Application for Works Approval

Division 3, Part V *Environmental Protection Act 1986*

Works Approval Number	W6356/2020/1
Applicant	Water Corporation
File Number	DER2019/000676
Premises	Mandurah No. 1 (Gordon Road) Wastewater Treatment Plant Lot 500 (500) Gordon Road and Lot 109 (2) Corsican Place, PARKLANDS WA 6180 Legal description - Lot 500 on Deposited Plan 44788 and Lot 109 on Deposited Plan 73737
Date of Report	21 August 2020
Status of Report	Final

Table of Contents

1. Definitions of terms and acronyms 3
2. Purpose and scope of assessment 5
   2.1 Application details 5
3. Overview of Existing Premises 6
   3.1 Operational aspects 6
   3.2 Existing Infrastructure 10
4. Proposed construction and upgrade works 10
5. Licensing history 14
6. Legislative context 14
   6.1 Contaminated sites 14
   6.2 Other relevant approvals 14
      6.2.1 Planning approvals 14
      6.2.2 Department of Health 14
   6.3 Part V of the EP Act 15
      6.3.1 Applicable regulations, standards and guidelines 15
      6.3.2 Compliance and complaints history 15
      6.3.3 Clearing 15
7. Emissions, receptors and pathways 16
   7.1 Emissions 16
   7.2 Receptors 16
   7.3 Pathways 18
8. Applicant controls 19
9. Risk assessment 20
   9.1 Detailed risk assessment – Treated wastewater discharge 27
      9.1.1 Current treated wastewater discharge quality 27
      9.1.2 Potential treated wastewater discharge quality 28
      9.1.3 Current ambient groundwater quality 28
      9.1.4 Potential impacts to down-gradient bore users with increased infiltration 30
      9.1.5 Potential impacts to the Indian Ocean with increased infiltration 31
      9.1.6 Potential impacts to Goegrup Lake with increased infiltration 32
      9.1.7 Proposed regulatory controls 33
10. Consultation 35
11. Determination of Works Approval conditions 36
12. Applicant's comments 37
13. Conclusion 37

References 38
Appendix 1: Summary of applicant's comments on risk assessment and draft conditions 39

1. Definitions of terms and acronyms

In this Decision Report, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
ADWF	Average Dry Water Flow
AER	Annual Environment Report
category/ categories/ Cat.	categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CS Act	*Contaminated Sites Act 2003* (WA)
Decision Report	refers to this document.
DBCA	Department of Biodiversity, Conservation and Attractions
Delegated Officer	an officer under section 20 of the EP Act.
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DWER	Department of Water and Environmental Regulation As of 1 July 2017, the Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of Water (DoW) amalgamated to form the Department of Water and Environmental Regulation (DWER). DWER was established under section 35 of the *Public Sector Management Act 1994* and is responsible for the administration of the *Environmental Protection Act 1986* along with other legislation.
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986* (WA)
EPP	Environmental Protection Policy
EP Regulations	*Environmental Protection Regulations 1987* (WA)
existing licence	The licence issued under Part V, Division 3 of the EP Act and in force prior to the commencement of, and during this review
licence holder	Water Corporation

m^3	cubic metres
Minister	the Minister responsible for the EP Act and associated regulations
MS	Ministerial Statement
NEPM	National Environmental Protection Measure
Noise Regulations	*Environmental Protection (Noise) Regulations 1997* (WA)
occupier	has the same meaning given to that term under the EP Act.
prescribed premises	has the same meaning given to that term under the EP Act.
premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report
revised licence	the amended licence issued under Part V, Division 3 of the EP Act following the finalisation of this review.
Risk Event	As described in *Guidance Statement: Risk Assessment*
RIWI Act	Rights in Water and Irrigation Act 1914 (WA)
SCADA	means supervisory control and data acquisition, a computer system used for gathering and analysing real time data.
$\mu g/m^3$	micrograms per cubic metre
µg/L	micrograms per litre

2. Purpose and scope of assessment

Water Corporation is Western Australia's principal supplier of water and wastewater and drainage services. Water Corporation is owned by the State Government of Western Australia, and reports to the Minister for Water.

Water Corporation currently operate the Mandurah No. 1 (Gordon Road) Wastewater Treatment Plant (WWTP) in Parklands, south of Perth under DWER licence L5950/1991/11. The premises has been in operation since 1973, and is licensed as a Category 54: Sewage facility premises. The current licence for the premises was issued in November 2015. The premises has a current design throughput of 12ML/day (12,000m^3/day) Average Dry Weather Flow (ADWF).

Under Section 53 of the *Environmental Protection Act 1986* (EP Act) a works approval is required prior to making any changes to a prescribed premises that may alter emissions and discharges from the site. On 17 December 2019 Water Corporation applied for a works approval to increase the premises throughput design to 15.5ML/day (15,500m^3/day) ADWF to accommodate future growth within the catchment and to increase the WWTP's performance. The proposed works include a number of upgrades to the existing infrastructure, replacement of old infrastructure, construction of a new Dissolved Air Floatation Thickener (DAFT) and installation of SCADA linked hydrostatic level measurement instruments on existing large infiltration basins. The increase up to 15.5ML/day allows for the additional service requirements to be met, within the limitations of existing underground infrastructure. This Decision Document considers and assesses the environmental risks associated with the proposed upgrade of the premises. Current premises activities and operations are not included in this assessment.

2.1 Application details

Table 2: Documents and information submitted during the assessment process

Document/information description	DWER Reference number
Works Approval Application submitted 17/12/2019, included supporting documents: - Application Form - Attachment A (supporting docs and Appendices A-C): - Appendix D: Odour Report - Appendix E: Environmental Risk Assessment - Appendix F and G (Groundwater modelling)	Record#: A1852265 Record#: A1856238 Record#: A1856239 Record#: A1856240 Record#: A1856241 Record#: A1856242
Interim response to the Request for Further Information submitted 17/04/2020	Record #: A1891062
Further information (slides) re DWER modelling queries, submitted 12/05/2020	Record #: A1902147

Table 3: Prescribed premises categories in the existing licence

Classification of Premises	Description	Premises production or design capacity or throughput
Category 54	Sewage facility: premises – (a) on which sewage is treated (excluding septic tanks); or (b) from which treated sewage is discharged onto land or into waters.	Current design throughput 12ML/day (12,000m^3/day) ADWF Proposed design throughput 15.5ML/day (15,500m^3/day) ADWF

3. Overview of Existing Premises

The Mandurah No. 1 (Gordon Road) Wastewater Treatment Plant (WWTP) is located in Parklands, approximately 70 km south of Perth within the city of Mandurah. The plant was constructed in 1973 in an underdeveloped area of dunes to support the growing city of Mandurah.

At present, the premises is surrounded by a mixture of residential areas, including rural, residential and retirement living. Mandjoorgoordap Drive borders the premises on the east, separating the premises from the nearby school and retirement village. A lot comprising native vegetation on the eastern boundary provides a separation buffer to the nearby rural residential area. The premises is bordered to the north by the Gordon Road Waste Transfer Station. A greyhound racing track is located to the south of the premises on the other side of Gordon Road. To the south west is the City of Mandurah's Gordon Road Commercial and Industrial Zone.

3.1 Operational aspects

The Mandurah No. 1 (Gordon Road) Wastewater Treatment Plant (WWTP) was constructed in 1973. Initially the premises operated a trickle filter system, with sludge sent offsite for disposal. As the surrounding catchment continued to grow the premises was upgraded to facilitate increased inflow and to improve the treatment quality. These upgrades included the construction of oxidation ditches, clarifiers and infiltration ponds, odour control equipment, pre-treatment works and a sludge handling facility.

The Mandurah No. 1 (Gordon Road) Wastewater treatment plant currently receives sewage inflows from Barragup, Mandurah, Yunderup, West Murray and North Mandurah sewer districts, treating it to a secondary level, prior to discharge to onsite infiltration ponds. The plant currently processes approximately 10.43 ML/day (10,439 m^3/day) Average Dry Water Flow (ADWF), with a premises design capacity of 12 ML/day (12,000 m^3/day) ADWF.

Inputs to the process include raw sewage from the catchment area and nutrient solutions such as ammonia, potassium and phosphate used in the bioscrubber. A polymer is also used to thicken sludge. Outputs from the process include grits and screenings (from inlet), secondary stage treated wastewater, dewatered sludge (from sludge treatment process) and odour (from the dispersion stack).

Water Corporation has provided a detailed description of their existing processes and site layout map for the WWTP. This is shown in Figure 1, Figure 2 and Figure 3.

