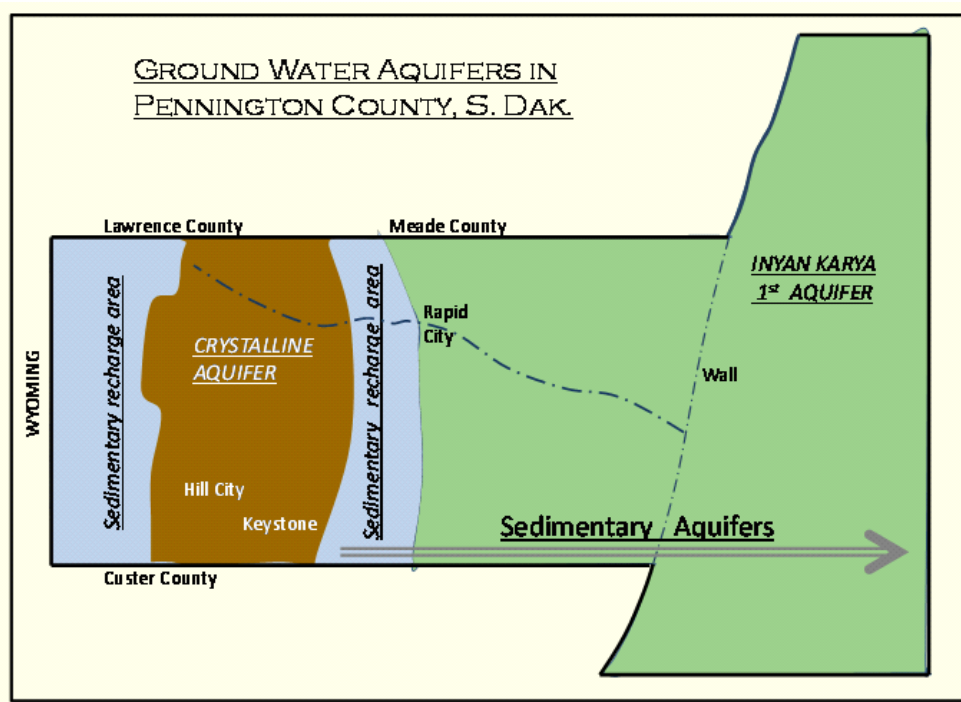


Pennington County Aquifers General Geology

Western Pennington County, from the Wyoming-South Dakota state line eastward to Rapid City is part of the Black Hills uplift with a core area of ancient (Precambrian) granite, schist, quartzite, etc.(forming crystalline aquifers) surrounded by a stacked sequence of sedimentary layers (forming sedimentary aquifers). The rock units in these areas are of different geologic ages and formed by very different geologic processes, but they provide water resources that supply home sites and towns within the Black Hills and across the prairies to the east. Geologic maps of many of 7.5 minute quadrangles in the Black Hills can be viewed at the South Dakota Geological Survey web site <http://www.sdgs.usd.edu/publications/>

