

"Andrew Nikiforuk crafts a stunning picture of fossil fuel industry and government abuse."
NAOMI KLEIN, author of *This Changes Everything*

Andrew Nikiforuk

SLICK WATER

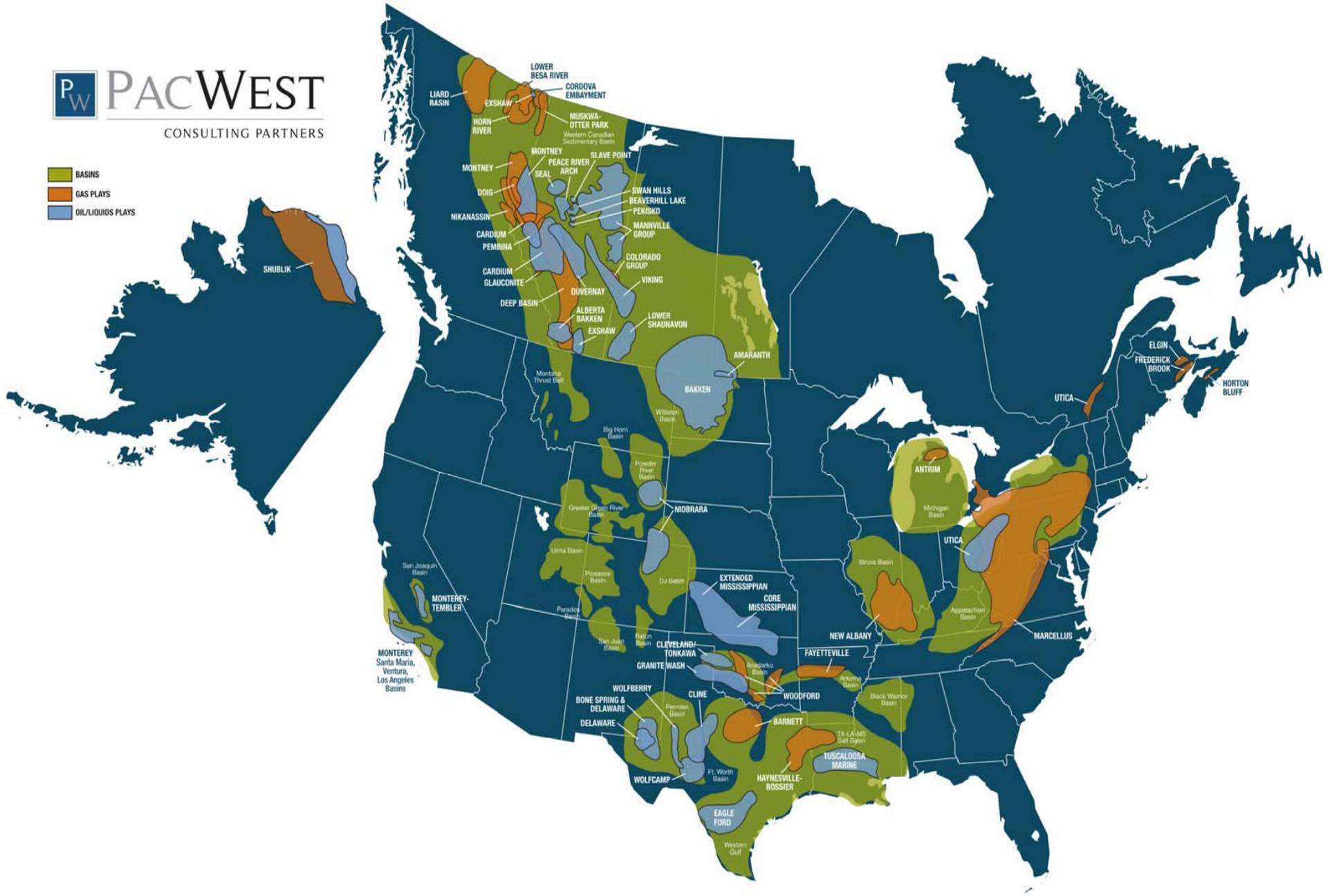
Fracking

and One Insider's Stand
Against the World's
Most Powerful Industry

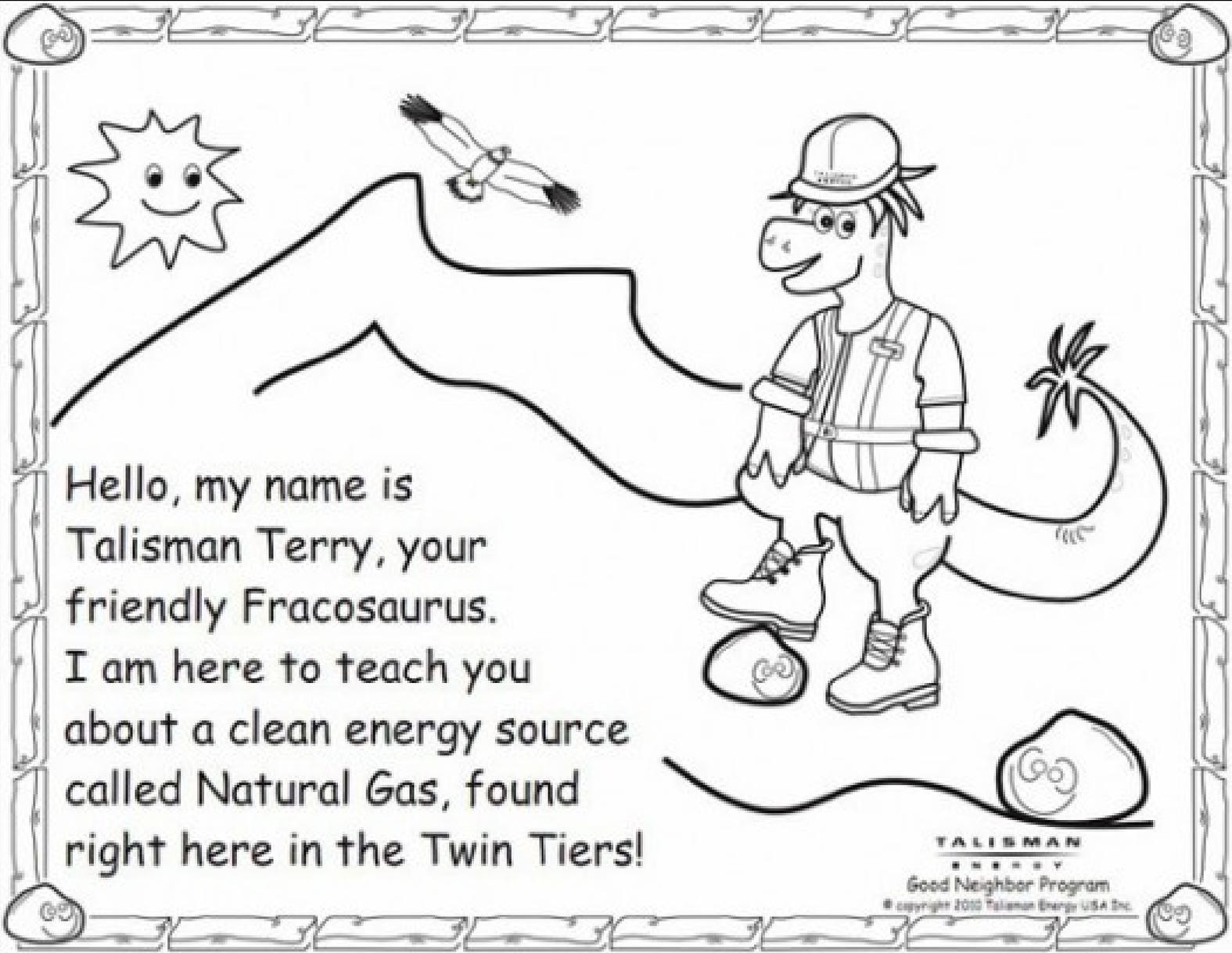


PW PACWEST
CONSULTING PARTNERS

- BASINS
- GAS PLAYS
- OIL/LIQUIDS PLAYS







Hello, my name is
Talisman Terry, your
friendly Fracosaurus.
I am here to teach you
about a clean energy source
called Natural Gas, found
right here in the Twin Tiers!

TALISMAN
ENERGY
Good Neighbor Program
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Affordable Alternative!
US Industrial Renaissance!
Bridge to the Future!
100 years Supply!
Energy Independence!
The Next Oil Sands!

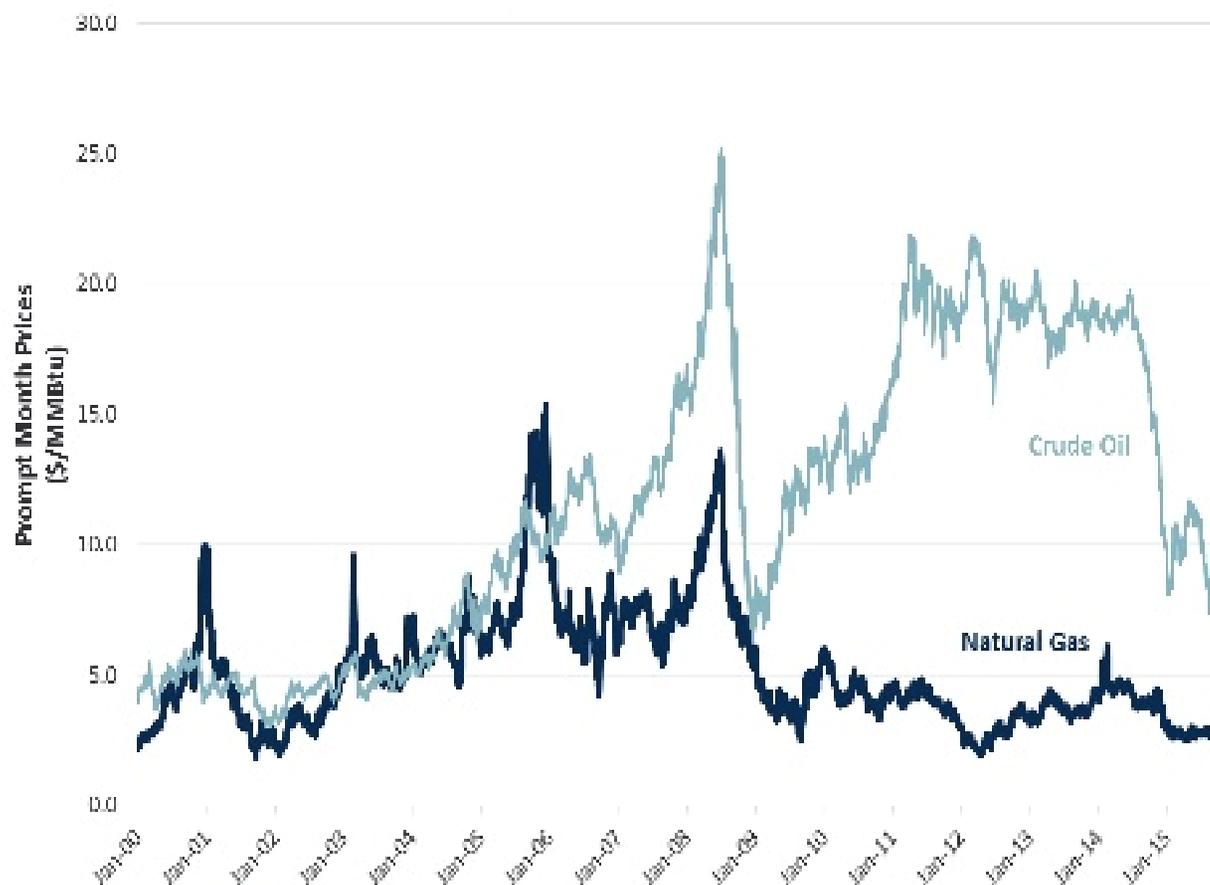


Chesapeake Stock Price Change Relative To US Natural Gas Fund - Since 2015

(%)



Figure 1
NYMEX Prompt Month Prices
Brent Crude Oil vs. Henry Hub Natural Gas
January 2000 – November 2015



Sources/Notes:

NYMEX data downloaded from EIA and Bloomberg. The natural gas line shows the prompt month Henry Hub prices. The crude oil line shows the prompt month Brent oil prices.



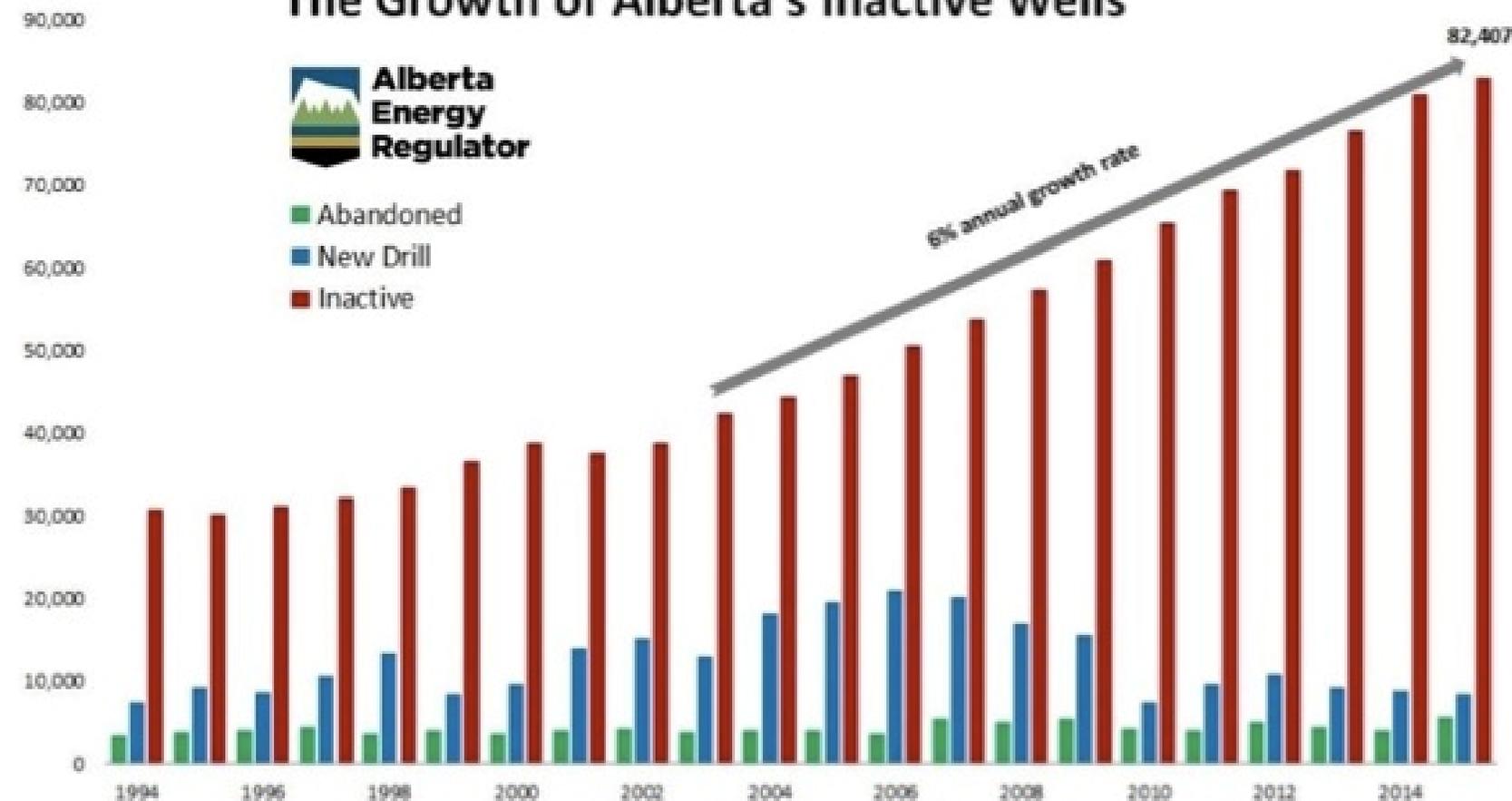
Oil companies have to make a big deal about shale plays because that is all that is left in the world. Let's face it: these are truly awful reservoir rocks and that is why we waited until all more attractive opportunities were exhausted before developing them. It is completely unreasonable to expect better performance from bad reservoirs than from better reservoirs.

