Optimizing Wastewater Treatment in Industrial Port Areas: A cost-saving approach to capacity and efficiency enhancement

Department of Environmental Engineering, Faculty of Engineering, Khonkaen University
Author : Punnatorn Greepala, Thatchakrit Thipphamon, Khomchan Wilaisilp, Tanatchai Phononsa
Advisor : Dr.Tippawan Singhopon

BACKGROUND

Wastewater is water that has been contaminated by human use, containing various waste products and pollutants. This contaminated water poses significant environmental risks, introducing toxic substances into local ecosystems and threatening the health of nearby communities.

Industrial facilities are major sources of wastewater pollution. However, these environmental impacts can be minimized through the implementation of wastewater treatment plants, which process contaminated water before it is discharged into natural water sources.

The wastewater treatment plant at the Map Ta Phut Industrial Port Area is currently facing operational challenges due to a reduced inflow of influent water. To address this issue, plans are underway to improve and redesign the plant to ensure it can operate efficiently despite the current lower water levels.

PROBLEM DEFINITION

Outdated System: The current infrastructure is based on legacy technology, which is no longer efficient or competitive.

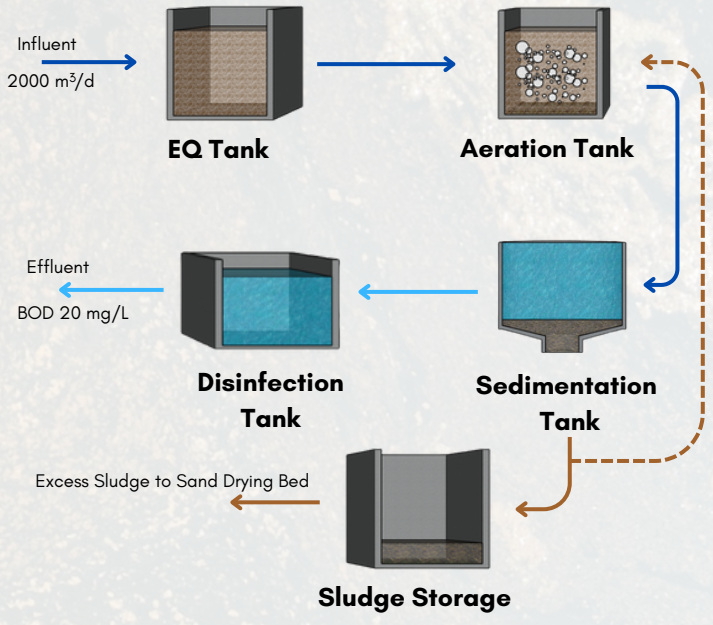
High Maintenance Costs: Ongoing expenses associated with the existing system are significantly elevated, impacting overall budget allocations.

Minimal Compliance with Design Criteria: The system demonstrates insufficient adherence to the latest design standards and performance benchmarks.

OBJECTIVES

- To evaluate and redesign the central wastewater treatment systems at the Map Ta Phut industrial port area
- To identify innovative design techniques that enhance wastewater treatment performance.

ESTABLISHED SYSTEM



DESIGN CRITERIA

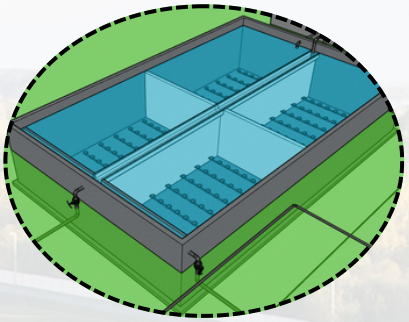
	SRT (d)	F/M (kgBOD/mgMLVSS)	OLR (kg BOD/m³-d)	MLVSS (mg/L)	V/Q or HRT (h)	QR/Q	%BOD removal
Conventional	5-15	0.2 - 0.4	0.3 - 0.6	1,500 - 3,000	4-8	0.25 - 0.75	85 - 95
Complete mix	5-15	0.2 - 0.6	0.8 - 1.9	2,500 - 4,000	3-5	0.25 - 1.0	85 - 95
Contact Stabilization	5-15	0.2 - 0.6	0.9 - 1.2	CT = 1,000 - 3,000, ST = 4,000 - 10,000	3-5	0.25 - 1.50	80 - 90
Extended aeration	20 - 30	0.05 - 0.15	0.1 - 0.4	3,000 - 6,000	18-36	0.5 - 1.5	75 - 95
High-rate aeration	5-10	0.4 - 1.5	1.6 - 16	4,000 - 10,000	2-4	1.0 - 5.0	75 - 90
Oxidation Ditch	10-30	0.05 - 0.3	0.1 - 0.5	3,000 - 6,000	8-36	0.75 - 1.5	75 - 95
Sequential Batch	8-20	0.05 - 0.3	0.1 - 0.3	1,500 - 5,000	1-3	0.25 - 0.5	85 - 95

