Government of Western Australia
Department of Water and Environmental Regulation

Decision Report

Application for Licence

Division 3, Part V *Environmental Protection Act 1986*

Applicant:	**Water Corporation**
Instrument Type	**L9034/2017/1**
File Number:	**DER2017/000181**
Premises:	**Advanced Water Recycling Plant** **Ocean Reef Road CRAIGIE WA 6025** **Part of Lot 8278 on Plan 30778**
Date of report:	**13/10/2017**
Status of Report	**Final**

Table of Contents

Application for Licence

1. Definitions of terms and acronyms v
2. Purpose and scope of assessment 1
3. Background 1
   - 3.1 Interagency Working Group 2
   - 3.2 Groundwater Replenishment Regulatory Framework 2
4. Overview of the Advanced Water Recycling Plant 3
   - 4.1 Infrastructure 3
   - 4.2 Operational aspects 4
5. Legislative context 5
   - 5.1 Part IV of the EP Act 6
     - 5.1.1 Groundwater Replenishment Trial 6
     - 5.1.2 Advanced Water Recycling Plant 6
     - 5.1.3 Ministerial Statement 382 7
     - 5.1.4 Ministerial Statement 569 7
     - 5.1.5 Section 45c and 46 Amendments to Ministerial Statements 382 and 569 7
   - 5.2 Contaminated sites 7
   - 5.3 Other relevant approvals 7
     - 5.3.1 Planning approvals 7
     - 5.3.2 Department of Mines, Industry Regulation and Safety 8
     - 5.3.3 Water 8
     - 5.3.4 Department of Health 8
   - 5.4 Part V of the EP Act 9
     - 5.4.1 Applicable Regulations, Standards and Guidelines 9
     - 5.4.2 Groundwater Replenishment Trial 9
     - 5.4.3 AWRP Works Approvals 9
     - 5.4.4 Clearing 10
6. Modelling and monitoring data 10
   - 6.1 Modelling of noise emissions 10
   - 6.2 Baseline Groundwater Monitoring 11
   - 6.3 Groundwater Fate and Transport Modelling and Monitoring Data 13
   - 6.4 Recharge Management Zone (RMZ) 15
7. Consultation 16
8. Location and siting 17
   - 8.1 Siting context 17
   - 8.2 Residential and sensitive premises 17

8.3 Specified ecosystems 18
8.4 Groundwater and water sources 20
8.5 Geology 21
8.5.1 AWRP Facility 21
8.5.2 AWRP Recharge sites 21
8.6 Meteorology 23
8.6.1 Wind direction and strength 23
9. Risk Assessment 23
9.1 Determination of emission, pathway and receptor 23
9.2 Consequence and Likelihood of Risk Events 26
9.3 Acceptability and Treatment of Risk Event 27
9.4 Risk Assessment – Noise emissions 27
9.4.1 Description of emission and impact 27
9.4.2 Identification and general characterisation of emission 27
9.4.3 Description of potential adverse impact from the emission 27
9.4.4 Criteria for assessment 28
9.4.5 Applicant controls 28
9.4.6 Key findings 28
9.4.7 Consequence 28
9.4.8 Likelihood of Risk Event 28
9.4.9 Overall rating of adverse impacts from low frequency noise or vibration from the AWRP 28
9.5 Risk Assessment – Geochemical reactions within the Leederville or Yarragadee aquifers 29
9.5.1 Description of discharge and impact 29
9.5.2 Identification and general characterisation of discharge 29
9.5.3 Description of potential adverse impact from the discharge 29
9.5.4 Criteria for assessment 30
9.5.5 Applicant controls 30
9.5.6 Key findings 30
9.5.7 Consequence 31
9.5.8 Likelihood of consequence 31
9.5.9 Overall rating of geochemical reactions within the Leederville or Yarragadee aquifers 32
9.6 Risk Assessment – Groundwater quality changes in the superficial aquifer from upward seepage 32
9.6.1 Description of discharge and impact 32
9.6.2 Identification and general characterisation of discharge 32

9.6.3 Description of potential adverse impact from the discharge 32
9.6.4 Criteria for assessment 33
9.6.5 Applicant controls 33
9.6.6 Key findings 33
9.6.7 Consequence 34
9.6.8 Likelihood of consequence 34
9.6.9 Overall rating of geochemical reactions in the superficial aquifer, from upward seepage of the recharged Recycled Water 34
9.7 Risk Assessment – Discharges to land 34
9.7.1 Description of emission and impact 34
9.7.2 Identification and general characterisation of emission 34
9.7.3 Description of potential adverse impact from the emission 35
9.7.4 Applicant controls 35
9.7.5 Consequence 36
9.7.6 Likelihood of Risk Event 37
9.7.7 Overall rating of a rupture of pipes / overtopping of holding tanks resulting in treated wastewater discharge to land 37
9.8 Summary of Acceptability and Treatment of Risk Events 37
10. Regulatory Controls 38
10.1 Licence controls 39
10.1.1 Infrastructure controls 39
10.1.2 Groundwater monitoring requirements including specified actions 39
10.1.3 Noise assessment requirements 41
11. Appropriateness of Licence conditions 41
12. Applicant's comments 41
13. Conclusion 42
Appendix 1: Key Documents
References
Appendix 2: Summaries of Baseline Groundwater Monitoring Program
Appendix 3: Summary of Applicant's Comments on Risk Assessment and Draft Conditions
Attachment 1: Issued Licence L9034/2017/1
Attachment 2: GWR Regulatory Framework
Attachment 3: DWER Technical Internal Advice Report

1. Definitions of terms and acronyms

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

Table 1: Definitions

Term	Definition
AACR	Annual Audit Compliance Report
AER	Annual Environment Report
ADWG	Australian Drinking Water Guidelines
AS 3780 - 2008 – 2000	Australian Standard 3780 – 2008: The Storage and Handling of Corrosive Substances
AWRP	Advanced Water Recycling Plant
Category/Categories (Cat.)	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CS Act	*Contaminated Sites Act 2003* (WA)
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.
Decision Report	this document
Delegated Officer	An officer under section 20 of the EP Act.
DSI	Detailed Site Investigation
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
Feed water	Secondary treated wastewater from the Beenyup Wastewater Treatment Plant fed to the Advanced Water Recycling Plant
GWR Regulatory Framework	Groundwater Replenishment Regulatory Framework
GWRT	Groundwater Replenishment Trial
GWRS	Groundwater Replenishment Scheme
Groundwater Replenishment	means the group of hydrogeological experts formed to inform the Inter Agency Working Group on hydrogeological / groundwater matters.

Term	Definition
Technical Reference Group	
Issued Licence	The Licence issued under Part V, Division 3 of the EP Act as a result of this assessment.
Licence Holder	Water Corporation (WC)
m^3	Cubic metres
Minister	the Minister responsible for the EP Act and associated regulations
MS	Ministerial Statement
mg/l	milligrams per litre
mbgl	metres below ground level
Noise Regulations	*Environmental Protection (Noise) Regulations 1997* (WA)
Occupier	As defined by the EP Act to mean a person who is in occupation or control of a premises, or part of a premises, whether or not that person is the owner of the premises or part of the premises.
PDWSA	Public Drinking Water Source Area
Premises	Advanced Water Recycling Plant, located on Part Lot 8278 on Plan 30778 Ocean Reef Road Craigie WA 6025.
Prescribed Premises	Premises prescribed under Schedule 1 to the EP Regulations
Primary Activities	as defined in Schedule 2 of the Issued Licence
Recycled Water	refers to secondary treated sewage from the Beenyup WWTP that has undergone further treatment through the AWRP to achieve drinking water standards.
Risk Event	As described in *Guidance Statement: Risk Assessment*
RWQI	Recycled Water Quality Indicator
UDR	*Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA)
WRMOS	Water Resource Management Operation Strategy
WWTP	Wastewater Treatment Plant

2. Purpose and scope of assessment

The Water Corporation (the Applicant) was granted Works Approval W5571/2013/1 on 10 April 2014 to construct Stage 1 of the Advanced Water Recycling Plant (AWRP). The AWRP Stage 1 proposes to further treat secondary-treated wastewater from the Beenyup Wastewater Treatment Plant (WWTP) (L7882/1992/14) to drinking water standards (Recycled Water) and inject (recharge) 14 GL annually of this Recycled Water into the Leederville and Yarragadee aquifers, with wastes discharged to the marine environment.

This assessment considers the environmental risks associated with the operation of the AWRP, excluding the waste discharges to the ocean outfall, which is regulated under Ministerial Statements 382 and 569.

3. Background

The Premises are located directly adjacent to the Beenyup WWTP operated under Licence 7882/1991/14.

Between 2008 and 2014 at the Premises, a pilot groundwater replenishment plant was constructed and a three year trial undertaken to research groundwater replenishment as a potential drinking source (Works Approval W4433/2008/2 and Licence L8379/2009/1) (see Section 5.4.2). As part of this trial, an Interagency Working Group (IAWG) and a Groundwater Replenishment Regulatory Framework was developed on advice from the former Office of the Environmental Protection Authority (OEPA) (see Sections 3.1 and 3.2 below).

The Premises currently holds Works Approval W5571/2013 for the construction of Stage 1 of the AWRP (see Sections 5.4.1 and 5.4.3). The Applicant submitted a construction compliance document on 24 August 2016 and has been testing the facility operation under commissioning.

An application for licence for the AWRP was received on 21 January 2017 to operate the facility constructed under W5571/2013/1 (the Application). This will involve the production of 14GL of Recycled Water for recharge into the Leederville and Yarragadee aquifers, through recharge wells located adjacent to the plant but outside the proposed Premises boundary. The waste from this process enters the Beenyup WWTP ocean outfalls through a separate recharge point into the disposal pipeline.

Table 2 lists the Prescribed Premises Categories that have been applied for.

Table 2: Prescribed Premises Categories being assessed

Classification of Premises	Description	Assessed production capacity
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.	14 GL / year

The AWRP is regarded as a Category 54 sewage treatment plant for the purposes of the *Environmental Protection Act 1986* (EP Act). The definition of a Category 54 sewage treatment facility (taken from the *Environmental Protection Regulations 1987*) is as follows "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".

The Delegated Officer takes this definition to include all structures and equipment that discharge into the environment. This definition is consistent with the intent of the EP Act to regulate the point of discharge.

The recharge of Recycled Water into the environment is still a discharge under the definition of the EP Act.

Under section 62 of the EP Act the CEO and Delegated Officer has the powers to impose conditions considered necessary for the prevention, control, abatement or mitigation of pollution or Environmental Harm. Section 62A of the EP Act also describes the kinds of conditions that can be required under a works approval or licence. These include but are not limited to: meeting specified ambient concentration limits in specified premises or places, monitor operations, conduct analysis of monitoring data, conduct environmental risk assessment studies, and provide reports on monitoring data and analysis of it, to the CEO.

The approach being undertaken by the Delegated Officer does not impose regulatory duplication and is consistent with DWER's current Regulatory Framework described in, Guidance Statement: Regulatory Principles (July 2015) and is consistent with the regulatory function and commitments DWER undertook as member of the IAWG.

3.1 Interagency Working Group

An Interagency Working Group (IAWG) was formed in 2007 to oversee the Groundwater Replenishment Trial (GWRT) and provide technical support and assessment. The IAWG comprised of the Water Corporation, the former Department of Water (DoW), the Department of Health (DoH) and the former Department of Environment and Conservation (DEC) and was developed upon advice from the Office of the Environmental Protection Authority (OEPA).

The IAWG developed the Groundwater Replenishment Regulatory Framework (GWR Regulatory Framework) (see Section 3.2), and a Memorandum of Understanding (MOU) with the DoH (see Section 5.3.4). The IAWG has also been instrumental in the development of DoW's Policy 101: Managed Aquifer Recharge.

The former DER ceased participation in the IAWG on 24 May 2016 for the purposes of its regulatory role under Part V of the EP Act. Following the formation of DWER, in the future, both the Regulatory Services (Water) and Regulatory Services (Environment) Branches of DWER will be part of and attend relevant meetings of the IAWG.

3.2 Groundwater Replenishment Regulatory Framework

In December 2012, the GWR Regulatory Framework was developed by the IAWG with the intent to review the framework in 5 years. The GWR Regulatory Framework defines the approvals pathway required to develop, approve commencement of recharge and provide ongoing regulation of Groundwater Replenishment Schemes.

Under the framework, DWER's Environmental Regulatory Services (Environment) Branch (formerly DEC) will consider Groundwater Replenishment Scheme approvals under Part V of the EP Act, including emissions and discharges.

DWER's interest in the recharge management zone is articulated in the GWR Regulatory Framework as it is the receiving environment for the discharge of Recycled Water from the Prescribed Premises (AWRP).

4. Overview of the Advanced Water Recycling Plant

4.1 Infrastructure

The AWRP infrastructure, as it relates to Category 54 activities, are detailed in Table 3 and with reference to the Site Plan (attached in the Issued Licence).

Table 3: AWRP facility Category 54 infrastructure

Infrastructure		Specifications
Prescribed Activity Category 54		
Advanced Water Recycling of secondary treated wastewater to meet Recycled Water Quality parameters.		
1	AWRP building	Building enclosing treatment process equipment on a concrete hardstand with bunding and drainage.
2	Pre-treatment and Mechanical screening system	Includes: Screens and pre-treatment filters.
3	Ultrafiltration (UF) system	Includes: UF membranes, hot water tank, recirculation pump and chemical dosing system, three critical control points (CCPs).
4	Reverse Osmosis system	The RO system comprises: high pressure pumps, two stage array of RO membrane racks energy recovery devices, a chemical clean-in-place (CIP) system and two CCPs.
5	Ultraviolet (UV) disinfection system	Includes: two duty UV reactors operating in parallel alignment. There are three CCPs monitoring performance of the UV system. Water is diverted to waste if all operating criteria and CCPs are not met.
6	Chemical storage, dosing, and dilution facilities	Includes: chemical dosing system. All chemicals and hazardous materials will be stored in accordance with Australian Standard 3780 and the Applicants operational procedures for chemical use.
7	Recycled Water storage	The Recycled Water Storage Tank provides buffer storage for the Recycled Water between the plant and the recharge bores. The working tank volume provides 30 mins of storage at Stage 1 plant peak flow rate (1,050kL working volume).
8	Waste and residuals management facilities.	Includes: Waste Retention Tank (with a 30kL capacity) and drainage pipes connecting to the Beenyup WWTP ocean outfall.
Directly related activities		
Recharge of Recycled Water into the Leederville and Yarragadee aquifers.		
9	Three recharge bores into confined aquifers within the Leederville formation LRB1 LRB2 LRB3	LRB1 - DN 400 FRP casing. Screened at 122-224 metres below ground level (mbgl), with DN 250 stainless steel (0.5mm aperture) screen
		LRB2 - DN 500 FRP casing. Screened at 134.3 238mbgl with DN 400 stainless steel (0.5mm aperture) screen
		LRB3 - DN 500 FRP casing. Screened at 132.3 236mbgl with DN 400 stainless steel (0.5mm aperture) screen

Infrastructure		Specifications
10	One recharge bore into confined aquifers within the Yarragadee formation	YRB1, DN 400 FRP casing, Screened at: 390.5 - 444.5, 450.5 – 486.5, 603.5 – 675.5, and 690.5 – 744.5mbgl with DN250 stainless steel (0.5mm aperture) screen
11	Pumping systems and pipework	Each of the recharge bores is fed by its own high-pressure pump and conveyance system.
12	Ambient groundwater monitoring bores LMB1 LMB2 LMB3 YMB1	LMB1 DN115 FRP Casing, Screened at 125.1 – 221.4mbgl
		LMB2 DN115 FRP Casing , Screened at 131.1 – 237.7mbgl
		LMB3 DN115 FRP Casing , Screened at 131.5 – 237.7mbgl
		YMB1 Screened at 389.5 – 442.47, 460.5 – 487.1, 605.5 – 676 and 690.6 – 743.8mbgl.