Arthur Berman/2014

**Alberta currently operates 174,000 wells, and has 82,407 inactive.
AB has a 2-1 active to inactive well ratio**

<https://www.aer.ca/about-aer/what-we-do>

The Growth of Alberta's Inactive Wells



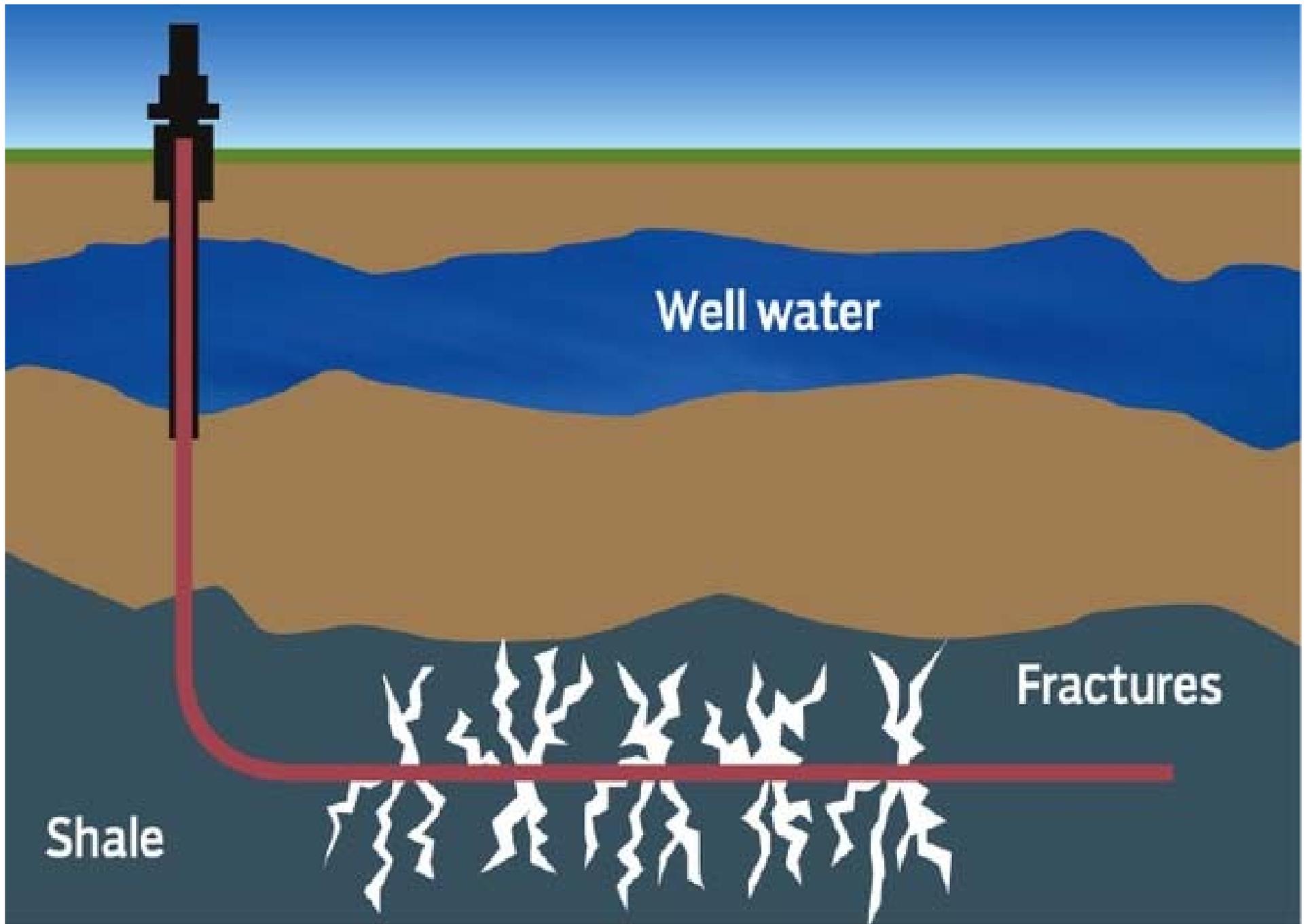
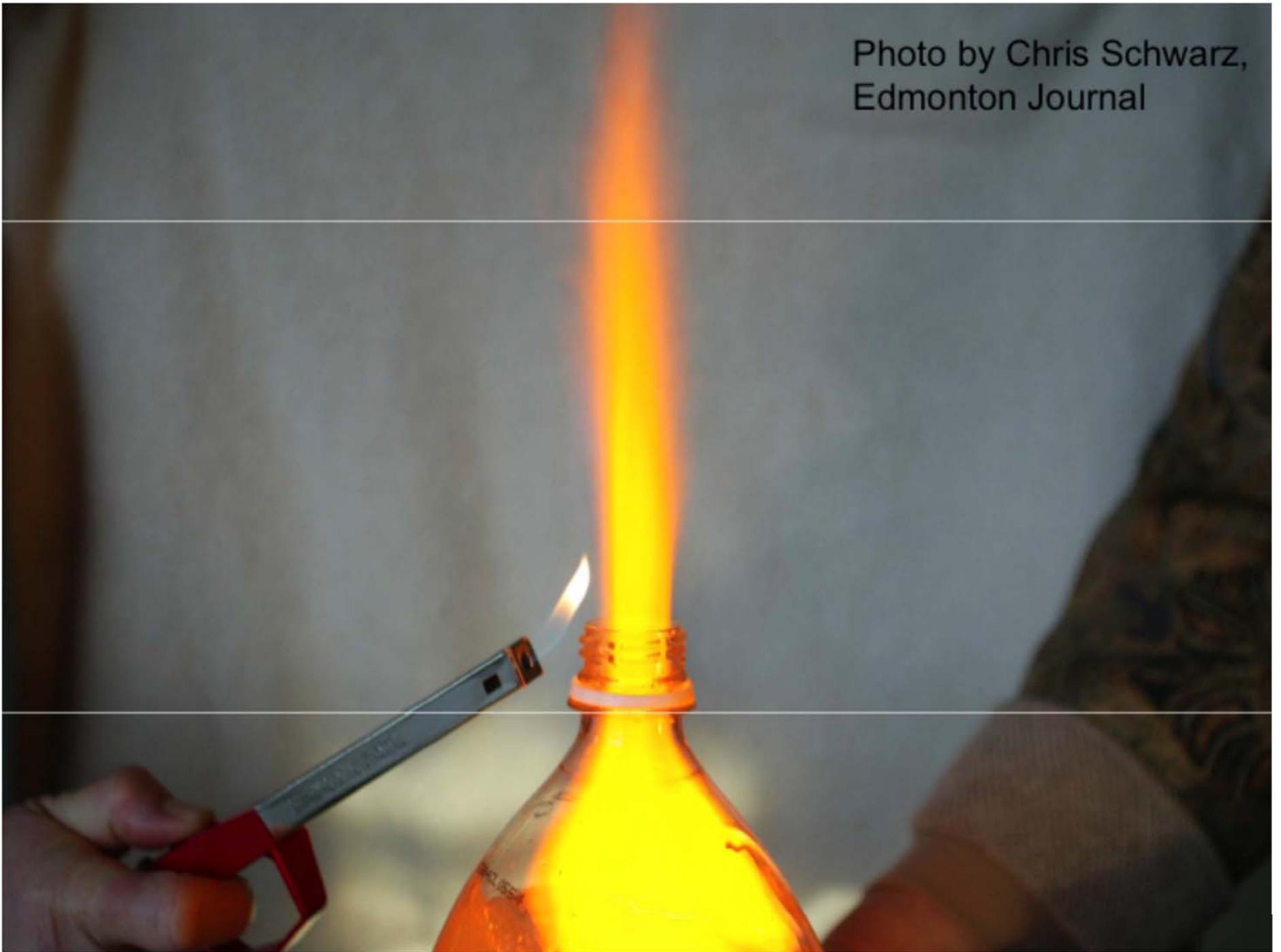
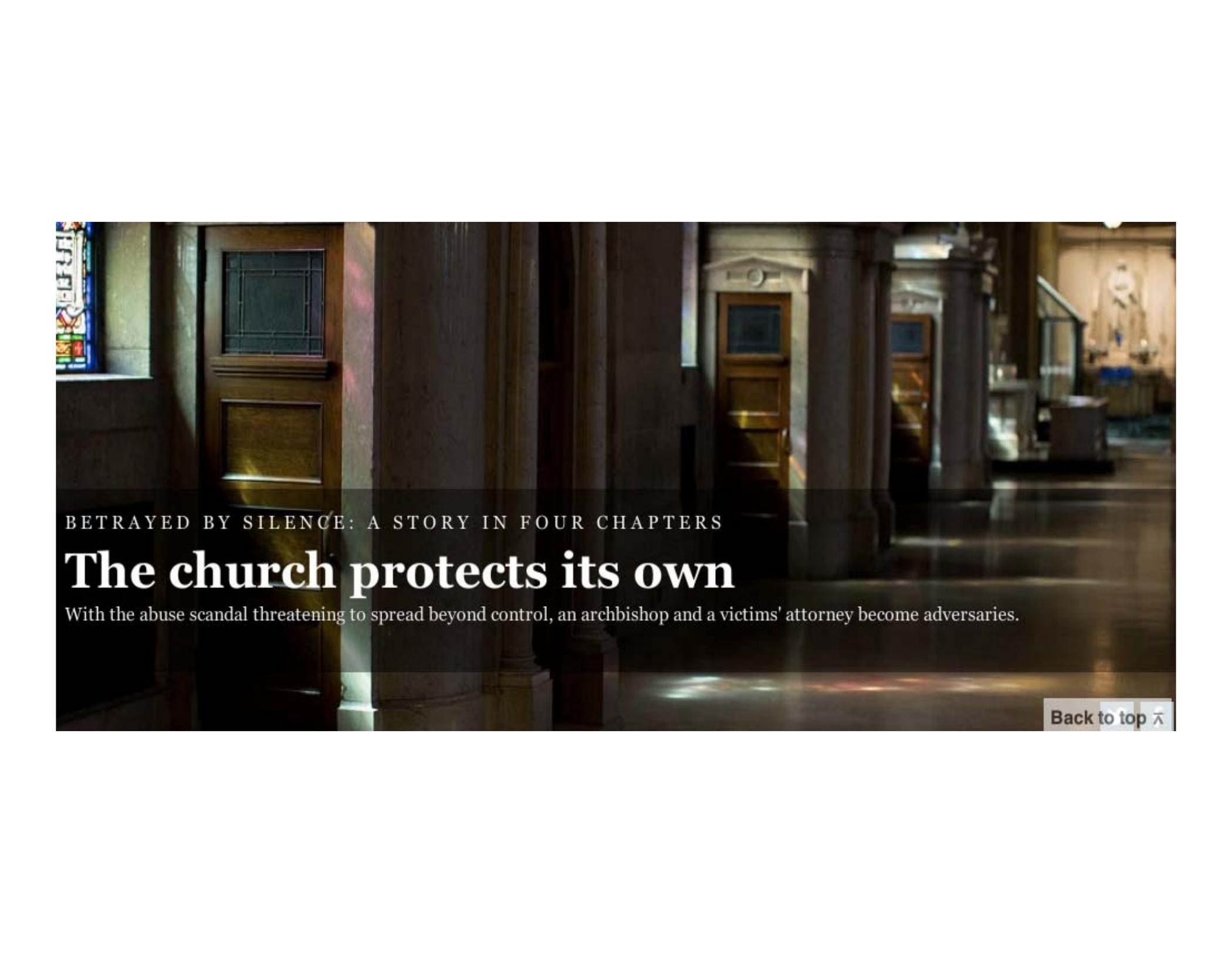


Photo by Chris Schwarz,
Edmonton Journal



A photograph of a church interior, showing a series of stone columns and wooden doors. The lighting is low, creating a somber atmosphere. A stained glass window is visible on the left side.

BETRAYED BY SILENCE: A STORY IN FOUR CHAPTERS

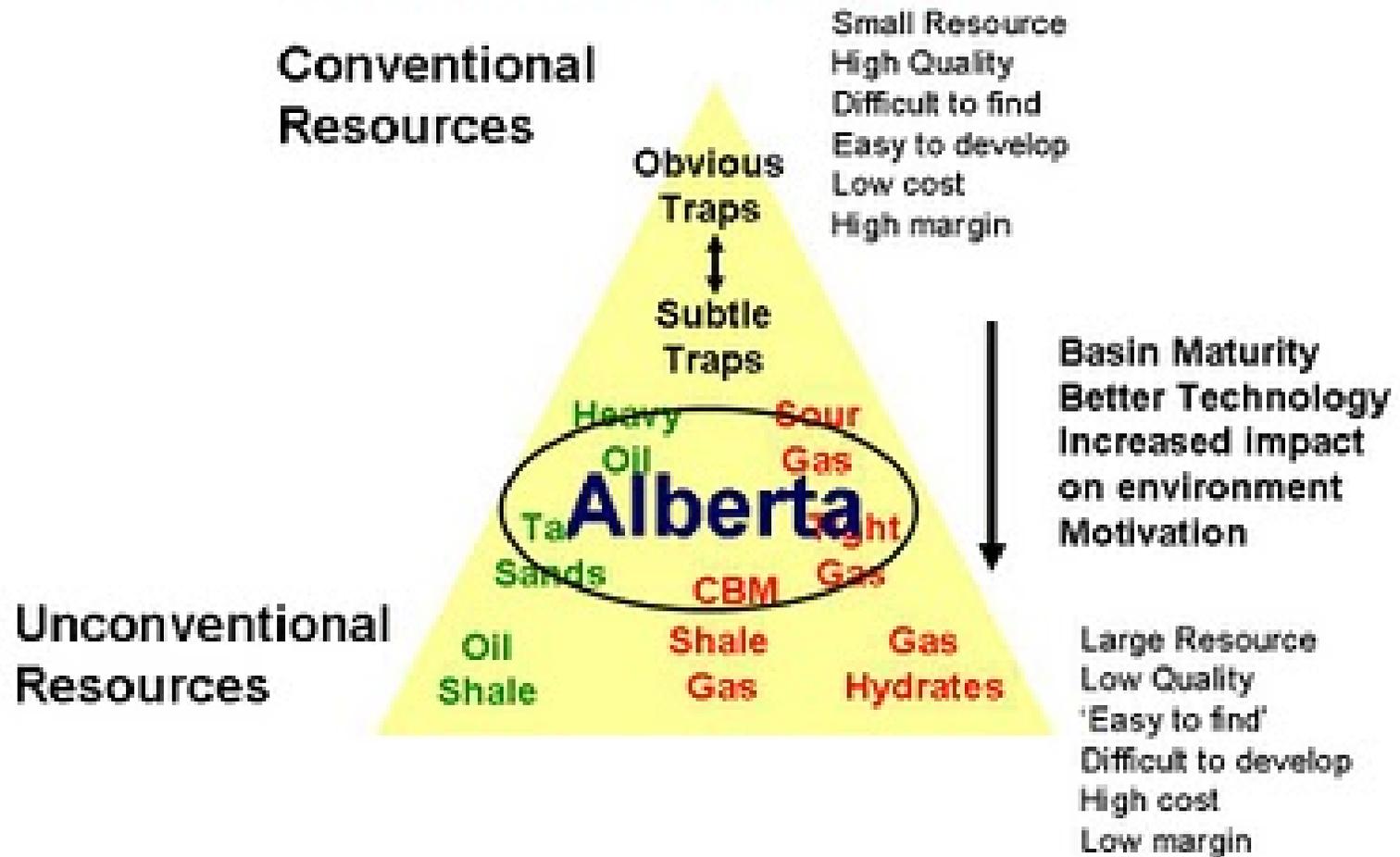
The church protects its own

With the abuse scandal threatening to spread beyond control, an archbishop and a victims' attorney become adversaries.

