Alaska Source Reservoired Oil Review

The Alliance
3/8/2012
Greg Hobbs, P.E.
Petroleum Engineer,
State of Alaska, Division of Oil and Gas

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:

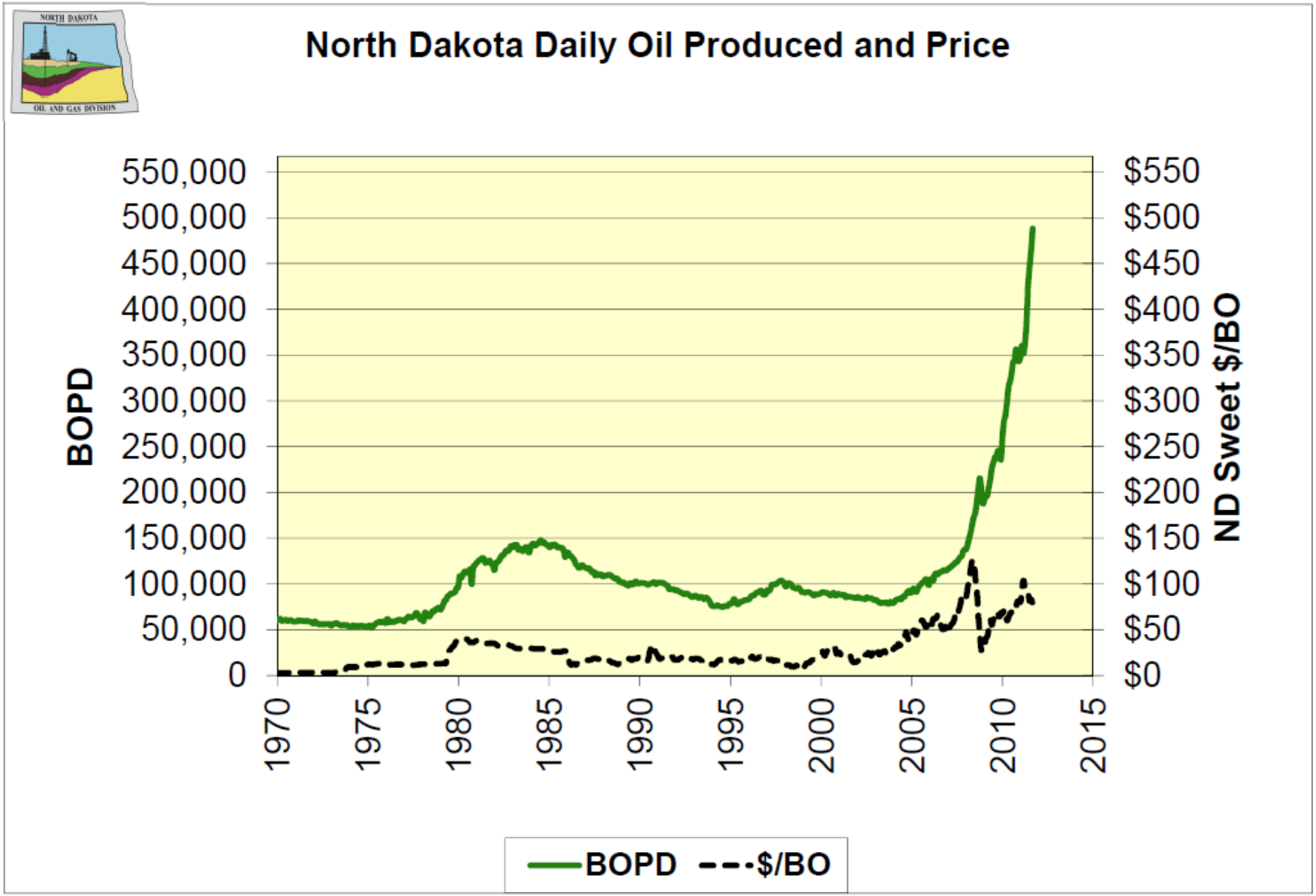
Oil Shale (typically mined)

(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 Oil and Gas Division (https://www.dmr.nd.gov/oilgas/stats/DailyProdPrice.pdf)

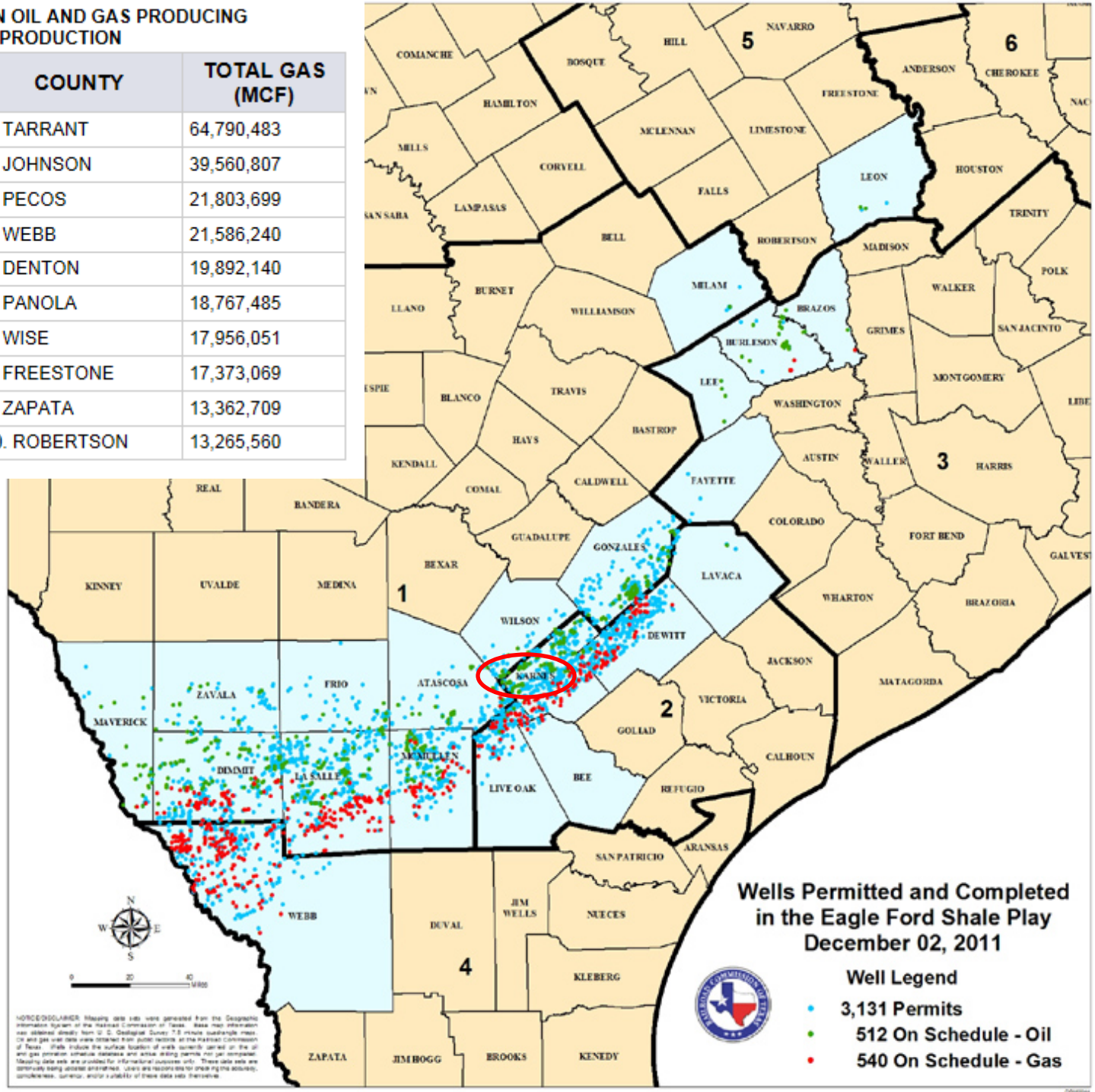
TABLE 2 – DECEMBER TEXAS TOP TEN OIL AND GAS PRODUCING COUNTIES RANKED BY PRELIMINARY PRODUCTION

