Wallcliffe House

Wastewater Treatment Plant – Basis of Design

Wallcliffe House Pty Ltd

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→ **The Power of Commitment**

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1. Introduction

Wallcliffe House Pty Ltd (the proponent) is proposing to redevelop Lot 101 Wallcliffe Road, Margaret River, for tourism purposes. The site is approximately 5.2 hectares in area, and is located within the Shire of Augusta Margaret River, about 8 km southwest of the Margaret River townsite. The site is bordered by the Margaret River and its associated riparian vegetation to the northwest, a nature reserve to the south, and existing tourism land uses and residences to the east.

At present, Water Corporation's nearest wastewater scheme (in Gnarabup) does not have sufficient capacity to accommodate additional flows from the Wallcliffe House development, and it would be cost prohibitive to pump wastewater to the Water Corporation's more remote Margaret River scheme. It is therefore proposed to install an onsite wastewater treatment and disposal system to service the proposed Wallcliffe House (WH) development.

Wastewater from each new building will be collected through gravity property sewers grading to pump stations, which will pump the wastewater to a single wastewater treatment facility near the Site entrance. The wastewater treatment plant (WWTP) shall be designed to achieve a high level of treatment suitable for on-lot disposal via a compact under-ground infiltration system.

The WWTP will comprise a flow equalisation tank, a Membrane Bioreactor (MBR) type prefabricated package plant, Treated wastewater storage tank and TunnelWell Leach Drains. Nitrogen reduction will be achieved via biological nitrification and denitrification processes, and phosphorous reduction will be achieved by chemical dosing and solids removal via membrane filtration, all within the MBR. The treated wastewater will be stored within the Treated Wastewater storage tank before being discharged to the TunnelWell Leach Drains, from which it will infiltrate into the underlying highly permeable sands and limestone.

The onsite wastewater system must be capable of managing the treated wastewater within the site, with no adverse impacts on the receiving environment including Margaret River which is more than 100m from the proposed site of the TunnelWell Leach Drains. It must also function within a constrained space and be managed in the context of ongoing operations of a Luxury Hotel development.

GHD Pty Ltd (GHD) has been engaged by Wallcliffe House Pty Ltd (WH) to develop performance specifications (with associated approvals documentation) and provide engineering services to support definition and delivery of the proposed WWTP to be installed as part of the Wallcliffe House development project in Margaret River.

1.1 Background

The site includes one of the original farms and homesteads constructed by the Bussell family, known as Wallcliffe House. The buildings, the construction of which commenced in 1858, comprise several limestone and ancillary buildings, as well as extensive cultivated gardens and grounds. Unfortunately, the buildings suffered significant damage from a bushfire in 2011. While they are no longer in use, the cultivated gardens and grounds around the buildings continue to be well-maintained.

The site currently has no connection to the Margaret River municipal sewer network, which is operated by Water Corporation. As such, prior to the bushfire the site was served by on-site domestic-scale treatment and land disposal systems. Since the fire these systems have been decommissioned and are no longer operational.

1.2 Purpose of this Report

The overall purpose of the BoD is to identify, define and agree all project inputs, drivers and requirements as early as possible in the project. This ensures all subsequent design work is delivered on a firm foundation of understanding.

To this end, the questions any BoD seeks to answer include:

– Has the current situation and project objectives been understood correctly?
– Have future external constraints been identified and understood correctly?
– Have current and future user, operator, maintainer, and customer requirements been identified and understood correctly?

– Have future external constraints (such as licence conditions and future potential hotel activities) been understood correctly?
– What are the key criteria for stakeholders? What ranking would these factors have? (i.e. CAPEX v OPEX, footprint)

This Basis of Design (BOD) and concept design for this project were initially centred around the use of Fuji Clean bio reactors for biological treatment, followed by a separate ceramic membrane polishing plant and associated sludge dewatering facility. However, after early vendor engagement the project design has since been revised to incorporate a Kubota Membrane Bioreactor (MBR) system (April 2025). The MBR system integrates biological treatment, nutrient removal, and polishing within a single unit, and includes internal sludge storage. This document has been updated to reflect these changes.

