Windfall/Zelman #1 DIW ~ Permit # PAS2D020BCLE

From the Supplement to the Statement of Basis:

> The Huntersville Chert/Oriskany formation, the intended injection zone, has been a prolific producer of natural gas in this area since the late 1950s/early 1960s. The removal of both natural gas and brine from this formation has lowered the formation's pore pressure and has created available pore space (storage capacity) making this reservoir a good candidate for the disposal of fluids. Sites such as depleted oil and gas reservoirs can make excellent disposal zones, because

There is not much available pore space in the intended injection zone due to gas production. A relatively small amount of brine has been removed compared to the 30,000 bbls per month that could be permitted to be injected. The natural gas that has been produced was in solution under high pressure in the existing brine fluids. When a gas well was drilled and the underground pressure was released, the gas came out of solution, but the total volume of fluid decreased insignificantly. Therefore, there is very little newly available pore space due to gas production for the injected fluids to go into. The waste water would have to make room for itself by displacing native fluids.

An analogy would be opening a can of beer. When the pressure in the beer can is released, the carbon dioxide dissolved in the beer is released. The beer will go flat, but its volume in the can is virtually the same, even though a significant amount of carbon dioxide gas has escaped.

Therefore, there is little or no available pore space for the injection of waste fluids into the proposed Windfall DIW, since the pore space is already filled with brine. Brine pressure on faults will be increased because of the injected waste water. The pore pressure in the injection zone is going to increase because the waste water has to make room for itself by pushing away the existing fluids. Since liquids have a very low compressibility, any nearby faults will be hydraulically linked to the injection well pressure. Thereby, fluid pressure on the faults will increase, possibly inducing earthquakes.

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There was human activity which induced seismic events that occurred at the Northstar 1 Class 2 injection well in the Youngstown, OH area.

Before January 2011, Youngstown, Ohio, which is located on the Marcellus Shale, had never experienced an earthquake, at least not since researchers began observations in 1776. However, in December 2010, the Northstar 1 injection well came online to pump wastewater from fracking projects in Pennsylvania into storage deep underground. In the year that followed, seismometers in and around Youngstown recorded 109 earthquakes, the strongest registering a magnitude-3.9 earthquake on Dec. 31, 2011. The well was shut down after that quake.

With only one seismometer deployed in the Youngstown area, state geologists lacked the necessary data on the earthquakes' depth and exact location to draw a direct correlation between the seismic events and the deep injection well.

Once sufficient monitoring equipment was in place, the focal depths of events were found to be about 4,000 ft (1,220 m) laterally and 2,500 ft (760 m) vertically from the wellbore terminus.

There is only one seismometer in the vicinity of the proposed Windfall/Zelman #1 DIW. This seismometer is located at the Penn State-DuBois Campus. It is part of the Penn State Seismic Network.

The reforms listed below will make Ohio's Class II deep injection wells among the most carefully monitored and stringently regulated disposal wells in the nation. Ohio will seek the following reforms to its Class II deep injection well program:

- Requires a review of existing geologic data for known faulted areas within the state and avoid the locating of new Class II disposal wells within these areas;
- Requires a complete suite of geophysical logs (including, at a minimum, gamma ray, compensated density-neutron, and resistivity logs) to be run on newly drilled Class II disposal wells. A copy of the completed log, with analytical interpretation will be submitted to ODNR;
- Evaluates the potential for conducting seismic surveys;
- Requires operators to plug back with cement, prior to injection, any well drilled in Precambrian basement rock for testing purposes.
- Requires the submission, at time of permit application, of any information available concerning the existence of known geological faults within a specified distance of the proposed well location, and submission of a plan for monitoring any seismic activity that may occur;
- Requires a measurement or calculation of original downhole reservoir pressure prior to initial injection;\
- Requires the installation of a continuous pressure monitoring system, with results being electronically available to ODNR for review;
- Requires the installation of an automatic shut-off system set to operate if the fluid injection pressure exceeds a maximum pressure to be set by ODNR;
- Requires the installation of an electronic data recording system for purposes of tracking all fluids brought by a brine transporter for injection;