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. KARNES	1,073,665	10. ROBERTSON	13,265,560

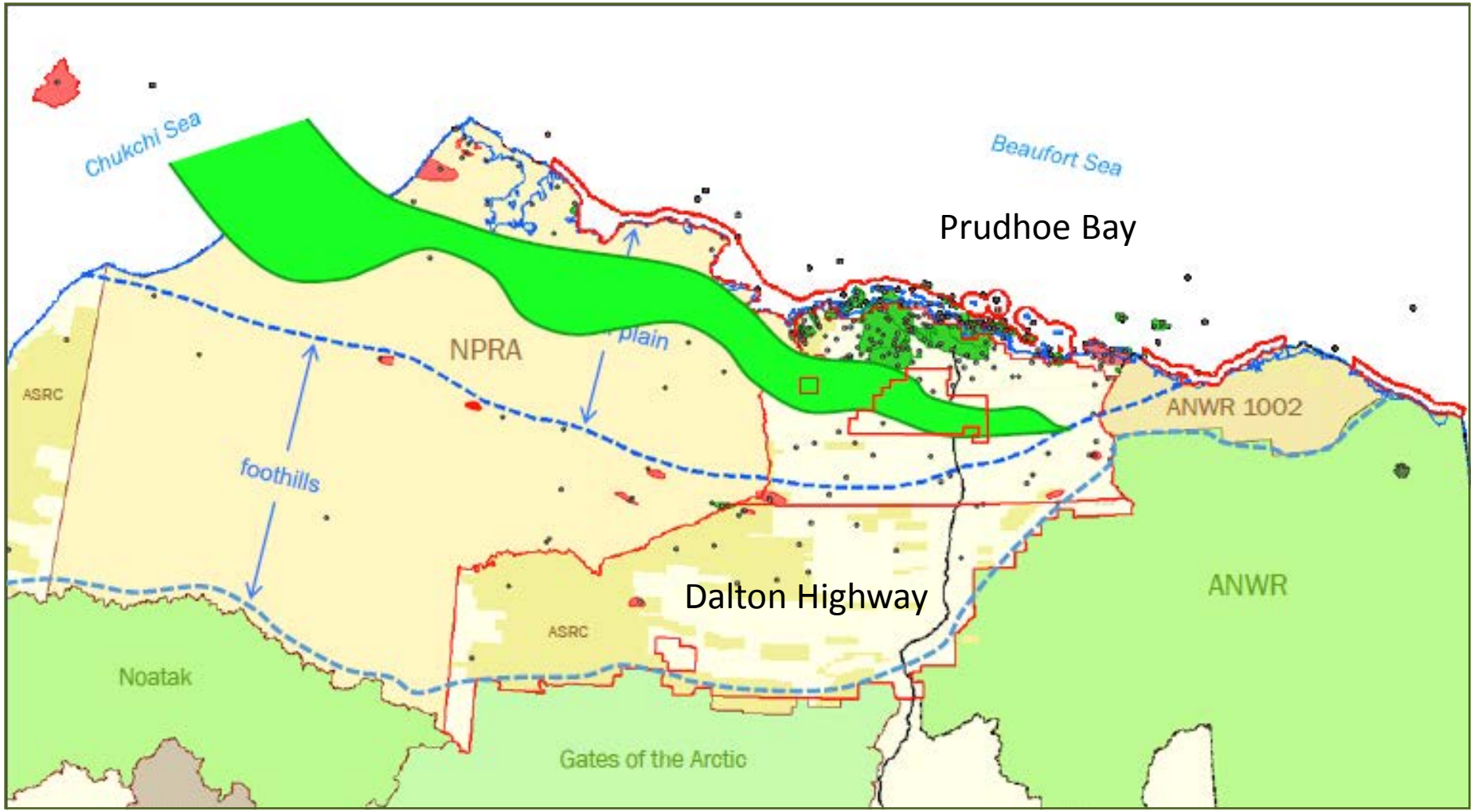
12/12/11 Data

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

(http://www.rrc.state.tx.us/)



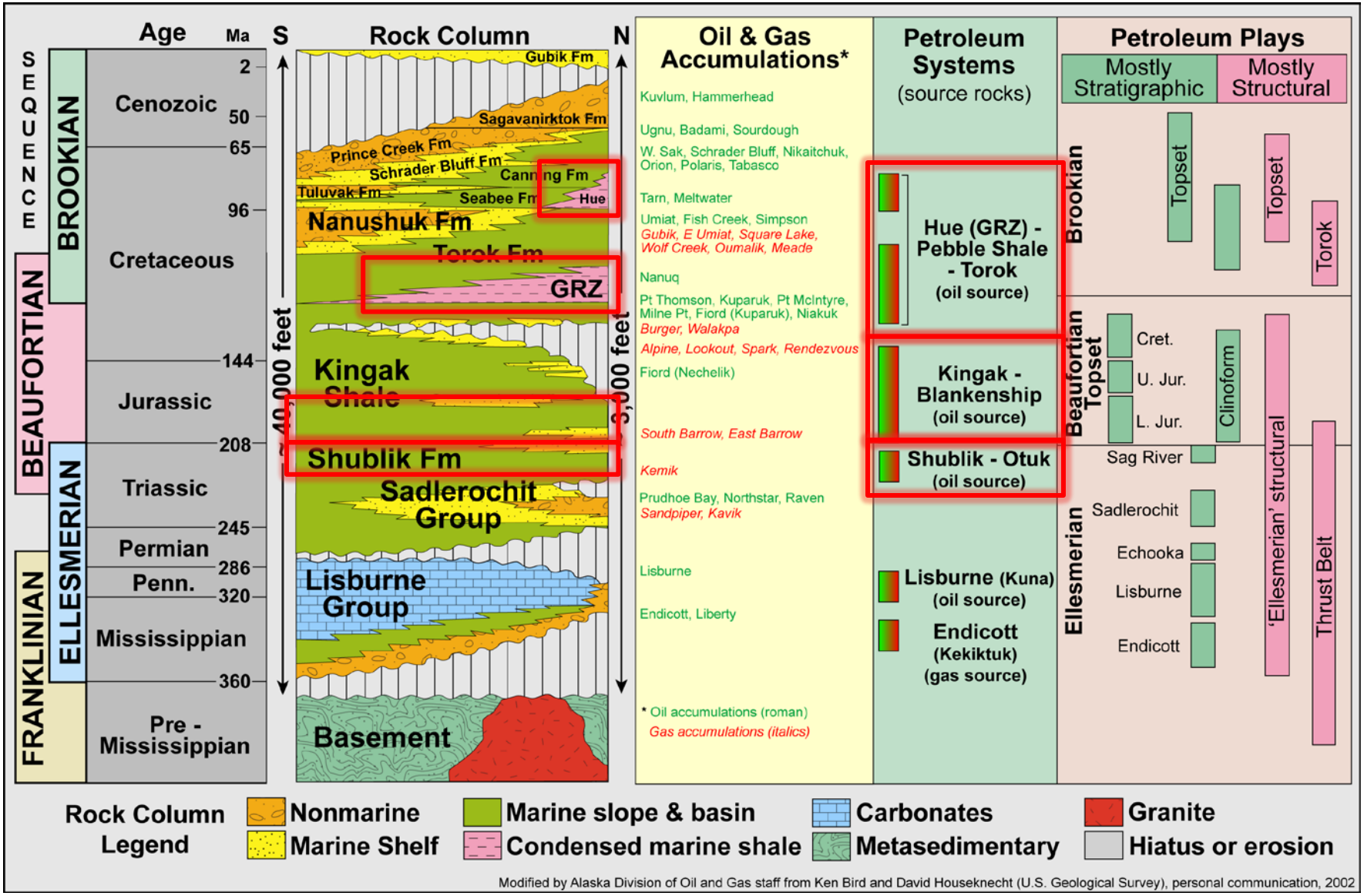
The Alaska Shale Oil Play



(State of Alaska, Division of Oil and Gas)

