

# Alaska Source Reservoired Oil Review

The Alliance

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# Outline

- Source Rock Development
- Potential Benefits to the State
- The Alaska Play
- Analogs
- Task Force and Potential Scenario
- Fracturing Points
- Animations of Drilling and Completion Practices

# Source Rock (Shale) Oil Development

- Wells are not prolific (50-100 BOPD stabilized)
- This leads to:
  - Dependable timing is a necessity
  - Many wells are required to maintain production
  - 10-20 rigs drilling for a single operator are typical in these plays
  - Year round operation is needed to maintain development and operations

# Shale Oil – Bakken Development, Watford City, ND



(Matthew Staver, Bloomberg.com, 11/17/11)

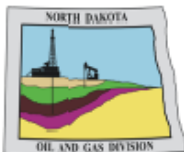
**NOT:**

Oil Shale (typically mined)

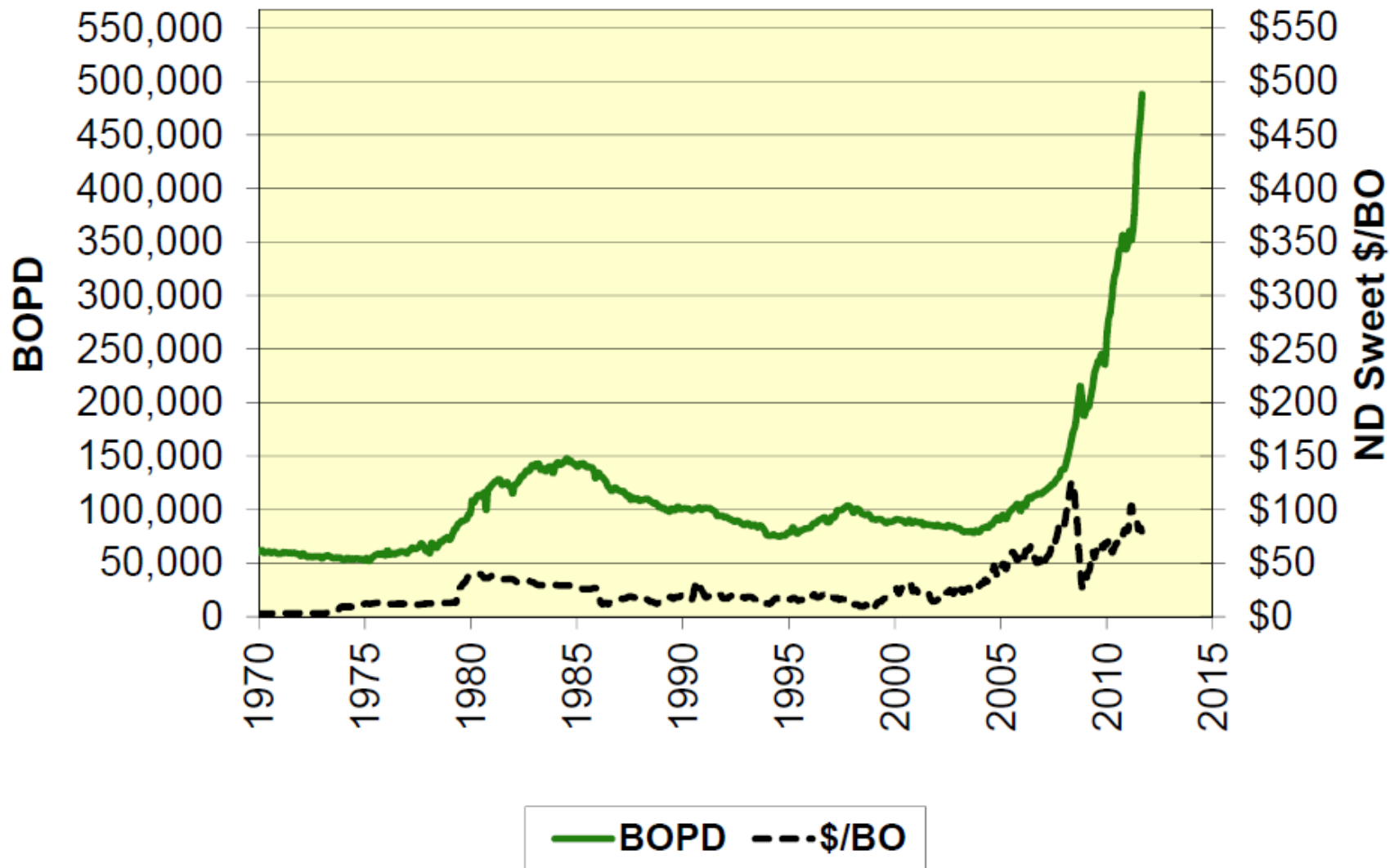
(JPTonline.org, The Tantalizing Promise of Shale Oil, January 2012)

# Potential Benefit to the State

- October 2011 production data from the North Dakota Industrial Commission website indicates 488,000 BOPD production rate for the state from 6000 wells in its Bakken development with future growth to 1,000,000 BOPD expected.
- In both Texas and North Dakota, benefits to the states have been staggering with the investment of oil and gas development. A December 22, 2011 article by Business Week entitled “Eagle Ford Drilling Rush May Boost Texas Tax Revenues 15-Fold” states that “States collected \$3.7 billion in taxes tied to extracting resources in the third quarter, a 76 percent increase from the same period in 2010, the U.S. Census Bureau reported today. **Texas’s collections increased 62 percent to \$807.6 million, second behind Alaska’s 1.26 billion, the bureau said.”**

