

COUNCIL RUN HYDROLOGICAL DRAINAGE AND SEDIMENT YIELD MODELING USING ARCSWAT AND TOPOGRAPHIC WETNESS INDEX IN RELATION TO MARCELLUS SHALE DRILLING INFRASTRUCTURE

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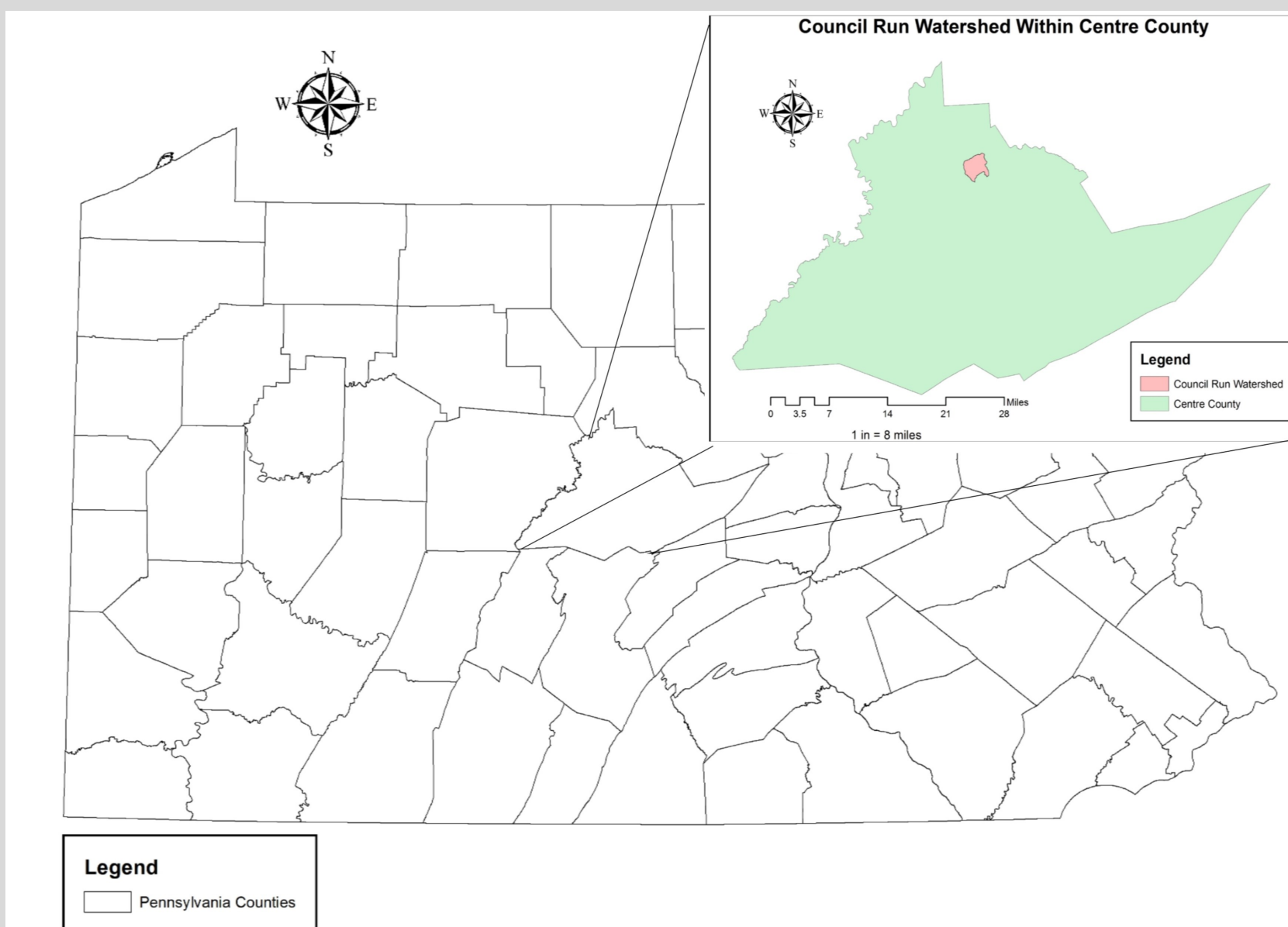


Figure 1. Council Run Watershed within Centre County, Pennsylvania.

