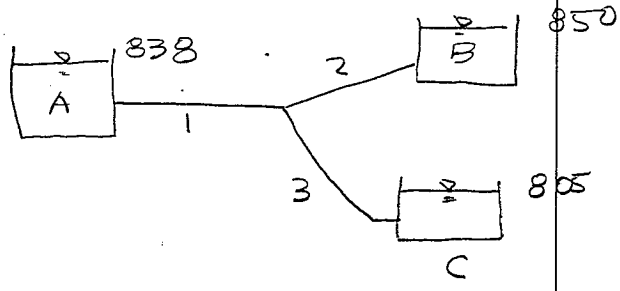
PIPE	D, ft	L, ft	f
1	1	800	0.03
2	1.25	700	0.03
3	1.5	600	0.03



Neglect h_m

FIND: Q_1, Q_2, Q_3

SOLUTION:

1. ASSUME $HGL_j = 836$

PIPE 1: $$z_A + \frac{P_A}{\gamma} + \frac{V_A^2}{2g} = \underbrace{z_j + \frac{P_j}{\gamma}}_{HGL_j} + \frac{V_1^2}{2g} + f_1 \frac{L_1}{D_1} \frac{V_1^2}{2g}$$

$$z_A - HGL_j = \frac{V_1^2}{2g}\left(1 + f_1 \frac{L_1}{D_1}\right)$$

$$\text{or } V_1 = \left[\frac{2g(z_A - HGL_j)}{1 + f_1 \frac{L_1}{D_1}}\right]^{1/2}$$

$$= \left[\frac{64.4(838 - HGL_j)}{1 + \frac{(0.03)(800)}{1}}\right]^{1/2}$$

$$\boxed{V_1 = 1.61\sqrt{838 - HGL_j} \quad \text{PIPE 1 EQN}}$$

$$= 1.61\sqrt{838 - 836}$$

$$= 2.27 \text{ ft/s}$$

$Q_1 = V_1 A_1$ with $A_1 = \pi (1\text{ft})^2/4 = 0.785 \text{ ft}^2$

$$= (1.61\sqrt{838 - HGL_j})(0.785 \text{ ft}^2) = 1.26\sqrt{838 - HGL_j} \quad Q_1$$

$Q_1 = 1.79$ cfs

PIPE 2: $$V_2 = \sqrt{\frac{64.4(850 - HGL_j)}{1 + \frac{(0.03)(700)}{1.25}}}$$

$$\boxed{V_2 = 1.90\sqrt{850 - HGL_j} \quad \text{PIPE 2 EQN}}$$

$$= 7.12 \text{ ft/s}$$

AND $Q_2 = V_2 A_2$ where $A_2 = \frac{\pi (1.25)^2}{4} = 1.23 ft^2$

$= (1.90\sqrt{850 - HGL_j})(1.23 ft^2)$

$= 2.33\sqrt{850 - HGL_j}$ ← Q_2

$= 8.72$ cfs

PIPE 3: $Z_j + \frac{P_j}{\gamma} + \frac{V_3^2}{2g} = Z_c + \frac{P_c}{\gamma} + \frac{V_3^2}{2g} + f_3 \frac{L_3}{D_3} \frac{V_3^2}{2g}$

or $HGL_j - Z_c = \frac{V_3^2}{2g}\left(f_3 \frac{L_3}{D_3} - 1\right)$

or $V_3 = \sqrt{\frac{(HGL_j - 805)2g}{\left(f_3 \frac{L_3}{D_3} - 1\right)}} = \sqrt{\frac{(HGL_j - 805)(64.4)}{\left(0.03\frac{(600)}{1.5} - 1\right)}}$