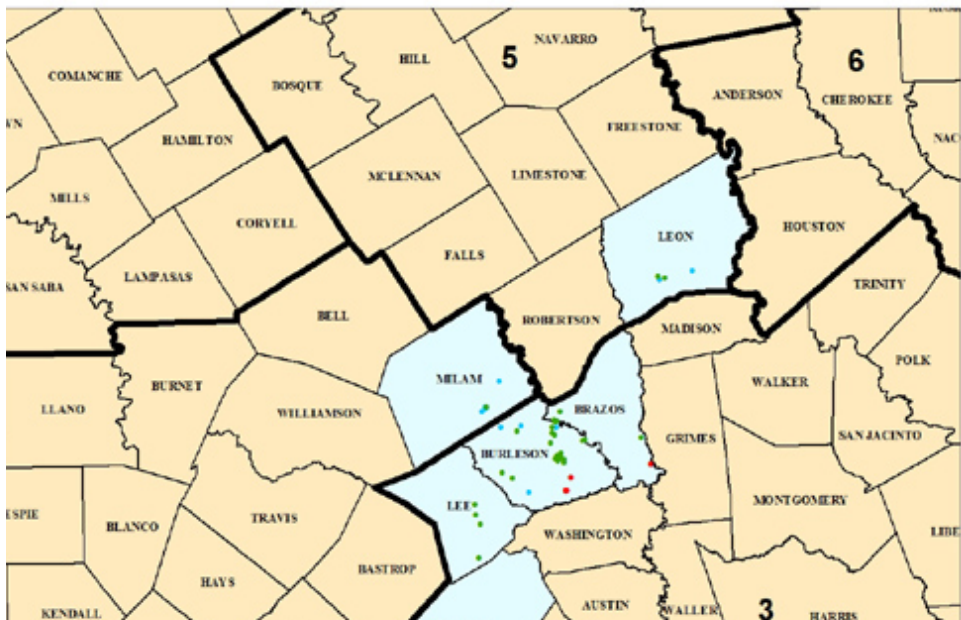


# North Dakota Daily Oil Produced and Price



**TABLE 2 – DECEMBER TEXAS TOP TEN OIL AND GAS PRODUCING COUNTIES RANKED BY PRELIMINARY PRODUCTION**

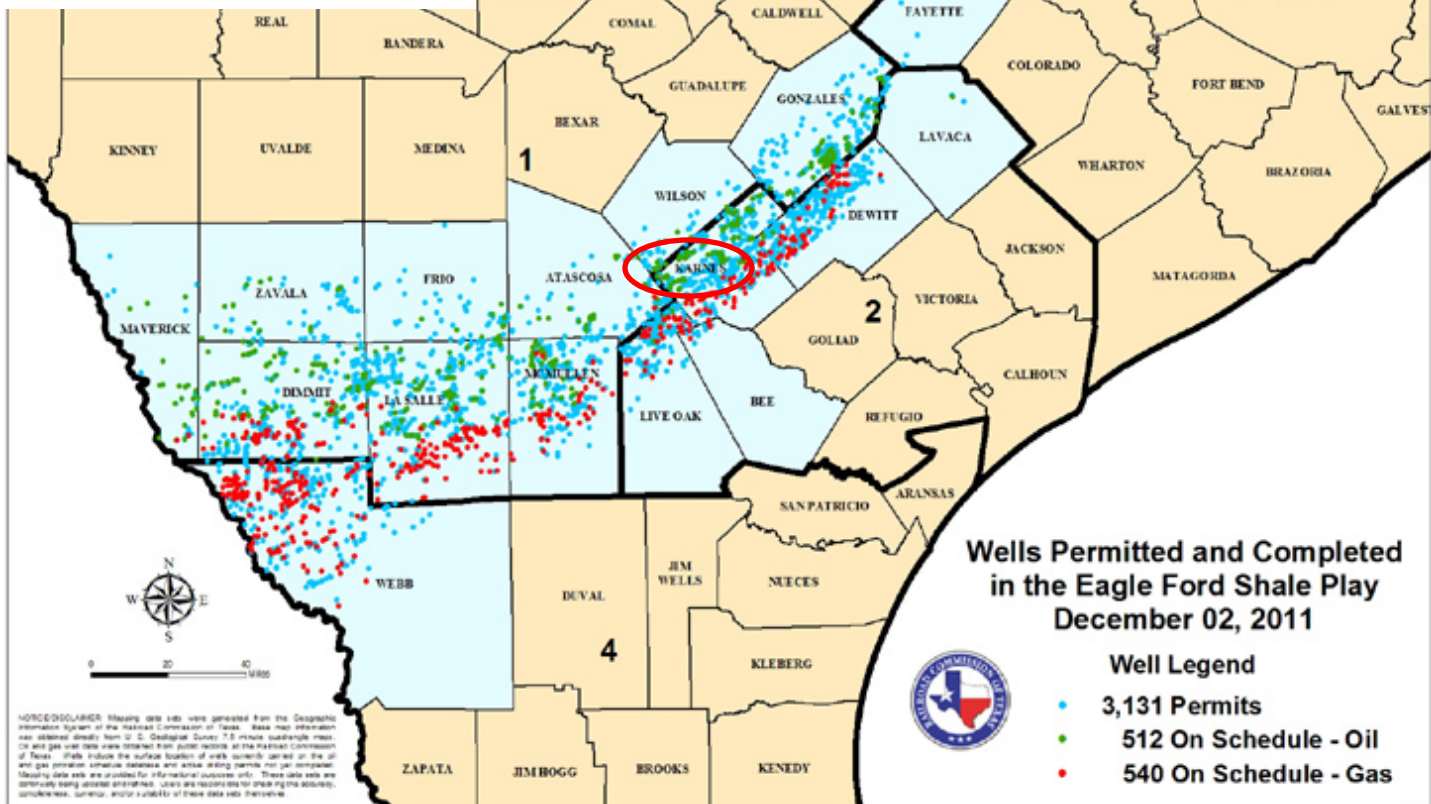
| COUNTY            | CRUDE OIL (BBLs) | COUNTY        | TOTAL GAS (MCF) |
|-------------------|------------------|---------------|-----------------|
| 1. ANDREWS        | 2,294,495        | 1. TARRANT    | 64,790,483      |
| 2. GAINES         | 2,124,264        | 2. JOHNSON    | 39,560,807      |
| 3. YOAKUM         | 1,805,359        | 3. PECOS      | 21,803,699      |
| 4. ECTOR          | 1,729,837        | 4. WEBB       | 21,586,240      |
| 5. UPTON          | 1,627,093        | 5. DENTON     | 19,892,140      |
| 6. MIDLAND        | 1,570,326        | 6. PANOLA     | 18,767,485      |
| 7. MARTIN         | 1,317,633        | 7. WISE       | 17,956,051      |
| 8. HOCKLEY        | 1,300,638        | 8. FREESTONE  | 17,373,069      |
| 9. SCURRY         | 1,178,243        | 9. ZAPATA     | 13,362,709      |
| 10. <b>KARNES</b> | 1,073,665        | 10. ROBERTSON | 13,265,560      |



12/12/11 Data

Source: Texas Railroad Commission 2/27/12 News Release

<http://www.rrc.state.tx.us/>



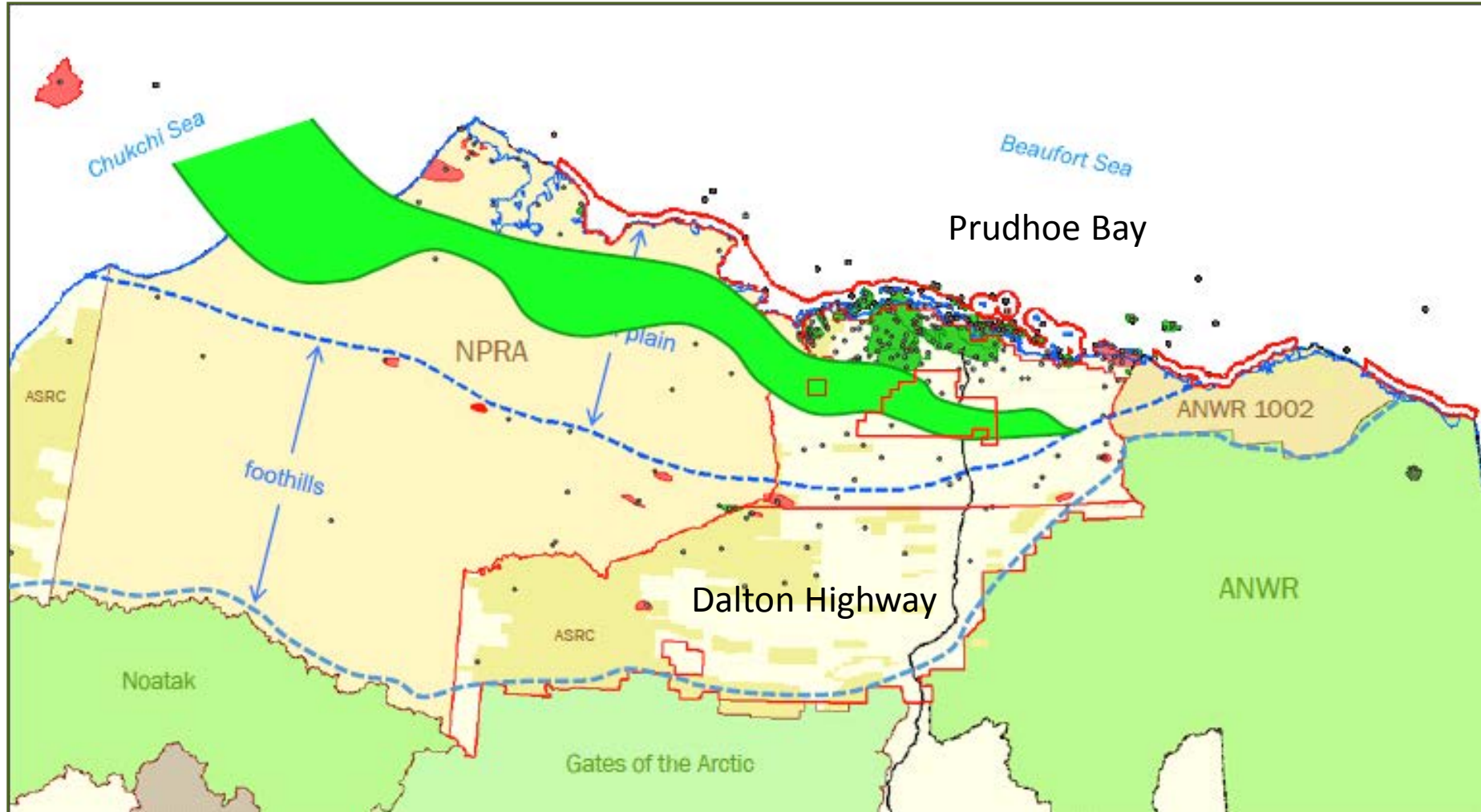
DISCLAIMER: Mapping data sets were generated from the Geographic Information System of the Railroad Commission of Texas. Base map information was obtained directly from U.S. Geological Survey 7.5 minute quadrangle maps. Oil and gas well data were obtained from public records at the Railroad Commission of Texas. Wells include the surface location of well centers, listed on the oil and gas permit, completion, leasehold and active drilling permits and gas compressor. Mapping data sets are provided for informational purposes only. These data sets are not intended to be used for legal purposes. Users are responsible for verifying the accuracy, completeness, currency, and/or reliability of these data sets themselves.