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To bolster its earthquake monitoring capabilities, ODNR will purchase four additional portable seismometers. These sophisticated monitoring devices will augment existing seismometers where necessary, and provide state geologists with quick access to detailed data on seismic activity. In addition, ODNR is in the process of identifying an “outside” expert with experience in seismicity, induced seismicity, and Class II injection wells to conduct an independent review of the currently available technical information, as well as information to be supplied by the injection well owners in the vicinity of the Northstar 1 well. This independent analysis will provide a scientific third party evaluation and analysis of all technical information to ensure thoroughness of the process.

The Region 3 EPA should copy the ODNR and institute the same reforms for their Class 2 Disposal Injection Well program.

The following, “PRECAMBRIAN BASEMENT MAP OF THE APPLACHIAN BASIN
AND PIEDMONT PROVINCE IN PENNSYLVANIA” shows seismic faults in the general area of the proposed Zelman #1 DIW, which is in the northwestern part of Clearfield County.

Seismic faults are seismically active geologic faults. This is a category of all geologic faults which may be seismically active and cause earthquakes or be long inactive.

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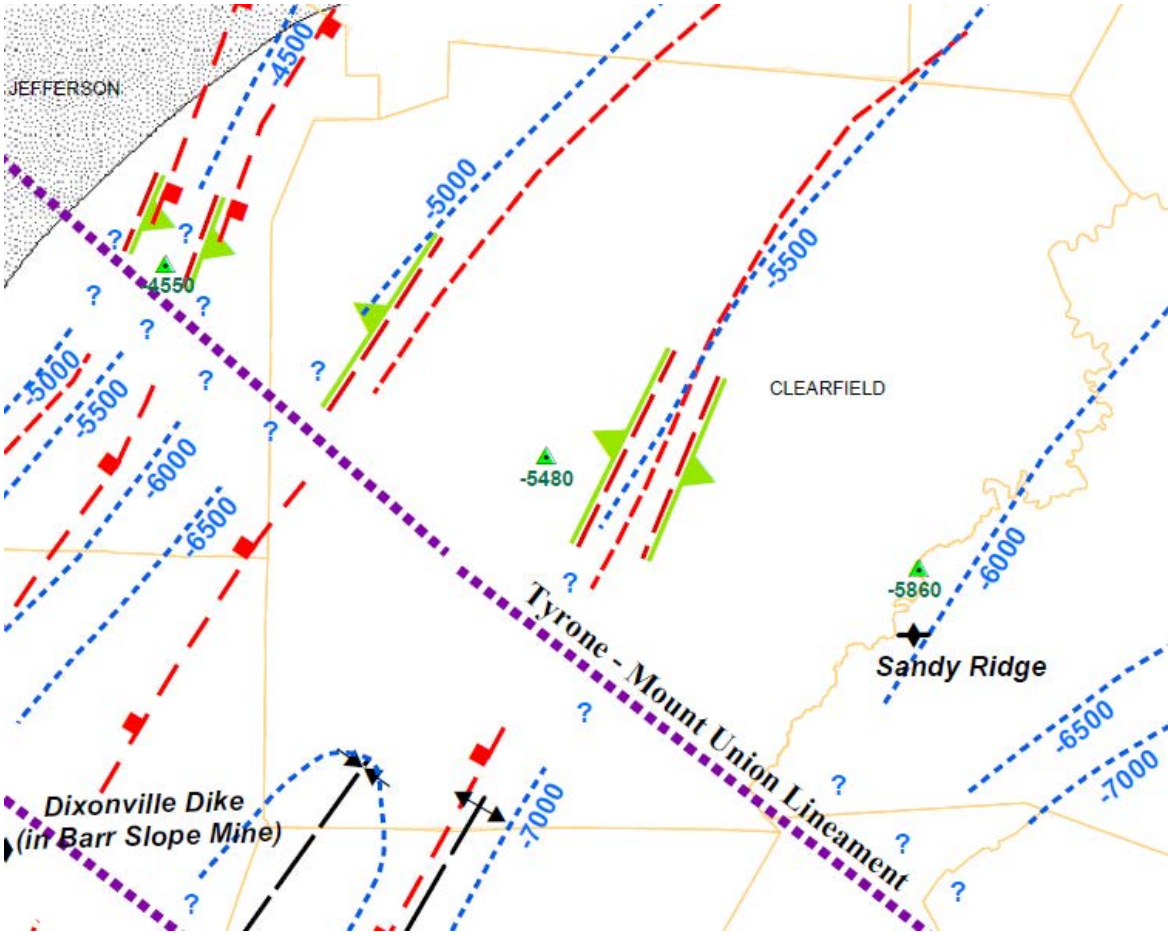
PRECAMBRIAN BASEMENT MAP OF THE APPLACHIAN BASIN AND PIEDMONT PROVINCE IN PENNSYLVANIA

