PROBLEM 2.21

Design a trapezoidal channel to irrigate 80000 feddan at a water duty of $60 m^3/f/day$. Assume the bed slope = 10 cm/km, n = 0.025 and V_{max} =0.85 m/s.

SOLUTION

V_{max} =0.85 m/s.

$Q = 80000*60/(24\times60\times60)=55.555\ m^3/s$

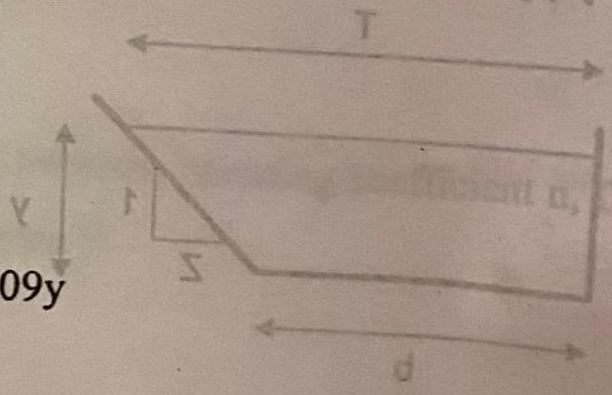
$A = 55.555/0.85 = 65.36\ m^2$

Since the side slopes is not given, then, $z=\frac{1}{\sqrt{3}}=0.577$

$65.36 = (b+zy)y = (b+0.557y)y$

Also, $R=\frac{y}{2}$

$$\frac{(b+0.557y)y}{b+2y\sqrt{\frac{1}{3}+1}}=\frac{y}{2}$$



$\therefore 2b + 1.114\ y = b + 2.309y$

$\therefore b = 1.20\ y$

$\therefore A = y\ (b + 0.577\ y) = y\ (1.2\ y + 0.577\ y) = 1.78\ y^2$

Applying Manning's equation:

$$55.555=\frac{1}{0.025}(1.78y^2)(\frac{y}{2})^{2/3}(\frac{10}{10^5})^{1/2}$$

From which:

$y^{8/3} = 123.85$

$\therefore\ y = 6.1m\ \ \&\ \ \ b = 7.31\ m.$

PROBLEM 2.22

A canal having one side vertical and the other side is sloping 3:2, carries a discharge of 20 m^3/sec. with a velocity of 0.50 m/sec. Determine the canal dimensions and its bed slope such that the section is best hydraulic section ($\frac{1}{n} = 40$).

SOLUTION:

$A = Q/V = 20/0.50 = 40.0\ m^2$.

For: $Q \rightarrow Q_{max.}$, then $P \rightarrow P_{min}$.

$$\frac{dP}{dy} = 0$$

$$P = b + y + y\sqrt{1.5^2 + 1} = b + 2.8y \qquad \text{(i)}$$

but, $A = 40 = by + \frac{1.5}{2}y^2$,

From which: $b = \frac{40}{y} - 0.75y$ (ii)

Substituting (ii) into (i):

$$\therefore P = \frac{40}{y} - 0.75y + 2.8y$$

$$\frac{dP}{dy} = -\frac{40}{y^2} + 2.05 = 0$$

$\therefore y = 4.42$ ms.

From (ii): $b = 5.73$ ms.

To get the slope,

$A = 40\ m^2$.

$P = 18.11$ m,

$\therefore R = A/P = 2.21$ ms.