**Wells Permitted and Completed in the Eagle Ford Shale Play December 02, 2011**

- Well Legend**
- 3,131 Permits
  - 512 On Schedule - Oil
  - 540 On Schedule - Gas

# The Alaska Shale Oil Play

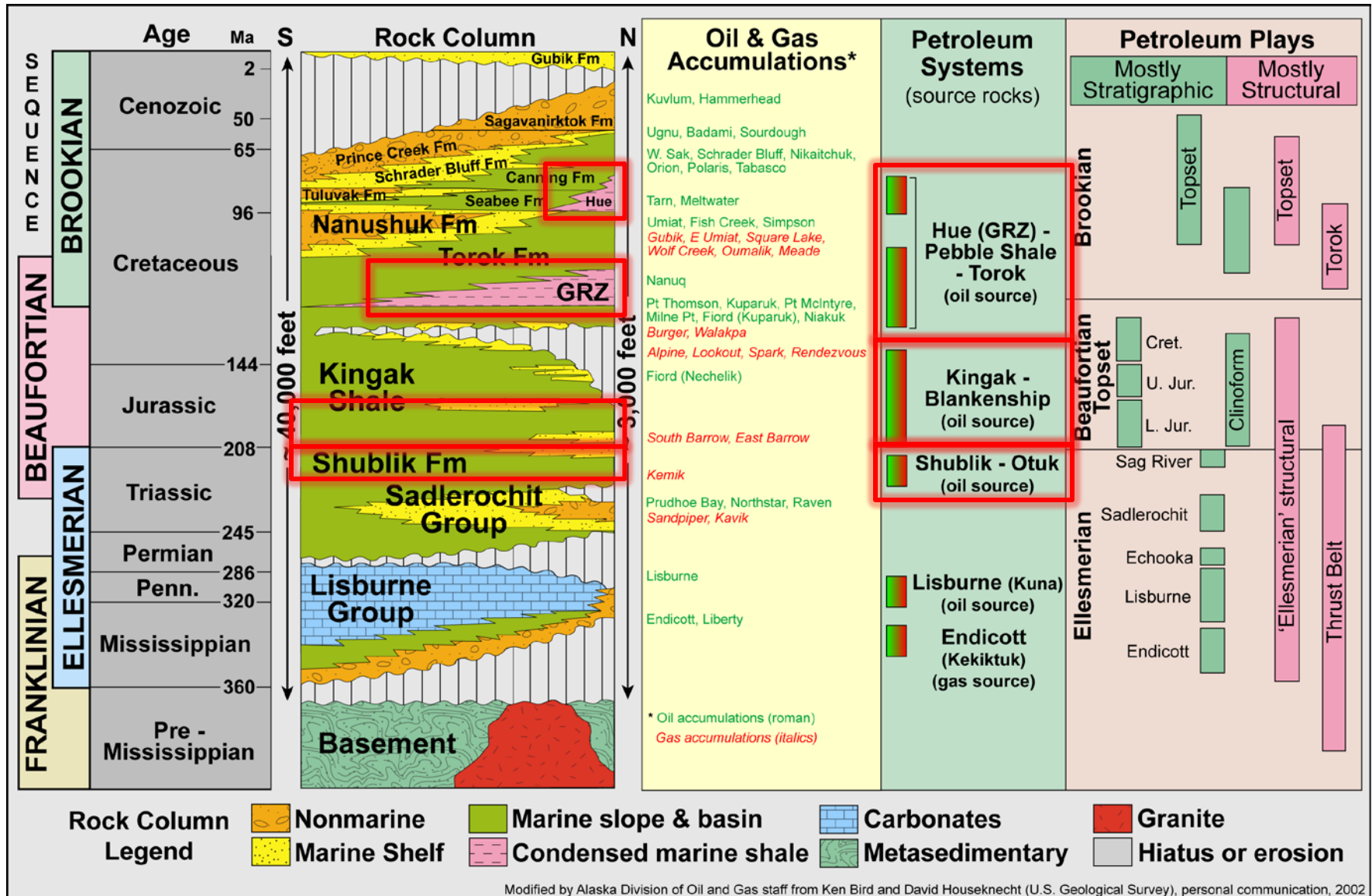


(State of Alaska, Division of Oil and Gas)



# North Slope Petroleum Systems

## 3 prolific source rock intervals

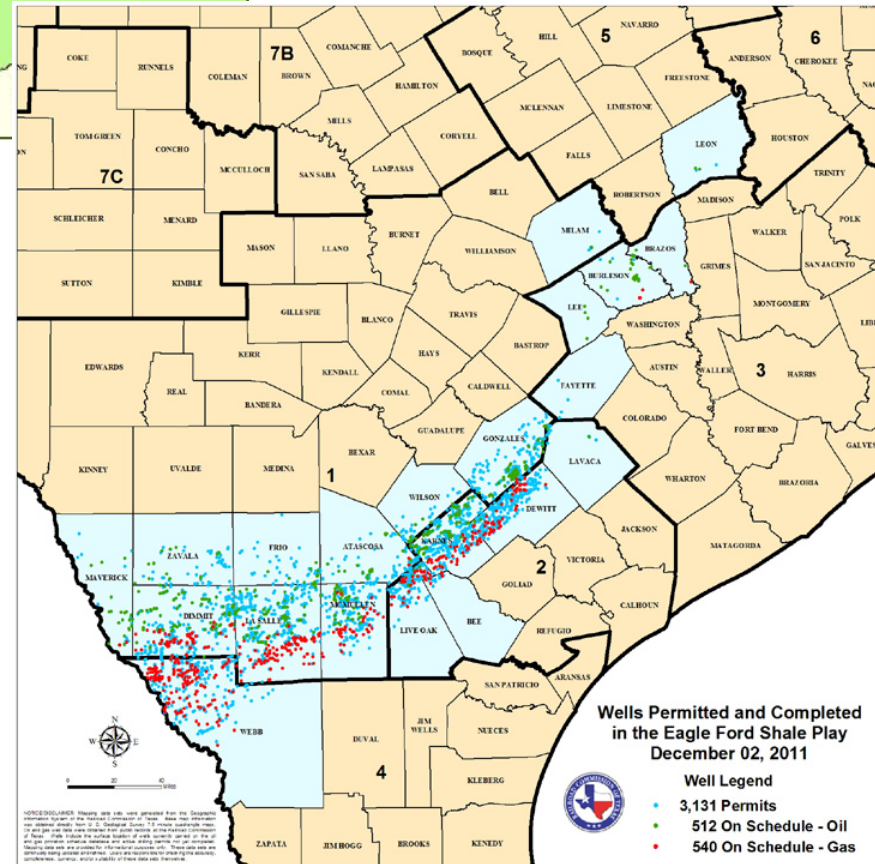
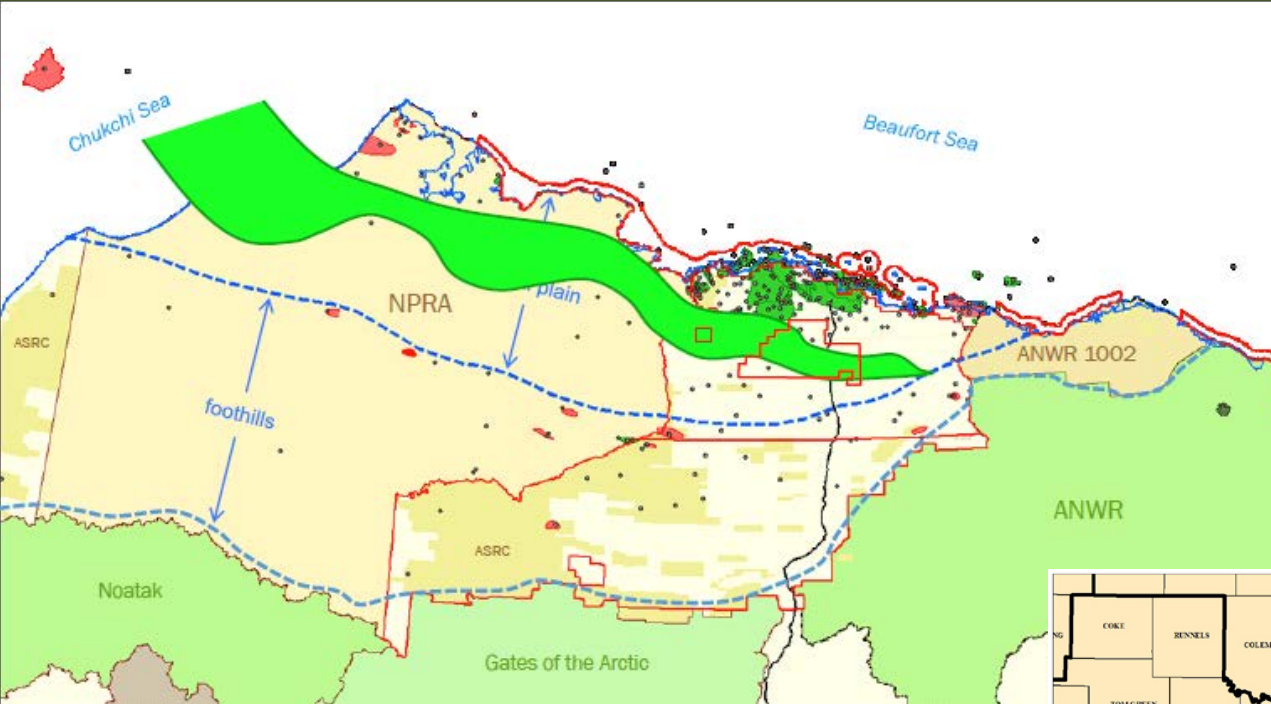


