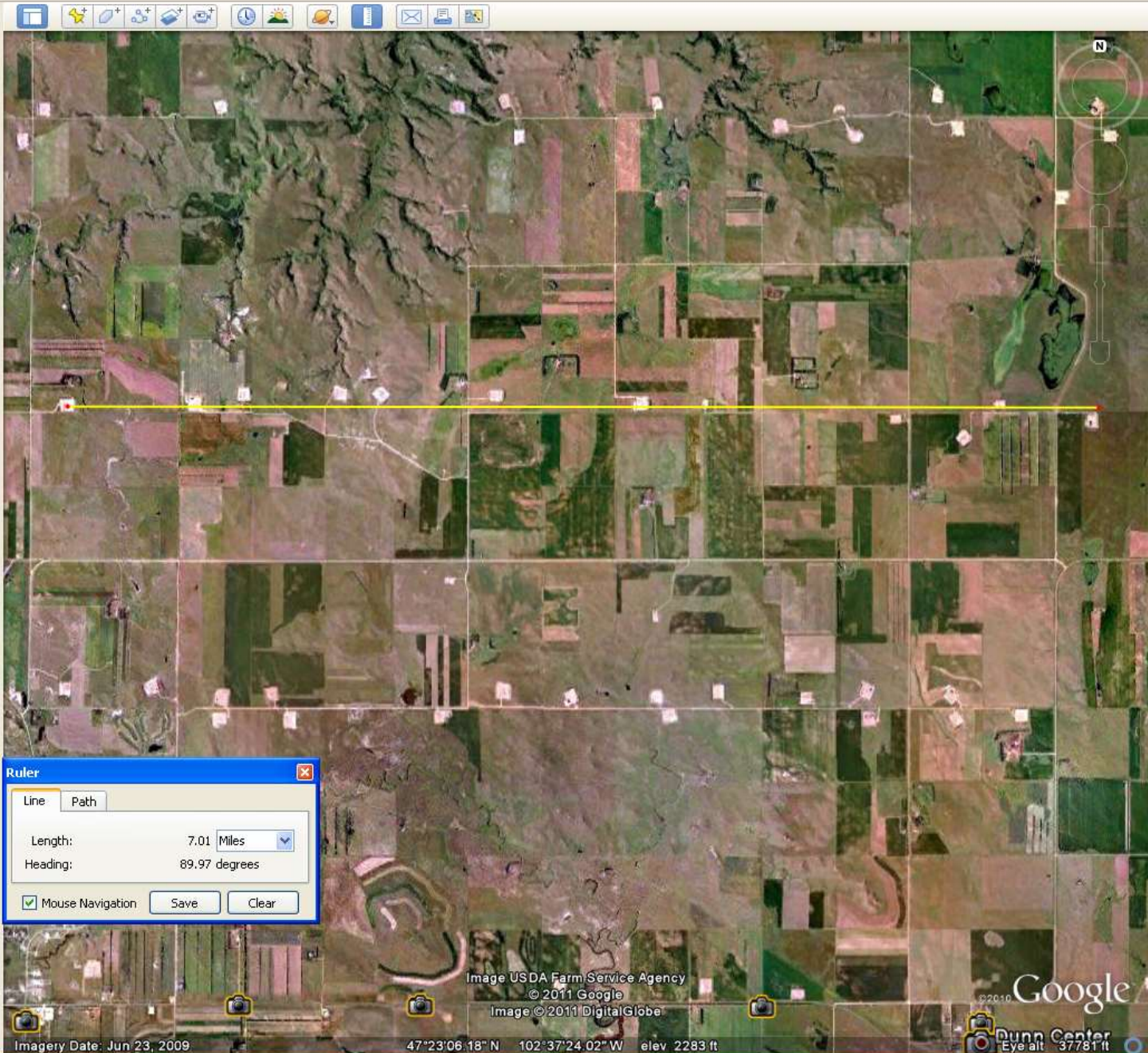
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