HYDRAULIC PROPERTIES OF THE SATURATED ZONE OF A RECLAIMED LIGNITE SURFACE MINE, EAST TEXAS

Author: Charles Dale Hewitt

Near-surface lignite resources in the Calvert Bluff Formation of the Wilcox Group often underlie shallow aquifers. Surface mining methods require that these shallow aquifers be dewatered prior to mining. During mining, overburden sands and muds are mixed randomly. The resulting material, or spoil, can be considered homogeneous and isotropic on a field scale but strongly heterogeneous on the scale of a few meters. Resaturation of the spoil can lead to the development of a shallow water table aquifer.

Two study areas at the Big Brown Mine in Freestone County, Texas, were found to have developed saturated zones ranging from 3 to 16 m in thickness for 4 and 9-year old spoil respectively. The thickness of the saturated zone in the 9-year-old spoil did not vary over the duration of this study which suggest that the water table may be at an equilibrium position. Multiple screened intervals in monitoring wells installed in the 9-year-old spoil permitted the detection of a downward vertical component of groundwater flow. The spoil, therefore, is acting as a recharge zone for the underlying unmined strata. Hydraulic conductivities measured in the saturated zone of the spoil ranged from 2.75×10^{-4} to 4.41×10^{-4} cm/s which are similar to those of unmined silty sand aquifers.

Resistivity surveys conducted in the both the 4 and 9-year-old study areas were unsuccessful in delineating the water table. They did, however, provide a qualitative assessment of the overall degree of resaturation of the areas. The 4-year-old site displayed generally higher resistivities and contained a poorly developed zone of low resistivity (high moisture content). The 9-year-old spoil contained a thick, laterally extensive low resistivity zone corresponding to its more extensive and uniform degree of saturation.

Recharge to the spoil from the percolation of precipitation does not alone account for the rapid development of saturated zones in the study areas. Reconstruction of pre-mining topography and, therefore, pre-mining groundwater follow directions and gradients, may induce water to flow through the spoil to regional discharge areas such as the Trinity River. This lateral inflow may account for the rapid resaturation of spoil.

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Department of Geology
The University of Texas at Austin
Austin, Texas 78713