# USGS Alaska North Slope Source Rock Assessment

*The U.S. Geological Survey estimated potential, technically recoverable oil and gas resources for source rocks of the Alaska North Slope. Estimates (95-percent to 5-percent probability) range from zero to 2 billion barrels of oil and from zero to nearly 80 trillion cubic feet of gas.*

| Total petroleum systems (TPS)<br>and assessment units (AU) | AU<br>probability | Field<br>type | Total undiscovered resources |            |              |            |            |               |               |               |              |            |            |            |
|--|-------------------|---------------|------------------------------|------------|--------------|------------|------------|---------------|---------------|---------------|--------------|------------|------------|------------|
|  |                   |               | Oil (MMBO)                   |            |              |            | Gas (BCFG) |               |               |               | NGL (MMBNGL) |            |            |            |
|  |                   |               | F95                          | F50        | F5           | Mean       | F95        | F50           | F5            | Mean          | F95          | F50        | F5         | Mean       |
| <b>Shublik TPS</b>   |                   |               |                              |            |              |            |            |               |               |               |              |            |            |            |
| Shublik Shale Oil AU                                       | 0.95              | <i>Oil</i>    | 0                            | 428        | 928          | 463        | 0          | 418           | 981           | 462           | 0            | 10         | 26         | 12         |
| Shublik Shale Gas AU                                       | 0.95              | <i>Gas</i>    |                              |            |              |            | 0          | 36,612        | 72,195        | 38,405        | 0            | 184        | 442        | 205        |
| <b>Brookian TPS</b>  |                   |               |                              |            |              |            |            |               |               |               |              |            |            |            |
| Brookian Shale Oil AU                                      | 0.90              | <i>Oil</i>    | 0                            | 421        | 955          | 449        | 0          | 818           | 1,996         | 898           | 0            | 20         | 51         | 22         |
| Brookian Shale Gas AU                                      | 0.90              | <i>Gas</i>    |                              |            |              |            | 0          | 2,124         | 4,375         | 2,184         | 0            | 21         | 46         | 22         |
| <b>Kingak TPS</b>  |                   |               |                              |            |              |            |            |               |               |               |              |            |            |            |
| Kingak Shale Oil AU  | 0.40              | <i>Oil</i>    | 0                            | 0          | 117          | 28         | 0          | 0             | 238           | 57            | 0            | 0          | 6          | 1          |
| Kingak Shale Gas AU  |                   | <i>Gas</i>    | Not quantitatively assessed  |            |              |            |            |               |               |               |              |            |            |            |
| <b>Total continuous resources</b>                          |                   |               | <b>0</b>                     | <b>849</b> | <b>2,000</b> | <b>940</b> | <b>0</b>   | <b>39,972</b> | <b>79,785</b> | <b>42,006</b> | <b>0</b>     | <b>235</b> | <b>571</b> | <b>262</b> |

<http://pubs.usgs.gov/fs/2012/3013/pdf/fs2012-3013.pdf>



Comparison to most discussed analog:

Alaska: South of Prudhoe Bay Development

Texas: Eagle Ford Shale Play in South Texas

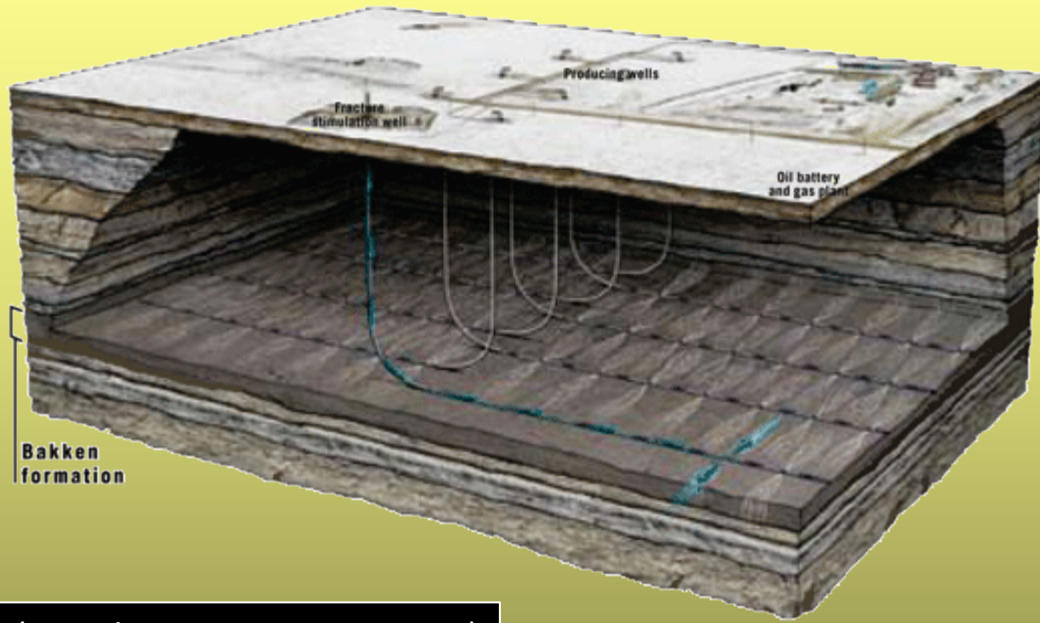
Scales of highlighted area in each map is approximately 400 Miles.

# Analog: Eagle Ford Shale



([www.royaltypartners.com](http://www.royaltypartners.com) 2011)

# Analog: Bakken Development



(Canadian Business Resources)

70 acres total surface impact (14 pads, 5 acres each) →  
17,920 acres of subsurface development (2 mile-long  
laterals on each side of road times 7 miles length times  
640 acres/mi<sup>2</sup>)



(courtesy Lynn Helms NDIC, DMR, 2011 )



**Alaska: Arctic Tundra – Not Conducive to Single Well Pads**

# Shale Task Force

- Multi-Agency State Task Force
  - Preparing for potential full development scenario
    - Familiarization
    - Logistics
    - Permitting Focus
  - Engaging Federal and Local Agencies
  - Working from speculative scenario

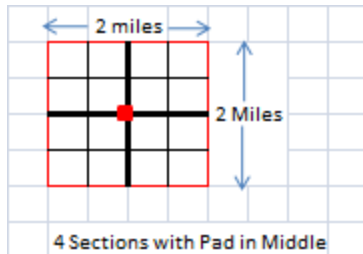
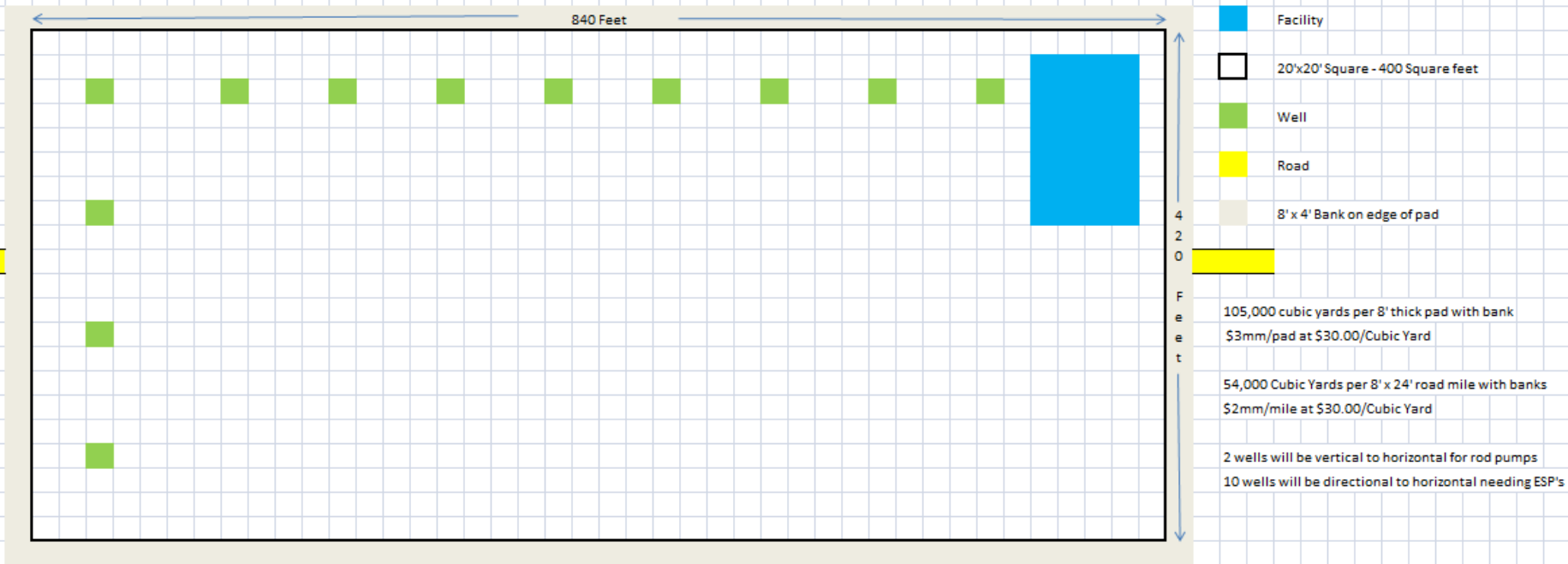
# Potential Scenario