In 2008 Water Corporation entered into an agreement with the City of Mandurah to provide reuse water for public open space (primarily for turf) irrigation via a Recycled Water Supply Agreement (RWSA). In 2018/19 this resulted in 120 ML of reuse water being provided to the City of Mandurah for irrigation.

Process Component	Description
Inlet works	• Consisting of screens and grit capture system that captures, treats and dewaters solids from the influent stream. • Captured solids are removed to landfill.
Secondary treatment of wastewater	• The treatment process consists of: o A bioselector and three oxidation ditches that provide biological secondary treatment. o A distribution chamber that receives mixed liquor from the oxidation ditches and distributes it to four clarifiers. o Four clarifiers that are used to settle out solids/sludge from the treated wastewater.
Sludge treatment and disposal	• Return Activated Sludge (RAS) System o RAS is captured from the clarifiers and returned to the bioselector via two RAS pump stations. • Waste Activated Sludge (WAS) system: o Waste Activated Sludge is received from the distribution chamber, and skimmings from the clarifier are pumped to a Dissolved Air Flotation Thickener (DAFT) via a WAS and Skimmings Pump stations. o The DAFT thickens sludge to and directs it to the thickened sludge storage tank. o The thickened sludge is then dewatered in centrifuges before storage in sludge hoppers and removal from site via trucks. o Polymer used in the thickening process is stored in a 9 kL) tank.
Odour Collection and Treatment	• Captures foul air from various components within the treatment process. • Consists of Odour Scrubbers, Extraction Fans, Carbon Filters and a disposal via a Dispersion Stack.
Treated Wastewater Disposal	• Treated wastewater that passes through the clarifiers is either: o infiltrated on site via four infiltration lagoons (only 2 currently in use - No 3 and No 4)) o recycled onsite via the Reclaimed Effluent Pump Station for use in the bioscrubber, and screenings wash press.

Figure 1: Treatment Process Description

Source: CS03381 Mandurah Gordon Road WWTP – 15.5MLD Upgrade, Works Approval Application Supporting Information – December 2019 (Water Corporation, 2019).

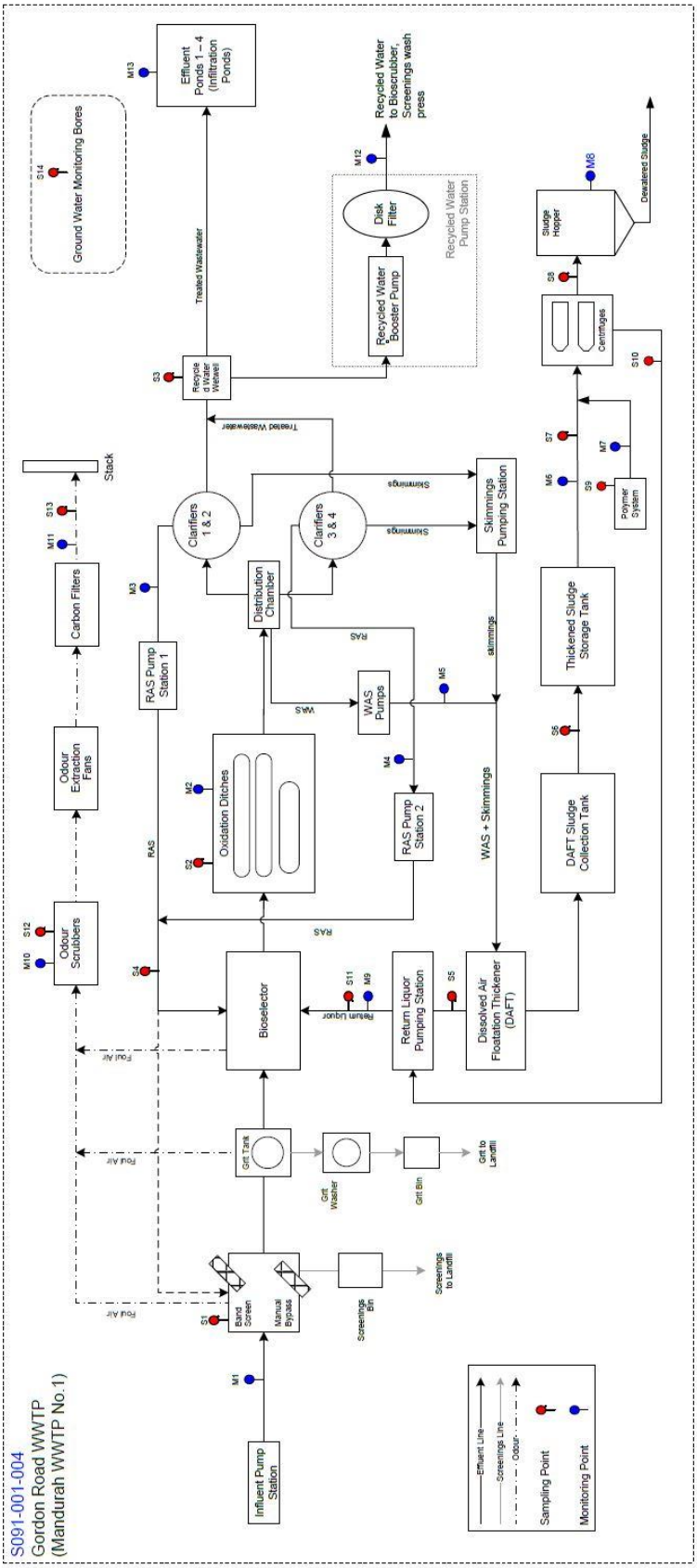

Figure 2: Process diagram

Source: CS03381 Mandurah Gordon Road WWTP – 15.5MLD Upgrade, Works Approval Application Supporting Information – December 2019 (Water Corporation, 2019).

Figure 3: Existing site layout

Source: CS03381 Mandurah Gordon Road WWTP – 15.5MLD Upgrade, Works Approval Application Supporting Information – December 2019 (Water Corporation, 2019).

3.2 Existing Infrastructure

The current Mandurah No. 1 (Gordon Road) Wastewater Treatment Plant facility infrastructure, as it relates to Category 54 activities, is detailed in Table 4.

Table 4: Mandurah No. 1 (Gordon Road) WWTP facility Category 54 infrastructure

	Infrastructure	Site Plan Reference
1	Inlet works – consisting of influent pump station, waste receival pit, band screen and grit tank.	As shown in Figure 3
2	Secondary treatment works – consisting of bioselector and three oxidation ditches, distribution chamber, four clarifiers.	
3	Sludge treatment – Return Activated Sludge (RAS) system consisting of two RAS pump stations. Waste Activated Sludge (WAS) system consisting of a pump station for the WAS and skimmings, Dissolved Air Flotation Thickener (DAFT), thickened sludge storage tank, sludge dewatering centrifuge, sludge hoppers and Polymer storage tank.	
4	Odour treatment infrastructure – consisting of odour scrubbers, extraction fans, carbon filters and dispersion stack.	
5	Treated wastewater disposal – consists of four infiltration lagoons (only 2 currently in use, being No. 3 and 4), and reclaimed effluent pump to recycle water onsite for use in the bioscrubber and screenings wash press.	

4. Proposed construction and upgrade works

The licence holder has applied for a works approval to undertake upgrades to the premises to increase the premises design capacity and increase WWTP performance. Water Corporation have undertaken a recent review of the premises operations which indicated that the bioselector is unable to operate efficiently at the current design capacity, resulting in poor mixed liquor settleability and the carryover of settled solids into the infiltration basins. This upgrade is proposed to assist in addressing this. The upgrade is designed to also accommodate future growth within the catchment.

The proposed premises' upgrades do not alter the processes undertaken on the premises and are to upgrade the treatment capacity only. The quality of treated wastewater achieved is expected to be similar to the current quality, with expected water quality to include:

- An average of 5 mg/L of total nitrogen, ranging up to 8 mg/L;
- An average of 5 mg/L of total phosphorus ranging up to a maximum of 8 mg/L;
- Total suspended solids of less than 10 mg/L; and
- Biological Oxygen Demand of < 5 mg/L.

The proposed upgrade and construction works are expected to commence in June 2021 and will be undertaken between 7am and 7pm Monday to Saturday. Works will take approximately 12 months to complete. Some specific timing or sequencing of works will be required during the construction process. This sequence is shown in Table 5 below. Environmental commissioning

of the completed works will take approximately 4 months, with time limited operations for 90 days to commence following commissioning.

