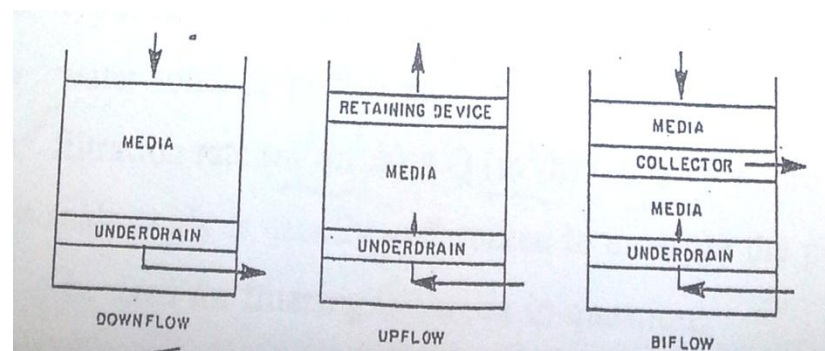# Water Treatment
3. Filtration

- Advantages of dual and mixed media filters over single medium filters
  - Longer filter runs
  - Greater filtration rates (lower head losses)
- Types of filters based on the direction of flow
  - Down-flow filters (most common)
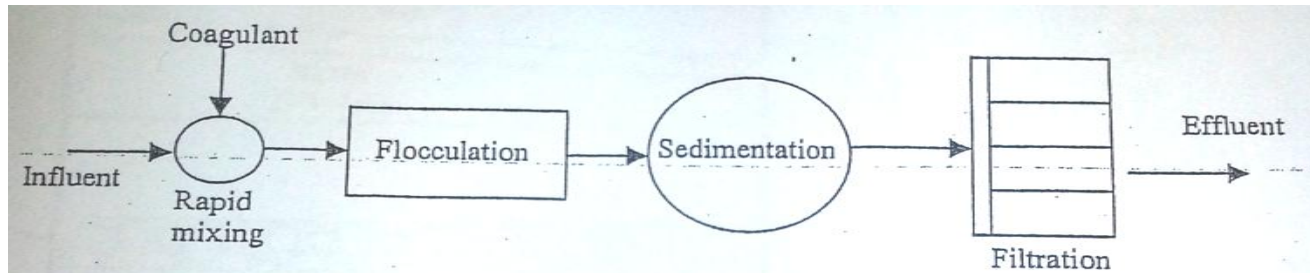 - Up-flow filters
  - Bi-flow filters

Water Treatment
3. Filtration

- Filtration Systems
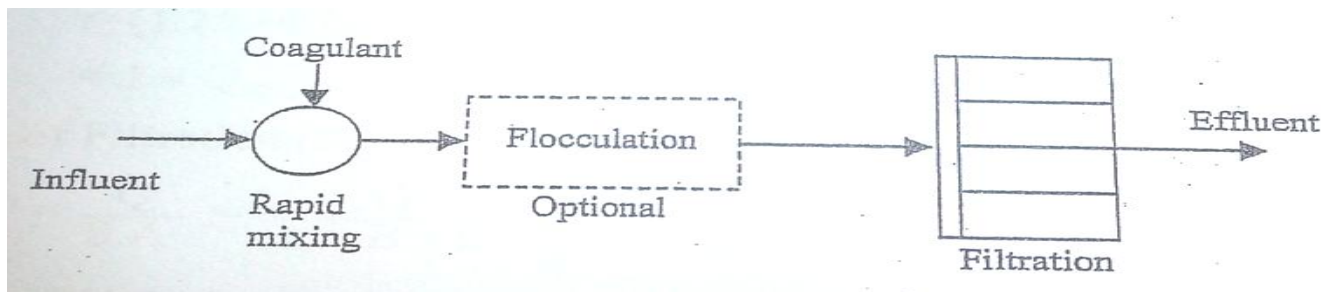 - Traditional Filtration System
    For treating surface waters (e.g. river water) with high turbidity.

  - Direct Filtration System
    For treating surface waters with:
    - Low turbidity (< 5 NTU)
    - Fe < 0.3 mg/L and Mn < 0.05 mg/L

Water Treatment
3. Filtration

- **Design Criteria**
  - The performance of the process is judged by:
    - Effluent quality, and
    - Head loss (filter run)
  - The process is affected by many interrelated variables such as:
    - Type and characteristics of media to be used
    - Water solids to be filtered
    - Filtration rate $(m^3/m^2.h)$ = Q (m^3/h) / A (m^2) where A = surface area
  - A pilot-scale study is usually undertaken to evaluate the performance of filter media to be used for filtering the water in question.
  - Number of filters: at least 4 filters in medium and large plants.

Water Treatment
3. Filtration

- Rapid Sand Filter
  - Design Criteria
    - Q_{design} = $Q_{max.\ monthly}$
      = $(1.25 \to 1.5)\ Q_{avg.}$
    - Rate of filtration (ROF) = $(100 \to 200)$ m3/m2/d
      ROF = Q_{design} / n x W x L
    - W (width) <= 8 m
    - L (length)<= 8 m   L = 1 – 1.25 W
    - Extra number of units
      - $n_{working}$ <= 5 $n_{total} = n_{working} + 1$
      - 5 < $n_{working}$ < 30 $n_{total} = n_{working} + 2$
      - $N_{working}$ >= 30 $n_{total} = n_{working} + 4$
      - n_{total} (total number of filters) must be an even number
    - To calculate amount of wash water:
      Rate of washing (ROW) = 5 $\to$ 6 ROF
      Washing time = 8 $\to$ 10 min
      amount of was water per day = ROW x washing time x area of one filter x number of filters washed daily x number of washing times per day