[Back to top](#) ↗



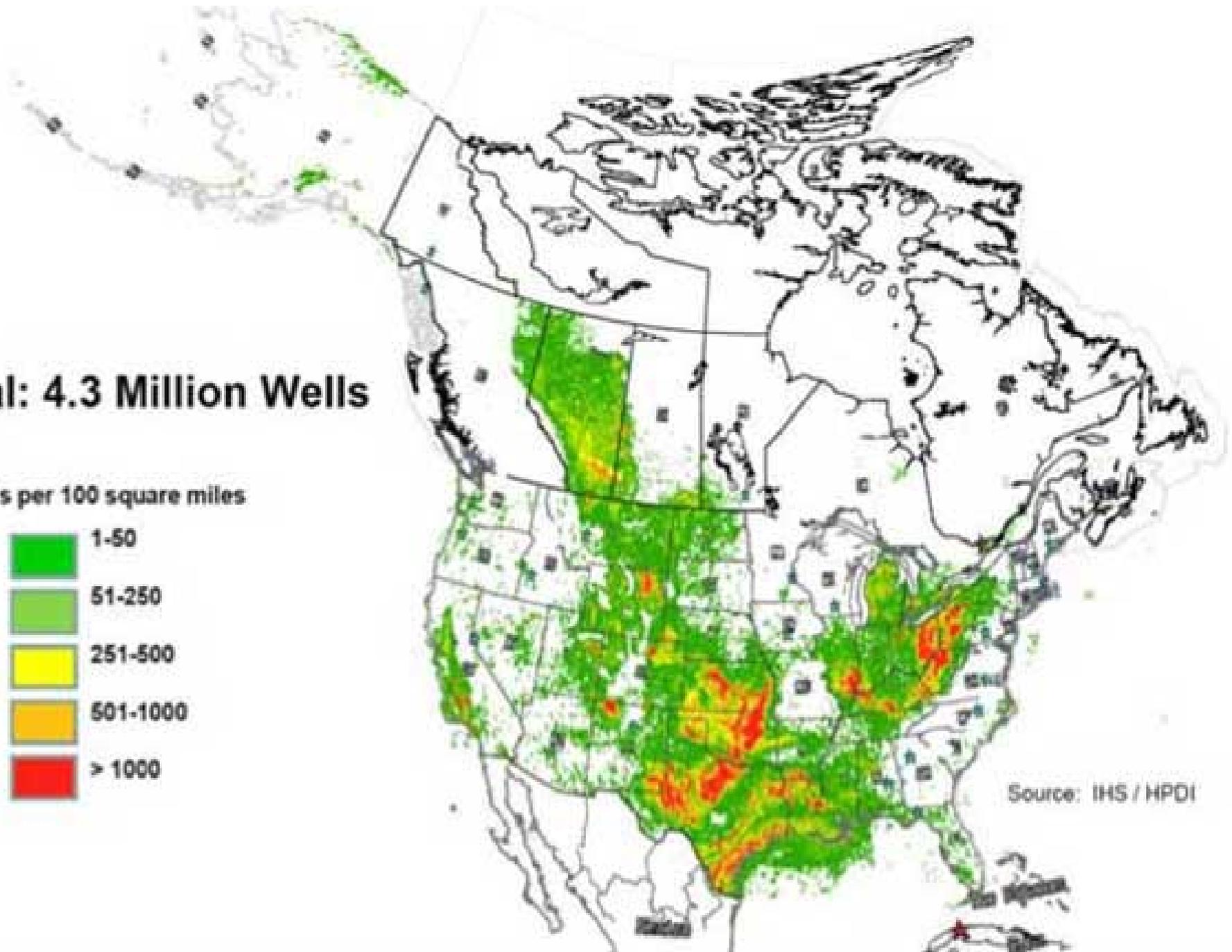
Resource Triangle



Source: Dave Russum, AJM Petroleum Consultants

Total: 4.3 Million Wells

Wells per 100 square miles



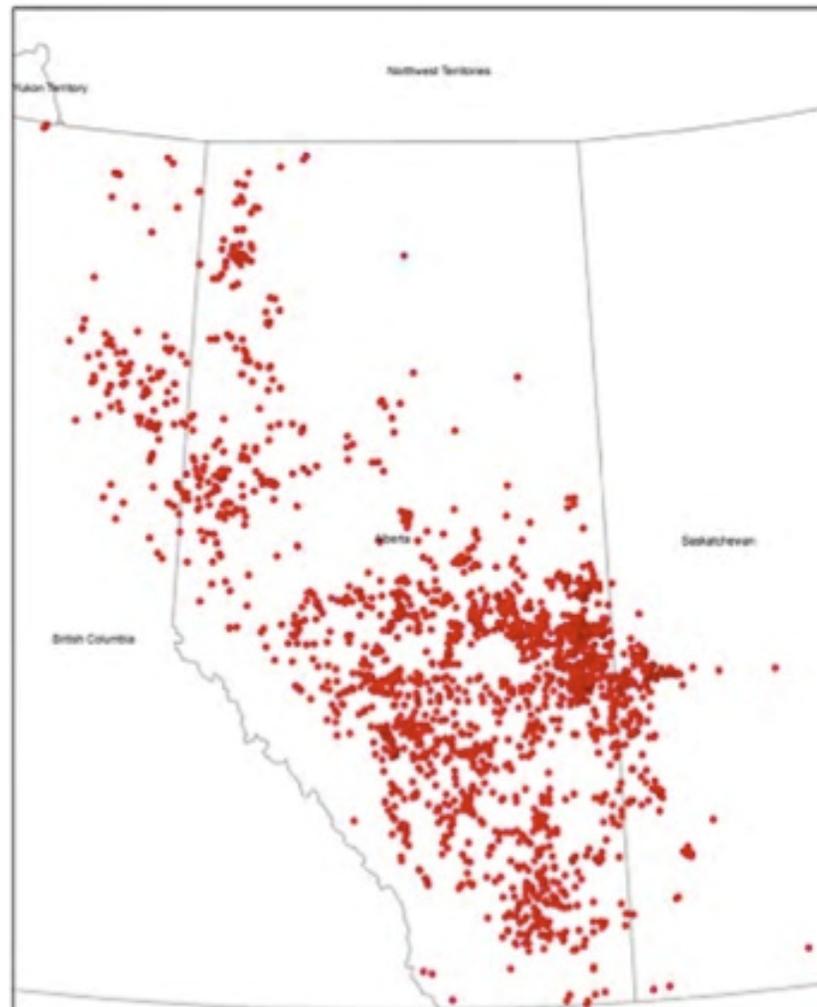
Source: IHS / HPDI

On June 23, 1978, commercial stimulation of a 3,050-m-deep well near Wilson (Oklahoma) triggered 70 earthquakes in 6.2 hours (Luza and Lawson, 1980).

Earthquake Hazard Associated
With Deep Well Injection—
A Report to the U.S. Environmental
Protection Agency

U.S. GEOLOGICAL SURVEY BULLETIN 1951

Locations of conventional SCV gases in U of A database



n = 3304



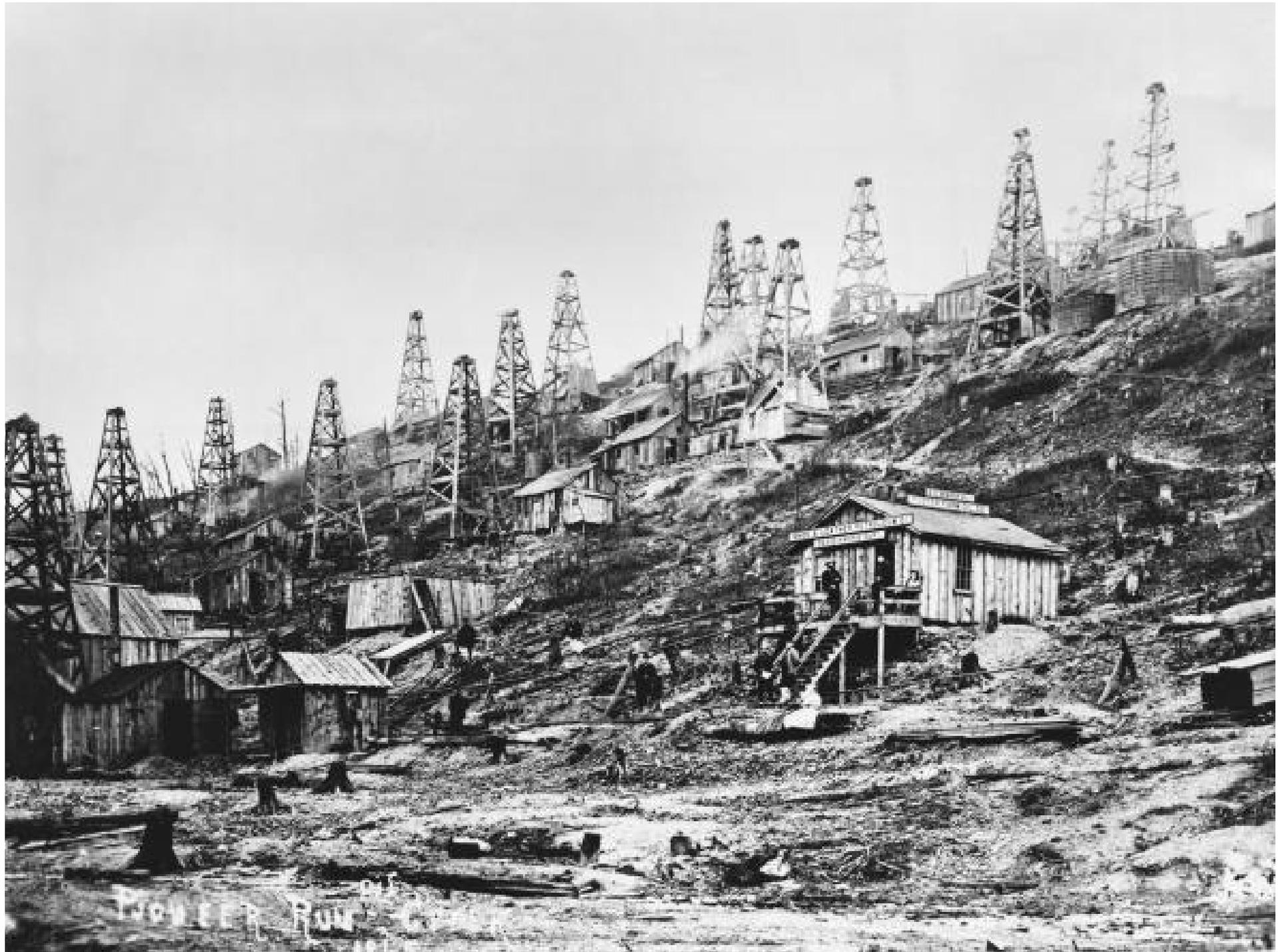
500,000 wells
“a threat to environment and
public safety”

The use of enhanced recovery methods
(steam injection and hydraulic fracturing)
elevates the mechanical and thermal
loading on wellbores and significantly
increases the probability of leakage.

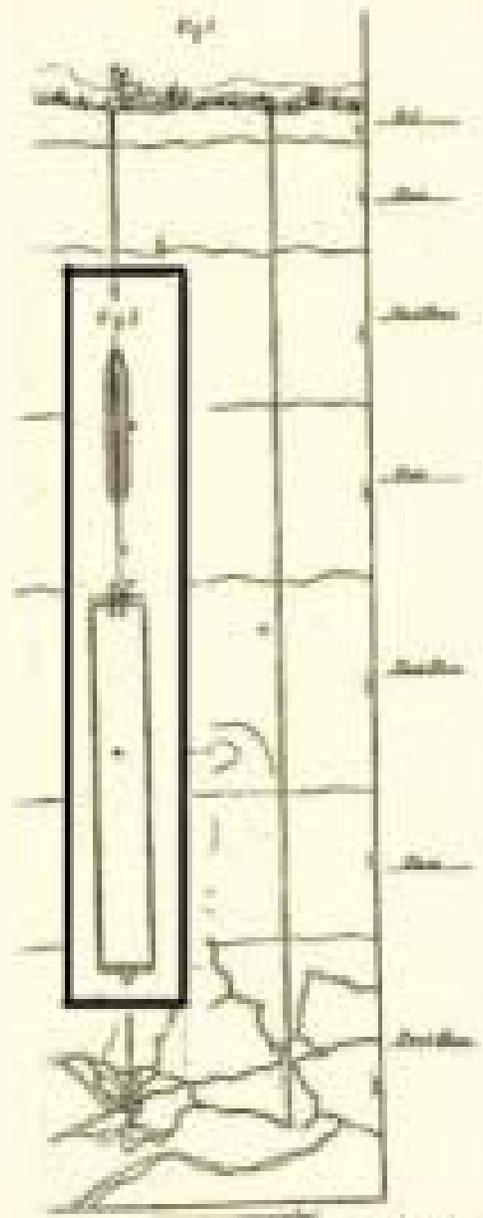
Dusseault/2014



Oil and Gas Wells

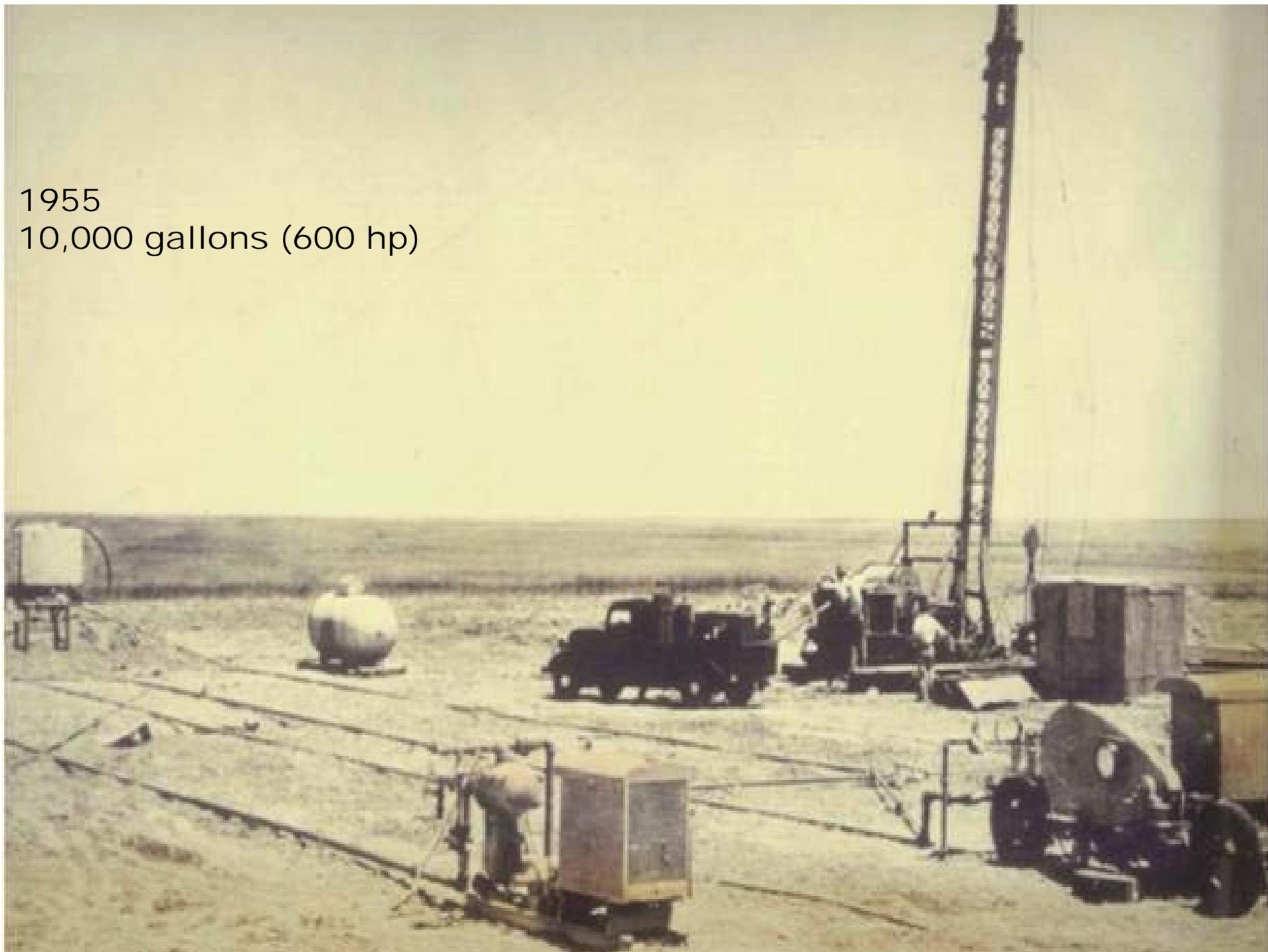


E. A. Roberts Tornado
Mappe. Patented Nov. 20 1884



DESIGNED BY
R. S. H. H. H.