SYMBOLS LEGEND

Pennsylvania database

- Fault (tab indicates dip direction)
- Fault, inferred
- Fault, mapped
- Seismic fault (barb indicates inferred dip direction)



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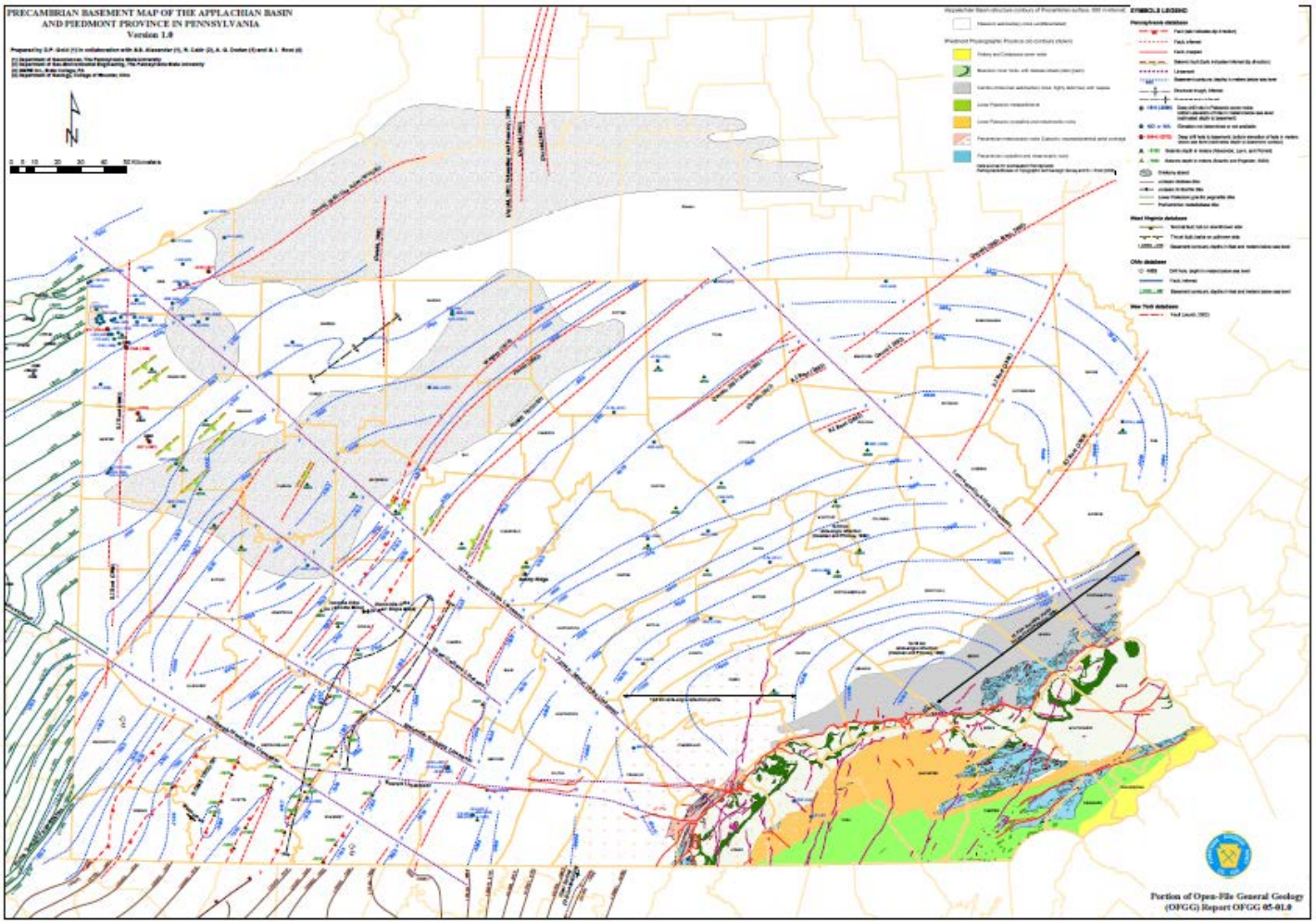

