Hydraulic Fracturing and Michigan's Waters

Tip of the Mitt Watershed Council

What is Hydraulic Fracturing?

Hydraulic fracturing or "fracking" is the pressurized injection of water, chemicals, and sand into underground rock formations to allow natural gas and oil to flow more freely to the surface. It stimulates wells in order to maximize the extraction of underground resources. Fracking does not include other activities associated with oil and gas development, such as well construction and production.

Drilling and Michigan's Water Resources

From an environmental perspective, one of the most significant impacts of oil and gas development results from the use and disposal of the water. Additional concerns for Michigan's water resources have been raised, due to the scale of operations associated with high volume hydraulic fracturing.

Hydraulic fracturing is not a new technology. It was first introduced to the petroleum industry in the 1940s. The technique has been used since 1952 in Michigan. However, advancements in technology have greatly expanded the use of fracking in recent years. Technological breakthroughs in horizontal drilling and fracturing have made it possible to extract crude oil and natural gas from resources that were previously deemed unproductive or uneconomical. Fracking, coupled with horizontal drilling, has significantly increased natural gas and oil production in the United States.

This new hydraulic fracturing technique is referred to as "high volume hydraulic fracturing." According to the Michigan Department of Environmental Quality (MDEQ), "high volume hydraulic fracturing well completion means a well completion operation that is intended to use a total of more than 100,000 gallons of hydraulic fracturing fluid."

Although hydraulic fracturing has been used historically in oil and natural gas fields in Michigan, it is not on the same scale as today's high volume hydraulic fracturing. These high volume fractured wells are deeper and require substantially more fresh water. They also require greater volumes of chemicals and produce larger quantities of wastewater.

The Hydraulic Fracturing Process

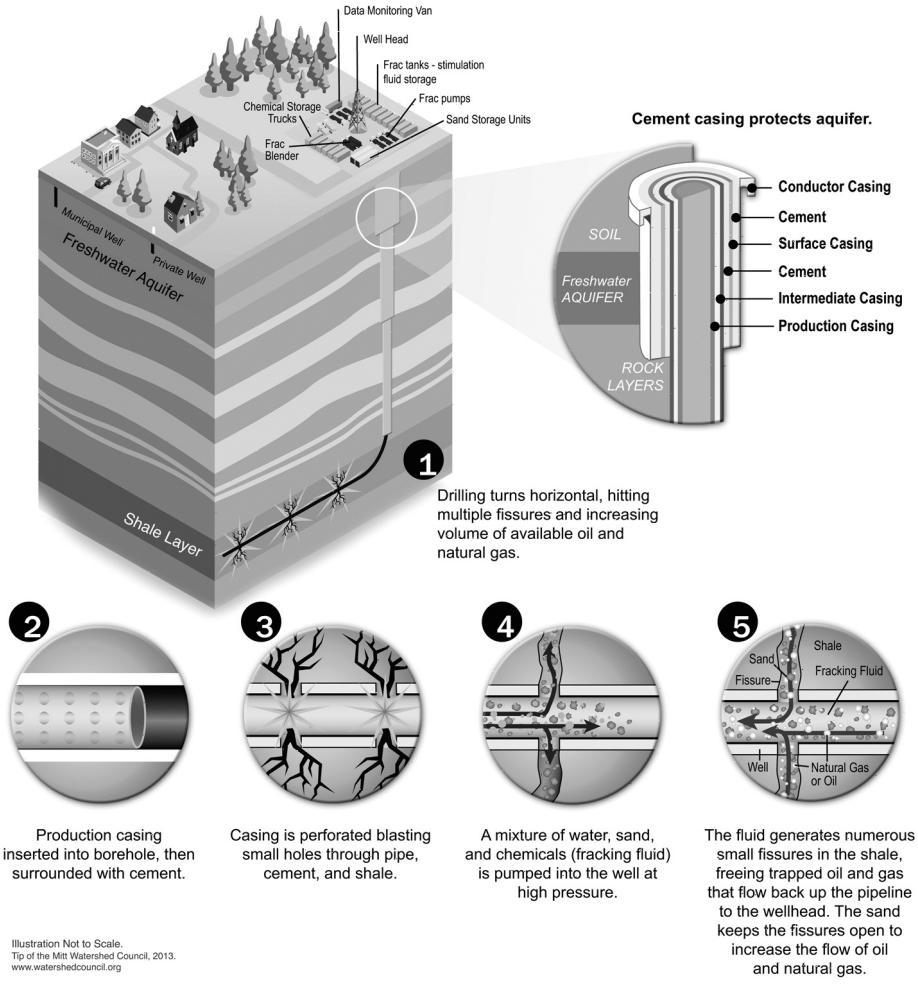


Illustration Not to Scale.
Tip of the Mitt Watershed Council, 2013.
www.watershedcouncil.org

