

Marcellus Gas Drilling in Karst Formation

Presentation to
The Office of Oil and Gas
DEP Charleston headquarters
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I am Ba Rea, a resident of Monroe County. I am speaking for the Indian Creek Watershed Association, SaveTheWaterTable.org, and many individual Monroe County citizens. We are concerned about planned drilling in our county for gas from the Marcellus Shale formation.

Monroe County is a beautiful rural area in southeastern West Virginia. Much of it rests on karst formation.

The Greenbrier limestone formation dominates the landscape lying over the Marcellus Shale in Monroe County. It accounts for over 70 square miles in the center of Monroe County including Union, Pickaway, Sinks Grove, and parts of Greenville and Wolf Creek. Swopes Knobs is a remnant of the Bluefield formation comprised of red and green shale with a few thin limestone lenses. It rests on top of the Greenbrier formation, draining onto the Greenbrier karstland to the north, east and west.

Monroe County karstland is one of the world's densest sinkhole plains, with an average of 18 sinkholes per square kilometer. This limestone also hosts the largest, deepest, and most complex caves, the largest karst basins, the largest number of caves, and one of the largest karst springs in West Virginia.

The 1925 West Virginia Geological Survey listed 49 caves in Monroe County. Hundreds are known today, including the extensive Scott Hollow cave system found in 1985. Scott Hollow drains an area of at least a fourteen square miles

and possibly much more. Mystic River, the underground river flowing through the Scott Hollow cave system, stretches five miles from deep under the Knobs to within two miles of the Greenbrier River. Twenty-eight miles of cave passages have mapped so far in Scott Hollow.

Modern day Monroe County was shaped by the Appalachian Orogeny roughly 270 to 225 million years ago. This area was uplifted, deposition of sediments ceased, and erosion began taking place. Marcellus shale outcrops can be found along the southeastern boundary of the county as a result of folding. In front of modern day Peters Mountain, older rock overrides the limestone and shale that dominates the rest of the county. Erosion from this ancient uplift ultimately exposed the Greenbrier formation and also cracked and rippled it creating synclines, anticlines and lineaments as well as many smaller fractures. This structure, in addition to erosion makes the underground paths of our water even harder to predict.

In addition to caves, our karst formation also has many cracks tunnels and fissures, some dramatic. The monitor lineament is an easily spotted straight line across the Monroe county landscape. On close observation it is a six-mile long string of sinkholes, likely caused by water flowing along an ancient fracture and slowly dissolving the limestone, causing it to collapse. Cavers doing dye testing and expecting that water would follow the Monitor lineament were surprised to find the dyes had crossed the lineament and ended up in Second Creek.

Monroe County is a rural community. Though public water is available in Union, Greenville and Peterstown, most of the county depends on springs and wells for water. Since Monroe County does not have streams with the capacity to provide for public water supply sources, almost all residents rely on groundwater for their water consumption needs. The public supplies available, which provide for about half of the county usage, primarily rely on springs or wells for their intake.

Living on karst formation has advantages and disadvantages. Water in our area often seems abundant. Our groundwater is rapidly replenished by surface water. However, in other watersheds toxins and other contaminants are filtered out

of surface water as it works its way slowly through soil and rock into the ground water. Flowing through relatively hollow karst, contaminants from the surface can dump directly into our groundwater. In addition, wells of any sort, shallow or deep, drilled into karst can potentially divert water by providing a crack through which water can be diverted to a deeper conduit in the limestone.

Judging by projections of the area in which the Marcellus Shale is 25-50 feet thick, most of the area of interest for Marcellus shale drilling in Monroe County is karst formation, or on the Knobs, which drains into karst formation. Even if we assume there are no side effects from hydraulic fracturing, wells created for Marcellus Gas drilling and the associated activities of frac water storage and transport have the potential of seriously impacting our drinking water, as well as water quality in the Greenbrier and New Rivers that our water flows into unfiltered by soil. Research in surrounding cave systems like Scott Hollow Cave may also be impacted.

Landmen have been leasing mineral rights/gas drilling rights from Monroe County landowners for years. Many farmers in our area have come to count on their gas rights money to pay their taxes. When I asked a neighbor why he had leased his rights, he told me "I've been doing it for years. Nobody ever did anything. Probably won't this time either." He never thought to look into the consequences.

Things have changed. In the last couple of years as the technology to exploit the Marcellus shale has been developed and used throughout Pennsylvania and West Virginia, we have heard stories of great riches, along with many more of industrialization, water pollution, destroyed roads, and illness. \

July 19th, Gordy Oil Company came to the Monroe County Courthouse to answer questions about the drilling in our county that they said they would begin in August. They have been polite and we appreciate them talking to us, but their grasp of the geological situation in our area is not encouraging. In an initial telephone call before the July 19th meeting, they were asked if they were aware that much of Monroe County is karst formation. They assured the callers that they intended to avoid the karst. At the

courthouse meeting there were many questions and few answers. When asked that if they had a permit to drill they admitted that they did not and perhaps drilling would not begin until September. At the meeting at the courthouse they admitted that they had no experience with karst formation. To their credit, they met after the meeting with a number of cavers to get more information about the caves, fissures and tunnels that underlie our area.

