

# **ENVIRONMENTAL ENGINEERING**

**Notes by-**

# **Pravin S Kolhe,**

BE(Civil), Gold Medal, MTech (IIT-K)

**Assistant Executive Engineer,**

**Water Resources Department,**

**[www.pravinkolhe.com](http://www.pravinkolhe.com)**

## DISTRIBUTION SYSTEM

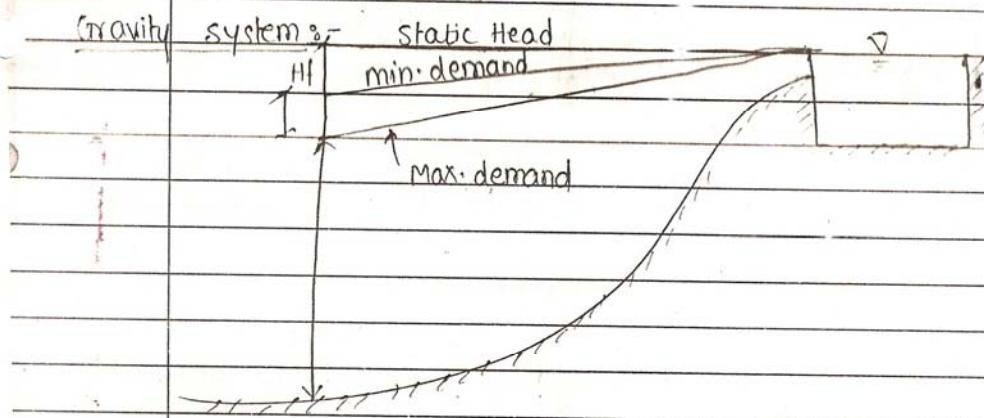
Er: Pravin Kolhe  
(B.E Civil)

- \* Factors affecting planning of distribution system:-
  - 1) Water circulation.
  - 2) const<sup>n</sup> & design should be safe & enough. (sufficient)
  - 3) Water pipeline should be min. 2m above & min. 3m apart from sewer line to avoid contamination of sewage
  - 4) Economy,
  - 5) Pumping head, type of pipes, storage requirement etc.
  - 6) fire demand.
  - 7) Gradients.
  - 8) Leakage.
  - 9) Maintenance.
  - 10) Connections

### Methods of distribution:-

Depending upon the topography of the area, following methods are used -

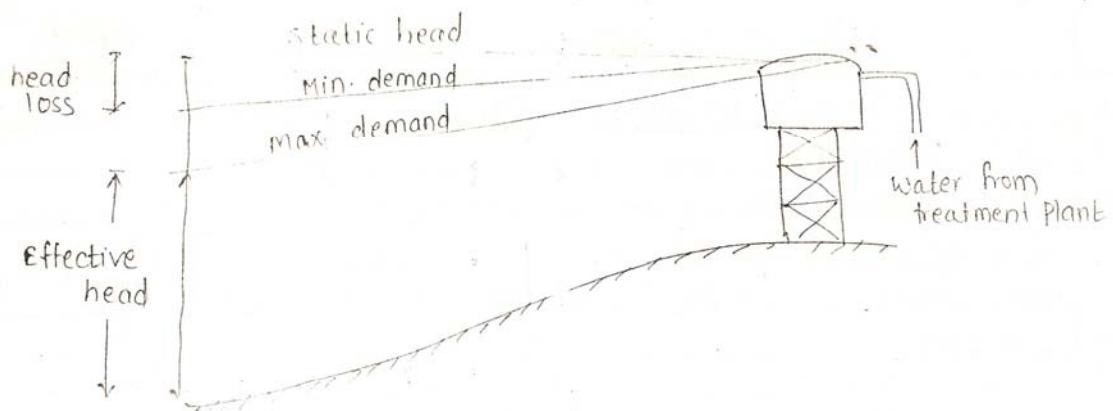
- 1) Gravity System
- 2) Gravity & Pumping system combined.
- 3) Pumping system.



When water is stored at higher elevation than the distribution area, this system is adopted. In case of fire, pumps are reqd. This is not reliable mtd. for distribution.