North Slope Petroleum Systems

3 prolific source rock intervals



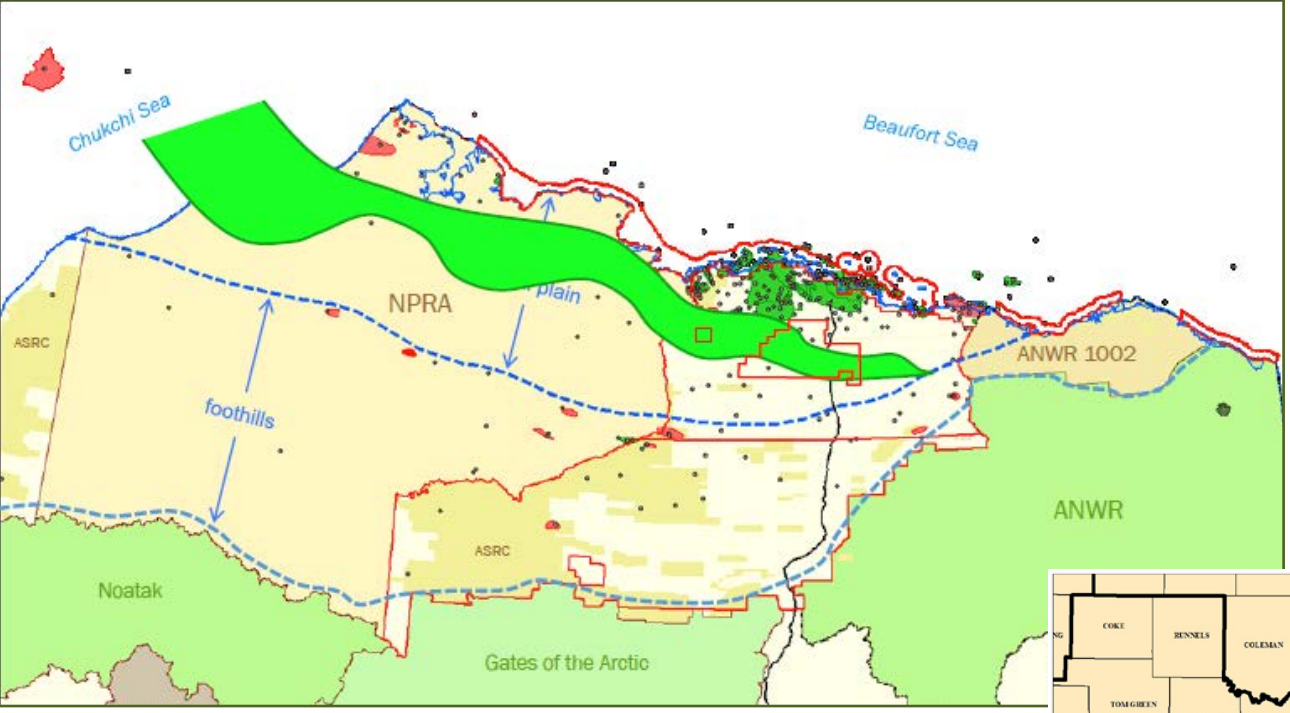
Modified by Alaska Division of Oil and Gas staff from Ken Bird and David Houseknecht (U.S. Geological Survey), personal communication, 2002

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

(http://pubs.usgs.gov/fs/2012/3013/pdf/fs2012-3013.pdf)

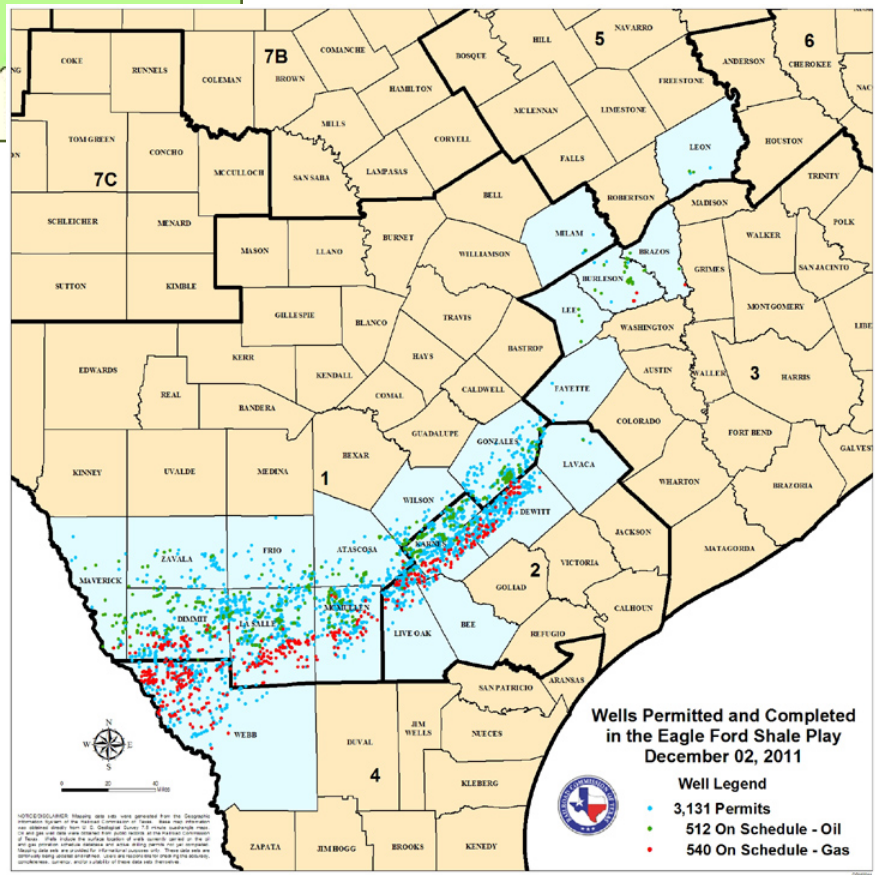


Comparison to most discussed analog:

