Geophysical Characterization in support of levee flood protection area seepage evaluation

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Numerous privately operated levee systems throughout the United States offer flood protection to agriculture, housing, and commercial development. As development within levee flood protection areas increases, the risk to public health and safety and property damage associated with potential levee failure has also dramatically risen. This paper will focus on a case study of the evaluation of one such levee system along the Ohio River and lessons learned from the use of geophysical surveys to support the assessment of seepage potential within the levee flood protection area. With more than 440 acres of flood protection area and 9,240 feet of levee embankment and foundation soils to evaluate, the use of geophysical surveys supplemented previous widely-spaced boring information to characterize the thickness and quality of an upper clay blanket layer and the underlying pervious foundation aquifer down to bedrock. The geophysical survey techniques included the completion of both electromagnetic terrain conductivity and two-dimensional electrical resistivity imaging throughout the levee flood protection area and on the levee itself to characterize granular and permeable soil conditions over the study area. The results were calibrated against previous soil boring and geotechnical engineering testing data to help identify the location of more critical, potentially higher permeability zones, which led to better implementation of a water level monitoring network and a more accurate estimate of seepage during flooding conditions. This study provided information to better characterize seepage occurring throughout the levee flood protection area in support of evaluating the performance of existing regional drainage features and guiding future assessment of drainage modifications.