

3.93

3.93 Water flows under the sluice gate shown in Fig. P3.93. Determine the flowrate if the gate is 4.6 ft wide.

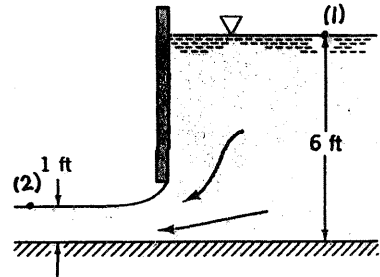


FIGURE P3.93

$$\frac{p_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{p_2}{\gamma} + \frac{V_2^2}{2g} + z_2 \quad \text{where } p_1 = 0, p_2 = 0, z_1 = 6 \text{ ft} \quad (1)$$

and $z_2 = 1 \text{ ft}$

Also, $A_1 V_1 = A_2 V_2$

or

$$V_2 = \frac{A_1}{A_2} V_1 = \frac{6 \text{ ft}}{1 \text{ ft}} V_1 = 6 V_1$$

Thus, Eq. (1) becomes

$$[6^2 - 1] V_1^2 = 2 (32.2 \frac{\text{ft}}{\text{s}^2}) (6 - 1) \text{ ft} \quad \text{or } V_1 = 3.03 \frac{\text{ft}}{\text{s}}$$

Hence,

$$Q = A_1 V_1 = (6 \text{ ft})(4.6 \text{ ft})(3.03 \frac{\text{ft}}{\text{s}}) = \underline{\underline{83.6 \frac{\text{ft}^3}{\text{s}}}}$$