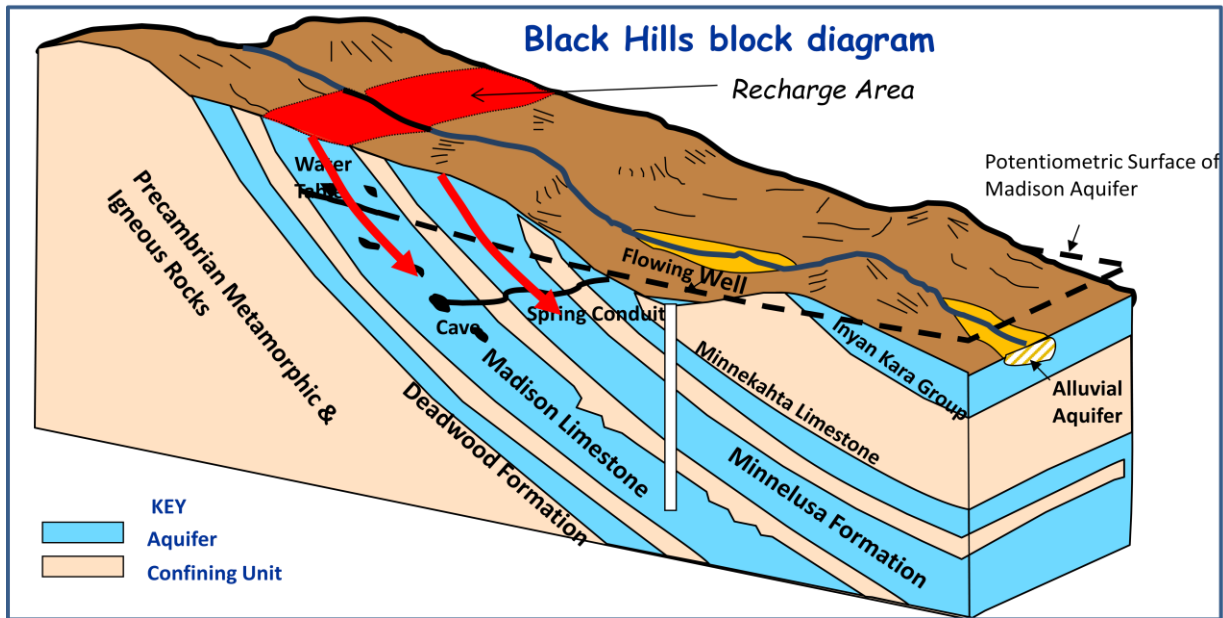


Generalized map of Pennington County showing areas of aquifer recharge in the Black Hills. For much of the county east of Rapid City, the Inyan Kara aquifer is the first to be encountered in water wells, the depth of which increases eastward.

Precambrian Crystalline Aquifer

Precambrian igneous and metamorphic rocks of the central Black Hills were formed either from molten magma, forming granite (e.g. the Harney Peak granite) and basalt/gabbros, or from sandstone, conglomerite, and shale which were subsequently squeezed and heated to form metamorphic rocks, e.g., quartzite and schist. Although not shown separately in the block diagram below, the metamorphic units generally form north-northwest-trending bands in map view, offset by large faults of the same trend. Because such rocks lack original porosity, they

contain ground water only in fractures. Therefore, the yields from wells tend to be less than those in sedimentary aquifers located to the east.



U.S. Geological Survey: South Dakota Water Science Center: <http://sd.water.usgs.gov/>

Block diagram illustrating the relationships of aquifers along the flanks of the Black Hills uplift. Adapted from the U.S. Geological Survey report noted above.

Sedimentary Aquifers

As shown in the block diagram above, the geology of the eastern flank of the Black Hills consists of a stacked group of sedimentary formations (a group of rock layers of similar composition) overlying the Precambrian basement. All of these formations extend from the surface (which is the recharge area for the aquifers) to greater and greater depths to the east beneath the prairies.

In this interpretation, five of these formations represent aquifers. The oldest, and deepest, is the Deadwood Formation and the youngest the sandstone layers of the Inyan Kara Group (exposed in M Hill and Dinosaur Hill in Rapid City). The thicknesses of these aquifers are variable, but generally:

Inyan Kara Group	~500 ft.
Minnekahta Limestone	40 ft.
Minnelusa Formation	550-650 ft
Pahasapa (Madison) Limestone	300-400 ft
Deadwood Formation	150-300 ft.

As shown in the block diagram, the depth to each formation is progressively greater eastward from the surface exposure (recharge area) of the formation. Beneath the prairies east of

Rapid City, the shallowest aquifer (the first reached in a drill hole) is the Inyan Kara Group. The Fall River Formation (the top unit of the Inyan Kara Group) is reached at a depth of 3,100 feet in city wells at Wall in eastern Pennington County. The other formations would be present at successively greater depths beneath the Inyan Kara Group.

Water quality in all of the aquifers is progressively less with distance from the outcrop.

Alluvial aquifers

Poorly consolidated sand and gravel deposits along valley bottoms may be several tens of feet thick and contain abundant ground water. In areas of multiple home sites, with on-site waste water facilities (septic tanks), such water supply sources need to be tested frequently for contamination.