Table 5: Proposed upgrades and construction sequence

Proposed upgrades and new infrastructure, in order of works	
1	Replacement of the existing inlet works outlet chamber and pipe to bioselector. Requirement: Must be able to accommodate flow rate of 687L/s. Construction of the new inlet works next to the existing bypass chamber to allow for construction to occur while the plant is operating to limit downtime.
2	Replacement of existing bioselector by constructing a new larger, passively mixed concrete bioselector. Requirement: Construction of the new bioselector on adjacent land and connection to the new bioselector from the new inlet works chamber. New infrastructure must accommodate instantaneous flow rate of 1,073L/s.
3	Upgrade to Oxidation Ditch 1 aerators to replace aged assets and increase oxygen delivery. Requirements: Must be taken offline for physical modification of the ditches prior to replacing assets. New infrastructure must maintain efficiency of at least 2.0kg O2/kWhr.
4	Upgrade to Oxidation Ditch 2 aerators to replace aged assets and increase oxygen delivery. Requirements: Must be taken offline for physical modification of the ditches prior to replacing assets. New infrastructure must maintain efficiency of at least 2.0kg O2/kWhr.
5	Replacement of existing Waste Activate Sludge (WAS) Pump Station and delivery pipework to the Dissolved Air Floatation Tanks (DAFT). Requirement: Construction of the new WAS as a standalone facility adjacent to the existing WAS, with new pipework being installed to allow for the construction works to occur while the plant is operating. Decommissioning of the existing WAS to occur after commissioning of the new infrastructure. New infrastructure must be able to provide a min. of 19L/s.
6	Replacements for most elements of the existing Return Activated Sludge (RAS) Pump Station No. 1 and delivery pipework to the new bioselector. Requirement: Construction of the new RAS pump station No 1 and discharge pipework to be constructed as a stand-alone unit to allow for the existing infrastructure to continue operating during construction and reduce down time when new connections are made. New infrastructure must be able to provide a maximum of 206L/s.
7	Replacement for most elements of the existing RAS Pump Station No. 2, discharging into the new RAS delivery pipework to the bioselector. Requirement: Upgrade of RAS Pump Station No. 2 to occur whilst operating, therefore progressive pump and discharge pipework replacement will occur. Construction of the RAS delivery main independent of the existing pipework to reduce downtime. Must be able to provide a maximum of 206L/s.
8	Replacement of the existing reclaimed effluent pumps, accumulators and filtration system. Requirement: Replacement of the existing pumps within the recycled effluent wet well in a duty/standby arrangement, and the replacement of existing filtration units and accumulator vessels. Reclaimed effluent pumps must be able to achieve a minimum of 15L/s at 500kPa at delivery points.

9	Installation of Sensory control and data acquisition (SCADA) linked hydrostatic level measurement instruments on the existing large infiltration basins. Requirement: Installation of pond monitoring equipment, and maintenance work to Pond 4 to replace an existing isolation valve. The pond will be offline for a minimal amount of time and will not affect operations.
10	Construction of the new DAFT No. 2 process to increase sludge thickening capacity. Requirement: DAFT No 2 installed as a stand-alone unit in an existing store sump to allow for minimum downtime, and sized to accommodate 24ML/day to accommodate beyond the current upgrade. Must be able to provide thickening of 182kg/hr.
11	Replacement of the existing Potable Water Booster Pump Package with a larger model. Installation of the new booster skid for the polymer batching system, including a bypass around the system and a temporary booster pump to remove the need for shutdowns during infrastructure replacement. Requirement: Must be capable of discharging at least 8L/s
12	Upgrade to Clarifiers No. 1 and 2 via the installation of a feed-well and Stamford baffles, to standardise equipment. Requirement: Refurbishment of Clarifiers No. 1 and No. 2 with Stamford baffles and a new inlet feed-well to improve flocculation and standardise the performance of all four clarifiers. During the refurbishment the clarifiers will need to be offline for an extended period of time, therefore one clarifier will be upgraded at a time.

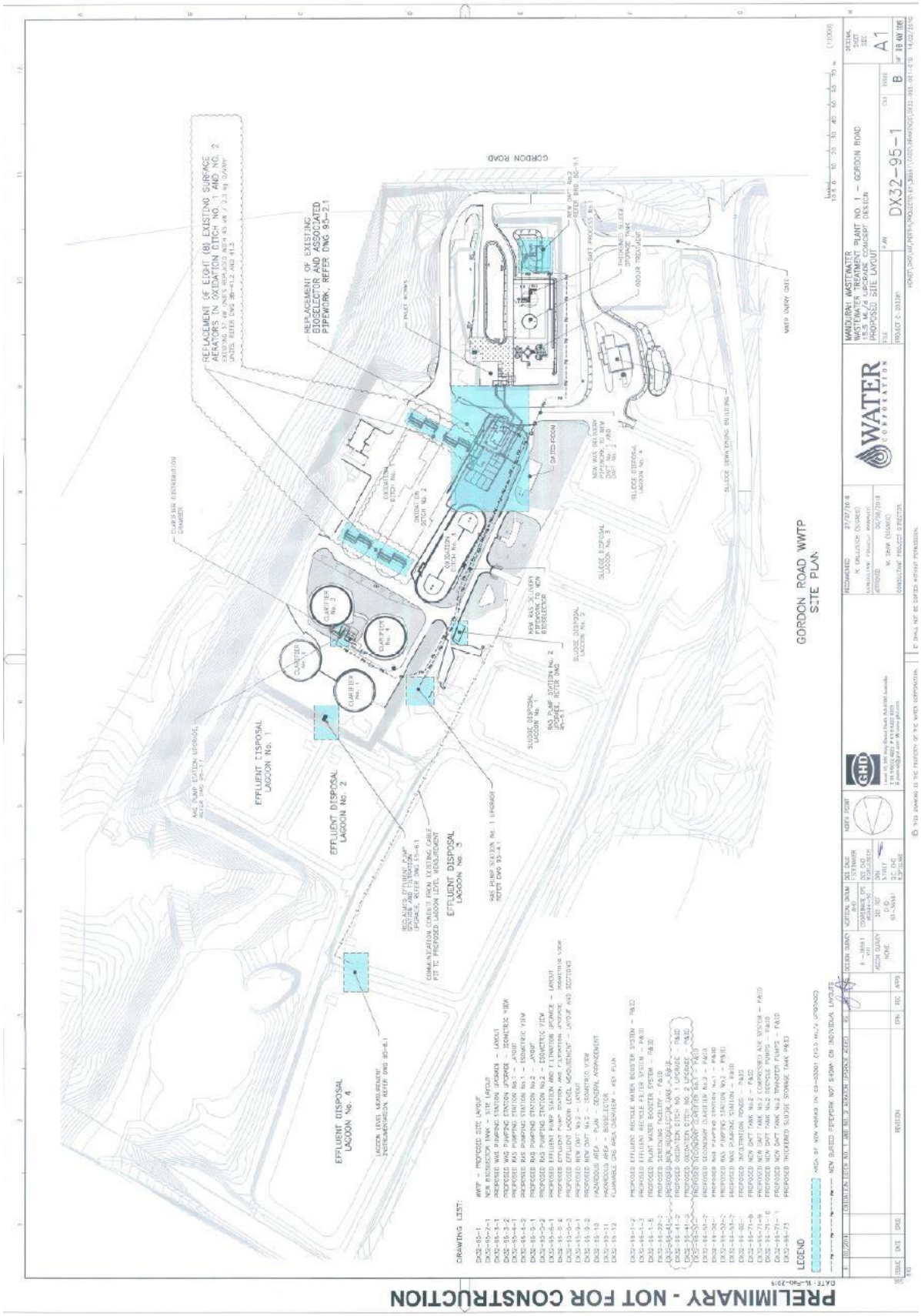

Figure 4: The areas of the premises undergoing works are shown in blue in the above figure

Source: CS03381 Mandurah Gordon Road WWTP – 15.5MLD Upgrade, Works Approval Application Supporting Information – December 2019 (Water Corporation, 2019).

5. Licensing history

Table 6 summarises the works approval and licence history for the premises in the last 10 years.

Table 6: Works approval and licence history

Instrument	Issued	Nature and extent of works approval, licence or amendment
L5950/1991/4	11/10/2000	Licence re-issue
L5950/1991/5	26/09/2001	Licence re-issue
L5950/1991/6	23/10/2002	Licence re-issue
L5950/1991/7	06/10/2003	Licence re-issue
L5950/1991/8	01/10/2005	Licence re-issue
L5950/1991/9	17/10/2005	Licence re-issue
L5950/1991/10	28/10/2010	Licence re-issue
L5950/1991/11	22/10/2015	Licence re-issue
W6356/2020/1	21/08/2020	Works approval to upgrade from 12 ML/day to 15.5 ML/day

6. Legislative context

6.1 Contaminated sites

The lots comprising the wastewater treatment plant were both reported under the *Contaminated Sites Act 2003*. However both lots were classified as 'Report not substantiated' on 2 January 2020, following a Detailed Site Investigation (DSI).