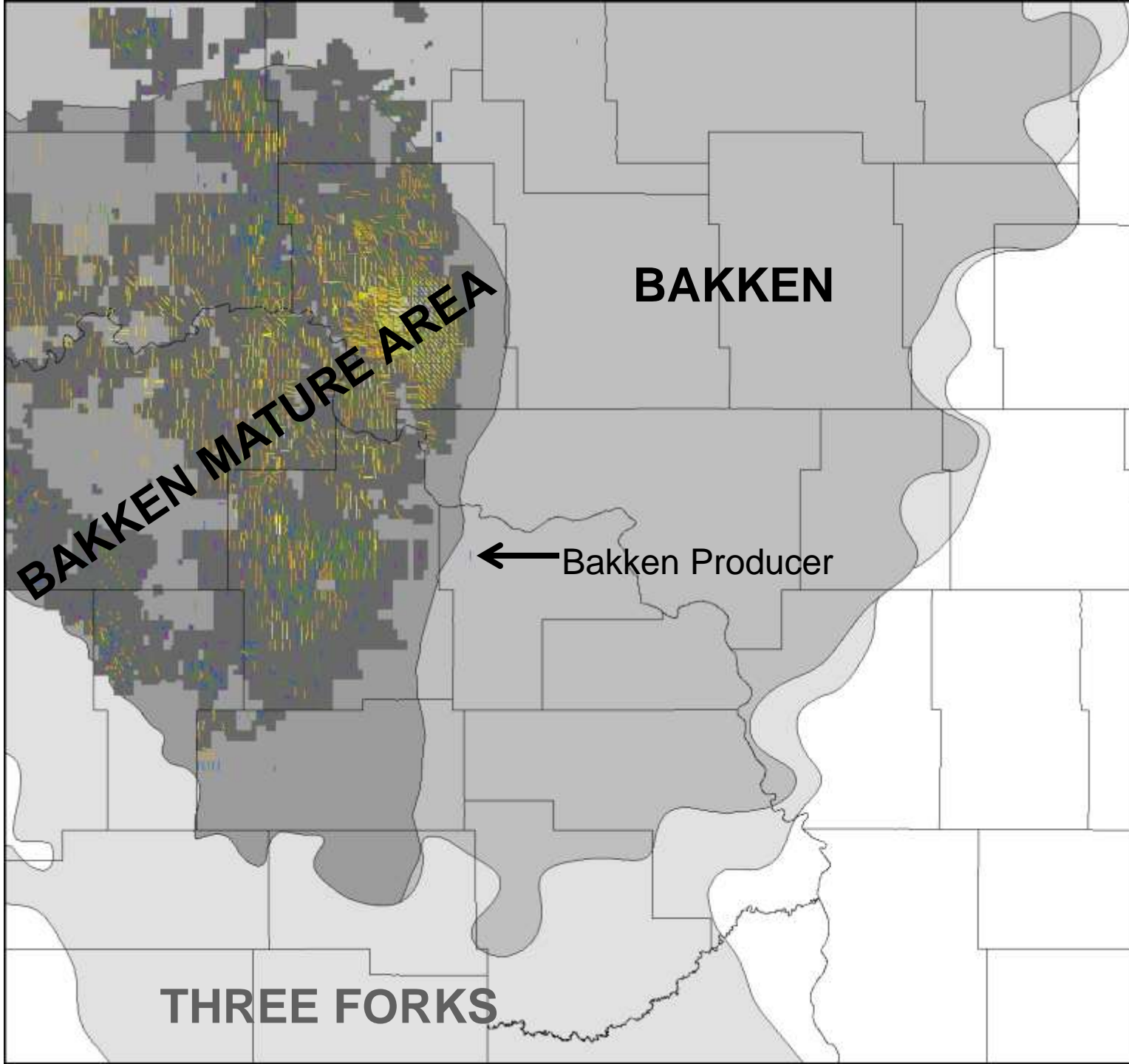


