

Oil and Gas Extraction in PA



- Joe Kraft, State Soil Scientist



History of Resource Extraction in PA

- 1859 First oil well was drilled in Titusville, PA. by Colonel Edwin L. Drake
- 1933 Discovery of large amounts of natural gas in the Lower Devonian Oriskany Sandstone in Steuben County NY set off a flurry of drilling in nearby Tioga County, PA
- LATE 1970S – EARLY 1990S EASTERN GAS SHALES (EGSP)
 - Results of Study Devonian Shale Could be an important gas reserve in northwestern PA
 - The Marcellus was a less important play and remain so until the price increased and technology advanced to make it more competitive with traditional sources
- 2000's that all changed

Distribution in the US

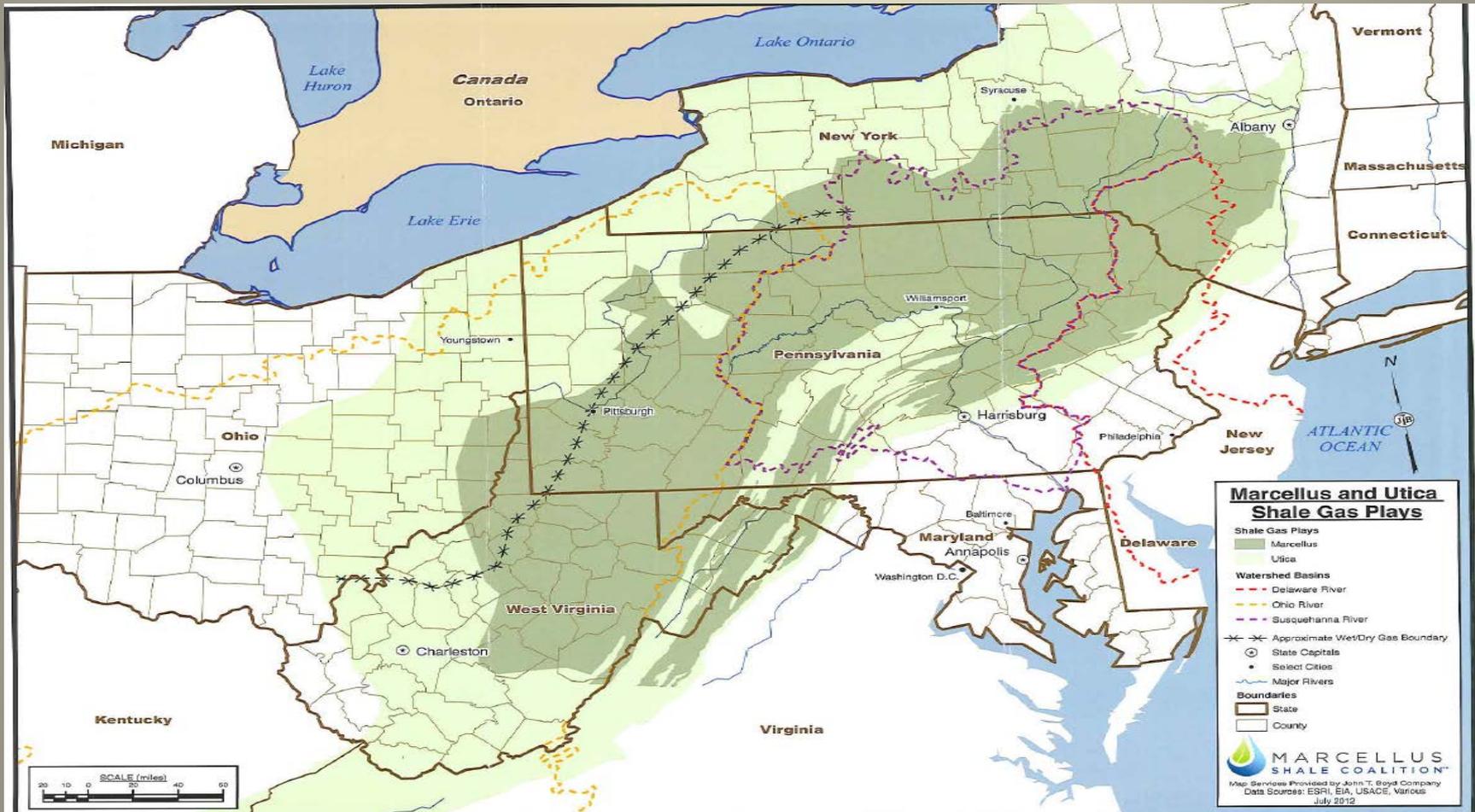
AND SO IT REMAINED UNTIL NEW TECHNOLOGIES FOR EXPLOITING GAS RESOURCES IN SHALE WERE DEVELOPED IN THE BARNETT SHALE OF TEXAS IN THE 1990S