6.2 Other relevant approvals

6.2.1 Planning approvals

A developmental approval is not required under the *Planning and Development Act 2005* as the works are deemed to be public works under Section 6 of the Act.

6.2.2 Department of Health

Water Corporation will require approval from the Department of Health for the proposed upgrade, as the works constitute a major upgrade with significant construction. This approval will be sought once the engineering design process is completed.

6.3 Part V of the EP Act

6.3.1 Applicable regulations, standards and guidelines

The overarching legislative framework of this assessment is the EP Act and EP Regulations. The guidance statements which inform this assessment are:

- *Guidance Statement: Regulatory Principles (July 2015)*
- *Guidance Statement: Setting Conditions (October 2015)*
- *Guidance Statement: Decision Making (February 2017)*
- *Guidance Statement: Risk Assessments (February 2017)*

6.3.2 Compliance and complaints history

A review of the premises' compliance for the last 5 years indicates that compliance is largely achieved for the premises. Two odour complaints were reported in 2018, with the Department attending the premises to review operations. No odours were noted at the premises boundary at the time of the inspection and the reports remained unsubstantiated. Two N1 notifications are noted for non-compliance, relating to the exceedance of the licence limit for nitrogen in the infiltration pond discharges. These events were linked to an unplanned shutdown of the clarifiers, and were resolved.

6.3.3 Clearing

Approximately 0.2 ha of native vegetation is proposed to be cleared as part of the upgrade proposal. Water Corporations state-wide Purpose Permit, CPS 185, is intended to be used for this clearing activity, and therefore clearing is not further assessed as part of this amendment.

7. Emissions, receptors and pathways

7.1 Emissions

The key emissions during construction which have been considered in this report are **noise, odour, dust and poor quality treated wastewater discharges** from activities including ground works, vehicle movement and placement and installation of equipment and infrastructure.

The key emissions considered during operation are **noise, odour and treated wastewater discharges.**

Following completion of works and commissioning, an amendment to the licence L5950/1991/11 will be required to authorise emissions associated with the ongoing operations of the premises. A risk assessment for the operational phase has been included in this Decision Report, however licence conditions will not be finalised until DWER assesses the associated licence application.

7.2 Receptors

Table 7 below lists the relevant sensitive land uses within 5km of the prescribed premises which may be receptors relevant to the proposed works.

Table 7: Receptors and distance from activity/prescribed premises

Human receptors	**Distance from activity/prescribed premises**
Industrial premises Gordon Road Waste Transfer Station	Site adjacent to the WWTP on the northern boundary
Rural Residential Premises (5 acre lots)	100 m east and north east
Frederick Irwin Anglican School	118 m west
Meadow Springs Sporting Facility	187 m north west
Gordon Road Commercial and Industrial Zone	200 m south west
RAAFA Meadow Springs Retirement Village	395 m north west
Environmental receptors	**Distance from the activity/prescribed premises**
Ramsar Site – Peel Yalgorup System	4.6 km to the south west
Conservation Category Wetland - Goegrup Lake	1.2 km east south east
Indian Ocean	2 km west
Peel Inlet	4.17 km south west
Serpentine River	4 km north east

DBCA Managed Lands – Goegrup Lake Un-named Nature Reserve	 1.2 km east south east 2.7 km north east
Waterways Conservation Act 1976 Areas Peel Inlet Management Area	 930 m west
Peel Harvey Environmental Protection Policy	Directly adjacent to the southern premises boundary, and 130 m from the eastern boundary.
Threatened Ecological Communities Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain	Directly adjacent to the premises boundary on the east and western sides. The premises falls within the designated 50m buffer zone.
Priority Ecological Community Subtropical and Temperate Coastal Saltmarsh –P3	1.2 km east south east at Goegrup Lake
Threatened/Priority Flora *Jacksonia sericea* – Priority 4 *Drakea elastica* - Endangered	There are 4 records of rare and priority flora within a 5 km distance of the premises, associated with areas of remnant vegetation and Goegrup Lake/Serpentine River.
Threatened/Priority Fauna *Isoodon fusciventer* (Quenda) *Calyptorhynchus latirostris* (Carnaby's Black Cockatoo) *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo)	Several recorded occurrences for each species within a 2 km radius of the premises, predominantly in well vegetated areas.
Environmental aspects	**Environmental value**
Groundwater aspect	Groundwater depth on the premises ranges from 1.5 mbgl to 23.5 mbgl, based on onsite monitoring information. Groundwater mounding is present on the site, associated with the infiltration of treated wastewater. Groundwater flows both east and west of the premises, due to groundwater mounding. The aquifer directly below the premises is an unconfined superficial aquifer, recharged predominantly by rainwater infiltration, and in the vicinity of the premises by artificial recharge from infiltrating treated wastewater.

Environmental aspects	Environmental value
Downgradient bore users/abstraction	There are 114 registered bores and 14 abstraction licences within 1 km of the wastewater treatment plant, with the primary use being irrigation (Water Corporation, 2019a).
Acid Sulfate Soils (ASS) risk	There is no known Acid Sulfate Soils risks associated with the premises.
Geology	The site is located on the Tamala Limestone Formation, which extends approximately 22-30 m below ground level at the premises. The Rockingham Sand Formation underlies the limestone.
RIWI Act areas	The premises is located within the South West Coastal proclaimed groundwater area.

7.3 Pathways

There is the potential for **air** to act as a pathway to noise, odour and dust emissions during construction works and ongoing operations. A review of annual windrose data on the Bureau of Meteorology website indicates that wind direction is predominantly from the south east in the morning, with a south westerly wind in the afternoons.

There is the potential for **groundwater** to act as a pathway for treated wastewater discharges to reach nearby downstream environmental receptors, being the Indian Ocean (2.1 km west), Goegrup Lake (1.2 km east) and downstream bore users, during the proposed works and ongoing operation of the premises. Infiltrated treated wastewater may migrate through the shallow and deep aquifers below the premises to these receptors. Groundwater flow is in a westerly direction (regional flow) and easterly direction (local flow), with groundwater mounding on the premises associated with infiltration of treated wastewater on the premises.

8. Applicant controls

Table 8: Summary of potential emissions and applicant controls

Emission	Source	Pathway	Proposed controls
Construction			
Noise	Excavation works Construction and placement of new infrastructure/equipment Vehicle movement	Air	Construction work to be undertaken between the hours of 7am and 7pm, Monday to Saturday (excluding public holidays). Construction Environmental Management Plan (CEMP) to be prepared detailing how noise emissions will be managed to comply with the Noise Regulations, and must include using the quietest reasonably available equipment for the works, and a complaints response process.
Odour	Interruption of treatment process to upgrade/install new equipment/infrastructure	Air	To minimise disruptions to the treatment process, the majority of works will occur alongside the operating plant reducing offline times. Complaints management procedure.
Dust	Excavation and stockpiling of soils, minor earthworks and movement of vehicles and plant on the premises	Air	Construction Environmental Management Plan (CEMP) to be prepared detailing how dust emissions will be managed and mitigated. Complaints management procedure
Poor quality wastewater discharge	Interruption of treatment process to upgrade/install new equipment/infrastructure	Groundwater	To minimise disruptions to the treatment process, the majority of works will occur alongside the operating plant reducing offline times
Operation			
Noise	Operation of upgraded wastewater treatment plant	Air	Existing operational controls
Odour	Receipt, processing and treatment of wastewater, and the discharge of wastewater into the onsite infiltration ponds.	Air	Existing operational controls will be used to manage and minimise the potential for odour emissions to impact offsite. This includes an odour collection and treatment system.

Emission	Source	Pathway	Proposed controls
Treated wastewater discharge	Discharge of treated wastewater into the onsite infiltration ponds.	Groundwater	Existing operational controls, and upgrades subject to this W/A to improve system performance

9. Risk assessment

Risk is assessed as a combination of emissions sources, the proximity and sensitivity of receptors to those emission sources and any pathways that can allow the emission to reach and potentially harm the receptor. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event. In addition, where an emission has an actual or likely pathway and a receptor which may be adversely impacted, but that emission is regulated through other mechanisms such as Part IV of the EP Act, that emission will not be risk assessed further and will be screened out through Table 9.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Table 9 below, consistent with the *Guidance Statement: Risk Assessments*. Risk ratings have been assessed for each key emission source and take into account potential source-pathway-receptor linkages. The mitigation measures / controls proposed by the applicant have been considered in determining the risk rating. Emissions during construction, commissioning and operation have been assessed separately to allow clear delineation of activity phases.

The works approval that accompanies this report authorises construction, commissioning and time-limited operations. A licence is required to operate the premises following the time-limited operational phase authorised under the works approval.

