



AQUASOL

WATER TREATMENT SOLUTIONS

Moore River South Waste Water Treatment & Recycling Scheme

1. Project Summary

Table 1: Summary

Scheme Characteristic	Description
Location	Moore River
Source of recycled water	Grey and Black water
Volumes of recycled water to be produced	Expected 400 kL/day
Proposed end uses of the recycled water	Surface Irrigation
Percentage of recycled water used in each one of the proposed end uses	100% for Irrigation
Type of treatment system	Tertiary treatment, including facultative, anaerobic / aerobic treatment / SBR / polishing / UF and disinfection system.
Location of the WWTP	Moore River South (Caraban).
Expected flows per day	Minimum : 300kL/day Expected: 400 kL/day Maximum: 450 kL/day
Estimated number of people that will benefit/use the recycled water scheme	Approximately 3,500 (Stage 1)
Irrigation area available (m ²)	200,000 m ²
Risk exposure level	Medium

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2. Premises Location

2.1 Premises Description

The subject site is located within the Shire of Gingin and is located approximately 75 kilometres north west of the Perth central business district, just south of the Guilderton town site. This site is bound by the Indian Ocean to the west, Moore River to the north and pastoral and uncleared land to the east and south.

The Shire of Gingin is one of the fast growing regions in Western Australia. Significant population growth within the north-west corridor of the Perth Metropolitan Region has seen urban development extend to the northern-most limits of the region. As the local government area immediately north of the Perth Metropolitan Region, the Shire of Gingin is likely to experience significant growth and change in the future as the Perth metropolitan region expands to the north along the coastal growth corridor.

2.2 Key Surrounding Environment Features

- **Groundwater:** From regional information and previous investigations, the depth to the water table in the area is generally more than 20m. Ten groundwater bores have been installed within the Moore River site to provide the best representation of anticipated groundwater systems. Refer enclosed to Attachment 9A - Monitoring Bores.
- **General Public:** The Waste Water Treatment Plant (WWTP) will be located within the proposed Light Industrial Area, fenced with restricted access to general public. Treated water from the WWTP will be reused for irrigation in open public spaces within the Development, which will be used by the general public. For this, the water quality achieved will be of a high enough quality to present no risk to members of the public using the parks.
- **Surface waters:** The subject site is located directly to the south of the mouth of the Moore River. Apart from the Moore River, which is more than 1km to the north, there are no known or mapped waterways on the site or within close proximity. Due to the distance between the Moore River and the location of the WWTP (and the good quality of irrigation water), project poses no adverse impact to the Moore River.
- **Flora and Fauna:** A flora and vegetation survey of the site was conducted in November 1992 (Alan Tingay and Associates 1993). This survey did not reveal any significant or protected flora and as the site has not been altered since then, no change to this status has been identified. The proposed site of the WWTP is low scrub typical of this locality. With respect to fauna in general, no significant impacts are expected. A significant

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proportion of the development area is already cleared or highly degraded and the development is unlikely to have any substantial impact on the status the fauna species most likely to be currently using the area. The proposed WWTP site is uncleared but represents only a small pocket of the extensive vegetation type and will not have a significant impact on fauna habitat.

2.3 Separation to Nearest PDWSA and Drinking Water Sources

According to the DoW Geographic Atlas, there are no declared Public Drinking Water Source Areas (PDWSAs) located within the subject site. However, a Priority 2 PDWSA is located approximately one kilometre to the north.

Development of the subject site is unlikely to impact on this PDWSA as Moore River acts as a barrier to groundwater flow to the north. This PDWSA was proclaimed with the intention to provide the town of Guilderton with a safe drinking water supply.

In relation to the Drinking Water Infrastructure, the WWTP will be located approximately one kilometre from the abstraction bore and the Water Treatment Plant, providing sufficient buffer distance between both systems.

Figure 1: Bore and WTP location





2.4 Topography

The topography of the study area rises steeply away from the beach and Moore River to a series of high dunes, dune ridges and valleys. The slopes from the Moore River up to the dune crests (50m Australian Height Datum [AHD]) are steep.