1955
10,000 gallons (600 hp)



Project Gasbuggy

ENGINEERING

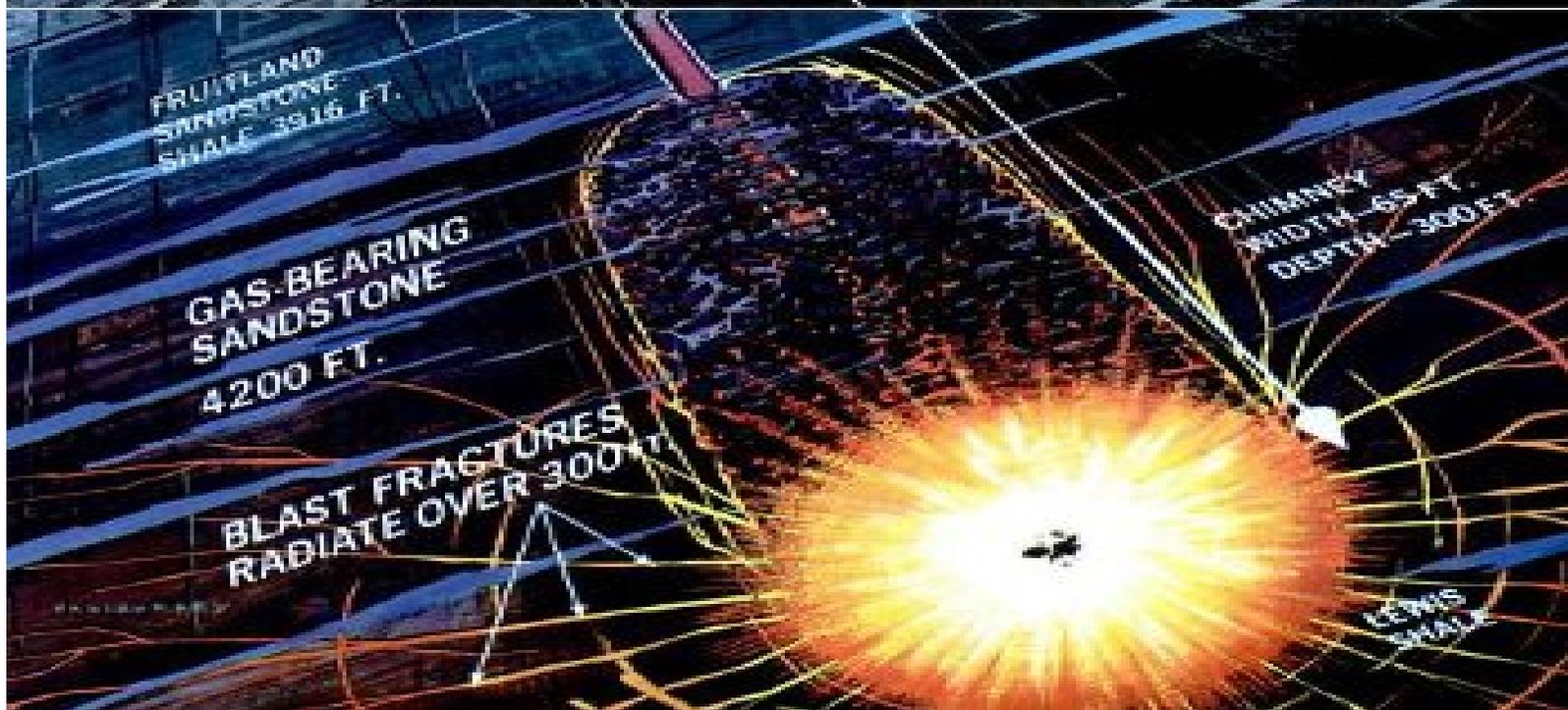
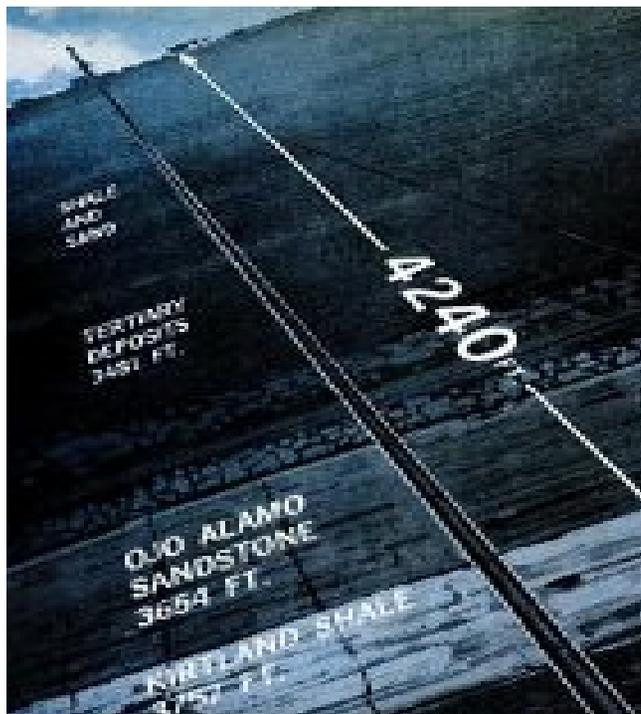
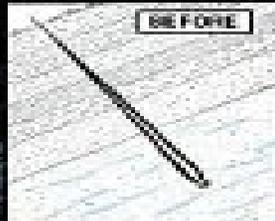
Next month an underground nuclear blast in New Mexico holds promise of doubling the world's supply of natural gas.

By Norman and Jan Gribble

It doesn't look like much. Just a puff of dust rising above the pilot pipe. It won't make much noise, just a heavy rumble like a passing freight train.

But the several hundred engineers and scientists who will gather next month at a remote wilderness spot 100 miles north of Gallup, N.M., will need only scanty evidence to tell them that the pipe has done in a daring atomic wager. They'll know that some 4,200 feet underground, a nuclear explosion with the awesome power of the Hiroshima bomb has triggered a unique experiment aimed at boosting the riches of the earth.

Project Gasbuggy is a \$4,700,000 bet by government and private industry that nuclear explosives can be used to shake loose vast quantities of something the United States needs a lot more of—natural gas. That's why you and everybody else in the nation have a big stake in the



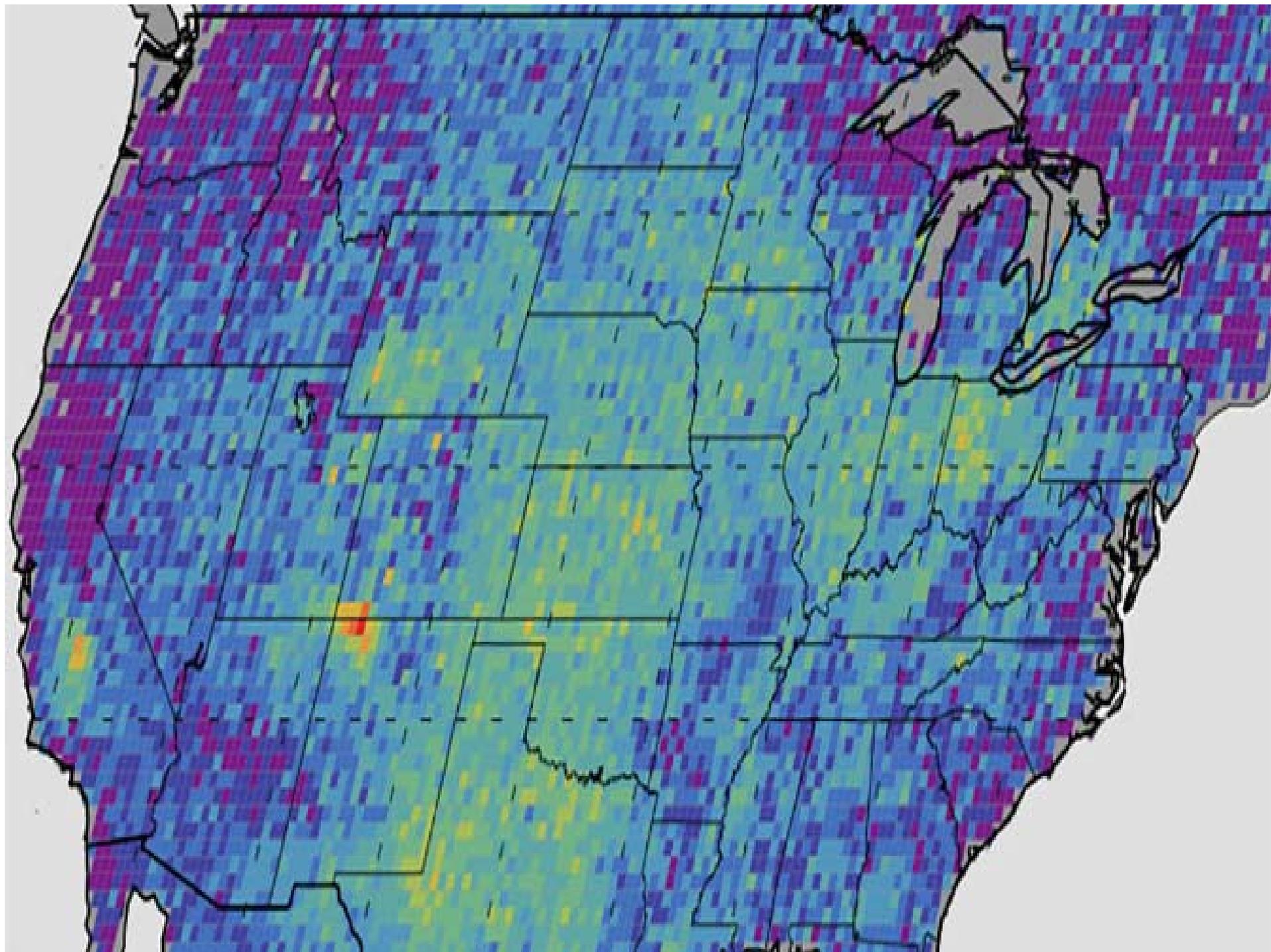
2005
5 million gallons (61,000 hp)





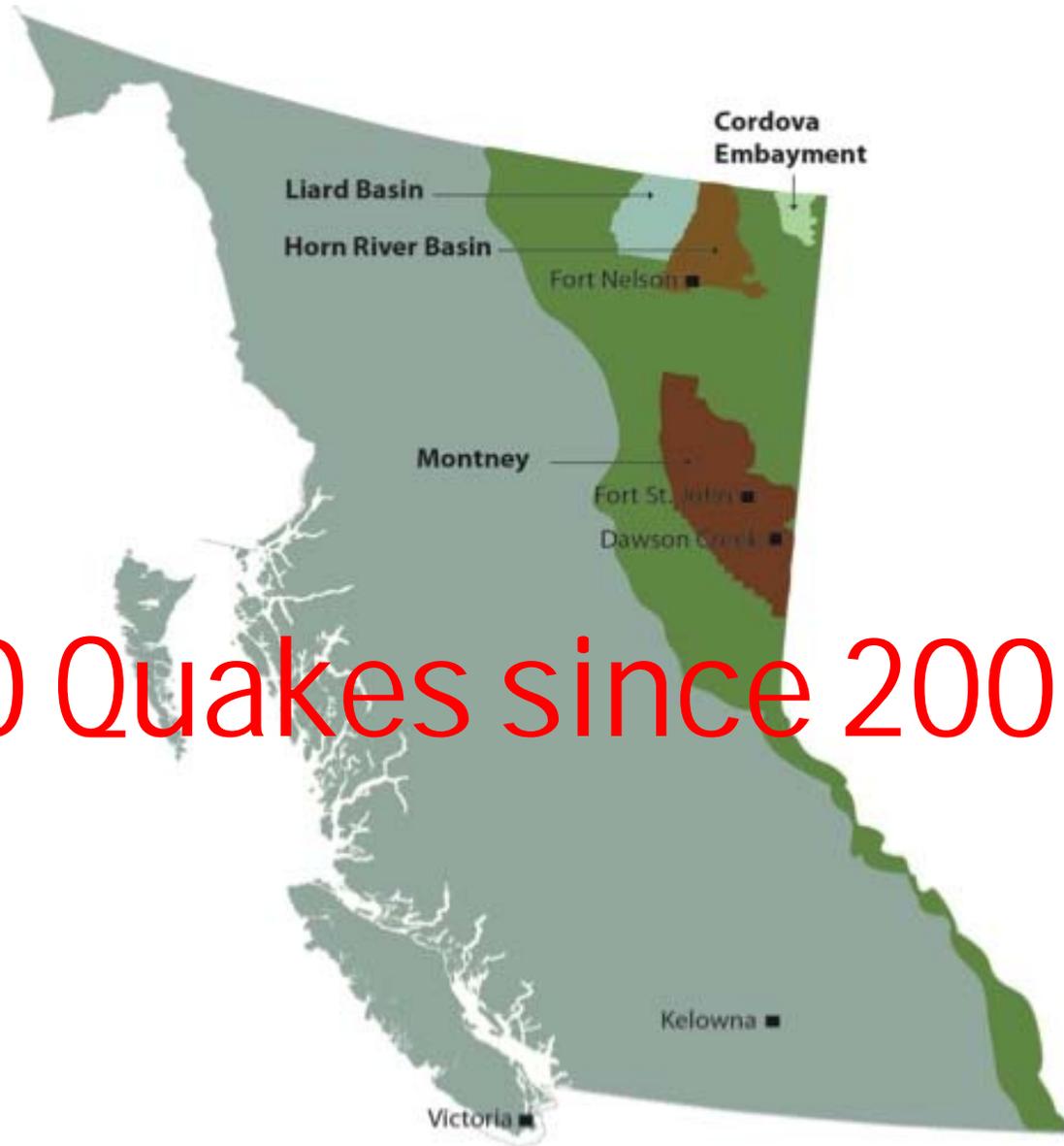


A well can be fraced several times during its lifetime and in some instances, however, hydraulic fracturing can harm a well *by fracing into water*. The hydraulically induced fractures extend vertically into a water reservoir that floods the well with water. Norman J Hyne





1000 Quakes since 2006



Seismic activity can create faults
and fractures and seismic
vibrations can increase
permeability and upward gas
migration
Chilingar/2000

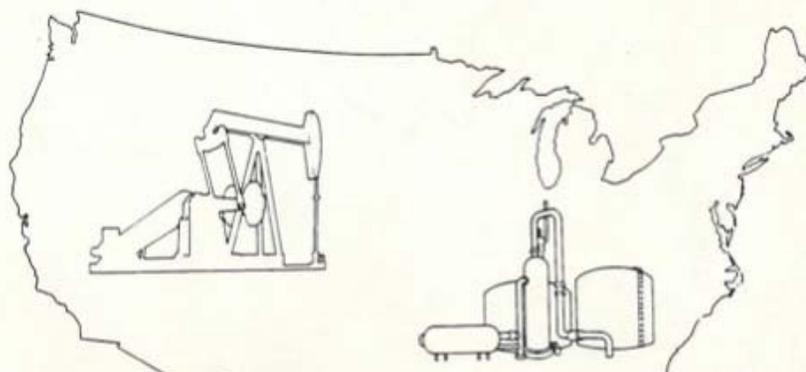
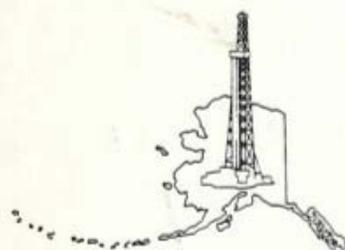


Solid Waste

Report to Congress

Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy

Volume 1 of 3
Oil and Gas



or sue the driller. Where there is contamination of a freshwater source, State regulations presume an oil or gas drilling site is responsible if one is located within 1,000 feet of the water source.

During the fracturing process, fractures can be produced, allowing migration of native brine, fracturing fluid, and hydrocarbons from the oil or gas well to a nearby water well. When this happens, the water well can be permanently damaged and a new well must be drilled or an alternative source of drinking water found.