### Gravity cum pumping system combined:-

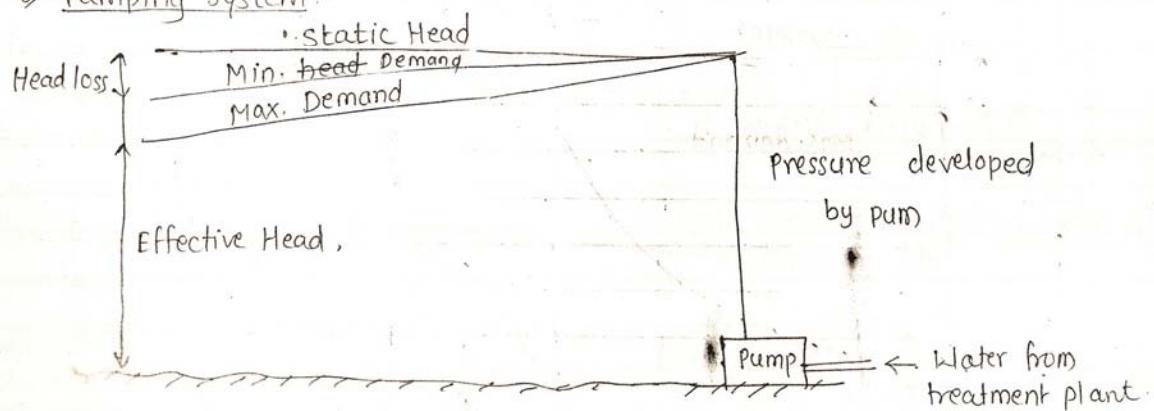
In this system, the treated water is pumped in to an elevated distribution reservoir. The excess water during low consumption is stored in the elevated reservoir. The pumps are run at uniform speed.



### Advantages:-

- 1) During fire conditions, water is available at pressure.
- 2) Pumps are run at uniform speed i.e. less wear & tear.
- 3) Economical.
- 4) During breakdown of pump, water is stored in the ESR.

### 3) Pumping System:-



In this system, water is directly pumped in to the distribution system.

- Disadvantages:-
- 1) In case of breakdown of pumps, whole distribution process gets affected.
  - 2) Uneconomical for a high discharge.

\* Service Reservoirs:-

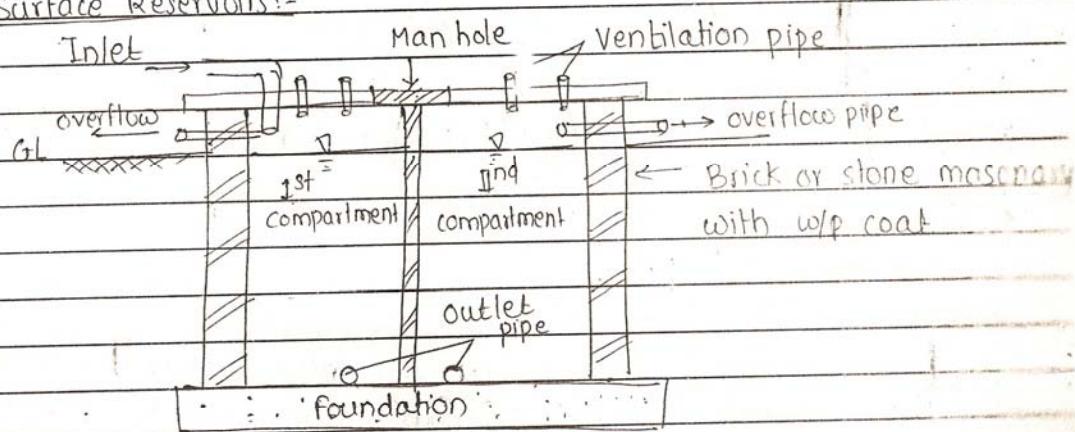
Service reservoirs are provided to store the heated water.

- Purpose:
- 1) For uniform & running of pumps.
  - 2) To facilitate smooth working during fluctuations.
  - 3) To maintain constant pressure in mains.
  - 4) During break down of pumps, it does not affects working.