The coastal dunes attain heights of 10m AHD near the coast and up to 30m AHD a short distance inland. In the northern section of the coast there is a large valley behind the dunes which has a low point of less than 5m AHD.

Further inland the study area lies between 10 and 60m AHD with several small sandy knolls rising above the surface level. A major dune ridge extends inland from the coast near the southern part of the study area and achieves elevations of 50 to 60m AHD.

For additional information refer enclosed to 9B – Site Topography.

2.5 Premises Vegetation, Fauna Habits and Status

Historically, the majority of the subject site was utilised for grazing and pastoral purposes, with some of the cleared areas of the Moore River Company landholding still utilised for these purposes. At present the majority of land along the foreshore is only used for the occasional beach access by either foot or vehicle.

A search of the Swan Coastal Plain Wetlands, Bush Forever 2007 and Environmentally Sensitive Areas databases on the WA Atlas (Landgate, 2009) indicated that the site does not contain environmental assets.

The study area was visited by botanists in October and November 2009 and a field survey, conducted in accordance with EPA Guidance Statement No. 51 – Terrestrial flora and vegetation survey environmental impact assessment in Western Australia (2004) was undertaken to the level of a detailed survey.

The vegetation ranged from 'Completely Degraded' to 'Pristine-Excellent' condition with a majority of the vegetation in either a 'Completely Degraded' or 'Excellent' to 'Pristine-Excellent' condition, in particular within the fenced foreshore reserve.

As mentioned, with respect to fauna in general, no significant impacts are expected.

For additional Information refer to Attachment 9C - Vegetation Report.



3. Proposal Description

3.1 Project Summary

Moore River Company Pty Ltd (MRC) is seeking to develop a parcel of land (Swan Location 2802 and portions of Swan Location 2424 and 2914) on the coast immediately south of the Moore River near Guilderton. This parcel of land forms part of a larger piece of land zoned "Urban Development" under the Shire of Gingin Town Planning Scheme No. 9 (LPS 9). The entire MRC landholding occupies approximately 2,000 hectares, however only 557 hectares in the north-western portion is to be subject to the future urban development.

An Outline Development Plan (ODP) was endorsed by the Shire of Gingin on 17 September 2013 and subsequently by the Western Australian Planning Commission (WAPC) on 20 October 2013. 'Outline Development Plan' is terminology used in LPS 9 at the time of approval, but since gazettal of the Planning and Development (Local Planning Schemes) Regulations 2015, all such plans are now referred to as a Structure Plans. However, for the purposes of this application and to avoid confusion with other documents, the term ODP will continue to be used.

The ODP provides guidance for the future subdivision and development of a 1,942 lot urban development comprising residential, tourism, commercial, community, educational, light industrial, and recreational sites. The endorsed ODP is represented on Attachment 2C, which also shows proposed areas of public open space (POS).

A subdivision application for the whole of the development was approved by the WAPC on September 2014 (Attachment 4C - Subdivision Approval). The breakdown of lot types across the whole subdivision is:

- 1,504 x Residential – standard (R20 density)
- 322 x Residential – medium density (R40)
- 91 x Mixed Business
- 7 x Town Centre
- 4 x Tourism
- 1 x Public Use Primary School
- 2 x Public Use Community Facilities
- 11 x Residual (Balance of landholding)

As the development will occur over an extended period of time (6 stages over approximately 25 years), the construction of the required WWTP will be approached in modular units.



The present application considers servicing Stage 1 of the development; however, a 450kL/day plant will be initially built (30% oversized for future expansion towards Stage 2).

Identical 450kL/d plants will be added as required in-line with the growth of the community. It is intended that expansion of the WWTP will occur when plant reaches 90% of its capacity (400kL/d). Before construction, the new modules will be presented to all relevant authorities for approval.

It is intended that treated waste water from the development will be disposed for irrigation in future public open spaces within the development.