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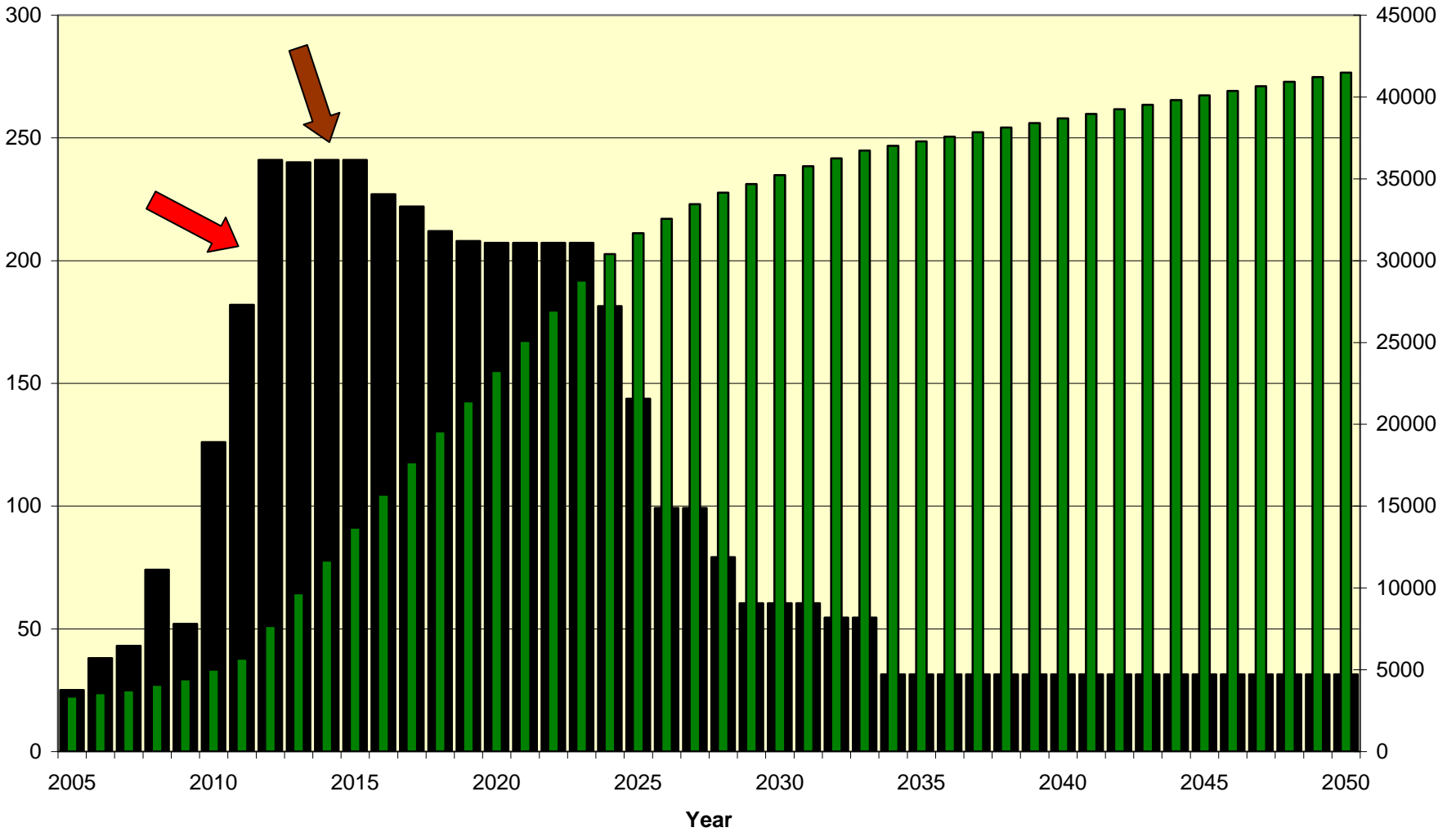
BAKKEN

