

New Mexico Junior College

Hydraulic Fracturing Basics

Presented by:

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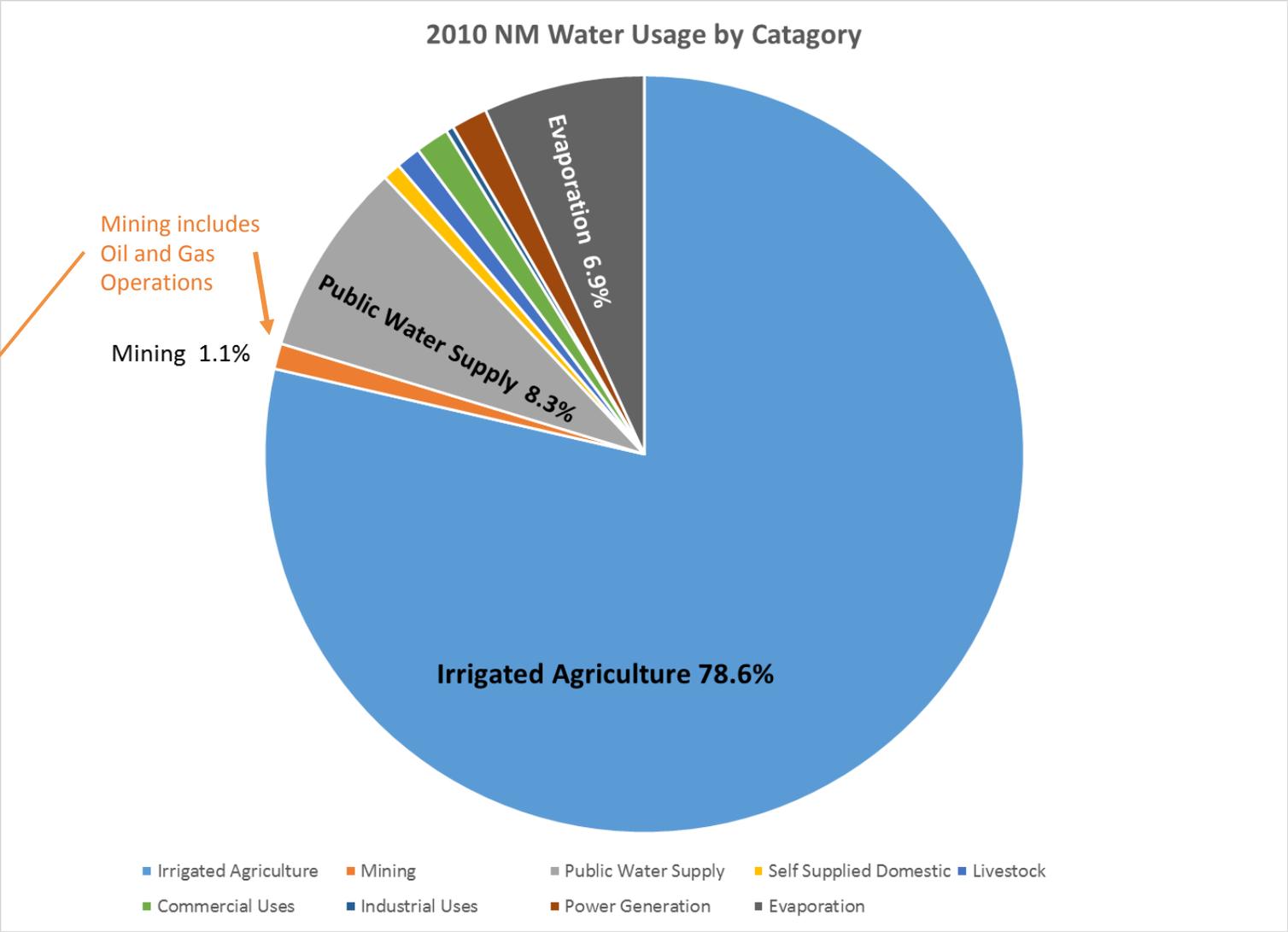
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2010 NM Water Usage

Category	percent
Irrigated Agriculture	78.62
Public Water Supply	8.32
Evaporation	6.87
Power Generation	1.53
Commercial Uses	1.43
Mining	1.09
Livestock	1.05
Self Supplied Domestic	0.76
Industrial Uses	0.33



Data from Office of NM State Engineer.