Council Run is a small sub-watershed which is located within the Beech Creek Watershed in Centre County, Pennsylvania. This sub-watershed is unique due to its small size (approximately six square miles) and the presence of Marcellus Shale drilling operations. Of concern is how Marcellus Shale drilling infrastructure impacts surface runoff and stream turbidity.

TauDEM software was utilized with high resolution LIDAR data in order to model the Topographic Wetness Index (TWI) for Council Run in an effort to establish and illustrate flow accumulation patterns. ArcSWAT software was used in conjunction with land use and soil data in attempts to determine monthly and annual surface discharge rates, HRU, and sediment yields. Layers were obtained of state, local, and unpaved roads as well as Marcellus Shale drilling infrastructure data, which was then superimposed on aerial imagery. By looking at aerial imagery from 2008 and 2013 as well as the TWI data and comparing them with the road and infrastructure data, additional road and infrastructure features were added to the existing data.

The ArcSWAT data shows that areas with Marcellus Shale drilling operations have moderate soil loss as well as moderate discharge rates. These values were not the highest observed within the models. Looking at the TWI data, alterations to drainage patterns due to Marcellus Shale drilling infrastructure were observed. The data from the models suggest that Marcellus Shale drilling has had an impact on discharge flow patterns, but more data and research is needed for a more accurate determination.

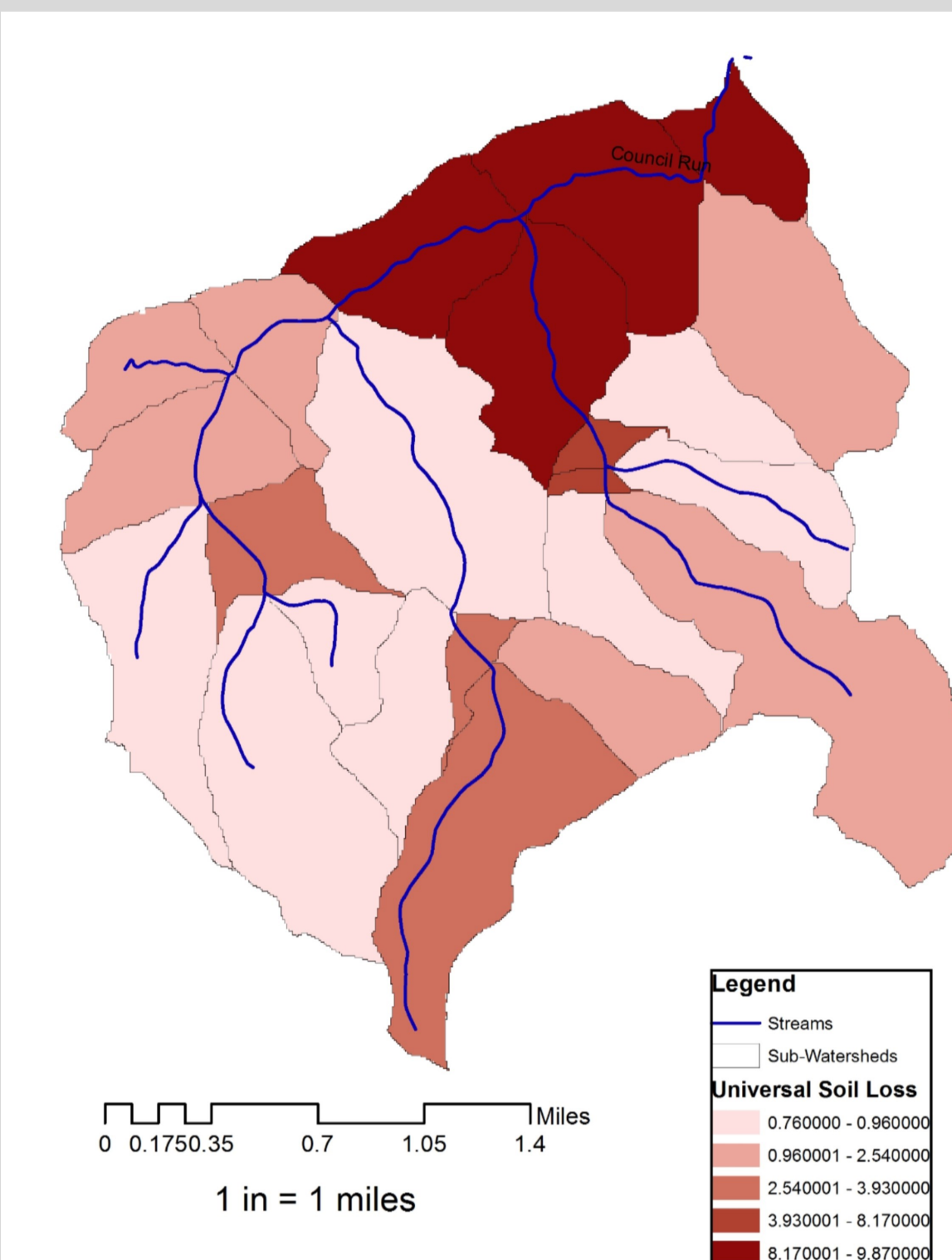
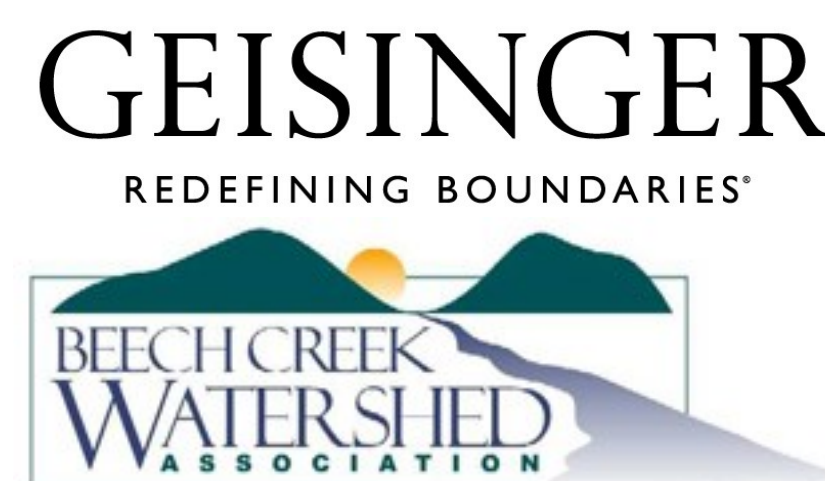