* In 1982, Kaiser Gas Co. drilled a gas well on the property of Mr. James Parsons. The well was fractured using a typical fracturing fluid or gel. The residual fracturing fluid migrated into Mr. Parson's water well (which was drilled to a depth of 416 feet), according to an analysis by the West Virginia Environmental Health Services Lab of well water samples taken from the property. Dark and light gelatinous material (fracturing fluid) was found, along with white fibers. (The gas well is located less than 1,000 feet from the water well.) The chief of the laboratory advised that the water well was contaminated and unfit for domestic use, and that an alternative source of domestic water had to be found. Analysis showed the water to contain high

2015
45 million gallons



Earthquake

4.8 M

4.8 magnitude
earthquake

Fox Creek

Edmonton

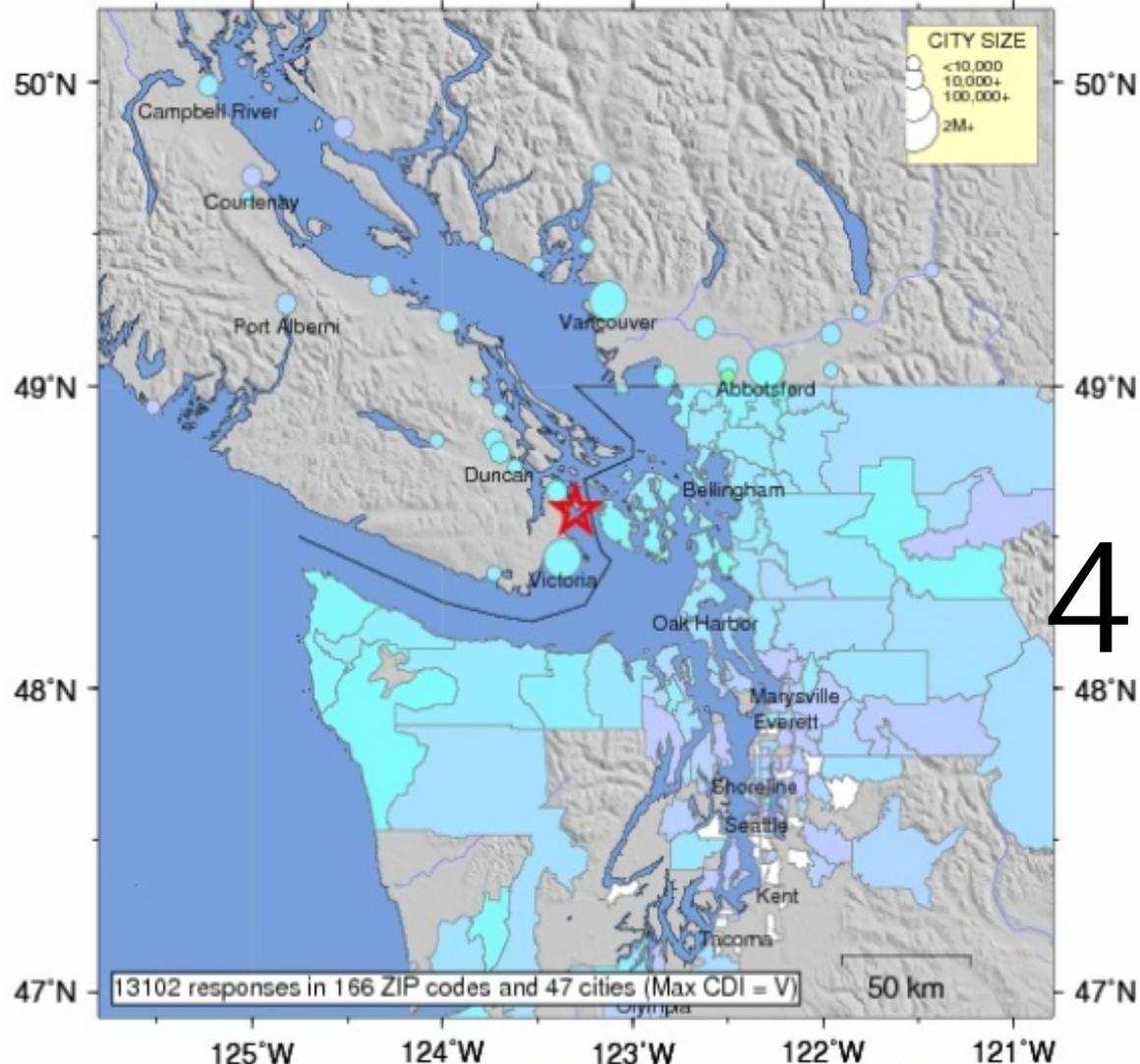
Corporate-Made Earthquakes



4.6 M

USGS Community Internet Intensity Map
VANCOUVER ISLAND, CANADA REGION

Dec 29 2015 11:39:29 PM local 48.5865N 123.3003W M4.8 Depth: 52 km ID:uw61114971



4.6 M

INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy

Processed: Wed Dec 30 21:03:22 2015

70% of unconventional wells in the U.S. do not reach their production targets*

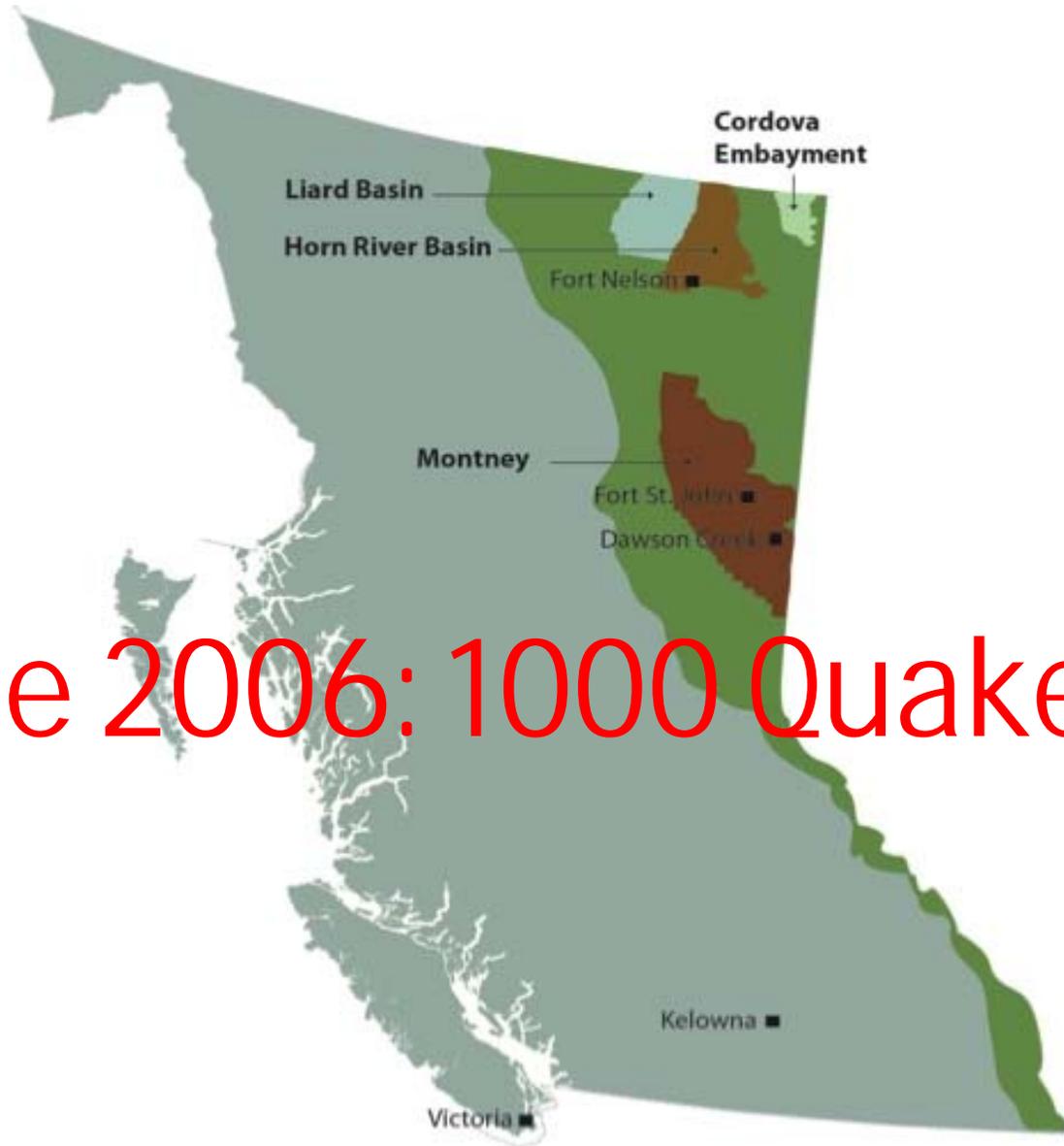
60% of all fracture stages are ineffective**

73% of operators say they do not know enough about the subsurface*

Efficiency and Effectiveness are key for Proper Placement of Well and Frac Stage in Sweet Spots

**Source: Welling & Company, 2012*

***Source: Hart's E&P, 2012*



Since 2006: 1000 Quakes

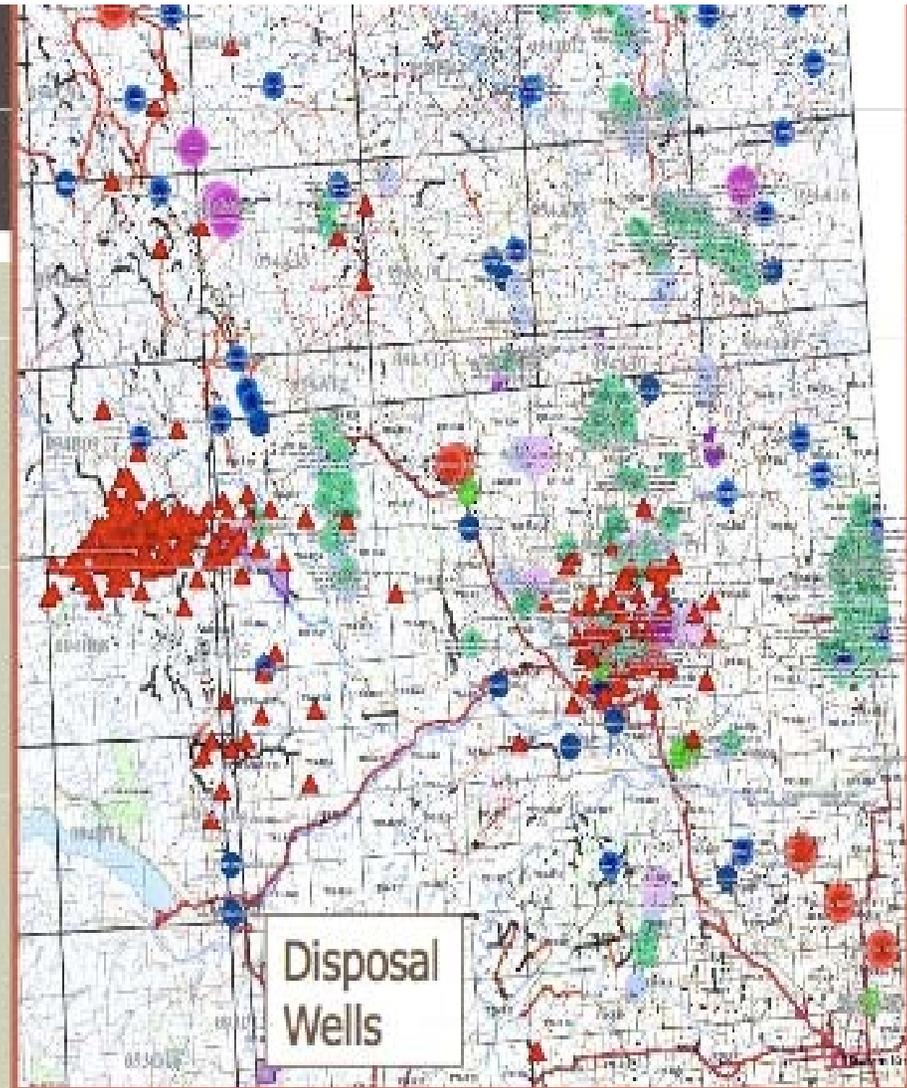
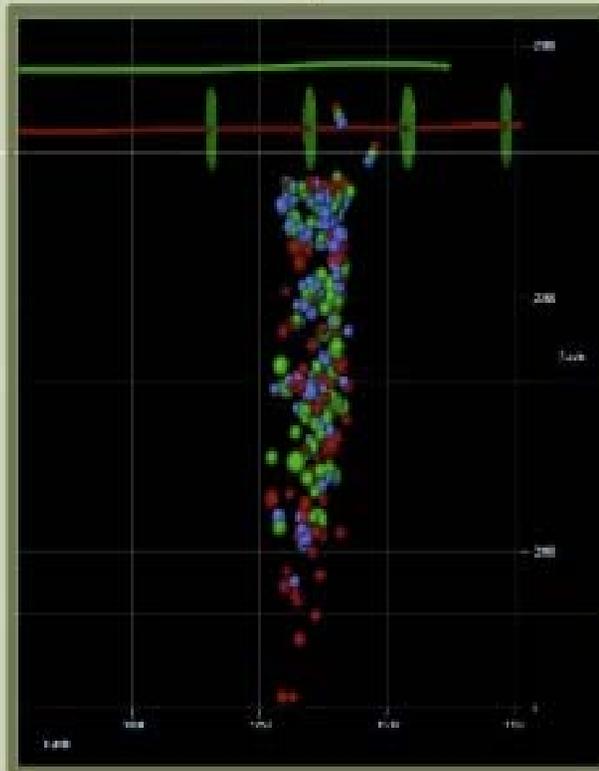
“Major challenges exist in understanding the relationship between injection volume, rate, reservoir pressure and induced seismicity, as well as how to identify critically stressed faults.”