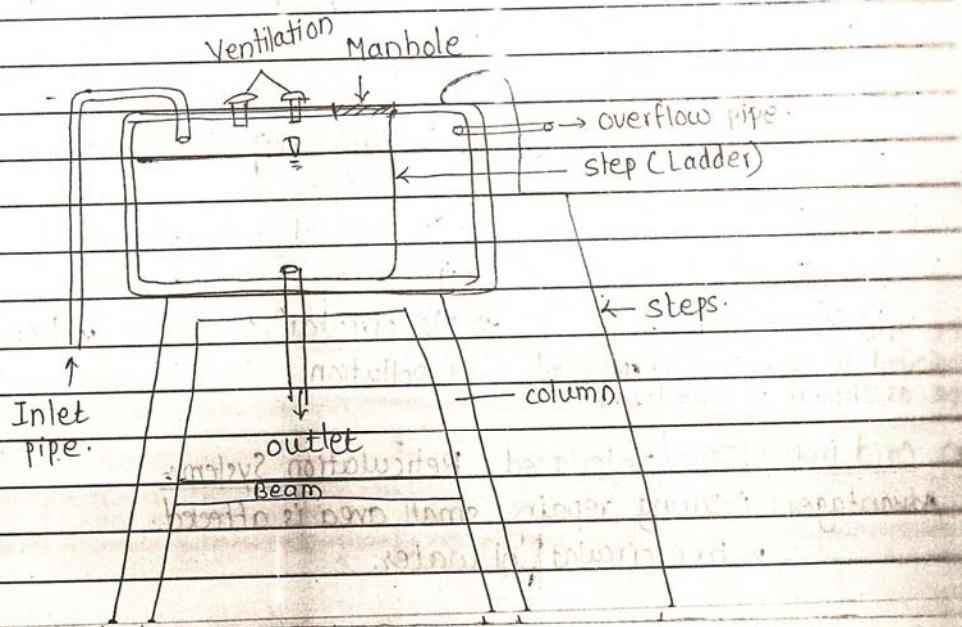
\* Types of service Reservoirs:-

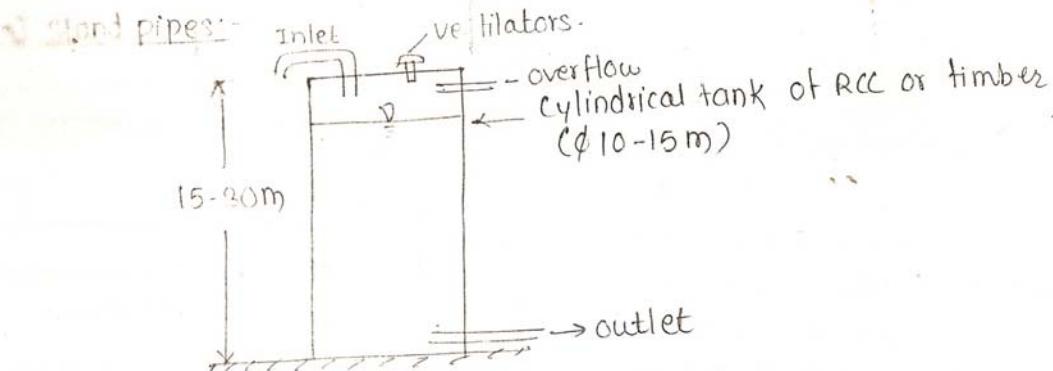
- 1) Surface Service Reservoirs.
- 2) Elevated -v- (ESR)
- 3) Stand pipes.

1) Surface Reservoirs:-



2) ESR:-





\* System of water Supply:-

- 1) continuous system : Water supply is for 24 hr. during a day.
- 2) Intermittent system : Water supply is for 6 to 8 hr. per day.

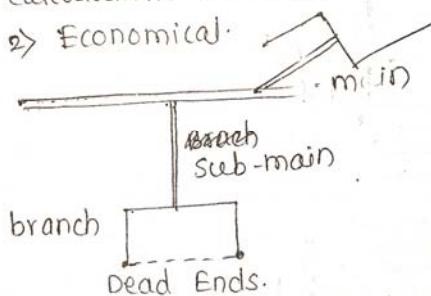
\* Methods of layout of distribution pipes:-

- 1) Dead end method / Tree system
- 2) Grid-iron method / Interlaced / Reticulation system
- 3) Circular method / Ring system
- 4) Radial method

1) Dead end / Tree system:-

If the development of city is irregular, pipes are laid at random without any planning. The system has advantage that, 1) Design calculations are simple & hence easy to lay pipes.

2) Economical.



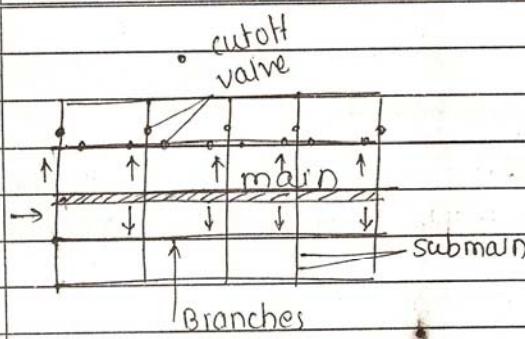
Disadvantages:-

- 1) During repair work, whole system gets affected.
- 2) In case of fire, pressure can not be increased.
- 3) No circulation of water & hence chances of pollution.

The grid-iron system can be employed in such case by connecting pipe as shown in dotted line.

2) Grid iron system / Interlaced / Reticulation System:-

Advantages: 1) During repairs, small area is affected.  
2) free circulation of water.

