Example Problem 3.3 SI
Final Clarifier

Batch settling tests have been performed using an acclimated activated sludge to give the data in Table 3.4.

Table 3.4. Concentrations, Settling Velocities, and Solids Flux for Various Tests

Test no.	C (mg/ℓ)	V (m/h)	$G = CV$ (kg/h-m^2)
1	12460	0.125	1.558
2	9930	0.249	2.473
3	7450	0.465	3.464
4	5220	1.000	5.220
5	3140	2.941	9.235
6	1580	4.180	6.604

The design mixed liquor flow to the final clarifier is 160 ℓ/s, the MLSS is 2500 mg/ℓ, and the underflow concentration is 12,000 mg/ℓ. Determine the diameter of the final clarifier.

Solution

The settling curve showing the settling velocity versus solids concentration is shown in Figure 3.23. From the previous data, the flux curve showing the solids flux versus solids concentration is shown in Figure 3.24. A tangent to the curve drawn from C_u = 12,000 mg/ℓ gives a G_L value of 8.90 kg/h-m^2. Using a scale-up factor of 1.5 gives G_L = 8.90/1.5 or 5.93 kg/h-m^2. The rate at which the solids settle, M_t, is equal to Q_0C_0, or M_t = (160 ℓ/s)(60 s/min)(60 min/h)(2.50 g/ℓ)(kg/1000 g) = 1440 kg/h. From Eq. (3.42) the area required is M_t/G_L,

or A = (1440 kg/h)(h-m^2/5.93 kg) = 242.8 m^2. The required diameter is given by

$$D = \left[\frac{4}{\pi}(242.8\ \text{m}^2)\right]^{1/2}$$

$$= \underline{17.58\ \text{m}}$$

Figure 3.23. Example Problem 3.3 SI

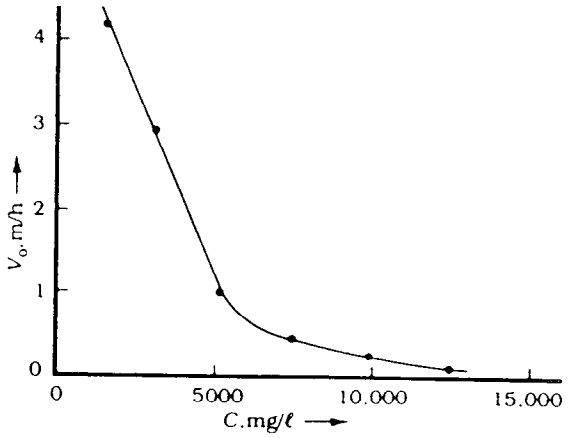
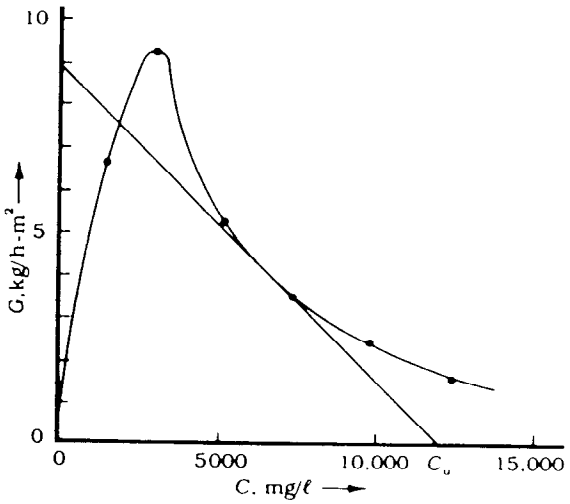


Figure 3.24. Example Problem 3.3 SI



SET - 5