Cathy Ryan 2015

CONCERNS

Surface Effects

- Ground motion
 - Public safety
 - Property damage



Wellbore Integrity

- Casing deformation
- Reservoir breakthrough
- Aquifer contamination

AER Traffic Light System - Duvernay Zone, Fox Creek



4.0M_L

cease operations,
inform the AER



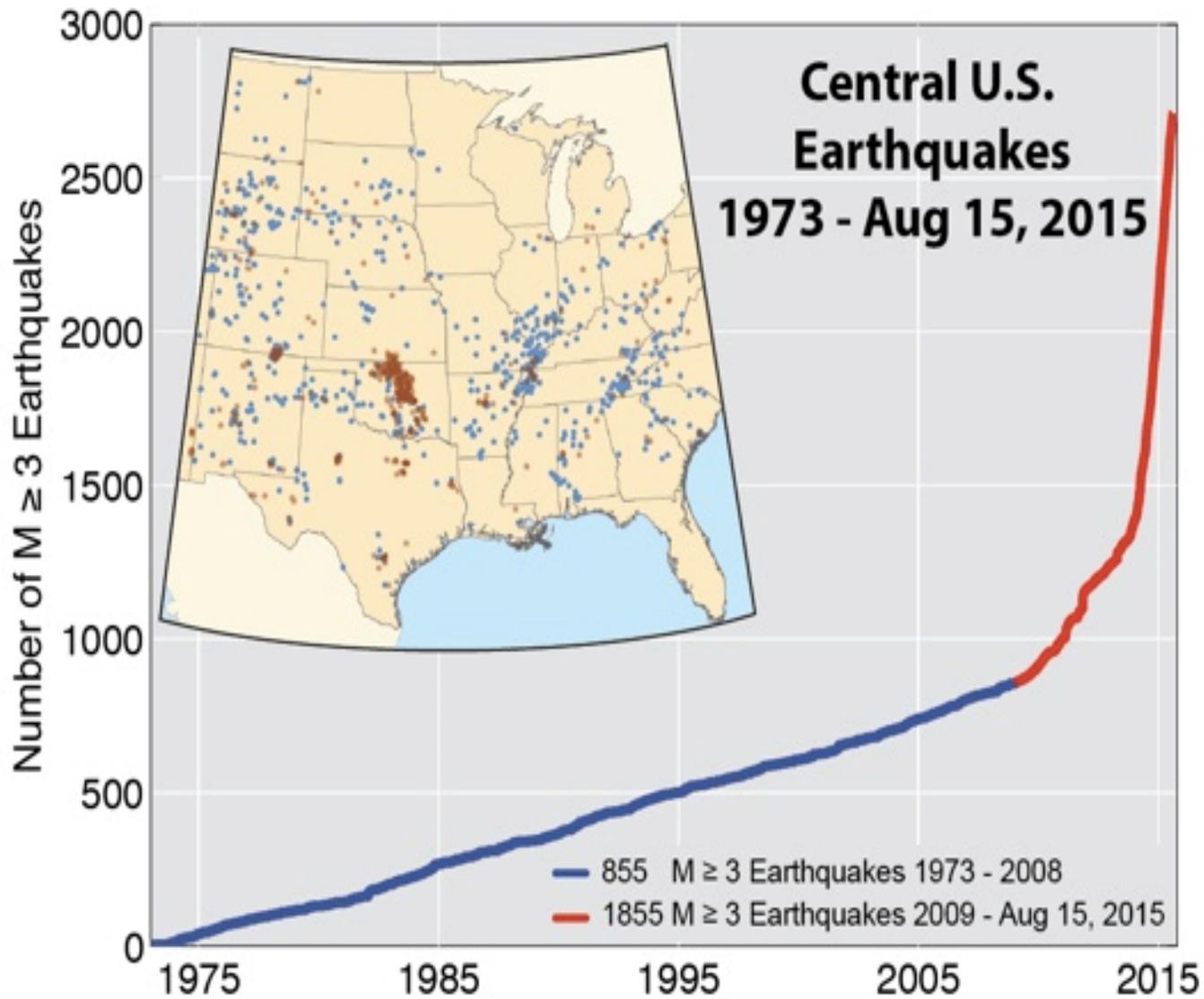
2.0M_L

inform the AER,
invoke response plan

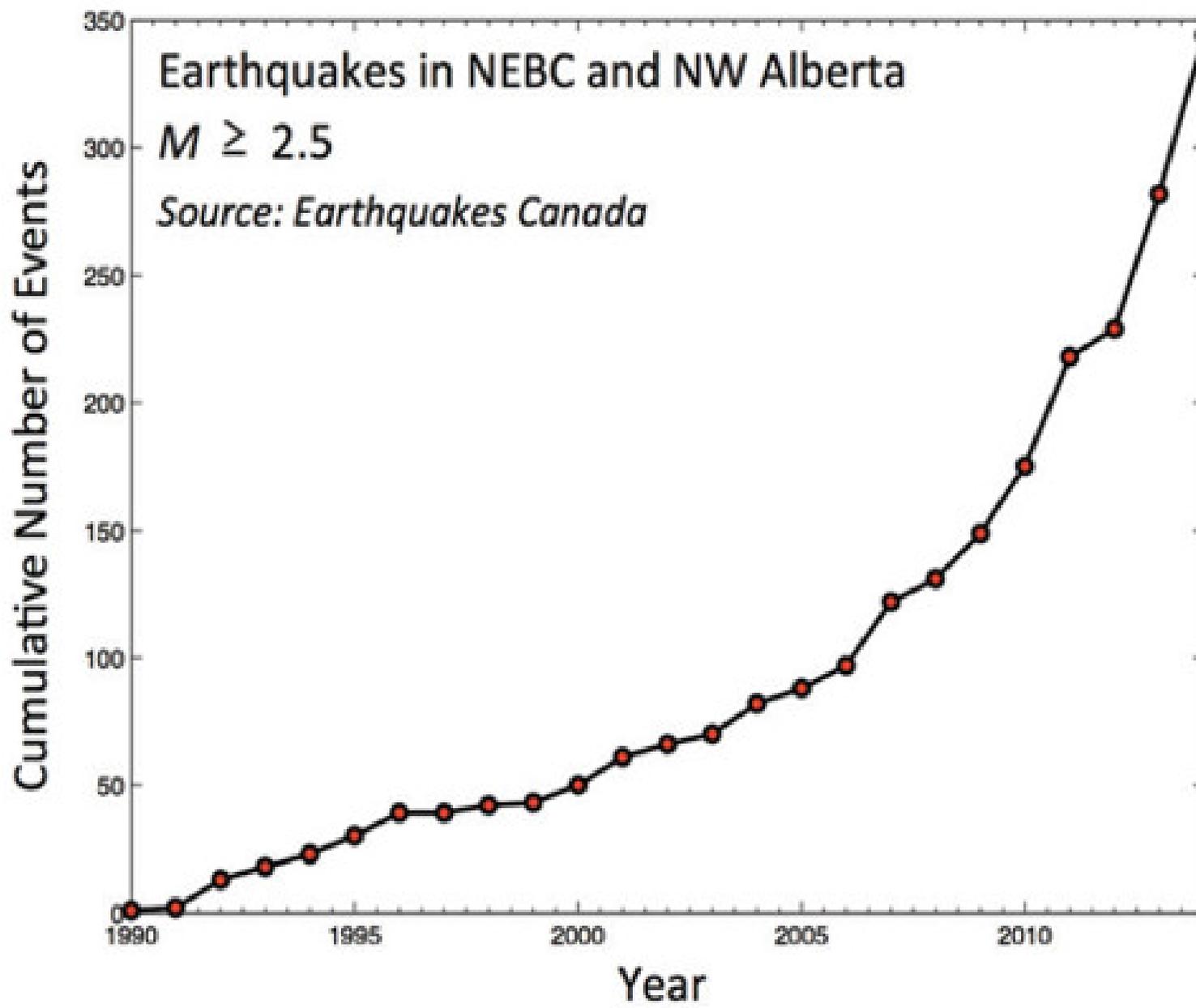


2.0M_L

no action required



Cumulative number of earthquakes with a magnitude of 3.0 or larger in the central and eastern United States, 1970–2015. The long-term rate of approximately 29 earthquakes per year increased sharply starting around 2009.



Alberta Law
Can't divert water without a permit
Resolve any allegation of impact



CONCLUSIONS:

THE MORE INDUSTRY FRACKS SHALE AND OTHER FORMATIONS, THE GREATER THE RISK TO GROUNDWATER AND ATMOSPHERE FROM METHANE LEAKS AND CONTAMINATION.

FRACKING AND HORIZONTAL DRILLING MAKES GAS MIGRATION WORSE.

A PennWell Publication

WEEK OF DECEMBER 5, 1994

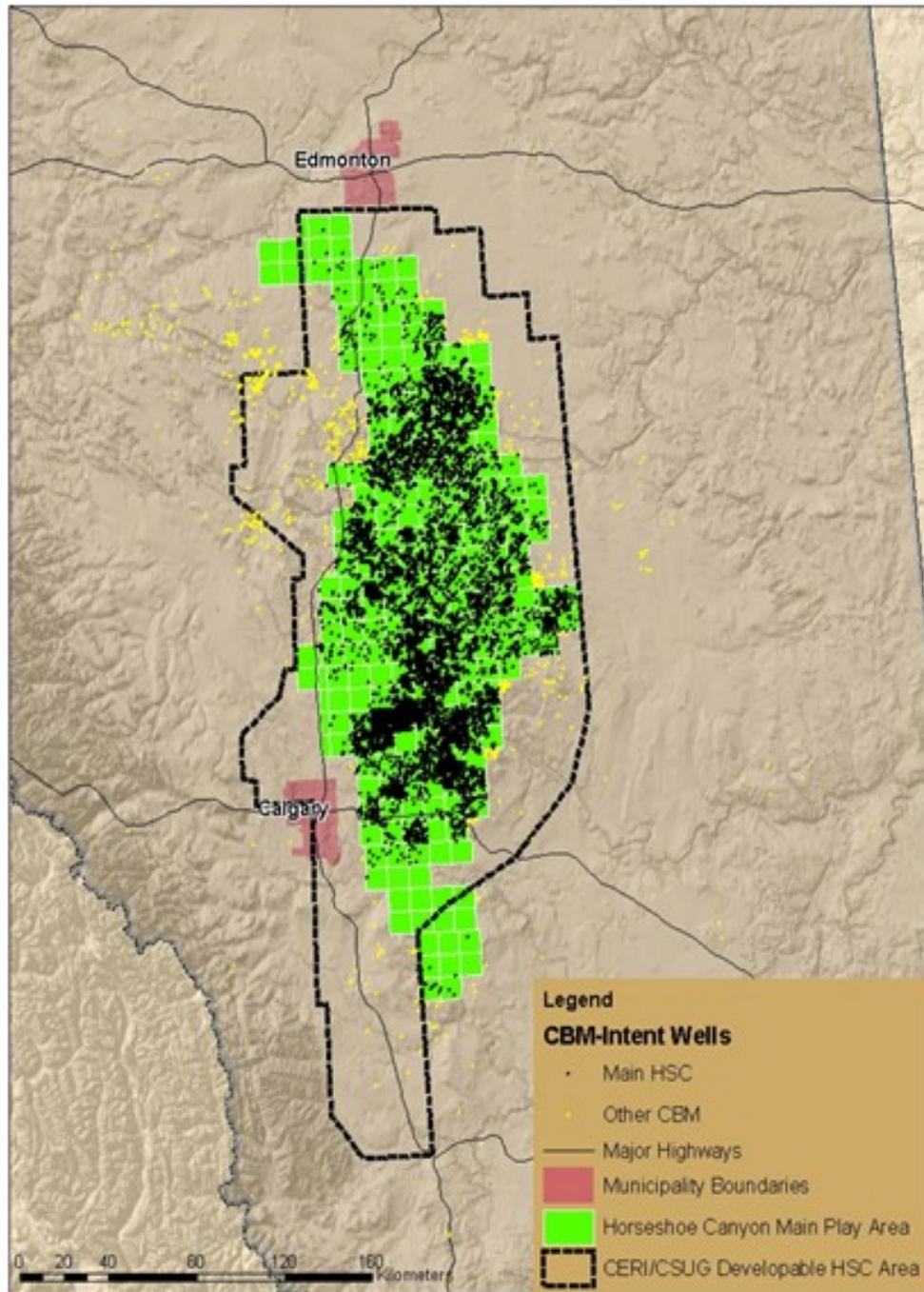
OIL & GAS JOURNAL

INTERNATIONAL PETROLEUM NEWS AND TECHNOLOGY



Triassic gas potential seen high in West Canada region Page 70

U.S. fuel oil demand to show fourth straight winter increase	21
Dull bit grading and rock strength analysis key to bit selection	45
FSU, U.S. design codes differ on key points of pressure testing	52
Equation predicts shrinkage of heavy oil-condensate blend	62