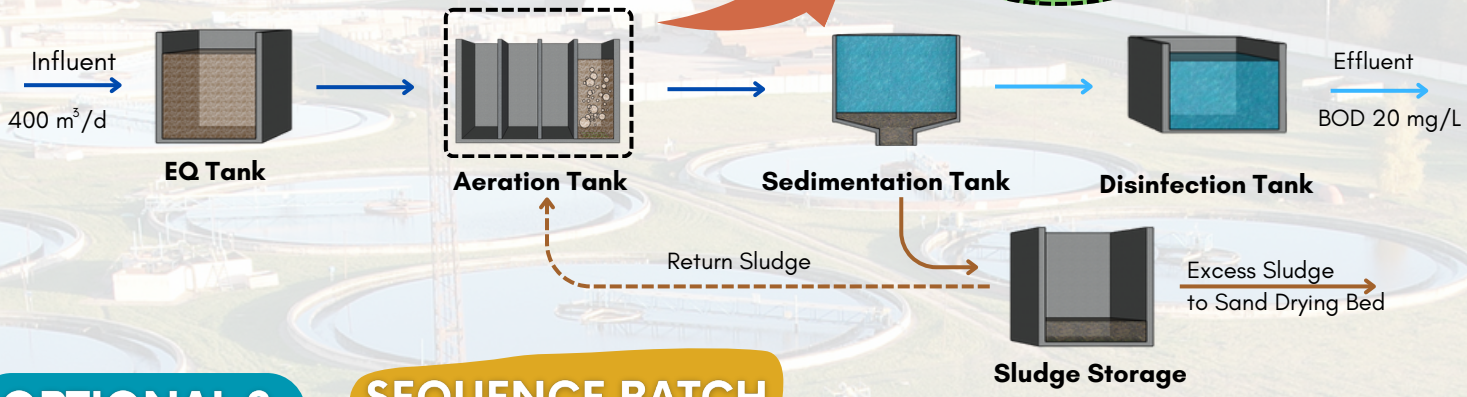
- SRT (Sludge Retention Time)
- F/M (Food-to-Microorganism Ratio)
- OLR (Organic Loading Rate)
- MLVSS (Mixed Liquor Volatile Suspended Solids)
- V/Q or HRT (Hydraulic Retention Time)
- QR/Q (Return Sludge Ratio)
- %BOD Removal

OPTIONAL 1

4 PARTITION AERATION TANK

Due to the low incoming wastewater flow, the aeration tank has been divided into four partitions. Only one section will be operational, while the remaining sections will serve as backup tanks to handle excess inflow when needed.

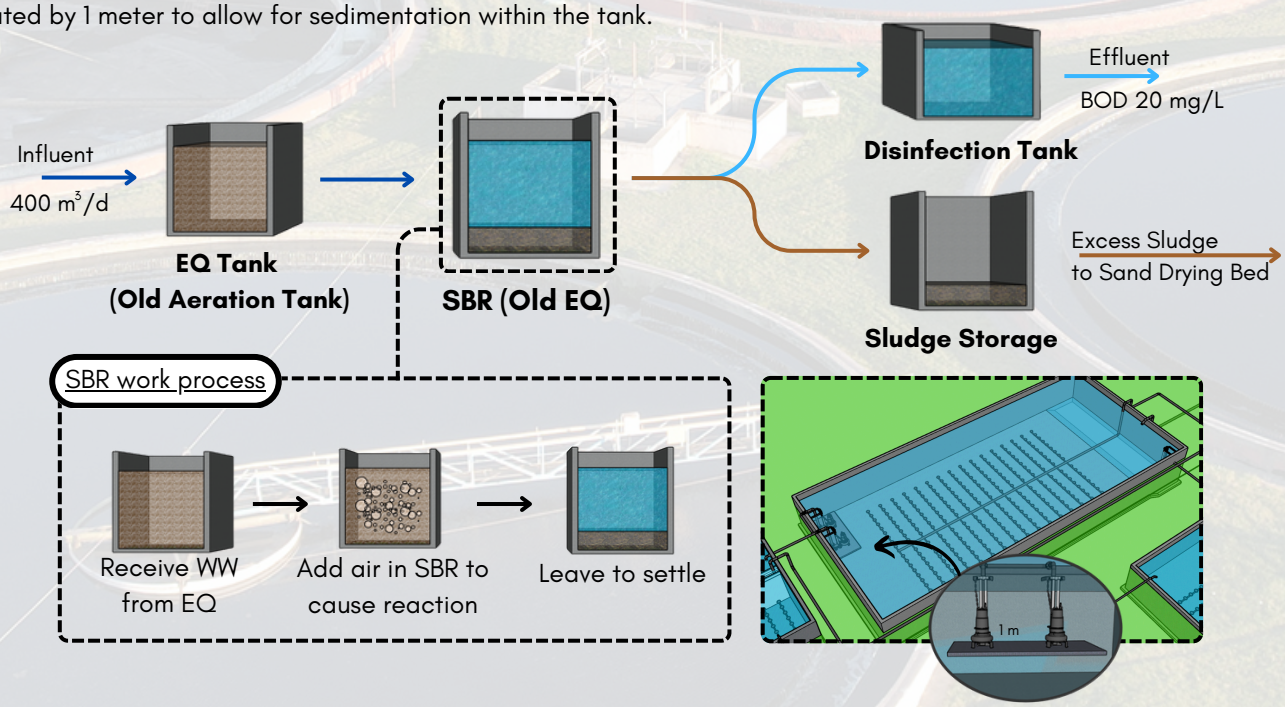




OPTIONAL 2

SEQUENCE BATCH REACTOR

The system is being converted from an Activated Sludge Process to a Sequencing Batch Reactor (SBR) to improve flow rate control and reduce operational costs. The existing Equalization tank will be repurposed as the SBR tank, while the current Aeration tank will serve as the new Equalization tank. Additionally, the SBR tank's water pump will be elevated by 1 meter to allow for sedimentation within the tank.



COST OF CONSTRUCTION AND OPERATION

No.	List	Cost (Baht)	Electricity bill (Baht/day)
1	Previous Treatment System	1,420,250	131.12
2	4 Partition Aeration Tank	896,879	44.77
3	Sequence Batch Reactor	789,113	40.14

CONCLUSION

The project aims to improve and optimize the wastewater treatment system in the selected industrial estate. The focus is on designing a treatment system for wastewater from office buildings, maintenance facilities, cafeterias, and public areas to ensure compliance with legal standards. The project also includes cost estimation for future system improvements.