BAKKEN MATURE AREA

← Bakken Producer

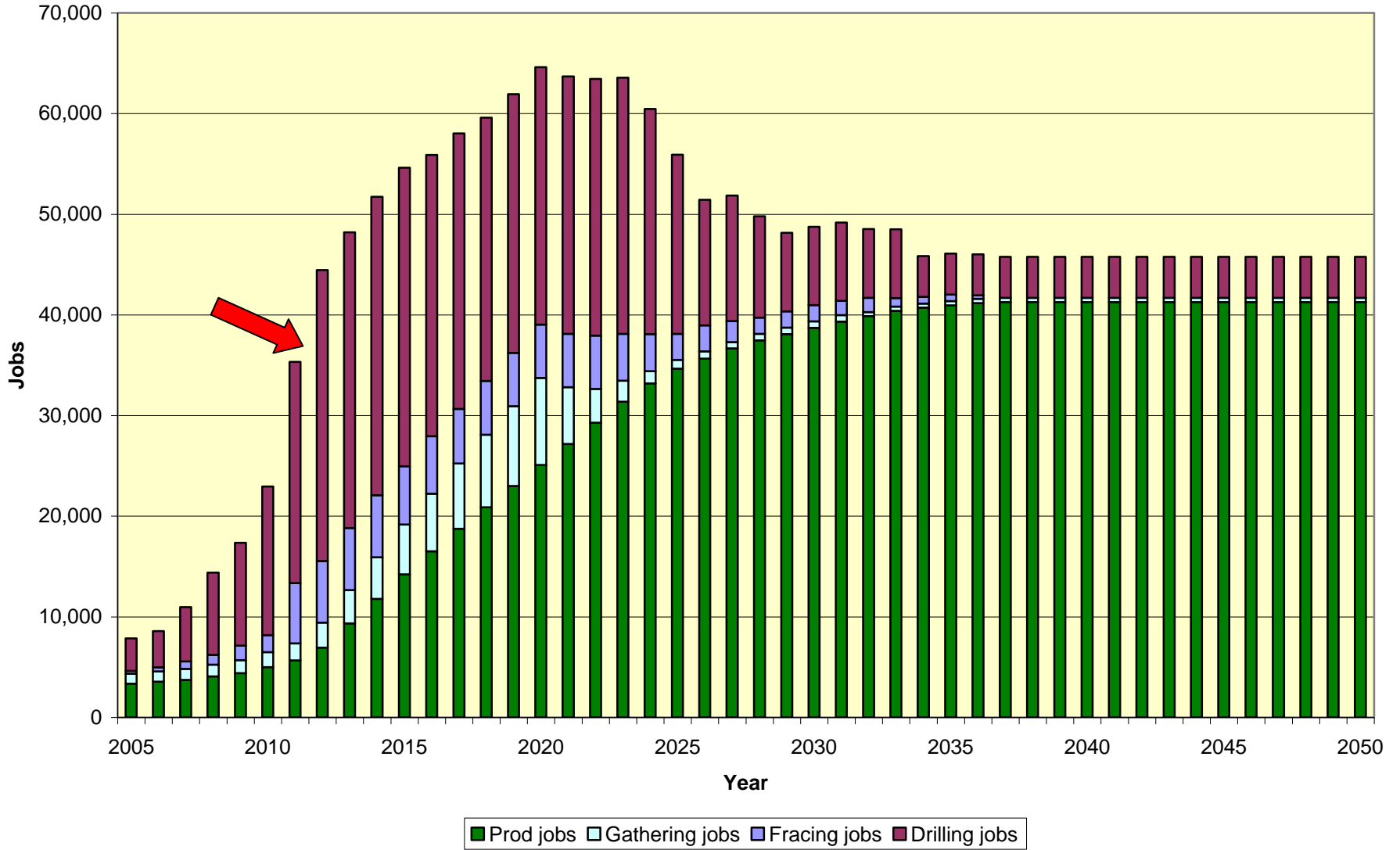
THREE FORKS

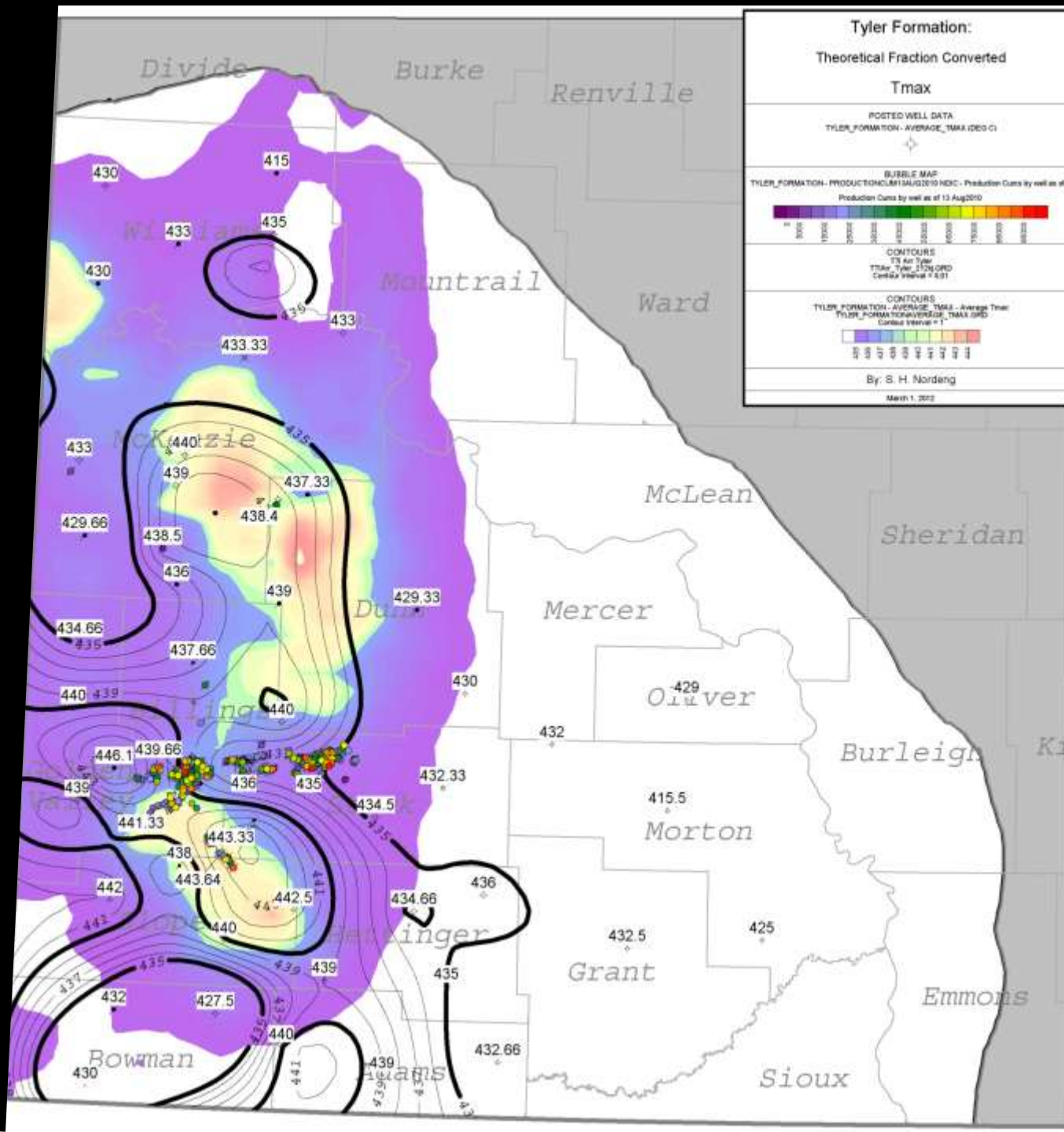
North Dakota Oil Industry Rigs & Wells



■ Rigs ■ Wells

North Dakota Oil Industry Jobs (Ph2=80% Ph1)





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Tmax

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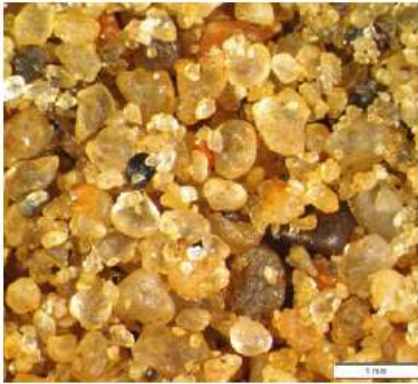
CONTOURS
 TYLER_FORMATION - AVERAGE_TMAX - Average Tmax
 TYLER_FORMATION/CONTOUR_TMAX.DPD
 Contour Interval = 1

By: S. H. Nordeng
 March 1, 2012

PROPPANT PROJECT

Millions of tons of sand and ceramic proppants are used every year in the Williston Basin, part of a multi-billion dollar industry. The Geological Survey has collected 125 sand samples throughout the state in our