Contribution of Subtle Geomorphic Features of the Mississippi River Alluvial Plain to Flood Vulnerabilities—A Case Study

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ABSTRACT

The Mississippi River alluvial plain lies, in part, east of the Mississippi River between Memphis, Tennessee, and Vicksburg, Mississippi. This region can be characterized as a gently sloping, relatively flat surface. A flood base level was derived from trend surface models based on the extent of the 1% annual chance flood hazard area delineated on the Flood Insurance Rate Maps distributed by the Federal Emergency Management Agency. The flood base level is interpreted as the mean surface datum for the Mississippi River alluvial plain. A complete coverage of lidar (light detection and ranging) elevation data acquired in 2009 (with associated low-altitude digital orthophotography) was used to define topography referenced to the base level datum. Many subtle topographic features become apparent when the mean surface is subtracted from the actual elevation above sea level. Alluvial fans associated with rivers and streams flowing westward from the Tertiary highlands areas are found along some stretches of the eastern bluff line, but some rivers, notably the Coldwater River, lack evidence of an alluvial fan. Many irregular ridges representing natural levee deposits are associated with prehistoric meander belts of the Mississippi River. A few anomalous closed topographic lows near the bluff line are of uncertain origin and significance. These subtle geomorphic features are a significant factor guiding the extent, direction, and distribution of floodwaters across the surface of the alluvial plain and often determine the magnitude of flood vulnerability to the built environment.