Frac Sand: Mining & Use

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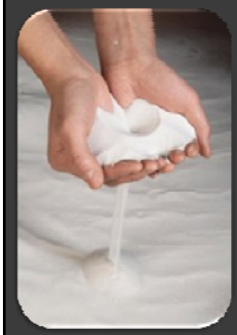
Frac Sand: Mining & Use

- What this presentation will cover:
  - What is frac sand?
  - Where is frac sand located in La Crosse Co., Western Wisconsin?
  - How is frac Sand being used?
  - What are the market forces affecting frac sand?

What is Frac Sand?



- Quartz sand
- Highly rounded
- High compressive strength

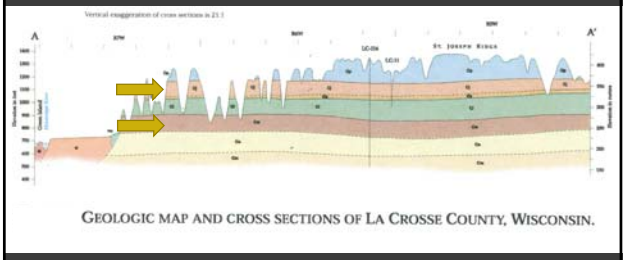
<u>Most desirable if:</u>

- Easily recoverable
- Minimal processing steps (costs), quartzite cement?
- Ability to get from mine to oil/gas drilling sites easily (close to transportation routes- i.e. train)

The Best Frac Sand is…
well rounded and nearly pure quartz

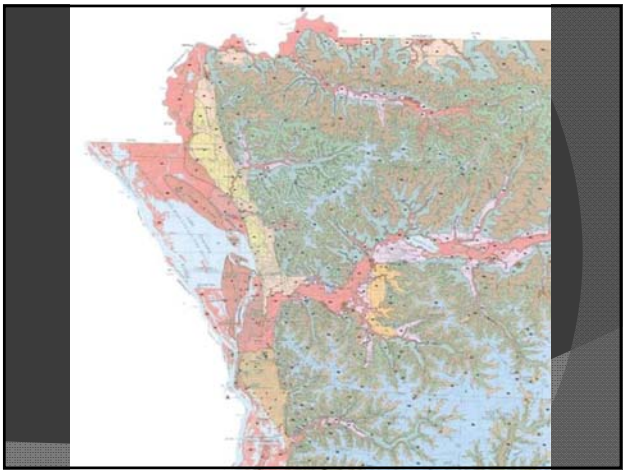
Many younger sands are too angular or contain other minerals or rock fragments

Where is Frac Sand located in La Crosse County

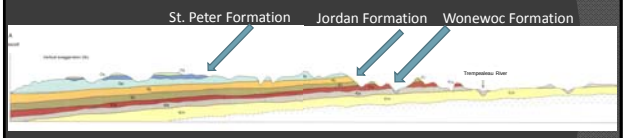


GEOLOGIC MAP AND CROSS SECTIONS OF LA CROSSE COUNTY, WISCONSIN.

The Jordan Sandstone & Wonewoc Sandstone are the regional quartz sand sources sought for frac sands.

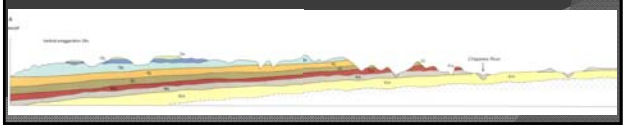


Western Wisconsin Geology



High Quartz Content Sand Stone Formations

Bedrock Geology in Western Wisconsin



How is frac sand being used?