Oil and Natural Gas – A Major Part of our Lives

TECHMAP - Mark Mathis

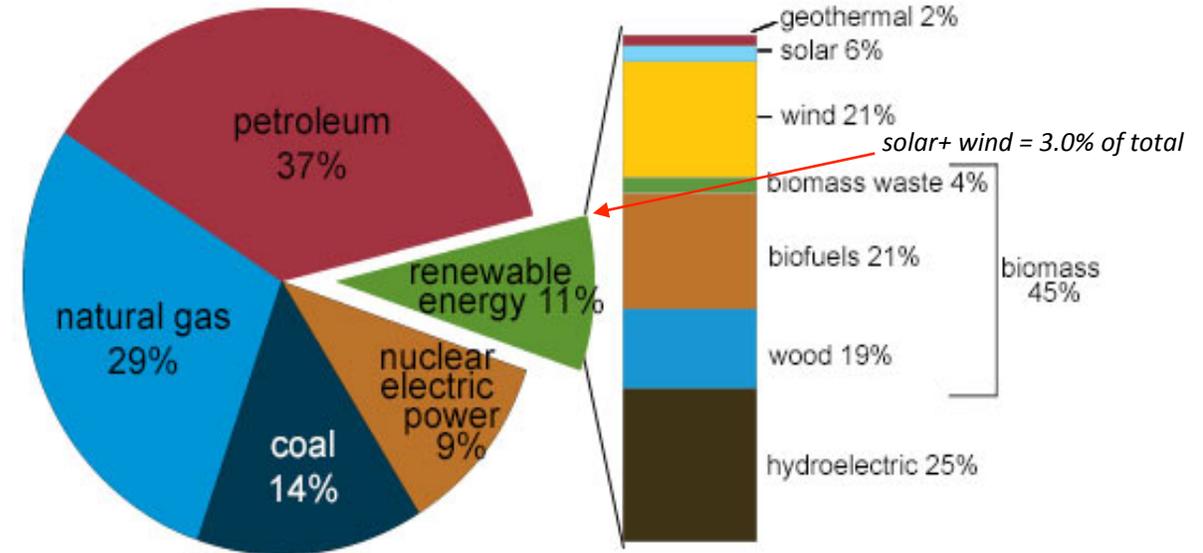
- **T**ransportation
- **E**lectricity
- **C**ooking
- **H**eating
- **M**anufacturing
- **A**griculture
- **P**roducts

Oil and natural gas are central to our national defense and our personal security.

<https://www.txoga.org/know-oil-natural-gas-central-national-security/>

U.S. energy consumption by energy source, 2017

Total = 97.7 quadrillion
British thermal units (Btu)



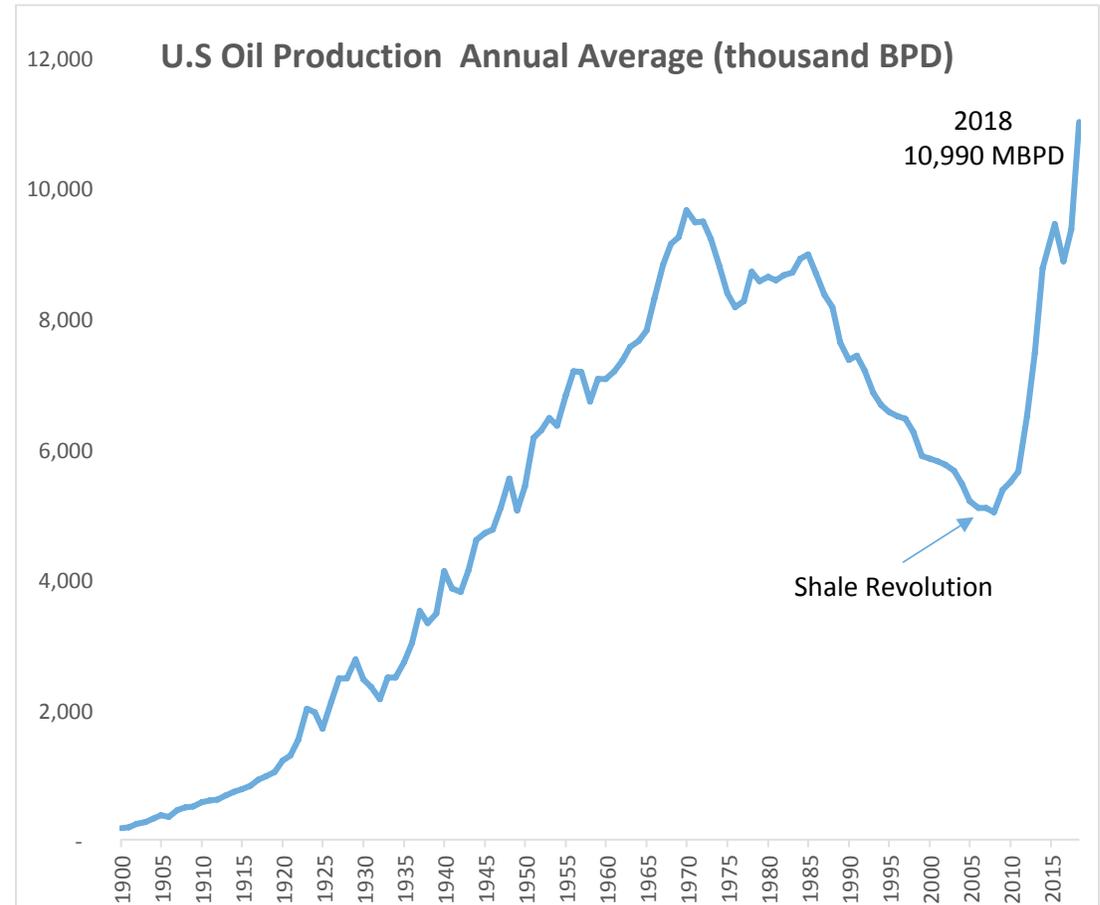
Note: Sum of components may not equal 100% because of independent rounding.
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.3 and 10.1, April 2018, preliminary data



