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Arkansas Geological Survey
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Depth to Groundwater in the Mississippi River Valley Alluvial Aquifer in Eastern Arkansas

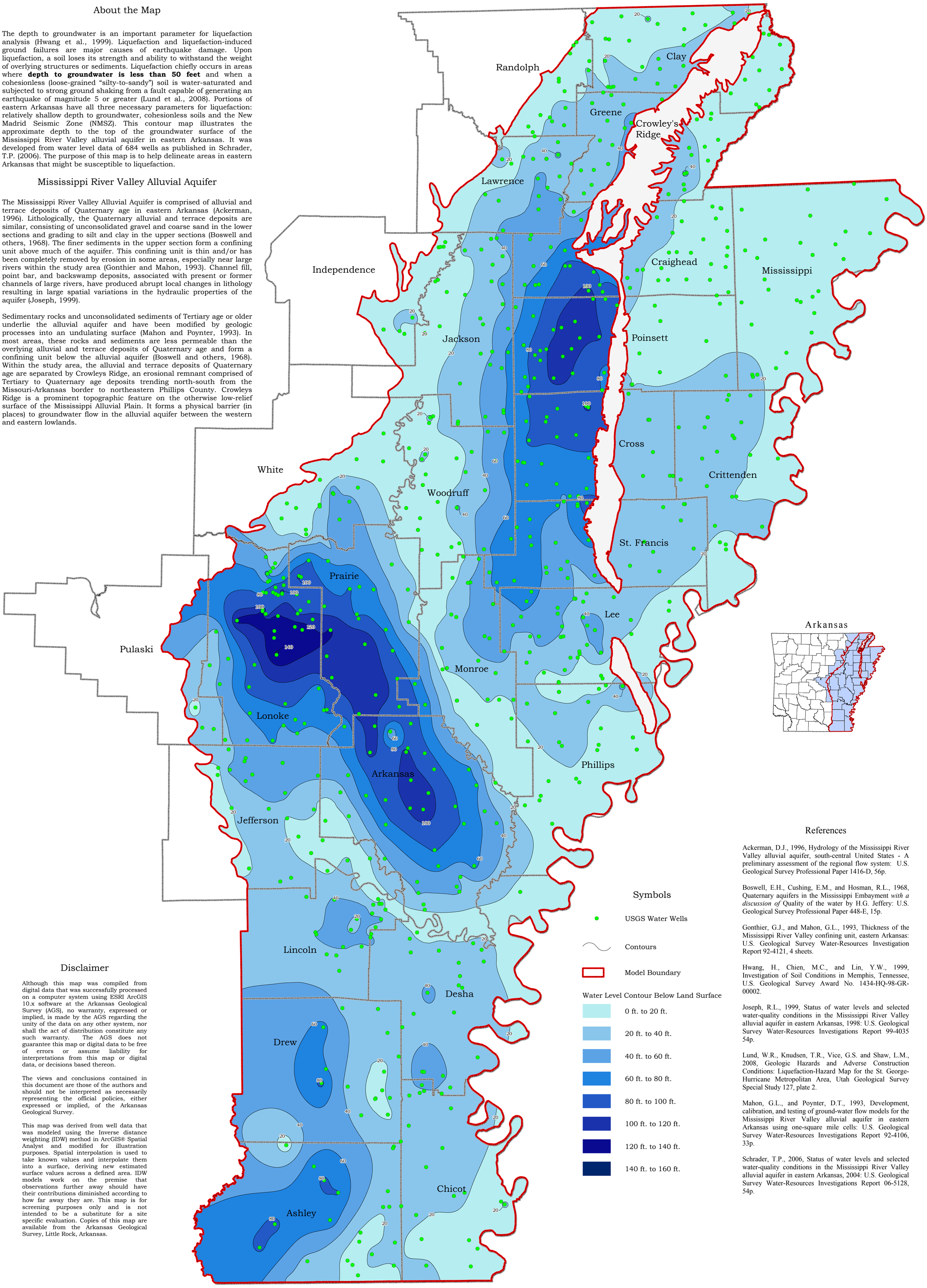
About the Map

The depth to groundwater is an important parameter for liquefaction analysis (Hwang et al., 1999). Liquefaction and liquefaction-induced ground failures are major causes of earthquake damage. Upon liquefaction, a soil loses its strength and ability to withstand the weight of overlying structures or sediments. Liquefaction chiefly occurs in areas where **depth to groundwater is less than 50 feet** and when a cohesionless (loose-grained "silty-to-sandy") soil is water-saturated and subjected to strong ground shaking from a fault capable of generating an earthquake of magnitude 5 or greater (Lund et al., 2008). Portions of eastern Arkansas have all three necessary parameters for liquefaction: relatively shallow depth to groundwater, cohesionless soils and the New Madrid Seismic Zone (NMSZ). This contour map illustrates the approximate depth to the top of the groundwater surface of the Mississippi River Valley alluvial aquifer in eastern Arkansas. It was developed from water level data of 684 wells as published in Schrader, T.P. (2006). The purpose of this map is to help delineate areas in eastern Arkansas that might be susceptible to liquefaction.