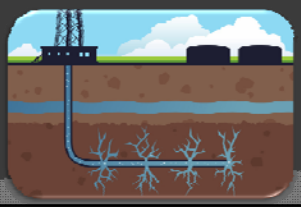
- Mixture of water, chemicals (1%) and sand (proppant)
- Sand slurry introduced into the fractured oil shale at high pressures
- Proppant (sand) holds formation open, increases porosity (interconnectivity), and allows oil/natural gas out of formation
- Chemicals used are dependent on the formation characteristics

Common chemicals added
(at drilling site)

- Hydrochloric Acid
- Ammonium Chloride
- Isopropanol/formic acid
- Methanol/Ethylene Glycol
- Guar Gum/Petroleum distillate
- Helps dissolve minerals and improve cracks
- Biocide (eliminates bacteria in the water that produces corrosive by-products
- Corrosion inhibitor/winter stabilizer
- Friction reducer
- Gelling agents

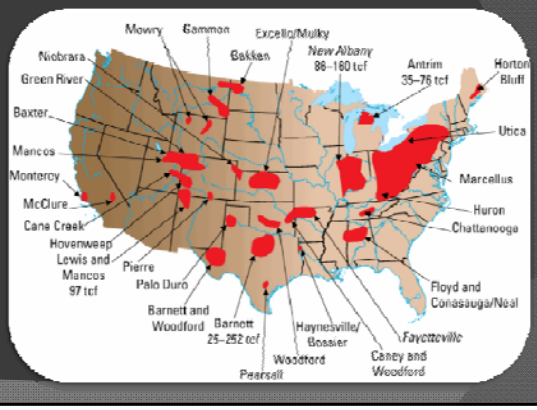
Hydrofracking a well

Fluid pressure fractures the rock, sand grains keep the fractures open

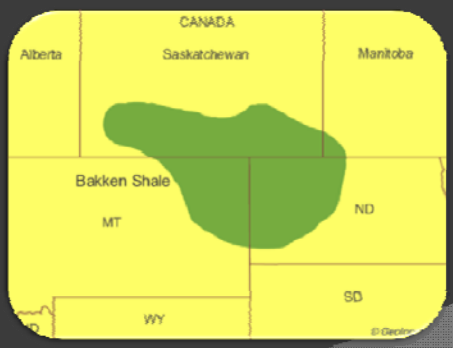


Video: http://tinyurl.com/HydraulicFracing

Where the Gas is…



Where is frac sand used regionally?



Assessment of Undiscovered Oil Resources in the Devonian-Mississippian Bakken Shale Formation, Williston Basin Province, Montana and North Dakota, 2008, USGS Oil and Gas Fact Sheet - April, 2008

What is the Bakken Formation's projected yield?

Table 1. Bakken Formation, Williston Basin Province assessment results.

[MMBO, million barrels of oil. BCFG, billion cubic feet of gas. MMBNGL, million barrels of natural gas liquids. Results shown are fully risked estimates. F95 represents a 95 percent chance of at least the amount tabulated; other fractiles are defined similarly. TPS, total petroleum system; AU, assessment unit]

	Total Petroleum System and Assessment Unit	Field Type	Total Undiscovered Resources											
			Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
Continuous Oil Resources	**Bakken-Lodgepole TPS**													
	Elm Coulee–Billings Nose AU	Oil	374	419	450	419	118	198	332	208	8	16	29	17
	Central Basin–Poplar Dome AU	Oil	394	482	589	485	134	233	403	246	10	18	35	20
	Nesson–Little Knife Structural AU	Oil	818	908	1,007	909	260	438	738	461	19	34	64	37
	Eastern Expulsion Threshold AU	Oil	864	971	1,091	973	278	469	791	493	20	37	68	39
	Northwest Expulsion Threshold AU	Oil	613	851	1,182	868	224	411	754	440	16	32	64	35
	Total Continuous Resources					2,645				1,848				148
Conventional Oil Resources	Middle Sandstone Member AU	Oil	1	4	8	4	1	1	3	2	0	0	0	0
	Total Conventional Resources					4				2				0
	Total Undiscovered Oil Resources					2,649				1,850				148

Reference:

Advantages of Sand Mining

- Local jobs and economic growth.
- The demand for natural gas as a clean fuel will sustain the industry into the future.
- Wisconsin has a history of industrial (foundry sands) sand mining that has recorded very few problems in 100+ years.
- When compared to other types of mining, sand mining has minimal environmental impact and sand mines can be reclaimed successfully.

Potential Problems and Issues

- Groundwater usage and potential for contamination.
- Air quality; dust and the risks from crystalline silica.
- Truck traffic, safety and cost of road maintenance.
- Blasting and potential damage to structures.
- Noise levels and hours of operation.
- Reclamation and subsequent land use.