The conditions in the issued works approval have been determined in accordance with the *Guidance Statement: Setting Conditions*.

Table 9. Identification of emissions, pathway and receptors

Risk Event					Risk rating[1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Construction								
Construction, mobilisation and positioning of infrastructure Excavation works Vehicle/heavy machinery movements	Noise	Air	Industrial premises next door; Rural residential receptors 100 m east/north east (boundary to boundary) (closest residential house is approx. 300 m from the nearest works areas).	A risk assessment undertaken by Water Corporation has determined that the potential noise emissions from the upgrades will comply with Regulation 13 of the *Environmental Protection (Noise) Regulations 1997*, which relates to noise emissions from construction sites.	Consequence: **Minor** Likelihood: **Possible** Risk rating: **Medium**	No	Conditions 1 and 2	Water Corporation has committed to having a Construction Environmental Management Plan (CEMP) which will address the potential for noise emissions and provide mitigation measures. This plan is yet to be developed. The works approval will specify the minimum requirements for the CEMP to manage Noise emissions.
Interruption of treatment process to upgrade/install new equipment/infrastructure	Odour	Air	Industrial premises next door; Rural residential receptors 100 m east/north east (boundary to boundary); Frederick Irwin Anglican School 118 m west; Commercial and industrial zone 200 m south west.	To minimise disruptions to the treatment process, the majority of works will occur alongside the existing operating plant, reducing the amount of time parts of the plant will be taken offline. Short-term interruptions of the plant have occurred historically with no complaints received at the premises (Water Corporation, 2019). A complaint management procedure on the premises will identify any offsite impacts from the short-term interruption of odour treatment for the proposed works.	Consequence: **Minor** Likelihood: **Unlikely** Risk rating: **Low**	Yes	Conditions 1 and 2	The works approval will specify the minimum requirements for the CEMP to manage odour emissions.

Risk Event					Risk rating[1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Excavation and stockpiling of soils, minor earthworks and movement of vehicles and plant on the premises	Dust	Air	Industrial premises next door; Rural residential receptors 100 m east/north east (boundary to boundary).	The majority of the premises comprises of hardstand areas and bitumised roads, reducing the potential for dust emissions to occur. However for those areas and activities that may result in dust emissions, mitigation measures will be included in the premises' Construction Environmental Management Plan (CEMP) to be prepared by the applicant's chosen contractor.	Consequence: **Slight** Likelihood: **Rare** Risk rating: **Low**	Yes	Conditions 1 and 2	The works approval will specify the minimum requirements for the CEMP to manage dust emissions.
Discharge of lower quality treated wastewater on the premises, from equipment being taken offline as required during works.	Low quality treated wastewater	Groundwater	Goegrup Lake, 1.2 km east Indian Ocean, 2 km west Downgradient bore users	To minimise disruptions to the treatment process, the majority of works will occur alongside the existing operating plant, reducing the amount of time parts of the plant will be offline.	Consequence: **Slight** Likelihood: **Possible** Risk rating: **Low**	Yes	Conditions 1 and 2	The Delegated Officer considers existing monitoring requirements are sufficient to monitor impacts to discharge water quality when the plant is offline during the works. The works approval will specify the minimum requirements for the CEMP to manage potential wastewater emissions during construction.

Risk Event					Risk rating[1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Commissioning								
Operation of the wastewater treatment plant	Noise	Air	Industrial premises next door; Rural residential receptors 100 m east/north east (boundary to boundary).	Existing operational controls are considered suitable for managing noise emissions from the commissioning of the upgraded plant and equipment.	Consequence: **Minor** Likelihood: **Unlikely** Risk rating: **Low**	Yes	N/A	N/A
Receipt, processing and treatment of wastewater, and the discharge of wastewater into the onsite infiltration ponds.	Odour	Air	Industrial premises next door; Rural residential receptors 100 m east/north east (boundary to boundary); Frederick Irwin Anglican School 118 m west; Commercial and industrial zone 200 m south west.	Existing operational controls will be used to manage and minimise the potential for odour emissions to impact offsite. This includes an odour collection and treatment system.	Consequence: **Moderate** Likelihood: **Unlikely** Risk rating: **Medium**	Yes	Condition 10	Existing licence conditions for the premises require that Water Corporation operate and maintain odour pollution control equipment on the premises to prevent and mitigate odour emissions. The controls provided in the existing licence condition has been included in the works approval to address odour emissions that may result from commissioning activities.

Risk Event					Risk rating[1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Discharge of secondary treated wastewater into the onsite infiltration ponds	Treated wastewater	Groundwater	Goegrup Lake, 1.2 km east; Indian Ocean, 2 km west; Downgradient bore users.	Existing operational controls and treatment processes will be used to treat wastewater to an acceptable standard for discharge. In addition, the proposed works will result in improvements in the system outputs.	Consequence: **Minor** Likelihood: **Possible** Risk rating: **Medium**	No	Conditions 11-15	The Delegated Officer notes that, whilst the proposed activities are anticipated to generate similar wastewater quality to the existing operations, there is the potential during commissioning for treated wastewater quality to fluctuate where plant commissioning takes equipment offline. In order to assess and monitor the potential impacts, monitoring of discharges and groundwater will be required during commissioning.
Operation (including time-limited-operations operations)								
Operation of the wastewater treatment plant	Noise	Air	Industrial premises next door; Rural residential receptors 100 m east/north east (boundary to boundary).	Existing operational controls are considered suitable for managing noise emissions from the commissioning of the upgraded plant and equipment.	Consequence: **Minor** Likelihood: **Unlikely** Risk rating: **Low**	Yes	N/A	N/A

Risk Event					Risk rating[1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Receipt, processing and treatment of wastewater, and the discharge of wastewater into the onsite infiltration ponds.	Odour	Air	Industrial premises next door; Rural residential receptors 100 m east/north east (boundary to boundary); Frederick Irwin Anglican School 118 m west; Commercial and industrial zone 200 m south west.	Existing operational controls will be used to manage and minimise the potential for odour emissions to impact offsite. This includes an odour collection and treatment system.	Consequence: **Moderate** Likelihood: **Unlikely** Risk rating: **Medium**	Yes	Condition 20	Existing licence conditions for the premises require that Water Corporation operate and maintain odour pollution control equipment on the premises to prevent and mitigate odour emissions. The controls provided in the existing licence condition has been included in the works approval for odour emissions that may result from time limited operations.
Discharge of secondary treated wastewater into the onsite infiltration ponds	Treated wastewater	Groundwater	Downgradient bore users	The existing and upgraded wastewater treatment plant and processes will be used to treat wastewater to a suitable quality for discharge. The upgraded plant at the maximum design capacity is anticipated to produce treated wastewater quality similar to current quality level.	Consequence: **Minor** Likelihood: **Unlikely** Risk rating: **Medium**	Yes	Conditions 21-25	See Detailed risk assessment section 9.1.4
			Indian Ocean		Consequence: **Minor** Likelihood: **Unlikely** Risk rating: **Medium**	Yes	Conditions 21-25	See Detailed risk assessment section 9.1.5

Risk Event					Risk rating[1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
		Groundwater	Goegrup Lake, 1.2 km east	The existing and upgraded wastewater treatment plant and processes will be used to treat wastewater to a suitable quality for discharge. The upgraded plant at the maximum design capacity is anticipated to produce treated wastewater quality similar to current quality level.	Consequence: **Major** Likelihood: **Possible** Risk rating: **High**	No	Conditions 21-25	See Detailed risk assessment Section 9.1.6

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the Department's Guidance Statement: Risk Assessments (February 2017).

9.1 Detailed risk assessment – Treated wastewater discharge

The Mandurah No. 1 (Gordon Road) Wastewater Treatment Plant (WWTP) is considered to be a locally significant source of potential contaminants due to the discharge and infiltration of secondary treated wastewater on the premises. The proposed works will increase the treatment capacity from 12ML/day to 15.5ML/day Average Dry Weather Flow (ADWF). The plant currently runs at an average of 10.44ML/day. Full capacity of the proposed upgrade is not expected to be realised until 2033, with increases to infiltration being undertaken gradually over time as demand increases.

A review of treated wastewater quality, ambient groundwater quality and flow has been undertaken to assess the potential impacts that may result from the increase of infiltration on site. Technical advice has been sought from DWER's Kwinana-Peel Region and Contaminated Sites Branch, and the Department of Biodiversity, Conservation and Attractions (DBCA) planning team, to assist in a determination and assessment of this proposal.

9.1.1 Current treated wastewater discharge quality

The Mandurah No. 1 (Gordon Road) WWTP treats wastewater to a secondary standard. The most recent treated wastewater quality results are shown in Figure 5 below.