The EIA provides independent statistics and analyses as part of the Department of Energy
2017 data is most current available for consumption by source

Hydraulic Fracturing is Required for O&G Production in New Mexico and the United States

- ✓ Oil and gas are produced from underground formations made of rock. The O&G have collected in tiny pores in this rock over hundreds of millions of years.
- ✓ The Shale Revolution began in 2005 ending 35 years of US and NM oil production decline.
- ✓ Shale has very low permeability meaning oil will not readily flow from this type of rock.
- ✓ The two primary technologies required to obtain economical production from shale are horizontal drilling, which exposes the wellbore to thousands of feet of pay-zone,
- ✓ And hydraulic fracturing which opens “super highways” in the formation creating pathways to the wellbore.
- ✓ Without this technology, the Shale Revolution immediately stops.

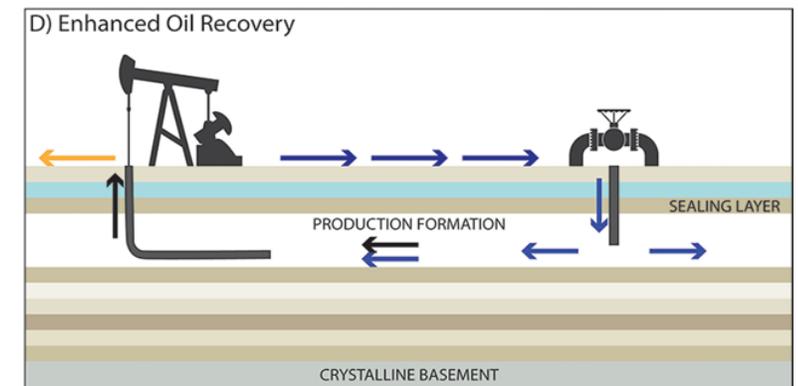
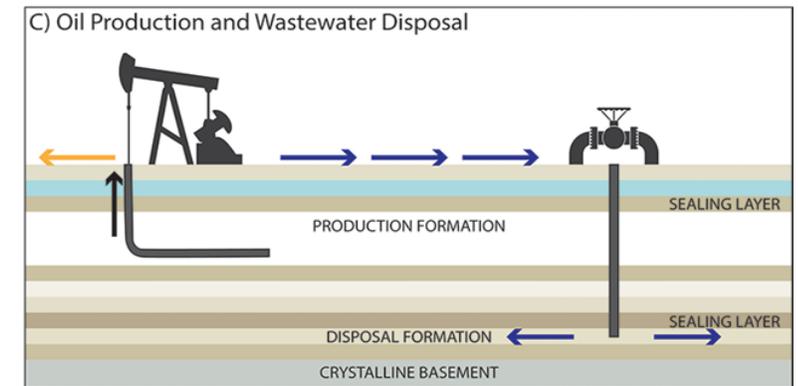
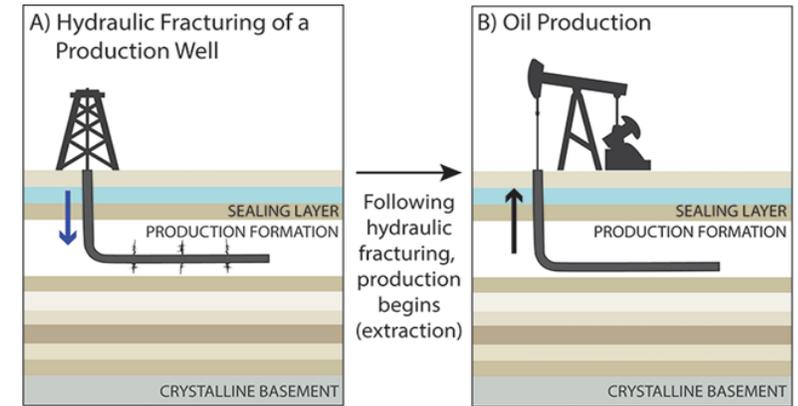