Alaska: South of Prudhoe Bay Development

Texas: Eagle Ford Shale Play in South Texas

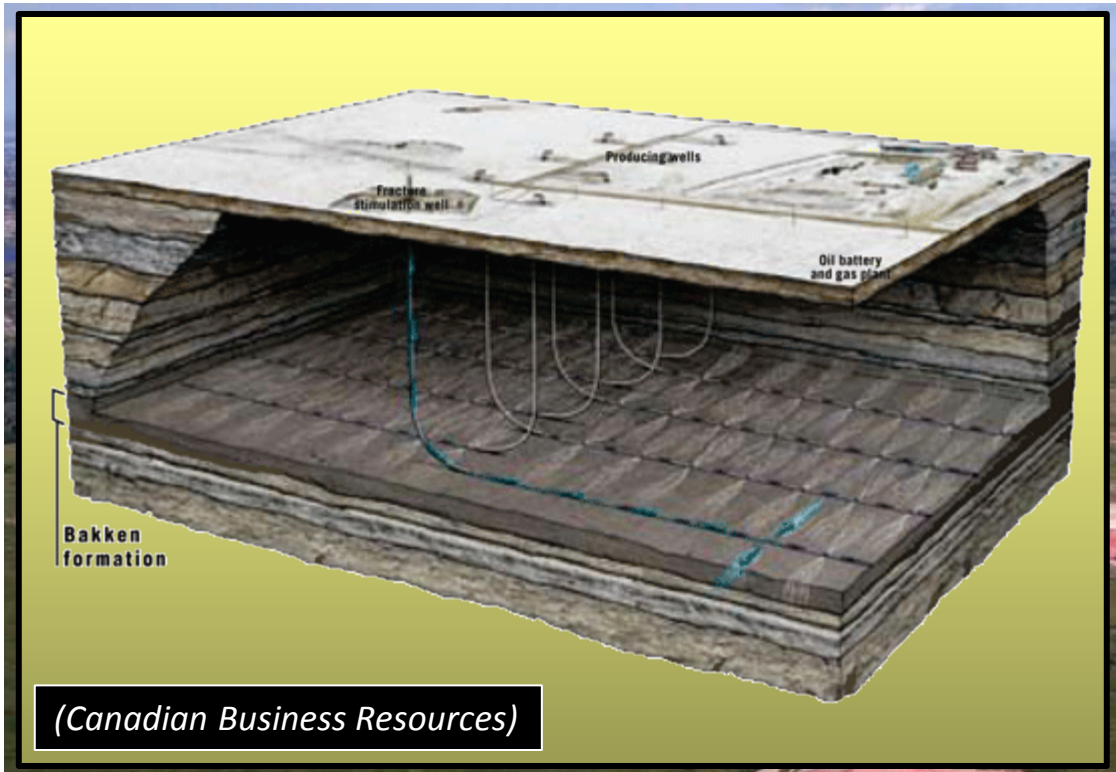
Scales of highlighted area in each map is approximately 400 Miles.



Analog: Eagle Ford Shale

(www.royaltypartners.com 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^2)

(courtesy Lynn Helms NDIC, DMR, 2011)

Alaska: Arctic Tundra – Not Conducive to Single Well Pads

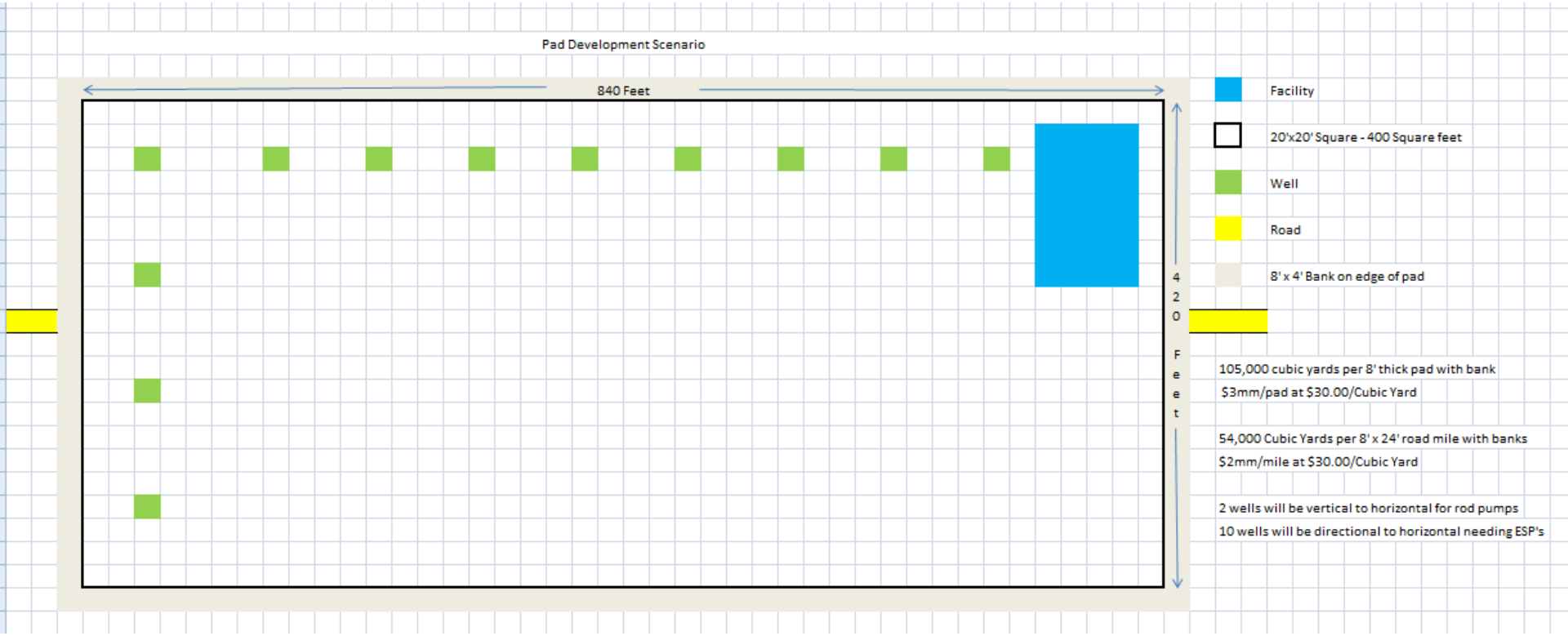
Shale Task Force

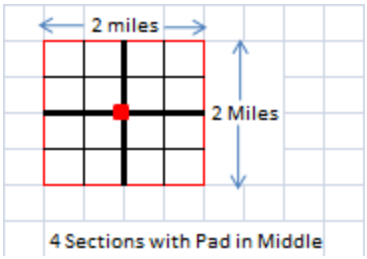
- Multi-Agency State Task Force
  - Preparing for potential full development scenario
    - Familiarization
    - Logistics
    - Permitting Focus
  - Engaging Federal and Local Agencies
  - Working from speculative scenario

Potential Scenario

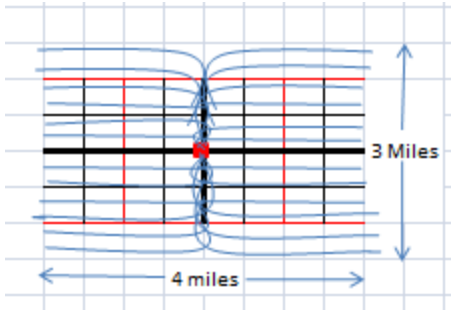
- Disclaimer
  - Scenario is completely hypothetical and does not represent any plans of any potential operator. Pipelines and Facilities not adequately represented.
  - Exploration is required to prove viability.