4.2 Operational aspects

The AWRP takes treated wastewater from the Beenyup WWTP and further treats it through the process illustrated in Figure 1 below.

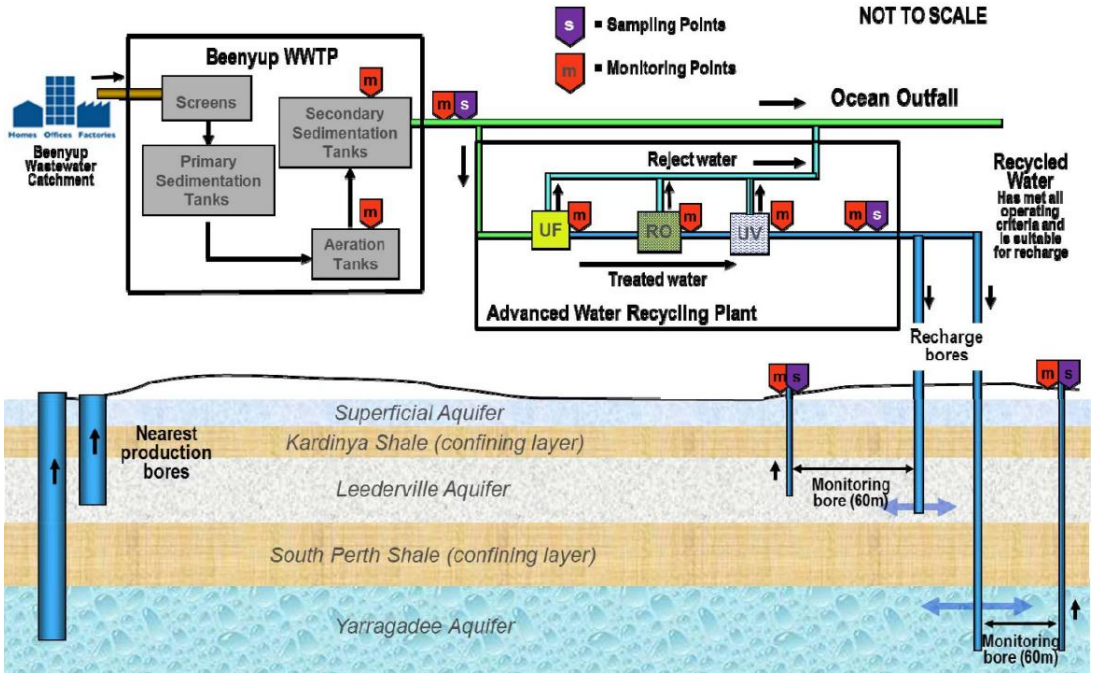

Figure 1: Illustration of the advanced water recycling process
(Figure 2 - Application: Licence to Operate – Advanced Water Recycling Plant - 14GLyear (Water Corporation 2017))

According to the Application, up to 70 ML/day of secondary treated wastewater (Feed Water) is pumped from the feedwater pump station at the Beenyup WWTP into a 12 ML (4 hours storage) tank. Five critical control points (CCPs) are located within the Beenyup WWTP to divert the treated wastewater to the ocean outlet if required criteria are not met.

The feedwater is pre-treated at the AWRP through screens and filters while also being chemically dosed with chloramine to prevent biological fouling of the Ultrafiltration (UF) and Reverse Osmosis (RO) units. The pH of the UF filtrate is adjusted to minimise scaling of the RO units.

The feedwater is then passed through a UF system. The UF membranes provide a further level of low-pressure filtration. The UF membranes are chemically cleaned during operation approximately every 1-2 weeks. Membrane cleaning incorporates the use of a hot water tank, recirculation pump and chemical dosing system.

Permeate from this process then flows to the RO system, being the final high-pressure filtration system prior to Ultraviolet (UV) disinfection. The RO membranes are chemically cleaned during operation approximately every 6 - 8 weeks. Membrane cleaning incorporates the use of a hot water tank, recirculation pump and chemical dosing system. Waste solutions are neutralised before discharge. There are two CCPs monitoring performance of the RO system. Water is diverted to waste if the operating criteria and CCPs are not met.

The UV disinfection system provides the final barrier which inactivates (or kills) pathogens from the water. There are three CCPs monitoring performance of the UV system. Water which does not meet the operating criteria of each CCP is prevented from continuing through the treatment process, either by diverting the flow to waste or shutdown of the UV units. From the UV system, the water flows to the final conditioning system where its pH and buffering capacity is adjusted prior to storage and aquifer recharge. As part of the Groundwater Replenishment Scheme (GWRS), the water is then piped a short distance to the adjacent recharge bores for injection into the Leederville (via three recharge wells) and Yarragadee (via one recharge well) aquifers.

The AWRP civil and building structure has a design life of 50 years. The mechanical and electrical instrumentation and control (including SCADA and security systems) within the AWRP have a design life of 25 years.

There is one CCP monitoring performance of the final Recycled Water quality.

Reject water generated from the AWRP through each of the treatment processes, is held in the Waste Retention Tank before being combined with the remaining treated wastewater from the Beenyup WWTP. It is then discharged through the Beenyup Ocean Outlet.

Acids and anti-scalants are necessary to prevent biofouling of membranes and for maintenance cleaning purposes. Neutralising agents are added post-treatment to neutralise the pre-treatment chemicals. The Application states that all chemicals and hazardous materials will be stored in accordance with Australian Standard 3780 and the Applicant's operational procedures for chemical use.

5. Legislative context

Groundwater replenishment and managed aquifer recharge is a new and evolving technology in Western Australia with multiple agencies having an interest in protecting future water resources, public health, and the environment. The legislative capacity for the protection of the environment is through administration of the EP Act. The Department of Water and Environmental Regulation (DWER) administers Part IV of the EP Act (previously administered by the OEPA) and is responsible for the emissions and discharges from Prescribed Premises under Part V of the EP Act.

Table 4 summarises approvals relevant to the assessment.

Table 4: Relevant approvals and tenure

Legislation	Unique Identifier	Entity	Approval
Rights in Water and Irrigation Act 1914	Multiple Ground and Surface water allocation licences collaboratively managed under a Water Resource Management Operation Strategy (WRMOS).	Water Corporation	The WRMOS is a deliberative and regularly updated water resource management agreement.
Health Act 1911	Construction and operation of the AWRP is regulated under Section 107a; water quality output is regulated against Section 98.	Water Corporation	The requirements to meet compliance with this legislation have been formalised within a MOU between the DoH and the Water Corporation.
Part IV of the EP Act (WA)	Not Assessed Public Advice Given	Water Corporation	Water Corporation is proposing to implement a 14 gigalitre per annum GWRS of Recycled Water to the Leederville and Yarragadee aquifers, located on the Swan Coastal Plain.
	Statement Number 382	Water Corporation	Beenyup Ocean Outlet Duplication.
	Statement Number 569	Water Corporation	Beenyup Ocean Outlet Duplication Nutrient Limits increased.
Dangerous Goods Safety Act 2004	Dangerous Goods Licence GDS021242	Water Corporation	For the storage of 144kL of Corrosive Substance of Packaging Group II or III and 15.6kL of Compressed Air.

5.1 Part IV of the EP Act

5.1.1 Groundwater Replenishment Trial

The former OEPA provided strategic advice on groundwater replenishment in 2005 recommending that a trial be undertaken in an area of low risk to human health and the environment (OEPA, 2005).

The OEPA during its assessment of the GWRT recommended that the IAWG involving the DoW, DoH, DEC and the Water Corporation be established to oversee the trial and GWRS (see Section 3.1).

The IAWG established the GWR Regulatory Framework in 2012 (see Section 3.2).

5.1.2 Advanced Water Recycling Plant

In 2013, a 14 GL per year (AWRP Stage 1), GWRS was referred to the OEPA (referral ID 13-278948). The proposal was not assessed with public advice given relating to the successful completion of the GWRT and expected implementation of the GWR Regulatory Framework.

The ocean outfall from the Beenyup WWTP is regulated under Ministerial Statements 382 and 569. This is directly relevant to the AWRP as its wastes are also discharged to the marine environment via the Beenyup WWTP Ocean Outfall infrastructure.

The OEPA confirmed in April 2017, that “DER is not constrained in making a decision under Part V of the EP Act for Stage 1 of the GWRS”.

5.1.3 Ministerial Statement 382

Ministerial Statement 382 (MS 382) issued on the 13 July 1990 and amended on 13 March 1995 relates to the duplication of an Ocean Outlet into Marmion Marine Park to dispose of treated effluent from the Beenyup WWTP.

This Ministerial Statement conditioned monitoring requirements and nutrient impact studies to be undertaken and limited total phosphorus to 913 kilograms per day and 3.6 tonnes per day for total nitrogen.

5.1.4 Ministerial Statement 569

Ministerial Statement 569 (MS 569) was issued on 19 July 2000 and supersedes condition 2-1 from MS 382, authorising the discharge of 1,500 kilograms of total phosphorus per day (plus 10%) and 3.6 tonnes per day of total nitrogen through the Ocean Outlet.

5.1.5 Section 45c and 46 Amendments to Ministerial Statements 382 and 569

The Water Corporation has applied to amend both the conditions and the proposal to allow for the discharge of waste from the future Stage 2 AWRP through the ocean outlets. When complete, this amendment is expected to deliver a single updated condition set.

The Delegated Officer has found:

1. The discharge of waste to the marine environment is currently regulated through MS 382 and MS 569 and therefore to avoid regulatory duplication, will not be assessed under Part V of the EP Act or regulated through the Issued Licence.

5.2 Contaminated sites

The location of the Beenyup WWTP, inclusive of the AWRP facility, is classified as ‘possibly contaminated - investigation required' under the *Contaminated Sites Act 2003*. The classification notes that soils on a portion of the site are impacted by the historical burial of WWTP residues and asbestos-containing material. Superficial groundwater beneath the site is also suspected to be impacted by historical activities at the site.

A targeted Detailed Site Investigation (DSI) was completed for the area on which the AWRP is situated, in November 2013. Based on the results the AWRP site was considered suitable for the current land use and the risk to surrounding residential areas and the environment was considered low.

A further DSI was undertaken in preparation for the construction of the AWRP, a formal classification for the site is yet to be determined with the wider area of the Beenyup location currently under investigation.

5.3 Other relevant approvals

5.3.1 Planning approvals

Under Section 137 of the *Water Services Act 2012*, the Water Corporation is exempt from the requirement to obtain development approvals for public water works under a Local Planning Scheme.

5.3.2 Department of Mines, Industry Regulation and Safety

The Water Corporation requires chemicals and compressed air for the AWRP process. Dangerous Goods Licence GDS021242 has been issued by the former Department of Mines and Petroleum in accordance with the *Dangerous Goods Safety Act 2004.* The licence pertains to the storage of 144 kL of corrosive substance of packaging group II or II and 15.6 kL of compressed air.

5.3.3 Water

The former DoW (now DWER's Regulatory Services (Water) Branch) manages water quality issues by using powers provided through the *Metropolitan Water Supply, Sewerage and Drainage Act (1909)* and the *Country Areas Water Supply Act (1947)* as well as associated by-laws under these Acts. The Regulatory Services (Water) Branch also manage abstraction of groundwater under the *Rights in Water and Irrigation Act (RIWI Act) 1914.*

Under the *Metropolitan Water Supply, Sewerage, and Drainage Act (1909)* there are two by-laws pertaining to the regulation of the AWRP recharging water into the aquifers within a Public Drinking Water Source Area (PDWSA). By-laws 5.4.6 and 5.4.7 regulate the discharge of polluted water, refuse or untreated sewage, effluent or other matter that may impact upon drinking water quality. DWER's Regulatory Services (Water) Branch has determined that water produced through the AWRP does not meet this definition for the purposes of these by-laws and has confirmed that administration of these by-laws will not be required for the approval of a GWR scheme.

DWER's Regulatory Services (Water) Branch proposes to regulate the groundwater recharge through Operational Policy 1.01 – Managed aquifer recharge in Western Australia (DoW 2011). This policy aims to define the approval of Managed Aquifer Recharge (MAR), including groundwater replenishment under the RIWI Act. DWER's Regulatory Services (Water) Branch will manage the groundwater abstraction based on natural recharge and injection quantities via the Water Resource Management Operation Strategy (WRMOS). Monitoring and reporting in the vicinity of recharge for determining abstraction will be conditioned within the WRMOS.

5.3.4 Department of Health

DoH administers the legislation concerning public health. Their role is to minimise the exposure to environmental health hazards that potentially pose a health risk, reduce incidence of communicable diseases, and guide and approve water recycling schemes to safeguard public health. The water quality to be recharged is managed under a MOU between the DoH and Water Corporation (October 2014).

The DoH have established Recycled Water Quality Parameters, contained within the MOU to ensure wastewater services meet required public health regulation and do not negatively affect public health standards across Western Australia.

The Department of Health provided the Water Corporation approval on 4 August 2017 to recharge up to 14 gigalitres per year into the Leederville and Yarragadee aquifers from the Beenyup WWTP, subject to ongoing compliance with the MOU and the Beenyup GWRS – Recycled Water Quality Management Plan (July 2017).

The DoH does not have the legislative power to regulate potential environmental impacts resulting from the recharge of Recycled Water.

5.4 Part V of the EP Act

5.4.1 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: Land Use Planning (February 2017)*
- *Guidance Statement: Licence Duration (August 2016)*
- *Guidance Statement: Decision Making (February 2017)*
- *Guidance Statement: Risk Assessments (February 2017)*
- *Guidance Statement: Environmental Siting (November 2016)*
- *Environmental Protection (Noise) Regulations (1997)*

5.4.2 Groundwater Replenishment Trial

Water Corporation were granted works approval W4433/2008/2 on 13 November 2008 for the construction of a pilot Groundwater Replenishment Plant and subsequent Licence L8379/2009/1 on 5 November 2009 to conduct a three-year trial to research groundwater replenishment as a potential future drinking source. As part of the trial 7.5ML/day of secondary treated wastewater was taken and processed to drinking water standards before reinjecting 5ML/day into the Leederville aquifer.

The treatment consisted of passing the effluent through three treatment processes:

- ultrafiltration;
- reverse osmosis; and
- disinfection with ultraviolet light.

