Other common design characteristics of a mechanically aerated lagoon are:

- aspect ratio   less than 3:1
- depth   10 to 12 feet
- detention time   4 to 10 days
- BOD loading   20–400 lbm/day-acre (220 typical)
- temperature range   32° to 100°F (70°F optimum)
- typical effluent BOD   20 to 70 mg/l
- oxygen requirements   0.7 to 1.4 times BOD removed

Activated Sludge Processes: Sludge produced during the oxidation process has an extremely high concentration of active aerobic bacteria. For this reason, partially oxidized sludge is called *activated sludge*. Purification of raw sewage can be speeded up considerably if the raw sewage is mixed (seeded) with activated sludge. The mixture of raw sewage and activated sludge is known as *mixed liquor* (*ML*). The biological systems in the mixed liquor are known as *mixed liquor suspended solids* (*MLSS*).

In operation, an activated sludge process takes raw water and allows it to settle. The settled effluent is mixed with activated sludge in the approximate ratio of 1 part sludge per 3 or 4 parts effluent. Mechanical aeration is used. The effluent is then settled in a second sedimentation tank, chlorinated, and discharged. Settled sludge from this last tank supplies the continuous seed for the activation.

Activated sludge processes are highly efficient, with the following typical characteristics for a conventional system. (Also, see table 8.14).

- BOD reduction   90 to 95%
- BOD loading   0.25 to 1 lbm/lbm MLSS
- maximum aeration chamber volume   5000 ft^3
- aeration chamber depth   10 to 15 feet
- aeration chamber width   20 ft
- air rate   1/2 to 2 ft^3/gal raw sewage
- minimum dissolved oxygen   2 mg/l
- biological mass density   1000 to 4000 mg/l
- sedimentation basin depth   15 ft
- sedimentation basin detention time   2 hours
- basin overflow rate   400 to 2000 gpd/ft^2 (1000 typical)
- % sludge returned   20 to 30%
- frequency of sludge transfer   once each hour
- activated sludge volume index   50 to 150
- weir loading   10,000 gpd/ft
- maximum tank volume   2500 ft^2

The *rate of oxygen transfer* (ROT) from the air to the mixed liquor during aeration is given by equation 8.42.
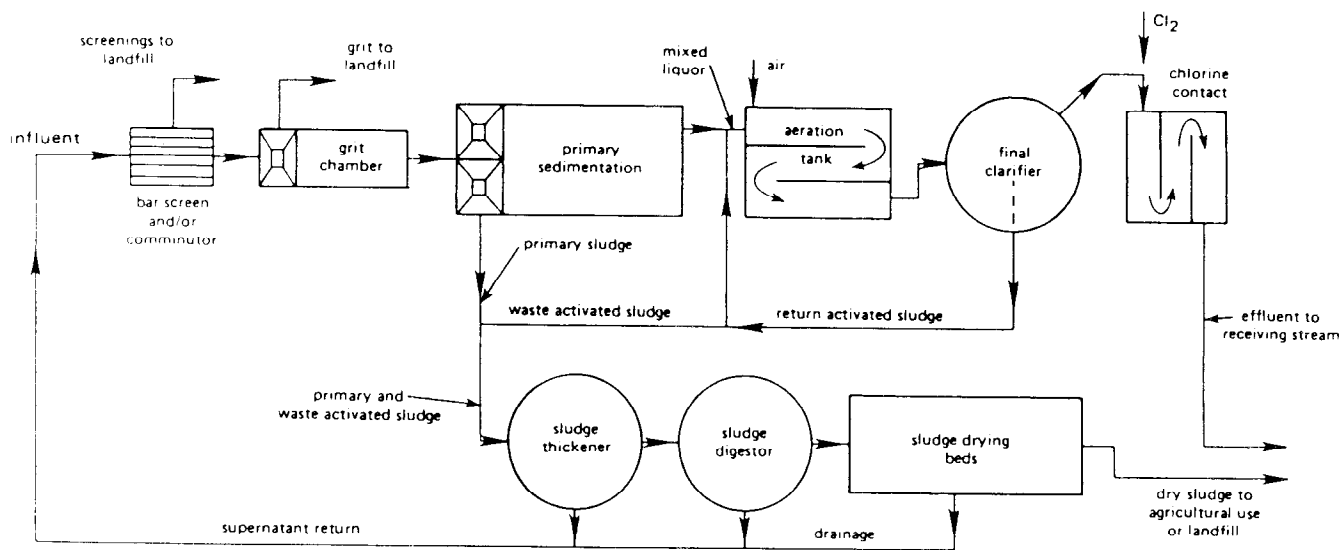
$$ROT = K_t D \qquad 8.42$$

Figure 8.14   A Typical Activated Sludge Plant