Hypothetical Development Concept

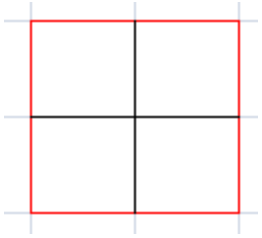




12 wells per pad
2 10,000’ Laterals / Well
24 Laterals / Pad
1 rig drills 1 pad per year

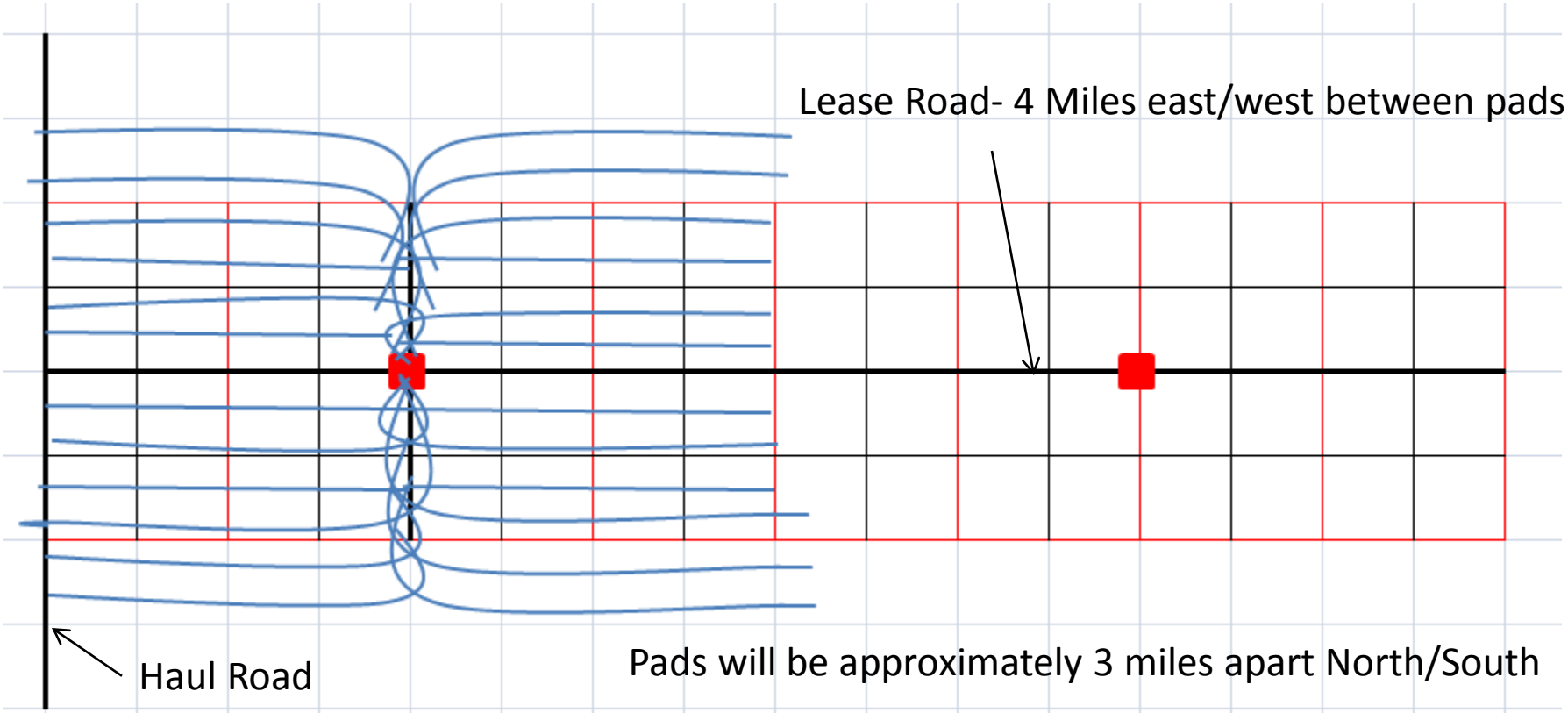


Hypothetical Development Concept



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

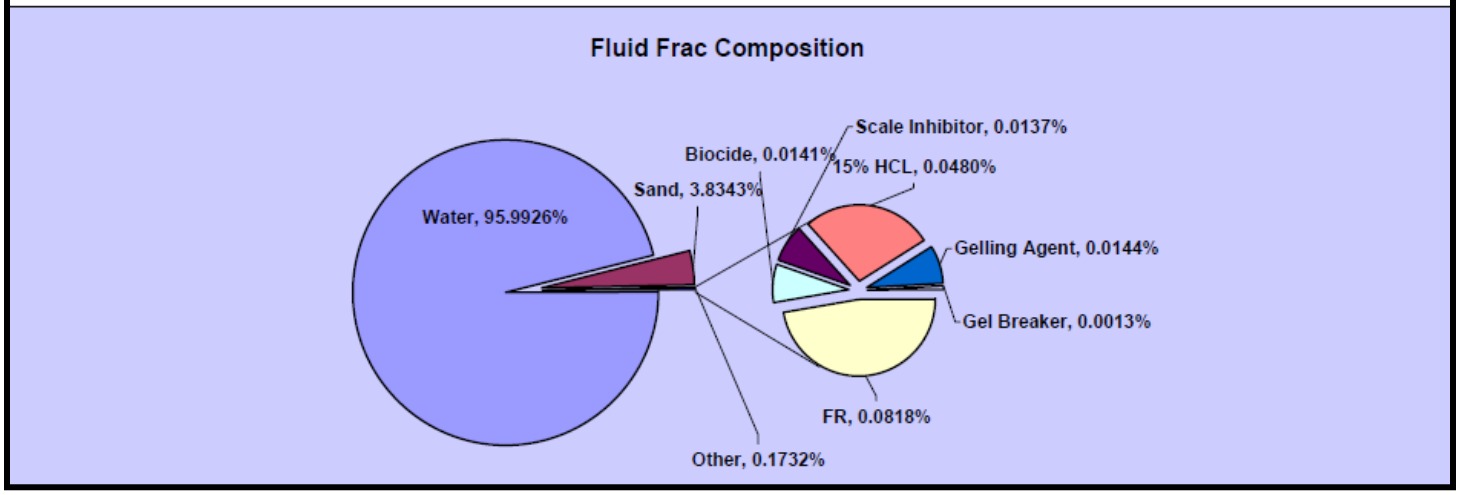
34 frac trucks on location
(Oil & Gas Journal)

(www.fracfocus.org)