Timing of the staging of the development will be dependent on market conditions so is only indicative at this point, however commencement is anticipated for 2019. The early stages will create a community focus near the tourist facilities, which will facilitate synergies between tourism and commercial uses during the early stages of development, and create the school site. The MRC has entered into an agreement with the Shire of Gingin in relation to early provision of community services and facilities to meet community development requirements on a progressive basis.

Table 2: Development projection

Year	Year 1	Year 5	Year 10	Year 15	Year 20	Year 25
Development Stage	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
WW Volume	350 kL/d					
WWTP Capacity	450kL/d		450kL/d		450kL/d	

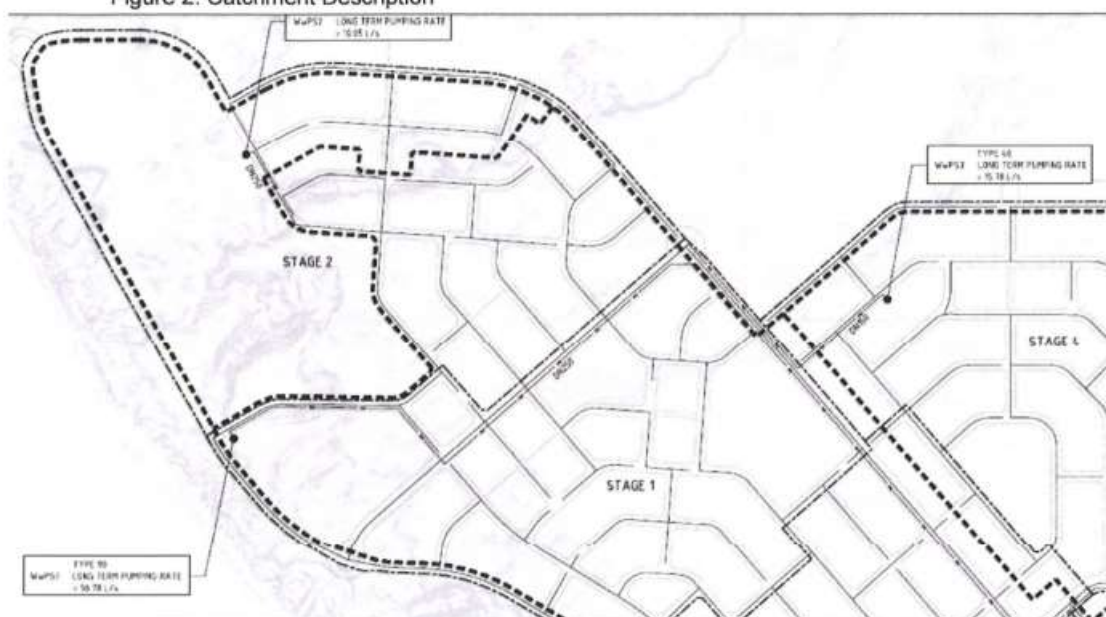
For details on Development Stages refer enclosed to Attachment 9D - Staging Plan.



3.2 Catchment description

At present, sewage catchment design hasn't been formally completed, however the preliminary design is detailed in Figure 2 below, and in Attachment 9E - Reticulation Plan.

Figure 2: Catchment Description



LEGEND

- CATCHMENT AREA BOUNDARY
- STAGING BOUNDARY
- PM PROPOSED SEWER PRESSURE MAIN
- G PROPOSED GRAVITY SEWER

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3.2 Position of Proposed Apparatus.

The land where the WWTP is proposed to be located is at the south-east corner of the Development, adjacent to the Light Industrial Area. At the time that the ODP was approved, a traditional system of waste water disposal using evaporation ponds was anticipated, and a site much further south was identified to allow for separation distances.

The proposed site for the current application will be located along the southern subdivisional road, south of the approved Light Industrial Area and immediately west of sites to be created for a council depot and emergency services site. A specific site will be created once approval has been obtained, as part of Stage 1 of the subdivision works. Future classification of the site under LPS 9 will be subject to agreement with the Shire of Gingin, and is most likely to be either zoned 'Light Industry' or reserved for 'Public Purposes – Infrastructure Services'.