$V_3 = 2.42\sqrt{HGL_j - 805}$ ← PIPE 3 EQN

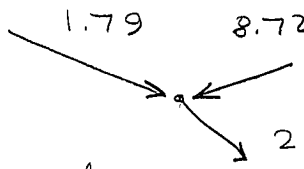
$= 13.47$ ft/s

AND $Q_3 = V_3 A_3$ where $A_3 = \frac{\pi (1.5 ft)^2}{4} = 1.77 ft^2$

$Q_3 = (2.42\sqrt{HGL_j - 805})(1.77 ft^2)$

$Q_3 = 4.28\sqrt{HGL_j - 805}$ ← Q_3

$= 23.8$ cfs



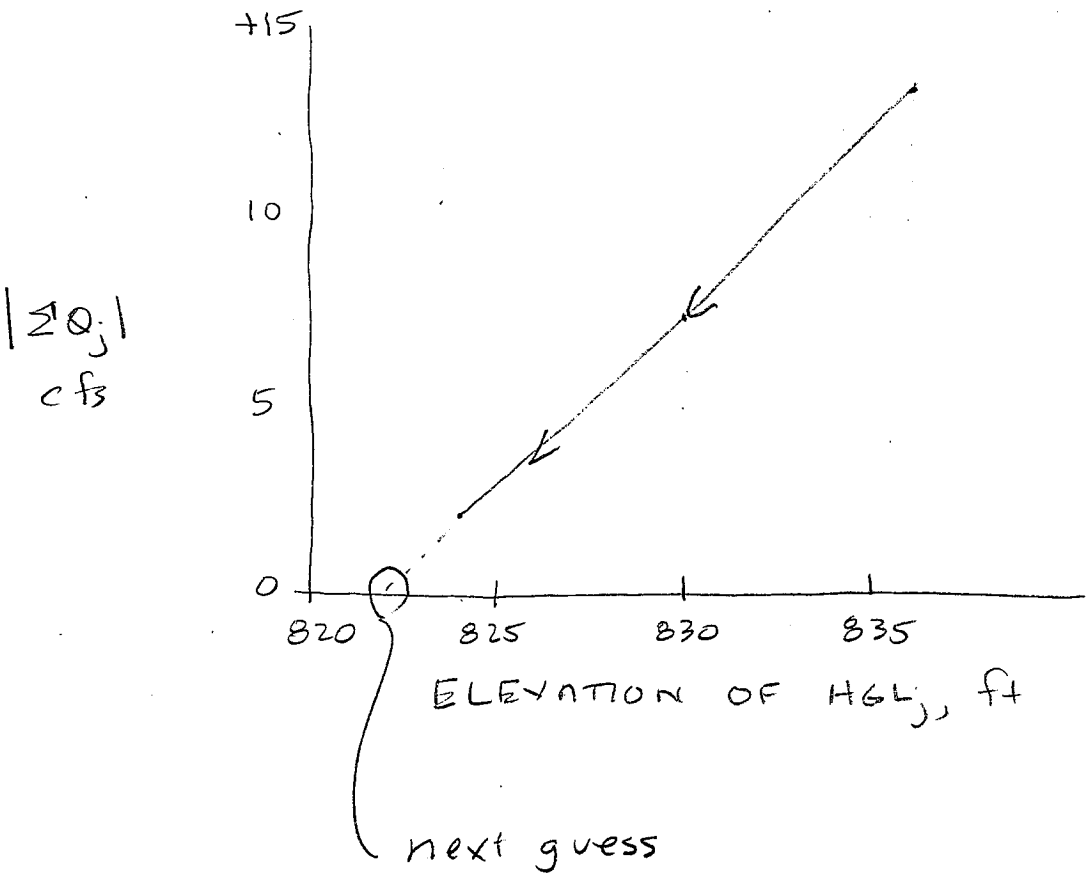
$\Sigma Q_j = 0$?

$(1.79 cfs + 8.72 cfs) = 10.51 cfs$ X

$10.51 - 23.8 = -13.3$

NEED TO ADJUST HGL_j DOWN!

TRIAL	HGL_j	V_1	Q_1	V_2	Q_2	V_3	Q_3	ΣQ_j
2	830	4.55	3.56	8.50	10.42	12.1	21.4	-7.42
3	824	6.0	4.71	9.7	11.9	10.5	18.6	-2.0
4	822	6.42	5.04	10.1	12.35	10.0	17.62	-0.24 close enough



Example of a 3-reservoir problem

Given:	Pipe	Diameter, ft	Length, ft	f
	1	1	800	0.03
	2	1.25	700	0.03
	3	1.5	600	0.03

Find: Q through each pipe

Solution: Step 1. Assume an elevation of the HGL at the junction. This will set the flow direction in each pipe

Step 2. Set up equations for velocity and discharge in each pipe

Step 3. Solve for Q at the junction and either do another trial or use

For this problem, the equations for Step 2 come from your handout.

		Pipe 1		Pipe 2		Pipe 3		
Trial	HGLj, ft	V, ft/s	Q, ft^3/s	V, ft/s	Q, ft^3/s	V, ft/s	Q, ft^3/s	Q at J
1	836	2.27	1.78	7.12	8.73	13.47	23.79	-13.28

To find solution, replace your initial guess of HGLj with a different number, or use Goal Seek