Water treatment – Sedimentation and settling Tanks
Types of Settling Tanks
Sedimentation tanks may function either intermittently or continuously. The intermittent tanks also called quiescent type tanks are those which store water for a certain period and keep it in complete rest. In a continuous flow type tank, the flow velocity is only reduced and the water is not brought to complete rest as is done in an intermittent type.
Settling basins may be either long rectangular or circular in plan. Long narrow rectangular tanks with horizontal flow are generally preferred to the circular tanks with radial or spiral flow.
Long Rectangular Settling Basin

- Long rectangular basins are hydraulically more stable, and flow control for large volumes is easier with this configuration.
- A typical long rectangular tank have length ranging from 2 to 4 times their width. The bottom is slightly sloped to facilitate sludge scraping. A slow moving mechanical sludge scraper continuously pulls the settled material into a sludge hopper from where it is pumped out periodically.
A long rectangular settling tank can be divided into four different functional zones:

**Inlet zone:** Region in which the flow is uniformly distributed over the cross section such that the flow through settling zone follows horizontal path.

**Settling zone:** Settling occurs under quiescent conditions.

**Outlet zone:** Clarified effluent is collected and discharge through outlet weir.

**Sludge zone:** For collection of sludge below settling zone.
Long Rectangular Settling Basin

Influent
Baffle wall
Inlet zone
Settling zone
Outlet zone
Sludge zone
Sludge hopper
Sludge scraper
Weir
Effluent
Launder

<Click play to see working of sludge scraper>
Circular Basins

- Circular settling basins have the same functional zones as the long rectangular basin, but the flow regime is different. When the flow enters at the center and is baffled to flow radially towards the perimeter, the horizontal velocity of the water is continuously decreasing as the distance from the center increases. Thus, the particle path in a circular basin is a parabola as opposed to the straight line path in the long rectangular tank.
- Sludge removal mechanisms in circular tanks are simpler and require less maintenance.
Settling Operations

Particles falling through the settling basin have two components of velocity:
1) Vertical component: \( v_t = \frac{(\rho_p - \rho_w)gd^2}{18\mu} \)

2) Horizontal component: \( v_h = \frac{Q}{A} \)

The path of the particle is given by the vector sum of horizontal velocity \( v_h \) and vertical settling velocity \( v_t \).
**Design Details**

Detention period: for plain sedimentation: 3 to 4 h, and for coagulated sedimentation: 2 to 2.5 h.

Velocity of flow: Not greater than 30 cm/min (horizontal flow).

Tank dimensions: $L:B = 3$ to $5:1$. Generally $L = 30$ m (common) maximum 100 m. Breadth = 6 m to 10 m. Circular: Diameter not greater than 60 m. generally 20 to 40 m.

Depth 2.5 to 5.0 m (3 m).

Surface Overflow Rate: For plain sedimentation 12000 to 18000 L/d/m² tank area; for thoroughly flocculated water 24000 to 30000 L/d/m² tank area.

Slopes: Rectangular 1% towards inlet and circular 8%.