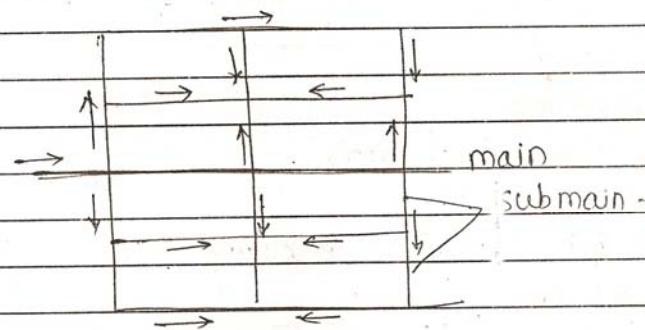


Disadvantages :-

- 1) High cost.
- 2) Longer length of pipe.
- 3) Design calculations are difficult.
- 4) More No. of valves are reqd.

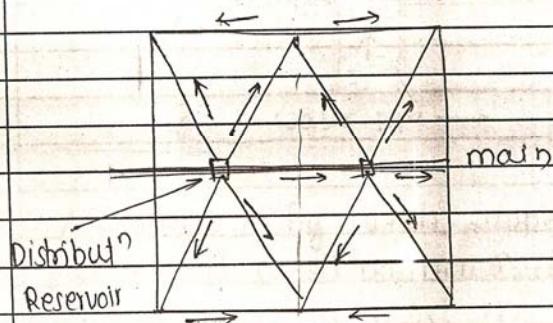
suitable for well planned towns having well planned network of roads & streets.

### 3) Circular mtd / Ring System:-



Same as grid iron system.

### a) Radial system :- Reverse of ring mtd.



Wastage of water:- is due to.

- 1) Carelessness of consumer
- 2) leakage through pipes.

\* Permissible wastage of water :-  $= 11.6 \text{ lit/cm dia/km length/hr}$ .  
e.g. for  $D = 300\text{mm}$ ,  $L = 5\text{km}$ , Permissible wastage  $= 11.6 \times 30 \times 5 = 1740 \text{lit/hr}$

\* Preventive measures:-

- 1) Design length of pipe should be min.
- 2) fitting should be standard.
- 3) Inspection
- 4) Metering system so that consumer uses min. water & leakages can be found out.
- 5) Advertisements.
- 6) Skilled supervision.
- 7) Intermittent system of supply.

\* Tests carried out to determine leakages:-

- 1) Coloured water
- 2) compressed air
- 3) filling the pipe
- 4) Hydraulic gradient
- 5) Metal rod
- 6) Observations
- 7) steel rod

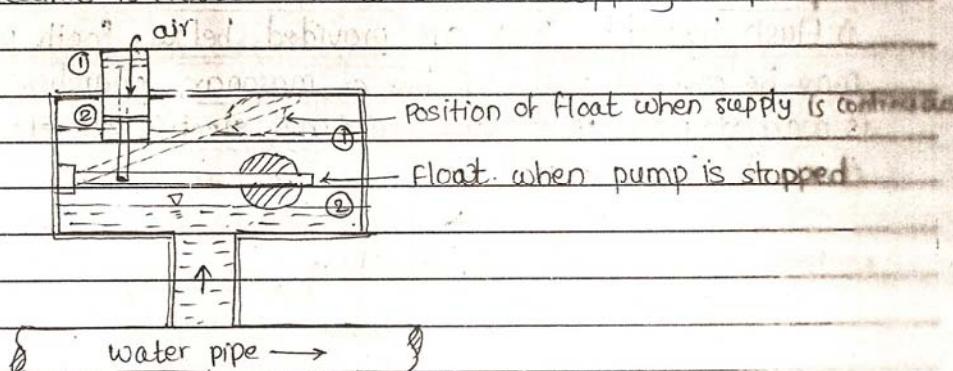
## PIPE APPURTENANCES

following are the pipe appurtenances used in water distribution system for easy & effective working -

- 1) Air valve / Air relief valves.
- 2) Bib cocks
- 3) Fire hydrants
- 4) Reflux valves / check / Non return valve
- 5) Relief valves / Automatic cutoff / Safety valve
- 6) Scour valves / Blow off / drain / washout valve
- 7) Sluice valves / gate / shut off / stop valves.
- 8) Stop cocks
- 9) Water meters.

### ① Air / Air Relief valve:-

Some quantity of air is contained in the flowing water. This air causes air locking i.e. effective area of flow decreases. To avoid this air relief valves are provided to facilitate exit of air. Air valve also helps in admitting air in the pipe when vacuum is created due to sudden stopping of pump.



As shown in fig., when supply of water is continuous the piston is at closed position ① w.r.t. the water level in the chamber. As flow stops, the water level in the chamber decreases & position ② occurs. At this stage air enters from the valve & it facilitates easy working without making vacuum in the pipe.