Figure 2. Universal Soil Loss by sub-watershed within Council Run Watershed.

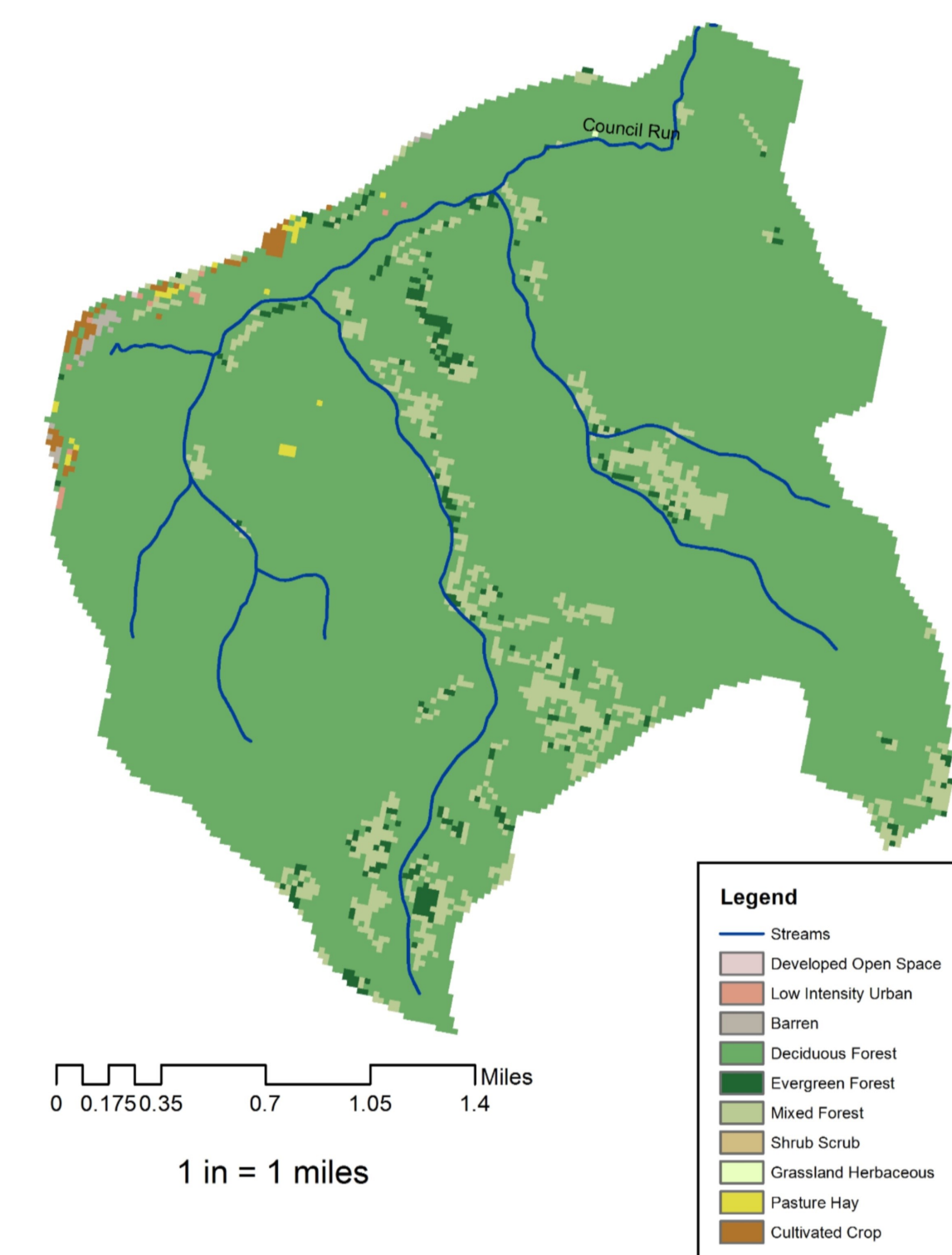


Figure 4. Land Use in Council Run Watershed