U.S. SHALE BASINS

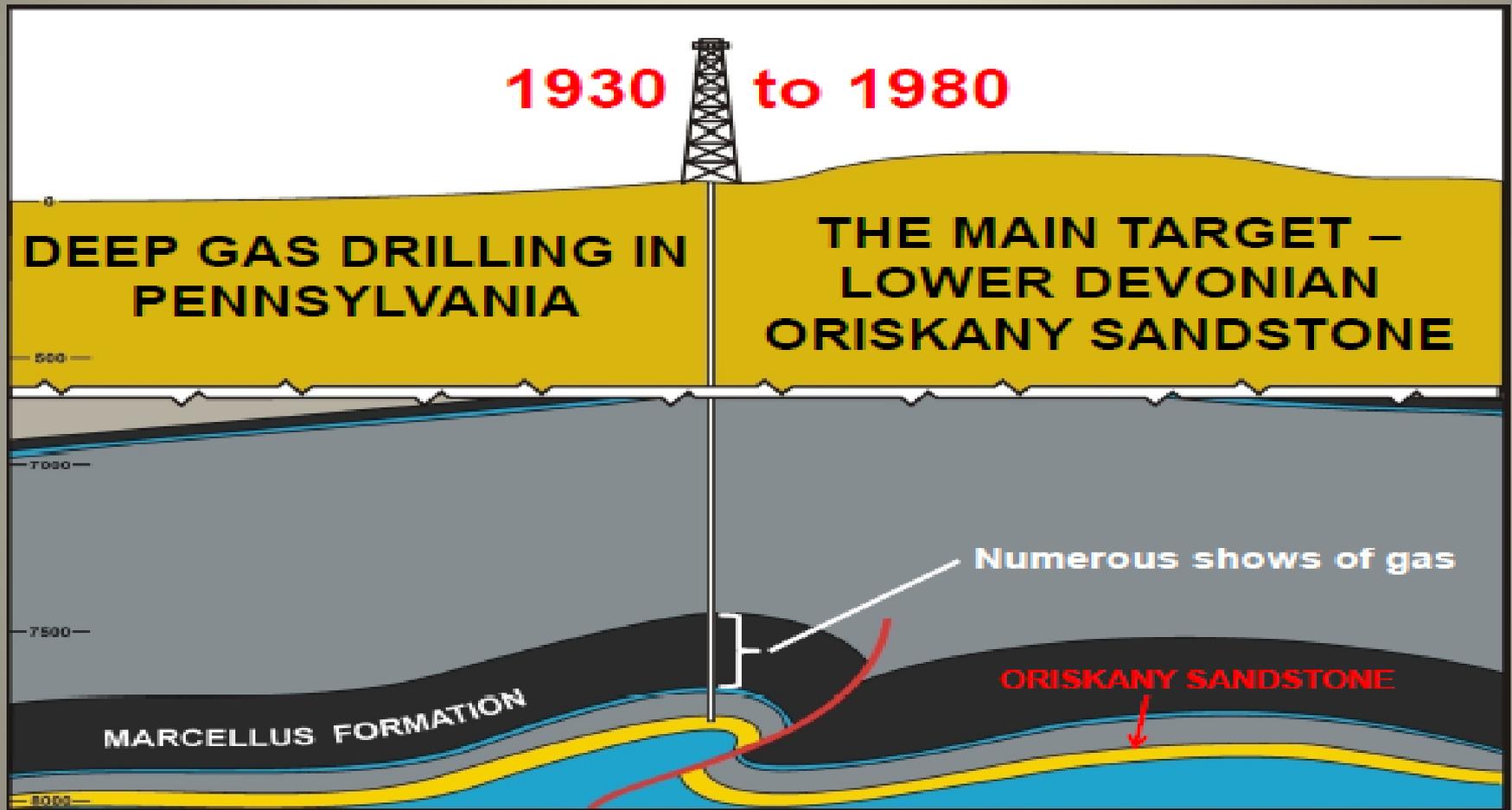


Modified from Groundwater Protection Council, 2009

