Primary Clarifier Sizing, Scour Velocity and BOD and TSS Removal

Rectangular primary clarifier area, length, detention and overflow rate at average and peak flow, Camp's scour velocity and BOD and TSS removal from t/(a + bt).

Input parameters

Unit system: SI

Parameter	Value	Unit
Average flow	4,000.0	m³/d
Peak flow	10,000	m³/d
Overflow rate at average flow	35.000	m/d
Number of tanks	1.0000	
Tank width	4.0000	m
Side water depth	3.5000	m
Cohesion constant (0.04 sand, 0.06 sticky)	0.050000	
Particle specific gravity	1.2000	
Particle diameter	0.10000	mm
Darcy friction factor	0.030000	

Calculated results

Parameter	Value	Unit
Required surface area (all tanks)	114.29	m²
Tank length	28.571	m
Detention at average flow	2.4000	h
Detention at peak flow	0.96000	h
Overflow rate at peak flow	87.500	m/d
Scour velocity	0.051138	m/s
Horizontal velocity at peak flow	0.008267	m/s
BOD removal at average flow	36.364	%
TSS removal at average flow	58.394	%
BOD removal at peak flow	25.806	%
TSS removal at peak flow	45.845	%

Notes for this case

- Removal constants at 20 °C: BOD a = 0.018 h, b = 0.020; TSS a = 0.0075 h, b = 0.014 (Crites and Tchobanoglous). The typical overflow rates are 30-50 m³/m²·d at average and 80-120 at peak flow.

Formula and method

$$A = \frac{Q_{avg}}{OR}, \quad t = \frac{Ah}{Q}, \quad v_H = \left[\frac{8k(s-1)gd}{f}\right]^{1/2}, \quad R = \frac{t}{a+bt}$$

Variables

Q_{avg}	Average flow	m³/s

Q_{peak}	Peak flow	m³/s
OR	Overflow rate at average flow	m/s
n	Number of tanks	-
W	Tank width	m
h	Side water depth	m
k	Cohesion constant (0.04 sand, 0.06 sticky)	-
s	Particle specific gravity	-
d	Particle diameter	m
f	Darcy friction factor	-
A	Required surface area (all tanks)	m²
L	Tank length	m
t_{avg}	Detention at average flow	s
t_{peak}	Detention at peak flow	s
OR_p	Overflow rate at peak flow	m/s
v_H	Scour velocity	m/s
v_p	Horizontal velocity at peak flow	m/s
R_{BOD}	BOD removal at average flow	-
R_{TSS}	TSS removal at average flow	-
$R_{BOD,p}$	BOD removal at peak flow	-
$R_{TSS,p}$	TSS removal at peak flow	-

Method and standards

Primary sedimentation design.

Assumptions and limits

- Empirical removal curves at 20 °C for typical municipal wastewater.

Report details

Report reference	FCC-M348-S0KJ (the same inputs always give the same reference)
Generated	23 November 2026, 17:50 UTC
Calculator	Primary Clarifier Sizing, Scour Velocity and BOD and TSS Removal
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/environmental/wastewater/primary-clarifier-design-removal

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.