The Licence included Recycled Water quality criteria targets and limits, with any wastewater not meeting recharge quality criteria discharged through the Beenyup WWTP to the marine environment (regulated by Part IV of the EP Act). Monitoring of groundwater impacts of recharge during the trial was undertaken for the Leederville aquifer.

The Licence was revoked; following the receipt of a surrender application on 24 November 2014 at the successful completion of the trial. The GWRT infrastructure was located immediately south of the AWRP site and some of the infrastructure was reused for the Stage 1 (14 GL/year) AWRP.

5.4.3 AWRP Works Approvals

Water Corporation were granted Works Approval (W5571/2013/1) on 10 April 2014 to construct and operate an AWRP as part of a full-scale GWRS producing up to 14 GL/year of Recycled Water to recharge to the confined Leederville and Yarragadee aquifers, adjacent to the Beenyup WWTP, as part of Stage 1 (Stage 2 will be to increase production to 28 GL/year). The approval is to take up to 70 ML/day of secondary treated wastewater through an advanced tertiary treatment process to produce potable water for groundwater recharge.

The Works Approval was amended on 10 February 2016 to update the scope of works to increase the number of proposed recharge wells from two to four as the Water Corporation identified that the capacity of the two original wells was not sufficient to achieve the desired

recharge rate of 14GL/year.

Water Corporation submitted a Works Approval construction compliance document on 21 December 2016. This document concluded that the "*environmental performance of the plant meets the design specifications*".

5.4.4 Clearing

No clearing under Part V of the EP Act was required for the construction of the AWRP. The Applications states that:

> *"The specific location for the AWRP, within the Beenyup project area, was chosen due to the highly degraded and cleared condition of the site. Construction of the AWRP at the specific location required no clearing of native vegetation".*

Clearing associated with the installation of recharge pipelines has been assessed under Part IV of the EP Act.

6. Modelling and monitoring data

6.1 Modelling of noise emissions

Noise modelling information provided in the application for Work Approval W5571/2013/1, did not include noise emissions from any source other than the AWRP. Noise emissions from the Beenyup WWTP, other neighbouring industrial sources, road traffic, aircrafts, animals, domestic sources, etc. were excluded from the modelling (and therefore the results). The model predicted that the AWRP facility would be compliant with the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations).

Work Approval W5571/2013/1 (condition 4.1.2) required a noise assessment to be undertaken during commissioning to demonstrate the emissions from the plant as installed comply with the assigned levels as defined in the Noise Regulations.

The reporting provided as part of the Works Approval compliance documentation, indicated compliance with the Noise Regulations with all noise monitoring undertaken at noise sensitive receptors confirming that actual sound pressure levels were within 2dB of the assigned levels approved under the Works Approval W5571/2013/1 (see Table 5 and Figure 2 below).

DWER's Noise Regulation branch reviewed the data supplied by the Applicant for noise verification monitoring as required by the Works Approval. After an initial review, additional information was requested to verify compliance. On receipt and analysis of additional spectral and contour data, DWER's Noise Regulation agreed that the operation of the AWRP facility, without consideration of surrounding sources, complies with the Noise Regulations at the 4 measurement locations (Figure 2).

Table 5: Comparison of Adjusted Assigned levels to the Post Processed L_{A10} Noise Levels at the AWRP nearest receptors.

Closest Residences	Adjusted Assigned L_{A10} Noise levels in dB(A)	Predicted Worst-case Noise Levels in dB(A)	Post Processed L_{A10} Noise Levels in dB(A)	Tonality	Compliance Assessment
A	38	36.7	34.3	Not Observed	Compliant
B	38	37.1	34.9		Compliant
C	39	31.6	33.7		Compliant
D	37	31.8	34.7		Compliant

Figure 2: Noise monitoring locations
(Figure 4-1 in Beenyup Advanced Water Recycling Plant - Environmental Noise Assessment)

Key Finding:

The Delegated Officer has found that the operation of the AWRP should comply with the Noise Regulations. However notes that the noise assessments undertaken by the Applicant only considered the AWRP itself and has not taken into consideration cumulative noise impacts from other sources in the vicinity of the Premises (e.g. the Beenyup WWTP).

6.2 Baseline Groundwater Monitoring

The Applicant has completed a groundwater baseline sampling program. Table 6 below compares the water quality parameters determined by the Delegated Officer as suitable indicators of performance of the AWRP in treating the water to a standard set by DoH to protect human health and parameters that may indicate geochemical reactions within the aquifer matrix (see Sections 9.5 and 9.6).

(a) Leederville Aquifer Water Quality

The tables in Appendix 2 summarises the water quality monitoring undertaken for the establishment of baseline water quality parameters in the Leederville aquifer. From the results, as illustrated in the water quality tables below, the Leederville aquifer is suitable for use as a public drinking water supply.

The results indicate that the sampled bores are all of a similar quality and are characteristic of the local aquifer.

(b) Yarragadee Aquifer Water Quality

The tables in Appendix 2 summarise the water quality monitoring undertaken for the establishment of baseline water quality parameters in the Yarragadee aquifer.

The sampling for the Yarragadee aquifer was undertaken over six other nearby bores, to better characterise the aquifer.

The Delegated Officer has determined a suitable indicator suite of parameters to determine the presence of a geochemical change. Parameters selected are based upon the final report from the GWRT, scientific investigations conducted by the DoH and DWER internal expert advice. Parameters selected are also indicators of compounds that have proven difficult to remove through the treatment process and have been determined to be good indicators of the efficiency of the treatment process.

Table 6: Summary of parameters used as indicators, AWRP product water, background groundwater, and Recycled Water Quality Indicators (RWQI)

	Monitoring Location					RWQI/ GWR Guideline
Parameter	**AWRP**	**Leederville Average (max – min)**			**Yarragadee**	
		LMB1	**LMB2**	**LMB3**		
Nitrate as Nitrogen (mg/L)	1.3	0.1	0.2 (0.1 – 0.11)	0.1	0.01 (0.1 – 0.01)	11
Filterable Reactive Phosphate (mg/L)	n/a	0.2 (0.1 – 0.32)	0.01 (0.01 - 0.02)	0.1	0.02 (0.01 – 0.02)	n/a
pH	6.9	7.4 (7.2 – 7.5)	7.3 (7.0 – 7.6)	7.2 (7.0 – 7.3)	8 (7.9 – 8.1)	6.0 – 8.5
TDS (mg/L)	<0.01	65.3 (48 – 75)	588.6 (500 – 690)	432.9 (11 – 62)	191 (170 – 210)	500
Lead (soluble) (mg/L)	27	0.0002 (0.0001 – 0.0008)	0.0001 (0.0001 – 0.002)	0.0001	0.0001 (0.0001 – 0.0001)	0.01
Boron (mg/L)	0.10	0.09 (0.07 – 0.11)	0.03 (0.02 – 0.04)	0.02 (0.02 – 0.03)	0.09 (0.07 – 0.11)	4
Cadmium (mg/L)	<0.0001	0.0001 (0.0001 – 0.0001)	0.0001 (0.0001- 0.0001)	0.001	0.001 (0.0001 – 0.0001)	0.002
Copper (mg/L)	0.10	0.0002 (0.001 – 0.0002)	0.001 (0.0001 – 0.0003)	0.0002 (0.0001 – 0.0003)	0.0001 (0.001 – 0.001)	2
Sulphate (mg/L)	<0.1	14.7 (12.4 – 16.3)	21.2 (15.8 – 28.1)	12.2 (9.9 – 18.3)	19 (18 – 20)	500
Uranium (mg/L)	<0.0001	0.0001	0.0001	0.0001	0.0001 (0.0001 – 0.0001)	0.02
Dissolved Oxygen (mg/L)	n/a	0.75 (0.1 – 2.1)	0.21	0.62	1.14 (0.11 – 2.49)	n/a
Zinc (mg/L)	<0.005	0.12 (0.005 – 0.033)	0.008 (0.006 – 0.01)	0.008 (0.005 – 0.02)	0.007 (0.005 – 0.014)	3 mg/L
Electrical Conductivity (mS/m)	4.0 mS/m	11.9 (10.3 – 14.4)	110.6 (92.7 – 128)	79.4 (73.8 – 98)	35.6 (35 – 37)	n/a

Key Finding:

The Delegated Officer has found:

1. Comparing GWR guideline values to those of background water sampling summary results, some background concentrations in the aquifers are already above guideline limits prior to recharge occurring.
2. The injected water will displace the native water in a low energy mixing environment. This is corroborated by the conclusions of the Perth Groundwater Replenishment Scheme – Stage 1 – GWR-14 Leederville and Yarragadee Aquifer Baseline Water Quality Report (2016).

6.3 Groundwater Fate and Transport Modelling and Monitoring Data

Scientific investigations, modelling and monitoring was undertaken during the GWRT and a final report developed by the Applicant. The report summarised the technical feasibility, community engagement and regulatory challenges faced in using Recycled Water as an augmentation to water supply in Western Australia.

It was concluded in this report that "*Aquifer monitoring has confirmed the validity of groundwater models developed for the trial and that these models can be used to understand and monitor the aquifer response to recharge from GWR schemes*" (Water Corporation 2013).

Some key points of the GWRT final report as relevant to this assessment are:

Technical feasibility:

An objective of the trial was to test the design process and operational protocols to ensure Recycled Water quality could consistently and reliably be achieved. All technical issues from the trial were documented for development of future AWRP's. The trial achieved consistent and reliable compliance with all water quality guidelines.

A component of the technical feasibility was to determine the aquifer response to the recharge of Recycled Water. Conclusions drawn were that the Leederville aquifer was confined in the vicinity of the recharge and that the modelling used to determine aquifer travel times was accurate and useful tool to plan and monitor future GWR schemes.

Community Engagement:

It was found that undertaking a multifaceted approach to community and stakeholder engagement, yielded a high level of support for a full scale GWRS.

Modelled vertical distribution of recharged water within the Leederville Aquifer

Figure 3 shows the modelled vertical distribution of the recharged water within the Leederville aquifer. It shows that the different layers within the aquifer have different horizontal permeability. The displacement of native groundwater with recharged water will occur in the areas indicated in red, while the areas indicated in blue and yellow are interpreted as the recharge interface where there is partial mixing prior to full displacement. Figure 3 also indicates the positions of the bore screens relative to the lithology.

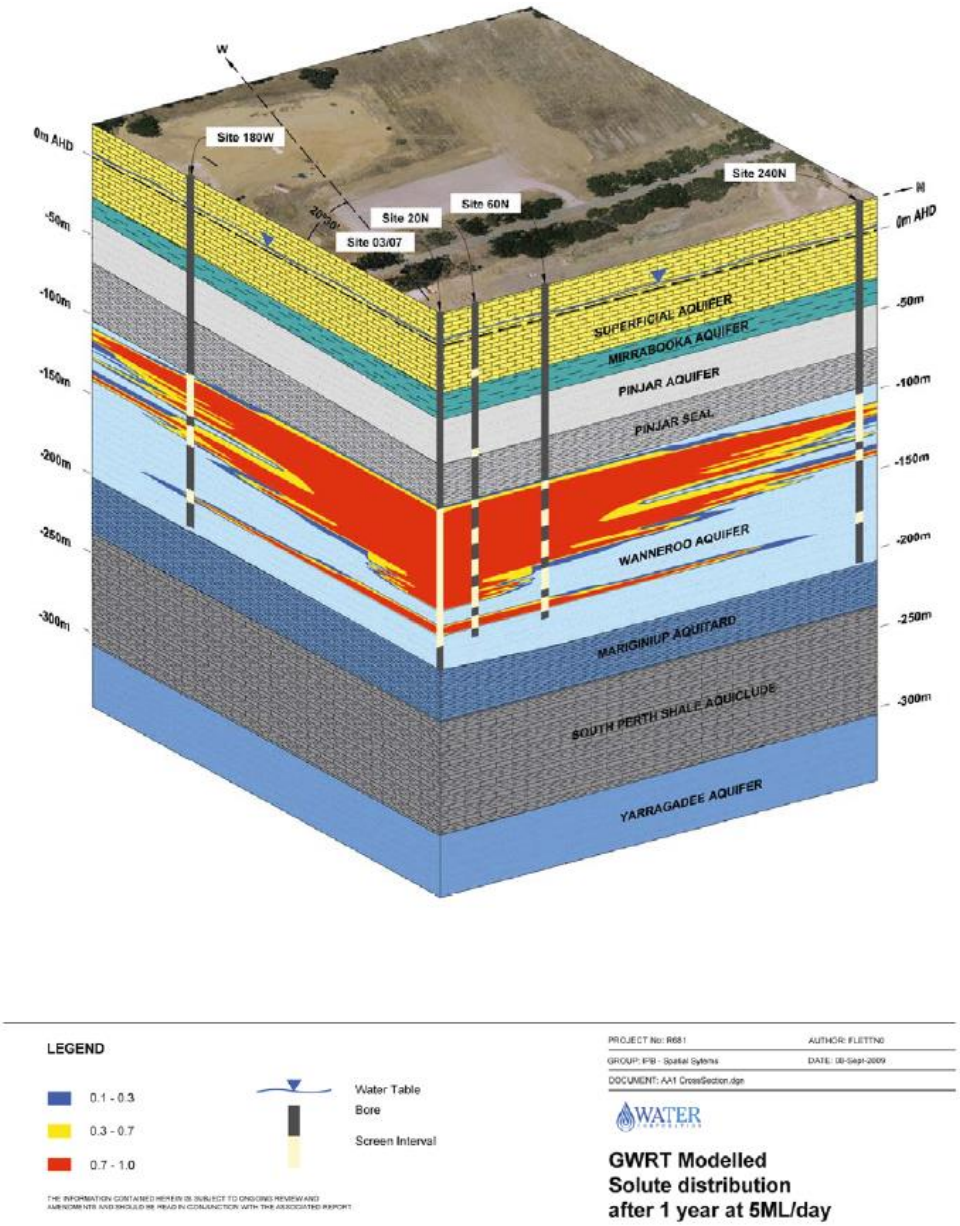

Figure 3: Representation of the modelled performance in the recharged water within the Leederville aquifer

(Figure 9.1 in Site Characterisation Report, Groundwater Replenishment Trial (2009))

Figure 4 shows that in 782 days during the GWRT, the recharged water moved 240m in an approximately radial pattern, with a slight northward elongation. It is assumed that the area contained within the blue shaded area indicated full displacement of native groundwater based on data from the monitoring network. However, it is uncertain whether similar rates can be expected from the AWRP where the recharge rates will create greater hydraulic pressure.

Figure 4: Representation of the horizontal distances recharged water has travelled in the GWRT
(Figure 14 in Groundwater Replenishment Trial: Final Report (2013))

6.4 Recharge Management Zone (RMZ)

The modelling and investigation data has identified that a 250 m radial boundary around each recharge bore, within each confined aquifer is appropriate. The purpose and performance of the aquifer at this boundary is varied depending upon which definition is employed.

The RMZ definition first used by the IAWG in 2012 defines it as "*the minimum distance between recharge of recycled water and abstraction of groundwater for public Drinking Water supplies*."

Within GWRS Works Approval Application; Water Corporation (2013), the RMZ is further defined as "*the minimum distance between recharge and abstraction and the extent at which the aquifer responds as anticipated*".