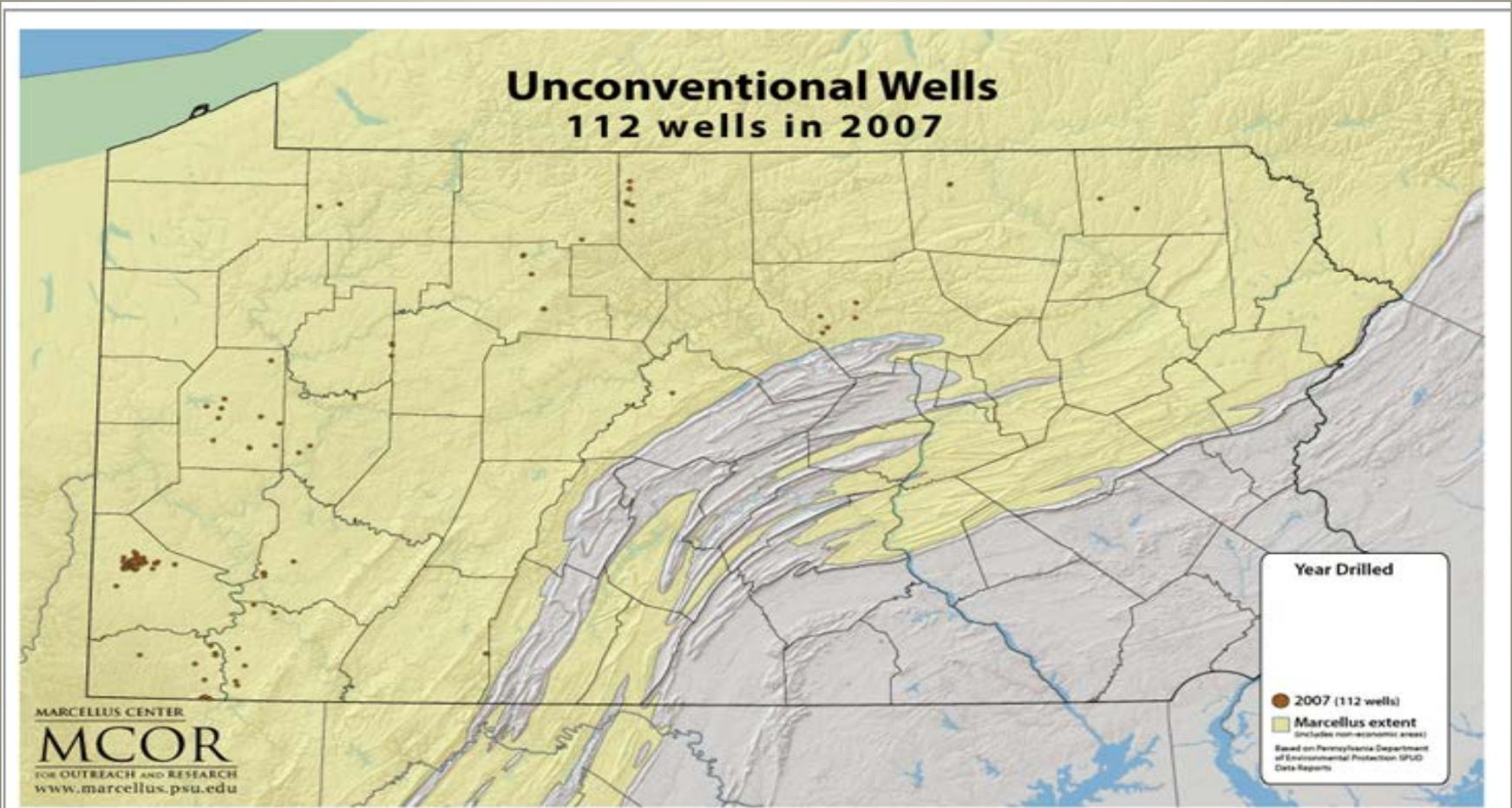
Distribution of Marcellus and Utica Shale in PA



