U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Map 3426
Sheet 1 of 2

Introduction

The Mississippi River Valley alluvial aquifer (MRVA) caps a shallow system of aquifers and confining units in the Mississippi Alluvial Plain (MAP) that extends across 45,000 square miles of the midwestern and southern United States from Illinois to Louisiana (fig. 1). Irrigation water from the MRVA is required to sustain extensive crop production, which has resulted in groundwater-level declines since the late 1920s equal to nearly half of its thickness and in reduced baseflow of streams. Increased groundwater withdrawal for irrigation is expected to continue and threatens complete and irreversible aquifer dewatering (depletion) (Clark and others, 2013; Reba and others, 2017). The exact amount of dewatering in the MRVA is uncertain because its vertical extent is poorly defined and the effects of groundwater withdrawal on the aquifer are not well understood. To provide stakeholders and managers with information and tools that promote understanding of the hydrogeologic framework of the MAP extent (Painter and Westerman, 2018) and its role in water-resource management, the U.S. Geological Survey (USGS) Water Availability and Use Science Program (WAUSP) has funded a 5-year effort to assess groundwater availability and project future sustainability of water resources. Part of this study involves mapping the bottom altitude and thickness of the aquifer by using compilations of hydrogeologic data and applications of geostatistical analytics. Results of this mapping effort, presented here, are intended to enhance characterization of the shallow hydrogeologic framework and direct future airborne, ground-based, and waterborne geophysical surveys. Data used in support of the findings presented in this report are available as a USGS data release (Torak and Painter, 2019).

Data Compilation, Processing, and Filtering Prior to Estimation

Bottom altitudes of the MRVA were compiled from interpretations of subsurface lithologic and geophysical logs (log picks) at about 10,000 boreholes located throughout the MAP extent that were available from previous investigations (fig. 2). Log picks were corrected to the National Elevation Dataset (NED) 10-meter digital elevation model (DEM; https://nationalmap.gov/elevation.html). Log picks that required a DEM correction of less than 20 feet were used for the geostatistical estimation of the MRVA bottom altitude, after additional filtering removed duplicate log picks, yielding a bottom-altitude dataset of 9,392 data points.

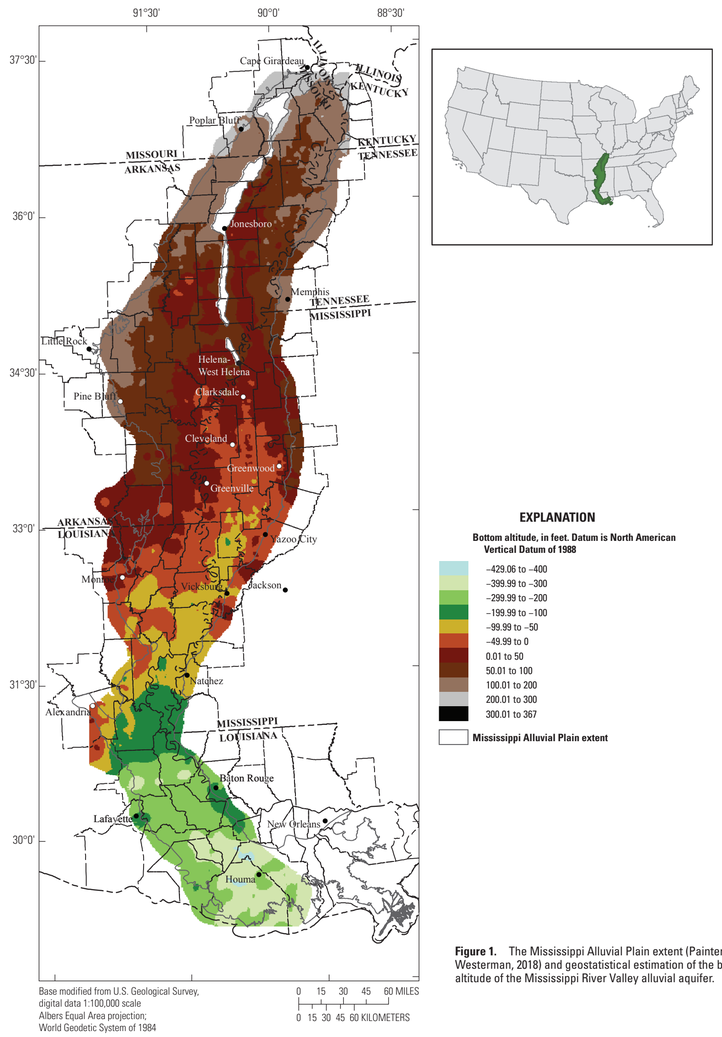

Figure 1. The Mississippi Alluvial Plain extent (Painter and Westerman, 2018) and geostatistical estimation of the bottom altitude of the Mississippi River Valley alluvial aquifer.

