Design of Cascade aerator

Following is detailed design and analysis of Cascade aerator for the capacity of 15 Mld

Let, Velocity of water in inlet pipe = 0.5 $^{m}/_{sec}$

Surface area of cascade aerator = 0.024 to 0.048 $^{m^2}/_{^{m^3}/_{hr}}$

Number of steps = 2 to 5

Height = 2 to 4 mt

Step 1] Design of Inlet pipe :

Here , Q = 15 Mld = 625 $^{m^3}/_{hr}$ = $\frac{625}{60\ X\ 60}$ = 0.1736 $^{m^3}/_{Sec}$

We Have ; Q = A V

0.1736 = $\frac{\pi}{4}$ x d^2 x 0.5

d = 0.665 mt

Step 2] Calculation of diameter of cascade aerator in plan :

Assuming surface area of cascade aerator = 0.03 $^{m^2}/_{^{m^3}/_{hr}}$

= 0.03 x 625

= 18.75 m^2 = 20 m^2

We Have ; Area = $\frac{\pi}{4}$ x d^2

20 = $\frac{\pi}{4}$ x d^2

d = 5 mt.

Total diameter of aerator = Diameter of inlet pipe + diameter in plan

= 0.665 + 5

= 5.665 mt.= 5.7 mt.

Step 3] Calculation of diameter of cascade aerator in step wise :

Assuming that total height of aerator as 3 mt and 4 Number of steps

Height of step = $\frac{3}{4}$ = 0.75 mt.

Width of Trades = 5.7 – 0.7 = 5 mt.

Now, $\frac{5}{2}$ = 2.5 mt on each side excluding Diameter of inlet pipe .

$\therefore \frac{2.5}{\text{Number of trades}} = \frac{2.5}{4}$ = 0.625 mt

∴ Diameter of 1st Step = (0.625 x 2) + 0.70 = 2 mt.

Diameter of 2nd Step = (0.625 x 2) + 2 = 3.25 mt.

Diameter of 3rd Step = (0.625 x 2) + 3.25 = 4.5 mt.

Diameter of 4th Step = (0.625 x 2) + 4.5 = 5.70 mt.

Step 4] Calculation of Exposure in cascade aerator :

In case of cascade aerator number of steps are provided to increase time of exposure for single descend .

The vertical distance (h) travelled by water is given by,

$h = \frac{1}{2} g t^2$

For 3 mt height of aerator,

$3 = \frac{1}{2}$ x 9.81 x t^2

T = 0.78 sec.