Water Demand Supply & Distribution (CE-562)
Lecture - 6

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Water Supply Systems (Part – 2)

Types of Water Distribution System

- For efficient distribution system, adequate water pressure is required depending upon the need at various points / locations in the distribution system.

- Depending upon the level of source, topography of the area and other local conditions, water may be supplied into distribution network by either of the following system:

1. Gravity system
2. Pumping system
3. Combined gravity and pumping system

Types of Water Distribution System

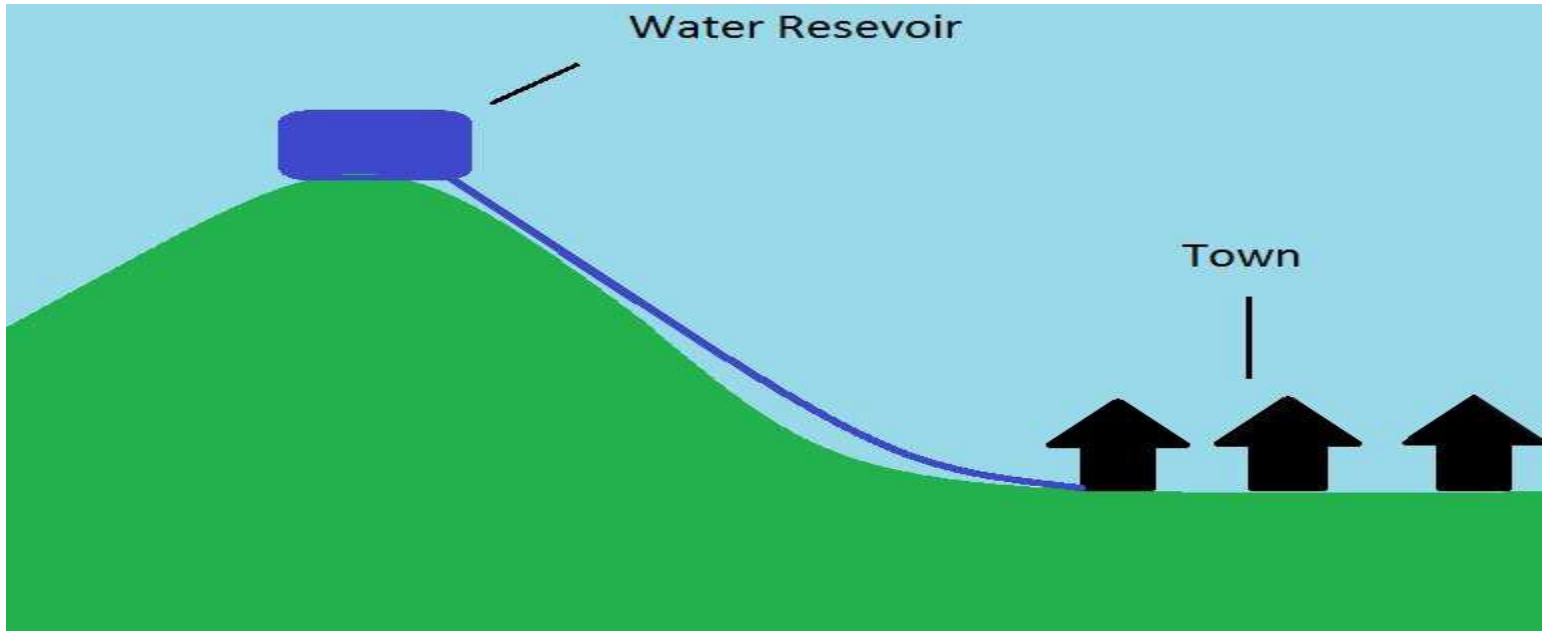
1. Gravity system:

- Suitable when source / storage tank is at sufficient height.
- Flow of water in the network is due to the level difference between source / storage tank and serving community.
- It is most economical distribution system.
- The water head available at the consumer end may just fulfill the minimum head requirement.

Types of Water Distribution System

1. Gravity system:

- The remaining head is consumed in the frictional and other losses.
- This system is suitable for rural and / or areas with minimum residual pressure requirement.



Types of Water Distribution System

2. Pumping system:

- In this system water is directly pumped from the source into the distribution main without storing.
- Water source may be surface source or ground water source.
- Also called pumping without storage system.
- Depending upon the demand, high lift pumps are required.
- Pressure in the distribution system reduces along the length of flow and depends on area topography as well.

Types of Water Distribution System

2. Pumping system:

- If power supply fails, complete stoppage of water supply occurs.
- Operational cost of this system is much higher than gravity system.
- This system is suitable in areas where high residual pressure and continuous flow is demanded.
- Normally electricity or solar energy is used for pumping.