How serious are the problems? *How do we deal with them?*

- Groundwater use- DNR regulates high capacity wells. Permits are based on extensive review.
- Mines and processing plants routinely recycle as much water as possible
- Impact to private wells can be minimized if mining companies :
  - well survey and/or
  - guarantee a water supply for close neighbors.
- This type of arrangement has worked successfully for the aggregate industry and protects the operator at a small cost compared to litigation.

How serious are the problems? *How do we deal with them?*

- Water quality- Runoff and surface water impact is regulated by DNR. Sand mining has the same potential for groundwater impact as a limestone quarry or gravel pit.
- The issue of prime concern is potential contamination from flocculants used in settling ponds. There is currently little data available and no standards or regulations, but also no history of problems from older mines.

Air Quality Issues

- Frac sand requires clean, round unbroken grains. Processing involves disaggregation and screening, usually done wet, rather than dry grinding.
- A frac sand plant will produce less angular crystalline silica dust than a quarry that crushes quartzite or a gravel pit that dry crushes coarse material.
- There are standard ways to minimize dust such as watering haul roads, paving roads, spraying conveyor belts, and wash baths for truck tires that have proven successful in other mining operations.
- MSHA and OSHA have strict workplace standards, and DNR and EPA air standards also apply.

Operating Issues

- Blasting is regulated by Dept of Commerce. Blasting is only used to loosen material. If rock is too heavily cemented, it is not useful for frac sand!
- Traffic, operating schedule, road maintenance etc. are best handled in a conditional use permit, but if no zoning, direct negotiation between Town government and the mining company can be productive as in Town of Howard in Chippewa Co.
- Reclamation is regulated under N.R.135, and a plan subject to public comment, along with financial assurance must be in place before mining begins.

So, what can we conclude?

- The sandstone formations of Wisconsin and Minnesota are the some of the best available for frac sand.
- As long as fracking is the best available technology for producing previously unrecoverable natural gas, frac sand mining will continue to be big business in our region.
- Interest in Wisconsin sand has been growing, but the "sand boom" took us by surprise. Many counties were overwhelmed by mining applications, and the scale of mining has presented problems we haven't dealt with before.

Continued…

- The good news is that Wisconsin has a 100 year history of sand mining with very few problems. Most environmental issues can be dealt with under existing regulations, by using existing technology, and applying standard industry practices.
- Many new mines rely on truck transport. This means traffic and safety issues and potential road maintenance issues that need to be resolved.
- Operational issues can usually be resolved by zoning conditions or negotiation.
- As new mines come into production, the demand should be met and the pace of development should slow, allowing time to work out remaining issues.

Questions for municipalities

- How large of an operation is proposed?
  - # of trucks daily
- How do the proposed operations deal with dust mitigation/control?
- How will this operation effect neighboring properties? Overall local land use?
- Is water drawdown part of the operational needs of this proposed mine/quarry?
- What are the proposed hours of operation?
- Are these hours subject to change?
- What is the sites reclamation plan?

Questions??

- Karl Green

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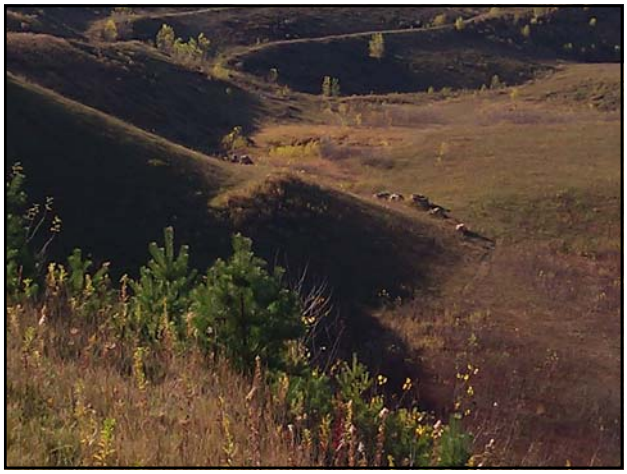

Outcrop Area of the Cambrian Sandstones Wisconsin and Minnesota