In the Application, it is stated that "*water quality criteria must also meet Australian guidelines for drinking or background groundwater quality (whichever is greater) at the boundary of the RMZ*". However, section 7.1.2 of the Application states that "*the recycled water must meet the Recycled Water Quality Guidelines (RWQG) or background groundwater quality at the boundary of the RMZ to ensure that the environmental values are always protected*".

Key Finding:
The Delegated Officer has found:

1. The fate and transport of the injected water within the Leederville aquifer are categorised for the volumes injected during the GWRT (rates approximately four-fold lower than that of the Application). Verification of these assumptions at full production volumes is necessary.
2. Comparatively limited information is available on the fate, transport, and geochemical reaction of the recharged water within the Yarragadee aquifer.
3. Recharged water spreads through the Leederville aquifer in an approximately radial pattern with a slight elongation north.
4. All modelling assumptions for the full-scale stage 1 proposal are yet to be validated through monitoring.
5. There is ambiguity of the RMZ water quality criteria as there is potential for reactions to occur within the aquifer beyond the 50m monitoring bore. The Applicant's assumption is that if the concentrations at monitoring bores are met, they will be met at the boundary. The Applicant has advised that research with the GWR Technical Reference Group will collect additional samples at the boundary of LRB1 RMZ (GWRT 240N bores) to validate the Reactive Transport Model and confirm if a RMZ of 250m is appropriate for the GWR.

7. Consultation

The Applicant stated they have undertaken the following community and stakeholder consultation regarding groundwater recharge:

- Presentations and briefings to over 160 stakeholder groups;
- Guided tours of the GWRT site with over 7,400 community members and school children through the site and Visitor Centre;
- Additional consultation through the construction of the AWRP, including tours of the Visitor Centre (over 11,000 people) and briefings to:
    - residents surrounding the Beenyup WWTP, including the Beenyup Community Reference Group (CRG);
    - local governments with jurisdiction over the GWRS site or an interest in the GWRS itself;
    - Members of Parliament within the vicinity of the GWRS site;
    - peak environment groups such as the Conservation Council; and
    - peak health organisations such as the Australian Medical Association and the Health Consumers Council." (Water Corporation 2017)"

The Applicant claimed a consistent average of 72% community support toward Recycled Water becoming a part of the drinking water supply; this has been tracked since 2009.

Consultation with regulatory agencies was undertaken through the IAWG. DWER has undertaken consultation with the former OEPA and DoW as part of the licence application assessment. This consultation was to ensure a lack of regulatory duplication and alignment in process and understanding.

The former DoW expressed concerns about regulatory duplication. DWER is confident that this has not occurred and that regulation under Part V is consistent with the GWR Regulatory Framework.

8. Location and siting

8.1 Siting context

The AWRP facility is located on a larger part of Lot 8278 on Plan 30778 (approximately 83 hectares of Crown land vested to the Applicant), Ocean Reef Road, Craigie WA 6025 adjacent to the existing Beenyup WWTP. The general location of the AWRP is shown in Figure 5 below as defined by the red boundary.

The Premises is bounded by the Mitchell Freeway to the east, Ocean Reef Road to the north, the residential suburb of Craigie to the west and bushland to the south.

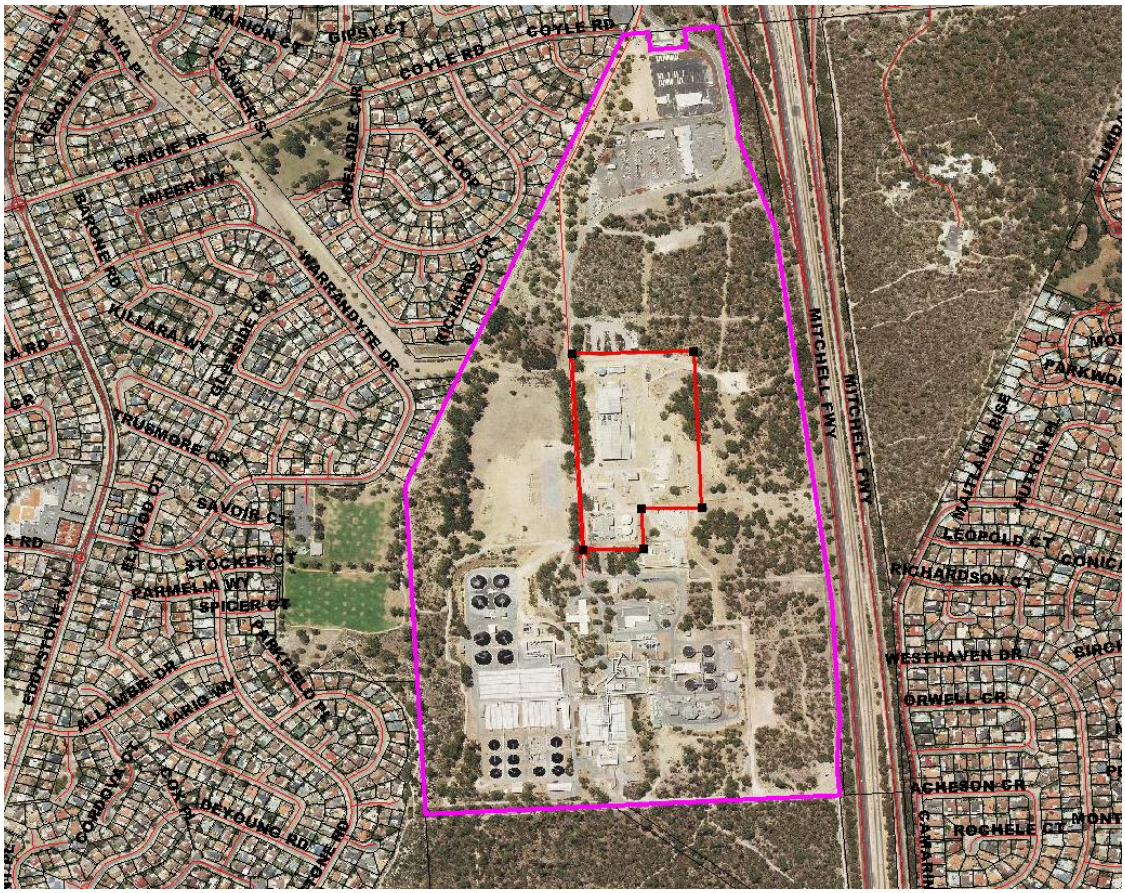

Figure 5: Location of AWRP in relation to surrounding area

8.2 Residential and sensitive premises

The distances to residential and sensitive receptors are as follows.

Table 7: Receptors and distance from activity boundary

Sensitive Land Uses	Distance from Prescribed Activity
Residential premises	The nearest residence is approximately 200m to the west of the Premises. Others are located approximately 450m to the south-east of the Premises.

8.3 Specified ecosystems

The distances to specified ecosystems are shown in Table 8.

Table 8: Specified ecosystems

Specified ecosystems	Distance from the Premises	Environmental value
Important wetlands – Western Australia	Joondalup Lake, approximately 1.8km to the west of the Premises.	Nationally significant wetlands identified in *A Directory of Important Wetlands in Australia* (Environment, 2001).
Geomorphic Wetlands	Lake Joondalup, approximately 1.8km to the east of the Premises (Conservation Category). Beenyup Swamp, approximately 1km east (Conservation Category).	This dataset displays the location, boundary, geomorphic classification (wetland type) and management category (Conservation, Resource Enhancement, or Multiple Use) on the Swan Coastal Plain.
Department of Biodiversity, Conservation and Attractions managed lands and waters	Woodvale Nature Reserve (R30809), approximately 300m to the east of the Premises. Marmion Marine Park is located approximately 5km west of the Premises and surrounds the ocean outfalls used to convey the waste. Yellagonga Regional Park located approximately 1.4km to the east of the Premises.	These are lands and waters managed by the Department of Biodiversity, Conservation and Attractions (formally Department of Parks and Wildlife).
Bush Forever: Regional open space or proposed regional open space	Groundwater recharge infrastructure located within Bush Forever site 303.	Bush Forever areas are areas identified for bushland protection through land use planning within the Perth Metropolitan Area.
Threatened Ecological Communities (TEC) and Priority Ecological Communities (PEC)	The nearest Priority 3 PEC is located approximately 2.5km south of the Premises (coastal shrub lands on shallow sands).	Communities are based on various life-forms including plants, invertebrates and microorganisms.
Threatened/Priority Fauna	Schedule 2 bird species identified within the AWRP Premises boundary.	The WA Threatened and Priority Fauna Database which contains records of observations of any fauna listed as threatened under the Wildlife Conservation Act 1950 or listed on the DPaW Priority Fauna List.
Groundwater Dependant Ecosystems (GDE) (as identified by the Bureau of Meteorology)	Located adjacent to the northern and southern edges of the Premises. Lake Joondalup is identified as a GDE, located approximately 1.8km to the east of the Premises and groundwater recharge wells.	GDE's are identified as ecosystems that are dependent on groundwater interaction for their survival.

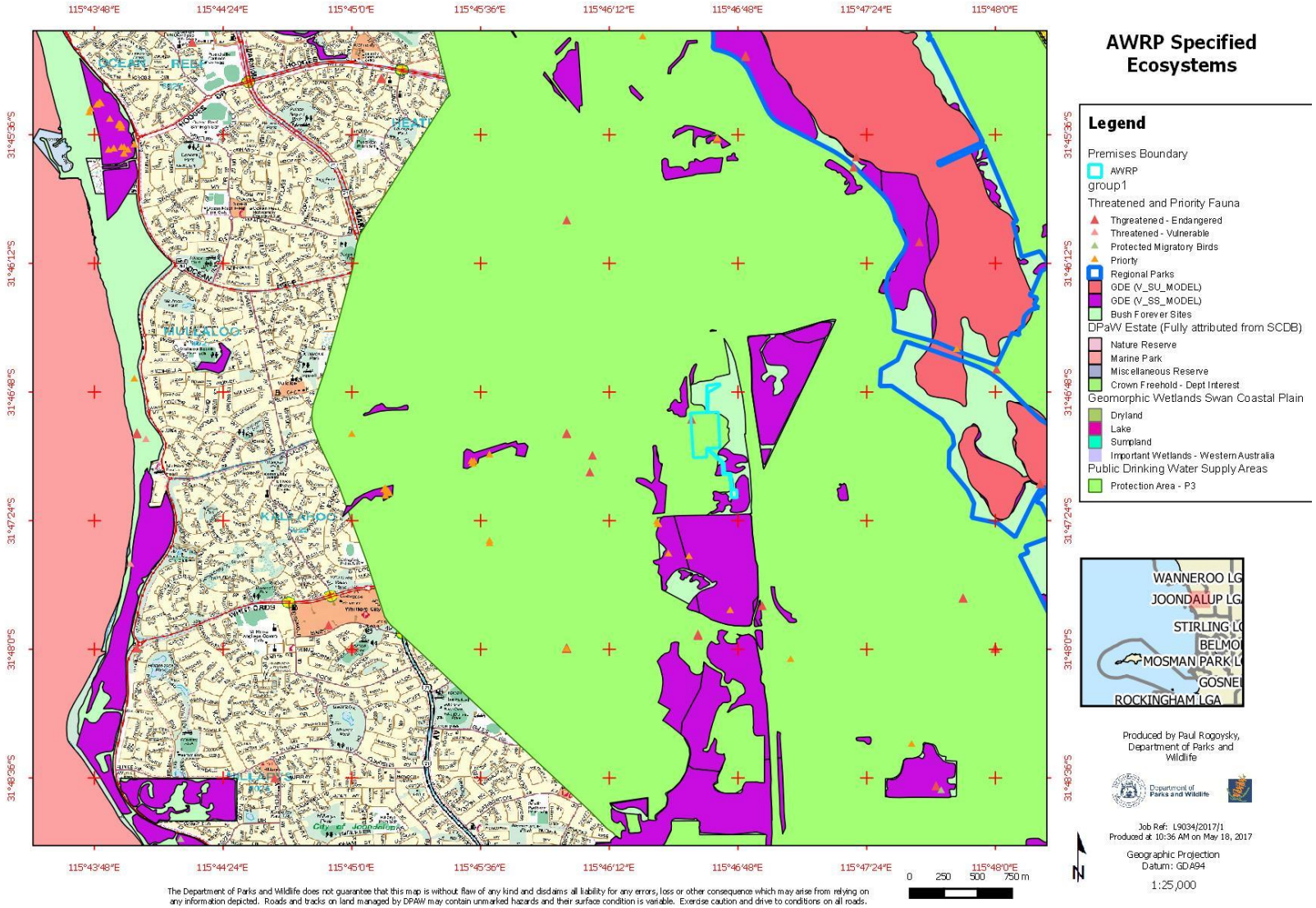

Figure 6: Map showing location of relevant specified ecosystems

8.4 Groundwater and water sources

The Premises is located within a Priority 3, Public Drinking Water Supply Area (Perth Coastal and Gwelup Underground Water Pollution Control Area).

The distances to groundwater and water sources are shown in Table 9.

Table 9: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental Value
Superficial aquifer (receptor)	Lies beneath the Premises from approximately 17mbgl (3mAHD) down to approximately 50mbgl. According to the DoW WIN database, there are at least 4 bores extracting from the superficial aquifer within a 2km radius of the Premises and multiple other unattributed bores.	A source for domestic and industrial water supply. Supports biological activity and GDE's.
Leederville Aquifer (receptor) and pathway (detailed in Section 6.1)	The top of the Leederville formation is at approximately 100mbgl and the base at approximately 260mbgl. The regional groundwater flow within the Leederville aquifer is generally described to be in a south-westerly direction. Detailed investigations conducted by the Applicant for the AWRP proposal have determined local groundwater flow in a north-westerly direction and is likely because of abstraction from bore WT45 (GWRT Site Characterisation Report May: Water Corporation, 2009). The Recycled Water is to be recharged into the aquifer at 3 locations between 120 to 220mbgl. Water Corporation Leederville abstraction Bore WT45 is located approximately 3km north.	The Leederville aquifer is identified by DWER as a water supply for Perth (Policy on Accessing the Leederville and Yarragadee aquifers of Perth, Water Allocation Policy, DoW 2006). The Leederville aquifer recharges the superficial aquifer in some locations however this appears unlikely at the vicinity of the AWRP recharge sites. The ambient groundwater quality as determined from baseline monitoring is detailed in Appendix 2.
Yarragadee aquifer (receptor) (detailed in Section 6.1)	The Yarragadee formation occurs from approximately 390 mbgl to over 700 mbgl. Regional groundwater contours indicated the Yarragadee flows in a south-westerly direction. The Recycled Water is recharged into the Yarragadee aquifer at one location.	The Yarragadee aquifer is identified by the DoW as a water supply for Perth (Policy on Accessing the Leederville and Yarragadee aquifers of Perth, Water Allocation Policy, DoW 2006). The ambient groundwater quality is determined from baseline monitoring as detailed in Appendix 2.