Indepth information on this topic is available at:

www.watershedcouncil.org

Hydraulic Fracturing and Michigan's Waters

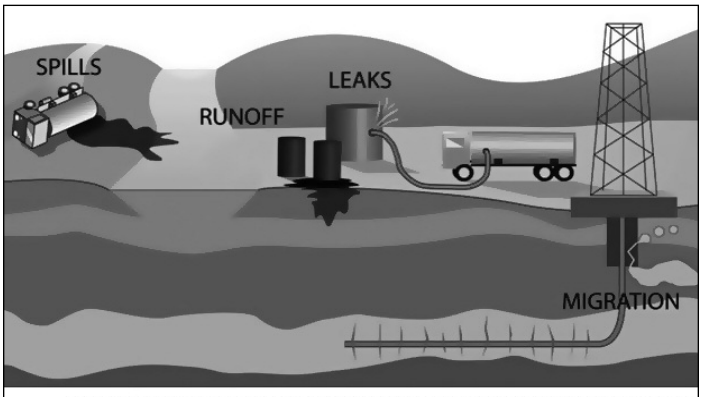
Water Withdrawals

Water withdrawals have the potential to reduce water storage in aquifers, destroy local water supplies, and cause wells to go dry. The withdrawal of surface water can also directly reduce the flow in streams and the water levels in lakes and wetlands causing a loss of fishing and tourism opportunities and dollars.

In general, more water is needed to hydraulically fracture a well with a longer wellbore. High volume hydraulically fractured wells are considerably deeper and usually have horizontal legs that extend for thousands of feet, increasing the volume of water needed per well. Based on current activity in Michigan, an average of 7.5 million gallons of water are used per well, but some wells have used up to 21 million gallons of water. Almost all of the water withdrawn for hydraulic fracturing in the Great Lakes Basin will not be returned to the source watershed to replenish water resources; instead, the water will be placed underground during use or for disposal.

By law in Michigan, surface water withdrawals are prohibited for drilling operations and are discouraged for fracking operations. Therefore, the source of water used in fracking is typically groundwater. Oil and gas operations are exempt from the registration and permitting requirements under Michigan's Water Use Law, which regulates large quantity withdrawals. However, to avoid adverse impacts from the water withdrawals, the MDEQ requires high-volume hydraulic fracturing operators to use a Water Withdrawal Assessment Tool as part of the permit process. The tool provides an initial screening level assessment of the potential impact of a proposed withdrawal on local stream or river ecosystem.

Despite the use of the water withdrawal assessment tool, the registration and permitting exemption prevents vital protections for Michigan's water resources such as reporting requirements. The reporting requirements for water withdrawals ensure that all large withdrawals are considered during any water withdrawal evaluation. Since oil and gas development is exempt from reporting, the 7.5 million or more gallons of water per well are omitted from the state's water database. This could lead to significant over use of Michigan's groundwater and have devastating impacts upon the aquatic ecosystem. To avoid excessive withdrawals, the amount of water available in a watershed as well as the amount of water withdrawn needs to be fully known.



(Riha & Rahm, Framework for Addressing Water Resource Impacts from Shale Gas Drilling (2010))

Contamination of Water Resources

Contamination of surface, ground, and drinking water with oil and gas, fracking chemicals, or wastewater can occur with oil and gas development. There are three main ways that oil and gas development can lead to water contamination:

- **Surface spills:** Chemicals, waste, or oil and gas can spill or leak during transport, storage, and use.
- **Migration**: Oil and gas or other fluids can migrate through cracks in the rock either natural or those caused by fracking, and make its way into groundwater supplies.
- **Well Failure:** Chemical mixtures can seep into water supplies if a well is designed, constructed, or operated incorrectly; for example, inadequate cementing of casing or cracked concrete.

