Bakken Water Management Trends

Supply volumes, handling and disposal trends, usage changes and future scenarios

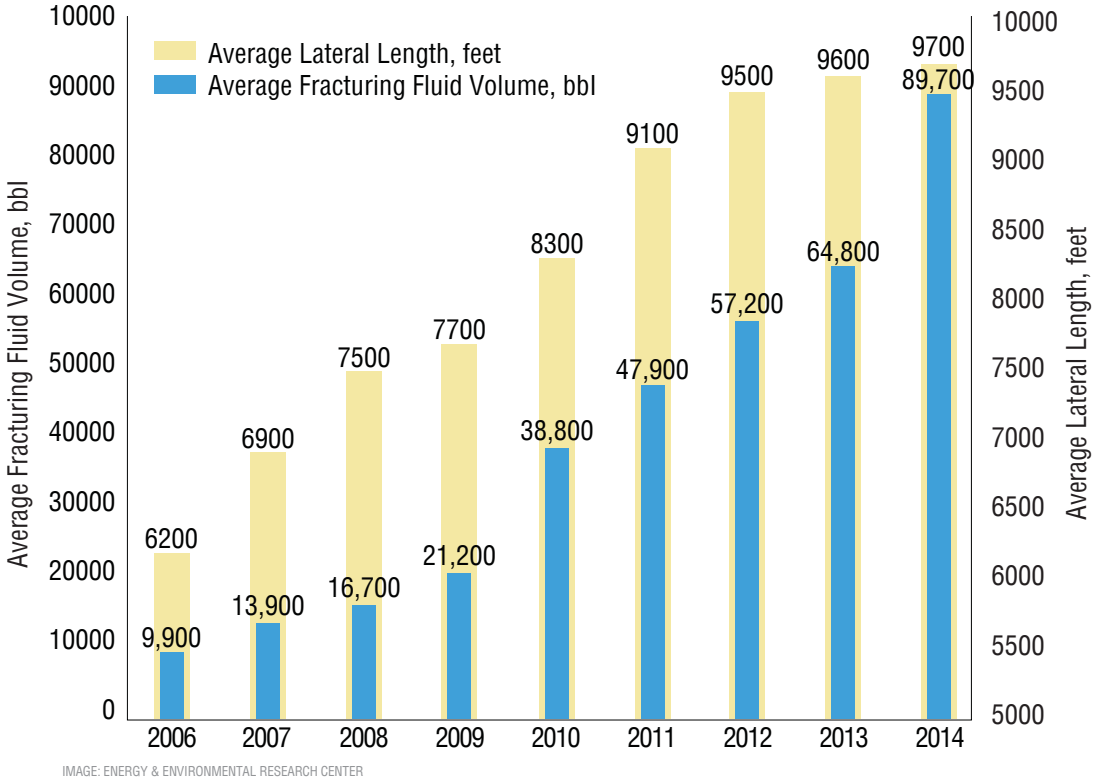

IMAGE: ENERGY & ENVIRONMENTAL RESEARCH CENTER

Like downhole technology and well-site operations, the role of water in the Bakken has changed through an improved understanding of what needs to change and what should stay the same. Following up on a previously started research effort to study the optimal strategies to produce the Bakken system, the University of North Dakota's Energy and Environmental Research Center, has released a new report that includes an analysis of Bakken water supply volumes, usage trends, future needs and potential issues. While the revamped look at water in the Bakken has once again shown that freshwater supply is a non-issue, the EERC research team—led by Bethany Kurz—uncovered several new findings and the potential for future work on the always-evolving topic.

Slickwater, Longer Lateral Impacts to Water Supply

In 2007, most Bakken-focused wells were hydraulically stimulated using 1 million gallons of freshwater or less, the report noted. But, as high-volume water fracks, or slickwater fracks, have become the preferred method for well completions in the Williston Basin, the average well requires 8 million gallons of water.