1.3 Scope

GHD has been appointed to act as the main contact for the development of the WWTP on site. This involves creating a performance-based procurement specification for the WWTP and gaining approval from the relevant authorities. Additionally, GHD will provide ongoing technical advice and supervise contractors on behalf of WH as needed. A summary of GHD scope of services for this project includes the following:

– Design Stage: Establish engineering design criteria, prepare detailed procurement specifications, and create associated drawings and documentation to describe the treatment plant requirements.
– Interdisciplinary Coordination: Provide continuous technical input, coordinate across various disciplines, and offer ad hoc advice to ensure project alignment and integration.
– Procurement Support: Prepare tender documents, manage the tender process, evaluate submissions, and recommend suitable contractors for the project.
– Regulatory Compliance: Ensure all specifications and activities comply with relevant authorities' regulations and standards to secure necessary approvals.
– Construction Phase Support: GHD offers technical supervision and oversight during the construction phase, ensuring adherence to specifications and quality standards up to commissioning and handover.
– Technical Supervision: GHD is available to provide ongoing support and supervision of the contractor's technical performance on behalf of WH.

The battery limits for the WWTP are as follows:

– The discharge of the wastewater rising main into the WWTP Equalisation/Feed Tank forms the upstream battery limit of these Works. The most downstream works are the TunnelWell Leach Drains, to be installed underneath the Estate Management Area, adjacent to the Gate House as well as in the Arrivals paddock near the staff parking area.
– For power, it includes all works from the upstream side of the WWTP System electrical switchboard.
– For communications and alarm systems, it includes all works from the upstream side of the WWTP communication switchboard.
– Buildings, vehicular access, footpaths, etc. are not within the treatment plant scope.

The battery limits for the WWTP scope are illustrated by the red shading in Figure 1.

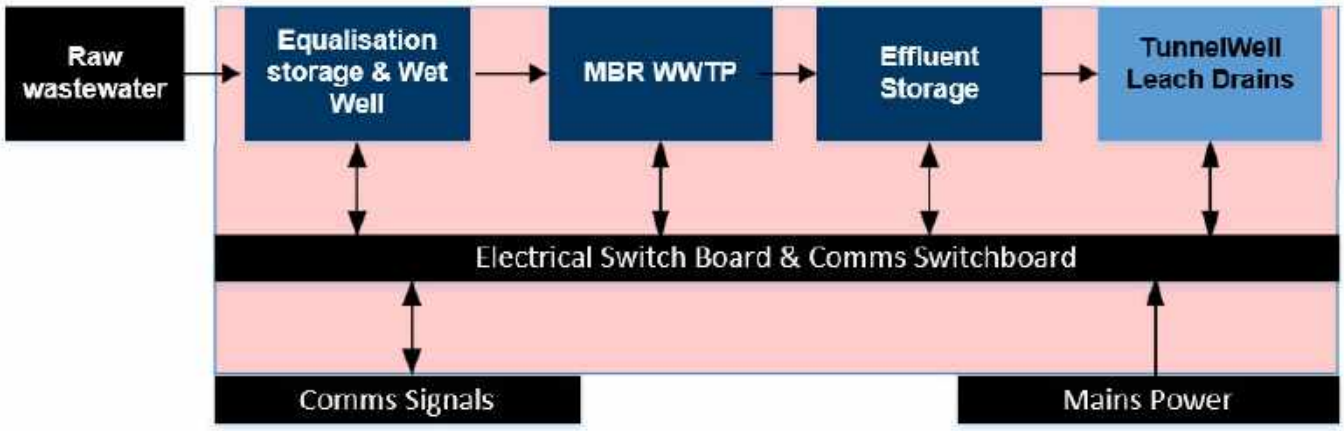

Figure 1 - Battery limits for the WWTP scope

1.4 Limitations

This report: has been prepared by GHD for Wallcliffe House Pty Ltd and may only be used and relied on by Wallcliffe House Pty Ltd for the purpose agreed between GHD and Wallcliffe House Pty Ltd as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Wallcliffe House Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