Date	Ammonium as Nitrogen (mg/L)	Biochemical Oxygen Demand (mg/L)	*Escherichia coli* (cfu/100 mL)	Nitrite plus Nitrate (mg/L)	pH	Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
Jul-18	1.2	<5	>24,000	0.46	7.89	<5	390	3.6	1.6
Aug-18	1.4	<5	24,000	0.72	7.84	10	420	3.1	3.4
Sept-18	1.9	<5	>24,000	0.86	8.02	5	410	4.3	2.3
Oct-18	0.86	<5	>24,000	0.96	7.81	<5	400	3.8	2.6
Nov-18	2.5	<5	16,000	0.93	8.07	<5	400	5.5	4.3
Dec-18	2.9	<5	>24,000	1.0	7.98	5	400	5.7	5.8
Jan-19	2.4	<5	>24,000	1.1	7.95	10	410	4.7	7.7
Feb-19	0.16	<5	>24,000	0.91	7.97	10	380	2.7	7.2
Mar-19	3.4	<5	>24,000	0.67	8.00	10	400	5.7	5.6
Apr-19	0.24	<5	>24,000	2.5	8.03	<5	410	4.4	5.4
May-19	0.09	<5	>24,000	5.1	7.95	5	390	7.2	6.7
Jun-19	1.1	<5	>24,000	4.7	7.78	5	410	7.5	5.0
Licence Limits	-	-	-	-	-	-	-	10	-

Figure 5: Wastewater treatment quality 2018/19

Source: CS03381 Mandurah Gordon Road WWTP – 15.5MLD Upgrade, Works Approval Application Supporting Information – December 2019 (Water Corporation, 2019).

9.1.2 Potential treated wastewater discharge quality

Figure 6 below provides the anticipated treated wastewater discharge quality at full capacity of the upgraded plant.

Emission Point	Parameter	Average	Max	SD	Upper range (Avg + 2*SD)	
Discharge infiltration ponds	pH	7.9	8.1	0.09	8.1	
	Total Suspended solids	5.8	10	3.2	12.3	
	Total dissolved solids	401.7	420	11.1	423	
	Biochemical oxygen demand	<5	<5	<5	<5	
	Total Phosphorous	4.8	7.7	2.0	8.8	
	Total Nitrogen	4.9	7.5	1.5	7.9	
	Nitrate + nitrite-nitrogen	1.7	5.1	1.6	4.9	
	Ammonium-nitrogen	1.5	3.4	1.1	3.7	
	E. coli	>24000	>24000	>24000	>24000	

Figure 6: Anticipated treatment quality at 15.5ML/day

Source: CS03381 Mandurah Gordon Road WWTP – 15.5MLD Upgrade, Works Approval Application Supporting Information – December 2019 (Water Corporation, 2019)

9.1.3 Current ambient groundwater quality

Infiltration of treated wastewater in infiltration ponds, historical infiltration in a former offsite quarry and leaching from the former sludge drying beds, has increased the nutrient concentration in groundwater beneath the site (Golder Associates 2019). In addition, groundwater mounding occurs underneath the premises as a result of onsite infiltration of treated wastewater.

Water Corporation currently monitor 12 bore sites as required under DWER licence L5950/1991/11. Groundwater is currently monitored for pH, E.coli, Total dissolved solids (TDS), Total Nitrogen (TN), Nitrate + Nitrite-nitrogen, Ammonium-nitrogen and Total Phosphorus (TP). The current groundwater monitoring sites are shown in Figure 7.

For the current monitored groundwater parameters, most have been relatively stable over the last few years with the most notable seasonal fluctuations in bores 1/88, 4/88, 1/01 and the Production Bore, for Total Nitrogen and Nitrate + Nitrite as Nitrogen.

Current groundwater monitoring indicates that Total Phosphorus (TP) is not significantly migrating within groundwater, with TP concentrations less than 0.2mg/L east of the WWTP boundary and less than 0.25mg/L overall, with concentrations returning to background levels (0.1mg/L) within 200 m of the premises. This is likely due to sorption of TP by the underlying Tamala Limestone.

A Detailed Site Investigation (DSI) undertaken by Golder Associates in 2019 for the contaminated sites investigation found that nutrient concentrations did not exceed Tier 1 screening criteria for non-potable uses, with the exception of Total Phosphorus which marginally exceeded the long term irrigation criteria. However this criteria was developed to prevent the clogging of irrigation equipment, and is therefore not relevant to potential environmental outcomes (Golder Associates 2019).

Figure 7: Current groundwater monitoring bores for Licence L5950/1991/11

An existing nitrogen plume exists beneath the premises within the groundwater aquifer as a result of historic infiltration and sludge drying activities. Whilst Total Nitrogen (TN) is known to be highly mobile, groundwater monitoring of the local area indicates that attenuation of nitrogen is occurring between the WWTP and Goegrup Lake such that elevated concentrations of TN relative to the lake's background levels are not seen (Water Corporation, 2019). It is unknown what specific mechanisms are facilitating the attenuation, however the Detailed Site Investigation by Golder Associates (2019) assessed that sorption of ammonia, followed by nitrification and denitrification may be occurring.

The DSI also found concentrations of metals and metalloids within 31 samples, including within the samples of treated wastewater. In particular, it was noted that boron concentrations exceeded Tier 1 risk screening criteria for ANZECC & ARMCANZ (2000) long term irrigation water (LTIW) use in 50% of samples. Boron is a common contaminant in wastewater recharge. It is noted that the LTIW use criteria for boron were developed to protect sensitive crops, and as the main irrigation downstream is to turf, these criteria do not apply in this setting. Notwithstanding, boron can be used as an effective tracer for groundwater wastewater contamination.

Phenols and Per and Poly-fluorinated substances (PFAS) concentrations in the treated wastewater were noted to be comparable with background levels in groundwater in the area, with PFAS levels in the discharge samples generally noted to be less than background groundwater concentrations. Consequently, these chemical constituents would not be expected to cause groundwater contamination in the area at the current rate of discharge (Golder Associates 2019).

9.1.4 Potential impacts to down-gradient bore users with increased infiltration

The proposed wastewater treatment plant upgrades have the potential to increase nutrient and contaminant concentrations in groundwater abstracted for irrigation and non-potable uses down-gradient of the treatment plant.

There are 114 registered bores and 14 registered abstraction licences within 1 km of the wastewater treatment plant, with the primary use being irrigation (Water Corporation, 2019). Groundwater flow from the wastewater treatment plant occurs locally in an easterly direction, and regionally in a westerly direction. Therefore, groundwater users east and west of the premises are considered to be the likely receptors for changes to groundwater quality that result from increased infiltration of treated wastewater on the premises.

A review of the treated wastewater discharges and groundwater monitoring concentrations against *Department of Health (2014) Non-potable Groundwater Use* (NPGU) criteria is considered most suitable for assessing the potential impacts to these receptors. However, it is noted that no NPGU criteria exist for Total Phosphorus, Total Nitrogen, Biological Oxygen Demand, Total Suspended Solids and Total Dissolved Solids. A water quality criteria value of 0.5 mg/L for Ammonia as NH_3 is provided, with all groundwater monitoring undertaken since 2015 reporting concentrations below this level for NH_3-N.

The Detailed Site Investigation (Golder Associates 2019) found that existing groundwater parameter concentrations are considered suitable for non-potable groundwater use. Given that treatment levels for the proposed upgrade at full capacity are expected to result in similar water quality outcomes, the 'consequence' for the proposed risk is considered to be 'minor', with a 'likelihood' of the risk event affecting down-gradient users being considered 'unlikely'. This result in an overall risk rating of 'Medium', with DWER noting that works approval and licence conditions requiring discharge to land and ambient groundwater quality will assist in identifying

any potential impacts from the increased infiltration of treated wastewater at the premises.

9.1.5 Potential impacts to the Indian Ocean with increased infiltration

The increased infiltration of treated wastewater from the premises also has the potential to impact the Indian Ocean due to its location down-gradient from the premises.

As part of the upgrade application, Water Corporation has undertaken groundwater modelling to assess potential groundwater impacts from 20 years of treated wastewater infiltration at the upgraded design capacity of the plant. The modelling focused on the potential impact of Total Nitrogen, and considered conservative and worst case scenarios. Under the worst case scenario, modelling indicates that after 20 years of increased infiltration TN concentrations within groundwater at the coast may increase by 0.4 mg/L compared to current levels. Increased groundwater levels were also noted in the modelling, with the potential for increased infiltration to result in a water table rise less than 0.1 m at the coast.