Figure 3: WWTP Location





3.3 Treatment Train Details

The process incorporates Anaerobic and Aerobic Treatment along with Filtration and Disinfection to facilitate biological wastewater treatment to effluent standards for Biochemical Oxygen Demand (BOD5), Turbidity, Total Nitrogen (N), Total Phosphorous (P) and Bacteria.

Waste water will be initially collected in a Pump Station. From there it will be sent to the first stage of the treatment train (Anaerobic Tank), passing through a rotating screen to remove larger solids that could potentially damage equipments in the plant.

The Anaerobic/Equalization Tank serves as an Anaerobic digester and as an Equalization tank buffering peak flows throughout the day. The tank is fitted with a level sensor for lowering the tank level prior to peak flow periods. From there, water is pumped into the 2 x Aeration Tanks for secondary treatment.

The Aeration Tanks have been sized to accommodate the requisite volume required to treat the incoming organic (BOD5) load. A submersible aerator will supply a high volume of oxygen for the biological process and will facilitate recirculation of the wastewater undergoing treatment on the entire volume of the tank. From there, water will be transferred into the SBR Tank.

The SBR will batch three to four times daily, or as required. Aeration is stopped for one hour to allow solids settling in the tank. Flocculent in the tank will aid in the settling process. Once the tank has settled a pump will clear/pump water from the top of the tank into the Polish Tank.

In the Polish Tank, water will be pumped through a deep bed media filters system fitted with automatic backwash valves that can be set to operate at a selected interval via the touch-screen HMI. Water will also be filtered through a bank of UF, connected to an automatic CIP system for 'cleaning in place'.

Sludge settled at the bottom of the Anaerobic Tank will be sent to the Sludge Tank. Once the Sludge Tank is full, excess water will be sent back to the Anaerobic Tank for re-treatment, and solids removed as needed basis to an approved disposal site.

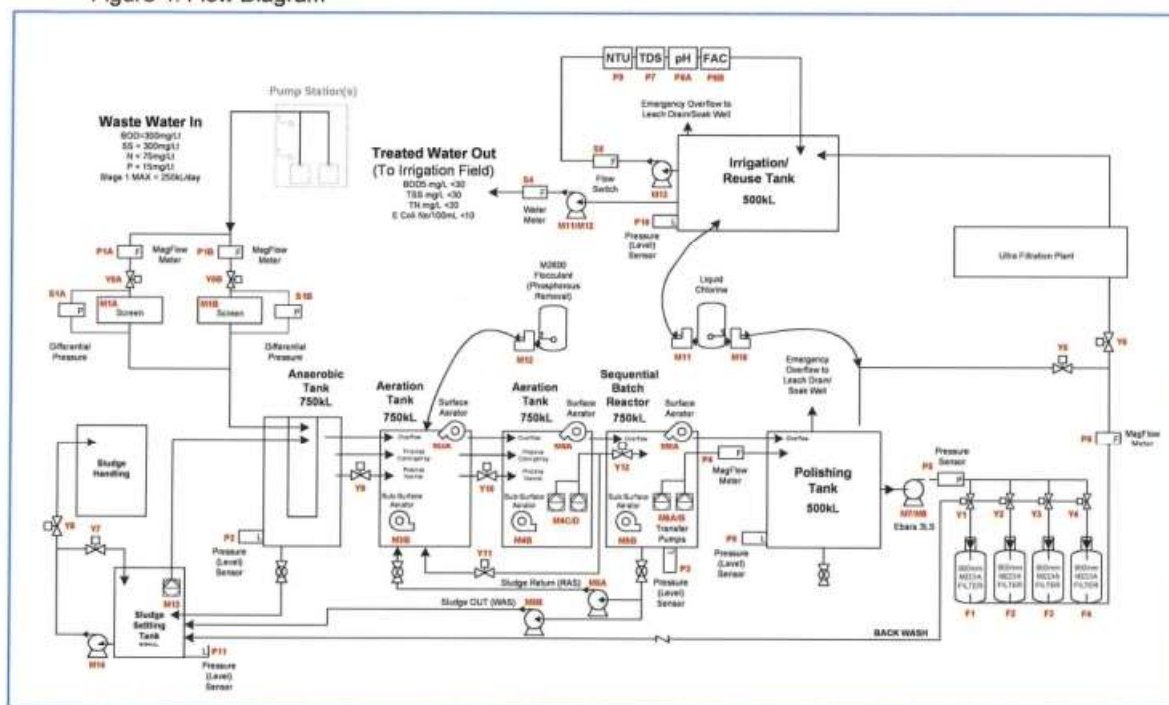
Water is then collected in an irrigation tank ready for reuse.