At the July 19th meeting Gordy Oil representatives stated that their first well would be exploratory, re-drilling a previously plugged well and taking core samples. The well number given to one of the cavers was the Beckett well number 063-00009. In a discussion between one of my colleagues and Gordy Oil representative Robbie Quinn on July 27th the story had been changed. We were told that they will be drilling a new well close to existing well number 063-00009, but claimed that it would not be in karst formation. That claim is disturbing since the entire area around well number 063-00009 is karst. Notes from the original well show Greenbrier limestone beginning under just 14 feet of soil, continuing to 386 feet and containing fresh water. Since the Greenbrier limestone is impermeable the only way to encounter water is to go through an area of erosion and karst. So for their exploratory well they will be making a second hole in the karst in that sensitive area close to the Monitor Lineament, though according to the DEP website no application has yet be made for a permit.

If everything goes well from their perspective, they have indicated that they intend to begin hydraulic fracturing within a year. We need the West Virginia DEP to help us educate this company and guarantee that they do not damage a beautiful and irreplaceable community and landscape.

We stand with other communities in West Virginia who are already experiencing Marcellus Shale drilling, asking that the operation of Marcellus Gas plays be regulated to protect the environment and lives of West Virginia citizens by regulating and monitoring:

1. Truck weight limits,
2. Road conditions,
3. Water removal limits,
4. Disclosure of frac water composition,
5. Frac water removal,

6. Reports and handling of any accidents or incidents that
might cause contamination,
7. And many other issues.

In addition, recognizing that karst aquifers are extremely vulnerable to contamination and the damage could be with us long after whatever gas available is extracted, we would ask the DEP to take steps to protect the unique watersheds and landscape of Monroe County. We need time and funding to assess the risks of drilling in Monroe County.

We would prefer that all drilling development activities conform to the Clean Water Act or at very least we would ask that the DEP enforce the WV Code 22-12, West Virginia Ground Water Protection Plan in the case of gas and oil drilling.

Before granting permits for Marcellus Shale Gas Drilling we request that:

- 1) Thorough dye tests of water flow through any area where drilling is anticipated, before drilling is allowed.
- 2) A thorough study of potential impacts of Marcellus Shale drilling in the karst aquifers in the drilling area determined by dye testing of the water flow.
- 3) Thorough water testing of any areas identified by the dye tests to allow us to accurately monitor impacts on our water.
- 4) Testing of any proposed drilling site with ground penetrating radar for caves, fissures and tunnels before any drilling permits are issued.
- 5) A professional assessment of the impact of any drilling on the exploration and documentation of known cave systems in the effected area, as well as on the health of both cave species and cave ecosystems.
- 6) We recommend that expenses for any of this testing should be paid for by the drilling company or by permitting fees charged to the drilling companies.
- 7) Limit the number of wells permitted to one per square mile or larger area, to limit the number of times the karst aquifer is pierced, potentially altering the flow of water to springs and wells.

- 8) We ask that the DEP prepare "incidental take statements" before any drilling is permitted in the county. Both the Indiana Bat and the Virginia Big Eared Bat are endangered in Monroe County. Populations of bats with white nose syndrome that may be spread or otherwise affected by drilling have been found in both Scott Hollow and Patton Caves in Monroe County. Statements should also be prepared for the mussel, James Spiney.

Should drilling be allowed we request that:

- 1) The number of permits granted be limited to a number that DEP Inspectors can reasonably handle. If more permits are wanted, permitting fees should be increased to pay for more inspectors.
- 2) Hydraulic fracturing sites in karst regions be constantly monitored for impact using real-time conductivity monitors with alarms in the areas determined by dye testing to be potentially affected—recognizing that in karst country impacts could well be spread over a 20-mile radius or more and the standing 1000 foot radius rule for impacts is not applicable in these vulnerable watersheds.
- 3) Install real-time conductivity monitors with alarms in the areas determined by dye testing to be potentially affected by any drilling accident or unintended effect.
- 4) Provide citizens with notification of all permits granted, their location and particulars so that we can be aware and vigilant in the monitoring of our own well and spring sites.
- 5) The impact of any drilling on the exploration and documentation of known cave systems shall be regularly assessed, as well as impacts on the health of both cave species and cave ecosystems.
- 6) Drilling shall be stopped immediately should any negative impacts be found.

Thank you for your time and attention.