1.5 Assumptions

The following assumptions apply to the preparation of this scope of services:

– Only a high-level conceptual design, including typical acceptable equipment selection is required to inform the preparation of the performance-based specification.
– WH will engage an appropriately qualified wastewater treatment plant Contractor, which will make final equipment selections and develop connection details, piping and valve works, power, instrumentation and control, and communication systems. The Contractor will also undertake clash detection with other relevant site works.
– GHD will review the equipment and treatment systems proposed by the Contractor, against the Specification.
– Iterative effort may be needed with the Contractor to ensure full compliance with the Specification.
– The WWTP design scope excludes the wastewater collection system upstream of the plant's receivals tank, which will be designed by others.
– Civil design work or geotechnical review is not included, however, a general layout plan for the WWTP will be prepared, to demonstrate site fit and accessibility.
– WH will be responsible from administering contract documents and engage Contractors as required.

2. Wastewater Parameters

2.1 General Requirements

Table 1 details the estimated maximum influent flow rate, derived using data provided in the Wallcliffe House Water Management Plan (WMP)[1], advice from WH on the number of occupants and estimated seasonal occupancy levels, and typical unit hydraulic loading rates (Supplement to Regulation 29 and Schedule 9 - Wastewater System Loading Rates).

Table 1 Wastewater Flow Design Basis

Parameter	Units	Requirement
Seasonal Occupancy Range (as per WMP)	%	57 - 79
Peak-Peak Capacity (Full special event attendance)	kL/d	38.4
Peak Capacity (100% Occupancy)	kL/d	34.1
Average Capacity (79% Occupancy)	kL/d	27.4
Off Peak (Min) Capacity (57% Occupancy)	kL/d	21.9
Peak instantaneous flow rate to MBR (based on 24-hour operation)	L/s	0.44
Minimum instantaneous flow rate to MBR (based on 24-hour operation)	L/s	0.25

2.2 Wastewater Influent Characteristics

Wastewater quality was estimated based on per capita loading data from AS 1546, as shown in Table 2.

Table 2 Wastewater Quality Design Basis

Parameter	Unit	Estimated value range
Biological Oxygen Demand (BOD)	mg/L	320 - 370
Total Suspended Solids (TSS)	mg/L	90 - 370
Total Nitrogen (TN)	mg/L	50 - 80
Total Phosphorous (TP)	mg/L	12 - 13

[1] Water Management Plan, November 2023, Rev 0, prepared by Emerge Associates for Wallcliffe House Pty Ltd.

2.3 Treated Wastewater Characteristics

The target treated wastewater quality, summarised in Table 3, is based on the WMP[2] and meets or exceeds water quality requirements detailed in appropriate government policies, procedures, and standards, including:

- Western Australian Government Sewerage Policy, September 2019.
- Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974
- AS/NZS 1547:2012 – On-site domestic wastewater management

Table 3 Treated Wastewater Quality Objectives

Parameter	Units	Requirement
Biological Oxygen Demand (BOD)	mg/L	<20
Total Suspended Solids (TSS)	mg/L	<1
Total Nitrogen (TN)	mg/L	<20
Total Phosphorous (TP)	mg/L	<1

[2] Total nitrogen target revised to < 20 mg/L, to reflect level of nitrogen reduction likely to be achievable by currently available package plants.

