The Importance of Considering Aquifer Susceptibility and Uncertainty in Developing Water Management and Policy Guidelines

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Abstract

The responsibility for providing safe drinking water to residents of the United States is shared by many organizations at the Federal, State, and local levels. A substantial component of this effort is focused on the quality of groundwater, which yields approximately one-third of all drinking water to communities through public supply wells. Observed groundwater quality is influenced by several factors of both natural and human origin. Many of the natural factors that affect aquifer susceptibility pertain to an aquifer's physical characteristics, such as the depth to water, permeability of the geologic media, and amount of water in storage. Other factors of natural origin may be related to the hydrologic conditions, such as the net recharge to an aquifer from precipitation and snow melt, and the linkage between surface-water bodies and the underlying aquifer. These natural components control the time required for chemical constituents to reach the water table, the residence time that they remain in the aquifer, and the resulting concentrations. Additional influences may be related to human activities, such as land-use zoning, population density, and urban infrastructure. Water managers must carefully consider all of the factors that influence aquifer susceptibility, as well as the implications of changing water quality on human health. An effective means of estimating both the current and future changes to aquifer susceptibility is through the use of hydrologic models. Predictions of aquifer susceptibility may vary temporally and spatially for different regions in an aquifer to the extent that a single generalization of susceptibility is unwarranted. It is equally important to consider that estimates of susceptibility are uncertain. Thus, to properly manage water quality in the face of changing natural and human-related conditions, managers must adapt management practices to estimated levels of susceptibility while considering the uncertainty in these predictions. Case studies of principal aquifers throughout the United States are compared and contrasted as a means to provide a broad overview of these points.

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