8.5 Geology

8.5.1 AWRP Facility

According to the DWER Geographical Information System (GIS), soil type in the vicinity of the Premises is described as undulating dune landscape with some steep dune slopes and underlain by aeolianite at depth: chief soils are brown sands (Uc4.22). Associated are siliceous sands (Uc1.22) on the deeper dunes, especially on the western side of the unit and leached sands (Uc2.21) on the more subdued dunes, especially on the eastern side of the unit. This is typical of Bassendean sands which derived from the weathering of the underlying Tamala limestone.

8.5.2 AWRP Recharge sites

The Perth Groundwater Replenishment Scheme – Environmental Values for the Leederville Aquifer and the Yarragadee Aquifer at the Beenyup Site (IAWG, 2013) provides the following stratigraphy for the Beenyup site based on the lithological description and geophysical logs from two cored boreholes correlated against previous interpretations of a number of boreholes in the vicinity as depicted in Table 10 below.

Table 10: Hydro-stratigraphic summary for the Beenyup Site

Summary Depth (m)		Description	Geological Unit	Hydrogeology
From	To			
0	20	Sand, medium to coarse grained quartz and limestone grains	Tamala Limestone	Superficial aquifer
20	50	Limestone	Tamala Limestone	Superficial aquifer
Unconformity				
50	65	Sandstone, silty, medium to coarse grained quartz and glauconite with silt and shale beds.	Osborne Formation	Mirrabooka aquifer / Kardinya Shale aquitard
Unconformity				
65	95	Sandstone, fine to coarse grained, moderately sorted, sub-rounded quartz with thin dark grey siltstone beds	Leederville Formation (undifferentiated)	Leederville aquifer
95	125	Siltstone and shale	Leederville Formation	aquitard
125	175	Sandstone, fine to coarse grained quartz with thin siltstone and mudstone beds	Leederville Formation: Wanneroo Member	Leederville aquifer
175	190	Siltstone, mudstone and poorly sorted sandstone.	Leederville Formation: Wanneroo Member	Intra-formational siltstone
190	225	Sandstone, fine to coarse grained quartz with thin siltstone and mudstone beds	Leederville Formation Wanneroo Member	Leederville aquifer
225	260	Siltstone and mudstone	Leederville Formation: Mariginiup Member	aquitard
260	320	Siltstone and mudstone	South Perth Shale	aquitard
Unconformity				
320	390	Sandstone and siltstone	Gage Formation	Yarragadee aquifer
390	>750	Sandstone and siltstone	Yarragadee Formation	Yarragadee aquifer

Note: yellow shading highlights the recharge zone for the Leederville bore.
After (Water Corporation, 2012)

(Table 5-1 - Perth Groundwater Replenishment Scheme – Environmental values for the Leederville Aquifer and the Yarragadee Aquifer at the Beenyup Site, February 2013)

Figure 7 below is an east to west cross section of the lithology relevant to the proposed groundwater replenishment. It shows that the confining layer known as the Pinjar seal between the Superficial and Leederville aquifers thins to the west.

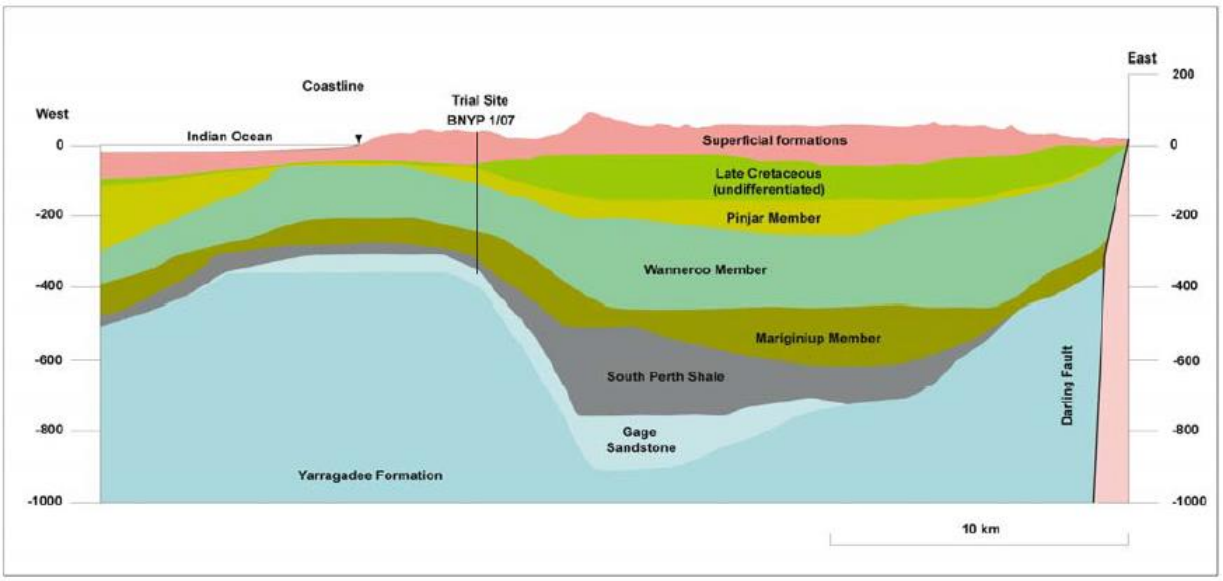

Figure 7: Lithological west-east transect profile relevant to the GWRS
(Figure 4.1 - Site Characterisation Report, Groundwater Replenishment Trial (2009))

Table 11 (below) confirms the graphical representation of the lithology represented in Figure 7 (above) in that the Pinjar seal is approximately 30 meters thick within the immediate vicinity of the recharge sites.

Table 11: Lithology of drilled bore logs associated with the AWRP

Geology (depth to base of unit)	Hydrogeology	1&2/87 Cored hole	3/07 Injection	20N	60N	120E	180W	240N
Superficial formations	Superficial aquifer mbgl	20 sand		30	15	6	18	21
		51 limestone		48	48	46	48	44
Osborne Formation	Pinjar aquifer mbgl (includes Mirrabooka aquifer at Trial site)	68		67	65	72	61	65
Leederville Formation: Pinjar Member		98	96	95	95	102	89	95
	Pinjar seal mbgl	127	125	125	124	133	124	118
Leederville Formation: Wanneroo Member	Wanneroo aquifer mbgl	224	225	225	>218	>205	200?	224
Leederville Formation: Mariginiup Member	Mariginiup aquitard mbgl	260						
South Perth Shale	South Perth Shale aquiclude mbgl	340						
Gage Formation	Yarragadee aquifer mbgl							

(Table 4.2 in Site Characterisation Report, Groundwater Replenishment Trial (2009))

8.6 Meteorology

8.6.1 Wind direction and strength

Residential premises identified in Section 8.2 are down wind during easterly and westerly wind events. Wind direction and speed identified in Figure 8 can influence both noise and odour emissions upon a receptor.

The wind rose shows the wind being predominantly from the south-southwest and east-southeast and there being calm periods of wind approximately 16% of the time. During periods of calm and light wind conditions, the impacts of noise and odour can be the most pronounced as the emission is not masked or diluted.

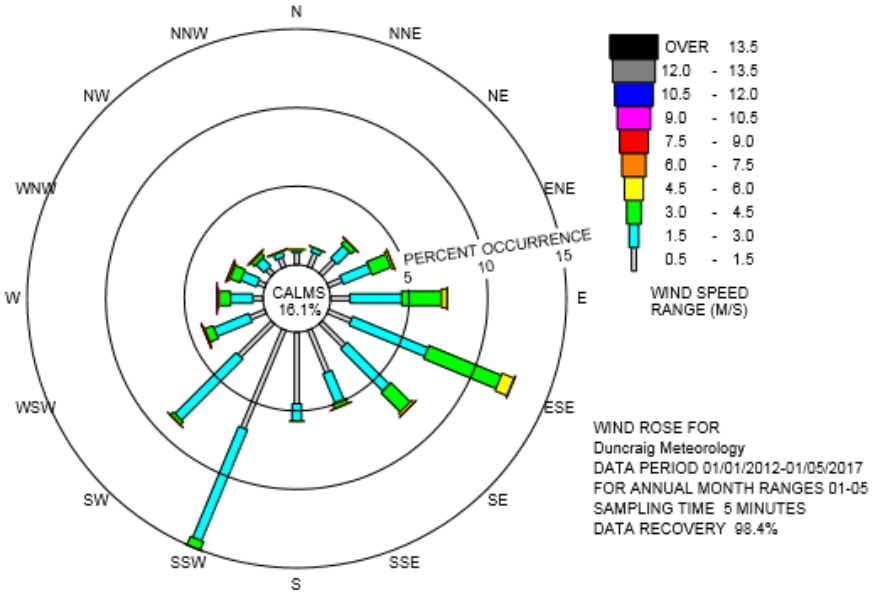

Figure 8: Historical wind speed and wind direction data for Duncraig air quality monitoring station

It is important to note that this wind rose shows historical wind speed and wind direction data for the Duncraig air quality monitoring station and should not be used to predict future data.

9. Risk Assessment

9.1 Determination of emission, pathway and receptor

In undertaking its risk assessment, DWER will identify all potential emissions, discharges, pathways and potential receptors to establish whether there is a Risk Event which requires detailed risk assessment.

To establish a Risk Event there must be an emission or discharge, a receptor which may be exposed to that emission or discharge through an identified actual or likely pathway and a potential adverse effect to the receptor from exposure to that emission or discharge. Where there is no actual or likely pathway and/or no receptor, the emission or discharge will be screened out and will not be considered as a Risk Event. In addition where an emission or discharge has an actual or likely pathway and a receptor which may be adversely impacted, but that emission or discharge 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 12.

The identification of the sources, pathways, receptors to determine Risk Events are set out in Table 12 below.

Table 12: Identification of emissions, pathway and receptors during operation

Risk Events						Continue to detailed Risk Assessment	Reasoning
Sources/Activities		**Potential Emissions or Discharges**	**Potential Receptors**	**Potential Pathway**	**Potential Adverse Impacts**		
AWRP	Operation of the AWRP	Fugitive odour	Nearest residential premises located approximately 200 m to the west of the Premises.	Air / wind dispersion	Health, welfare or amenity impacts.	No	The Premises only accepts secondary treated wastewater. The AWRP treatment process is a fully sealed system with the exception of a small (approximately 30 m^2) waste retention tank. The waste in this retention tank has already been treated through the Beenyup WWTP and will have minimal odour causing substances. As such, the Delegated Officer considers that no significant odour source is present at the Premises.
		Noise emissions	Nearest residential premises located approximately 200 m to the west of the Premises.	Air / wind dispersion	Health, welfare or amenity impacts.	Yes	See Section 9.4
		Wastewater from the AWRP treatment process discharged to Marmion Marine Park via the Beenyup Ocean Outlet.	Marmion Marine Park	Direct discharge to marine surface waters	Health impacts upon human receptors. Adverse impacts on the marine Environment.	No	The wastewater discharges to the Marmion Marine Park through the Beenyup Ocean Outlet are regulated through Ministerial Statements 382 and 569 under Part IV of the EP Act (see Section 5.1).
	Reinjection of Recycled Water from the AWRP into the Leederville and Yarragadee	The recharge of Recycled Water from the AWRP into the aquifers may cause geochemical reactions within the aquifer matrix	The Leederville and Yarragadee aquifers	Recharge Bores	Contamination of the aquifer/s from geochemical reactions with matrix impacting beneficial use.	Yes	See Section 9.5

Risk Events						Continue to detailed Risk Assessment	Reasoning
Sources/Activities		Potential Emissions or Discharges	Potential Receptors	Potential Pathway	Potential Adverse Impacts		
	aquifers.	which have the potential to impact the beneficial use of the aquifers.	Human receptors impacted through extraction of potentially contaminated water	Groundwater abstracted from the Leederville and Yarragadee aquifers	Health impacts upon human receptors.	Yes	See Section 9.5
		Potential upward seepage of Recycled Water into the superficial aquifer. This has the potential to cause geochemical reactions in the superficial aquifer which have the potential to impact the beneficial use of the aquifer.	Superficial aquifer and groundwater dependent ecosystems	Groundwater dynamics resulting in Injected water breaching the Pinjar seal	Impacts to the current and potential beneficial use of the superficial aquifer including impacts to groundwater dependent ecosystems.	Yes	See Section 9.6
	Sewage or chemical pipes	Rupture of pipes resulting in treated wastewater or chemical discharge to land.	Vegetation and Bush Forever Site 303 adjacent to discharge area Soils and groundwater	Direct discharge onto land	Soil contamination inhibiting vegetation growth and survival. Contamination of superficial groundwater	Yes	See Section 9.7
	Sewage or chemical storage tanks	Breach of containment tanks resulting in treated wastewater or chemical discharge to land.	Vegetation and Bush Forever Site 303 adjacent to discharge area Soils and groundwater	Direct discharge onto land	Soil contamination inhibiting vegetation growth and survival. Contamination of superficial groundwater	Yes	See Section 9.7

9.2 Consequence and Likelihood of Risk Events

A risk rating will be determined for risk events in accordance with the Risk Rating Matrix set out in Table 13 below.

Table 13: Risk Rating Matrix

Likelihood	Consequence				
	Slight	Minor	Moderate	Major	Severe
Almost Certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 14 below.

Table 14: Risk Criteria Table

Likelihood		**Consequence**		
The following criteria has been used to determine the likelihood of the Risk Event occurring.		**The following criteria has been used to determine the consequences of a Risk Event occurring:**		
			Environment	**Public Health* and Amenity (such as air and water quality, noise, and odour)**
Almost Certain	The risk event is expected to occur in most circumstances	Severe	• **on-site impacts**: catastrophic • **off-site impacts local scale**: high level or above • **off-site impacts wider scale:** mid-level or above • Mid to long term or permanent impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are significantly exceeded	• Loss of life • **Adverse health effects:** high level or ongoing medical treatment • Specific Consequence Criteria (for public health) are significantly exceeded • **Local scale impacts:** permanent loss of amenity
Likely	The risk event will probably occur in most circumstances	Major	• **on-site impacts**: high level • **off-site impacts local scale**: mid-level • **off-site impacts wider scale**: low level • Short term impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are exceeded	• **Adverse health effects:** mid-level or frequent medical treatment • Specific Consequence Criteria (for public health) are exceeded • **Local scale impacts**: high level impact to amenity
Possible	The risk event could occur at some time	Moderate	• **on-site impacts**: mid-level • **off-site impacts local scale**: low level • **off-site impacts wider scale**: minimal • Specific Consequence Criteria (for environment) are at risk of not being met	• **Adverse health effects:** low level or occasional medical treatment • Specific Consequence Criteria (for public health) are at risk of not being met • **Local scale impacts:** mid-level impact to amenity
Unlikely	The risk event will probably not occur in most circumstances	Minor	• **on-site impacts**: low level • **off-site impacts local scale**: minimal • **off-site impacts wider scale**: not detectable • Specific Consequence Criteria (for environment) likely to be met	• Specific Consequence Criteria (for public health) are likely to be met • **Local scale impacts:** low level impact to amenity
Rare	The risk event may only occur in exceptional circumstances	Slight	• **on-site impact**: minimal • Specific Consequence Criteria (for environment) met	• **Local scale**: minimal to amenity • Specific Consequence Criteria (for public health) met

^ Determination of areas of high conservation value or special significance should be informed by the *Guidance Statement: Environmental Siting.*

* In applying public health criteria, DWER may have regard to the Department of Health's, *Health Risk Assessment (Scoping) Guidelines*

"on-site" means within the prescribed premises boundary.

