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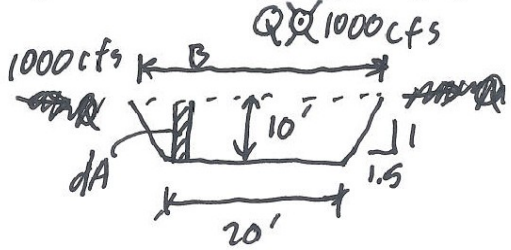
Assignment No. 1.1 Due Date : Next lecture.

1. Classify the flow regime in the following trapezoidal channel (use typical properties):

Q = 1000 cfs
b = 20 ft
z = 1.5
y = 10 ft
Kinematic viscosity = 10^{-5} ft ^{2}/sec



Area A = 350 ft^2 $A = y(b + zy) = 10'(20' + 1.5(10')) = 350 ft^2$

surface width B = 50 ft $B = b + (2zy) = 20' + (2(1.5)(10')) = 50 ft$

wetted Perimeter P_w = 56.1 ft $P_w = b + (2y\sqrt{1+z^2}) = 20' + (2(10')\sqrt{1+1.5^2}) = 56.1 ft$

Hydraulic radius R = 6.24 ft $R = \frac{A}{P_w} = \frac{350 ft^2}{56.1 ft} = 6.24 ft$

mean depth D = 7 ft $D = \frac{A}{B} = \frac{350 ft^2}{50 ft} = 7 ft$

velocity V = 2.86 ft/s $V = \frac{Q}{A} = \frac{1000 ft^3/s}{350 ft^2} = 2.86 ft/s$

(N_F) Froude Number = 0.1905 Subcritical $N_F = \frac{V}{\sqrt{gD}} = \frac{2.86 ft/s}{\sqrt{32.2 ft/s^2 (7 ft)}} = 0.1905$

(N_R) Reynolds Number = 1,784,640 Turbulent $N_R = \frac{V(R)}{\nu} = \frac{2.86 ft/s (6.24 ft)}{10^{-5} ft^2/s} = 1784640$

2. Estimate the velocity head and momentum flow (M) for the channel in problem 1.
Assume that the kinetic energy and momentum correction factors are: α = Kinetic energy correction factor = 1.05; β = Momentum correction factor = 1.02.

velocity head $\alpha V^2/2g$ = 0.1334 ft $1.05 (2.86^2) \frac{ft^2}{s^2} / 2(32.2 ft/s^2) = 0.1334 ft$

momentum flow M' = 5665 $\frac{slug \cdot ft}{s^2}$ lbs $= \beta \rho V^2 A = 1.02 \left(1.94 \frac{slug}{ft^3}\right) \left(2.86 \frac{ft}{s}\right)^2 (350 ft^2)$

$= 5665 \frac{slug \cdot ft}{s^2}$