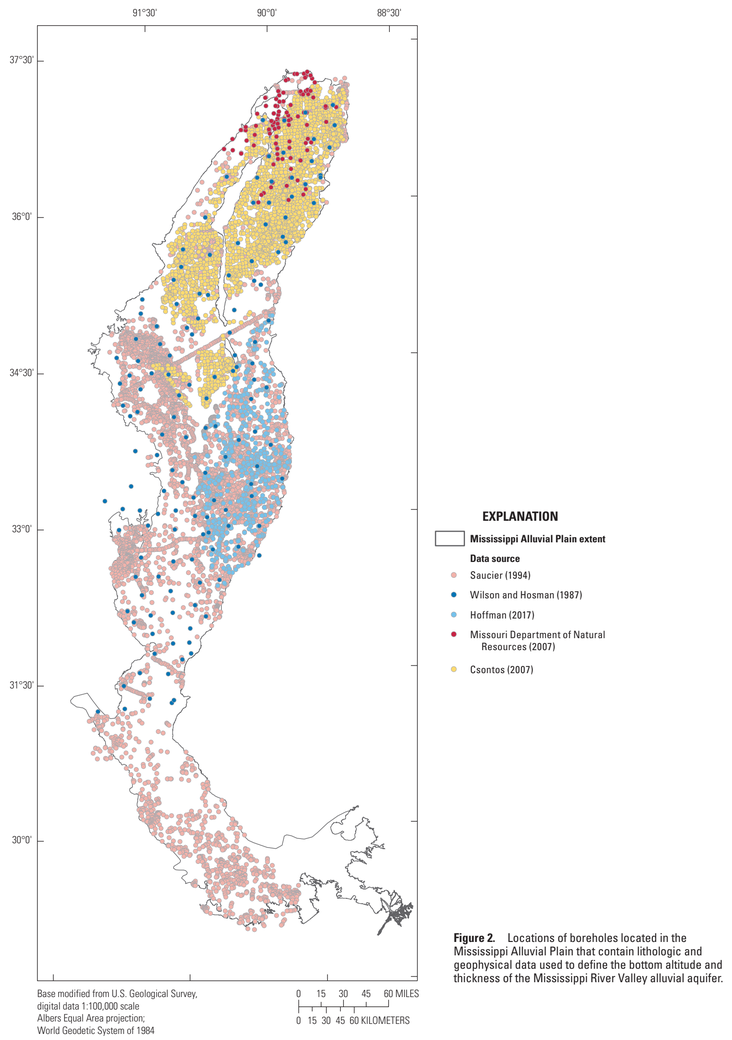

Figure 2. Locations of boreholes located in the Mississippi Alluvial Plain that contain lithologic and geophysical data used to define the bottom altitude and thickness of the Mississippi River Valley alluvial aquifer.

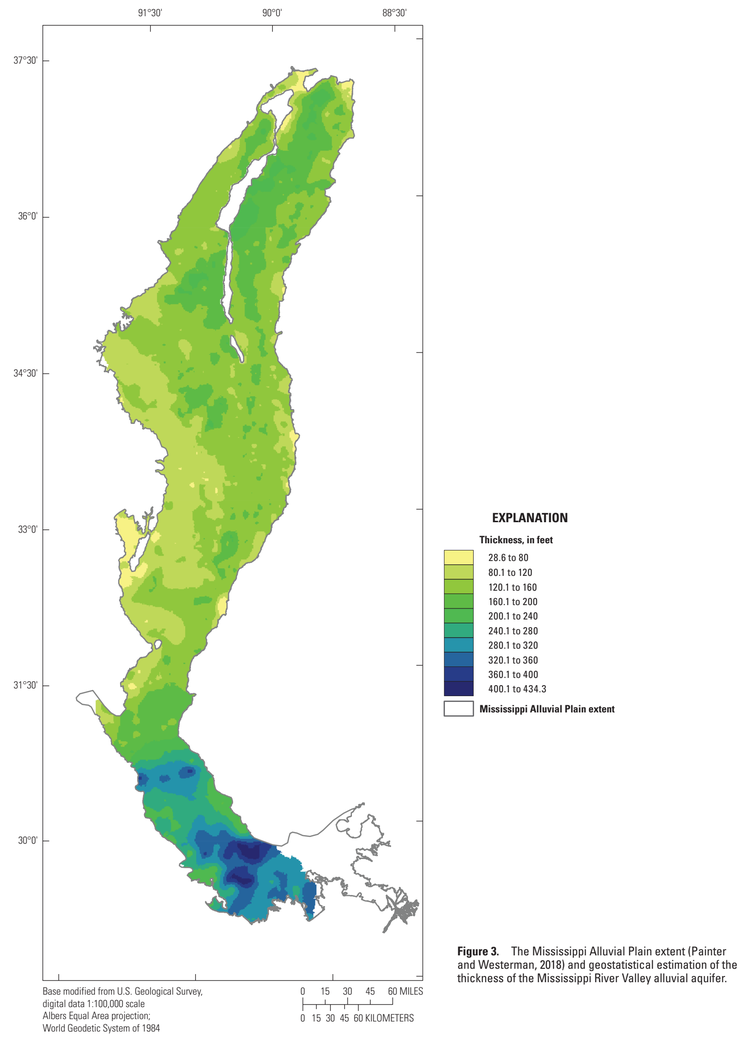

Figure 3. The Mississippi Alluvial Plain extent (Painter and Westerman, 2018) and geostatistical estimation of the thickness of the Mississippi River Valley alluvial aquifer.

Geostatistical Estimation of the Bottom Altitude and Thickness of the Mississippi River Valley Alluvial Aquifer

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