3. Basis of Design

The proposed WWTP is to be designed to achieve the target treated wastewater quality detailed in Table 3. The conceptual design for the proposed plant proposes that the WWTP and treated wastewater disposal system will include:

- Up-front equalisation storage
- Biological treatment via activated sludge process designed to remove nitrogen
- High level of solids removal via membrane filtration
- Phosphorous removal via chemical dosing and filtration
- Treated wastewater storage
- Treated wastewater disposal via below-ground TunnelWell Leach Drains
- Liquid Sludge removal from Membrane Bio Reactor and equalisation tank will be via tanker approximately every 6 to 12 months) and disposed offsite

Plant components with a potential for odour generation will be plumbed to an odour treatment (carbon adsorption) system to prevent any nuisance odour emissions and consequent impacts on any sensitive receptors.

Conceptual drawings for the proposed WWTP and treated wastewater disposal system, including a Process Flow Diagram (PFD) and layout drawings, are included in Appendix A.

3.1 System Requirements

The Basis of Design for the waste treatment process is summarised hereunder:

Basis of Design Item	Minimum Requirements
Scope of the Project	As per Section 1.3.
Relevant Policies, Legislation and Regulations	– Western Australian Government Sewerage Policy, September 2019. – Environmental Protection Act 1986 and Environmental Protection Regulations 1987. – Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974.
Applicable Codes and Standards	Australian Standards applicable to the design, construction and operation of wastewater treatment assets and associated works including: – AS/NZS 1547:2012 – On-site domestic wastewater management.
Redundancy philosophy	– All pumps to be Duty / standby arrangement – Dry spares for key items will be provided to the site. – The Designer will identify items worthy of dry spares (i.e. pumps) and include them in the Scope of Work for project delivery. – Availability is provided by maximising the volume in the equalisation /feed tank and treated wastewater tank. The tanks provide storage to allow operations to continue without outage whilst the Operators rectify faults or change out equipment with dry spares.
Operational attendance	The system is intended to operate independently with minimal Operator or maintainer attendance. The system will be configured for remote attention by both hotel staff and the maintenance contractor and shall raise the necessary alarm signals when faults occur.
Chemical delivery frequency	Chemical delivery frequencies shall be no shorter than 28 days. Storage tanks shall be sized accordingly.
Design Parameter – Flow	WWTP capacity will be at least 38.4 kL/d, but daily influent flows could be as low as 21.9 kL/d during off-peak times.

	The design basis suggested is 38.4 kL per day of wastewater generation; the instantaneous capacity of treatment is therefore 0.44 L/s (38.4 kL x 1000 L / 24 hours / 60 minutes / 60 seconds = 0.44 L/s) During commissioning the system will be treating flow and loads from site amenities for 10 to 20 site staff.
Design Parameter – Feed Wastewater Quality	The feed water quality has been inferred from numerous sources: – Guidance from AS 1546. – Typical townsite wastewater quality in the Region (based on data available for the Water Corporation's Margaret River WWTP).
Design Parameter – Treated Wastewater Quality	– The product water quality from the treatment process must be acceptable to allow treated wastewater to be discharged to the below-ground TunnelWell Leach Drains. – Based on the WMP, relevant guidelines and the proposed treated wastewater disposal method and sizing basis, it is expected that the treated wastewater will need to meet the following parameters: • Total Suspended Solids (TSS) concentration of less than 1 mg/L • Total Nitrogen (TN) concentration of less than 20 mg/L • Total Phosphorus (TP) concentration of less than 1 mg/L
Design Parameter – Solid Waste Quality	– No sludge treatment will take place on site. – Surplus sludge will be taken off site via vacuum tanker to a suitable landfill from the MBR and Eq/Feed tank on an estimated 6 monthly basis. – No quality/concentration requirements apply to the liquid waste stream.
Environmental conditions and requirements	– EQ/Feed tank and the treated wastewater tank, will be installed, below-ground, in the treatment area. – The MBR will be installed within an area retained by retaining walls, and backfilled. – Electrical plant in the treatment building, protected from the environment. – Odour control provided to key odour generating treatment processes/equipment. This then allows the main treatment building to receive conventional mechanical ventilation without risk of fugitive odours.
Site-specific conditions and requirements	The WWTP is to be located adjacent to the entry gate for the property. As such, some site-specific requirements are applicable: – Noise should be kept as low as reasonably practical. – Fugitive odours should be avoided as far as reasonably practical. – Vehicle attendance, particularly large vehicles for chemical deliveries, sludge disposal or desludging, should be minimised or as infrequent as reasonably practical.
Safety Requirements	– Australian Standards. – Worksafe.
Material specifications	Materials specified to meet design life for installed environment.
Design Life	Water industry standard for mechanical plant – 25 years.
Constraints: Site access, material selection or material movement, or any such constraint	GHD has prepared a preliminary WWTP site plan, indicating the amount of land required and access requirements. The site plan will be based on the footprint of a conceptual treatment system, with flexibility built in where possible. Should the contractor's proposed general arrangement exceed the allowed footprint, this would need to be discussed with the greater project team to determine how best to address the space required.
Operated & Maintained by	Wallcliffe House Pty Ltd will operate and maintain the WWTP post-Handover. Contractor will train Wallcliffe House Pty Ltd operations staff, and assist with maintenance of the WWTP during commissioning and after Practical Completion for a period of 2 years, with an option to extend the support for a further five years.
Commissioning requirements (at high level)	WWTP will need to be designed to allow commissioning within the constraints of the project – i.e. waste or treated wastewater will need to be compliant with infiltration