Mississippi River Valley Alluvial Aquifer

The Mississippi River Valley Alluvial Aquifer is comprised of alluvial and terrace deposits of Quaternary age in eastern Arkansas (Ackerman, 1996). Lithologically, the Quaternary alluvial and terrace deposits are similar, consisting of unconsolidated gravel and coarse sand in the lower sections and grading to silt and clay in the upper sections (Boswell and others, 1968). The finer sediments in the upper section form a confining unit above much of the aquifer. This confining unit is thin and/or has been completely removed by erosion in some areas, especially near large rivers within the study area (Gonthier and Mahon, 1993). Channel fill, point bar, and backswamp deposits, associated with present or former channels of large rivers, have produced abrupt local changes in lithology resulting in large spatial variations in the hydraulic properties of the aquifer (Joseph, 1999).

Sedimentary rocks and unconsolidated sediments of Tertiary age or older underlie the alluvial aquifer and have been modified by geologic processes into an undulating surface (Mahon and Poynter, 1993). In most areas, these rocks and sediments are less permeable than the overlying alluvial and terrace deposits of Quaternary age and form a confining unit below the alluvial aquifer (Boswell and others, 1968). Within the study area, the alluvial and terrace deposits of Quaternary age are separated by Crowleys Ridge, an erosional remnant comprised of Tertiary to Quaternary age deposits trending north-south from the Missouri-Arkansas border to northeastern Phillips County. Crowleys Ridge is a prominent topographic feature on the otherwise low-relief surface of the Mississippi Alluvial Plain. It forms a physical barrier (in places) to groundwater flow in the alluvial aquifer between the western and eastern lowlands.



Disclaimer

Although this map was compiled from digital data that was successfully processed on a computer system using ESRI ArcGIS 10.x software at the Arkansas Geological Survey (AGS), no warranty, expressed or implied, is made by the AGS regarding the unity of the data on any other system, nor shall the act of distribution constitute any such warranty. The AGS does not guarantee this map or digital data to be free of errors or assume liability for interpretations from this map or digital data, or decisions based thereon.

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This map was derived from well data that was modeled using the Inverse distance weighting (IDW) method in ArcGIS® Spatial Analyst and modified for illustration purposes. Spatial interpolation is used to take known values and interpolate them into a surface, deriving new estimated surface values across a defined area. IDW models work on the premise that observations further away should have their contributions diminished according to how far away they are. This map is for screening purposes only and is not intended to be a substitute for a site specific evaluation. Copies of this map are available from the Arkansas Geological Survey, Little Rock, Arkansas.

References

Ackerman, D.J., 1996, Hydrology of the Mississippi River Valley alluvial aquifer, south-central United States - A preliminary assessment of the regional flow system: U.S. Geological Survey Professional Paper 1416-D, 56p.

Boswell, E.H., Cushing, E.M., and Hosman, R.L., 1968, Quaternary aquifers in the Mississippi Embayment *with a discussion of* Quality of the water by H.G. Jeffery: U.S. Geological Survey Professional Paper 448-E, 15p.

Gonthier, G.J., and Mahon, G.L., 1993, Thickness of the Mississippi River Valley confining unit, eastern Arkansas: U.S. Geological Survey Water-Resources Investigation Report 92-4121, 4 sheets.

Hwang, H., Chien, M.C., and Lin, Y.W., 1999, Investigation of Soil Conditions in Memphis, Tennessee, U.S. Geological Survey Award No. 1434-HQ-98-GR-00002.

Joseph, R.L., 1999, Status of water levels and selected water-quality conditions in the Mississippi River Valley alluvial aquifer in eastern Arkansas, 1998: U.S. Geological Survey Water-Resources Investigations Report 99-4035 54p.

Lund, W.R., Knudsen, T.R., Vice, G.S. and Shaw, L.M., 2008, Geologic Hazards and Adverse Construction Conditions: Liquefaction-Hazard Map for the St. George-Hurricane Metropolitan Area, Utah Geological Survey Special Study 127, plate 2.

Mahon, G.L., and Poynter, D.T., 1993, Development, calibration, and testing of ground-water flow models for the Mississippi River Valley alluvial aquifer in eastern Arkansas using one-square mile cells: U.S. Geological Survey Water-Resources Investigations Report 92-4106, 33p.

Schrader, T.P., 2006, Status of water levels and selected water-quality conditions in the Mississippi River Valley alluvial aquifer in eastern Arkansas, 2004: U.S. Geological Survey Water-Resources Investigations Report 06-5128, 54p.

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