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The map below shows basement faults in the vicinity of the proposed Windfall/Zelman #1 DIW. If the UIC permit is issued, the same fate could happen in Brady Township as happened near Youngstown, Ohio. The UIC permit should be denied.

Structural contour map of basement with major faults, modified from Schumaker, 1996

The proposed Windfall/Zelman #1 injection well is the black dot below the black arrow.

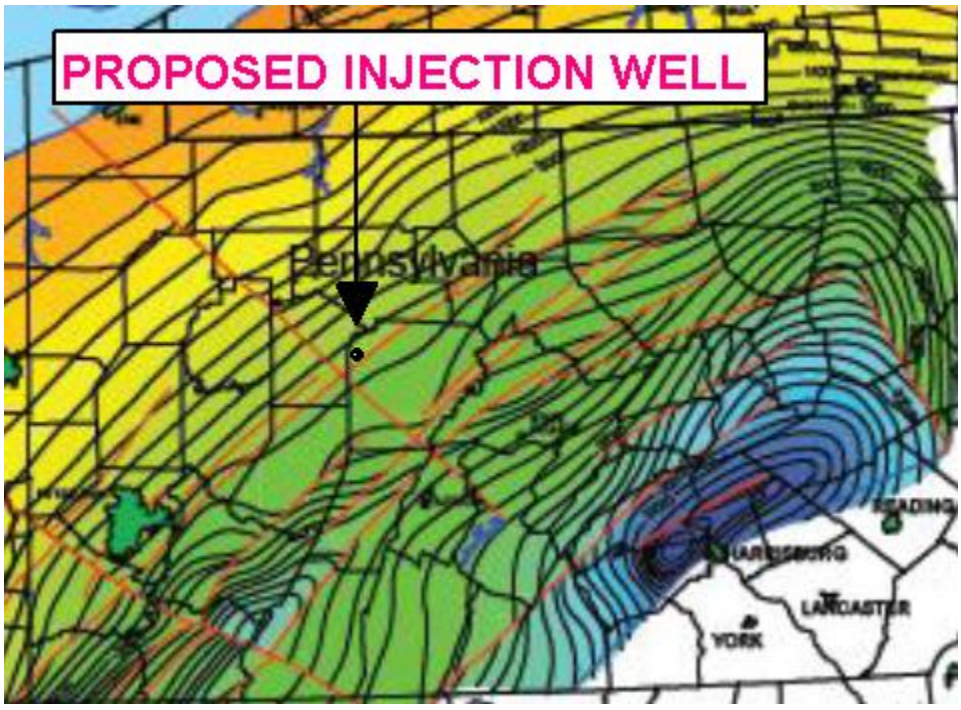

Figure 1. Structural contour map of basement with major faults, modified from Schumaker, 1996