search for deposits that could be utilized for oil and gas proppants in the well fracing process. We are in the process of performing preliminary analysis on those samples to determine if any would fit the proppant criteria. We have also collected clay samples and will be testing those samples for their kaolin content to determine their suitability in the manufacturing of ceramic proppants.

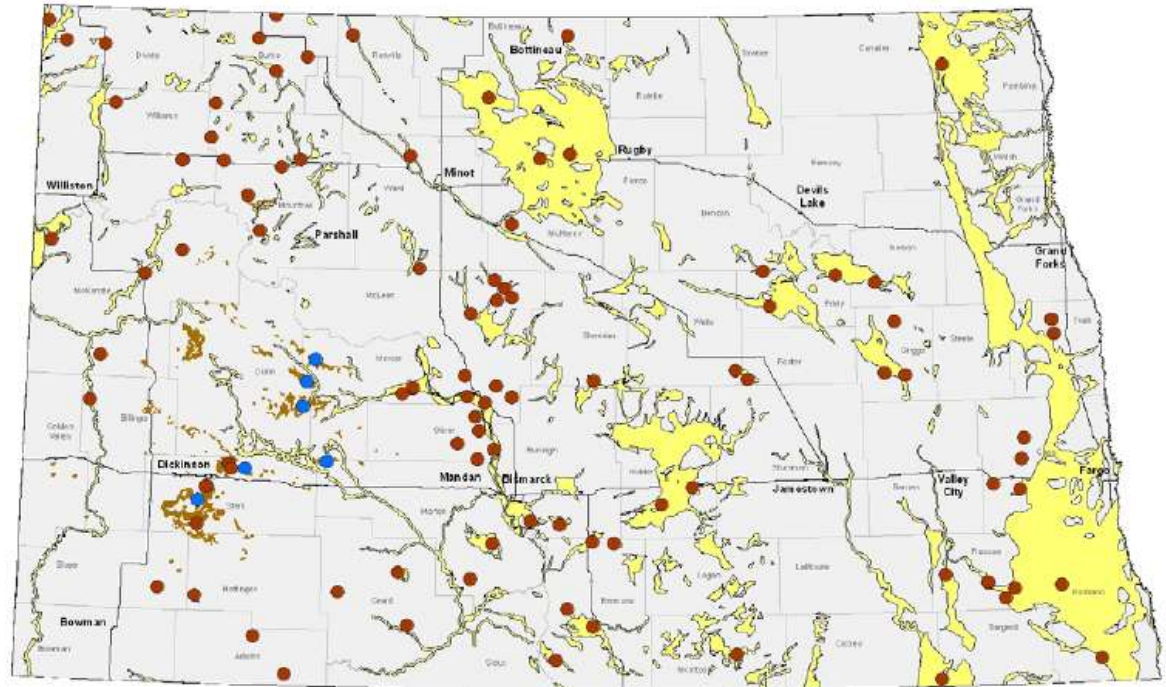
Under the second phase of this project, the ten most promising sand samples will undergo full ISO analysis (including bulk density, specific gravity, crush resistance, etc), mineralogy (XRD), and stack conductivity analysis to determine which are the most suitable proppant candidates and we will continue to evaluate the clay beds.



