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Lecture 4

Design exercise

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Group design exercise

A mixed development area in a water catchment area is to be developed across a river system with 10,000 unit residential, 200 shop lots, 5 schools and 50 units of SMI. The SMI types are shown in Table. The intake for raw water treatment plant is located 2 km downstream of the river in the catchment (Class II, average $Q_{\text{dry}} = 100 \text{ m}^3/\text{min}$, average width = 3 m, depth = 1 m).

Task:

1. Provide various frameworks available for sustainable wastewater management system
2. Select the most appropriate framework in order to protect the quality at the water intake point
3. Provide a feasibility design for the wastewater treatment plant (s) (only)
4. Estimate the cost the system

Types	No.	Effluent quality	Average flow rate
Food processing	20	COD = 3000 mg/l	200 m ³ /d each
Tannery	5	COD = 40,000 mg/l, color > 2000 NTU	50 m ³ /d each
Beverage	10	COD = 5000 mg/l	400 m ³ /d each
Slaughter house	5	COD = 10,000 mg/l, oil & grease > 1000	300 m ³ /day each
Mechanical workshop	10	Scheduled wastes	<50 m ³ /d each

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Activated sludge: Design parameters (1)

Process Modification	θ_c, d	F/M lb BOD ₅ /lb MLVSS.d	Volumetric loading rate, lb BOD ₅ / 10 ³ ft ³ .d	MLSS,mg/l	V/Q, h	Q _r /Q
Conventional plug flow	3-15	0.2-0.6	20-40	1000-3000	4-8	0.25-0.75
Complete mix	0.75-15	0.2-1.0	50-120	800-6500	3.5	0.25-1.0
Step feed	3-15	0.2-0.5	40-60	1500-3500	3-5	0.25-0.75
Single-stage nitrification	8-20	0.10-0.20 (0.02-0.15)*	5-20	1500-3500	6-15	0.50-1.50
Separate stage nitrification	15-100	0.05-0.20 (0.04-0.15)*	3-9	1500-3500	3-6	0.50-2.00

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Activated sludge: Design parameters (2)

Process Modification	θ_c, d	F/M lb BOD ₅ /lb MLVSS.d	Volumetric loading rate, lb BOD ₅ / 10 ³ ft ³ .d	MLSS,mg/l	V/Q, h	Q _r /Q
Contact Stabilization	5-15	0.2-0.6	60-75	(1000-3000)' (4000-9000)''	(0.5-1.0)' (3-6)''	0.5-1.50
Extended Aeration	20-40	0.04-0.10	5-15	2000-8000	18-36	0.5-1.50
Oxidation Ditch	3-15	0.04-0.10	5-15	2000-8000	8-36	0.5-1.50
Intermittent decanted extended aeration	8-20	0.04-0.08	5-15	2000-8000	20-40	N/A
Sequencing Batch Reactor	15-100	0.04-0.10	5-15	2000-8000	12-50	N/A

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