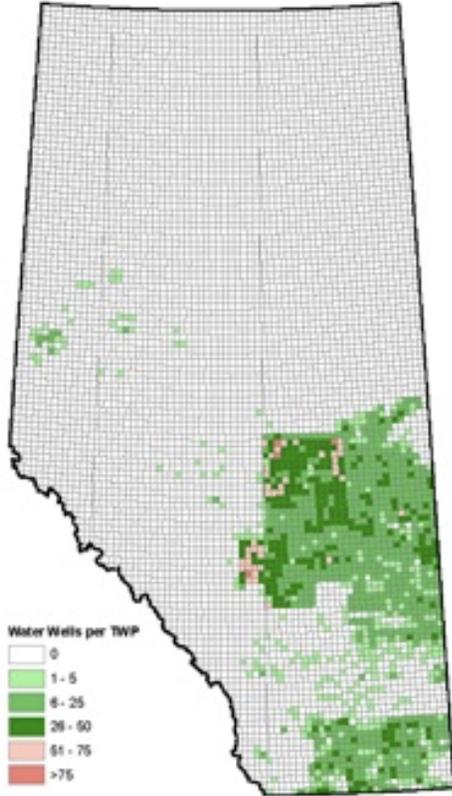


Water Well Density

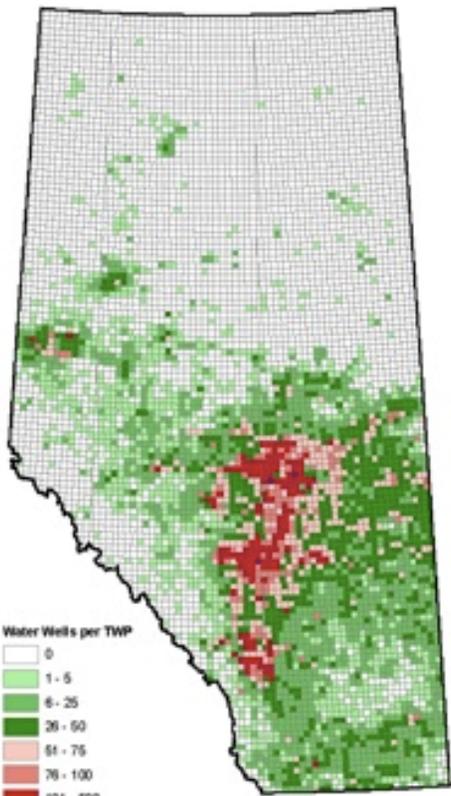
1950

1980

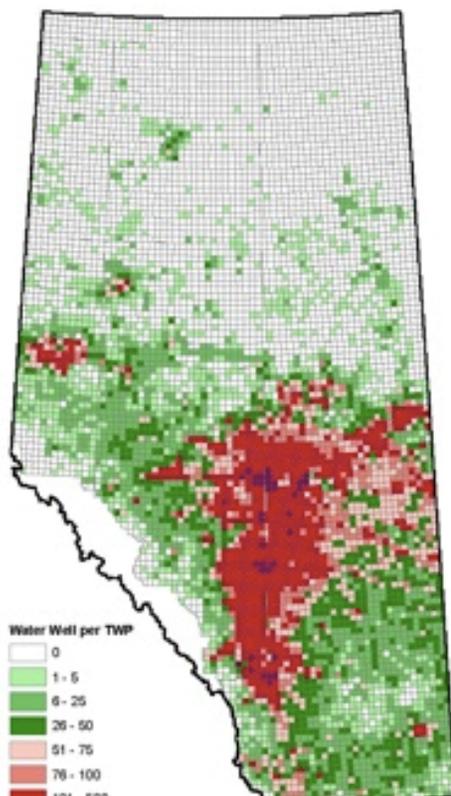
2010



Total Wells: 22,338



Total Wells: 93,437



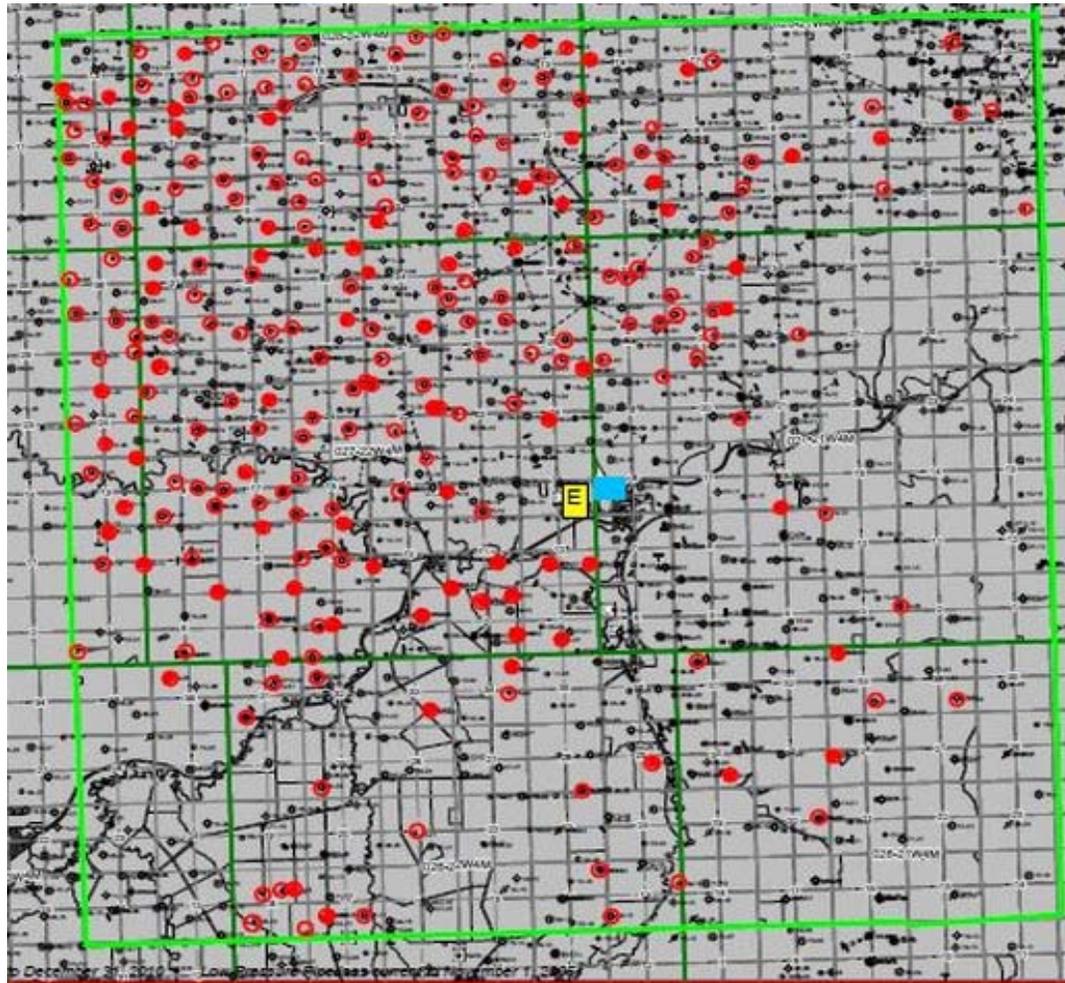
Total Wells: 223,070

Government of Alberta



February 2011

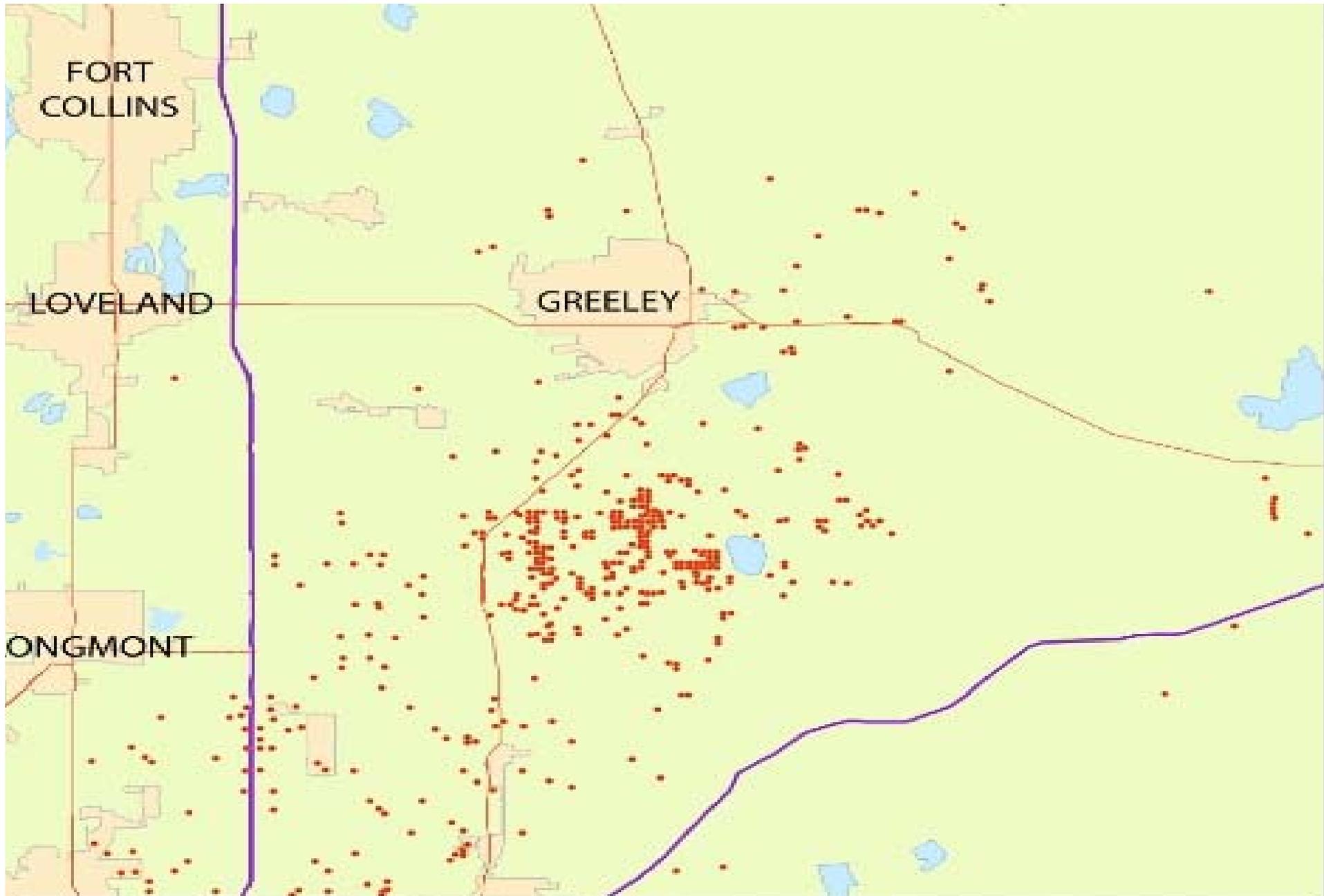
Red dots = Gas wells fracked in fresh water zones at Rosebud to April 2006
Small black dots = conventional & deeper fracked wells



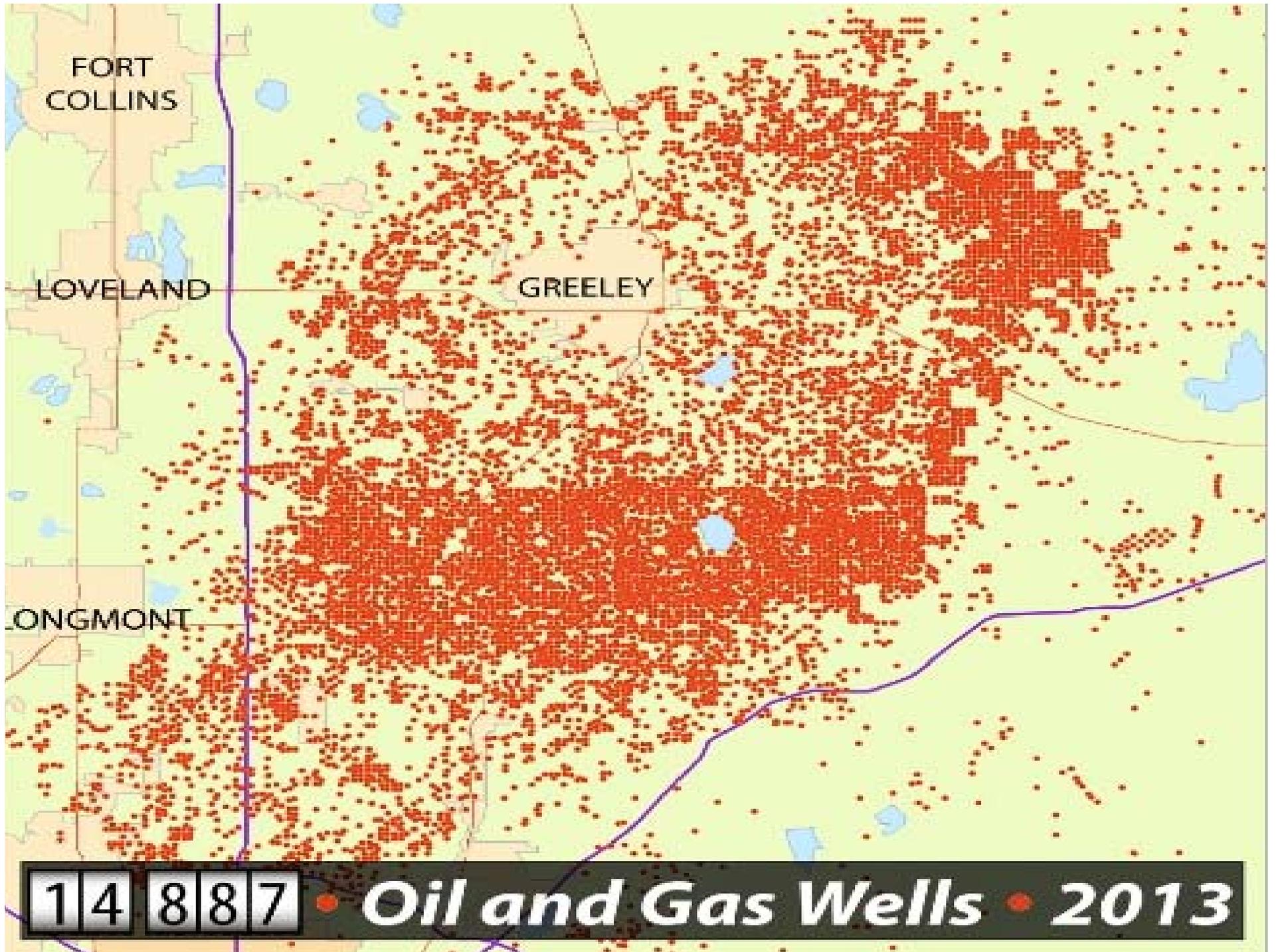
E = approximate location of Ernst property

~ 1 mile

■ = Rosebud Community Water Tower that exploded in 2005



00 479 • Oil and Gas Wells • 1991



2006

Yukon Territory

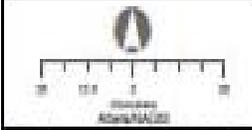
Northwest Territories

LANDS & RESOURCES DEPARTMENT
Fort Nelson Provisional
88th Ave SE, Keesee Highway
Fort Nelson, BC, V0C 1R0
Tel: 250-774-0313
Fax: 250-774-0317

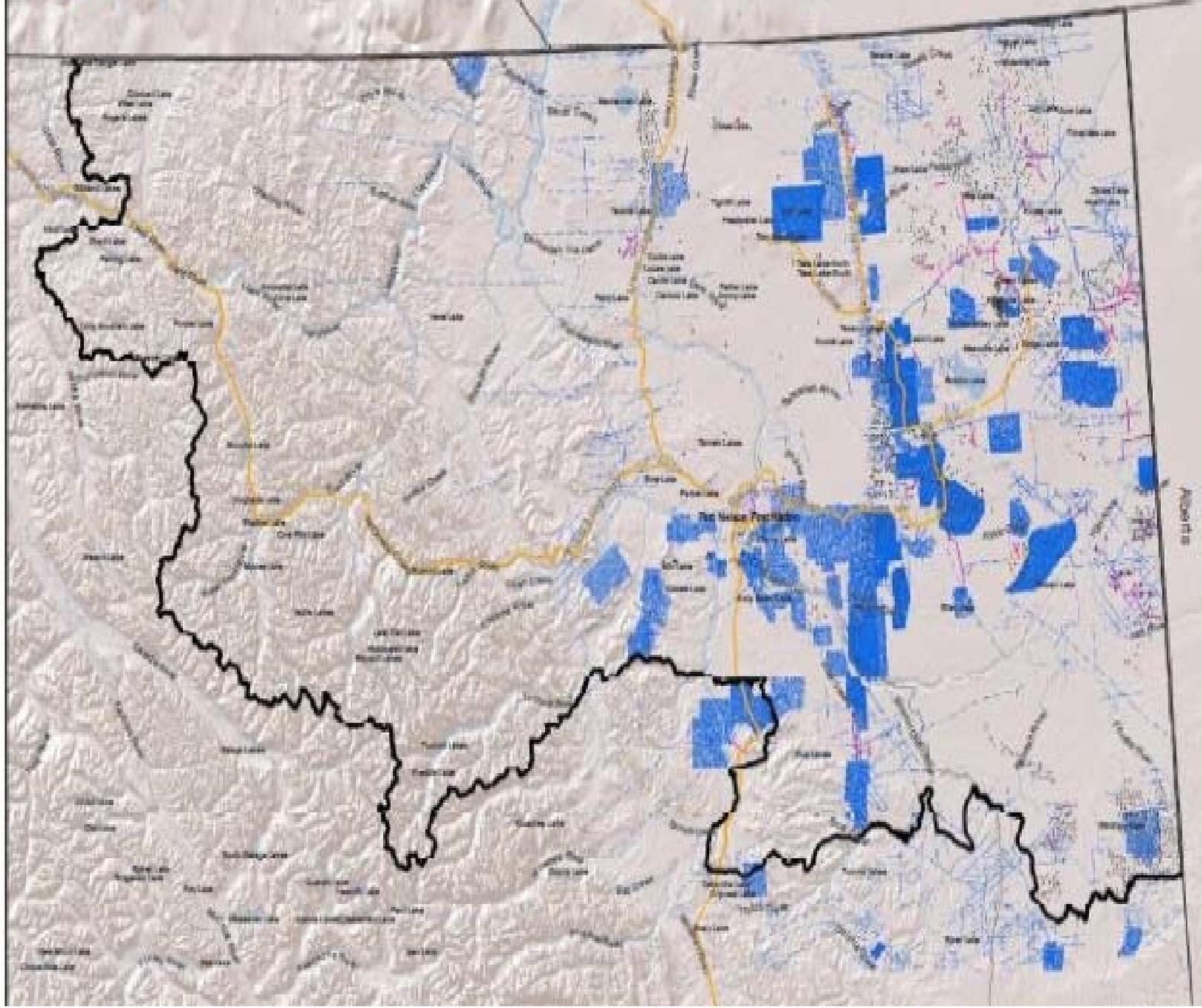
Oil and Gas Development Footprint in PNFN Territory, 2006

Legend

- PNFN Core Territory
- PNFN Reserve
- Developer**
- Main Road
- Railroad
- River
- Lake
- Industry Activity 2006**
- Well
- Petroleum Access Road
- Seismic Line
- Pipeline Right of Way
- Facility
- Wellsite
- Auxiliary & Other Application



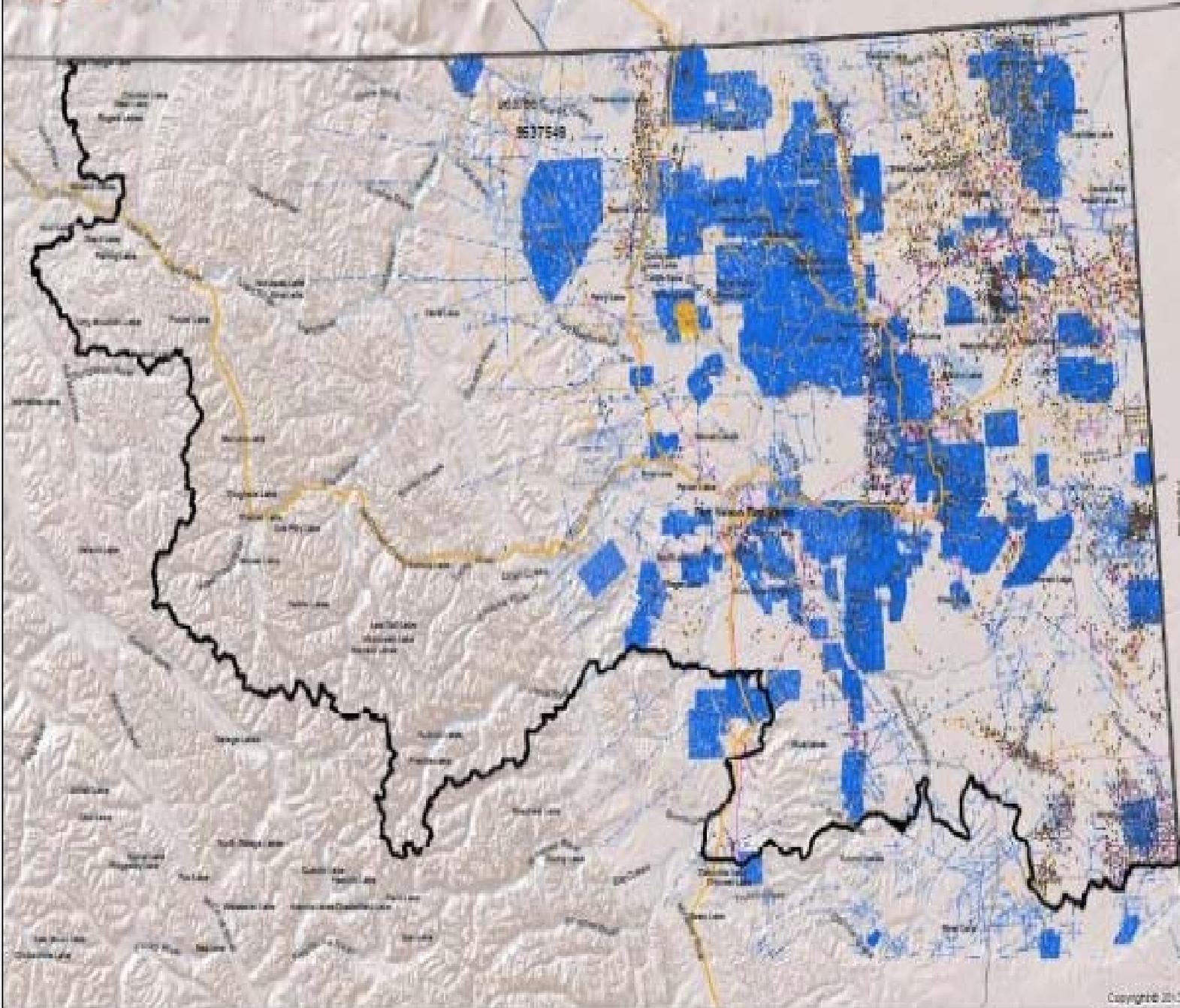
Prepared by: **Geomatics Canada**
 Client: **Government of Alberta**
 Project: **Oil and Gas Development Footprint in PNFN Territory, 2006**
 Date: **11 January 2014**



2013

Yukon Territory

Northwest Territories



LANDS & RESOURCES DEPARTMENT
 Fort Nelson First Nation
 55th Mile 200, Alasca Highway
 Fort Nelson, BC, V4C 1R5
 Tel: 250-774-8013
 Fax: 250-774-8017

