

HEAD LOSS I

EXAMPLE

EXAMPLE : POINT OF THE MOUNTAIN : DARCY-WEISBACH

GIVEN: $Q = 77 \text{ MGD}$ $L = 9.58 \text{ MILES}$
 $D = 60 \text{ INCH}$ WELDED, COATED STEEL

REQUIRED: FIND h_L USING DARCY-WEISBACH

SOLUTION:

$$h_L = f \frac{L}{D} \frac{V^2}{2g}$$

$$V = \frac{Q}{A} = \frac{\left(\frac{77 \times 10^6 \text{ GAL}}{\text{DAY}} \right) \left(\frac{\text{ft}^3}{7.48 \text{ GAL}} \right) \left(\frac{\text{DAY}}{24 \text{ hr}} \right) \left(\frac{\text{hr}}{3600 \text{ s}} \right)}{\frac{\pi}{4} \left(\frac{60}{12} \text{ ft} \right)^2} = 6.07 \text{ ft/s}$$

$$D = \frac{60}{12} \text{ ft} = 5 \text{ ft}$$

$$L = 9.58 \text{ MILES} \left(\frac{5280 \text{ FT}}{\text{MILE}} \right) = 50582.4 \text{ FT}$$

TO OBTAIN f , CALC N_R , D/ϵ AND USE MOODY DIAGRAM

$$N_R = \frac{VD}{\nu} = \frac{(6.07 \text{ ft/s})(5 \text{ ft})}{1.21 \times 10^{-5} \text{ ft}^2/\text{s}} = 2.51 \times 10^6$$

← WATER @ 60°F
TABLE A.2

$$\frac{D}{\epsilon} = \frac{5 \text{ ft}}{1.5 \times 10^{-4} \text{ ft}} = 3.33 \times 10^4$$

FROM MOODY
DIAGRAM $f \approx 0.011$

$$h_L = 0.011 \left(\frac{50582.4 \text{ FT}}{5 \text{ FT}} \right) \left(\frac{(6.07 \text{ ft/s})^2}{2(32.2 \text{ ft/s}^2)} \right) = 63.6 \text{ FT}$$