Hydraulic Frac Fluid - Chemistry

1. The most common frac fluid used in SE NM is commonly called ‘Slick Water’ and is approximately 95% water, 4.9% sand, and **0.1% chemicals**.
2. **Frac fluid does not enter our fresh water supply.** This fluid is mixed on surface, immediately pumped deep underground, and later returned with produced water and oil to surface. The frac water and produced water are then either reused or disposed of down a regulated disposal well into a deep underground non-productive formation.
3. Each service company has products/chemicals with different names, concentrations, and diluents. Larger service companies will invest in R&D to improve the safety and performance of their products and technique. **Service companies comply with federal/state/local regulations but minimize shared data to remain competitive.** This is done in the same fashion as Coca-Cola and WD-40, simply to protect trade secrets from competitors.
4. Safety Data Sheets are required by OSHA to list all hazardous ingredients and their maximum concentration. The active ingredients are not required on a SDS unless they are hazardous. **The majority of the hazardous ingredients listed on the SDS are simply a small portion of the diluent, or carrier liquid...not the active product.** Examples commonly referenced:
 - Benzene –Found as a by-product in some diluents. *Commonly found in gasoline (approximately 1%).*
 - Ethylene glycol –Used in frac products as a diluent or to stabilize actives. *Commonly used as automotive antifreeze.*
 - Methanol –Used in frac chemicals to stabilize actives. *Used to remove water from gasoline (Heat) and in windshield washer fluid.*
 - Glutaraldehyde – Biocide added to frac water to inhibit bacterial growth. *Found in cleaning products and the medical industry.*
 - Petroleum distillates - Used as a diluent in frac chemicals. *Commonly diesel, kerosene, charcoal lighter.*
 - Hydrochloric and/or acetic acid – pH adjustment or to enhance perforating prior to frac. *Acids used in swimming pools and food products.*
 - Peroxydisulfate –Utilized to enhance frac fluid flow-back. *Commonly used to lighten hair.*
 - Polyacrylamide –Reduces friction as frac fluid is pumped downhole. *Used in cosmetics, water treatment, and soil conditioning.*

Produced Water Disposal

- Most oil and gas wells naturally produce water with the oil and gas. This “produced water” is normally reinjected into a deep non-productive underground formation.
- The vast majority of this water is from prehistoric oceans that existed when the oil and gas was formed.
- Frac flow-back water is either cleaned and reused or disposed of in a non-productive formation. Wells that use water during the completion process (hydraulic fracturing or acidizing) will produce most of this water back over the life of the well.
- The largest water producers will typically be “water-floods” which are a form of enhanced oil recovery. This water is continuously reinjected during the life of the flood, normally 20+ years.



