Secondary Clarifier: Surface Overflow and Solids Loading

Clarifier area needed by surface overflow rate and by solids loading rate for an activated sludge plant, with the governing area, diameter and the actual rates.

Method: Metcalf & Eddy; Wastewater Engineering: Treatment and Resource Recovery; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Average influent flow	10,000	m³/d
Peak flow factor	2.5000	
Return sludge ratio	0.50000	
MLSS	3,500.0	mg/L
Maximum surface overflow rate at peak	1.6667	m/h
Maximum solids loading rate at peak	9.0000	kg/(m²·h)
Number of clarifiers	2.0000	

Calculated results

Parameter	Value	Unit
Area by overflow rate	625.00	m²
Area by solids loading	486.11	m²
Governing area	625.00	m²
Diameter of each clarifier	19.947	m
Overflow rate at average flow	0.66667	m/h
Solids loading at average flow	3.5000	kg/(m²·h)

Notes for this case

• Typical limits for activated sludge: overflow 16–28 m³/(m²·d) average and 40–64 at peak; solids loading 4–6 kg/(m²·h) average and up to 8–10 at peak (Metcalf & Eddy). A state-point analysis with settling data is better than fixed limits.

Formula and method

$$A_{SOR} = \frac{Q_p}{SOR_{max}}, \quad A_{SLR} = \frac{(Q_p + RQ)X}{SLR_{max}}, \quad A = \max(A_{SOR}, A_{SLR})$$

Variables

Q	Average influent flow	m³/s
PF	Peak flow factor	-
R	Return sludge ratio	-
X	MLSS	kg/m³
SOR_{max}	Maximum surface overflow rate at peak	m/s
SLR_{max}	Maximum solids loading rate at peak	kg/(m²·s)
n	Number of clarifiers	-
A_{SOR}	Area by overflow rate	m²
A_{SLR}	Area by solids loading	m²
A	Governing area	m²
D	Diameter of each clarifier	m
SOR_{avg}	Overflow rate at average flow	m/s

SLR_{avg}	Solids loading at average flow	kg/(m²·s)

Method and standards

Overflow and solids loading definitions.

Assumptions and limits

- Circular clarifiers of equal size; the number of clarifiers is a whole number (a fractional entry is rounded, with a note).

References

• Metcalf & Eddy
• Wastewater Engineering: Treatment and Resource Recovery
• 5th ed. (McGraw-Hill, 2014)
• ch. 8 (secondary clarifier overflow and solids loading rates)

Report details

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Release checks	2 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/secondary-clarifier-solids-flux

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.