All alarms in the system will be recorded in the PLC, and activate a flashing light on the control box. All wiring will be completed to Australian standards. System control will be via Delta PLC and HMI.



3.4 Diagram / Process Flow

Figure 4: Flow Diagram



3.5 Buffer Tanks Volumes

Table 3: Tanks Capacity

Tank	Total Capacity	Designed Capacity (Stage 1)	Max Capacity	Buffer at Max Capacity
Anaerobic tank 1	750 kL	350 kL	450 kL	300 kL
Aeration tank 2	750 kL	350 kL	450 kL	300 kL
Aeration tank 3	750 kL	350 kL	450 kL	300 kL
SBR tank 4	750 kL	350 kL	450 kL	300 kL
Polish tank 5	500 kL	350 kL	450 kL	50 kL
Irrigation tank 6	500 kL	350 kL	450 kL	50 kL
Sludge tank 7	50 kL	40 kL	40 kL	-
Total buffer capacity				1300 kL
				2.9 days

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4. Discharge to Land

4.1 Source, Composition and Quantity

The water source will be grey and black water from the new Development at a maximum rate of 450kL/d.

Design criteria were based on Regulation 29 of the Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974.

The proposed methodology is to treat waste water to such a quality that it can be irrigated above ground in future open public space within the Development.

For a detailed water balance, refer enclosed to Attachment 9F.- Water Projection.

4.2 Water Quality Objectives

Following the National Guidelines for Exposure Risk Level, the proposed treatment will achieve the required water quality to be reused for "urban surface irrigation with some restricted access and application".

For more information on Aquasol's previous experience managing similar systems, please refer enclosed to Attachment 5A - AQ Experience in WWTP.

All chemicals used in the system will be pumped and monitored automatically. Sample points will be fitted throughout the system to verify the effectiveness of the entire process. The expected water quality achieved after treatment is detailed in table below.

Table 4: "Medium" Water Quality

Parameter	Units	Value
E Coli	cfu/100 mL	<10
pH	pH units	6.5 – 8.5
Disinfection	mg/L	0.2 - 2.0
TN	mg/L	<10
TP	mg/L	0~0.5
Turbidity	NTU	<5



4.3 End-Uses and Their Location

Treated grey and black water from Stage 1 of the Development will be treated to a "Medium" quality and reused for irrigation within green areas. Based on the infiltration factor for sandy soils specified in AS/NZS 1547:2012 (see Table 5, below), the required area at maximum capacity (450kL/d) has been estimated at 90,000m² (9ha).

Table 5: Infiltration Factors

AS/NZS 1547:2012

RECOMMENDED DESIGN IRRIGATION RATE (DIR) FOR IRRIGATION SYSTEMS

Soil Category (see Note 1)	Soil texture	Structure	Indicative permeability (K_{sat}) (m/d)	Design irrigation rate (DIR) (mm/day)		
				Drip irrigation	Spray irrigation	LPED irrigation
1	Gravels and sands	Structureless (massive)	> 3.0	5 (see Note 2)	5	(see Note 3)
2	Sandy loams	Weakly structured massive	> 3.0 1.4 – 3.0			4

As outlined in the approved District and Local Water Management Strategy (DLWMS - Cardno, 2013), the intention is to use public open space (POS) and other landscaped areas as the primary area for disposal of treated wastewater. In addition, the primary school playing field and irrigation of gardens within tourism sites will be capable of taking some of the water.

