**Section 370.710 Design Considerations**

a) Dimensions

The minimum length of flow from inlet to outlet should be 10 feet unless special provisions are made to prevent short circuiting. The sidewater depth for primary clarifiers shall be as shallow as practicable, but not less than 7 feet. Clarifiers following the activated sludge process shall have sidewater depths of at least 12 feet to provide adequate separation zone between the sludge blanket and the overflow weirs. Clarifiers following fixed film reactors shall have sidewater depth of at least 7 feet.

b) Surface Settling Rates (Overflow Rates)

The hydraulic design of settling tanks shall be based on the anticipated peak hourly flow.

1) Primary and Bypass Settling Tanks

A) Primary Settling

Some indication of BOD removals may be obtained by reference to Appendix E, Figure No. 2. The figure should not be used to design units which receive wastewaters which have BOD and total suspended solids concentrations which are substantially different from normal domestic sewage. The operating characteristics of such units should be established by appropriate field and laboratory tests. If activated sludge is wasted to the primary settling unit, then the design surface settling rate shall not exceed 1,000 gallons per day per square foot based on design peak hourly flow, including all flows to the unit. Refer to subsection (b)(3) and Section 370.820.

B) Combined Sewer Overflow and Bypass Settling

The maximum surface settling rate shall not exceed 1,800 gallons per day per square foot based on peak hourly flow. Minimum liquid depth shall not be less than 10 feet. Minimum detention shall not be less than one hour. The minimum length of flow from inlet baffle to outlet should be 10 feet, unless special provisions are made to prevent short-circuiting.

2) Intermediate Settling Tanks

Surface settling rates for intermediate settling tanks following series units of fixed film reactor processes should not exceed 1500 gallons per day per square foot based on design peak hourly flow. Surface settling rates for intermediate settling tanks following the activated sludge process shall not exceed 1000 gallons per day per square foot based on design peak hourly flow.

3) Final Settling Tanks

Settling tests should be conducted wherever a pilot study of biological treatment is warranted by unusual waste characteristics or treatment requirements. Testing shall be done where proposed loadings go beyond the limits set forth in subsections (b)(3)(A) and (b)(3)(B).

A) Final Settling Tanks - Fixed Film Biological Reactors

Surface settling rates for settling tanks following trickling filters or rotating biological contactors shall not exceed 1000 gallons per day per square foot based on design peak hourly flow.

B) Final Settling Tanks - Activated Sludge

i) Multiple units capable of independent operation shall be provided at all plants. To perform properly while producing a concentrated return flow, activated sludge settling tanks must be designed to meet thickening as well as solids separation requirements.

ii) Since the rate of recirculation of return sludge is quite high in activated sludge processes, surface settling rate and weir overflow rate should be adjusted for the various processes to minimize the problems with sludge loadings, density currents, inlet hydraulic turbulence, and occasional poor sludge settleability.

iii) The hydraulic loadings shall not exceed 1000 gallons per day per square foot based on design peak hourly flow, and 800 gallons per day per square foot based on peak hourly flow for separate activated sludge nitrification stage. Refer to Section 370.1210(c)(4).

iv) The solids loading shall not exceed 50 pounds solids per day per square foot at the design peak hourly rate.

v) Flow equalization is recommended where the peak hourly load exceeds 300% of the design average load.

C) Rectangular Units

Rectangular final settling tanks following the activated sludge process frequently exhibit poor solids separation characteristics and should therefore be avoided. If land availability or other local conditions mandate the use of rectangular final clarifiers following the activated sludge process, the following design modifications shall be made:

i) Within practicable limits, length shall be approximately equal to the width.

ii) Excess weir length shall be provided.

iii) Baffles shall be provided to interrupt longitudinal density currents.

iv) Weir placement shall be adjustable, so as to allow optimization of the upflow takeoff points.

c) Inlet Structures

Inlets and inlet baffling should be designed to dissipate the inlet velocity, to distribute the flow equally both horizontally and vertically and to prevent short circuiting. Channels should be designed to maintain a velocity of at least one foot per second at one-half the design flow. Corner pockets and dead ends should be eliminated and corner fillets or channeling used where necessary. Provisions shall be made for prevention or removal of floating materials in inlet structures.

d) Weirs

1) General

Overflow weirs shall be readily adjustable over the life of the structure to correct for differential settlement of the tank.

2) Location

Overflow weirs shall be located to optimize actual hydraulic detention time, and minimize short circuiting.

3) Design Rates

Weir loadings shall not exceed 20,000 gallons per day per lineal foot based on design peak hourly flows for plants having design average flows of 1.0 mgd or less. Overflow rates shall not exceed 30,000 gallons per day per lineal foot based on design peak hourly flow for plants having design average flow of greater than 1.0 mgd. Higher weir overflow rates may be allowed for bypass settling tanks. If pumping is required, weir loadings should be related to pump delivery rates to avoid short circuiting. Refer to Section 370.410(c)(8).

4) Weir Troughs

Weir troughs shall be designed to prevent submergence at maximum design flow, and to maintain a velocity of at least one foot per second at one-half design average flow.

e) Submerged Surfaces

The tops of troughs, beams, and similar submerged construction elements shall have a minimum slope of 1.4 vertical to 1 horizontal; the underside of such elements should have a slope of 1 to 1 to prevent the accumulation of scum and solids.

f) Unit Dewatering

Unit dewatering featuring shall conform to the provisions outlined in Section 370.530. The bypass design should also provide for redistribution of the plant flow to the remaining units.

g) Freeboard

Walls of settling tanks shall extend at least 6 inches above the surrounding ground surface and shall provide not less than 12 inches freeboard. Additional freeboard or the use of wind screens is recommended where larger settling tanks are subject to high velocity wind currents that would cause tank surface waves and inhibit effective scum removal.

(Source: Amended at 21 Ill. Reg. 12444, effective August 28, 1997)