Modeling slug tests in unconfined aquifers with both oscillatory and overdamped responses, and with low-K and high-K skin effects

Details

Meeting	2009 Fall Meeting
Section	Hydrology
Session	Innovative Field and Theoretical Methods for Hydrogeophysical Characterization of Aquifers I Posters
Identifier	H43C-1055
Authors	Thoma, M J, Geosciences, Boise State University, Boise, ID, United States Malama, B, Geological Engineering, Montana Tech, Butte, MT, United States Barrash, W, Geosciences, Boise State University, Boise, ID, United States Bohling, G, Kansas Geological Survey, Lawrence, KS, United States Butler, J J, Kansas Geological Survey, Lawrence, KS, United States
Index Terms	Groundwater hydrology [1829] Modeling [1847]

Abstract

We extend the models for slug tests developed by Hyder et al. (1994) and Butler and Zhan (2004) to obtain a single general model for slug tests in unconfined aquifers in partially penetrating wells with a near-well disturbed zone (skin). The full range of responses, oscillatory to overdamped, is considered since both types of responses are common in wells in unconsolidated coarse fluvial aquifers, and others. The general semi-analytical solution allows for skin and formation storage as well as anisotropy in skin and formation hydraulic conductivity (K). The water table is treated as a fixed head boundary so the solution is applicable for wells screened below the water table. The model is validated by comparison with other models and by matching field data from unconfined fluvial aquifers at sites in Nebraska (MSEA) and Idaho (BHRS). We examine the effects of varying skin K and skin thickness to simulate the impact of a near-well disturbed zone that is lower (damage) or higher (filter pack) K than the formation. Results indicate that, for a given set of measured behavior at an example test zone, minor progressive decreases in estimated formation K occur with increases in assumed skin K, and moderate increases in estimated formation K occur with decreases in assumed skin K. Major increases (orders of magnitude) in estimated formation K occur with increased thickness of low-K skin. The importance of incorporating a finite-thickness representation of the skin, rather than the conventional infinitely thin representation, is also addressed.

Cite as: Author(s) (2009), Title, *Eos Trans. AGU, 90*(52), Fall Meet. Suppl., Abstract H43C-1055