- Disclaimer
  - Scenario is completely hypothetical and does not represent any plans of any potential operator. Pipelines and Facilities not adequately represented.
  - Exploration is required to prove viability.

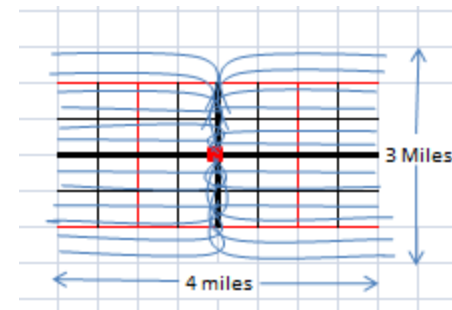


# Hypothetical Development Concept

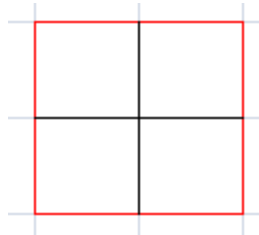
Pad Development Scenario



12 wells per pad  
 2 10,000' Laterals / Well  
 24 Laterals / Pad  
 1 rig drills 1 pad per year

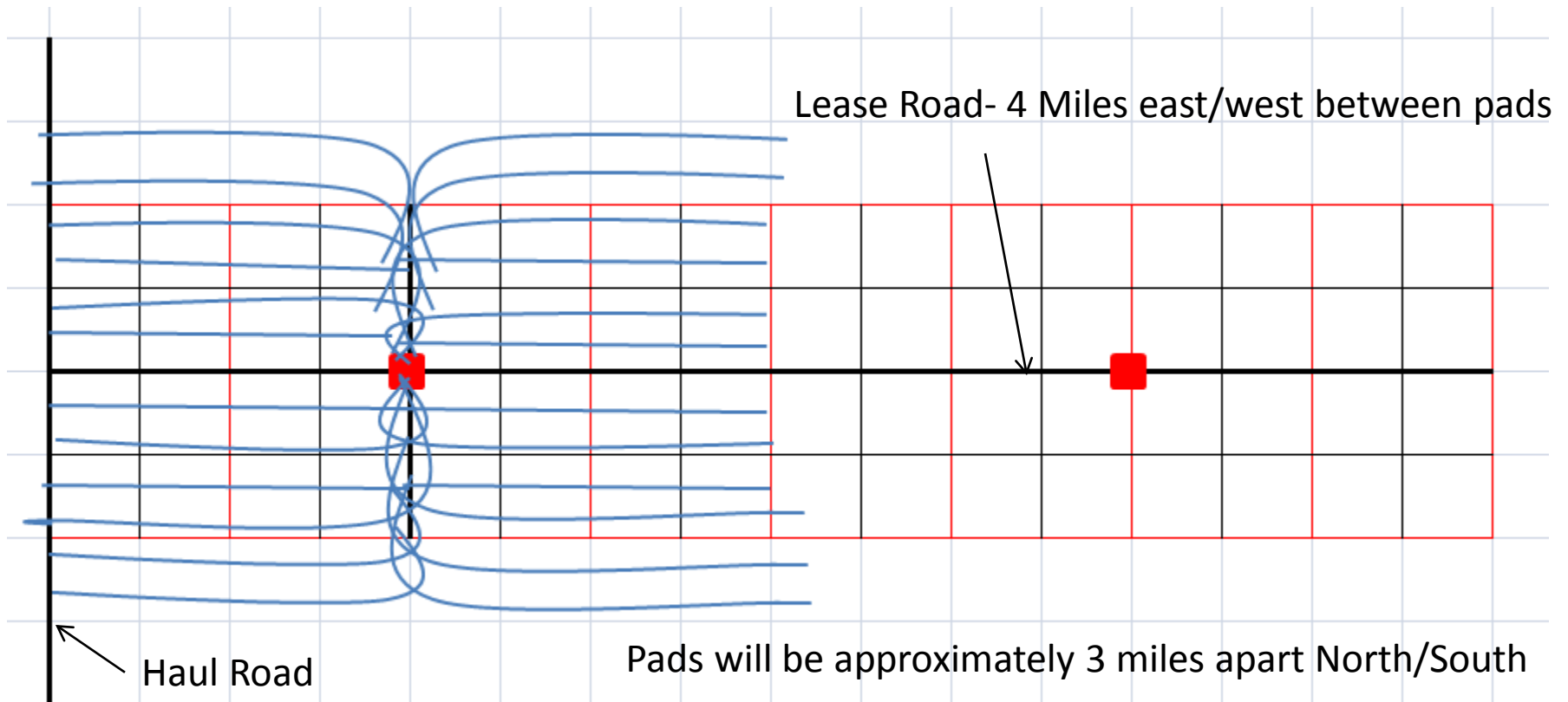


# Hypothetical Development Concept



One Section – One Mile by One Mile

Drill Existing Pad while Road and Next Year's Pad is being built- On a per rig basis