9.3 Acceptability and Treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk Treatment Table 15.

Table 15: Risk Treatment Table

Rating of Risk Event	Acceptability	Treatment
Extreme	Unacceptable.	Risk Event will not be tolerated. DWER may refuse application.
High	May be acceptable. Subject to multiple regulatory controls.	Risk Event may be tolerated and may be subject to multiple regulatory controls. This may include both outcome-based and management conditions.
Medium	Acceptable, generally subject to regulatory controls.	Risk Event is tolerable and is likely to be subject to some regulatory controls. A preference for outcome-based conditions where practical and appropriate will be applied.
Low	Acceptable, generally not controlled	Risk Event is acceptable and will generally not be subject to regulatory controls.

9.4 Risk Assessment – Noise emissions

9.4.1 Description of emission and impact

The AWRP is largely automated and uses electrically driven devices in the advanced treatment of wastewater that could generate noise resulting in health and amenity impacts for people nearby the Premises.

9.4.2 Identification and general characterisation of emission

A noise assessment was undertaken by the Applicant during commissioning and further information provided which confirmed compliance with the Noise Regulations at the four measurement locations (see Section 6.3). It is noted that this report only relates to the AWRP facility itself and does not consider cumulative impacts from other sources.

The issue of low frequency noise was raised through public comments on the proposed Licence. The adjacent Beenyup WWTP operated under Licence L7882/1991/14 has ongoing exceedances of the Noise Regulations. These exceedances are the subject of ongoing compliance investigations and remedial action by the Applicant. Due to the nature of low frequency emissions it is difficult to locate and attribute the emission to a single source or premises.

Water Corporation state in their Application that vibration assessments have been undertaken during the GWRT and that there is no correlation between the operation of the 1.5 GL / year trial plant and measurable vibration at the Beenyup site boundary. Reports associated with these assessments have not been provided to DWER to validate this.

9.4.3 Description of potential adverse impact from the emission

Industrial Noise has been documented to cause health and amenity impacts. The emission of low frequency noise can also lead to health, welfare, and amenity impacts. Public submissions draw inference to health and amenity impacts from the alleged low frequency noise emissions

from the AWRP and Beenyup WWTP, in particular, numerous residences located to the west of the Premises being affected.

9.4.4 Criteria for assessment

The current applicable criteria for noise emission levels are detailed in the Noise Regulations. The prescribed standard within the Noise Regulations refers to the one-third octave band 25Hz to 20,000Hz inclusive.

The emission of low frequency noise and vibration fall under the general provisions of the EP Act.

9.4.5 Applicant controls

The Application states that the AWRP has been designed such that its operation complies with the Noise Regulations. Noise emissions have been mitigated through an enclosed design and specific sound engineering improvements to reduce noise. Specifics of the sound engineering improvements have not been provided by the Applicant. Provided the Applicant has complied with the noise emission control specifications approved under Works Approval W5571/2013/1. It is not anticipated that there will be additional noise emission during normal operation of the AWRP.

9.4.6 Key findings

The Delegated Officer has reviewed the information regarding noise emissions and has found:

1. Noise emissions from the AWRP are likely to be compliant with the Noise Regulations, however cumulative impacts from the AWRP and the Beenyup WWTP, specifically the potential emission of low frequency noise and vibration impacting the health welfare and amenity of residences requires more investigation. This issue was raised through public comments on the proposed Licence.
2. Verification of low frequency noise and vibration levels will be needed to validate the acceptability of levels for the 14GL/year AWRP (Stage 1).

9.4.7 Consequence

If adverse impacts from low frequency noise from the AWRP occurs, then the Delegated Officer has determined that the impact on health welfare or amenity will be minimal offsite and not detectible on a wider scale. Therefore, the Delegated Officer considers the consequence of adverse impacts from low frequency noise from the AWRP to be **Minor**.

9.4.8 Likelihood of Risk Event

The Delegated Officer has determined that the likelihood of adverse impacts from cumulative noise emissions from the AWRP and surrounding sources could occur at some time based on complaints received. Therefore, the Delegated Officer considers the likelihood of adverse impacts from low frequency noise from the AWRP impacting upon nearby sensitive receptors to be **Possible**.

9.4.9 Overall rating of adverse impacts from low frequency noise or vibration from the AWRP

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 13) and determined that the overall rating for the risk of adverse impacts from low frequency noise or vibration from the AWRP is **Medium**.

9.5 Risk Assessment – Geochemical reactions within the Leederville or Yarragadee aquifers

9.5.1 Description of discharge and impact

The Recycled Water from the AWRP is injected (recharged) into both the Leederville and Yarragadee aquifers. There is potential for geochemical reactions to occur within the aquifer matrix as a result of the recharge, which may impact upon the beneficial use of the aquifer including potential impacts to the final end users of the water.

9.5.2 Identification and general characterisation of discharge

Secondary treated wastewater from the Beenyup WWTP is further processed through the AWRP to meet the Recycled Water Quality Indicators (RWQI) and Recycled Water Quality Parameters (RWQP) set by the Department of Health.

The GWRT injected 1.5 GL/ year of Recycled Water into the Leederville aquifer. The recharge bore was surrounded by a groundwater monitoring network to validate modelling assumptions.

The full-scale AWRP will inject up to 14 GL/year of Recycled Water into both the Leederville and Yarragadee aquifers. A breakdown of volumes to be injected through each bore has not been provided by the Applicant.

The Application states that: "*Further characterisation of the aquifer will provide additional information to allow further assessment of all risks, including the three unranked risks, however the ultimate mitigation will be to appropriately manage the recharge rates to all bores".*

9.5.3 Description of potential adverse impact from the discharge

With an approximately four-fold increase in the inject volume of Recycled Water over the trial volumes there may be more pronounced physical and chemical changes within both the Leederville and Yarragadee aquifers.

Both the Leederville and Yarragadee aquifers are identified by DWER as sources of water for public drinking water supply and industrial uses with the Perth metropolitan area (Policy on Accessing the Leederville and Yarragadee aquifers of Perth, Water Allocation Policy, DoW 2006).

Addition of the Recycled Water, which has a different chemical composition, may induce physio chemical changes in the aquifer that may impact upon its current and future beneficial uses.

(a) Leederville Aquifer

The nearest Leederville production bore is located approximately 3 km to the north of the AWRP.

The GWRT undertook a three-year trial recharge program of the effect and technical feasibility of groundwater replenishment as augmentation for Perth's Drinking Water. As a result, the Leederville aquifer has more information in determining the effects of recharged advanced treated wastewater than the impacts on the Yarragadee aquifer. As has been discussed and illustrated within the Decision Report, the conclusion of scientific investigations is that there will always be some uncertainty due to heterogeneity of the Leederville aquifer. After the trial, the Applicant concluded there have not been any notable geochemical reactions that impacted upon its beneficial use as a drinking water aquifer.

(b) Yarragadee Aquifer

The GWRT did not undertake recharge of any Recycled Water into the Yarragadee aquifer. All assumptions and modelling is based upon understanding gained from the GWRT into the

Leederville aquifer and characterisation of the Yarragadee aquifer from the completion of the recharge and monitoring bores, along with other literature and groundwater sampling.

9.5.4 Criteria for assessment

From data gathered during the GWRT, a set of 18 Recycled Water Quality Indicators (RWQI) were developed by DoH .The RWQI's are an indicative subset of the 292 RWQP's. The RWQP's must be measured and assessed against the 254 Recycled Water Quality Guidelines (RWQG) required to protect human health. All of these criteria are applicable to the performance of the AWRP.

As criteria for assessment and performance of the Recycled Water within the aquifer and for the protection of the aquifer as a drinking water supply, the Delegated Officer has determined to use a smaller subset of indicators from the RWQI as well as additional parameters considered appropriate to assess the environmental impacts to the aquifer/s at the point of recharge and as action criteria at the 60 m monitoring bore.

9.5.5 Applicant controls

The Applicant has proposed the following controls set out in Table 16 below to manage specified discharge criteria and geochemical reactions within the Leederville and Yarragadee aquifers.

Table 16: Applicant's proposed controls for recharged Recycled Water

Site Infrastructure	Description	Operation details	Reference to Issued Licence Plan (Schedule 2 – Infrastructure Map)
Controls for geochemical reactions that impact on the beneficial use of the aquifer			
Recharge Bores	Infrastructure to control recharge rates to all bores.	Management of recharge rate based on monitoring data from 6 groundwater monitoring bores.	LRB1, LRB2, LRB3 and YRB1
Water Quality Process controls			
AWRP	13 CCP's to meet water quality discharge criteria	Process control through automated continuous process monitoring. Failure of meeting any of the CCPs will immediately divert flows to the marine discharge point	N/A

9.5.6 Key findings

The Delegated Officer has reviewed the information regarding recharged Recycled Water causing geochemical reactions within the Leederville or Yarragadee aquifer and has found:

1. Groundwater monitoring bores are not located at the boundary of the RMZ; therefore there is some uncertainty as to the actual groundwater concentrations at this boundary. Geochemical reactions within the aquifer matrix have the potential to alter the concentrations at this boundary which

may not be accounted for at the current groundwater monitoring bores.

2. The Applicant has advised that exceedance of a parameter in the DoH MoU will trigger a corrective measure (e.g. further research, additional monitoring, or amendment of the recycled water). Data will also be reviewed by the GWR Technical Reference Group and Risk Assessment Process may initiate a corrective measure.
3. The application of background water quality parameters as corrective action criteria would give a higher confidence limit of the water quality at the boundary of the RMZ being in equilibrium with that of the aquifer. However, data collected and conclusions drawn during the GWRT have indicated native groundwater is displaced by the Recycled Water. Should the action criteria be exceeded at the 60m monitoring bore defined corrective measures should be investigated then implemented.

9.5.7 Consequence

(a) Leederville Aquifer

If geochemical reactions occur within the Leederville aquifer matrix, then the Delegated Officer has determined that the impact of degrading the potential and actual beneficial use of the aquifer will be minimal at the local scale. Therefore, the Delegated Officer considers the consequence of recharged Recycled Water causing unexpected geochemical reactions within the Leederville aquifer impacting to be **Minor.**

(b) Yarragadee Aquifer

If geochemical reactions occur within the Yarragadee aquifer matrix, then the Delegated Officer has determined that the impact of degrading the potential and actual beneficial use of the aquifer will be minimal at the local scale. Therefore, the Delegated Officer considers the consequence of recharged Recycled Water causing unexpected geochemical reactions within the Yarragadee aquifer that impact on its beneficial use to be **Minor**.

9.5.8 Likelihood of consequence

(a) Leederville Aquifer

Through the GWRT no impacts were identified on the Leederville aquifer for the rates of water injected. For full scale production, it is proposed that there will be an approximately four-fold increase in the volume recharged to an additional two sites in the Leederville Aquifer.

Through expert opinions within DWER and the availability of a scale trail, The Delegated Officer has determined that the likelihood of adverse geochemical reactions within the Leederville aquifer matrix occurring will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood to be **Unlikely.**

(b) Yarragadee Aquifer

During the GWRT there was no recharge of water into the Yarragadee aquifer, as such, a true response has not been documented through in-situ monitoring. Presumptions are based upon the response of the Leederville Aquifer and aquifer characterisation as described in Section 6.2.

With a reduced level of investigation and the lack of a scale trial, The Delegated Officer has determined that geochemical reactions within the Yarragadee aquifer matrix, could occur at some time. Therefore, the Delegated Officer considers the likelihood to be **Possible**.

9.5.9 Overall rating of geochemical reactions within the Leederville or Yarragadee aquifers

The Delegated Officer has compared the consequence and likelihood ratings described above with the Risk Rating Matrix (Table 13) and determined that the overall rating for the risk of geochemical reactions occurring, that impact on the beneficial use of the aquifer is **Medium**.

9.6 Risk Assessment – Groundwater quality changes in the superficial aquifer from upward seepage

9.6.1 Description of discharge and impact

DWER internal technical advice suggested that potential over-pressurisation of the Leederville aquifer or over-abstraction from the superficial aquifer may cause enough difference in pressure to allow the recharged Recycled Water to permeate to the lower layers of the superficial aquifer, the Pinjar Seal confining layer (Attachment 3).

9.6.2 Identification and general characterisation of discharge

The secondary treated wastewater (Feed Water) is further treated by the AWRP and injected at a standard that meets the DoH water quality parameters and not specifically those of the receiving aquifer. The Recycled Water injected into the Leederville aquifer has the potential to impact on the quality of groundwater within the superficial aquifer. Recycled Water will be recharged into the Leederville aquifer through three of the four recharge bores (LRB1, 2 and 3).

Section 6.3 illustrates the thinning of the confining layers between the Leederville and superficial aquifer. The GWRT injected 1.5 GL/year of Recycled Water into the Leederville aquifer. A groundwater monitoring network surrounded the recharge bore to validate modelling assumptions.

The full-scale AWRP will inject up to 14 GL/year of Recycled Water across both the Leederville and Yarragadee aquifers. With an approximately four-fold increase in the injected volume of Recycled Water over the trial volumes there will be increased pressure within the Leederville aquifer.

The GWRT Site Characterisation report identifies that potentiometric heads within the Leederville Aquifer have substantially declined since abstraction commenced from Bore WT 45. The report also calculated that there is generally a downward vertical hydraulic gradient present within the Pinjar seal.

9.6.3 Description of potential adverse impact from the discharge

The superficial aquifer is an important source of water for Perth's Drinking water supply, industrial and domestic users, and groundwater dependant ecosystems. The groundwater quality in the superficial aquifer is variable and has been impacted by land use and abstraction.

Physio chemical changes in the superficial aquifer may impact upon its current and future beneficial uses where there is substantial upward leakage from the Leederville to the superficial aquifer. Ecosystems that are directly reliant upon this groundwater water may be impacted by the oxidation and reduction processes releasing precipitated contaminants.

Impacts on the superficial aquifer were not observed during the trial due to the thickness of the Pinjar seal near the recharge bores.

9.6.4 Criteria for assessment

Due to the nature, heterogeneity and varying beneficial uses of the superficial aquifer within the vicinity of recharge area, application of specific consequence criteria would be difficult. The water quality of the aquifer is varied and the required water quality is dependent upon its final use.

Based on DWER technical advice regulating the pressure within the Leederville aquifer to prevent vertical movement of the injected water will prevent the oxidising condition produced by the injected water occurring at the base of the superficial aquifer.

The MAR guidelines provide a conservative maximum recharge pressure that the aquitard can tolerate, derived by calculating 1.5 x depth of overburden to base of the aquitard. Using this calculation, the maximum recharge head at the Beenyup site has been estimated to be 180m above the surface (Water Corporation, April 2016). Recharging at a maximum instantaneous rate of 48ML/d (~16ML/d per bore) into three Leederville recharge bores, for five years, would result in an increase in head to approximately 73m above ground level in LRB1-03/07. An average daily rate of ML/d (~2.7ML/d per bore), would result in an increase of 43m above ground level (Water Corporation, April 2016). This is well below the180m maximum recharge head value estimated for the site.