Types of Water Distribution System

2. Pumping system:

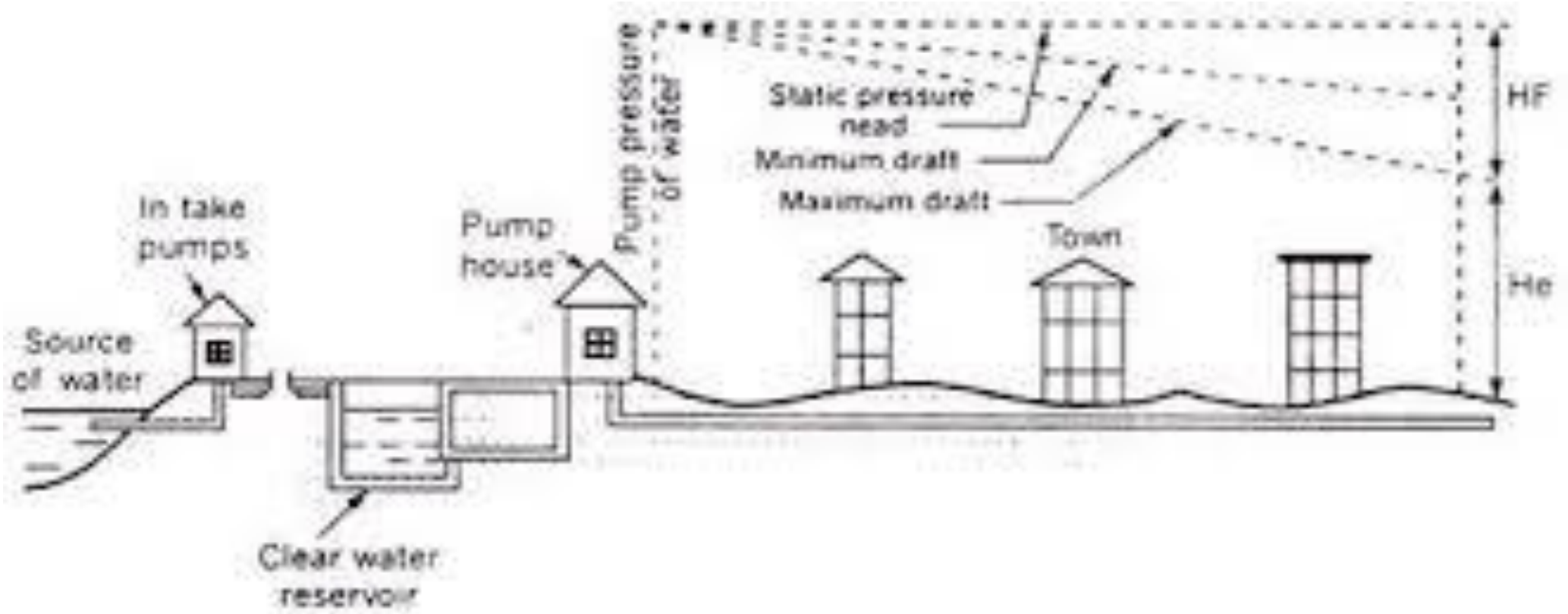


Fig. 18.2. Pumping System of Distribution.