	disposal water quality guidelines, otherwise it will need to be tankered off site for disposal.
Power Supply	– The treatment process and all associated assets will be connected to the site's power supply. – The contractor will be responsible for the electrical design, electrical switchboard, and cabling/conduits for each unit process in the treatment plant. – It is expected that a permanent backup generator (refer to Section 6.3.8 in the Water Management Plan) will be included in the treatment plant scope to power the WWTP electrical switchboard.
Control and Monitoring, site SCADA	– Local HMI (Human-Machine Interface) will serve as the primary control point, featuring a touchscreen and cubicle setup. – The plant will be fully linked to a SCADA system to permit remote monitoring and operational capabilities. This will enable hotel staff and maintenance contractors to oversee system performance. – Alarm signals will be configured to alert personnel of any operational faults promptly. – Each process within the treatment facility is expected to have dedicated communication protocols and fault/alarm systems.
Local content	No specific requirements for local delivery content are nominated.
Instrumentation / Sampling	– Online instrumentation will be provided for key parameters (inlet and outlet flow, MLSS, DO, pH and turbidity). – Manual sample points will be provided as a minimum on the inlet and outlet of the MBR.

4. Process Description

The proposed plant will be automatically controlled through PLC inputs from various physical switches, level transducers/switches, flow instruments as well as dissolved oxygen and mixed liquor suspended solids instruments. The following sections provide a high-level summary of the anticipated plant operations and should be read in conjunction with the Process Flow Diagram.

4.1 Main Wastewater Pump Station

Wastewater from the internal gravity property sewer network is collected in the Main Wastewater pumping station (supplied and operated by others) before it is pumped via macerator type pumps and transferred to the Equalisation / Feed tank at the WWTP.

The main pumping station is equipped with 60kL of emergency storage in addition to the operating capacity of the wet well.

It is a requirement that this Main PS will be prevented from pumping to the WWTP Equalisation/Feed Tank if a high level in this tank is reached or a high priority alarm is activated from the WWTP.

Table 4 Main Sewerage PS

Equipment	Information	Comment
Main Pump Station	60 kL emergency storage	In addition to the operating capacity of the wet well
Transfer Pumps to WWTP	Macerator type	Flow expected to be 2 to 3 L/sec
Controlled on	Wet well level	
Level monitoring	Yes	Via pump control panel
Inhibits / alarms / control	High level at EQ/Feed Tank	Stop main PS transfer pumps - There is no overflow at WWTP

4.2 WWTP Equalisation / Feed Tank

The equalization tank serves to balance the flow and load of the incoming wastewater, which can vary significantly due to daily usage and seasonal patterns. By storing and gradually releasing wastewater at a controlled rate, the equalization tank ensures a consistent flow to downstream treatment processes, optimizing their performance and efficiency. This buffering capability also helps to manage down time associated with maintenance activities. The tank is required to provide sufficient buffer for a maximum occupancy flow event such as weekend wedding or similar.