A review of the proposed treated wastewater discharge against the ANZECC and ARMCANZ (2000) 95% marine water quality criteria is considered most suitable for assessing the potential impacts to these receptors. However, it is noted that no criteria exist for Total Phosphorus, Total Nitrogen, Biological Oxygen Demand, Total Suspended Solids and Total Dissolved Solids. A 95% marine water quality criteria of 0.91mg/L is provided for Ammonia as NH_3-N, which is exceeded in the average expected discharge water quality at the upgraded premises at full capacity (1.5mg/L). However it is noted that the average discharge concentration of NH_3-N currently observed in treated wastewater discharge is also around 1.5mg/L.

A review of groundwater monitoring results for bore 1/01 located down-gradient of the premises to the west, indicates that whilst the discharge from the wastewater treatment plant currently exceeds these ecological marine water criteria, these criteria are unlikely to be exceeded at the coast with groundwater results for NH_3-N at this bore generally below the level of detection (<0.05mg/L). Therefore the proposed upgrade and increased infiltration is not considered likely to increase the potential for marine protection water quality guidelines to be triggered. In addition, the recent Detailed Site Investigation (Golder Associates 2019) noted that Tier 1 screening criteria for the protection of marine ecosystems was unlikely to be exceeded from the current activities at the wastewater treatment plant, given the distance to the Indian Ocean and observations through groundwater monitoring that attenuation of nutrients through the aquifer and soils is occurring.

DWER notes that although nitrogen attenuation appears to be occurring through groundwater from the site to nearby receptors, there is currently insufficient groundwater chemical data available from monitoring to demonstrate that these processes are taking place with a high level of certainty. In addition, the observation of nitrogen attenuation could also be caused by other means, such as the movement of ammonium ions (the dominant nitrogen species in groundwater in the area) being slowed down by sorption by minerals in the aquifer matrix (Buss *et al*., 2004), which could result in negligible nitrogen loss from the aquifer. If the latter were to be the case, groundwater flow could eventually transport nitrogen concentrations at levels of environmental concern to discharge areas at the coast (DWER 2020).

Considering that the proposed upgrade and increased infiltration of treated wastewater will result in discharges of a similar water quality, and the longer distance of the premises to the Indian Ocean, the consequence of the risk event is considered to be ‘minor’ with a likelihood of the risk event occurring considered to be ‘unlikely’. This results in an overall risk rating of ‘Medium’, with the Delegated Officer noting that conditions relating discharge to land and ambient groundwater quality will assist in identifying any potential impacts from the increased infiltration of treated wastewater at the premises to the Indian Ocean.

9.1.6 Potential impacts to Goegrup Lake with increased infiltration

Goegrup Lake is a local conservation area, connected to the Serpentine River and the Peel Inlet, all of which are within the *Environmental Protection Peel Inlet – Harvey Estuary Policy 1992* (EPP Peel-Harvey Policy) area. The lake comprises of Priority Ecological Community (PEC) (P3) Subtropical and Temperate Coastal Saltmarsh. Due to its connection to the Peel Inlet, Goegrup Lake is subject to tidal influences from the Indian Ocean. Water quality of the lake is known to comprise a seasonal cycle of salinity and nutrient concentrations and low dissolved oxygen, with nutrients typically lower in summer when tidal influences are the dominant hydrological factor (Water Corporation, 2019). High winter surface flows bring large volumes of nutrients to the catchment.

The majority of nutrient inputs to the lake are reportedly generated from agricultural runoff within the catchment. Concentrations of Total Nitrogen (TN) recorded at sampling locations at the northern inlet and southern outlet of the lake, show that concentrations significantly exceed the ANZECC & ARMCANZ (2000) guideline values for TN in lowland rivers of south west Australia for slightly disturbed ecosystems. Point sources such as the WWTP are estimated to provide less than 0.4% of all inputs (Water Corporation, 2019). Notwithstanding, Goegrup Lake has been subject to toxic phytoplankton blooms due to TN inputs, and given the lake's high conservation value, the potential migration of additional nutrients from the proposed increased infiltration of treated wastewater from the treatment plant needs to be considered and monitored.

As part of the upgrade application, Water Corporation has undertaken groundwater modelling to assess potential groundwater impacts from 20 years of treated wastewater infiltration at the upgraded design capacity of the plant. The modelling focused on the potential impact of Total Nitrogen, and considered conservative and worst case scenarios. Under the worst case scenario, modelling indicates that after 20 years of increased infiltration, TN concentrations within groundwater adjacent to Goegrup Lake may increase by up to 0.7 mg/L compared to current levels. Conservative groundwater modelling shows a potential increase of 0.2-0.4 mg/L for TN adjacent to Goegrup Lake. Increased groundwater levels were also noted in the modelling, with the potential for increased infiltration to result in a water table rise of 0.6 m near the treatment plant, reducing to less than 0.1 m at Goegrup Lake.

DWER has reviewed the proposal and supporting information and notes that although nitrogen attenuation appears to be occurring through groundwater from the site to nearby receptors, there is currently insufficient groundwater chemical data available from monitoring to demonstrate that these processes are taking place with a high level of certainty. In addition, the observation of nitrogen attenuation could also be caused by other means, such as the movement of ammonium ions (the dominant nitrogen species in groundwater in the area) being slowed down by sorption by minerals in the aquifer matrix (Buss *et al*., 2004), which could result in negligible nitrogen loss from the aquifer. If the latter were to be the case, groundwater flow could eventually transport nitrogen concentrations at levels of environmental concern to discharge areas at Goegrup Lake (DWER 2020).

While it is noted that the impacts from the wastewater treatment plant are currently considered to be low, and the current distribution of elevated nitrogen concentrations is unlikely to change significantly over the short term (i.e. a time period of at least 10 years), due to the uncertainty regarding the long-term fate and transport of nitrogen compounds associated with the final treated wastewater and infiltration rate, potential impacts to groundwater and downstream receptors requires further investigation. This requires that sufficient data is collected from the monitoring of treated wastewater and groundwater to demonstrate that the inferred nitrogen removal processes are taking place in the superficial aquifer.

Given the high conservation value of Goegrup Lake, the high potential impacts from an increase to nutrient inputs to the lake (e.g. increases to algal blooms, impacts to the priority ecological saltmarsh vegetation community) and the high level of uncertainty around long-term fate and transport of nutrients and other contaminants that originate from the wastewater treatment plant

discharges and underlying nitrogen plume, the risk consequence for Goegrup Lake is considered to be 'major', with the likelihood of the event occurring considered to be 'possible'.

This results in an overall risk rating of 'High'. The issued works approval and existing licence conditions requiring discharge to land and ambient groundwater quality will assist in identifying any potential impacts from the increased infiltration of treated wastewater at the premises to Goegrup Lake. However additional regulatory controls are also required to obtain further information from groundwater monitoring to assist in identifying the long-term fate and transport mechanisms occurring within the groundwater near the premises, and the results of which will likely inform the nature of future regulatory controls to manage this discharge. Initially proposed regulatory controls are detailed below.

9.1.7 Proposed regulatory controls

Works Approval

Monitoring of discharges during construction, commissioning and time limited operations

In order to reduce the potential for impacts to occur from the construction and installation works, the majority of works will be undertaken alongside the plant as it is operating, with minimal time required for taking sections or parts of the plant offline. Monitoring of discharge emissions during construction will allow for the identification and monitoring of any increased contaminants that may occur during the construction and installation process.

Water Corporation have requested commissioning and time limited operations under the works approval. Monitoring of treated wastewater discharges to land and ambient groundwater monitoring, are considered suitable to monitor discharges and potential impacts during the commissioning and time limited operations stages.

Licence L5950/1991/1 Amendment following proposed works

Following the completion of works a Licence Amendment application will be required to incorporate the new plant and equipment on the existing licence and to upgrade the premises' design capacity. The following requirements will be considered during the assessment of the licence amendment application, and may added to the licence following the completion of works to address the potential emissions and impacts from the proposed plant upgrade. The rationale is also provided below.

1) *Addition of testing parameters to groundwater monitoring to assist in identifying nitrogen attenuating processes*

There is some evidence to indicate that Total Nitrogen is being attenuated through the groundwater prior to reaching nearby sensitive receptors, however the specific mechanism for this is not known. Additional groundwater testing parameters are considered suitable to help identify the movement of nitrogen through the aquifer and demonstrate if the inferred nitrogen removal processes are actually taking place. The additional groundwater testing parameters of dissolved organic carbon, iron, bicarbonate, sulfate, chloride and major cations (sodium, potassium, calcium, magnesium), will be placed on the revised licence to address this.

