Table 4-26 Conventional Sewage Treatment Plant Design Factors

Preliminary Treatment

Racks

Area: 200% plus sanitary sewer; 300% plus combined sewer. Bar space: 1" to $1\frac{1}{4}$", dual channels.

Screens

Net submerged area: 2 ft^2 per mgd for sanitary sewer; 3 ft^2 per mgd for combined sewer. Slot opening $\frac{1}{8}$" min. Dual units, preceded by racks.

Grit Chamber

Sewage velocity: 1 fps mean, $\frac{1}{2}$ fps, min. Detention: 45 to 60 sec, floor 1 ft below outlet. Min. of 2 channels.

Skimming Tank

Air or mechanical agitation with or without chemicals. Detention: 20 min for grease removal, 5 to 15 min for aeration, 30 min for flocculation.

Comminutors

Duplicate or bypass, downstream from grit chamber.

Flow Basis

100 gal per capita plus industrial wastes. Usual to assume total flow reaches small plants in 16 hours.

Flow Equalization

Based on 24-hour plot to smooth out hydraulic and organic loading.

Chemical Treatment

For odor control, oxidation, corrosion control, neutralization.

Coagulation and Sedimentation Treatment

Sedimentation

Surface settling rates at peak flows: primary and intermediate set—tanks 1500 gpd/ft^2, final set—tanks 1200 gpd/ft^2 after trickling filters or rotating biological contactors, and for activated sludge for conventional, step aeration, contact stabilization, and the carbonaceous stage of separate-stage nitrification; following extended aeration 1000 gpd/ft^2; for physical-chemical treatment using lime: 1400 gpd/ft^2.

Weir rates: 10,000 gpd per linear foot for average flows to 1.0 mgd and up to 15,000 for larger flows.

Sludge hopper: 1 hor. to 1.7 vert.

Sludge pipe: 6 in./min.

Chemical Precipitation

Rapid mix, coagulation, sedimentation. Ferric chloride, ferrous sulfate, ferric sulfate, alum, lime, or a polymer.

Imhoff Tank

Detention period: 2 to $2\frac{1}{2}$ hours. Gas vent: 20 percent total area of tank min. Bottom slope: $1\frac{1}{2}$ vert. to 1 hor. Sludge compartment: 3 to 4 ft^3 per capita 18 in. below slot; 6 to 10 ft^3 per capita secondary treatment. Bottom slope: 1 to 1 or 2. Slot and overlap: 8 in. Sludge pipe: 8 in. min. under 6 ft head. Velocity: 1 fpm. Surface settling rate: 600 gpd/ft^2.

Tube and Inclined Plate Settlers

PVC or metal tubes, at 45 to 60 deg. from hor., 2 in. × 2 to 6 in., 4 ft long. May be installed in existing basin.

Note: Surface settling rate = gpd/ft^2 = $\frac{180 \times \text{tank depth in ft}}{\text{detention, hr}}$

[a] Anaerobic sludge digestion will require approximately 65 days at 55°F, 56 days at 60°, 42 days at 71°, 27 days at 86°, 24 days at 95°, 20 days at 113°. The optimum temperature is 86 to 95°F. Mixing of sludge can reduce digestion time up to 50 percent. In large plants, sludge is usually digested in two stages. Temperature of 140° causes caking on pipes.

[b] Gallons per acre per day = gpad

[c] Million gallons per acre per day = mgad

[d] For multimedia, see state standards.

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