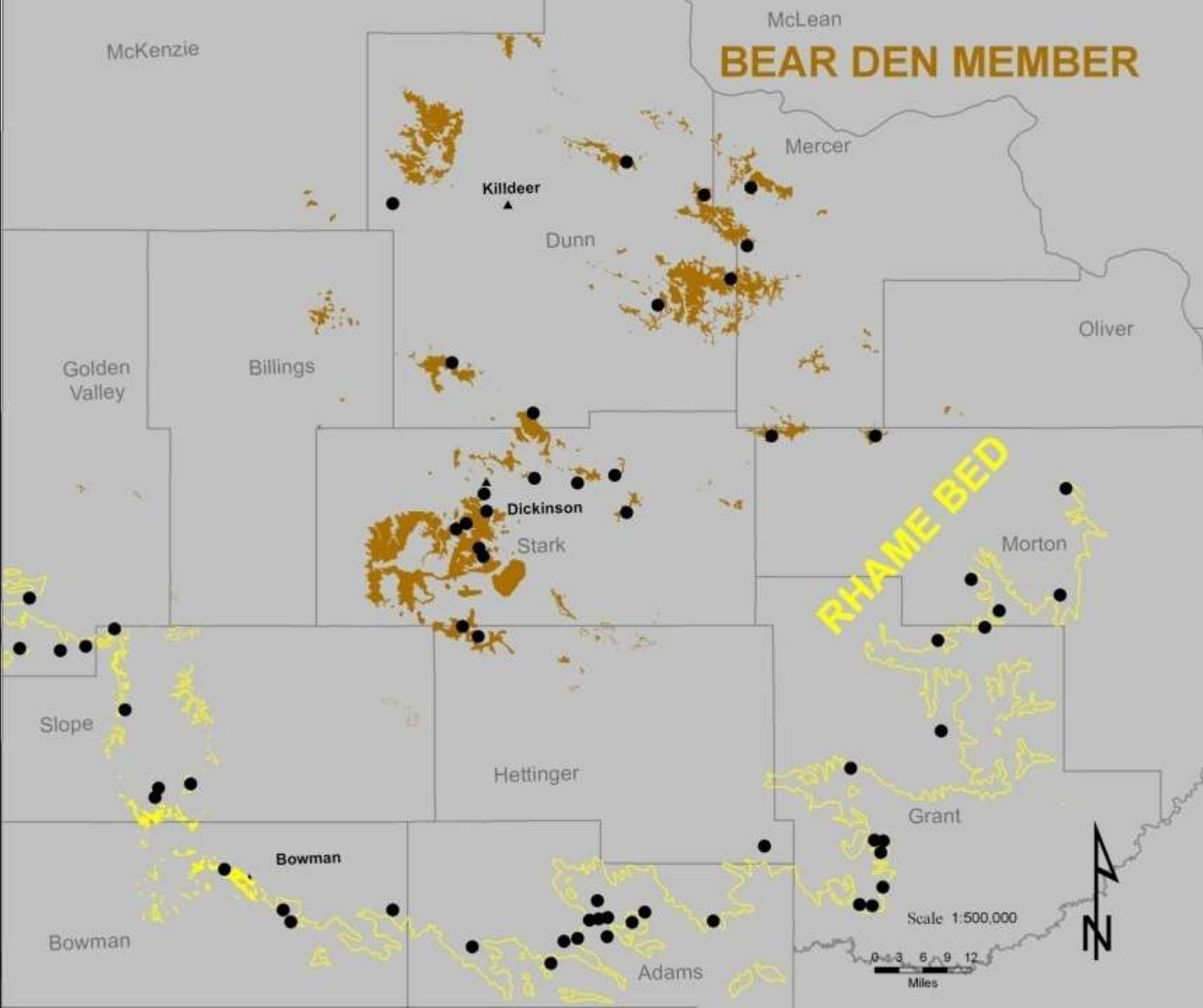
Photomicrograph of sand grains collected in McHenry County.



