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west virginia department of environmental protection

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WVDEP  
Industry Guidance  
Gas Well Drilling/Completion  
Large Water Volume Fracture Treatments  
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### Background

Devonian aged shales, such as the Marcellus, are rock formations that underlie much of West Virginia, Pennsylvania, and portions of New York at varying depths. They are believed to hold trillions of cubic feet of natural gas. Exploration of some of these shales have not previously been considered economical, but recent advances in drilling technology and rising natural gas prices have attracted new interest in these under-developed resources. The combination of these factors suggests that areas in West Virginia that have not traditionally experienced much gas well drilling might soon experience exploration. Horizontal drilling, coupled with large volume hydraulic fracture treatments, is becoming a common exploration technique. These fracture treatments often use much more water than the traditional process. Large amounts of water mixed with sand and other additives are pumped into the shale formation under high pressure to fracture the rock around the well to create a permeability conduit to the well bore. Water used in the hydraulic fracturing process, often referred to as “frac fluid,” must be processed in one of three ways. It can be injected in permitted disposal wells, treated to remove generated pollutants then disposed of properly, or reused.

### Purpose

The West Virginia Department of Environmental Protection (DEP) has developed this guidance document to assist well operators in planning for the drilling and operation of these wells and the associated need to either dispose of or reuse large water volume fracture treatment wastes. It is intended to facilitate compliance with applicable statutory and regulatory requirements and to generally minimize negative environmental impacts associated with these activities, by promoting the use of necessary best management practices. In addition to this guidance, the Office of Oil and Gas (OOG) is requiring companies to submit additional information through an addendum to permit applications for this type of activity. The additional information will provide a more thorough understanding of the proposed activity and better ensure protection of the environment. The addendum will become part of the permit and will be subject to inspection and enforcement requirements. The guidance focuses on three main areas, which are water use and withdrawal, site construction and fluid disposal.

Promoting a healthy environment.

## Water Use/Withdrawal

In 2003, the West Virginia Legislature passed the Water Resources Protection Act (Chapter 22, Article 26). That legislation requires users of water resources whose withdrawals exceed 750,000 gallons in any given month for one facility, to register with the DEP's Division of Water and Waste Management (DWWM). It is likely that some of the oil and gas industry operations engaged in exploring the Marcellus Shale or horizontal drilling will exceed this threshold and consequently be required to submit information to the DWWM. Operators should coordinate with the DWWM when submitting the required information so that it may be done in a timely manner.

Currently, the Act requires submission of the withdrawal information after it has occurred. However, to protect both ground and surface waters, when operators apply for a permit, they will provide information regarding the source(s) of withdrawals, volumes anticipated to be obtained from those sources, and the time of year the withdrawals are anticipated, as part of the OOG's permit addendum.

In no case shall the operator withdraw water from ground or surface waters at volumes beyond which the waters can sustain. The DEP has developed a guidance tool to assist in minimizing or eliminating environmental impacts associated with stream water withdrawal. It may be found on our Web site ([www.dep.wv.gov](http://www.dep.wv.gov)) by clicking on the "water use" button. This opens to the Water Use Section's web page, where you may click on the "Water Withdrawal Guidance Tool" link. This navigates you to the first page of the guidance tool. After reading the instructions and warnings, click on the "I agree" button. This brings up a state map where you select your intended withdrawal location. Following the instructions, you may determine whether it is advisable to remove water from your chosen stream, take water from one of the larger area streams, or move to an entirely different area for your water needs. To directly access the tool, go to: <http://gisonline.dep.wv.gov/wwt/index.html>

Various researchers have developed general categories of stream flow based on their impact on aquatic habitat. Streams are classified into one of seven categories, ranging from "severe degradation" to "optimum range," based on a percentage of the average yearly stream flow. The water withdrawal guidance tool builds upon this concept.

The guidance divides the state into areas associated with a stream gauge that has been determined to be statistically representative of streams in the area by the United States Geologic Survey. Two numbers were then determined for each area based on "poor or minimum flow" and "good flow." If the daily stream flow, as determined by the USGS's representative gauge, is at or above the "good flow" regime, the possibility of taking water from any stream in the area exists so long as proper precautions are observed. If the daily flow is between the "good flow" and the "poor or minimum flow" numbers, water withdrawals should only be taken from the listed streams. Although the listed streams are the larger streams in the area, care must be taken to not withdraw at a rate that will significantly reduce the flow either at, or downstream of the withdrawal point. If the daily flow is below the "poor or minimum flow" regime, water should not be withdrawn from any stream in the area