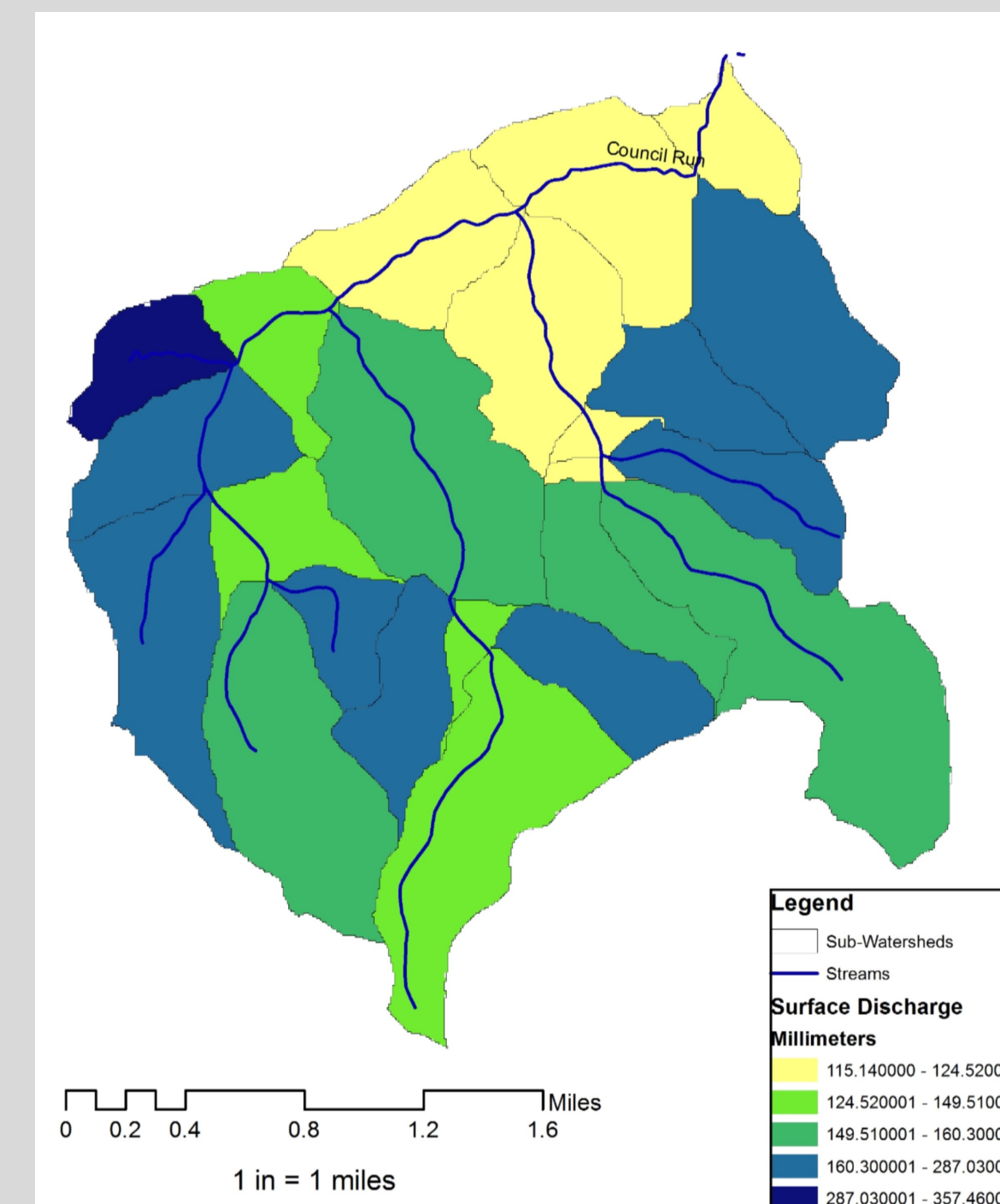


Figure 3. Annual Surface Discharge by sub-watershed within Council Run Watershed.