Fracturing: Frac Fluids

Composition for a 16-stage West Virginia Marcellus Shale well

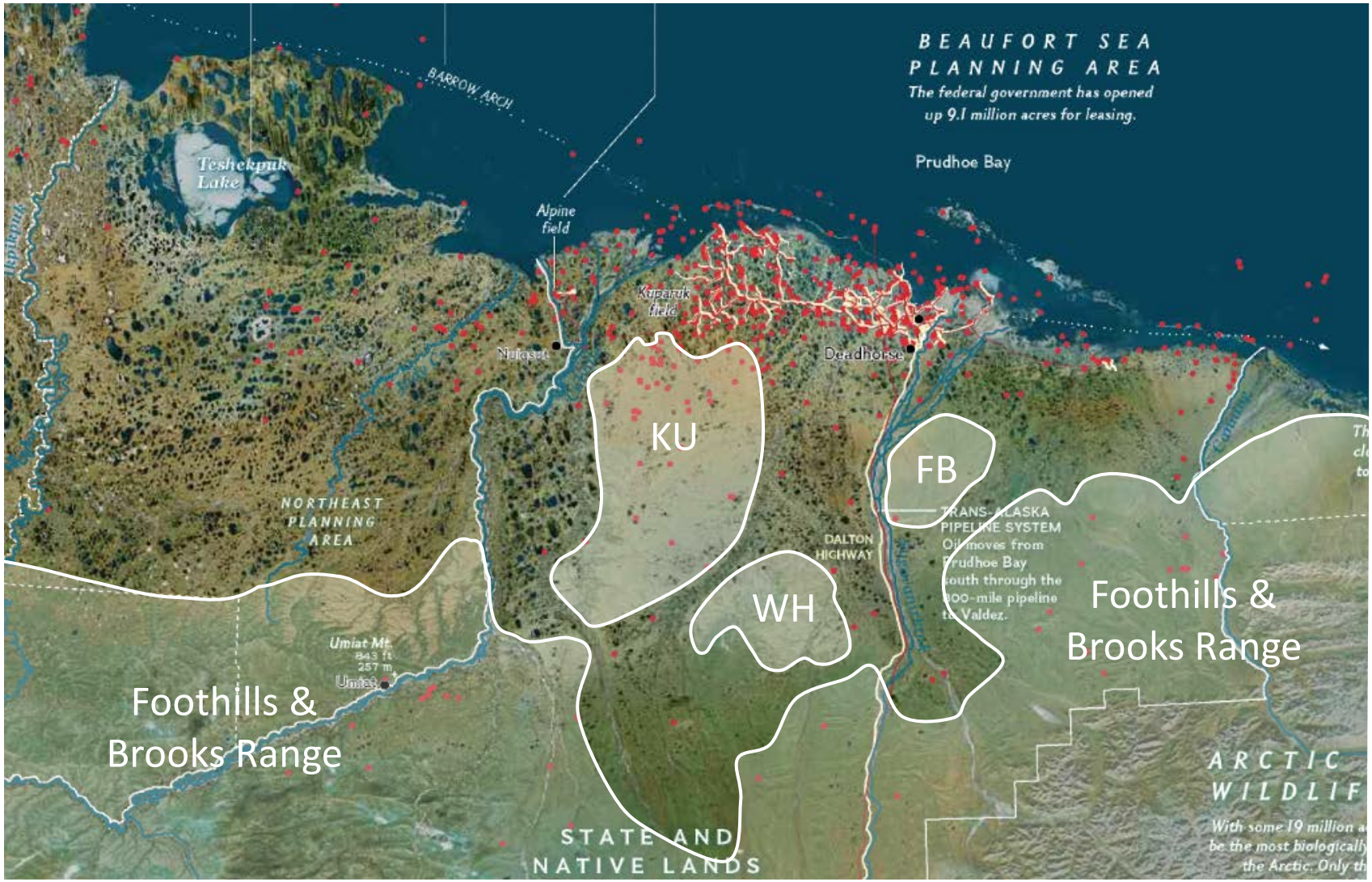
Product Name	Additive	Purpose	Use and Dilution	Actual Volume	Overall %
Water	Carrier Fluid	Creates fracture network in shale and carry sand to the formation	Approximately 4 million gallons per well	7,416,822 gal	95.9926%
Sand	Sand	Enable fractures to remain open and allow gas to escape into the wellbore	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?

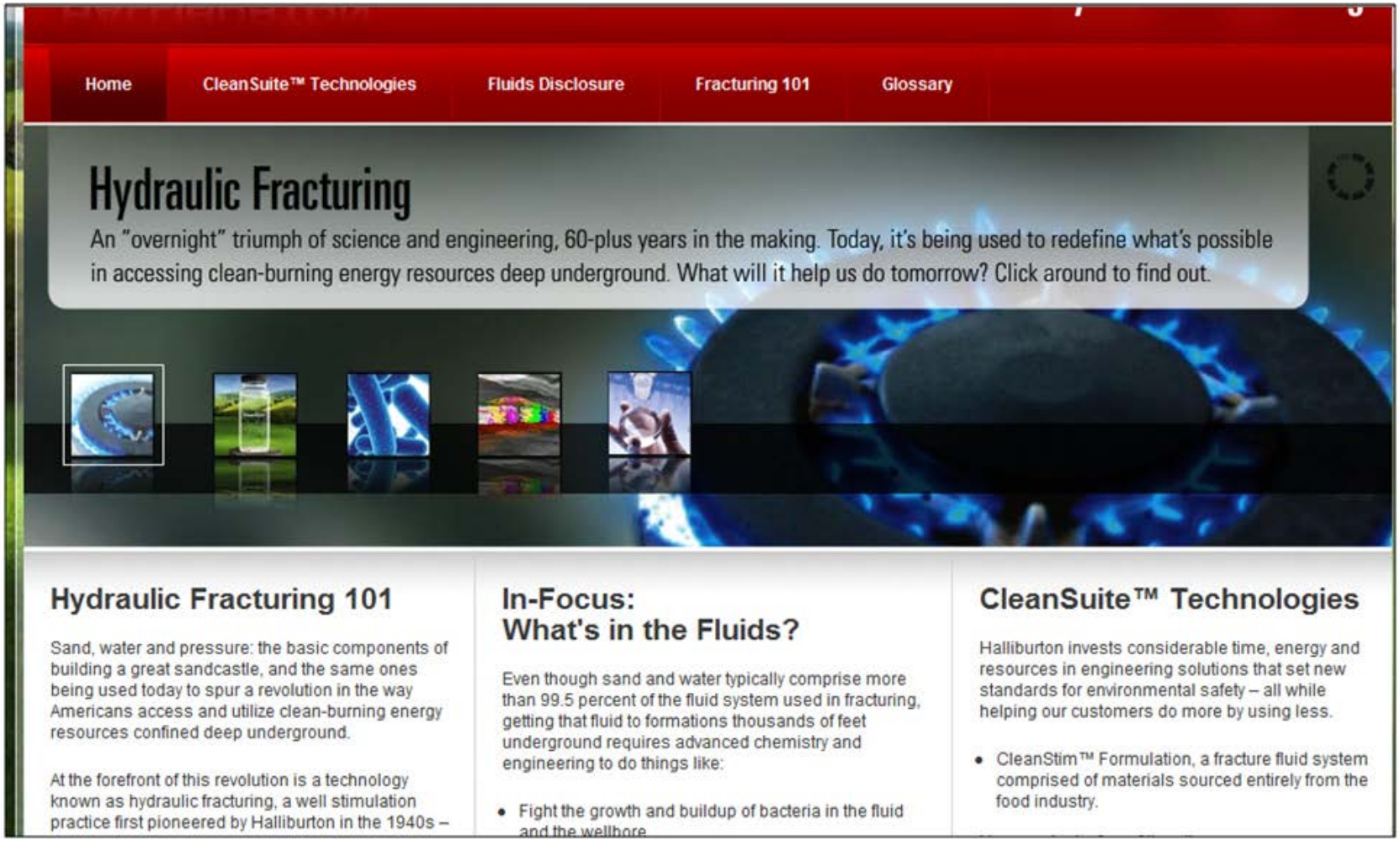
Kuparuk Uplands, White Hills, Franklin Bluffs, Foothills