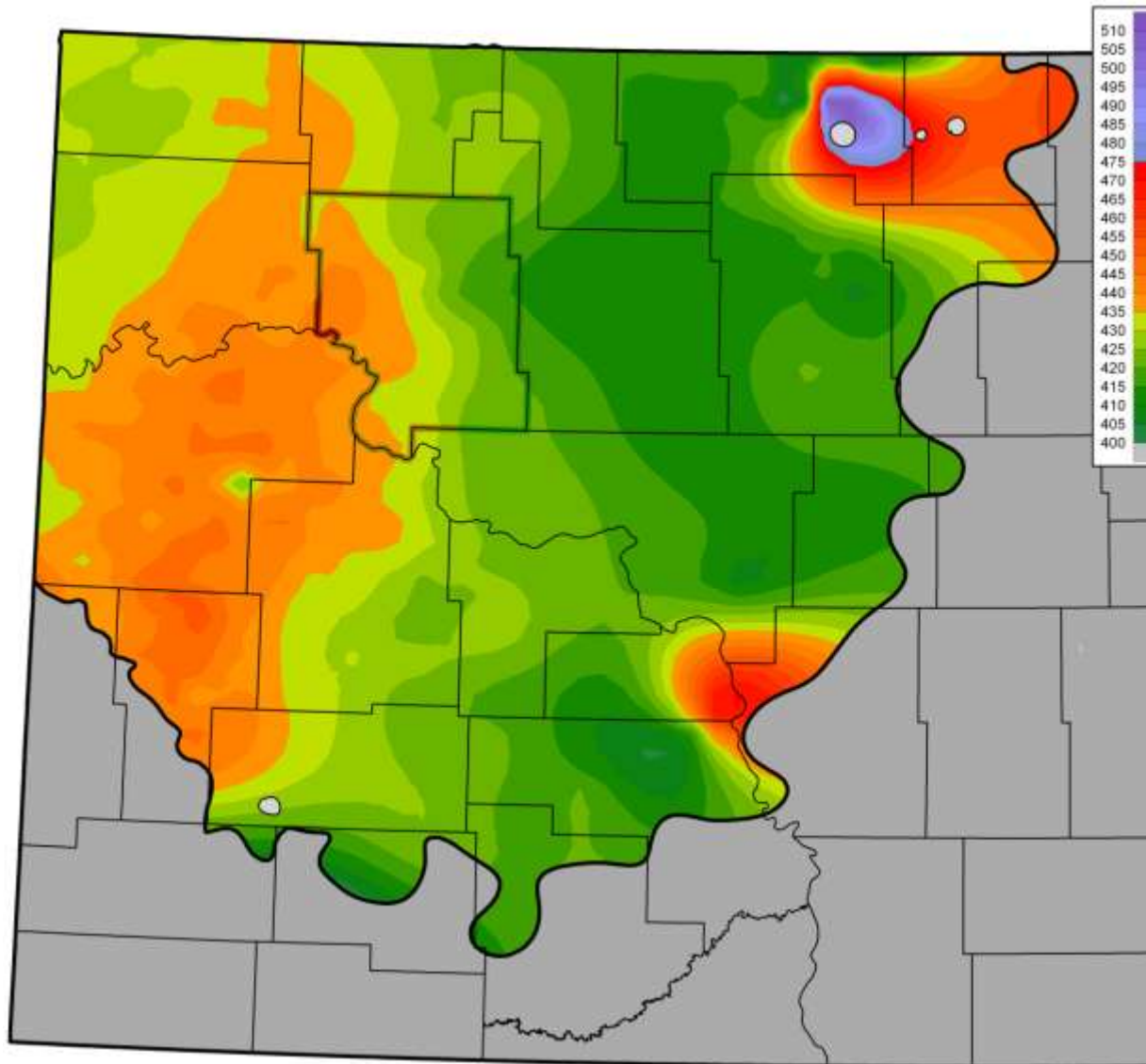
Photomicrograph of ceramic proppant from a batch that was used in a Bakken well in North Dakota. This proppant was manufactured in China.



