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Q Design the approximate dimension of a set of two rapid gravity filter for treating water required for a population of 50,000, the rate of supply being 180 lit/day/person. the filter are rated to work 5000 lit/hr/m². assume maximum daily demand to be 1.8 times the avg daily demand assume any other data. if necessary

Sol

the maximum water demand per day

= Population × maximum daily rate of supply

= population × 1.8 × avg daily rate of supply

= 50000 × 1.8 × 180

= 16.2 MLD

water demand per hour (neglecting time lost in washing the filter)

$$= \frac{16.2 \times 10^6}{24} = 675 \times 10^3 \text{ lit/hr}$$

Rate of filtration = 5000 lit/hr/m²

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∴ Area of filter bed req^n = $\frac{\text{water demand per hr}}{\text{Rate of filtration}}$

$= \frac{675 \times 10^3}{5000} = 135 m^2$

Since two units are required to be designed,

∴ area of each unit $= \frac{135}{2} = 67.5 m^2$

Assuming length of filter bed (L) as 1.5 times the width of filter bed (B)

$L \times B = 67.5$

$1.5B \times B = 67.5$

$B = 6.71 m$

$L = 1.5 \times 6.71 = 10.065 m$

Adapting 6.75m width and 10m length. hence two units of size 10m x 6.75m are required. one additional unit as standby may also be provided for breakdown, repair and cleaning.

Q. Design Slow Sand filter for a population of 40000 with an avg rate of water of water supply of 150 lit per capita/day.

Sol Population = 40000

Per Capita demand = 150 lit/day

Avg daily demand = Population × per capita demand
= 40,000 × 150

= 6×10^6 lit/day

Assuming maximum demand as 1.8 time the avg daily demand

Maximum daily demand = 1.8 × Avg. daily demand

= $1.8 \times 6 \times 10^6$

= 10.8×10^6 lit/day

Assuming rate of filtration as 180 lit/hr/m^2 of filter area

total surface area of filter req^n = $\frac{\text{Max}^n \text{ daily demand}}{\text{Rate of filtration per day}}$

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$= \frac{10.8 \times 10^6}{180 \times 24} = 2500\ m^2$

When surface area is more than $1200\ m^2$, then six slow filter are designed. one unit will be standby.

Area of each filter $= \frac{2500}{5} = 500\ m^2$

Assuming length of each unit as twice its breadth

$L \times B = 500$

$2B \times B = 500$

$B = 15.81 \simeq 16m$

$L = 2 \times 16 = 32m$

Hence, 6 filter will be used with one unit as standby, each unit of size $32m \times 16m$, arranged in series with 3 units on either side.