

If  $Q$  &  $P_2$  are given,

again trial and error procedure is needed

1\* Guess  $D$

2\* evaluate  $u_m = \frac{Q}{\frac{\pi}{4} D^2}$

3\* evaluate  $Re$

4\* evaluate  $\frac{E}{D}$

5\* find  $f_f$  from shacham equation

6\* Find  $D$  from  $u_m = \sqrt{\frac{D}{2f_f \rho L} [P_2 - \rho g \Delta Z]}$

$$D^{New} = \frac{2f_f \rho u_m^2 L}{P_2 - \rho g \Delta Z}$$

7\* evaluate  $Diff \left| \frac{D_{New} - D_{Old}}{D_{New}} \right| \times 100$

8\* if  $diff < 1$  Stop go to 9, else go to 2

9\*  $D = D^{New}$