Induced Seismicity – Oklahoma Earthquakes

Stanford University Study

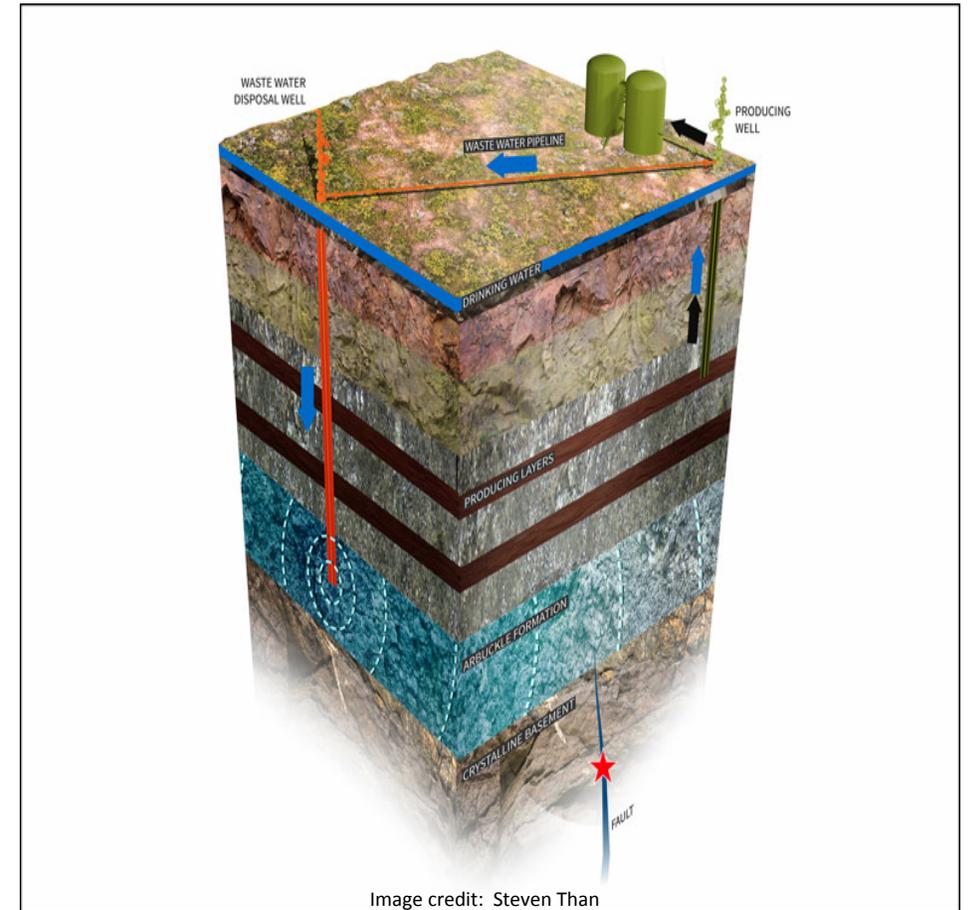
“What’s happening in Oklahoma is unrelated to hydraulic fracturing. It’s unrelated to hydraulic fracturing flow-back water. It’s caused by massive injection of produced water”

The OK seismic activity is due to large volumes of water being injected into the Arbuckle formation. The overwhelming majority of this water is produced water which naturally co-exists in the ground with the oil and gas.

“Earthquakes being felt throughout the state pose little danger to the public”.

The increase in pore pressure within the rock is triggering prebuilt stress in existing faults. “The earthquakes in OK would have happened eventually, but by injecting water into the faults, we’ve advanced the clock and made them happen today”.

One solution is to cease injection into the Arbuckle formation. This is successfully occurring in problem areas.



New Mexico Seismicity

Earthquakes in New Mexico – USGS.gov

<https://earthquake.usgs.gov/earthquakes/map>

Jan 1, 2000 to present (18+ years): the USGS lists 247 earthquakes with a magnitude greater than 2.5 in NM. Only 12 exceeded 4.0, averaging 4.2 magnitude with none exceeding 5.

- 2.5 or less - usually not felt.
- 3.0 - You may notice a hanging object swing a little. It's unlikely you will feel anything unless you are sitting still or lying down.
- 4.0 - Feels like a large truck passing by or even the shaking caused by an explosion nearby.
- 5.0 - Unmistakable as an earthquake, this can rattle dishes, break windows and rock cars.

