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Probability Distributions of Hydraulic Conductivity for the Hydrogeologic Units of the Death Valley Regional Ground-Water Flow System, Nevada and California

Water-Resources Investigations Report 02–4212

Prepared in cooperation with the
U.S. DEPARTMENT OF ENERGY
NATIONAL NUCLEAR SECURITY ADMINISTRATION
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transmissive properties (Laczniak and others, 1996). Relations between secondary processes such as fracturing and alteration that affect measured hydraulic conductivity also are examined.

Location

The DVRFS is in southeastern California and Nevada (fig. 1). The DVRFS encompasses about 45,000 km^2 within the Great Basin section of the Basin and Range physiographic province. The area for this study is considerably larger than the DVRFS in order to include areas that contain sites important to defining hydraulic-property estimates for units contained within the DVRFS. The topography typically consists of northerly and northwesterly trending mountain ranges surrounded by broad sediment-filled basins. The Spring Mountains, the highest topographic feature in the area, are about 3,600 m above mean sea level. Other prominent topographic features within the region include the Sheep Range, Pahute Mesa, the Funeral Mountains, and the Panamint Range. Basins generally decrease in altitude from north to south. The lowest altitude at 86 m below sea level in the study area is at Badwater in Death Valley National Park.

Purpose and Scope

The purpose of this report is to present statistical-probability distributions that can be used by hydrologists to constrain hydraulic-conductivity estimates in their studies. These distributions could be useful for hydrologic studies involving numerical simulations of ground water, recharge, rainfall runoff, evapotranspiration, basin analyses, and water budgets. Other uses of the distributions could include contaminant-transport modeling, water-supply issues, and resource protection. The probability distributions also could be used to apply the principle of parsimony (Hill, 1998, p. 35) to simulation efforts. Specifically, the work presented in this report is for use in a transient numerical ground-water flow model of the DVRFS, but because of the diversity of rock types within the study area, these distributions may be useful to flow modelers in other regions and other types of studies for which hydraulic-conductivity information is required.

Limitations

The analyses in this report have several limitations:

1. The hydraulic-conductivity measurements presented in this report are based mostly on the results of field-scale tests and represent a very small part of an overall regional HGU. Lithologic factors that can affect hydraulic conductivity, such as facies changes in sedimentary rock, welding and alteration in volcanic rocks, and degree of fracturing can cause hydraulic properties to vary greatly, even over relatively short distances.

2. Significant spatial bias may exist in the hydraulic-conductivity measurements. Wells tested for aquifer properties were installed to meet the objectives of their parent studies or to provide an adequate water supply, not necessarily to provide adequate spatial coverage for a regional study.

3. Transmissivity measurements from aquifer tests were divided by a thickness value to obtain hydraulic conductivity. The length of the open interval of the well or borehole was used to calculate hydraulic conductivity from this transmissivity. This is a simplistic assumption. If the thickness of the rock or sediment contributing flow is less than the open interval, the hydraulic conductivity will be underestimated, and if the thickness is greater than the open interval, the hydraulic conductivity will be overestimated.

4. Hydraulic-conductivity estimates in heterogeneous aquifers can be biased above the average hydraulic conductivity because many wells are screened preferentially across more productive intervals.

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