2) *Addition of metals and metalloids to treated wastewater discharge and groundwater monitoring*

Current ambient groundwater monitoring requirements do not include testing for metals and metalloids. DWER considers that a revised groundwater monitoring suite should also include arsenic, as metalloids and some metals that are naturally present in minerals in the aquifer matrix can be released into groundwater due to microbially-driven chemical reactions caused by the recharge of wastewater. Of particular concern, is the release of arsenic from iron oxide coatings on sand grains within the aquifer. The large amount of iron staining of walls caused by domestic bores near the Gordon Road WWTP site suggests that this is taking place, therefore it is important that arsenic concentrations are continually assessed in groundwater monitoring

carried out at the site (DWER 2020). DWER notes that Water Corporation have also included arsenic as a parameter in their proposed treated wastewater discharge and groundwater monitoring programs in the works approval application.

3) Addition of borate ions to discharge and groundwater monitoring suite

In addition to the above analytes, DWER's Contaminated Sites Branch (2020) have recommended that boron (as borate ions) is added to the analytical suite for groundwater. This analyte is considered necessary as wastewater recharge is likely to be the only significant source of this chemical constituent in groundwater in the area (i.e. it would be an effective chemical tracer of the effects of the discharge scheme on groundwater). Additionally, as borate ions are likely to behave in a conservative fashion in groundwater, the distribution of these ions will likely provide a more accurate indicator (as opposed to nitrogen) of the full extent to which groundwater quality near the Gordon Road WWTP site has been influenced by treated wastewater infiltration. Ongoing monitoring of boron (as borate ions) in groundwater is also considered to indicate whether the groundwater plume caused by recharge at the site is continuing to expand over time, or has reached a steady-state length. The inclusion of borate ion monitoring in the discharge wastewater suite will assist in identifying the boron concentrations infiltrated.

4) Inclusion of additional groundwater monitoring bores and monitored parameters as part of Water Corporation's proposed monitoring program

As part of the works approval application Water Corporation has recommended that the existing groundwater monitoring regime required by the current licence, be updated to include newly installed down gradient sentinel monitoring bores. Water Corporation also provided a proposed monitoring program which included additional testing parameters Aluminium, Arsenic, Cadmium, Chromium, Cobalt, Lead, Manganese, Nickel, Potassium and Zinc.

The Detailed Site Investigation (DSI) (Golder Associates 2019) also recommended that the groundwater monitoring program be revisited such that changes in nutrient concentrations is monitored in the future.

5) Speciation of nitrogen and ammonia in monitoring requirements

The current licence provides for monitoring of nitrogen in several forms (Total N, Nitrate+ Nitrite-Nitrogen and Ammonium – nitrogen). It is considered likely that monitoring conditions within the amended licence will detail Nitrogen species, such that total concentrations of each are easier to identify and assess.

6) Provision of a Site Specific Hydrological Assessment

Additional monitoring of wastewater discharges and ambient groundwater will provide data to assist in the demonstration of how groundwater is behaving around the premises, and how contaminants and nutrients from the infiltration of treated wastewater are behaving and moving through the aquifer.

It is considered likely that the amended licence include a condition for the submission of a Site Specific Hydrological Assessment to present the findings of the increased monitoring. This assessment report would be required 3 years from the date of the amendment, to allow for at least 2 years of monitoring data to be obtained for analysis.

Key findings:

The Delegated Officer considers that:

1. Worst case scenario modelling of the proposal indicates that after 20 years of increased infiltration, TN concentrations within groundwater adjacent to Goegrup Lake may increase by up to 0.7 mg/L compared to current levels. Conservative groundwater modelling shows a potential increase of 0.2-0.4 mg/L for TN adjacent to Goegrup Lake. Increased groundwater levels were also noted in the modelling, with the potential for increased infiltration to result in a water table rise of 0.6 m near the treatment plant, reducing to less than 0.1 m at the coast and Goegrup Lake;
2. Attenuation of nitrogen appears to be occurring through groundwater, however there is insufficient data available to assess how this is occurring. The long-term fate and transport of nitrogen compounds needs to be determined;
3. The licence amendment undertaken to DWER Licence L5950/1991/11 to incorporate the premises upgrade and increased design capacity following the completion of works will consider requiring additional monitoring of treated wastewater discharges and ambient groundwater, and the provision of a site specific hydrological assessment. Conditions such as these will assist in addressing DWER's outstanding queries regarding the transport and migration of nutrients and contaminants from the premises.

10. Consultation

DWER sought comment from the Department of Health (DoH), Department of Biodiversity, Conservation and Attractions (DBCA) and City of Mandurah on the proposed upgrade. The Department of Health advised on 19 March 2020 that they had no objection to the proposed upgrades. No response was received from the City of Mandurah.

DBCA have advised that their primary concern with the proposal is to maintain the existing hydrology, inclusive of nutrient and contaminant load, entering Goegrup Lake and the Serpentine River. Given the uncertainties around groundwater modelling that currently determines a low potential impact to Goegrup Lake, DBCA have requested that a contingency plan with control measures be implemented, that allows for mitigation actions to be undertaken in the event that nutrient and contaminants attributed to the wastewater treatment plant, exceed set limits. DBCA has asked that this contingency plan be developed as a collaboration between DWER and DBCA. DWER considers that contingency plans are appropriate for including on any future licence application for ongoing operation of the facility. DBCA will be consulted on future applications at the premises, and any controls relating to contingency actions will be determined in consultation.

11. Determination of Works Approval conditions

The conditions in the issued Works Approval in Attachment 1 have been determined in accordance with the *Guidance Statement: Setting Conditions*.

The *Guidance Statement: Licence Duration* has been applied and the issued works approval expires in 3 years from date of issue. Table 10 provides a summary of the conditions to be applied to this works approval.

Table 10: Summary of conditions to be applied

Condition Ref	Grounds
Construction Environmental Management Plan Conditions 1-2	Exact details for the management/prevention of emissions during construction has not been provided. Water Corporation will require the construction contractor to prepare this document. Provision of the agreed CEMP to DWER will assist in identifying risk areas and the emission control measures proposed.
Construction conditions Condition 3-6	Standard condition sets to identify works proposed, and to report compliance.
Environmental Commissioning, including monitoring requirements 7-17	Standard commissioning conditions, with monitoring and reporting requirements, risk-based
Time-limited operations including monitoring requirements Condition 18-27	Standard time-limited operation conditions, risk-based.
Reporting conditions Conditions 5, 6, 16, 17, 26 and 27	Standard reporting conditions to demonstrate completion of works/commissioning/time limited operations and report on compliance with works approval conditions.
Standard general record-keeping and reporting conditions Conditions 28-30	Standard conditions for record keeping and reporting

DWER notes that it may review the appropriateness and adequacy of controls at any time and that, following a review, DWER may initiate amendments to the works approval under the EP Act.

12. Applicant's comments

The Applicant was provided with the draft Decision Report and draft issued Works Approval on 14 July 2020. The Applicant provided comments which are summarised, along with DWER's response, in Appendix 1.

13. Conclusion

This assessment of the risks of activities on the premises has been undertaken with due consideration of a number of factors, including the documents and policies specified in this Decision Report.

Based on this assessment, it has been determined that the Issued Works Approval will be granted subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

Michael Greenslade

Digitally signed by Michael Greenslade
Date: 2020.08.21 09:45:10 +08'00'

A/MANAGER – WASTE INDUSTRIES
REGULATORY SERVICES

Delegated Officer under section 20 of the *Environmental Protection Act 1986*

References

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Appendix 1: Summary of applicant's comments on risk assessment and draft conditions

Condition	Summary of Licence Holder comment	DWER response
Assessed design capacity, front page of Works Approval	Correction of assessed design capacity from 15,000m^3/day to 15,500ML/day	Corrected.
Compliance Reporting condition 5 Environmental Commissioning condition 7 Environmental Commissioning Report condition 18 Commencement of Time limited operations condition 20	Clarification with respect to the stages and condition requirements of the compliance reporting vs environmental commissioning required. It is not clear if compliance reporting relates to the submission of a compliance document for each item in Table 1 or if one report is submitted once all works are completed. Typically the activities in Table 1 are commenced and completed at varying stages of the overall upgrade. Following the construction of these activities commissioning commences at each stage of completion. Water Corporation consider "environmental commissioning" is when all elements detailed in Table 1 are online and the 4 month "proving/commissioning period" commences for the overall upgrade. It is preferred that reporting and commissioning (for the purposes of meeting conditions of the WA) relate the project as a whole (multiple activates meeting the objective of the upgrade). Therefore one compliance report is submitted to DWER and one environmental commissioning report is submitted once everything is online and we enter the final 4 month proving period.	DWER assessed the application and the intent of the conditions was for one Compliance Report and one Environmental Commissioning Report to be submitted, rather than individual reports for each item of infrastructure installed/upgraded. Therefore the conditions of the works approval have been updated to more accurately reflect this requirement.