

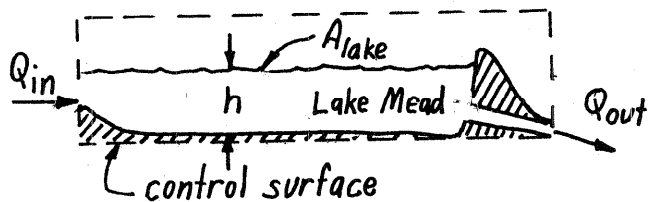
## 5.23

5.23 The Hoover Dam backs up the Colorado River and creates Lake Mead, which is approximately 115 miles long and has a surface area of approximately 225 square miles. (See Video V2.3.) If during flood conditions the Colorado River flows into the lake at a rate of 45,000 cfs and the outflow from the dam is 8,000 cfs, how many feet per 24-hour day will the lake level rise?

For the control volume shown:

$$\dot{m}_{in} - \dot{m}_{out} = \frac{d}{dt} \int_{cv} \rho dV$$

or since  $\dot{m} = \rho Q$ ,



$$Q_{in} - Q_{out} = \frac{d}{dt} (A_{lake} h) = A_{lake} \frac{dh}{dt}$$

$$\begin{aligned} \text{Thus, } \frac{dh}{dt} &= \frac{Q_{out} - Q_{in}}{A_{lake}} = \frac{(45,000 - 8,000) \frac{\text{ft}^3}{\text{s}}}{225 \text{ mi}^2 \left(5280 \frac{\text{ft}}{\text{mi}}\right)^2} = 5.90 \times 10^{-6} \frac{\text{in.}}{\text{s}} \\ &= 5.90 \times 10^{-6} \frac{\text{in.}}{\text{s}} \left(3,600 \frac{\text{s}}{\text{hr}}\right) \left(24 \frac{\text{hr}}{\text{day}}\right) = \underline{\underline{0.510 \frac{\text{ft}}{\text{day}}}} \end{aligned}$$