In 2014, 237 wells had fracture fluid volumes with greater than 150,000 barrels used (with an average of 240,600 barrels per well). In 2013, there were only 94 wells that used more than 150,000 barrels of fluid (each with an average of 238,600 barrels of fluid).

The increasing length of the horizontally drilled lateral along with the number of discrete fracture stages used in each well is also a factor in the amount of water used per well. According to experts, slickwater fracking creates a more complex fracture network near the wellbore, allowing more hydrocarbons to flow into the well.

Even with an increase in slickwater and longer laterals, Kurz does not see an issue. "Freshwater supply isn't an issue. It is available and inexpensive," Kurz said.

The Future of Saltwater Disposal Practices

Between 2008 and 2014, saltwater disposal volumes have increased by 341 percent, according to the report, and between 2014 and 2035 volumes will increase by another 328 percent. Those projections indicate that in addition to the 500 SWD wells currently in operation throughout North Dakota, another 1,500 new disposal wells will be needed. And, those well projections do not take into account the possibility that high-water-volume frack jobs will continue.

"We are very fortunate with the Bakken in respect to water management and disposal," Kurz said. "In the Bakken, we really don't have any issues with saltwater disposal."

The Dakota formation is ideal for SWD purposes, according to Kurz, due to the sandstone nature of the formation located more than one mile below the surface. But, Kurz believes the industry needs to know more about the long-term potential of the Dakota formation and how feasible other options may become.

"The reliance of indus-

Projected Water Generation in the Bakken*

Year	Estimated Number of Bakken Wells	Estimated Annual Bakken Produced Water Generation, million bbl	Estimated Number of SWD Wells at an Average Annual Injection Rate of 793,000 bbl	Additional SWD Wells Needed Beyond Those Existing in 2014
2020	21,183	624	787	300
2025	31,183	918	1158	671
2030	39,290	1157	1459	972
2035	40,000	1178	1485	998

*ASSUMES A WELL LIFETIME OF 20 YEARS

Typical Treatment Costs Associated with Produced Water Treatment (Grottenthaler and Kern, 2014)

	Simple Filtration	0.50-1.50 (per barrel)
	Chemical Precipitation/Sedimentation	2.00-8.00 (per barrel)
	EC	1.00-3.00 (per barrel)
	EC/Ozonation	1.50-4.00 (per barrel)
	SWD (other shale plays)	1.50-3.50 (per barrel)

Approximate Water Acquisition, Disposal, and Transportation Costs in the Bakken

	Cost, $/bbl
Acquisition Costs	
Raw Water	0.60-1.05
Transportation	0.65-5.00
Disposal Costs	
Transportation	0.65-9.00
Deep Well Injection	0.50-1.75
Total Costs	**2.40-16.80**

try on the Dakota aquifer as a disposal target warrants an assessment to determine the long-term impacts of produced water injection and to evaluate the capacity of alternative SWD targets," Kurtz said.

Water Recycling, Reuse Trends

Three years ago, the EERC believed water reuse and recycling practices were not economically feasible. "However, in the past three years, significant technological developments related to salt-tolerant fracturing fluid systems allow the use of minimally treated produced water and have created new opportunities for treatment and recycling," the report said.

The main issue today is produced water storage. "There are concerns over spilling that water if you have to store it in large volumes," Kurz said. EERC will perform some follow-up work to analyze various water storage options and other methods that would increase the feasibility of produced water storage in the Bakken.

Maintenance Needs to Raise Water Volumes

As production continues, the EERC and industry are still working to understand how much water is currently needed to maintain a well and how much will be needed in the future. Estimates by the North Dakota Department of Mineral Resources indicate a well usually needs 15 barrels of water per well per day for flushing and maintenance. The EERC believes each well requires up to 50 barrels of water per well per day.

Each well in each different location requires different water requirements for flushing and maintenance, the report noted. Because of that, it is still unclear which chemical or physical parameters have the greatest impacts on scaling tendencies of Bakken produced water.