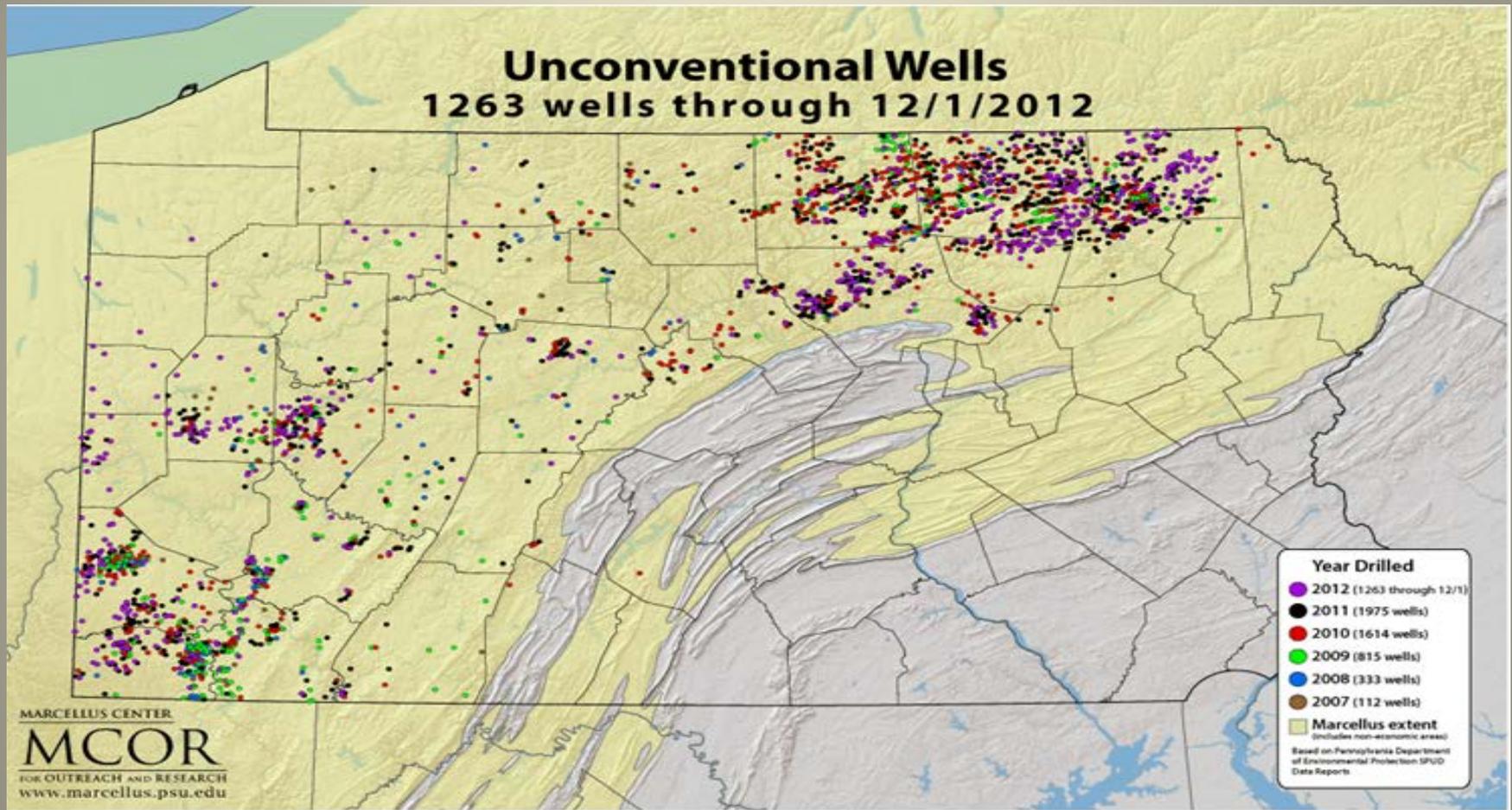
Geologic Cross Section



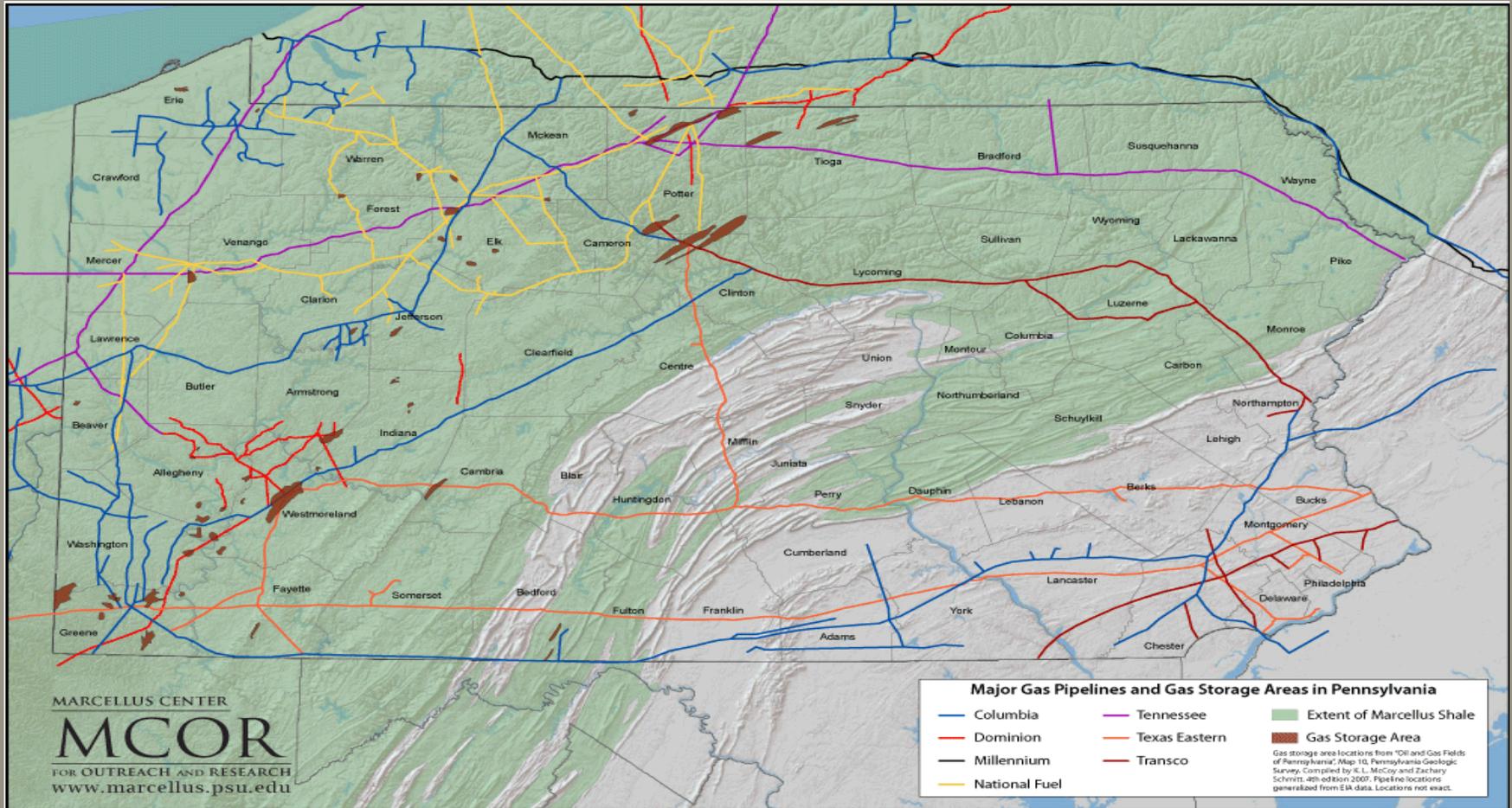
Well Development in PA



Well Development in PA



Distribution Lines



Another Perspective

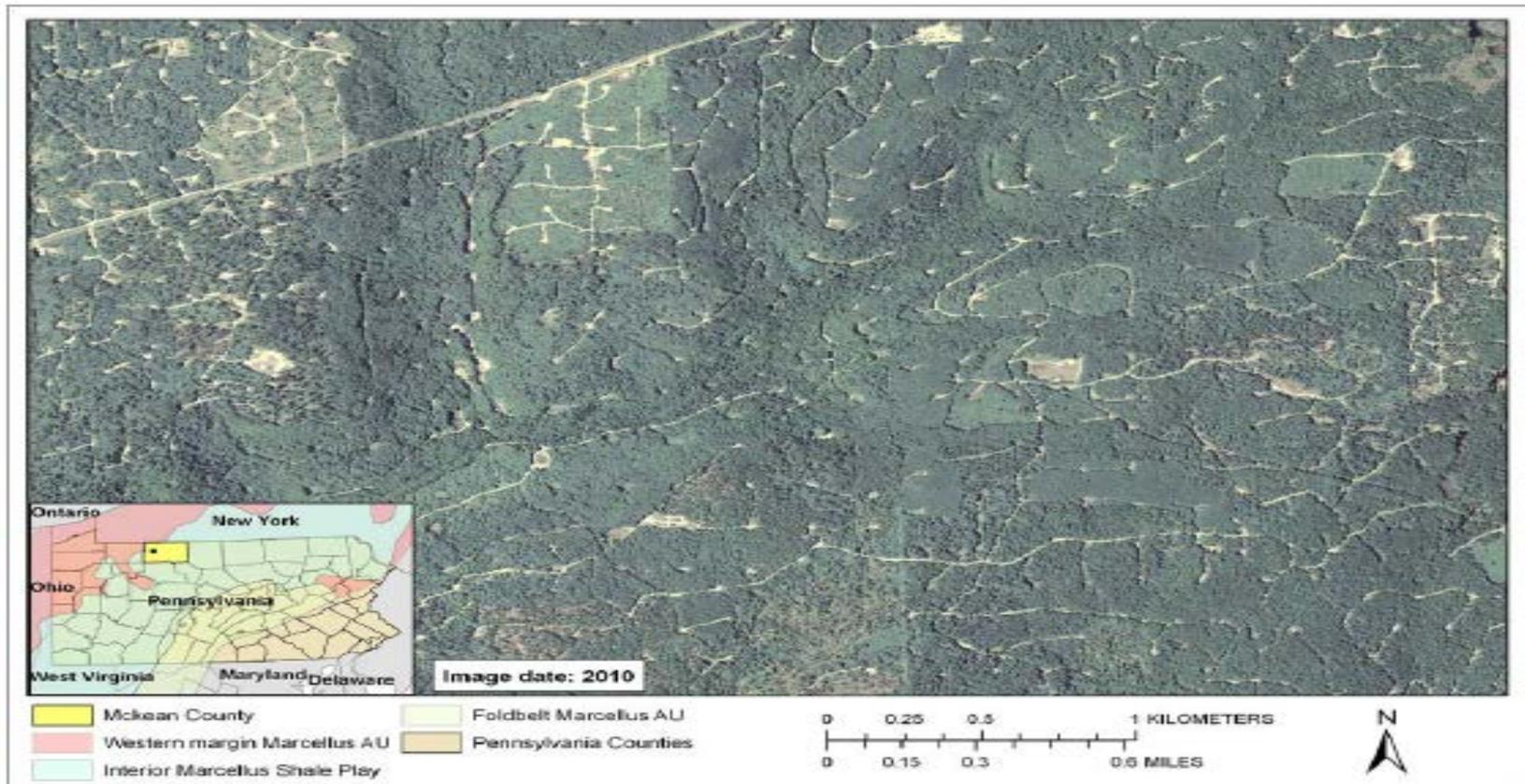


Figure 2. A forested landscape in McKean County, Pennsylvania, showing the spatial effects of roads, well pads, and pipelines related to natural gas development. Inset shows the location of the image. Base-map data courtesy of the National Atlas [(<http://viewer.nationalmap.gov/viewer>) (U.S. Geological Survey, 2011)].

Directional Horizontal Drilling Distribution Lines



Impact on Water Quality & Water Movement



What brings Us Here

during our horizontal directional drilling procedures, be considered as a co-product for the following activities:

Erosion prohibitor and soil supplement on reclaimed right of ways (ROW).

- Applying bentonite to the subsoil during the reclamation of pipeline right of ways, helps in erosion control by absorbing water during heavy rain events before vegetation has