**Oil and Gas Development
 Footprint in FNN Territory,
 2013**

Legend

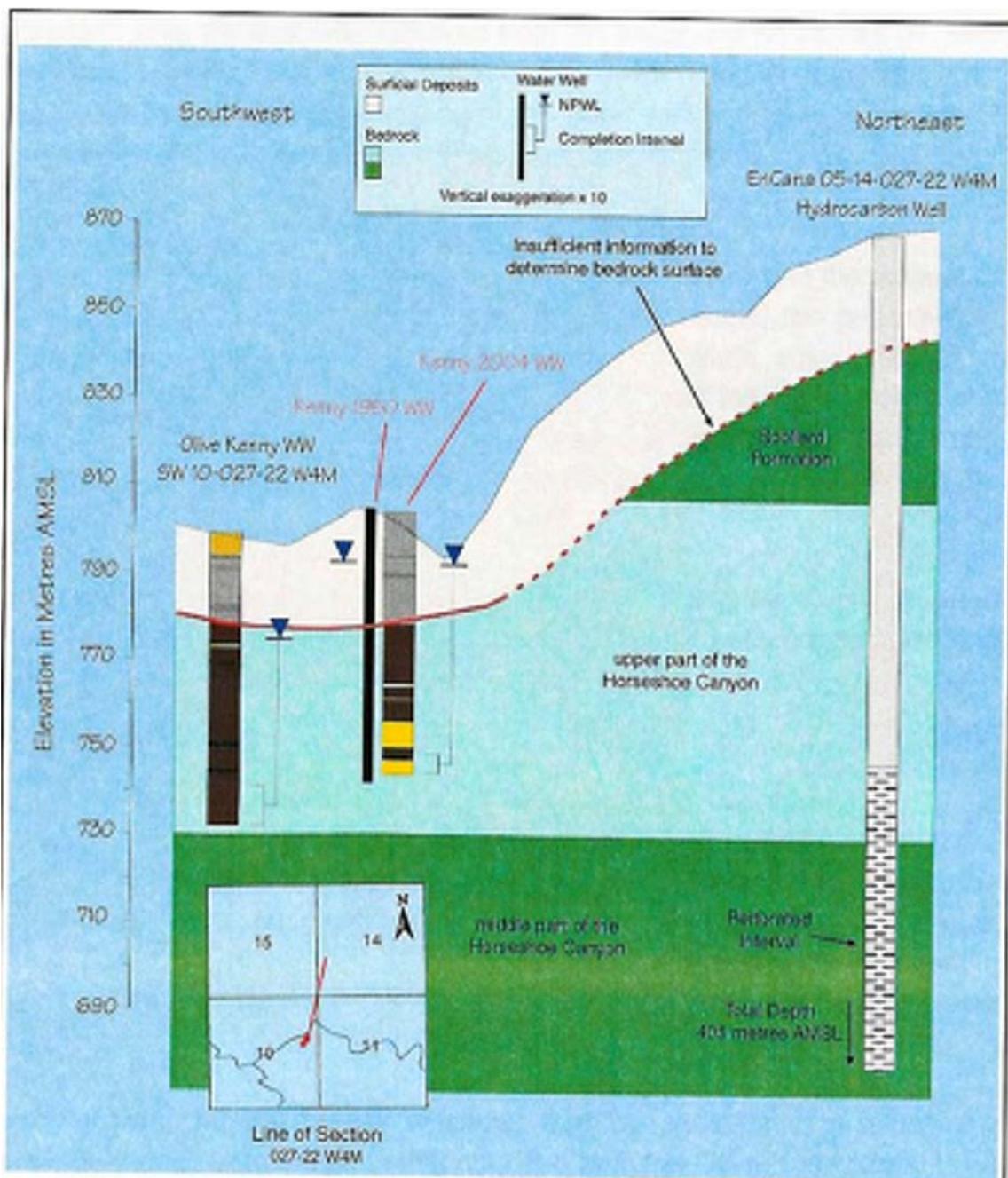
- FNN Core Territory
- FNN Reserves
- Infrastructure**
- Main Road
- Railroad
- River
- Lake
- Industry Activity 2013**
- Well
- Petroleum Access Road
- Seismic Line
- Pipeline Right of Way
- Facility
- Wellsite
- Ancillary & Other Application



Prepared by: Robert L. Cospercos
 Date: January 2013



Copyright 2013 Bay



South-North Cross-Section

Evaluating System for Ground-Water Contamination Hazards Due to Gas-Well Drilling on the Glaciated Appalachian Plateau

by Samuel S. Harrison^a

ABSTRACT

Recent drilling for natural gas in the Glaciated Appalachian Plateau area of northwestern Pennsylvania has caused limited, but increasing ground-water contamination. By evaluating hydrogeologic parameters at a proposed gas well site, such as the ground-water flow system, permeability of surficial sediments, and the presence of fracture zones, the contamination hazard of the site can be assessed. Three case studies document that the most hazardous sites are generally located on or near valley walls of major drainage-ways. The relatively steep hydraulic gradient, the frequent presence of highly permeable surficial sediments, and the low to moderate dilution of contaminants along the intermediate-length flow paths at these sites all contribute to a relatively high pollution hazard. In addition to locating gas wells in high-hazard hydrogeologic zones, allowing the annulus of gas wells to become pressurized is the other major factor contributing to aquifer contamination.

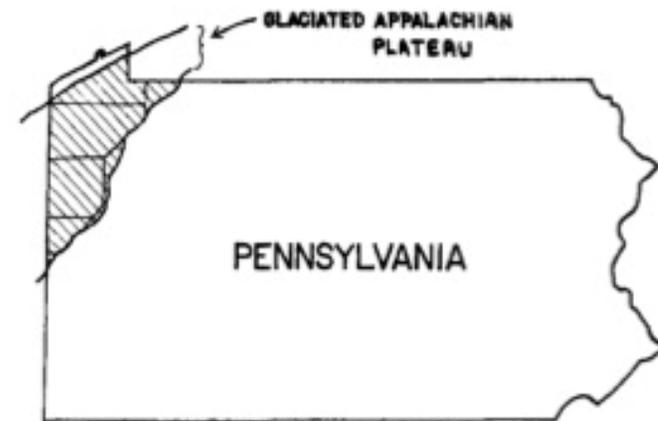
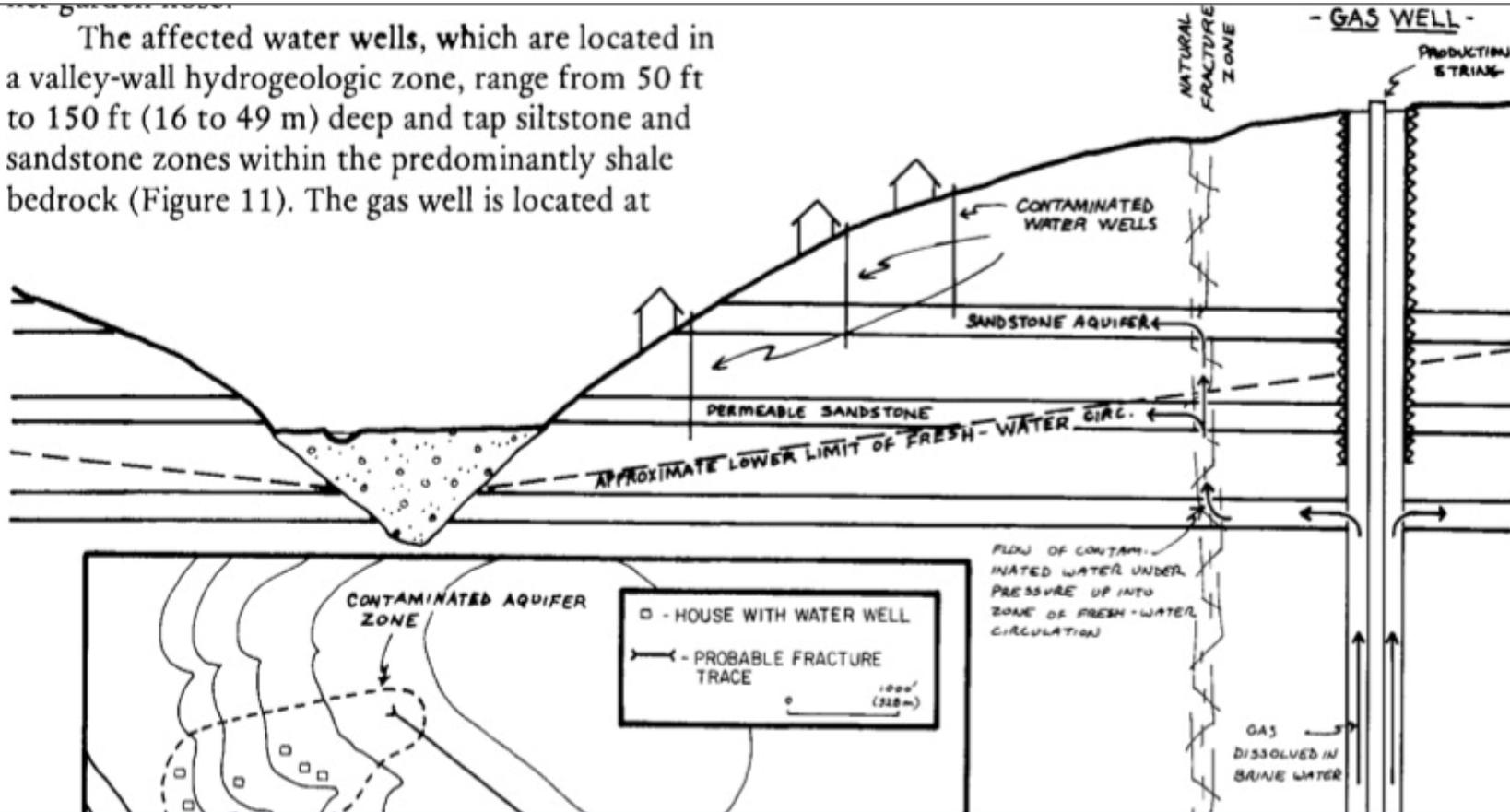


Fig. 1. Location of the Glaciated Appalachian Plateau in Pennsylvania.

with gas-well drilling, and discusses in detail factors affecting the movement of these contaminants into and within shallow aquifers. A qualitative model is

The affected water wells, which are located in a valley-wall hydrogeologic zone, range from 50 ft to 150 ft (16 to 49 m) deep and tap siltstone and sandstone zones within the predominantly shale bedrock (Figure 11). The gas well is located at







EnCana fracked into local aquifers.

The energy regulator falsely branded Ernst
as a “criminal threat.”

Alberta Environment conducted a bogus
water investigation.

The Alberta Research Council covered-up
government fraud.

“As well density increases it becomes increasingly probable that wells will communicate either through previously created fractures or through adjacent wellbores and then into previously created fractures.”

Denbury Resources, at EPA Frac Workshop, March 10/11 2011

Much protest is naive; it expects quick, visible improvement and despairs and gives up when such improvement does not come. Protesters who hold out for longer have perhaps understood that success is not the proper goal. If protest depended on success, there would be little protest of any durability or significance. History simply affords too little evidence that anyone's individual protest is of any use. Protest that endures, I think, is moved by a hope far more modest than that of public success: namely, the hope of preserving qualities in one's own heart and spirit that would be destroyed by acquiescence.

Wendell Berry

COAL SEAM GAS IN AUSTRALIA



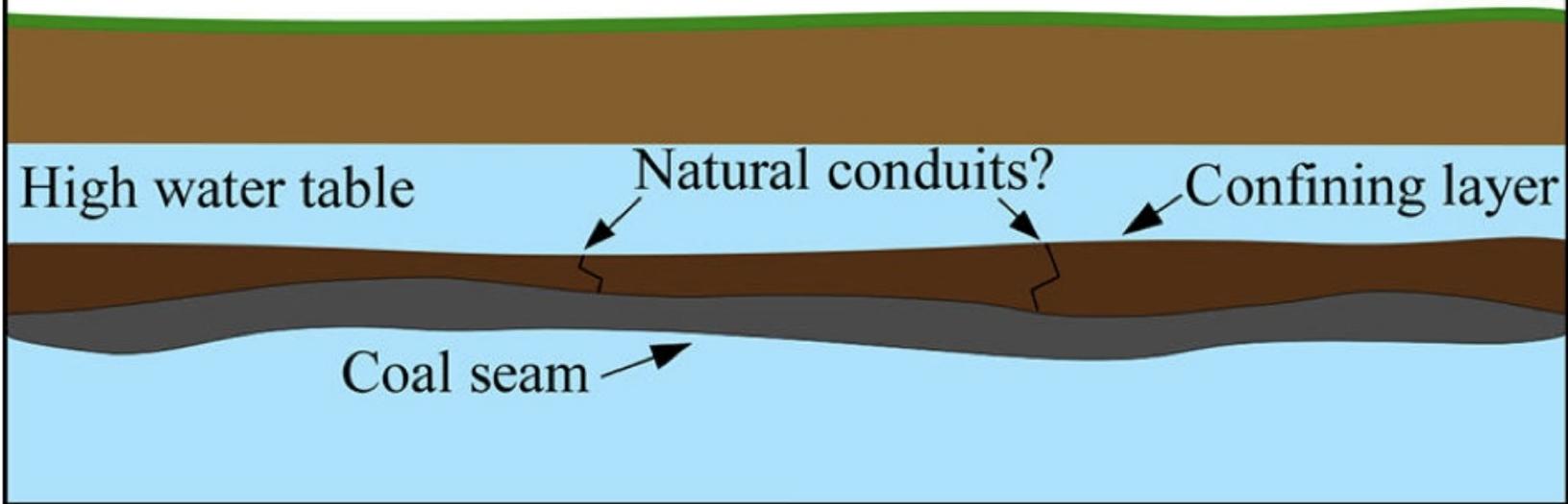
The red areas of the map show coal basins with proven recoverable coal seam gas. Exploration is underway in Victoria and CSG

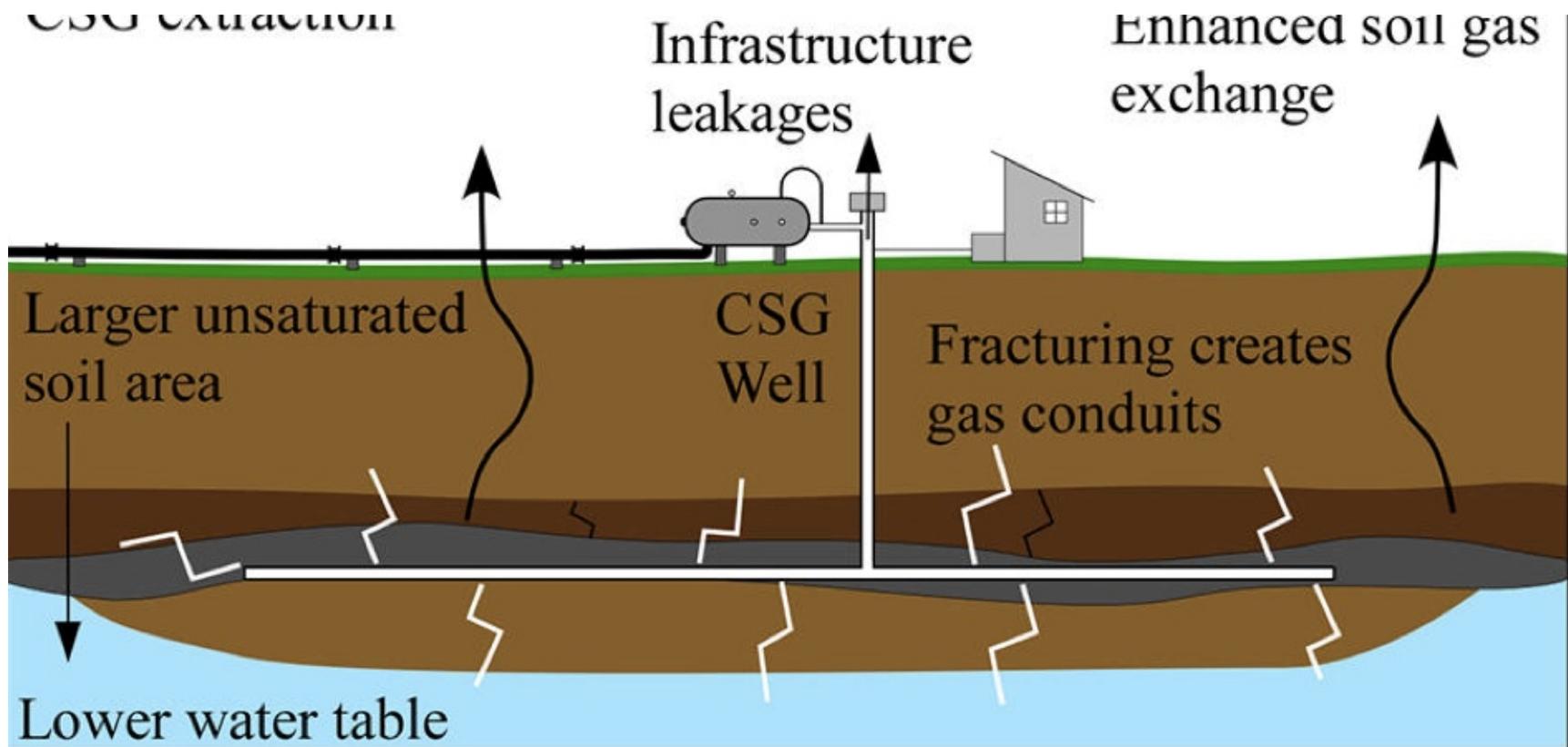






Control (no CSG extraction)





3 Times More Methane/ CO2/ Radon