

# ENVIRONMENTAL ENGINEERING

## **WATER DEMAND:**

- The designing of treatment plant is done on the basis of water demand. Hence following quantities must be assessed before designing the treatment plant.
  - Total volume of water required in a year= $V$   
(annual draft/demand)
  - Total volume of water required in a day= $V/365$   
(annual average daily draft /demand)
  - Total volume of water required in a day by each individual = $V/365P$   
 $P$ =population at end of design life (annual average per capita daily draft)
- Total water demand comprises of following demands:
  - Domestic water demand :
    - (i) It is the amount of water required for all domestic activity viz drinking, cooking, washing, bathing etc.
    - (ii) For city having full flushing system it varies between 135-225 lit/capita/day normally taken 200 lpcd.
  - Industrial water demand:
    - (i) It is amount of water required for all industrial activities in city.
    - (ii) It varies between 50-450 lpcd.
  - Institutional water demand:
    - (i) The amount of water required to meet all requirements of institutes of all locality i.e. schools, hospitals, and hotels.
    - (ii) It varies between 20-50 lpcd.
  - Water for public use:
    - (i) It is the quantity of water required to meet the public requirements like cleaning of roots gardening.
    - (ii) It is normally taken to be 10 lpcd.
  - Fire demand:
    - (i) It is the quantity of water required for fire hazards in the city.
    - (ii) It is taken as 1 lpcd or it may be also computed as
$$Q_{\text{fire}} = 100\sqrt{P} \text{ kilo lit , } p=\text{thousands(as per GOI manual)}$$
Total water demand is addition of all above demand and it is taken to 250-350 lpcd.

## **Factors affecting water demand:-**

1. Size of city:  
Larger city will include more industrial, institutional, public usage and fire demand.
2. Climate: In summer more water will be used.

3. Industrial activity :

More industrial activities more is water demand.

4. Sewerage system :

It sewerage system is water carrying. Water demand will be more in city and conservatory system. It is less.

5. Quality:

Better will be the quality more is the water demand.

6. Cost of water:

More cost of water will reduce water .i.e. the water will be used more judiciously.

7. Type of distribution system :

Wastage of water will be more in continuous system than intermittent water supply system. Thus water demand is more due to more usage in continuous system.

8. Pressure :

More pressure more losses and thus more water demand.

Fluctuation in water demand

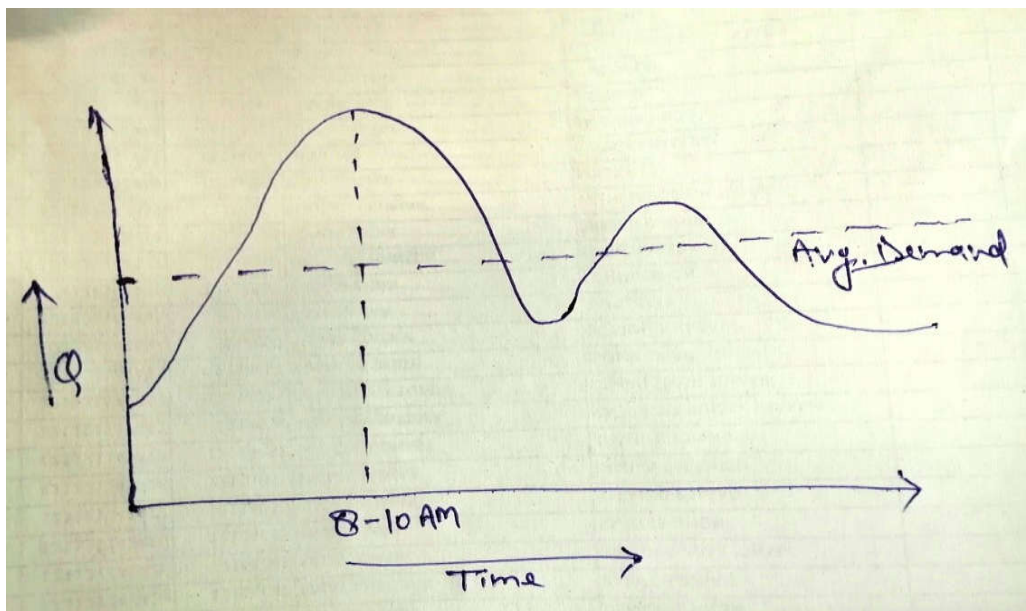


Fig. Variation of water demand in a day

Max. Daily demand =  $1.8 \times$  Avg. daily demand

Max. Hourly demand =  $1.5 \times$  (Avg. daily of max. day)

Max. Hourly demand =  $1.5(1.8 \times \text{avg. daily demand}/24)$

$$=2.7(\text{avg. hourly demand of max. day})$$

Note:

In general ratio of max. Demand to avg. Demand for a particular duration can be calculated using good rich equation

$$P = \text{max.Demand} / \text{avg.Demand} = 180.t^{-10}$$

Where -  $t$  = time duration in days

**Sources of water:** Main source of water is precipitation

1. **Surface source:** have water on the surface of the earth such as in stream, river, lake, irrigation canal, wetland or ocean etc.
2. **Sub-Surface/Underground:** spring, well, Infiltration Gallery, Infiltration well etc.
3. **Rain.**

➤ **Merits of surface sources and Ground water source:**

1. Being underground, the ground water supply has less chance of being contaminated by atmospheric pollution.
2. The water quality is good and better than surface source.
3. Prevention of water through evaporation is ensured and thus loss of water is reduced.
4. Ground water supply is available and can even be maintained in deserted areas.
5. The land above ground water source can be used for other purposes and less environmental impacts.

➤ **Demerits of surface sources and Ground water source:**

1. The water obtained from ground water source is always pressure less. A pump is required to take the water out and is then again pumped for daily use.
2. The transport / transmission of ground water are a problem and an expensive work. The water has to be surfaced or underground conduits are required.
3. Boring and excavation for finding and using ground water is expensive work.
4. The modeling, analysis and calculation of ground water are less reliable and based on the past experience, thus posing high risk of uncertainty.

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