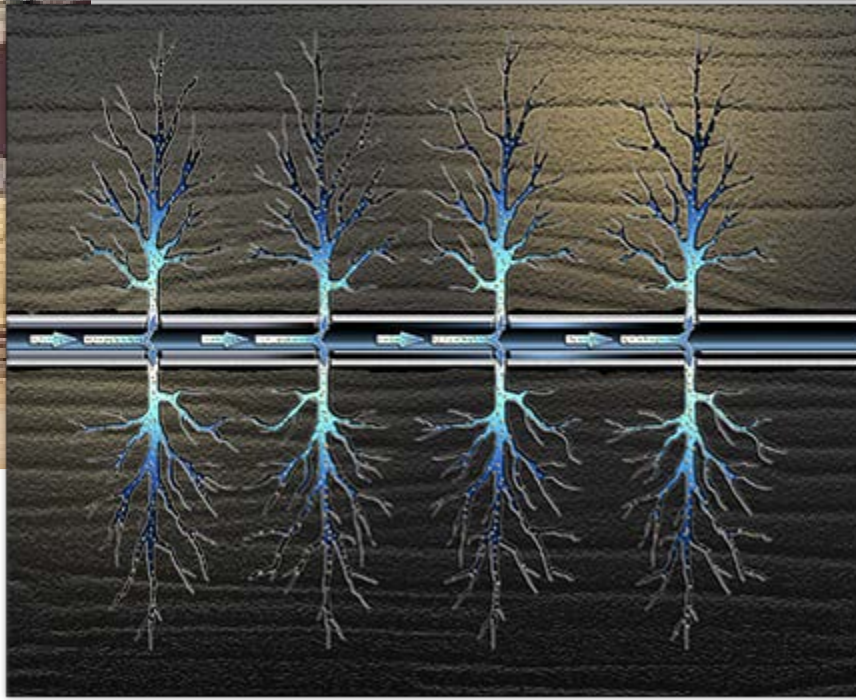


# Fracturing

34 frac trucks on location  
*(Oil & Gas Journal)*



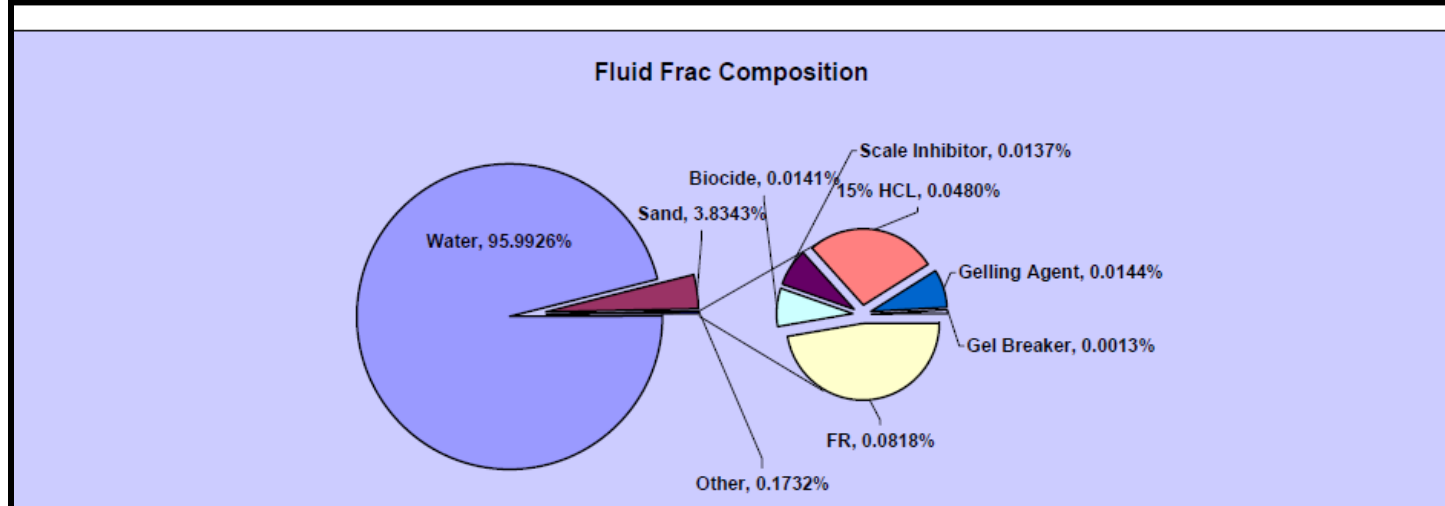
**Hydraulic Fracturing:** Mixture of water, sand and chemicals pressurized and pumped into the well to form microscopic fractures in shale.



# Fracturing: Frac Fluids

Composition for a 16-stage West Virginia Marcellus Shale well

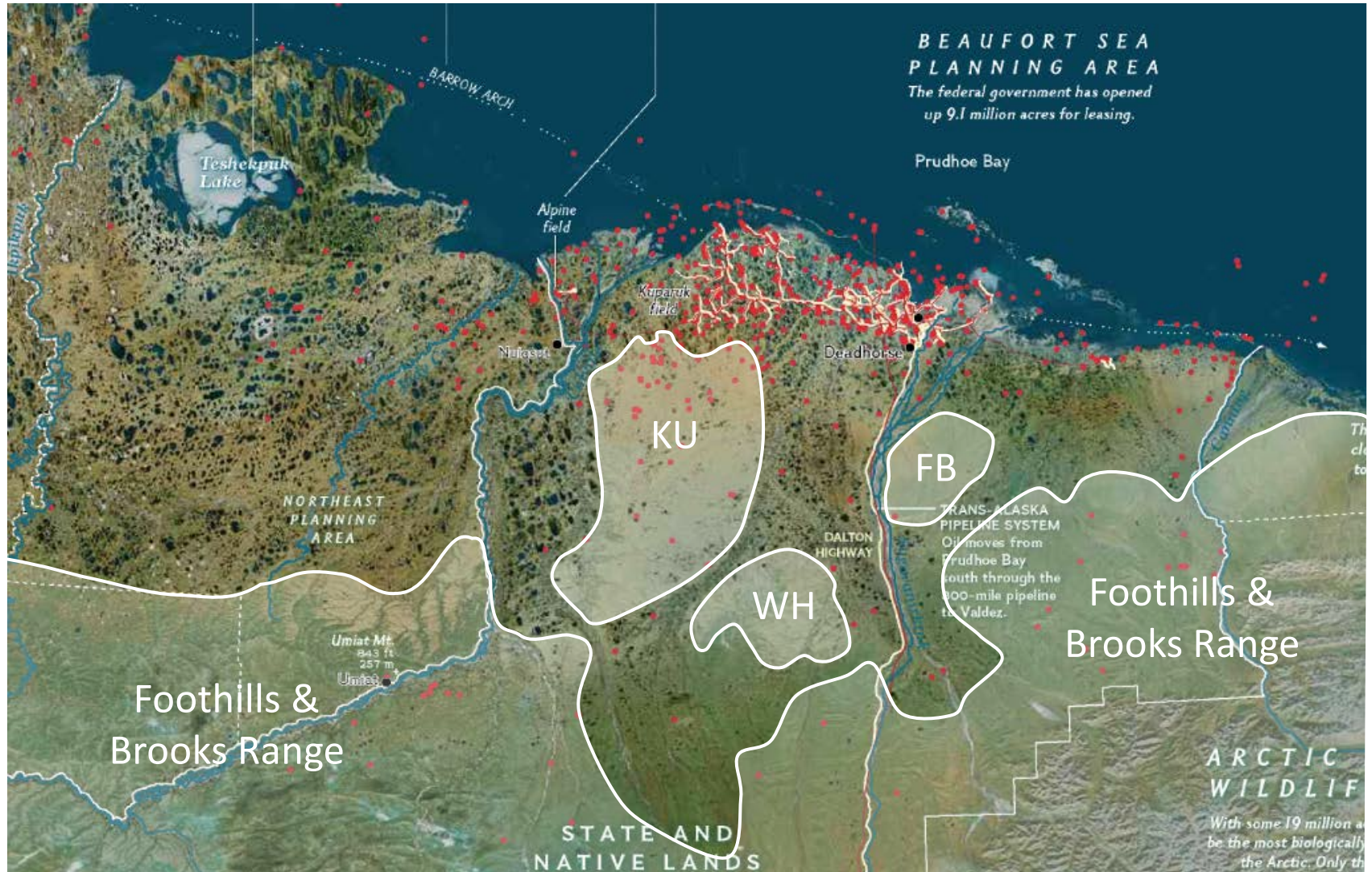
| Product Name    | Additive            | Purpose   | Use and Dilution                                       | Actual Volume | Overall % |
|-----------------|---------------------|---|--|---------------|-----------|
| Water           | Carrier Fluid       | Creates fracture network in shale and carry sand to the formation         | Approximately 4 million gallons per well               | 7,416,822 gal | 95.9926%  |
| Sand            | Sand                | Enable fractures to remain open and allow gas to escape into the wellbore | Approximately 4 million pounds per well                | 296,255 gal   | 3.8343%   |
| FR              | Friction Reducer    | Reduces friction between pipe and fluid                                   | Diluted at one gallon per 1,000 gallons of water       | 6,318 gal     | 0.0818%   |
| Biocide         | Antimicrobial Agent | Eliminates bacteria in water sources                                      | Diluted at one-half gallon per 1,000 gallons of water  | 1,089 gal     | 0.0141%   |
| Scale Inhibitor | Scale Inhibitor     | Prevents scale deposits   | Diluted at one gallon per 1,000 gallons of water       | 1,057 gal     | 0.0137%   |
| 15% HCL         | Acid                | Dissolves cement and minerals in the perforations (non-diluted)           | 250 gallons per stage (non-diluted chemicals)          | 3,709 gal     | 0.0480%   |
| Gelling Agent   | Viscosifier         | Adds viscosity to the fluid   | Diluted at five gallons per 1,000 gallons of water     | 1,109 gal     | 0.0144%   |
| Gel Breaker     | Breaker             | Reduces viscosity of fluid  | Diluted at one-half gallons per 1,000 gallons of water | 98 gal        | 0.0013%   |



Source: EQT Energy, 2011 (<http://www.eqt.com/docs/pdf/FluidCompositions/Well512456.pdf>)

# Surface Water Limitations?

Kuparuk Uplands, White Hills, Franklin Bluffs, Foothills



(National Geographic, 2006; <http://ngm.nationalgeographic.com/ngm/0605/feature1/map.html>)

# Halliburton Outreach

## HF Microsite

Home   CleanSuite™ Technologies   Fluids Disclosure   Fracturing 101   Glossary

## Hydraulic Fracturing

An "overnight" triumph of science and engineering, 60-plus years in the making. Today, it's being used to redefine what's possible in accessing clean-burning energy resources deep underground. What will it help us do tomorrow? Click around to find out.