reached a growth capable of holding soils in place. Bentonite also helps as a soil supplement during the application of fertilizer to the ROW. Bentonite has been found to cover the fertilizer grains applied to the soil and decrease loss of fertilizers during runoff events. Bentonite has also been found to improve the fertility of the soils by increasing microbial activity and decreasing soil acidity by increasing pH levels.

Agricultural Field Application

- Local farmers have asked for the excess bentonite solution to apply on their crop fields. As described above, farmers also see a benefit of applying bentonite as a soil supplement to produce a better yield of crops.

Pond Sealing

- Locals have asked for the excess bentonite solution to assist in sealing constructed ponds on their properties. Bentonite can be applied and incorporated as a clay layer into the soils of the bottom of the pond to reduce seepage and loss of water. Treating pond bottoms with bentonite clay is often necessary when an insufficient

What Brings Us Here

This letter is intended to clarify correspondence from the Department of Environmental Protection's (DEP's) North Central Regional Waste Program Office regarding the role of conservation districts when an applicant plans to use bentonite slurry to assist in nutrient retention in agricultural soils. DEP included a condition in the coproduct determination asking the county conservation district to review the findings of the applicant regarding on-site suitability based on soil analysis, or site knowledge, and consistency of the application with the Nutrient Management Plan, prior to using this material for agricultural use as approved.

DEP considers sites for agricultural beneficial use of this product have soils that are:

- Moderately Well Drained
- Well Drained
- Somewhat Excessively Drained
- Excessively Drained

DEP considers sites for beneficial use of this product have soils that possess a surface texture of:

- Loam
- Sandy Loam
- Loamy Sand
- Sand

Most farms that could benefit from bentonite application will be on glacially transported material consisting of sand and gravel on floodplains and the old floodplain terraces of major creeks and rivers. The general caution is that bentonite should not be used where there is an existing problem with soil drainage. In addition, adding bentonite to a soil where the surface texture is a silt loam or finer may actually be detrimental to crop growth by reducing pore size and restricting available water, compaction resistance, etc.

The conservation district is not approving the use of this material as a coproduct. DEP would like to rely on the district's soil and Nutrient Management Plan knowledge as part of DEP's coproduct determination. DEP's intent was to utilize the expertise of those who know the most about local soils and agriculture -the district- without putting the burden of approval on the district. DEP's

Interpretations

- Bentonite Land Application
- Salt accumulation
- Water Quality
- Water Movement
- Water Recharge Areas
- Soil Reclamations (Pad Sites & ROW's)
- Erosion and sediment control
- Well Pad Placement

Questions?

