Specific Yield and Specific Retention

Porosity is important in ground-water hydrology because it tells us the maximum amount of water that a rock can contain when it is saturated. However, it is equally important to know that only a part of this water is available to supply a well or a spring. Figure 7 gives some graphical examples of porosity.

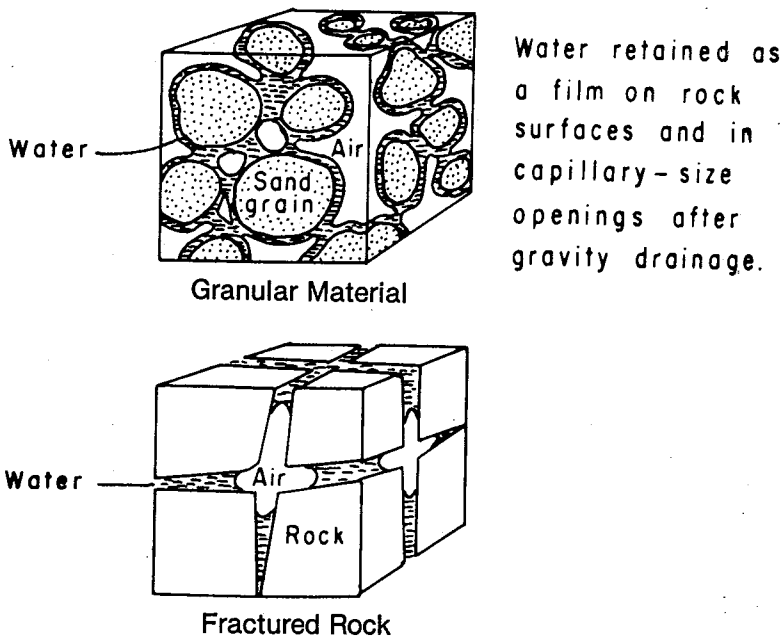


Figure 7. Graphical Example of Porosity

Hydrologists divide water in storage in the ground into the part that will drain under the influence of gravity (called *specific yield*) and the part that is retained as a film on rock surfaces and in very small openings (called *specific retention*). The physical forces that control specific retention are the same forces involved in the thickness and moisture content of the capillary fringe.

Specific yield tells how much water is available for man's use, and specific retention tells how much water remains in the rock after it is drained by gravity. As

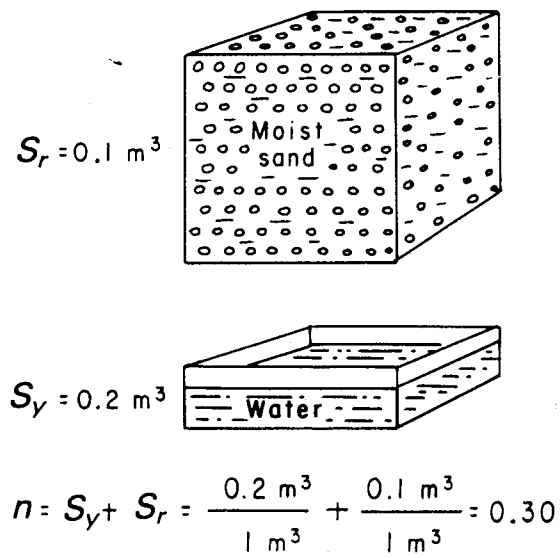


Figure 8. Porosity is the Sum of Specific Yield and Specific Retention

Figure 8 shows, porosity is the sum of specific yield and specific retention. Thus,

$$n = S_y + S_r \qquad (2)$$

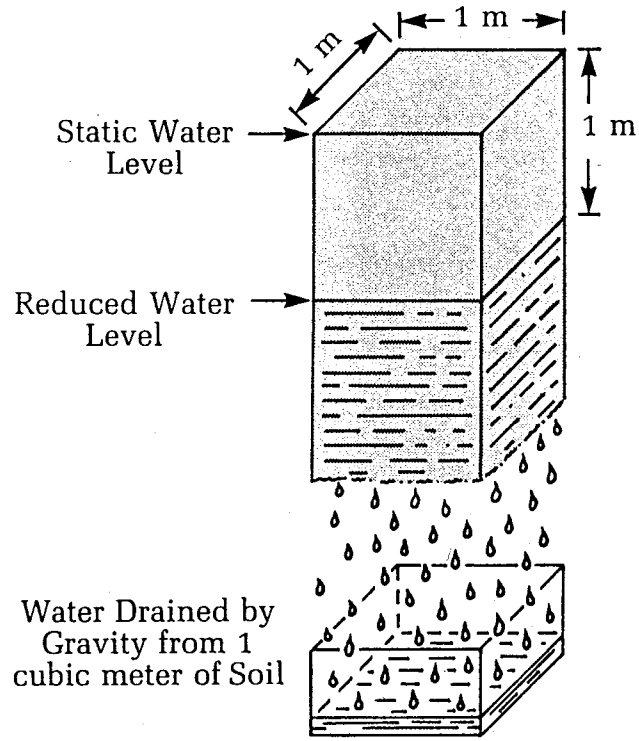
$$S_y = \frac{V_d}{V_t} \qquad S_r = \frac{V_r}{V_t} \qquad (3), (4)$$

where n is porosity, S_y is specific yield, S_r is specific retention, V_d is the volume of water that drains from a total volume of V_t, V_r is the volume of water retained in a total volume of V_t, and V_t is total volume of a soil or rock sample. Table 3 lists values of porosity, specific yield, and specific retention for selected materials.

Table 3. Selected Values of Porosity, Specific Yield, and Specific Retention
[Values in percent by volume]

Material	Porosity	Specific Yield	Specific Retention
Soil	55	40	15
Clay	50	2	48
Sand	25	22	3
Gravel	20	19	1
Limestone	20	18	2
Sandstone (semiconsolidated)	11	6	5
Granite	.1	.09	.01
Basalt (young)	11	8	3

SOURCE: EPA/625/4-85/016



Specific yield

(*Source:* Johnson Division, UOP, *Ground Water and Wells*. St. Paul, Minn.: Johnson Division, UOP, 1975. Reprinted by permission.)

$$\text{Specific Yield} = \frac{\text{Volume Water}}{\text{Volume Soil}}(100\%)$$