The main pumping station transfers wastewater into the EQ/Feed tank, the flow then moves by gravity into the wet well where it is pumped to the MBR inlet.

Table 5 WWTP Equalisation / Feed Tank

Equipment	Information	Comment
Tank	23kL capacity	Fed by main PS flow rate estimate to be 2 to 3 L/sec with gravity feed to wet well.

Pumps	In wet well	
Level Monitoring	Yes	
Inhibits / alarms / control	High level in EQ Tank – stop main PS transfer pumps	There is no overflow at the WWTP

4.3 MBR Feed Pumping Station (DN1800)

The wet well is fed by gravity from the EQ/Feed tank, the wet well should be deep enough to allow the EQ/Feed tank to drain completely during periods of low flow and also to minimise the potential of settlement of solids in the EQ/Feed Tank.

Flow monitoring will be provided on the feed to the MBR.

Table 6 MBR Feed Pumping Station Wet Well PS

Equipment	Information	Comment
Wet Well	DN1800	Fed by gravity from EQ/Feed Tank
Pumps to MBR inlet	Macerator type Duty/Standby/Assist	
Level Control	Yes – for pump operation	Wet well pump cut out should be below the invert of the feed Gravity connection between tank and wet well should include a baffled connecting pipe, graded to the wet well.
Level Switches	Yes	Pump Control
Inhibits / alarms / control	Failure of both MBR feed pumps	Critical alarm

4.4 Membrane Bioreactor (MBR)

A Membrane Bioreactor (MBR) treats wastewater by combining biological treatment and membrane filtration. In this process, wastewater first undergoes biological treatment where microorganisms break down organic matter and remove Total Nitrogen (TN) through nitrification and denitrification.

Using submerged membrane technology, the treated water is then filtered through microfiltration membranes, which effectively separate solids and pathogens. For phosphorus (P) removal, chemical dosing with polyaluminium chloride (PAC) is employed, precipitating phosphorus as insoluble compounds that are then removed by the membrane. This integrated approach ensures high-quality treated wastewater with significantly reduced levels of phosphorus and nitrogen, making it suitable for discharge.

The MBR at Wallcliffe will consist of 2 tanks operating in series, each tank will have several chambers that will contain the following;

1. Fine Screen
2. Denitrification chamber
3. Chemical dosing (Coagulant, Carbon Feed Source, Cleaning)

4. Nitrification tank and membrane unit
5. Treated wastewater Chamber
6. Sludge Storage Chamber

Pumps are used to transfer flow through the tanks and chamber before the treated wastewater is transferred to the Treated Wastewater Storage Tank prior to discharge at the TunnelWell Leach Drains.

The MBR system operates continuously, the recirculation and aeration systems operate 24 hours per day. The membrane system operates to meet the feed flow rate from the wet well and levels within the tanks allow the membrane to operate. Within the MBR the system operates on level control.

The MBR has some volume to allow buffering of inflows for events such as cleaning. If a high level was reached within the MBR, feed from the wet well would be stopped, a warning would be raised, if High-High Level was reached an alarm would be raised.

Table 7 MBR

Equipment	Information	Comment
MBR Tanks	2	Each tank will have a number of chambers
Fine Screen	max volume 200 kL/day	
Denitrification Chamber	Volume	TBC at detailed design
Chemical dosing		
Coagulant (PAC)	Phosphate removal	
Methanol	Carbon feed source	(seasonal depending on influent)
Sodium Hydroxide	pH correction and Cleaning	
Sodium Hypochlorite	Cleaning	
Kubota Submerged Membrane Unit	Kubota Model - FF Type	
	Surface area 0.8m2 per sheet	Dependant on flows
	30 to 50 sheets per cartridge	
	2 cartridges	Pore size - Nominal max 0.4, avg 0.2µm
	Membrane sheet – Microfiltration membrane	
Treated wastewater Chamber	Approx. 1kL	TBC at detailed design
Sludge Storage	Min 5kL	TBC at detailed design
Level Switches	Yes	Used for internal pump control in each chamber
Process Monitoring	pH,	
	Dissolved Oxygen	
	Mixed Liquor Suspended Solids	