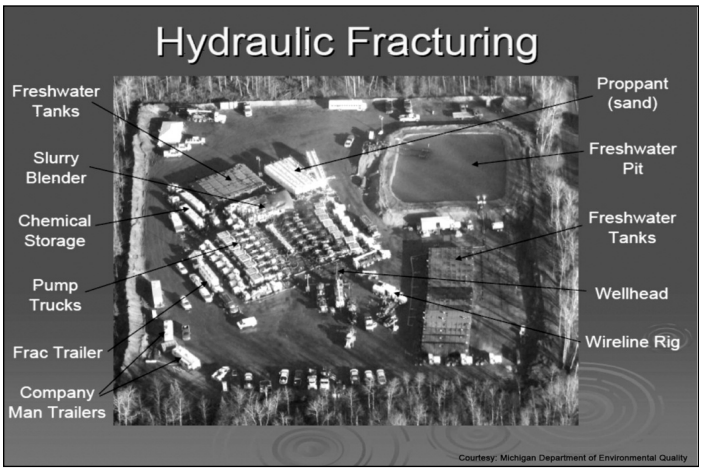
Of greatest concern is that fracking uses hundreds of chemicals, which are mixed with water and pumped underground, directly through aquifers, to fracture rock. Many chemicals used in the fracking process are undisclosed from the public because they are considered to be a trade secret and proprietary information. The chemical constituents in fracturing fluid range from benign substances to those that have acute or chronic health effects.

Fracking fluid is typically 99 percent water and sand and approximately one percent chemicals. However, when millions of gallons of water are being used, that one percent represents a very large volume of chemicals per fracking operation. According to U.S. Environmental Protection Agency (EPA) estimates, a well stimulated using 5 million gallons of fracturing fluid would be injected with 25,000 to 100,000 gallons of chemical additives.

Hydraulic Fracturing and Michigan's Waters

Wastewater Disposal

Once the fracking process is complete, anywhere from 25-75% of the fracture fluid comes back to the surface. This means that each well produces millions of gallons of wastewater, called flowback, which requires disposal. During production, oil and natural gas come out of the well mixed with water. This second type of wastewater is called produced water. Produced water generally does not have the chemicals added to fracking fluid during the hydraulic fracturing process. However, this water often has high levels of Total Dissolved Solids (TDS) and leaches out minerals from the shale including barium, calcium, iron, and magnesium. It also contains dissolved hydrocarbons such as methane, ethane, and propane and naturally occurring radioactive materials (NORM) such as radium isotopes.



Both the flowback and produced water are considered wastes and must be disposed of appropriately. Options for disposal include underground injection wells, discharge to surface waters, and use of commercial or publicly-owned treatment facilities. Another option used elsewhere in the country is for the waste to be treated and re-used in another fracking job.

In Michigan, the law requires that oil and gas waste be disposed of in Class II deep injection wells or nonhazardous injection wells. Class II wells have less protective requirements for the design, construction, monitoring, testing, reporting, and closure than wells that can accept hazardous waste. High volume hydraulically fractured wells often use chemicals that are identified as hazardous or extremely hazardous. However, the wastes are designated simply as oil and gas waste. Therefore, any hazardous waste from oil and gas sites does not need to be disposed of in hazardous waste wells. Applicants who wish to inject wastes associated with oil and gas operations do not even have to identify hazardous waste components in the waste.

Actively Involved to Protect Michigan's Water Resources

Tip of the Mitt Watershed Council has been actively involved since it was first announced publically that high volume hydraulic fracturing was occurring in Michigan. We continue to conduct research, educate landowners and the public, and work with the DEQ and Michigan's legislators to improve protections for Michigan's water resources. It is essential for Michigan to be proactive in protecting against unnecessary negative impacts to our vital water resources while encouraging the wise development and use of the State's energy sources. Prior to an influx of high volume hydraulic fractured wells in Michigan, the State has the opportunity to be a leader, setting an example for the rest of the country regarding sustainable development and protection of natural resources. The Watershed Council is working to accomplish this and ensure that Michigan's current regulations are strengthened to keep up with the advancements in technology.

Published April 2013

Tip of the Mitt Watershed Council
426 Bay Street
Petoskey, MI 49770

(231) 347-1181
www.watershedcouncil.org