**Hydraulic Fracturing 101**

Sand, water and pressure: the basic components of building a great sandcastle, and the same ones being used today to spur a revolution in the way Americans access and utilize clean-burning energy resources confined deep underground.

At the forefront of this revolution is a technology known as hydraulic fracturing, a well stimulation practice first pioneered by Halliburton in the 1940s –

**In-Focus: What's in the Fluids?**

Even though sand and water typically comprise more than 99.5 percent of the fluid system used in fracturing, getting that fluid to formations thousands of feet underground requires advanced chemistry and engineering to do things like:

- Fight the growth and buildup of bacteria in the fluid and the wellbore

**CleanSuite™ Technologies**

Halliburton invests considerable time, energy and resources in engineering solutions that set new standards for environmental safety – all while helping our customers do more by using less.

- CleanStim™ Formulation, a fracture fluid system comprised of materials sourced entirely from the food industry.

# Public Access

## Pennsylvania Water Frac Formulation

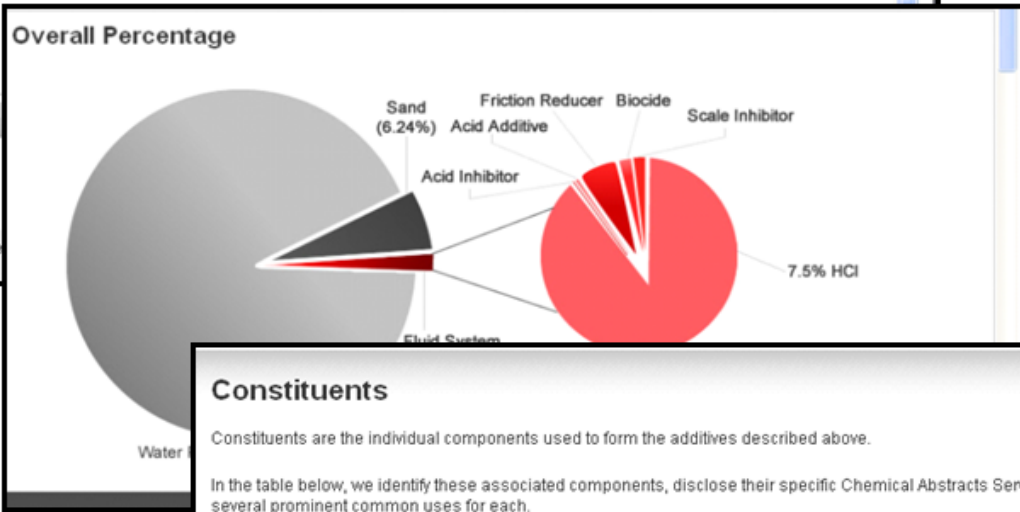
Close X

The Marcellus Shale is a 390-million-year-old rock formation that underlies more than 34,000 square miles of Pennsylvania, in addition to extending into a number of neighboring states.

Estimated to house hundreds of trillions of cubic feet of natural gas, the Marcellus shale play is currently under development primarily in the southwest and north-central regions of the state. Typical fracturing operations in Pennsylvania take place at a depth of between 4,000 feet and 8,500 feet below the ground surface.

### Additives

| Product Name | Additive      |
|--------------|---------------|
| BE-9         | Biocide       |
| FE-1A        | Acid Additive |



### Constituents

[Additives](#) | [Overall Percentage](#) | [Constituents](#)

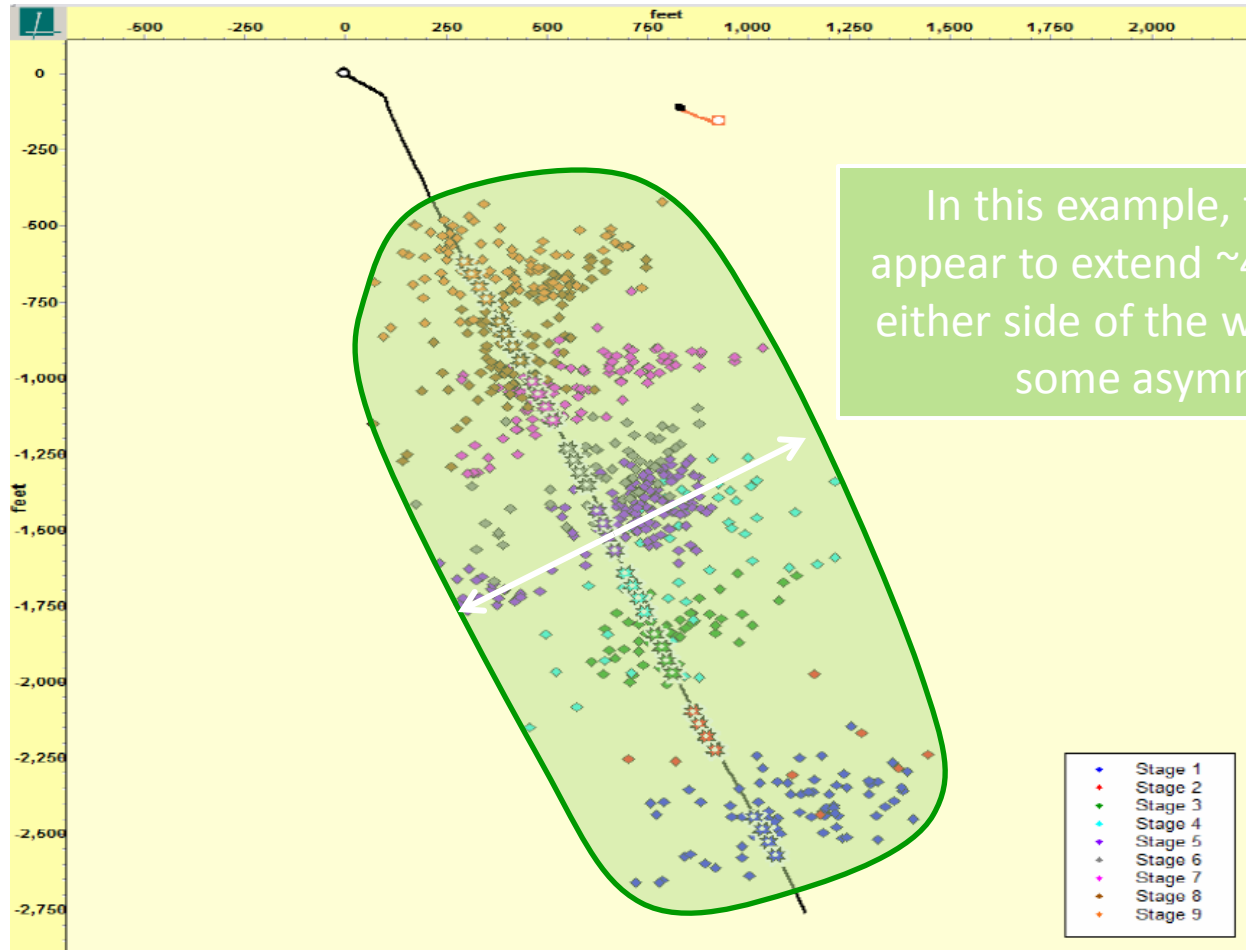
Constituents are the individual components used to form the additives described above.

In the table below, we identify these associated components, disclose their specific Chemical Abstracts Service (CAS) identification numbers, and list several prominent common uses for each.

| Constituent Name                             | Generic Name              | CAS Number | Common Use   | Hazardous as Appears on MSDS |
|--|---------------------------|------------|--|------------------------------|
| Acetic Acid                                  | Organic Acid              | 64-19-7    | Processed Fruit, Cheese, Meat and Poultry                          | Yes                          |
| Acetic Anhydride                             | Anhydride                 | 108-24-7   | Agricultural Microbiocide Agent                                    | Yes                          |
| Acetophenone, Thiourea, Formaldehyde Polymer | Modified Thiourea Polymer | 68527-49-1 | Industrial Acid Corrosion Inhibitor for Cooling Towers and Boilers | No                           |
| Alcohol, C14-C15 Ethoxylate                  | Polyoxyalkylene           | 68951-67-7 | Liquid Detergent, Disinfectant Toilet Cleaner, Stain Remover       | No                           |

# Fracturing: Job Placement

Where are the fractures and how far do they extend?

