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HYDROGEOLOGIC ATLAS OF THE BLACK HILLS, PENNINGTON
COUNTY, SOUTH DAKOTA

PIEDMONT QUADRANGLE

Structure Contour Map.

Structure Contour Map: A map showing, by means of contour lines of equal elevation, the shape of the surface of a selected rock layer (contact), including beneath the Earth's surface.

The sedimentary rock layers within the Piedmont Quadrangle are affected by a regional tilt of three to seven degrees to the east or northeast. This regional dip is interrupted by folds (anticlines, synclines, monoclines) in which the layers are locally rotated as much as 90°.

The Hudson Ranch anticline crosses the quadrangle from the northwest to southeast, paralleled on the southwest side by a syncline. The tilt (dip) on the surface in the common limb of these folds is gentle in the northwest, but near the southeast margin of the map area they are 30° or greater. The elevation difference between the crest of the anticline and the trough of the syncline is more than 500 feet in the southeast. Two smaller folds parallel the Hudson Ranch structure about one mile to the northeast.

In the northeast corner of the quadrangle, just west of Piedmont, the sedimentary layers are strongly tilted in the White Gates Monocline. Layers within this southeast-trending fold are tilted down to the northeast as much as 90° from the horizontal and the differences in the elevation of the surface across the fold are approximately 1,000 feet. A second, and much smaller, monocline parallels the White Gates structure about one mile to the northeast.

Deadwood Formation (See Map)

The Cambrian age Deadwood Formation underlies most of the area of the Piedmont Quadrangle. Structure contour lines indicate that elevations on the upper surface of the Deadwood Formation descend from about 5,000 feet on the west to 1,600 feet in the extreme northeast corner of the quadrangle. The surface is not planar across this distance, however, as indicated by local curvature (indicating folding) and narrow spacing (indicating strong tilting) of the contour lines: dips may be greater in the limbs of folds.

Madison Aquifer (Pahasapa Limestone) (See Map)

The Mississippian age Pahasapa Formation, which comprises the Madison Aquifer in the Black Hills area, is exposed at the surface across much of the central portion of the Piedmont Quadrangle.

The formation is present as an aquifer (i.e., in the subsurface) in two parts of the quadrangle. The first is the northeast-most portion around the village of Piedmont, northeast of the White Gates monocline (noted in the Minnelusa section). The aquifer area extends southward to Stagebarn Canyon in Sec. 22. As shown by the structure contour lines, the

elevation of the surface descends from about 4,300 feet at the White Gates monocline along Little Elk Creek on the west to 2,000 feet in the extreme northeast corner of the quadrangle. The average tilt (dip) of the formation in this area is about 5°NE.

The second area in which the formation functions as an aquifer is at the southeast corner of the map area in Sec.'s 9, 10 and 15, T2N., R.6E. There it is found in the core of a syncline which parallels the Hudson Ranch Anticline on the south side. The tilt (dip) on the formation surface in the common limb of these folds is 30°SW or greater. The elevation difference between the crest of the anticline and the trough of the syncline is more than 500 feet in the southeast.

***Minnelusa Formation* (see map)**

The recharge area (the area in which the formation is exposed at the surface) of the Pennsylvanian-Permian-age Minnelusa Formation is near the eastern edge of the map area: The formation is present as an aquifer only in the northeast-most, northeast of the White Gates monocline, and southeast-most portions of the quadrangle. The White Gates monocline is indicated on the map by closely spaced structure contour lines, as shown in Sec's. 15 and 16, T.3N., R.6E. and may be recognized topographically as the area of abrupt increase in elevation south and west of Piedmont village.

As shown by the structure contour lines, the elevation of the surface descends from about 4,000 feet west of the White Gates monocline to 2,500 feet in the extreme northeast corner of the quadrangle and the average tilt (dip) of the formation in this area is about 5°NE.