9.6.5 Applicant controls

This assessment has reviewed the controls set out in Table 17 below.

Table 17: Applicant's proposed controls for adverse geochemical reactions within the aquifer

Site Infrastructure	Description	Operation details	Reference to Issued Licence Plan (Schedule 2 – Infrastructure Map)
Controls for aquifer recharge of advanced treated water			
Recharge Bores	Infrastructure to control recharge rates to all bores.	Management of recharge rate based on monitoring data from 4 groundwater monitoring bores. The Applicant has advised that they undertake potentiometric monitoring for operational requirements in real time.	LRB1, LRB2, LRB3 and YRB1

9.6.6 Key findings

The Delegated Officer has reviewed the information regarding adverse geochemical reactions occurring within the aquifer and has found:

1. To mitigate the risk of groundwater quality changes in the superficial aquifer from upward seepage of the recharged Recycled Water (identified by internal DWER experts), a downward pressure gradient must be maintained from the Superficial to the Leederville Aquifer
2. Based on the MAR guidelines maximum recharge head value estimated for the site, the likelihood of maximum recharge head being exceeded is rare.

9.6.7 Consequence

If geochemical reactions in the superficial aquifer from the upward seepage of the recharged Recycled Water occur, then the Delegated Officer has determined that the impact of affecting the current or potential beneficial use of the superficial aquifer will be minimal across a wider scale. Therefore, the Delegated Officer considers the consequence of geochemical reactions in the superficial aquifer, from upward seepage of the injected Recycled Water occurring to be **Moderate**.

9.6.8 Likelihood of consequence

The Delegated Officer has determined that, based on the MAR guidelines maximum recharge head value estimated for the site, the likelihood of the maximum recharge head being exceeded and resulting in geochemical reactions in the superficial aquifer would only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood of geochemical reactions in the superficial aquifer, from upward seepage of the recharged Recycled Water occurring to be **Rare**.

9.6.9 Overall rating of geochemical reactions in the superficial aquifer, from upward seepage of the recharged Recycled Water

The Delegated Officer has compared the consequence and likelihood ratings described above with the Risk Rating Matrix (Table 13) and determined that the overall rating for the risk of geochemical reactions occurring in the superficial aquifer, from upward seepage of the recharged Recycled Water is **Medium**.

9.7 Risk Assessment – Discharges to land

9.7.1 Description of emission and impact

During operation of the AWRP, rupture of pipes or breach of containment tanks may result in discharge of treated wastewater or process chemicals to land.

9.7.2 Identification and general characterisation of emission

Secondary treated wastewater from the Beenyup WWTP is further processed through the AWRP to drinking water quality. Typical effluent quality from the Beenyup WWTP has total nitrogen concentrations ranging from 10 to 23 mg/L and total phosphorous concentrations ranging from 3.65 to 10.55 mg/L (as taken from the 2015 – 2016 Annual Environmental Report for Beenyup WWTP). The AWRP has a production volume of approximately 50 ML/day and a total throughput of 70 ML/day.

The AWRP uses several chemicals for its operation with all chemicals with the exception of the anti-scalant (Permatreat PC191T) being considered hazardous, while several are also classified as a dangerous good. These are identified in Table 18, as provided by the Applicant.

Table 18: Summary of chemicals, their nature and storage specifications

Chemical	Bulk Concentration	Dangerous Good	Chemical Volume (m^3)	Bund Specification		Hazardous substance
				Volume (m^3)	Height (m)	
Anti-scalant (Permatreat PC191T)	100%	No	12.47	16.19	0.3	No
Aqueous ammonia	25% w/w	Yes – Class 8	10.31	15.01	0.3	Yes
Citric acid	50% w/w	No	10.31	15.01	0.3	Yes
Sodium bisulphite	31% w/w	Yes – Class 8	10.31	15.01	0.3	Yes
Sodium hydroxide	50% w/w	Yes – Class 8	44.23	50.37	0.7	Yes
Sodium hypochlorite	12.5% w (available chlorine)	Yes – Class 8	44.23	50.37	0.7	Yes
Sulphuric acid	98% w/w	Yes – Class 8	44.23	50.37	0.7	Yes

9.7.3 Description of potential adverse impact from the emission

There is potential for contamination of soil and groundwater as a result of infiltration.

Bush Forever site 303 is located immediately adjacent to the east of the Premises. Emissions of treated wastewater or chemicals may impact on vegetation within Bush Forever site 303.

9.7.4 Applicant controls

This assessment has reviewed the controls set out in Table 19.

Table 19: Applicant's proposed controls for rupture of pipes/breach of containment tanks

Site infrastructure	Description	Operation details	Reference to Infrastructure map (Schedule 1 of Issued Licence)
Pipes and Tanks	As detailed in Works Approval W5571/2013/1, the AWRP has largely been constructed on a concrete pad	The nature of the concrete pad is generally impervious and minor spills will be contained. The concrete floor is plumbed to the “reject return line”.	N/A
	Siting of the AWRP	In the event of equipment failure, the entire AWRP can be bypassed whilst the problem is addressed, thereby minimising spill volumes.	N/A
	Recycled Water storage tanks	Contain water that has been treated to meet DoH standards.	Recycled Water Storage Tank
	Waste Retention Tank (see Figure 9 below for	The waste retention tank accepts drainage from:	Waste Retention Tank

Site infrastructure	Description	Operation details	Reference to Infrastructure map (Schedule 1 of Issued Licence)
	specifications)	• Ultrafiltration, • Chemical dosing bund, • Chemical storage building, • Roads and monitoring bores The Waste Retention Tank then discharges through the ocean outfall (section 4.2.2).	(Figure 9 below)
	Storage of the chemicals detailed in Table 18.	Storage volumes and bunds as specified in Table 18.	Chemical Storage Building

All waste from the AWRP and drainage from the bunds flows to waste retention tank as depicted in the extract below. Waste from the waste retention tank then flows to the feed water pump station which is constructed below surface level using reinforced concrete.

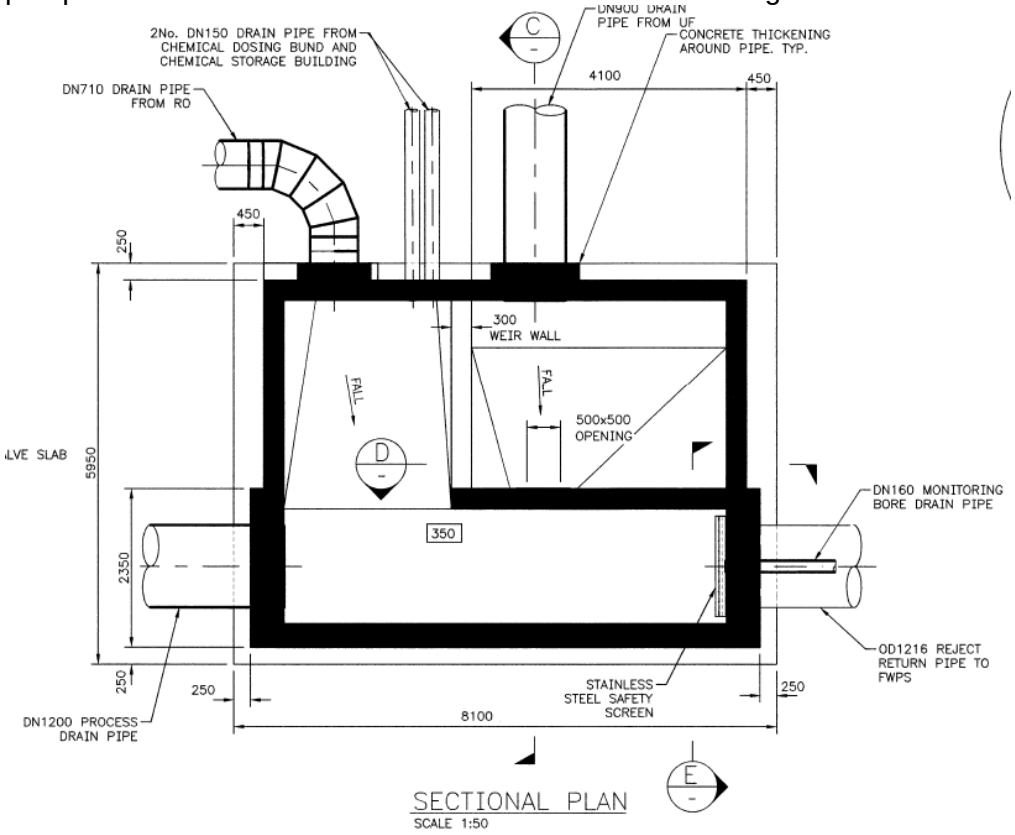

Figure 9: Specification of waste retention tank
(taken from Water Corporation Drawing LJ20 – 031 – 200 – 018)

9.7.5 Consequence

If rupture of pipe/s or an overtopping of holding tank/s occurs resulting in a discharge of treated wastewater or process chemical to land, the Delegated Officer has determined that the impact of the discharge to land will be minimal and contained onsite. Therefore, the Delegated Officer considers the consequence to be **Slight.**

9.7.6 Likelihood of Risk Event

The Delegated Officer has determined that the likelihood of a rupture of pipes or overtopping of holding tanks resulting in treated wastewater or chemical discharge to land will only occur in exceptional circumstances. Therefore, the Delegated Officer considers the likelihood to be **Rare.**

9.7.7 Overall rating of a rupture of pipes / overtopping of holding tanks resulting in treated wastewater discharge to land

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 13) and determined that the overall rating for the risk of a discharge to land from the rupture of pipes or overtopping of holding tanks is **Low.**

9.8 Summary of Acceptability and Treatment of Risk Events

A summary of the risk assessment and the acceptability or unacceptability of the Risk Events set out above with the appropriate treatment and control are set out in Table 20 below. Controls are described further in Section 10.

Table 20: Risk assessment summary

	Description of Risk Event			**Applicant controls**	**Risk Rating**	**Acceptability with controls (conditions on instrument)**
	Emission/ Discharge	**Source**	**Pathway/ Receptor** **(Impact)**			
1	Noise emissions from the operation of the AWRP.	AWRP Operation	Air or Ground	Enclosed design Specific sound engineering mitigation measures	Minor Consequence Possible likelihood **Medium Risk**	Acceptable subject to regulatory controls
2	Geochemical reactions within the Leederville or Yarragadee aquifers.	Recycled Water injected into the aquifers	Recharge bores Aquifer matrix within the Leederville and Yarragadee aquifers may react with the Recycled water.	An extensive monitoring program based upon the GWRT	***Leederville Aquifer*** Minor consequence Unlikely likelihood **Medium Risk** ***Yarragadee Aquifer*** Minor consequence Possible likelihood **Medium Risk**	Acceptable subject to regulatory controls

	Description of Risk Event			Applicant controls	Risk Rating	Acceptability with controls (conditions on instrument)
	Emission/ Discharge	**Source**	**Pathway/ Receptor (Impact)**			
3	Geochemical reactions in the superficial aquifer from upward seepage of the recharged Recycled Water.	Injected oxygenated water from the Leederville Aquifer	Leakage through the Pinjar Seal formation	Infrastructure and management controls.	Moderate consequence Rare likelihood **Medium risk**	Acceptable subject to proponent controls conditioned
4	Discharges to land from pipe rupture or containment breach.	Secondary treated wastewater/ chemical pipework or storage	Direct discharge	Infrastructure and management controls.	Slight consequence Rare likelihood **Low risk**	Acceptable subject to infrastructure being maintained

10. Regulatory Controls

A summary of regulatory controls determined to be appropriate for the Risk Events is set out in Table 21. The risks are set out in the assessment in section 9 and the controls are detailed in this section. DWER will determine controls having regard to the adequacy of controls proposed by the Applicant. The conditions of the licence will be set to give effect to the determined regulatory controls.

Table 21: Summary of Regulatory Controls to be applied

		Controls (references are to sections below, setting out details of controls)		
		10.1.1 Infrastructure and equipment	**10.1.2 Groundwater monitoring and specified actions**	**10.1.3 Noise assessment**
Risk Items (see risk analysis in section 9)	**1. Noise emissions from operation of the AWRP.**	●		●
	2. Geochemical reactions within the Leederville or Yarragadee aquifers.	●	●	
	3. Geochemical reactions in the superficial aquifer from the upward seepage of the recharged Recycled Water.	●	●	
	4. Discharges to land from pipe rupture or containment breach	●		

10.1 Licence controls

10.1.1 Infrastructure controls

The following infrastructure identified in the Application must be operated and maintained to manage risks associated with the operation of the AWRP.

- AWRP building
- Pre-treatment and mechanical screening system;
- UF system
- RO system
- UV disinfection system
- Chemical storage, dosing and dilution facilities
- Recycled Water storage
- Waste and residuals management facilities
- Recharge bores
- Pumping systems and pipework
- Ambient monitoring bores.

Note: These controls have been derived from the Applicant's Application documentation.

10.1.2 Groundwater monitoring requirements including specified actions

The Licence Holder will be required to undertake groundwater monitoring including the potentiometric pressure within the recharge bores.

The Licence Holder will be required to meet specified ambient concentration limits in specified premises or places, monitoring operations, conduct analysis of monitoring data, conduct environmental risk assessment studies and provide reports on monitoring data and analysis of it to the CEO.

Monitoring reports must be completed and submitted comparing operational groundwater monitoring to statistically valid site-specific background groundwater quality data.

Grounds: In accordance with Section 62 of the EP Act, and the large increase in volume, the Delegated Officer deems it necessary that monitoring and specified actions are included in the Licence to manage the potential risk events discussed in Section 9.

Potentiometric pressure monitoring has been included to ensure that the resultant hydraulic head of the aquifer is monitored and limits included to prevent over-pressurising the Leederville aquifer that could in turn breach the Pinjar seal and interact with the superficial aquifer. The limit is based on recharging at planned maximum instantaneous rate of 48ML/day (16ML/bore). The MAR guidelines state that a maximum pressure that can be exerted before compromising the Pinjar seal is 180m above ground level. The Applicant confirmed on 21 August 2017 that potentiometric level monitoring at injection locations is not a regulatory requirement but is currently undertaken by the Applicant in real-time to inform operational requirements.

The Applicant has suggested a pressure limit of 135mAHD for both the Yarragadee and Leederville aquifers to protect the aquifers/confined units and recharge well 135mAHD is an average of maximum predicted head increases (indicated in green in

Table 22 below) between 25-50ML/day assuming varying skin factors (reductions in bore/aquifer permeability.

