BASIS OF DESIGN

Client: - RIO Tinto

Project: - Rhodes Ridge FEED

Project Type: - W-RBC068

Project Number: - 3025P01

Version	Date	Prepared	Approved	Description
A	24/11/2023	[redacted]		Issued for review

1.Wastewater Influent Specifications

Details		Units	Parameter
Influent Quality	Water source	-	Domestic strength sewage
	Number of Person	P	220
	Wastewater Rate	L/P/D	310
	Daily Flow	m^3/ day	68.2
	Hourly Flow	m^3/ hr	2.84
	Peak flow[1]	m^3/ hr	3.1
	Temperature[3]	°C	15~32
	BOD_5	mg/l	<300
	TSS	mg/l	<300
	pH	pH units	6.5~8.5
	TN	mg/l	< 80
	TP	mg/l	<15
	FOG[3]	mg/l	<20

2.Wastewater Effluent Specifications

Details		Units	Parameter
Treated Effluent Quality	Exposure risk level	-	Low (optional upgrade to Medium)
	Daily Flow	m^3/ day	68.2
	Hourly Flow	m^3/ hr	2.84
	BOD	mg/l	<20
	TSS	mg/l	<30
	pH	pH units	6.5~8.5
	TN	mg/l	< 40
	TP	mg/l	<10
	E Coli	cfu/100mL	<1,000
	Free chlorine	mg/l	0.2~2.0
Spray Field	Flow	m^3/day	68.2
	Max. nutrient loading	kg/ha/year	Not considered
	Area[3]	m^2	20772
	Hydraulic loading	mm/day	3.3
	Sprinklers	-	30 x 15m spray radius, impact type, on 0.9 m risers

3.System overview

This wastewater treatment system is based on Rotating Biological Contactor (RBC) technology follows a systematic process to treat incoming wastewater. Initially, raw wastewater undergoes screening and optional primary settling to remove debris and heavy particles. The core of the system consists of RBC units with rotating discs or media coated with microorganisms, facilitating the degradation of organic matter and contaminants as the discs rotate through the wastewater. Aeration maintains dissolved oxygen levels, while mixing promotes contact between microorganisms and wastewater. Treated effluent proceeds to secondary settling, where clarified water is separated from settled activated sludge. Further treatment, such as disinfection, ensures effluent quality compliance. Excess sludge undergoes additional processing, and the final treated water is either discharged or reused. Monitoring, control systems, and regulatory adherence ensure effective and environmentally compliant operation)

3.1.System design parameters

3.1.1. Primary subsystems

In the subsequent sections, you will find a concise explanation of the main subsystems and assemblies that make up this system. Additionally, it outlines the sequential order in which feedwater passes through the subsystems during the processing phase. The details concerning the individual components utilised within these subsystems have been generated and provided by third-party vendors responsible for manufacturing the said components.

3.2.Process Description

3.2.1. Inlet works facility (pumpstation)

Raw sewage is fed to the WWTP from a pump station sized to absorb the incoming flows. The pumpstation is fitted with grinder pumps operating on duty/standby with control panel, guide rails and an external valve pit.

3.2.2. Balance tank

The raw sewage is then pumped from the pumpstation to the balance tank via a bar screen which screens any incoming solids. The balance tank provides suitable retention to cater for variations in the diurnal flows.

3.2.3. Sedimentation Tank

From the balance tank the screened influent is transferred to the Sedimentation Tank by the balance pump which then overflows to the MLR tank by gravity. This tank removes the remaining inorganic matter and digests the solids from the influent.

3.2.4. MLR Tank

MLR tank also known as the anoxic tank receives screened sewage from the primary tank and mixed liquor from the break tank. The tank allows nitrate-specific bacteria to use nitrate (NO3) as an oxygen source and a nutrient in a process called de-nitrification. De-nitrification occurs when oxygen levels are depleted, and nitrate becomes the primary oxygen source for microorganisms.

3.2.5. Rotating Biological Contactor

The wastewater is then fed by gravity from the MLR Tank via flow divider to the Rotating Biological Contactors (RBC) units, which are known as one of the reliable fixed film technologies, where biological treatment is conducted. Coagulant is introduced at a fixed rate prior to the RBCs to aid reduction of Total Phosphorous and improve settling in the clarifier.

The RBCs are rotated slowly through a direct drive reduction gearbox and is arranged so that around 40% proportion of its surface area is submerged in the effluent at any time. As the RBC rotates, the surface of the media is subjected alternately to sewage and air, encouraging an aerobic, biologically active film of micro-organisms (biomass) to become established on each side of the media sheets. The system includes plastic disks attached to a chrome plated steel mill rotating at low speeds such as 3-4 rpm with 40% of it being immersed in the wastewater at any time. This biologically active film grows in size, is self-regulating and oxides the pollutants in the sewage. The micro-organisms use the polluting material (measured as BOD) as a substrate (food) and as they do so, multiply in number, maintaining a specific 1 – 2.5 mm biomass thickness to ensure optimum process efficiency in about 8 -14 days. Material from the whole stages of the RBC is kept in suspension via rotation and carried forward into the break tank.

3.2.6. Break Tank

Mixed Liquor from the RBC's then is fed into the break tank by means of gravity. To improve nutrient reduction a portion of the mixed liquor from the break tank is returned to the MLR Tank for further treatment whilst the remainder is fed forward to the lamella clarifier for solids removal.

3.2.7. Lamella Clarifier

Mixed Liquor enters the lamella clarifiers by means of gravity from the break tank. The lamella clarifiers remove heavier solids by means of settlement and separation from the liquid phase. It is designed to have a large surface area with adequate retention time. The hopper bottom channels the sediment to the centre of the tank and is returned via the RAS pump to Primary Tank. Clear liquor from the top of the Clarifier then overflows by gravity into the lift tank.

3.2.8. Lift Tank

Gravity conveys clarified water from the Lamella clarifiers to the lift tank, positioned just below the clarifier outlets. Within this tank, you will find both duty and standby pumps responsible for transferring the clarified water to the irrigation tank for the next stage of processing.

3.2.9. Irrigation Tanks

Within the irrigation tanks, the treated effluent undergoes chlorination directly within a recirculation line before being discharged. After chlorination, this treated water is pumped to the irrigation field using the irrigation pumps. To monitor the volume of treated water distributed to the irrigation field, a flowmeter has been installed.

3.2.10. Spray field

An effluent sprayfield is a land-based wastewater treatment approach where treated effluent from a wastewater treatment plant is distributed over a designated area of land. This method serves as a final stage of treatment, relying on natural processes within the soil to further purify the effluent. The effluent is evenly spread over the field through a network of pipes or channels, allowing it to percolate through the soil. As it moves through the soil, contaminants are broken down through physical, chemical, and biological processes. This approach offers benefits such as nutrient uptake by vegetation, water reuse for irrigation, and minimal energy consumption. However, successful implementation necessitates careful consideration of factors such as soil characteristics, hydraulic design, plant selection, seasonal variations, regulatory compliance, and ongoing maintenance to ensure effective treatment and environmental protection.

3.2.11. Sludge Handling System (Geo Bags)

The Waste Activated Sludge (WAS) pump automatically transferred sludge from the primary tank to the GEO bags There are two bags in total with one bag been filled whilst the other one is awaiting filling or drying out prior to disposal.