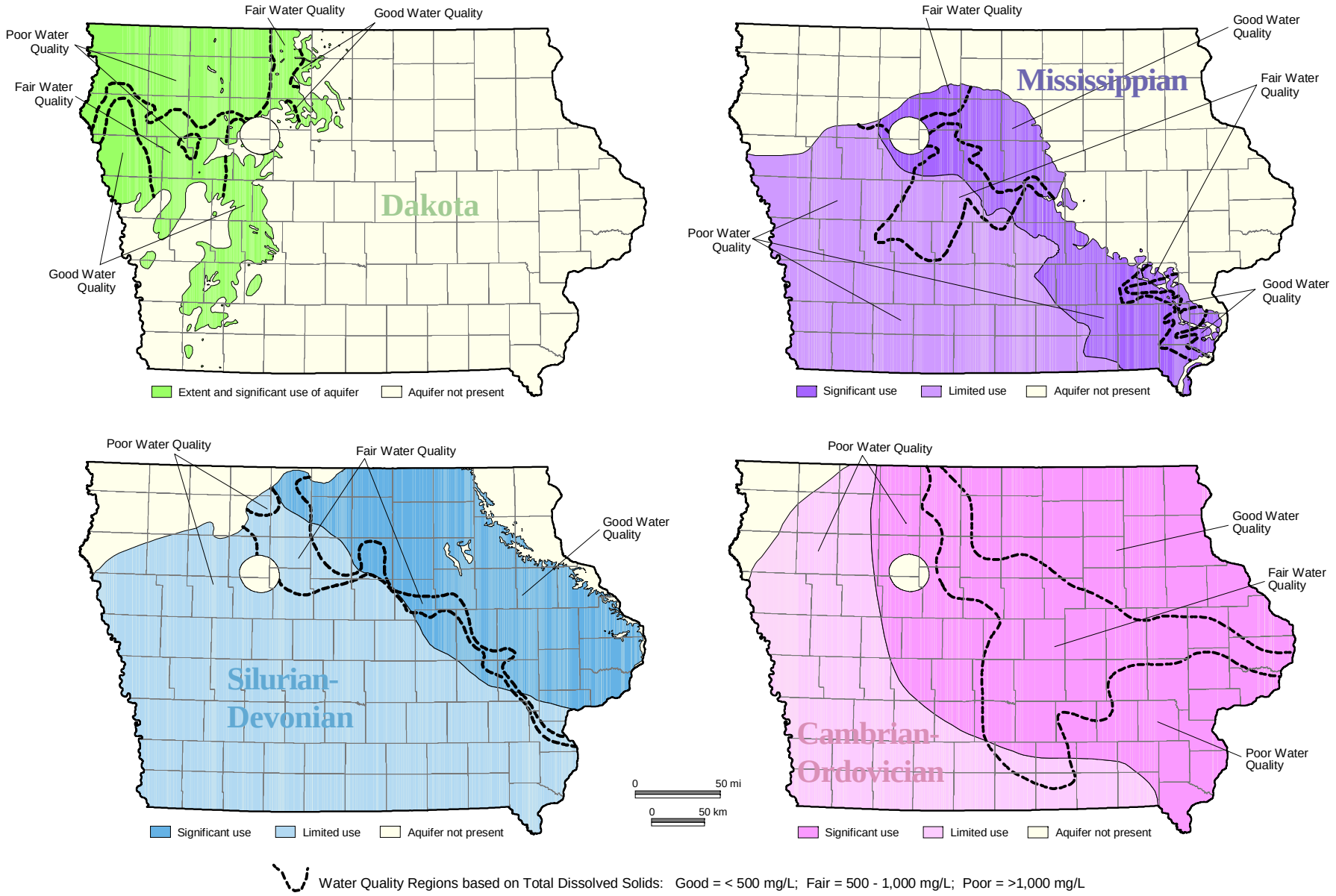
BEDROCK AQUIFERS OF IOWA

2004



Water Quality Regions based on Total Dissolved Solids: Good = < 500 mg/L; Fair = 500 - 1,000 mg/L; Poor = >1,000 mg/L

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BEDROCK AQUIFERS

Bedrock aquifers occur in sedimentary rock layers composed of limestone and dolomite (carbonate rocks) and sandstone, which originated as deposits in seas and rivers that occupied Iowa from 75 to 550 million years ago (Cretaceous to Cambrian age). Total thickness of these rocks ranges from 5,200 feet in southwest Iowa to about 800 feet in northeast Iowa.