	Outlet pH and Turbidity	
Inhibits / alarms / control	High-High level within MBR	Stop EQ Wet Well / MBR Feed pumps / Alarm
	High-High level in Effluent Storage Tank	Stop MBR / raise critical alarm
	High Turbidity, measured at MBR outlet	Stop MBR / raise critical alarm

4.5 Treated Wastewater Storage Tank

The treated wastewater from the MBR is transferred via Duty/Standby pumps to the Treated Wastewater Storage tank. This tank is provided with internal submersible pumps that will operate on the level within the tank and control valves on the discharge pipe to send flow to either of the two TunnelWell Leach Drain areas.

- Area 1 - Entry Area
- Area 2 - Arrivals Paddock

Flow from the Treated Wastewater Storage tank to the TunnelWell Leach Drains is to be monitored for flow.

Table 8 Treated Wastewater Storage Tank

Equipment	Information	Comment
Tank	7kL capacity	
Pumps	Duty/Standby	
Flow monitoring	Yes	As a minimum, operations will need to manually log monthly
Level Switches	Used for pump control	Low stop duty pump High start duty pump
Inhibits / alarms / control	High-High level	Stop inlet flow from MBR / raise critical alarm
	High Level on all TunnelWell Leach Drains	Stop treated wastewater flow from Treated Wastewater Storage tank / raise critical alarm
	All 4 x TunnelWell Leach Drains inlet valves closed	Stop treated wastewater flow from Treated Wastewater Storage tank / raise critical alarm

4.6 Infiltration Structures / TunnelWell Leach Drains

The TunnelWell Leach Drains receive treated wastewater pumped from the Treated Wastewater Storage tank, and will be configured to operate on a rotational Duty/Standby/Standby/Spare basis. The inlets to the TunnelWell Leach Drains will be designed to ensure that discharge of treated wastewater to the leach drains does not result in scouring of the leach drains' compacted sand foundation. The TunnelWell Leach Drains are the final element of

the treated wastewater disposal system, and each have been designed to infiltrate the treated wastewater at the maximum peak flow.

The TunnelWell Leach Drains will be cycled by the control system based on operating time (will be set during commissioning), they will also swap duty on detection of high level within an individual leach drain.

The flow will be directed via control valves to either the Entry Area or the Arrivals Paddock. Each Leach drain will also have an individual inlet control valve to allow flexibility in operation. Control valves and levels will be displayed on WWTP control system.

Table 9 Infiltration Structures

Equipment	Information	Comment
TunnelWell Leach Drains	4	2 x Entry Area 2 x Arrivals Paddock
Pressure / Level monitoring	Yes, on each individual leach drains (x 4)	To warn of high level and signal the system to direct flows to another leach drain
Inhibits / alarms / control	High level	Redirect flow to another leach drain
	1 x TunnelWell Leach Drain Area and individual leach drain inlet valve to be open and able to always receive flow.	If not Stop treated wastewater flow from Treated Wastewater Storage tank / raise critical alarm

4.7 Sludge

Excess sludge and screenings generated in the MBR, will be stored in an internal chamber with a capacity adequate to ensure desludging of the tank (by vacuum truck) is not required more frequently than once every 6 months. Sludge removal from the EQ / Feed tank or wet well if needed will also be by vacuum truck.

4.8 Odour

The luxury resort development requires that there is no noticeable odour from the WWTP system and its associated storage tanks. It is the Contractor's responsibility to manage and ensure that odour control measures are effectively implemented and maintained.