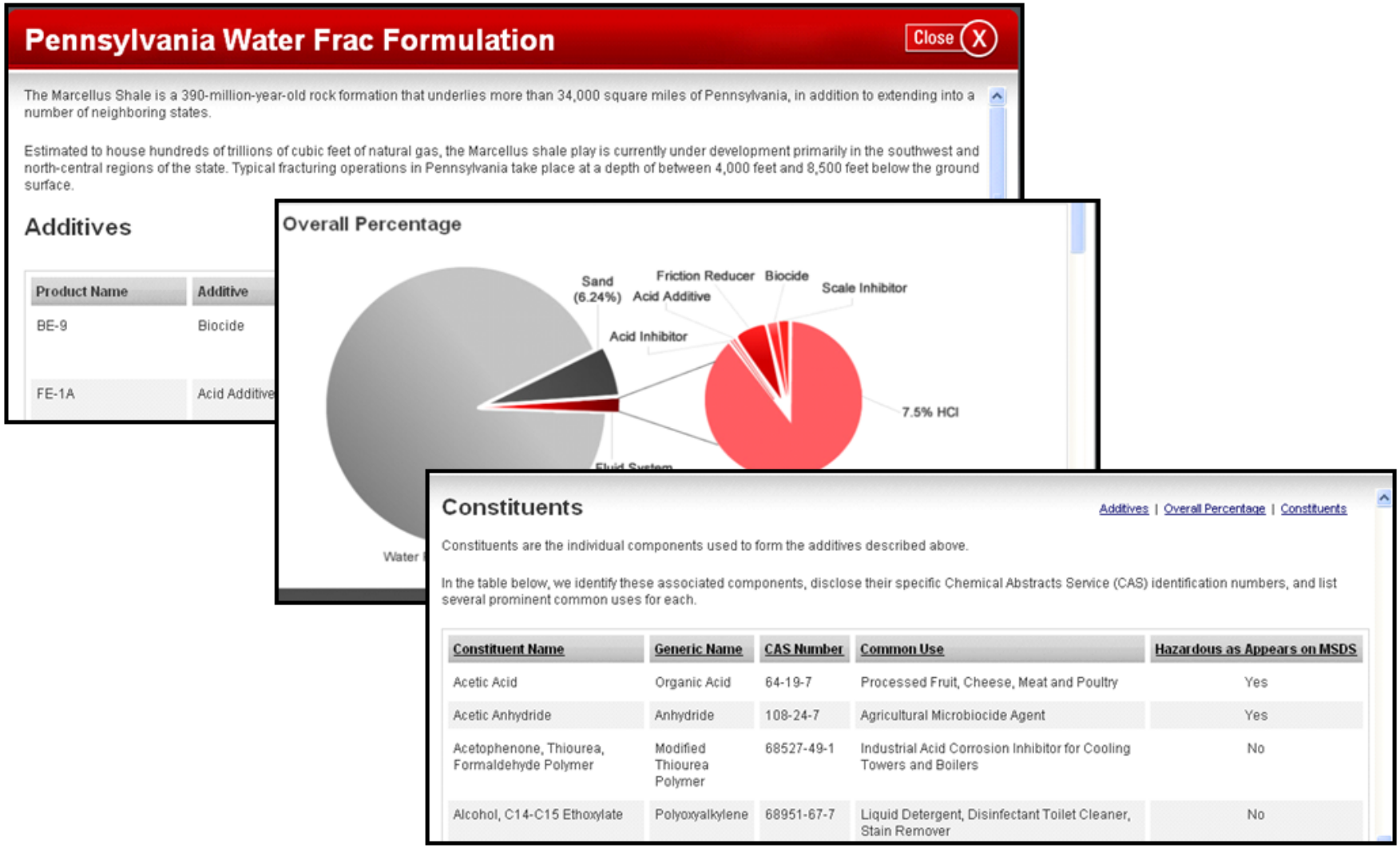
(National Geographic, 2006; http://ngm.nationalgeographic.com/ngm/0605/feature1/map.html)

Halliburton Outreach

HF Microsite



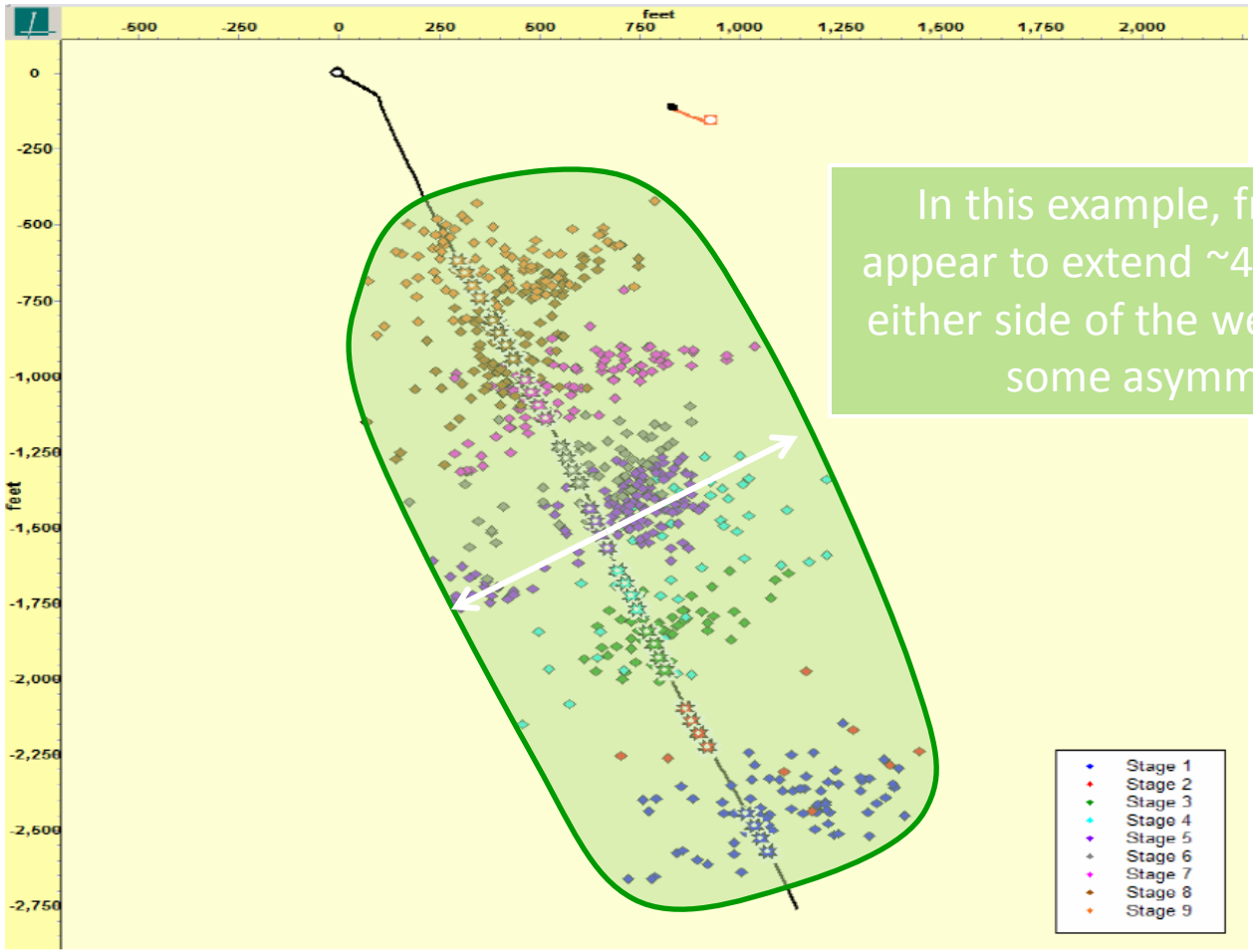
Public Access



HALLIBURTON

Fracturing: Job Placement

Where are the fractures and how far do they extend?