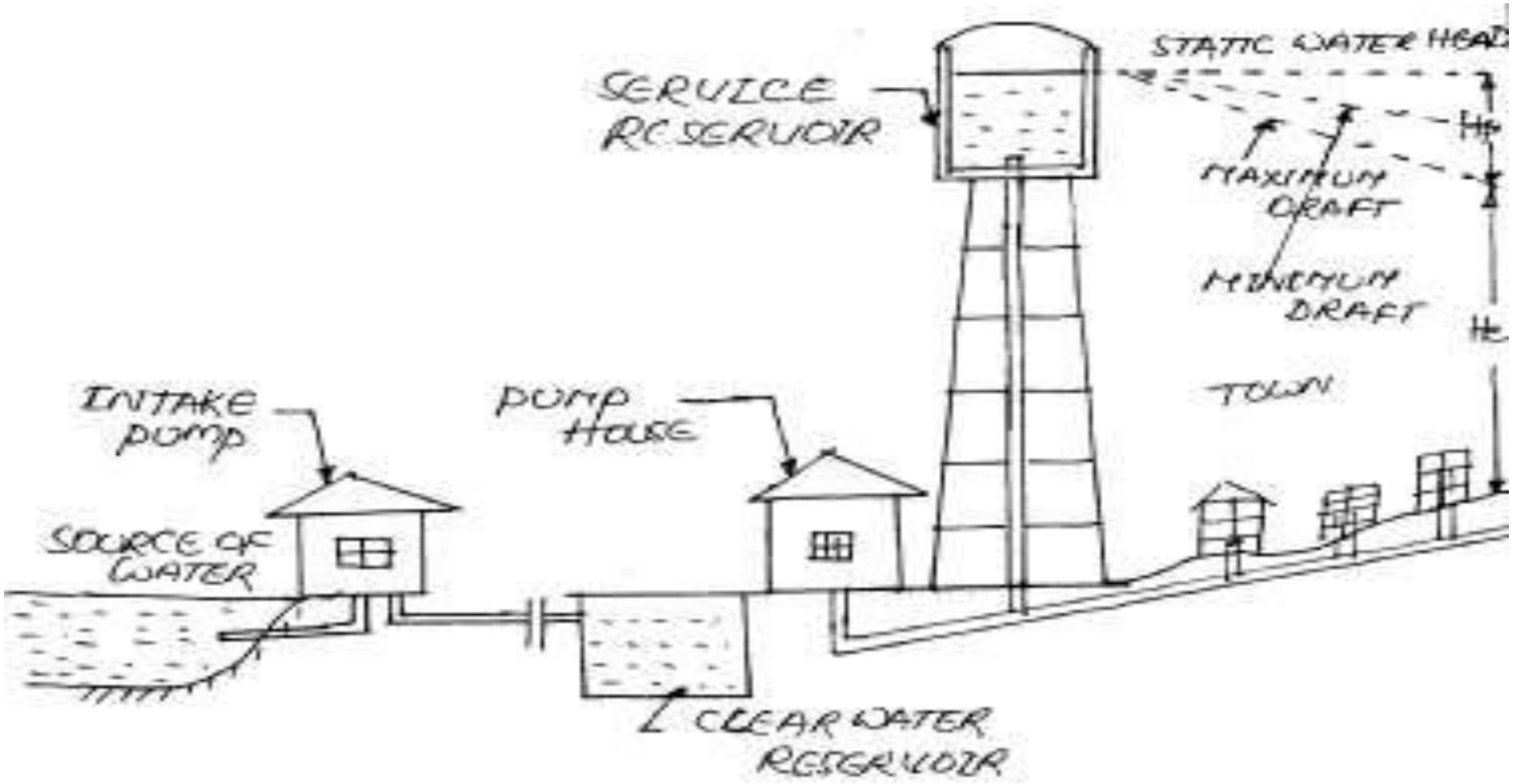
Types of Water Distribution System

3. Combined Gravity and Pumping system:

- It is the most common distribution system.
- Water is pumped and stored in an elevated distribution reservoir.
- Then supplies to consumer by action of gravity.
- The excess water during low demand periods is stored in reservoir and is supplied during high demand period.
- Economical, efficient and reliable system.

Types of Water Distribution System

3. Combined Gravity and Pumping system:



Distribution Reservoirs

- Distribution reservoirs, also called service reservoirs, are the storage reservoirs, which store water for distributing during emergencies (such as during fires, repairs, peak demand etc.) and also to help in absorbing the hourly fluctuations in the normal water demand.

- It should be located as close as possible to the center of demand.

- Water level in the reservoir must be at a sufficient elevation to permit gravity flow at an adequate pressure.

Types of Reservoirs

Depending upon their elevation w.r.t ground it may be classified into:

1. Surface reservoirs

2. Elevated reservoirs

Types of Reservoirs

1. **Surface reservoirs:**

- These are also called ground reservoir.
- Mostly circular or rectangular tank.
- Under ground reservoirs are preferred especially when the size is large.
- In case of gravity system, underground reservoirs are generally constructed on high natural grounds and are usually made of stones, bricks, plain or reinforced cement concrete.

Types of Reservoirs

1. Surface reservoirs:

- The side walls are designed to take up the pressure of the water, when the reservoir is full and the earth pressure when it is empty.

- The position of ground water table is also considered while designing these reservoirs.

- The floors of these reservoirs may be constructed with R.C.C slab or stone blocks with sufficient water profing.

