

ALLUVIAL AQUIFERS OF IOWA 2004



Iowa Department of Natural Resources
Geological Survey • 109 Trowbridge Hall • Iowa City, Iowa 52242-1319

ALLUVIAL AQUIFERS

River valleys are one of Iowa's major landscape features. Underlying these valleys are shallow sand and gravel deposits called alluvial aquifers, which are the youngest aquifers in Iowa and are Quaternary in age. They are grouped with "Surficial aquifers" since they are at or near the land surface. The sand and gravel that make up an alluvial aquifer form a record of the river's history. Such sediment may be remnants of last year's flood or 10,000-year-old gravel deposits left by the last glacier's meltwater flow. Water is generally recharged to the alluvial aquifer from local precipitation, river infiltration, and discharge from adjacent geologic units.

The texture of alluvial materials can change abruptly both vertically and horizontally, reflecting their varied depositional history. Some alluvial deposits are dominated by fine-grained silts and clays, which reduce the ability of water to move through the aquifer in response to pumping. In contrast, coarse, thick, widespread alluvial materials often form a productive and dependable water source. The advantages of alluvial aquifers are their abundant yields and shallow well depths (typically less than 100 feet). Conversely, their shallow depths and high porosity make them particularly vulnerable to extremes in water level fluctuations due to seasonal variations in precipitation. The lack of an overlying impermeable (confining) layer also makes these aquifers vulnerable to contamination from the land surface.

Alluvial aquifers typically contain the least mineralized groundwater in Iowa (less than 500 milligrams per liter of dissolved solids) because the water has been in contact with sediments for only a short time. Water quality depends on aquifer characteristics, well depth, the character of an underlying aquifer or aquiclude, and the source of the groundwater. Since sand and gravels are usually hydraulically connected with an adjoining river, these deposits also tend to reflect the river's natural recharge and quality characteristics.

Significant alluvial aquifers occur along the Missouri and Big Sioux river valleys in western Iowa and along the Mississippi River corridor in eastern

Iowa. Alluvial aquifers are also present along Iowa's larger interior rivers. In both cases, the lateral extent of the aquifers is limited by the width of the valley. The coarser, more permeable deposits in these valleys result from sorting and deposition of outwash transported during glacial meltwater flooding. Alluvial materials range from 50 to 160 feet thick along the Mississippi and Missouri rivers where they store enormous quantities of groundwater. Thinner, narrower alluvial aquifers along major interior rivers may be from 30 to 70 feet thick. A few deposits of very thick alluvium are found where modern river valleys coincide with older, deeper, buried valleys cut into the underlying bedrock surface. In general, alluvial deposits are thicker, coarser, and more productive in a downstream direction and tend to thin out near the edge of valleys and grade into finer grained, less productive sediments.

Groundwater and surface water interact closely in alluvial settings. Since alluvial aquifers are unconfined, the water table, or groundwater surface, fluctuates in response to variations in precipitation and river levels. The lakes seen along floodplains are actually low-lying areas where the water table intersects the land surface. A rising river level will cause a simultaneous rise in the water table of an adjacent alluvial aquifer. Similarly, a falling river stage will produce a falling water table, and shallow lakes may disappear. The subsurface gradient of the water table slopes toward the river during falling river levels and away during rising river levels. The continuous contribution of groundwater to streams, known as baseflow, keeps streams flowing even after long periods without rainfall.

Alluvial aquifers are important sources of moderate-to-large water supplies across the state. These aquifers provide valuable, as well as vulnerable, water supplies for large numbers of urban-dwelling Iowans.

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.