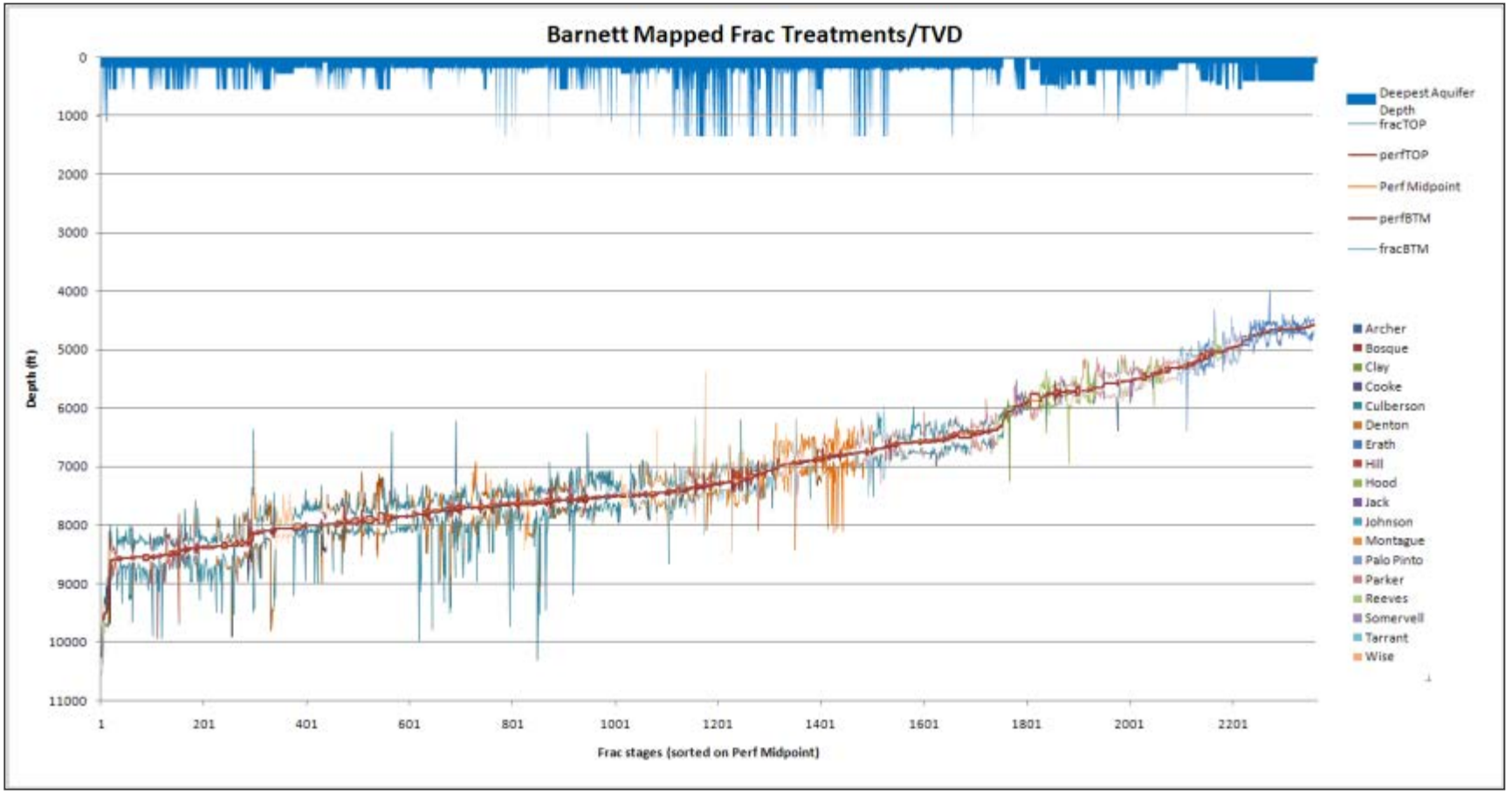


In this example, frac wings appear to extend ~450-550 ft to either side of the wellbore with some asymmetry

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

Fracture Height Determination

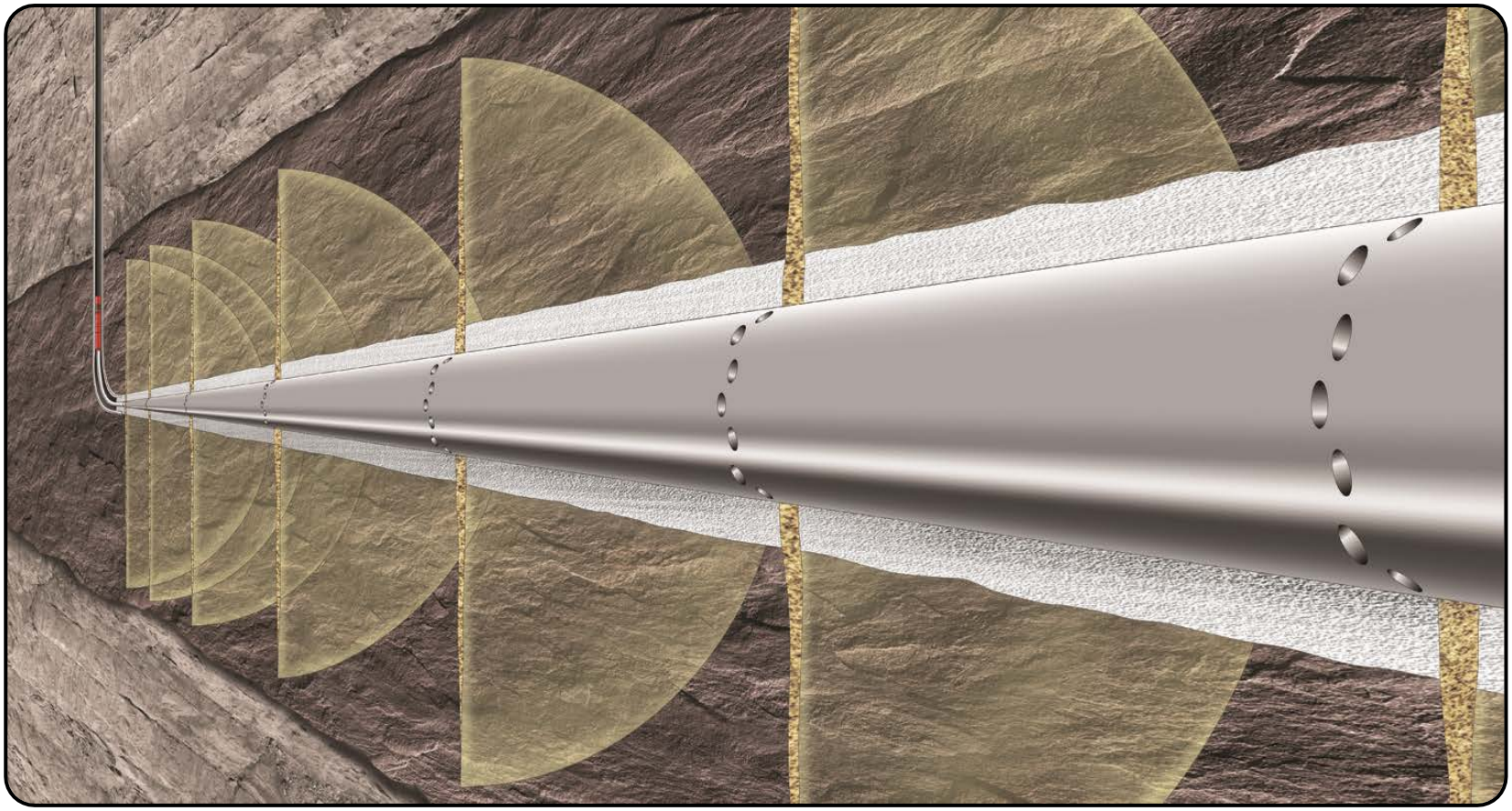
Barnett



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
- 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, Eagle Ford: As oil flows, so do region's jobs and growth with no end near, 2/1/2011)

Questions?