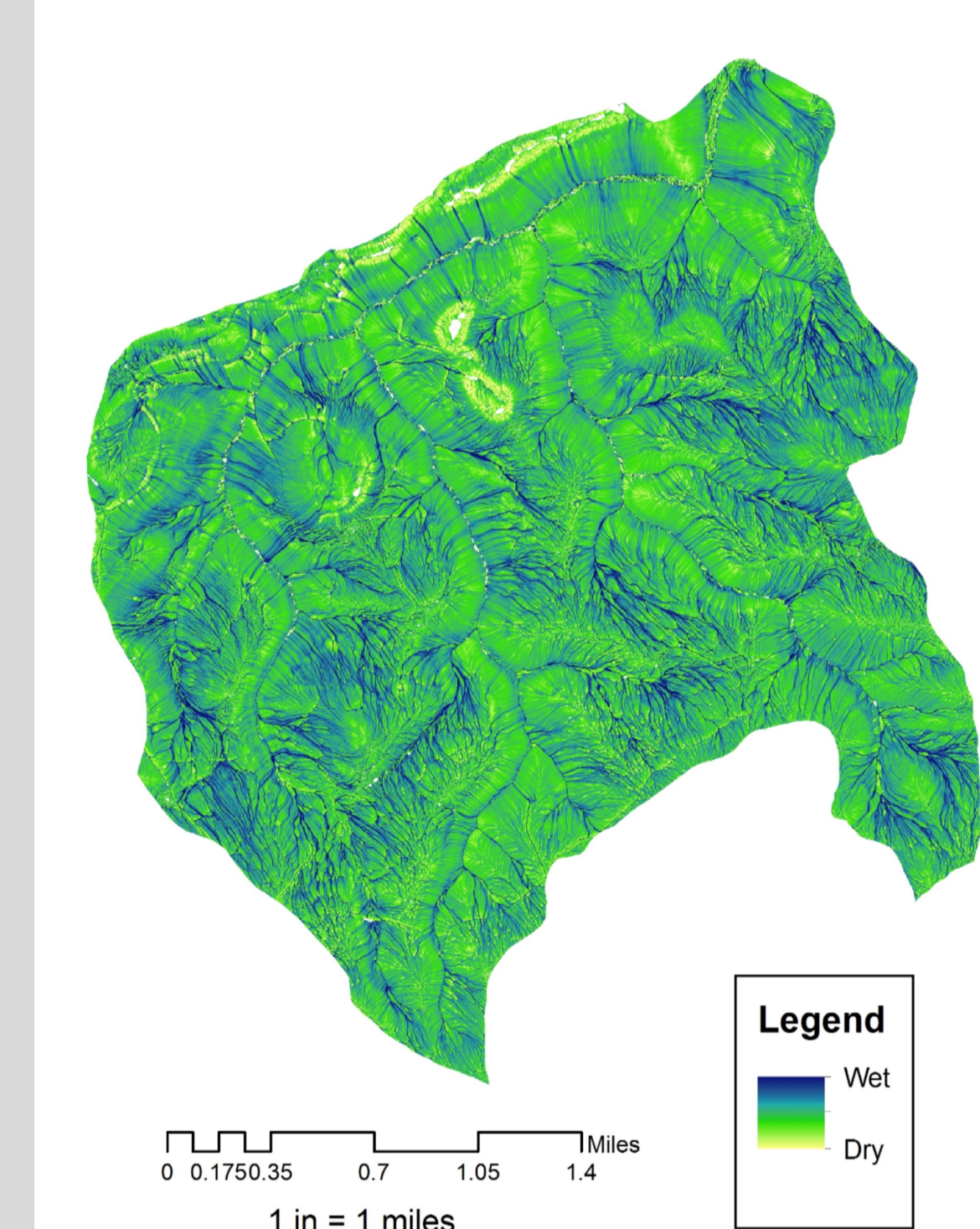


Figure 5. TWI for Council Run Watershed.