Types of Reservoirs

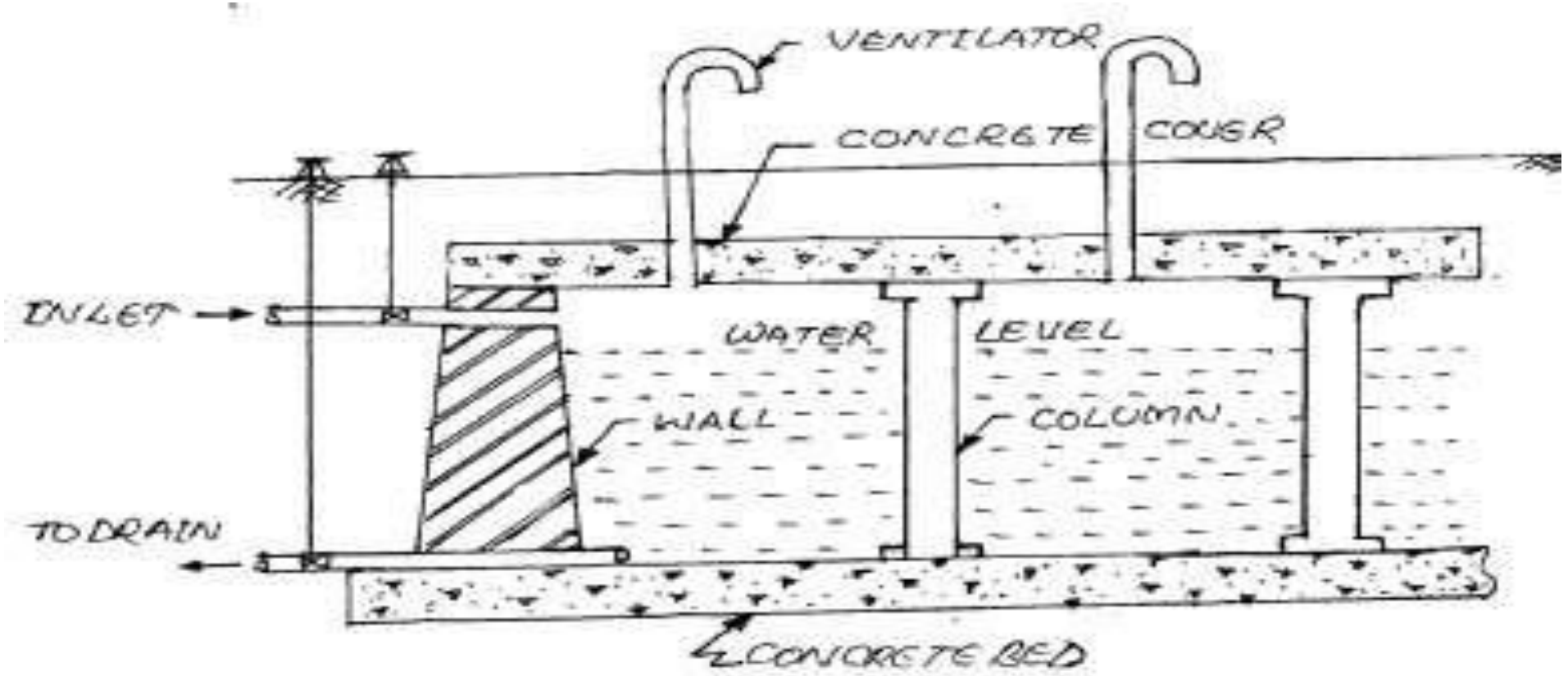
1. **Surface reservoirs:**

- To obtain water tightness bitumen compounds are used at all construction joints.

- For aeration of water and inspection, manholes, ventilation pipes and stairs are provided.