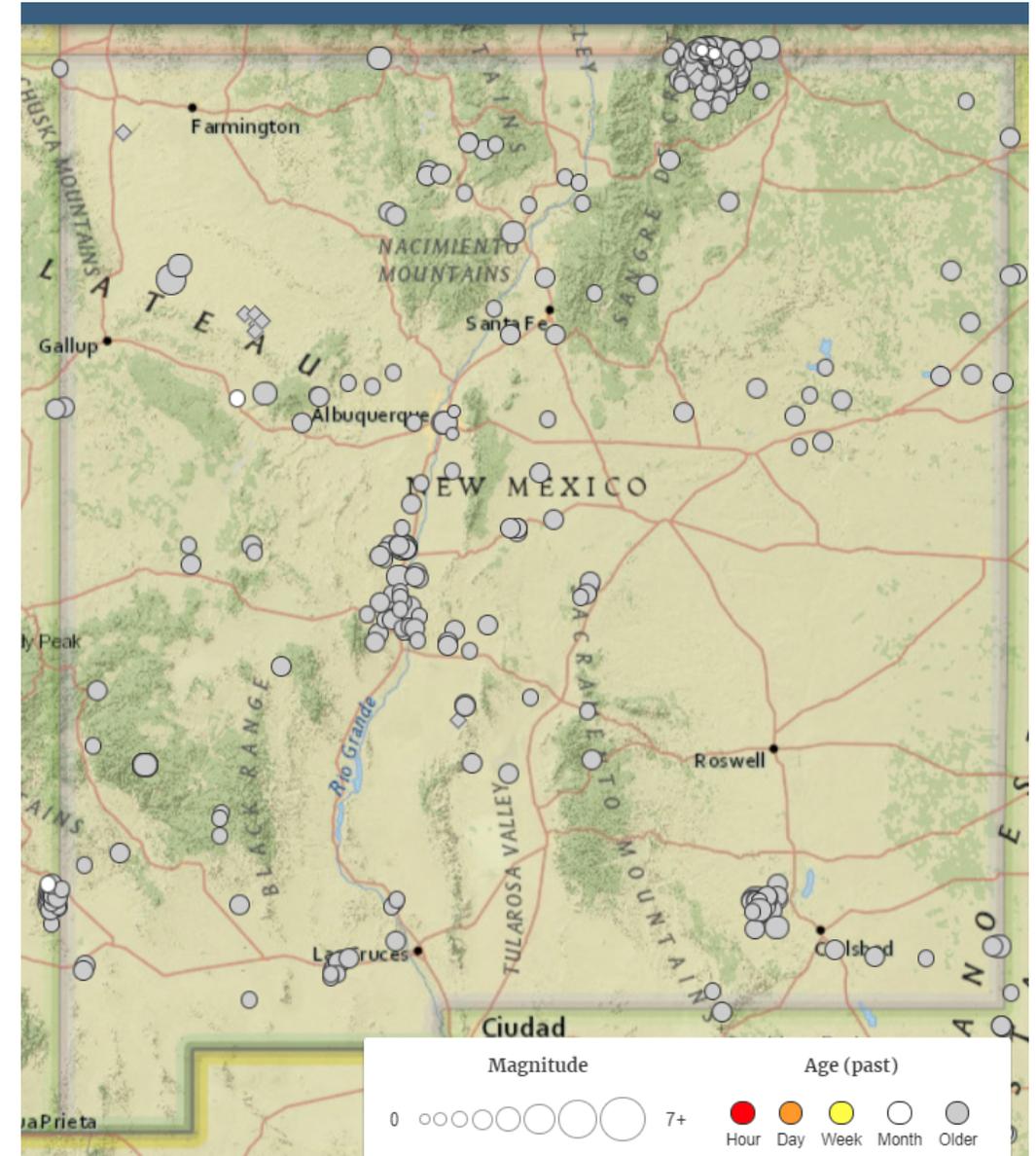
Facts from USGS – U. S Geological Survey (U.S. Department of the Interior)

<https://earthquake.usgs.gov/research/induced/myths.php>

Hydraulic fracturing is not causing induced seismic activity.

Although very few, some wastewater injection wells induce seismic activity.

Wastewater is produced at all oil wells, not just hydraulic fractured sites.



Fresh Water Net Gain From O&G Operations

- The water used in hydraulic fracturing is replaced in the natural water cycle as we use the newly produced oil and natural gas for TECHMAP.
- Oil and natural gas are commonly referred to as hydrocarbons. When hydrocarbons are utilized, they produce energy for transportation, electricity, cooking, heating, manufacturing, agriculture, and products.
- The simplified chemical reaction:
$$\text{Hydrocarbons} + \text{Oxygen} \longrightarrow \text{Water} + \text{Carbon Dioxide} + \text{Energy}$$
- The average O&G well will replenish the fresh water consumed during drilling and completion within two years.