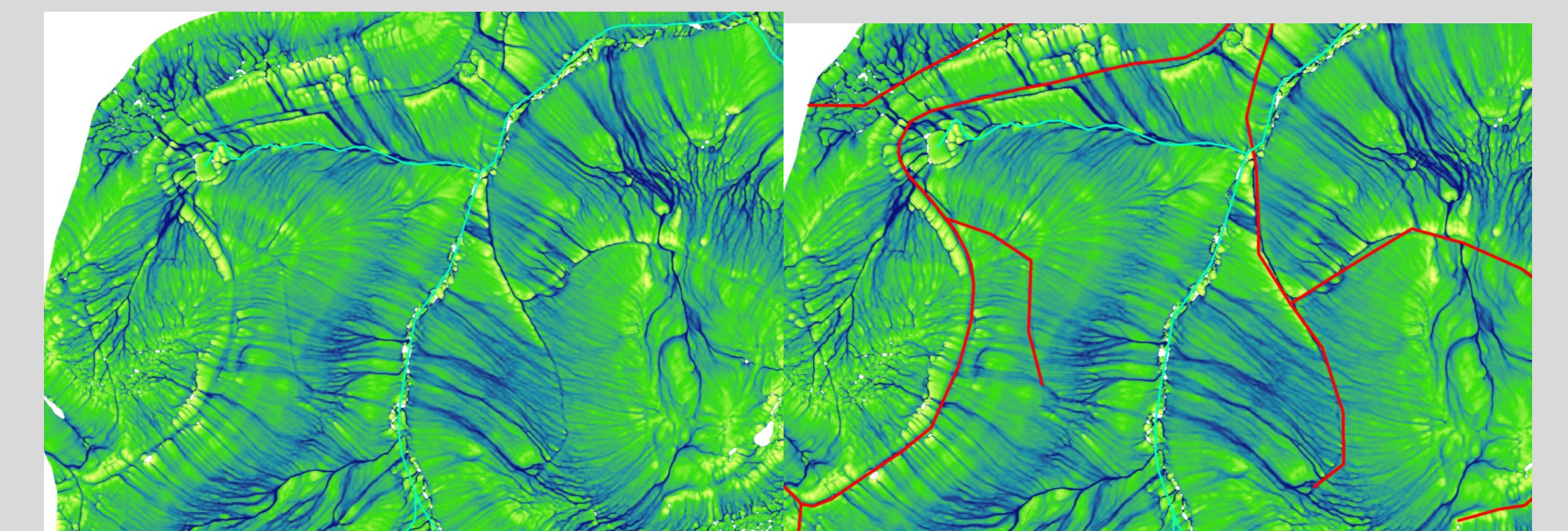


Figure 6. Digitization of roads using TWI layer.