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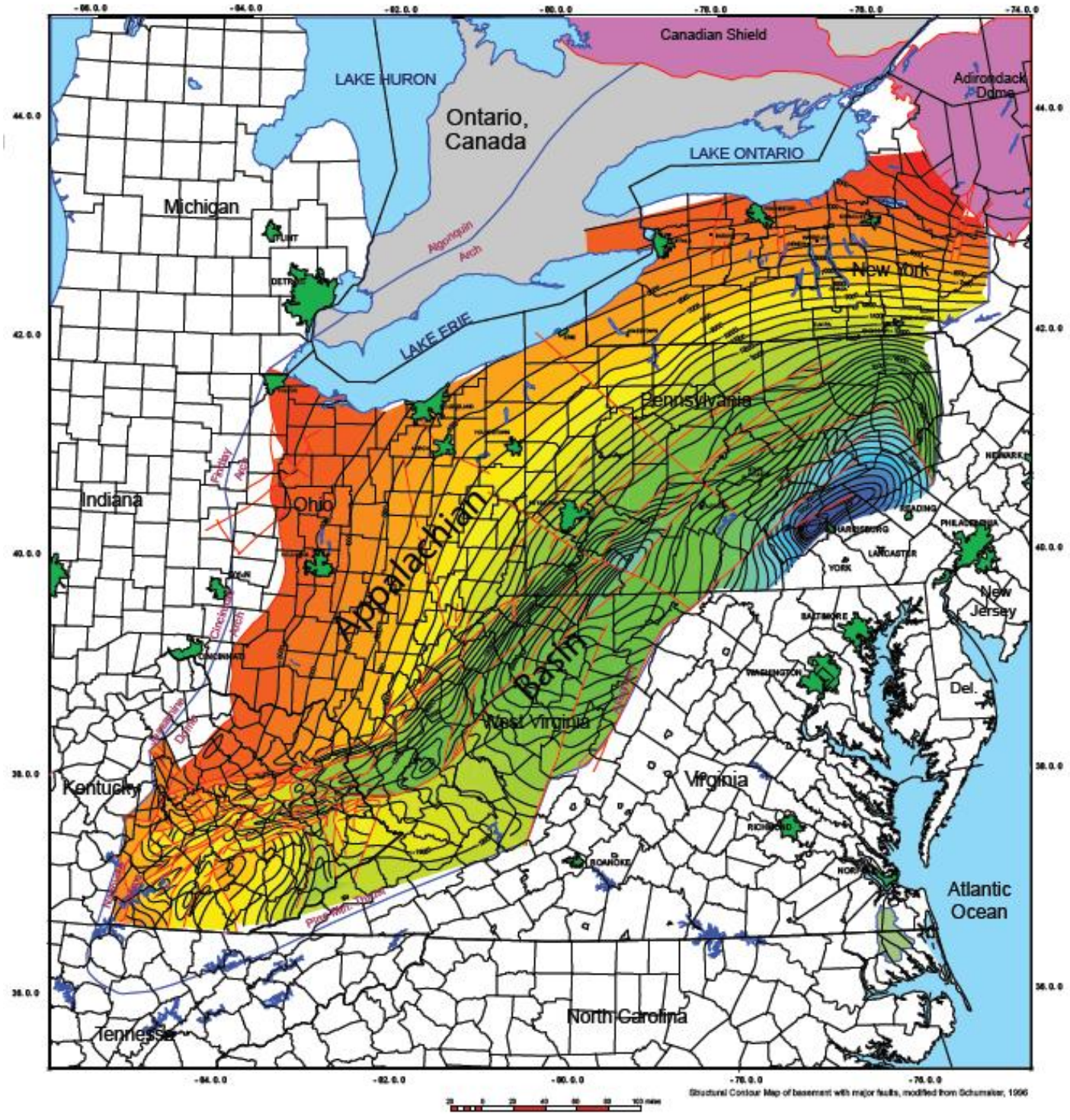

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