Regardless of the volume of water withdrawn from the State's water resources, well operators must ensure that all uses of the waters are protected. Consequently, operators must consider water availability as part of their exploration and development strategy. For instance, if streams are expected to provide the source of the water, location and seasonal variations in precipitation may significantly impact water availability. It may be necessary to store water during higher stream flow periods. Construction of centralized ponds for water storage may be appropriate, but must be done in an environmentally protective manner, with land owner approval. Guidance on proper construction techniques for ponds can be obtained from the DEP, DWWM, Dam Safety Section or the local Natural Resource Conservation Service field office. The Dam Safety Rule 47CSR34 may apply, depending on the size of the structure and volume of water contained. Questions about the applicability of dam safety rules can be directed to the Dam Safety Section at 304-926-0495. Additionally, if stream flows and/or storage is not adequate, public water supplies should be identified and considered.

Operators should also consider the manner (hailed or pumped) in which the water will be delivered to the well site. Hauling large volumes of water will result in significantly increased truck traffic that may create safety concerns, road damage, dust problems and other environmental issues. Stream access when pumping from streams must also be carefully considered. Boat launch ramps and other public access points could be damaged by excessive use and should be avoided.

### Site Construction

The activities for which this guidance has been prepared, particularly those incorporating horizontal drilling, are likely to result in considerably larger well sites than historically have been constructed. While these horizontal drilling sites may replace several vertical well sites, and result in less total surface disturbance at any given site, additional acreage is impacted. Whether horizontal or vertical, larger sites create greater challenges for sediment and water control. Operators shall be required to utilize best management practices, which are designed to address larger sites and access roads. In addition to the requirements contained in the Erosion and Sediment Control Manual of the OOG, operators should consult the DEP's Construction Stormwater Manual. The manual can be found on the DEP's website at <http://www2.wvdep.org/dwwm/stormwater/BMP/index.html>.

As the pits associated with these operations will be containing significantly larger volumes of fluid than conventional operations, they must be designed and installed in such a manner as to provide structural integrity for the life of the pit. Proper design and installation is imperative to the objective of preventing a failure or improper discharge that could result in significant adverse impacts. Increased efforts will be necessary when these features are not completely located in cut portions of the site. Additionally, as outlined in the industry directive dated December 16, 2008 from the DEP, the operator will be required to conduct regular inspections of all pits and ponds with a capacity greater than 5,000 bbl.

For an increased level of safety, pits must incorporate lifelines and perimeter fencing. Additionally, as these sites are likely to have additional equipment during the drilling and completion of the well, operators must plan for adequate spacing of equipment and access to all areas of the site to assist in creating a safe working area.

Specific to the permit application, the construction and reclamation plan must provide an estimate of the amount of acreage to be disturbed, the location of all pits at the drill site (with approximate dimensions of the drill site and pits), and the land application area if applicable.

Accurate drawings of the site and access roads, including locations of all best management practices, will be required. It is imperative that the plan be clear, concise and complete so that all parties understand the proposed activity. Due to the quality and quantity of the pit fluids, land application will not be a viable disposal option in many instances.

### Water Disposal

Perhaps the greatest challenge faced by these operations is the disposal of the drilling or frac fluids. The operator must thoroughly plan for this situation. Once wells are drilled and completed, thousands of barrels of this fluid may need treatment and disposal. Currently there are limited options, all of which may involve some time constraints for authorization or implementation.

While land application may generally be an option on smaller, shallower wells, it may not be practical in dealing with the volume of water expected at these sites. Presently, underground injection control (UIC) may be the best option. This practice is generally recognized as being environmentally sound and has proven effective for the past 25 years. However, to handle the expected amount of water, many additional UIC wells will need to be permitted, drilled or converted. The Office of Oil and Gas issues Class II UIC permits for brine and fluid disposal. Currently, WV has only two permitted commercial UIC wells available.

Operators should seriously consider options for the recycling of fracture treatment flow-back fluid. Technological advances are making it more economical to treat these fluids with better results in water quality. The treatment of these fluids may greatly enhance the quantity of acceptable, reusable fluids and provide more options for ultimate disposal. Transport and disposal at a centralized treatment facility is an acceptable option.

Some operators may consider transporting frac fluids to local, publicly owned treatment works (POTWs). The OOG and the DWWM must be notified, via the application addendum, if this is an option being considered for disposal. The DWWM will be in contact with the POTW to ensure that the treatment facility can handle the flow and the quality of the waste. If the facility does not already have a permit for pretreatment, an NPDES permit modification and treatment requirements will need to be evaluated before approval of the discharge to the facility is allowed. Federal regulations prohibit on-site treatment and disposal of the frac fluid to a nearby receiving stream.