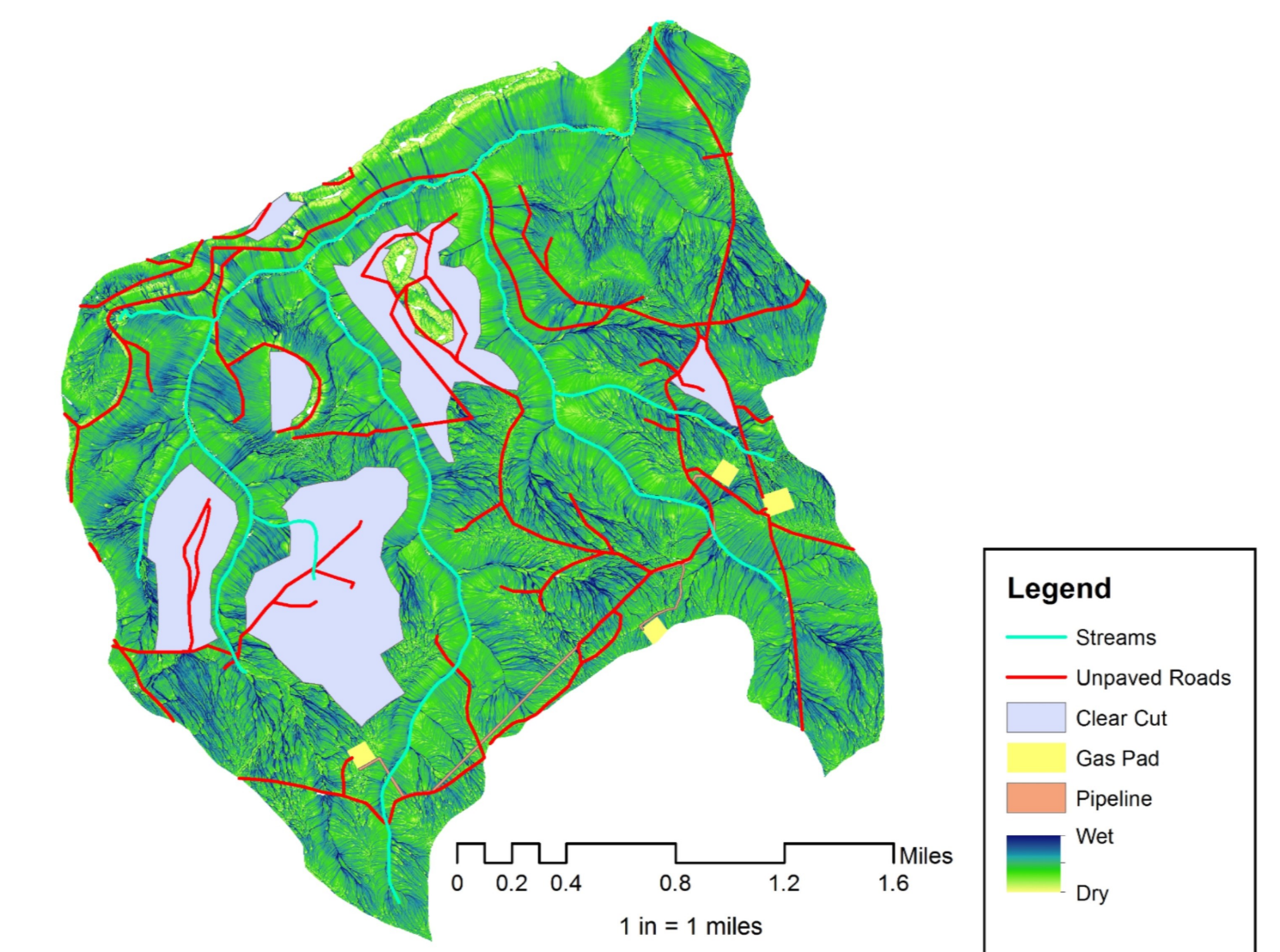


Figure 7. Digitized Marcellus Shale Structures and Unpaved Roads in Council Run Watershed.

Continuing Research

The modeling of Council Run is only a small part of a larger research project to determine the impact that Marcellus Shale drilling operations have on sediment yields and runoff rates. The modeling data for Council Run will be combined with modeling data from Marsh Creek and Baker Run Watersheds. Sediment samples will be collected from each of these watersheds and analyzed using an XRF to determine sediment compositions. These compositions can then be used to try to fingerprint sediment extracted from streams in order to identify their source. This data will help to illustrate the impact that Marcellus Shale drilling operations have had on sediment yields and runoff within the watersheds that they are located.