Of the state's sedimentary rocks, sandstones and carbonates make the best aquifers, as they can store and transmit water easily. Sandstones have interconnected spaces between sand grains, allowing groundwater to move through the rock. However, mineral cement can diminish a sandstone's ability to transmit water. Carbonate rocks are finer grained, and groundwater flows through vertical fractures and thin partings that separate rock layers. The dissolving action of groundwater enlarges the openings to crevices or caves. Dissolution of fossils and fracturing also adds to openings in rocks.

Aquifers below the Cretaceous-age Dakota gradually slope to the southwest, so that aquifer depth increases in southwestern Iowa. The region of greatest use of an aquifer coincides with the area where it is at or near the land surface. This is where the aquifer receives the fastest recharge and has a better natural water quality. Where aquifers are deeper, the water has been in contact with minerals longer, making the natural water quality poorer.

The **Dakota aquifer**, composed of riverine sandstone deposits 200 to 300 feet thick, generally yields 100 to 500 gallons per minute (gpm) of fair to poor quality water. The aquifer is confined by 200 to 400 feet of glacial till and younger Cretaceous-age strata. Recharge is by downward percolation through confining units. Regional flow in the Dakota is from north to south and it discharges to the lower reaches of major rivers in western Iowa.

The **Mississippian aquifer** consists of limestone and dolomite, with thinner deposits of sandstone and gypsum. It is used mainly in north-central Iowa where water quality is generally good, and produces much smaller yields of poorer quality water in central and southeastern Iowa. Along the outcrop belt, it is overlain by alluvium, loess, and glacial drift and elsewhere is overlain by Pennsylvanian-age shales and sandstones. Regional flow in the aquifer is southerly, and it discharges into the Des Moines and Skunk rivers.

The **Silurian-Devonian aquifer** is mainly Silurian dolomites and Devonian limestones, which have similar hydrogeologic properties and are hydraulically connected. In eastern and northern Iowa, the aquifer is 200 to 400 feet thick and yields 150 to 400 gpm. In some areas, differences in rock types cause the Silurian and Devonian to behave as separate aquifers. The water quality rapidly deteriorates as the aquifer thickens toward the west and southwest. Where the aquifer is deeper, well-developed fractures found in the eastern subcrop area are fewer and yields are smaller. Regional groundwater flow in the aquifer is to the southeast. Discharge from the aquifer towards valleys provides baseflow to many northeastern Iowa streams.

The **Cambrian-Ordovician aquifer** consists of multiple bedrock formations, including (in ascending order) the Jordan Sandstone, the dolomite and sandstone of the Prairie du Chien Group, and the St. Peter Sandstone. High capacity wells typically use the full thickness of the aquifer, while other wells may penetrate only the upper strata. Often called the "Jordan aquifer," much of the groundwater flow also comes from the Prairie du Chien, thus "Cambrian-Ordovician aquifer" is a more accurate name. Well depths range from 300 to 2,000 feet, and yields vary from several hundred to over 1,000 gpm. The best water quality is found in northeast Iowa, nearest the areas of outcrop and recharge. In western and southwestern Iowa, depth to the aquifer increases and dissolved mineral content increases to undesirable levels. The main area of recharge is in southern Minnesota and northern Iowa, via vertical leakage from overlying aquifers. Subsurface flow is to the southeast, with discharge to the Mississippi Valley.

For further information: Iowa's Groundwater Basics *by Jean C. Prior and others, 2003, Iowa Dept. of Natural Resources, Iowa Geological Survey Educational Series 6, 83 pages.*