Locations of sand samples (red dots) and clay samples (blue dots) collected during this study. The areas in yellow are known sand deposits and the areas in brown are kaolinitic claystones within the Golden Valley Formation.



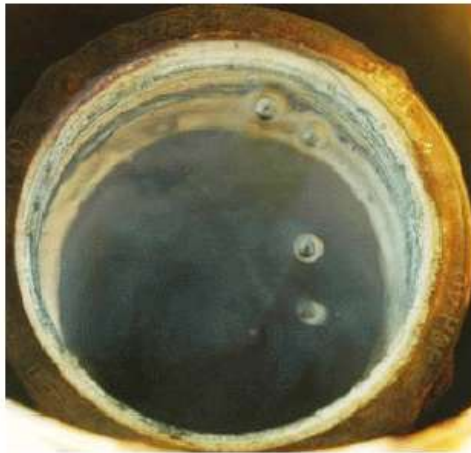
2) Bakken T_{max} : Maturation Index



SHALLOW GAS PROJECT



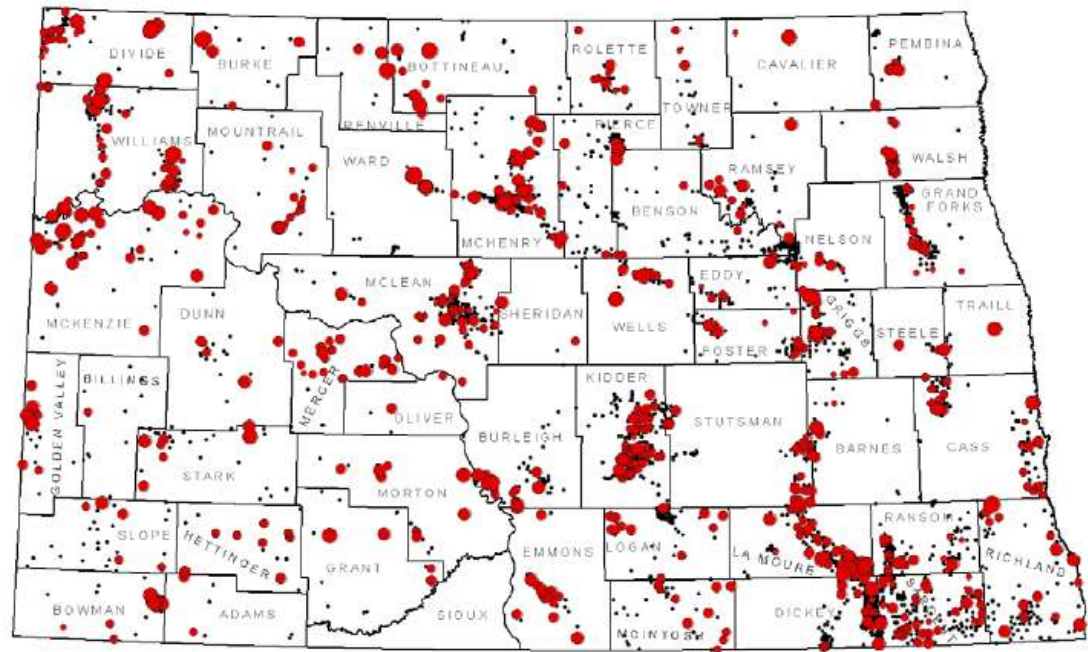
The Geological Survey tested 4,325 NDSWC monitoring wells for methane in 52 of the 53 counties in North Dakota from 2006-2010.



Methane bubbling to the surface in a two-inch NDSWC monitoring well.

The Geological Survey recently completed phase I of a study of shallow natural gas in North Dakota. We investigated 9,400 ND State Water Commission monitoring well sites, tested 4,325 wells, and detected methane in 905 wells. Approximately 20% of the wells contained detectable gas.

During the second phase of the project, thirty groundwater samples, primarily from eastern North Dakota, will be analyzed for dissolved gas composition, isotopes, and general chemistry. This will enable us to determine the source of the gas and identify chemical groundwater signatures that might assist the oil and gas industry in natural gas exploration.



Monitoring wells that contained methane are indicated with red dots, black dots are wells that contained no detectable methane. The red dots are sized to reflect the concentration of methane -- the higher the concentration, the larger the dot.