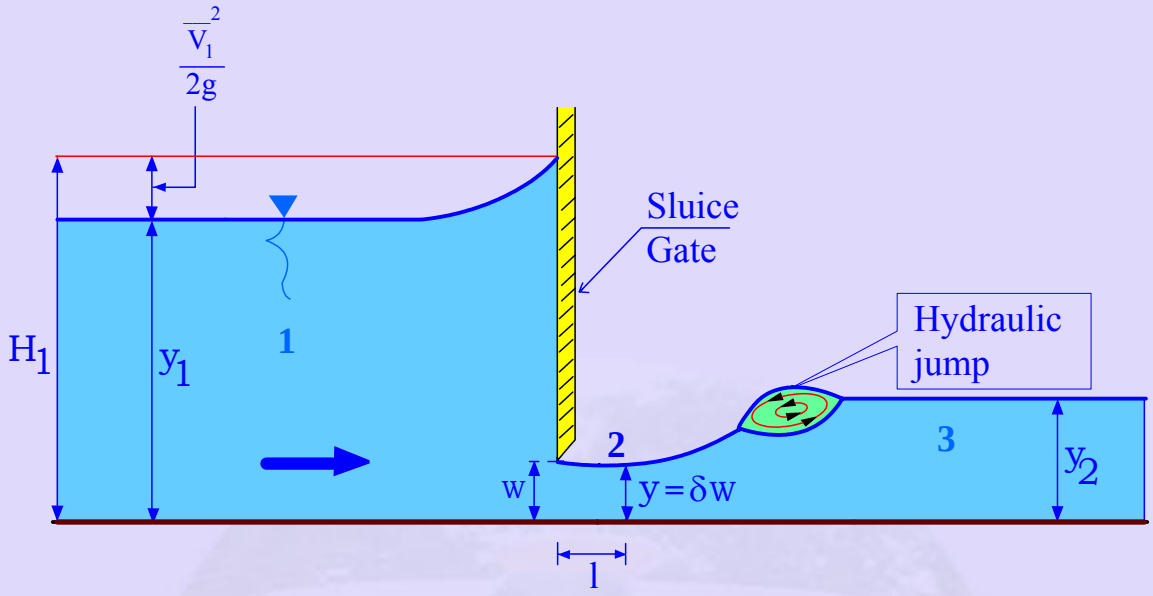
15.1 Flow below a Sluice Gate



Rapidly varied flow with Hydraulic jump (1 and 3 subcritical flows, 2 Super critical flow)

Flow below a Sluice gate

$$H_1 = y_1 + \frac{v_1^2}{2g}$$

opening w

depth at vena contracta $y = \delta w$ or $\delta = \frac{y}{w}$, $n = \frac{y_1}{w}$

$$Q = C_d C_v b w \sqrt{2g(y_1 - y)}$$

$$= C_d C_v b w^{1.5} \sqrt{2g(n - \delta)}$$

$$= K\, b w^{1.5} \sqrt{2g}$$

The value of $n = \frac{y_1}{w}$, range is 1.50 to 5.00.

δ ranges between 0.648 to 0.624.

C_d ranges between 0.607 to 0.596.

As 'n' increases from 1.5, C_d decreases upto 2.40 with a value of 0.600 to 0.596. Then further increase in n (> 2.40) the C_d value increases from 0.596 to 0.624. For the same range, 'K' increases from 0.614 to 1.279.

For

n = 2 δ = 0.630

n = 3 δ = 0.625

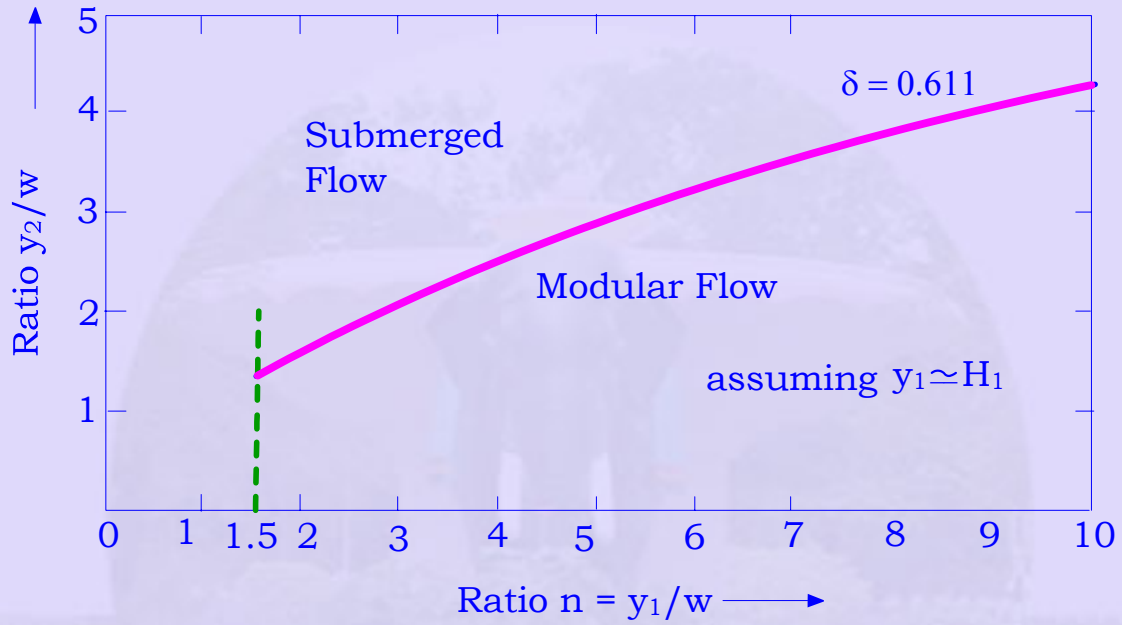
n = 10 δ = 0.620

Vena contra is located at a distance of $\frac{y_1}{n\delta} = 1$.

The sequent depth of jump should not exceed the value given by

$$\frac{y_2}{w} = \frac{\delta}{2}\left[\sqrt{1+16\left(\frac{H_1}{\delta w}-1\right)}-1\right]$$

Figure shows the limiting tail water level for modular flow below a sluice gate.



Limiting tail-water level for modular flow below a sluice gate

Henderson proposed an equation for the contraction coefficient δ for the radial (Tainter) gate which depends on inclination angle θ.

$$\delta = 1 - 0.75\left(\frac{\theta}{90^\circ}\right) + 0.36\left(\frac{\theta}{90^\circ}\right)^2$$

The expected error is less than 5% provided that $\theta < 90^o$. Thus the discharge coefficient for radial gate is given by $C_d = \frac{\delta}{\left(1+\frac{\delta w}{y_1}\right)^{0.5}}$.