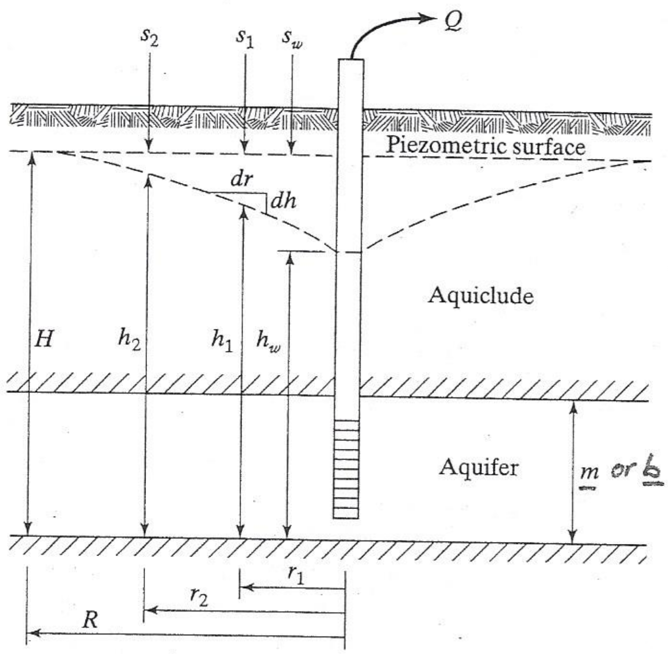
Steady-State Groundwater Flow:

Single Well Pumping in Confined Aquifer – Thiem's Equation



$$Q = \frac{2\pi T(h_2 - h_1)}{\ln(r_2/r_1)}$$

$$s_w = H - h_w = \frac{Q}{2\pi T}\ln(R/r_w)$$

Example 9.7

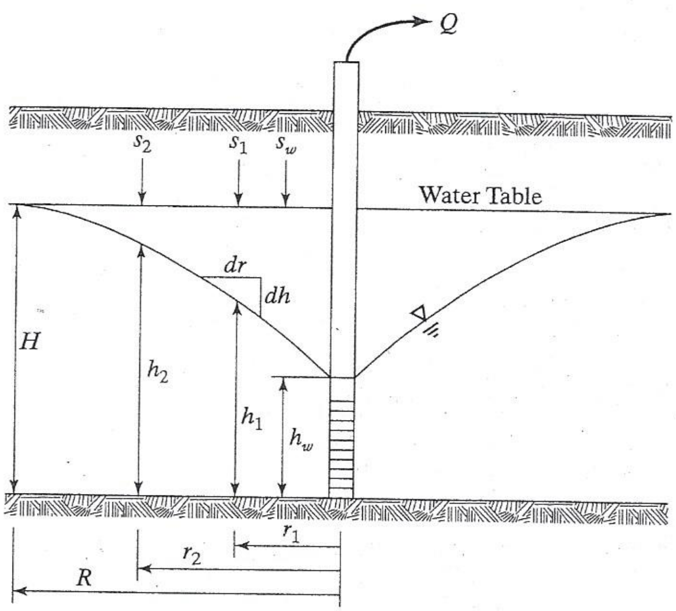
Steady-State Drawdown in a Confined Aquifer

A 24-inch diameter well is installed in a confined aquifer using a 6-inch gravel pack (r_w = 1.5 ft). The aquifer has a transmissivity of 40,000 gpd/ft, and the well is pumped at a rate of 2,000 gpm. If the radius of influence (R) of the well is 100,000 ft, determine the steady-state drawdown at the well.

$$s_w = \frac{Q}{2\pi T}\ln\left(\frac{R}{r_w}\right) = \frac{2{,}000 \times 1{,}440}{2\pi \times 40{,}000}\ln\left(\frac{100{,}000}{1.5}\right) = 127 \text{ ft}$$

Steady-State Groundwater Flow:

Single Well Pumping in Unconfined Aquifer – Dupuit's Equation



$$Q = \frac{\pi K(h_2^2 - h_1^2)}{\ln(r_2/r_1)}$$

Example 9.8

Steady-State Drawdown in an Unconfined Aquifer

A 12-inch diameter well is installed in an unconfined aquifer with a saturated thickness of 100 ft. The aquifer has a transmissivity of 40,000 gpd/ft, and the well is pumped at a rate of 600 gpm. If the radius of influence (R) of the well is 4,000 ft, determine the steady-state drawdown at the well.

$$h_2^2 - h_1^2 = \frac{Q}{\pi K}\ln\left(\frac{r_2}{r_1}\right)$$

$$100^2 - h_w^2 = \frac{600 \times 1{,}440}{3.1416 \times 400}\ln\left(\frac{4{,}000}{0.5}\right)$$

$$h_w^2 = 10{,}000 - 6{,}179$$

$$h_2 = 61.8 \text{ ft}$$

$$s_w = h_2 - h_w = 38.2 \text{ ft}$$

For comparison, the computed drawdown using the confined aquifer equation is

$$s_w = \frac{Q}{2\pi T}\ln\left(\frac{R}{r_w}\right) = \frac{600 \times 1{,}440}{2\pi \times 40{,}000}\ln\left(\frac{4{,}000}{0.5}\right) = 31.0 \text{ ft}$$