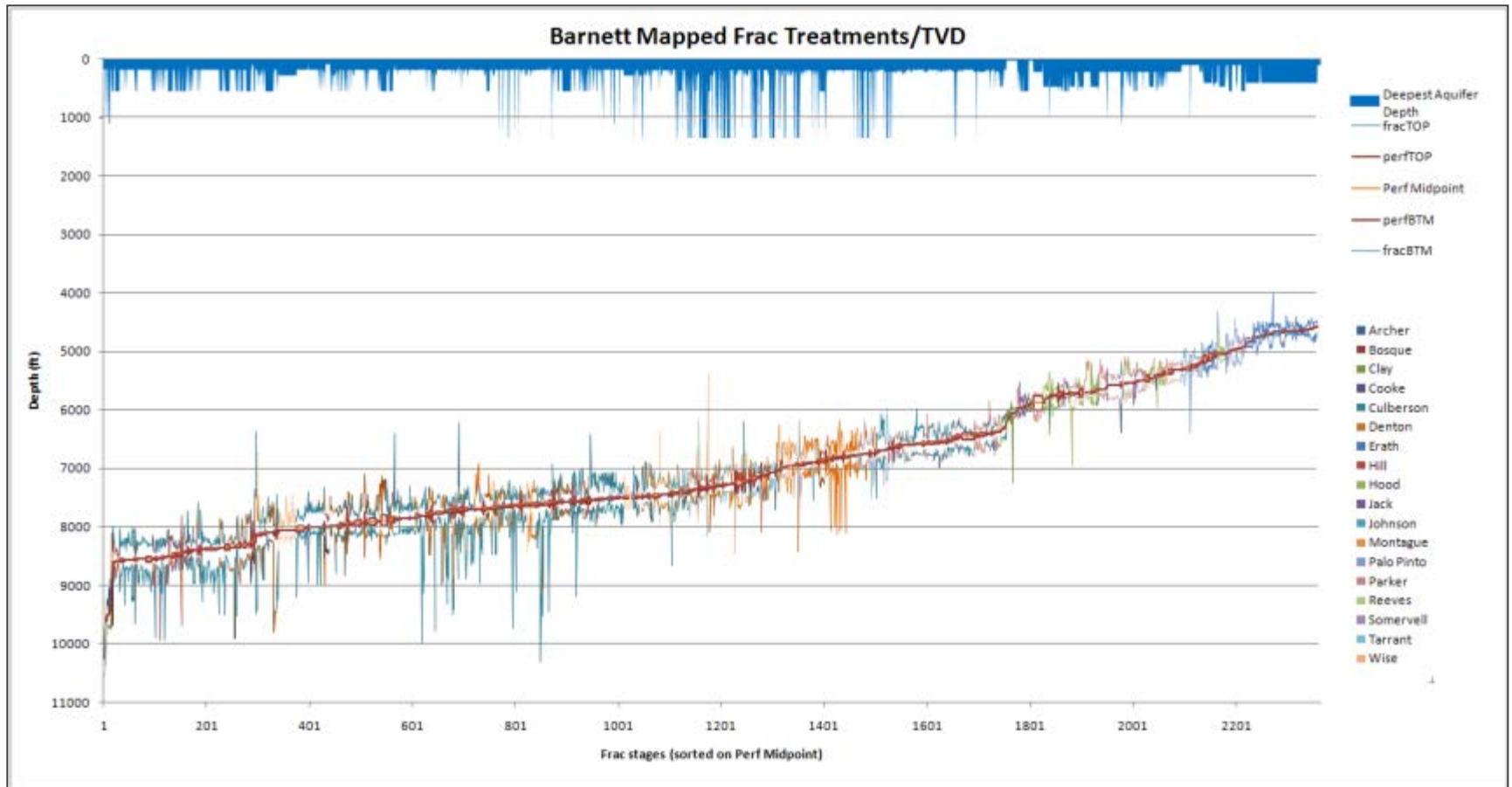


Microseismic map of 9-stage hydraulically fractured horizontal well (Bello, 2009)



# Fracture Height Determination

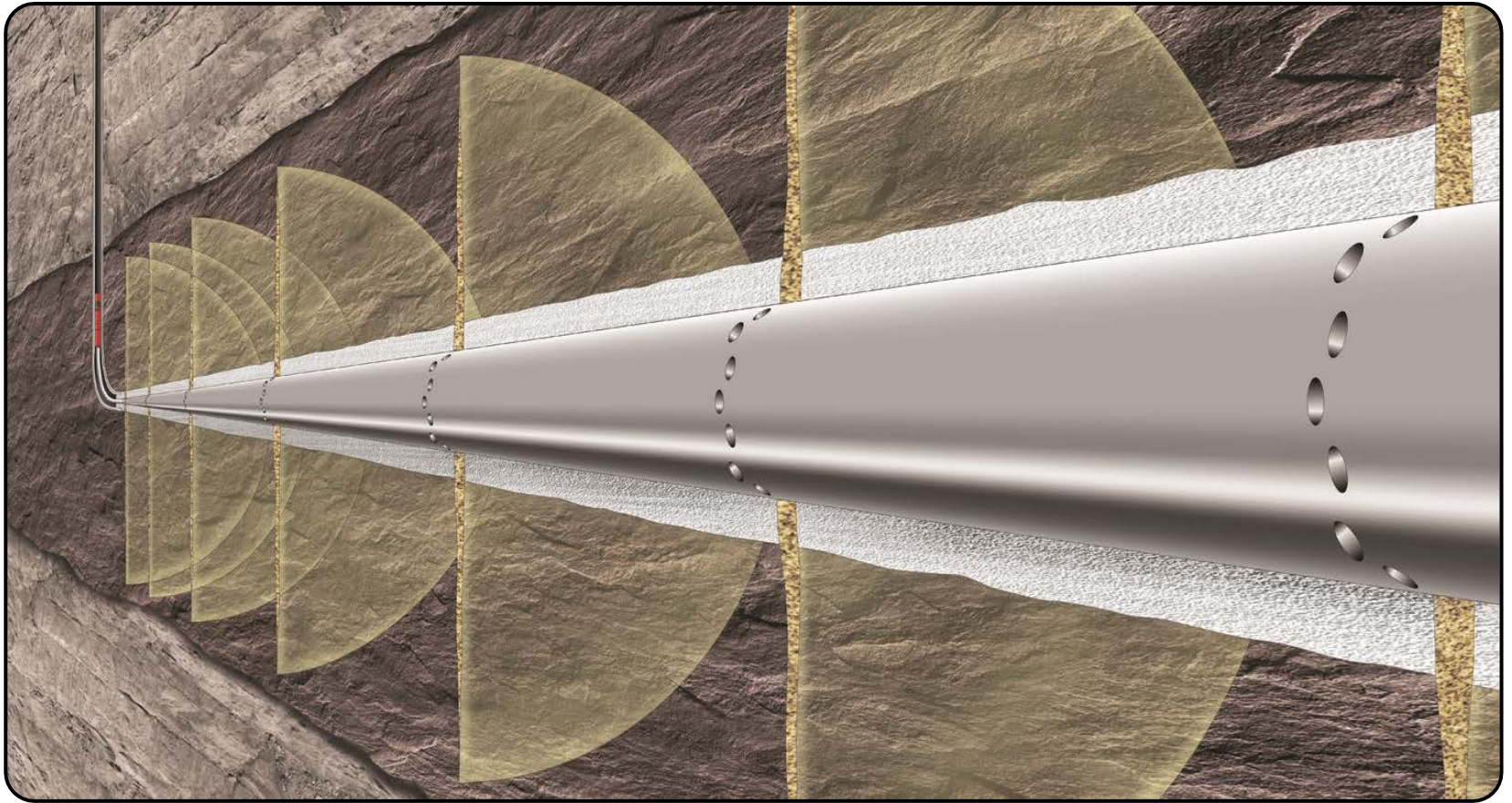
*Barnett*



Kevin Fisher, "Data Confirm Safety of Well Fracturing" *The American Oil & Gas Reporter* – July 2010

# Drilling and Well Completion

*Completion Videos (10 Minutes)*



Courtesy: Halliburton

# Additional Information

- Legislative Testimony 11/1/11  
[http://www.legis.state.ak.us/basis/get\\_documents.asp?chamber=HRES&session=27&bill=&date1=11/1/2011&time2=1001](http://www.legis.state.ak.us/basis/get_documents.asp?chamber=HRES&session=27&bill=&date1=11/1/2011&time2=1001)
- USGS Assessment (Report and Fact Sheet)  
<http://energy.usgs.gov/Miscellaneous/Articles/tabid/98/ID/146/Shale-Gas-and-Shale-Oil-Resource-Potential-of-the-Alaska-North-Slope.aspx>
- Frac Focus: <http://fracfocus.org/>
- <http://www.Halliburton.com/HydrualicFracturing>

Photo by Todd Yates, Corpus Christi Caller-Times



([www.caller.com](http://www.caller.com), Eagle Ford: As oil flows, so do region's jobs and growth with no end near, 2/1/2011)

Questions?