

ABOVE & BELOW

Produced water management in the oil & gas industry

By Steve Shiner & Taylor Morrison

Humans have been treating water for thousands of years to improve their quality of life. Early technologies from the Greeks, like sand and gravel filtration, are still in use today. Modern times introduced oil and gas operations, which bring produced water to the surface. This water must be dealt with in a safe and cost-effective manner.

Produced Water

Unconventional shale plays in the U.S. have created a surge in drilling activity and subsequent hydraulic fracturing (fracking) activities. Both water and oil and gas are important natural resources in the U.S. They are linked because together they can increase the production of oil and gas through fracking. When an oil and gas producer fracks a well, it uses on average 200,000 barrels of water, along with sand and chemicals, to make the well produce hydrocarbons.

Large amounts of water are pumped into a well to enhance production of oil and gas, and the wells return large volumes of produced water, with an average of 5 barrels of water produced per barrel of oil. Produced water typically is disposed of via truck for injection into disposal wells. To satisfy the large demand of water for fracking, recycled produced water often is used instead of freshwater, which also lowers trucking and injection volumes.

Treatment Evolution

Three layman categories can define the evolution of treating produced water: open pit, centralized treatment and decentralized treatment.

The most primitive technique for treating this oilfield waste is the open



Colorado floods in September showed that any oil field fluids in an earthen pit may be washed downstream in a flood. Photo courtesy of Jane Pargiter, EcoFlight, 2013.

pit method. With a minimal amount of treatment technology required, this batch method utilizes an earthen plastic-lined pit to collect produced water. It achieves improved effluent quality by treating the water primarily to allow the settling of suspended solids. While this quick oilfield solution is site specific, this first stab at treating produced water comes with room for design improvement that would emphasize environmental exposure.

Following open pit methods was centralized treatment, which is logistically similar to municipal treatment solutions in that water is conveyed to a centralized facility from multiple oil or gas wells. Central plant designs may feature improved water treatment technology. While environmental exposure is decreased via high-volume metal tanks, a centralized plant often creates the economic problem of transporting water to the plant.

The demand to decrease trucking coupled with lower flowback volumes from shale formation wells encouraged the design of smaller, decentralized treatment facilities. These systems typically are

enclosed in containers or skid-mounted, and are transportable. They pipe to the wellhead or water source for in-line treatment. Enhanced movable treatment also provides an answer to the environmental risk and producer trucking expense.

Environmental Intersection

Last September, Colorado experienced approximately 15 in. of rain—normally one year's worth—in only five days. Due to the resulting flooding, more than 18,000 gal of produced water were released into the environment, according to the Colorado Oil and Gas Conservation Commission. The flood received national exposure when produced water spilled from well pad storage tanks into the St. Vrain and South Platte rivers. Oil and gas producers had to control and clean up environmental damage from toxins released from tanks and open pits by floodwater.

During the event, residents in Colorado experienced the disadvantages of outdated produced water treatment designs. Widespread flooding highlighted practices in oil and gas fields that could result in a threat to human health and

the environment.

Open pits containing 200,000 to 400,000 barrels of liquid increase the opportunity for unnecessary environmental damage. "We are assessing the impact to open pits, including building a count of how many pits may have been affected," said Todd Harman of the Colorado Department of Natural Resources in a September 2013 Reuters article.

Older produced water treatment methods and their associated risks may inspire legislative initiatives that encourage best recycling practices to lower environmental risk. If oilfield waste has the ability to reach watersheds, then available precautions have not been taken to avoid unnecessary risk to the water supply downstream. Using a closed-loop system piped directly to the

production infrastructure allows producers the ability to shut in during an unplanned event.

"Engineered water ponds and pits with in-line recycling systems bolted directly to the production infrastructure lower environmental liability, especially in a storm or flood scenario," said Archie Filshill, construction practice leader for the global environmental and construction firm Golder Associates. "The risk management and legislative environment supports an engineered solution for energy-water issues."

Legal Groundwork

State permits are available for recycled water discharge on the ground in Colorado, when oilfield water is cleaned to an agricultural standard. Most oilfield ponds were not permitted to these allowable discharge permits during the Colorado flood. If the produced water in open pits had been cleaned to avoid environmental risk in a flood, then risk of untreated oilfield waste sweeping into Colorado streams, including the Platte and St. Vrain rivers—which are sources for agricultural and human consumption—would have been reduced.

