

GROUNDWATER RESOURCE EVALUATION

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are given in Table 2.2. The porosity of a saturated rock is equal to the sum of specific yield and the specific retention. Meinzer (1959) outlined several methods for determining specific yield.

For most rocks, gravity drainage of interstices is not instantaneous and the water-yielding capacity increases at a diminishing rate as the time of drainage increases, gradually approaching the specific yield. *Gravity yield* has been defined as the percentage of the total volume of rock occupied by groundwater that will drain under the action of gravity during a given period of drainage (see Rasmussen and Andreasen, 1959).

2.4 Coefficients of Storage, Permeability, and Transmissibility

The *coefficient of storage* S of an aquifer has been defined as the volume of water the aquifer releases from or takes into storage per unit surface area of the aquifer per unit decline or rise of head. In Fig. 2.4, the volume of water released from storage in the aquifer prism divided by the product of the prism's cross-sectional area and the change in head results in a dimensionless number which is the coefficient of storage. Under water-table conditions, the coefficient of storage is equal to the specific yield, provided gravity drainage is complete. The coefficient of storage of water-table aquifers ranges from about 0.02 to 0.30. Although rigid limits cannot be established, the storage coefficients of artesian aquifers may range from about 0.00001 to 0.001.

Permeability is a measure of the ease of movement of groundwater through aquifers and aquitards. The *field coefficient of permeability* of an aquifer, P , has been defined as the rate of flow of water, in gallons per day, through a cross-sectional area of 1 square foot of the aquifer (see opening A, Fig. 2.5) under a hydraulic gradient of 1 foot per foot at the prevailing temperature of the water. A related term, the *coefficient of transmissibility* T , indicates the capacity of an aquifer to transmit water through its entire thickness and is equal to the coefficient of permeability multiplied by the saturated thickness of the aquifer, m , in feet. The coefficient of transmissibility is defined as the rate of flow of water, in gallons per day (gpd), through a vertical strip of the aquifer (see opening B, Fig. 2.5) 1 foot wide and extending the full saturated thickness under a hydraulic gradient of 1 foot per foot at the prevailing temperature of the water. The rate of vertical leakage of groundwater through an aquitard is dependent upon the permeability of the aquitard. The *aquitard field coefficient of permeability* P' is defined as the rate of vertical flow of water, in gpd, through a horizontal cross-sectional area of 1 square foot of the aquitard (see opening C, Fig. 2.5) under a vertical hydraulic gradient of 1 foot per foot at the prevailing temperature of the water. Some authors use the terms *hydraulic conductivity* ($K = k\gamma/\mu$), *permeability* (k), *transmissivity* ($T = KD$), and *storativity* (ξ).

Laboratory coefficients of permeability P_L and P'_L may be computed by adjusting the field coefficients to equivalent values for the standard temperature of 60°F. The