If,

$$E_1 = E_2$$

$$y + H + \frac{{v_1}^2}{2g} = y + y_c + \frac{{v_c}^2}{2g}$$

$$H + \frac{{v_1}^2}{2g} = y_c + \frac{{v_c}^2}{2g}$$

If,

$$\frac{{v_1}^2}{2g} \approx 0$$

$$H = y_c + \frac{{v_c}^2}{2g}$$

At critical state, for a rectangular weir :

$$\frac{{v_c}^2}{2g} = \frac{1}{2} y_c$$

So,

$$H \approx \frac{3}{2}\frac{{v_c}^2}{g} \approx \frac{3}{2}\frac{Q^2}{(by)^2}\frac{1}{g}$$

$$Q^2 \approx \frac{2}{3} gHb^2Y^2$$

But as,

$$y_c = \frac{2}{3}E \approx \frac{2}{3}H$$

$$Q^2 \approx \frac{2}{3} gH \left(\frac{2}{3}\right)^2 H^2 b^2$$

Therefore,

$$Q \approx \left(\frac{2}{3} g\right)^{1/2} \left(\frac{2}{3} H\right)^{3/2} b$$

$$Q \approx \sqrt{g} b \left(\frac{2}{3} H\right)^{3/2}$$

As,

$$\sqrt{g} \left(\frac{2}{3}\right)^{3/2} = 3.09$$

Then,

$$Q \approx 3.09 bH^{3/2}$$