It is WAPC policy to require 10% of the gross subdivisible area to be given up as POS. This excludes the foreshore reserve and drainage basins subject to inundation more frequently than annually (ie: one in one year rainfall)..

Even though exact location of the irrigation area available within each area of POS and the primary school site is subject to detailed design, all possible/available areas are detailed in Table 6 and Figure 5, confirming that there will be more than enough area available to accept irrigation water.

Table 6: Areas Available for Irrigation within Stage 1

POS No.	Stage	Irrigation Area (ha)
1	1A	7.764
2	1A	11.465
5	1A	0.197
9	1A	0.5089
12	1B	0.5646
Total		20.499
Primary School site 4.737ha	1A	2
Total including school oval		22.499



Figure 5: Possible Irrigation Areas



4.4 Management priority

Following DoH guidelines to reuse treated water for surface irrigation (see Table 7), the management priority risk was classified as **Medium**.

Table 7: Medium exposure risk level

Exposure Risk Levels	End Uses
Medium	<ul style="list-style-type: none"> • Urban surface irrigation with some restricted access and application^a • Fountains and water features • Stock watering, dairy cattle, grazing • Industrial use with potential human exposure • Dust suppression • Wash down water • Cooling towers • Commercial food crops

4.7 Maintenance, Monitoring and Pollution Control

Please refer enclosed to Attachment 6A - Public Health and Environmental Risks, 6B - Odour Management Plan, 6C – NIMP and 9G - Routine Maintenance Plan.



4.8 Contingency Plans

Table 8: Alarm System (**)

Control Point Limits	Alarm System	Affected Components
Suction Pump, Pump Station	Pump blocked	Non flow to the plant; stand by pump to start automatically.
Screen Blockage	Flow blockage	Low flow to the plant; stand by Screen to start automatically.
Aeration tank 2 - Aerator	Block or low flow / An automatic alarm will indicate the incorrect function of the aeration.	Alarm notification
Aeration tank 3 - Aerator	Block or low flow / An automatic alarm will indicate the incorrect function of the aeration.	Alarm notification
Aerobic tank 3 – Delivery pump	Blockage / An automatic alarm will indicate the incorrect function of the pump.	Alarm notification. Stand by pump to start automatically.
SBR tank 4 – Aerator	Block or low flow / An automatic alarm will indicate the incorrect function of the aeration.	Alarm notification
SBR tank 4 – Delivery pump	Blockage / An automatic alarm will indicate the incorrect function of the pump.	Alarm notification. Stand by pump to start automatically.
Polish tank 5 – Delivery pump	Blockage / An automatic alarm will indicate the incorrect function of the pump.	Alarm notification. Stand by pump to start automatically.
Irrigation tank 6 – Delivery pump	Blockage / An automatic alarm will indicate the incorrect function of the pump.	Alarm notification. Stand by pump to start automatically.
Chemical injection	Low injection / Aquasol staff will check levels and refill tanks periodically.	Dose pump will be set to dose chemicals for a certain period of time. Alarm will also warn on low levels.
Blockage Media Filtration	Pressure gage installed will warn any unusual pressure drop. Automatic backwash can be carried out.	Alarm in place to detect problem.
Blockage UF	Pressure gage installed will warn any unusual pressure drop.	Alarm in place to detect problem.
Power Failure	Breakdown of the energy supply / manual inspection	For emergency power failure, water will stop running and kept in tanks using buffer capacity.

** Alarm system may vary after plant is built



4.9 Identify Environmental Receptor and Pathway

Table 9: Pathways & Receptors

	Odour	Noise	Discharge to Land
Potential Receptors	Employees at the Light Industrial Area	Employees at the Light Industrial Area	Groundwater and Vegetation
Pathway Type	Air (wind)	Air (wind)	Leaching

For additional information, refer to Attachment 6A - Public health and environmental risks.