Types of Reservoirs

1. **Surface reservoirs:**



Types of Reservoirs

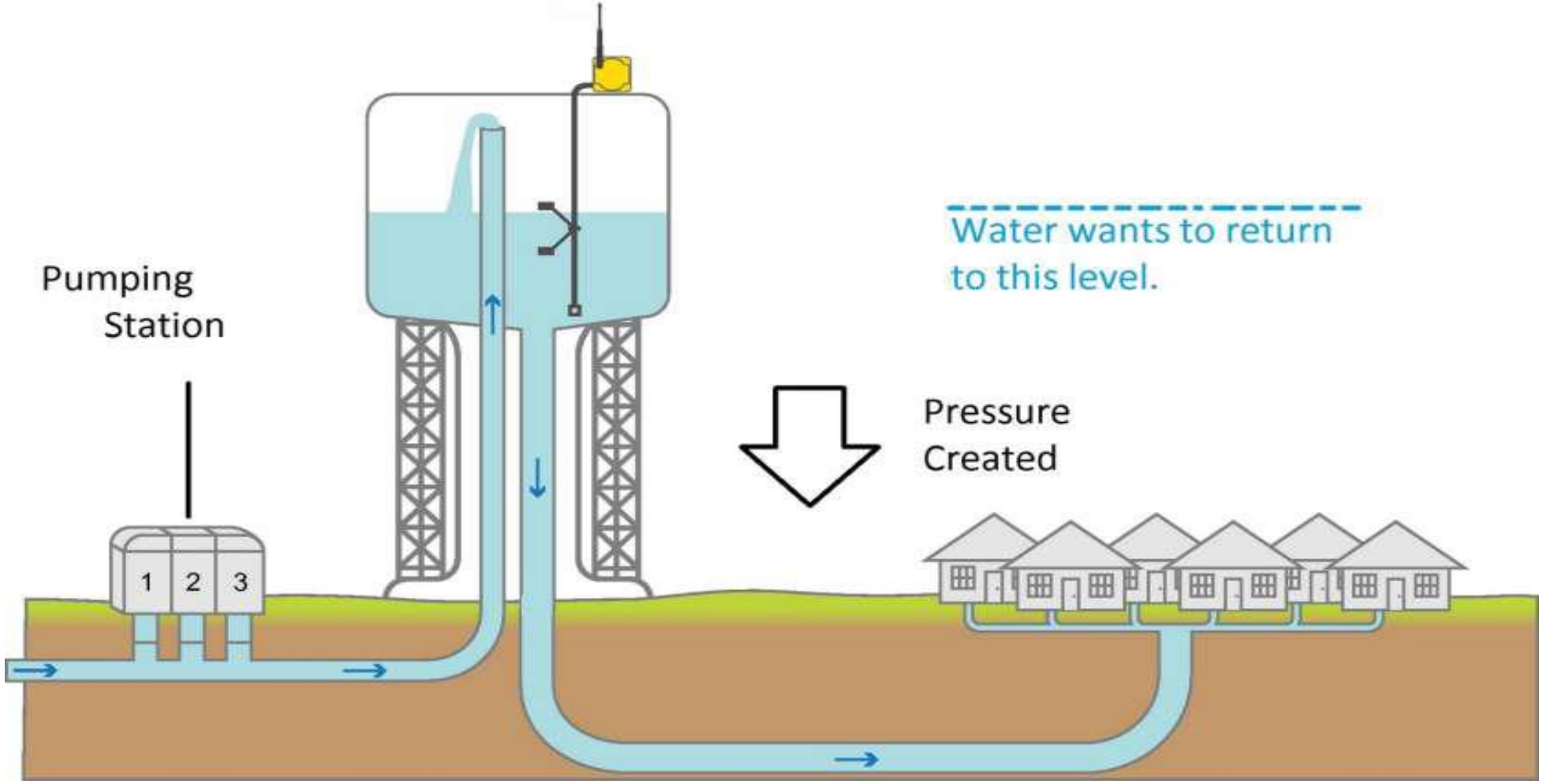
2. Elevated Storage Reservoirs:

- Elevated Storage Reservoirs (ESRs) also referred to as Overhead Tanks are required at distribution areas which are not governed and controlled by the gravity system of distribution.
- These are rectangular or circular in shape.

- If the topography of the town is not suitable for gravity system, the elevated tank or reservoir are used to provide sufficient pressure head.
- They are constructed where combine gravity and pumping system of water distribution is adopted.

Types of Reservoirs

2. Elevated Storage Reservoirs:



Storage Capacity Reservoirs

- The total storage capacity of a distribution reservoir is the summation of:

1. **Balancing Storage:**

- The quantity of water required to be stored in the reservoir for equalizing or balancing fluctuating demand against constant supply is known as the balancing storage (or equalizing or operating storage).

Storage Capacity Reservoirs

2. Breakdown Storage:

- The breakdown storage or often called emergency storage is the storage preserved in order to tide over the emergencies posed by the failure of pumps, electricity, or any other mechanism driving the pumps.

- A value of about 25% of the total storage capacity of reservoirs, or 1.5 to 2 times of the average hourly supply, may be considered as enough provision for accounting this storage.

Storage Capacity Reservoirs

3. Fire Storage:

- The third component of the total reservoir storage is the fire storage.
- This provision takes care of the requirements of water for extinguishing fires.
- Fire demand maybe calculated by the given formulas:

$$Q_F = 65\sqrt{P}(1-0.01\sqrt{P})$$

Q_F = fire demand *l/s*
P = population in thousands

$$Q_F = 53\sqrt{P}$$

Q_F = fire demand *l/s*
P = population in thousands

$$Q_F = 320 * C\sqrt{A}$$

Q_F = fire demand flow m^3/d
A = areas of all stories of the building under consideration (m^2)
C = constant depending on the type of construction;

- **The total reservoir storage can finally be worked out by adding all the three storages.**

Thank You