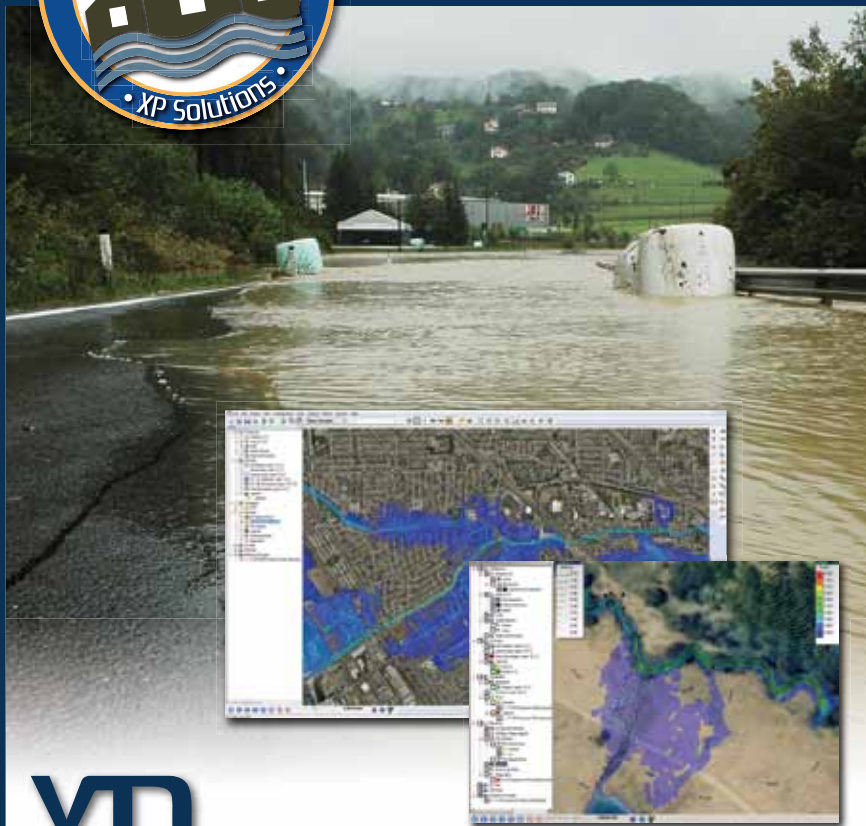
Some states have legislation meant to encourage recycling. Disposal well use is curtailed in states such as Pennsylvania and New York, which have fewer than 15 injection wells permitted across both states. The lack of disposal well capacity encourages recycling and reuse of produced water.

The Evolution of Water Management

Texas has approximately 50,000 disposal wells permitted. However, in its 2013 legislative session, the chair of the Natural Resources Commission, State Rep. Tracy King, proposed House Bill 2292 to prevent oil and gas fracking waste disposal in injection wells unless it could not be treated and reused. A recycling mandate like this may take longer to pass, as this bill was not approved in 2013; nor was Texas State Rep. Jim Keffer's proposed House Bill 3315, which determined that recycled water is not a waste product, so adequately cleaned water from oilfields may be used on crops. Because

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neither bill passed, an oil and gas producer that chooses to recycle does so to lower trucking and injection well use.

"Changes in water-related laws and regulations are increasingly likely in oil and gas states affected by long-term droughts and where incidents like the Colorado floods of 2013 elevate public concerns and put pressure on policy makers," said David Blackmon, who writes for *Forbes* on public policy issues affecting the oil and gas industry.

An Industry Approach

The Eagle Ford Shale, currently the fastest growing play in the world, is a booming field that might be the single largest in Texas history. Drilling permits alone are indicative of the growth, with 94 issued in 2009 and 4,416 issued in 2013. Oil and gas production curves are following the upward trend, reaching almost 1 million barrels and 4,000,000 cu ft per day, respectively, according to the U.S. Energy Information Administration.

The water recycling effort in the Eagle Ford Shale has been a race for new water treatment companies. The unique position of the play to the strong financial and technical hubs of Houston and Austin, coupled with the play's thirst for water, encourage best practices to quickly adapt and guard the aquifers of south Texas.

Heavy rains in October 2013 found their way to some of the busiest counties in the Eagle Ford Shale, and created the potential to wreak havoc for producers, similar to what happened in Colorado.

The Nueces River, running through La Salle County, is only one of many rivers with floodplains in the Eagle Ford Shale. It was brought to its fourth highest recorded level last October. The water was high enough to shut in some production in the region.

Energy Water Solutions is in production with a movable, decentralized produced water recycling system in the Eagle Ford Shale. Oil and gas producers contract for such onsite recycling of produced water on well pads and collection facilities to

improve total fluids management.

The onsite recycling system cleans water for reuse as frack water. This configurable process reduces environmental risks, injection well volumes and truck traffic.

A decentralized produced water recycling solution increases water availability for fracking of more wells, connects directly to the production infrastructure to clean lower volume water in more locations, and lowers health and environmental risks. **SWS**

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