Table 22. Expected head increases at various rates and time periods

Well	LRB1 (mAHD)			LRB2 (mAHD)			LRB3 (mAHD)			YRB1 (mAHD)		
Rate	1yr	3yr	5yr	1yr	3yr	5yr	1yr	3yr	5yr	1yr	3yr	5yr
5 ML/d	15.8	18.5	20.4	19.2	22	23.8	20.3	23.1	24.9	-9.7	-2.6	2.9
10 ML/d	28.4	38.3	47.5	31.4	41.3	50.9	32.5	42.4	51.5	14.3	41.7	69.5
12.5 ML/d	35.5	50.6	64.9	38.3	53.4	67.7	39.4	54.5	68.7	28.8	71.4	96
15 ML/d	43.2	64.6	84.9	45.8	67.1	87.5	46.9	68.2	88.6	45.1	106	167.3
20 ML/d	60.3	97.4	**133.7**	62.4	99.5	**135.7**	63.5	100.6	**136.8**	82.7	190.3	304.3
25 ML/d	79.6	**136.8**	191.5	81.1	**138.3**	193	82.2	**139.4**	194	**127**	294.7	430
30 ML/d	101.1	182.7	264	102	183.6	264.9	104.3	184.8	265.9	178.3	419.1	621.1

The groundwater monitoring program aims to quantify potential geochemical changes in the aquifer that compromise its beneficial use due to the recharge interface front of the recharged water and the natural variability of the aquifer lithology. Although the monitoring within the Leederville aquifer has been extensive during the trial it has been at a reduced rate, compared with that of the proposed 14GL/ year scheme and at only one recharge site. The Stage 1 operation scheme proposes to recharge Recycled Water into the Leederville aquifer at three locations and one into the Yarragadee.

Due to the lack of wider scale dedicated monitoring infrastructure a larger scale program must be developed that monitors both aquifers before, within and beyond the recharge interface to verify the assumption and conclusion of the trial and protect the beneficial use of the Leederville and Yarragadee aquifers.

DWER reviewed data provided by the Applicant to determine a suite of parameters that indicate the performance of the AWRP, the presence of Recycled Water and any potential reactions that may occur within the aquifer that impact upon its environmental value and beneficial use as a drinking water source.

Parameter	DWER reasoning
Nitrate as nitrogen	Indicator of performance of the AWRP
Total Dissolved Solids (TDS)	Determined to a strong indicator of the presence of Recycled Water and used to validate monitoring assumptions.
Redox potential	To facilitate the identification of potential geochemical reactions within the aquifer matrix.
Lead (soluble)	A metal present in the aquifer sediments that may become soluble and mobile as a result of geochemical reactions within the aquifer.
Boron	Indicator of performance of the AWRP.
Cadmium	A metal present in the aquifer sediments that may become soluble and mobile.
Copper	A metal present in the aquifer sediments that may become soluble and mobile.
Zinc	A metal present in the aquifer sediments that may become soluble and mobile.

Parameter	DWER reasoning
Phosphate (filterable reactive)	An indicator of dissolution of crandallite and similar mineral sediments.
Sulfate	Indicator of performance of the AWRP.
Uranium	An indicator of dissolution of crandallite and similar mineral sediments.
pH	A parameter within both aquifers that will facilitate geochemical reactions.
Electrical Conductivity	Determined to be an efficient indicator of the presence of Recycled Water within the Leederville aquifer.

10.1.3 Noise assessment requirements

The Licence Holder will be required to undertake noise verification monitoring at the locations shown in Figure 2.

Noise verification monitoring must be reported against compared against the adjusted LA_{10} Noise levels.

Grounds: The Delegated Officer considers it appropriate to require noise verification monitoring to confirm the results of noise modelling undertaken during commissioning and in response to comments received during the public consultation process. Further assessment is required to determine if the cumulative impacts from the AWRP and the Beenyup WWTP are at risk of exceeding the standards prescribed in the Noise Regulations.

11. Appropriateness of Licence conditions

The conditions in the Issued Licence 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 Licence expires in 20 years from date of issue.

Condition Ref	Grounds
Emissions 1	This condition is valid, risk-based and consistent with the EP Act.
Infrastructure and Equipment 2	These conditions are valid, risk-based and contain appropriate controls (see section 10 of this Decision Report).
Noise Assessment 3	
Monitoring and Reporting 4, 5, 6, 7, 8 and 9	
Record Keeping and Reporting 10, 11, 12, 13 and 14	These conditions are valid and are necessary administration and reporting requirements to ensure compliance.

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 licence under the EP Act.

12. Applicant's comments

The Applicant was provided with the draft Decision Report and draft Licence on 12 June 2017. The Applicant provided comments which are summarised along with DWER's response in Appendix 3.

13. Conclusion

This assessment of the risks of activities on the Premises has been undertaken with consideration of several factors, including the documents and policies specified in this Decision Report (summarised in Appendix 1).

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

Alan Kietzmann
Manager Licensing (Waste Industries)
Delegated Officer
under section 20 of the *Environmental Protection Act 1986*

Appendix 1: Key Documents

Letter from the former OEPA to the former DER regarding the removal of Part V condition duplicated under Part IV of the EP Act. Letter also confirms S45c and S46 are underway to amend ministerial statements 382 and 569 . Letter also advises “DER is not constrained in making a decision under Part V of the EP Act for Stage 1 of the GWRS”

Government of **Western Australia**
Office of the **Environmental Protection Authority**

Mr Dan Volaric
Acting Director General
Department of Environment Regulation
Locked Bag 33 Cloisters Square
PERTH WA 6850

Our Ref: *AC06-2016-0024, 17-051603*
Enquiries: *David Anthony, 6467 0964*
Email: *david.anthony@epa.wa.gov.au*

ATTENTION: Mr Paul Rogoysky

Dear Mr Volaric

BEENYUP WASTEWATER TREATMENT PLANT – REMOVAL OF PART V LICENCE CONDITIONS

The Office of the Environmental Protection Authority (OEPA) refers to the Department of Environment Regulation (DER) letter dated 9 March 2017 regarding the licence amendment application for the Beenyup Wastewater Treatment Plant.

The Beenyup Wastewater Ocean Outfall into the Marmion Marine Park (BWOO) proposal is subject to the conditions of Ministerial Statement 382 (MS 382) as amended by Ministerial Statement 569 (MS 569). The proposal is for the discharge of wastewater via two ocean outlets into the Marmion Marine Park.

The proponent for the BWOO, Water Corporation, requested a change to the proposal and implementation conditions of MS 382 and MS 569 under sections 45C (s45C) and 46 (s46) of the *Environmental Protection Authority 1986* (EP Act). The proponent requested to consolidate and contemporise the implementation conditions of MS 382 and MS 569.

The Water Corporation's Perth Groundwater Replenishment Scheme (GWRS) processes treated wastewater through an Advanced Water Recycling Plant (AWRP). The recycled water is reinjected into the groundwater aquifer and the reject water is discharged via the BWOO. The GWRS is being constructed in two stages. Stage 1 includes a 14 gigalitre per year (GL/y) AWRP with Stage 2 including an additional 14 GL/y plant for a combined capacity of 28 GL/yr. The proposed s45C and s46 relates to the combined throughput of 28 GL/yr.

Level 8, The Atrium, 168 St Georges Terrace, Perth, Western Australia 6000
Telephone 08 6145 0800 Facsimile 08 6145 0895 Email info@epa.wa.gov.au

Locked Bag 10, East Perth WA 6892

www.epa.wa.gov.au

The Water Corporation referred Stage 1 of the GWRS to the Environmental Protection Authority (EPA) in 2013. The EPA determined a level of "Not Assessed – Public Advice Given" for Stage 1 of the GWRS in August 2013. Given this determination, the OEPA considers that DER is not constrained in making a decision under Part V of the EP Act for Stage 1 of the GWRS.

The OEPA notes that the proponent's modelling included with the referral of Stage 1 of the GWRS indicated that nutrient loadings and contaminants in the wastewater discharge were not expected to be additional to or different from that originally approved in MS 382 and MS 569. It is the OEPA's expectation that the Water Corporation ensure that all wastewater discharged via the BWOO meets the requirements of MS 382 and MS 569. However, the EPA's position to date has been that operational emissions and discharges are more appropriately managed by DER under Part V Environmental Regulation of the EP Act.

Should you have any questions relating to this matter please contact David Anthony on 6145 0964 or via email at david.anthony@epa.wa.gov.au.

Yours sincerely

Mr Anthony Sutton
ACTING GENERAL MANAGER

24 April 2017

CC. Chief Executive Officer, Water Corporation

Letter from the DOH advising that approval to recharge has been granted for the Beenyup Groundwater Replenishment Scheme – Stage 1.

Government of **Western Australia**
Department of **Health**
Public Health Division

COPY

Your Ref: PM#17417118
Our Ref: F-AA-22477/6
Contact: Clemencia Rodriguez (08) 9388 4812

Ms Sue Murphy
Chief Executive Officer
Water Corporation
PO Box 100
LEEDERVILLE WA 6902

Dear Sue Murphy

APPROVAL TO RECHARGE – BEENYUP GROUNDWATER REPLENISHMENT SCHEME – STAGE 1

I am pleased to advise that the Department of Health (DOH) is satisfied with the reporting documents submitted by the Water Corporation as part of the requirements to obtain approval to recharge the Leederville and Yarragadee aquifers with water from the Beenyup Advanced Water Recycling Plant (AWRP).

In accordance with the *Public Health Act 2016* and Section 107 of the *Health (Miscellaneous Provisions) Act 1911,* approval is granted to recharge up to 14 gigalitres per year of water produced by the Beenyup AWRP.

Ongoing operation of the Beenyup Groundwater Replenishment Scheme (GWRS) will be subject to ongoing compliance with:

1. The Memorandum of Understanding for Wastewater Services and Groundwater Replenishment between the DOH and the Water Corporation (October 2014); and
2. The Beenyup GWRS – Recycled Water Quality Management Plan (July 2017).

If you have any questions, or wish to discuss this matter further, please do not hesitate to contact Mr Richard Theobald, Manager Water on (08) 9388 4967.

Yours sincerely

Professor Tarun Weeramanthri
CHIEF HEALTH OFFICER

4th August 2017

Cc: Department of Water and Environmental Regulation

Office of the Chief Health Officer
All correspondence to: PO Box 8172 Perth Business Centre Western Australia 6849
Grace Vaughan House 227 Stubbs Terrace Shenton Park WA 6008
Telephone (08) 9388 4999 Fax (08) 9388 4955
www.health.wa.gov.au
28 684 750 332

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Appendix 2: Summaries of Baseline Groundwater Monitoring Program

Table: GWR monitoring bore, baseline sampling program

Date	LMB1	LMB2	LMB3	YMB1
18/06/2013	Baseline 1*	-	-	Baseline 1*
10/07/2013	Baseline 2*	-	-	Baseline 2*
14/08/2013	Baseline 3*	-	-	Baseline 3*
06/09/2013	Baseline 4*	-	-	Baseline 4*
09/10/2013	Baseline 5*	-	-	-
10/10/2013	-	-	-	Baseline 5*
13/11/2013	Baseline 6*	-	-	Baseline 6*
11/04/2014	Validation of Fully Screened Bores 1*	-	-	Baseline 7*
16/05/2014	Validation of Fully Screened Bores 2*	-	-	Baseline 8*
17/06/2014	Validation of Fully Screened Bores 3*	-	-	Baseline 9*
06/08/2014	Validation of Fully Screened Bores 4*	-	-	Baseline 10*
14/01/2015	Validation of Fully Screened Bores 5 / Biannual Compliance	-	-	-
19/03/2015	Validation of Fully Screened Bores 6	-	-	-
15/04/2015	Validation of Fully Screened Bores 7	-	-	-
13/05/2015	Validation of Fully Screened Bores 8	Baseline 1	Baseline 1	-
10/06/2015	Final Baseline – RWQI (MS2 sample lost in transit to laboratory	Baseline 2	-	Baseline 11
16/07/2015	Biannual Compliance	Baseline 3	Baseline 2	Final Baseline -
	and replacement MS2 sample			RWQI
15/09/2015	-	Baseline 4	-	-
12/08/2015	-	-	Baseline 3	-
14/10/2015	-	Baseline 5	Baseline 4	-
23/11/2015	-	Final Baseline - RWQI	Baseline 5	-
9/12/2015	-	-	Final Baseline - RWQI	-

Parameters	
Metals	Aluminium (filtered), Aluminium (unfiltered), Antimony, Arsenic, Arsenic (III), Arsenic (V), Barium, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Iron (filtered), Iron (unfiltered), Lanthanum, Lead, Lithium, Manganese (filtered), Manganese (unfiltered), Mercury, Molybdenum, Nickel, Selenium, Silver, Strontium, Thallium, Tin, Uranium, Vanadium, Zinc
Major Ions	Alkalinity as $CaCO_3$, Bicarbonate, Bromide, Calcium, Carbonate, Chloride, Fluoride, Iodide, Magnesium, Potassium, Silicon as SiO_2 , Sodium, Sulphate
Nutrients	Ammonia as nitrogen, Filterable reactive phosphorous, Nitrate as nitrogen, Nitrite as nitrogen, Total kjeldahl nitrogen, Total nitrogen, Total phosphorous
Physical	Conductivity at 25°C, Total Suspended Solids, Total dissolved solids, Turbidity, pH, Total Organic Carbon, Dissolved Organic Carbon
Field	Conductivity, Dissolved oxygen, Oxidation Reduction Potential (ORP), pH, Temperature
RWQI	Boron, Nitrate as N, 1,4-Dioxane, 1,4-Dichlorobenzene, Carbamazepine, EDTA, Diclofenac, MS2 Coliphage, N-Nitrosodimethylamine, Chloroform, Chlorate, Estrone, Trifluralin, Alpha particle activity, Beta particle activity (-K40), Fluorene, Octadioxin

(4.1 Perth Groundwater Replenishment Scheme – Stage 1 – GWR-14 Leederville and Yarragadee Aquifer Baseline Water Quality Report; Water Corporation, 2016))

Table: Summary of the physical water quality data for the Leederville aquifer from the proposed montitoring bores

Parameter	Units	GWR Guideline	LOR	BNYP LMB1 - 02/12		BNYP LMB2 - 01/14		BNYP LMB3 - 01/15	
				Avg. (Min.–Max.)	Std. Dev. (n)	Avg. (Min.–Max.)	Std. Dev. (n)	Avg. (Min.–Max.)	Std. Dev. (n)
Conductivity at 25°C	mS/m	-	<0.2	11.9 (10.3-14.4)	1.0 (16)	110.6 (92.7-128)	10.9 (7)	79.4 (73.8-98)	7.8 (7)
pH	-	6.0 – 8.5	0.1	7.4 (7.2-7.5)	0.1 (16)	7.3 (7.0-7.6)	0.2 (7)	7.2 (7.0-7.3)	0.1 (7)
Total Suspended Solids	mg/L	-	<1	<1.0 (<1.0-1.0)	0.0 (16)	9.9 (<1.0-15)	4.7 (7)	10.0 (8-12)	1.2 (7)
Total Dissolved Solids	mg/L	500	<10	65.3 (48-75)	7.0 (16)	**588.6** (**500-690**)	55.9 (7)	432.9 (400-**520**)	39.9 (7)
Turbidity	NTU	5	<0.5	0.7 (<0.5-1.1)	0.2 (16)	**51.4** (**16-75**)	18 (7)	**43.9** (**11-62**)	16.1 (7)
Dissolved Organic Carbon	mg/L	-	<1	<1.0 (n/a)	0.0 (16)	1.1 (<1.0-1.1)	0.0 (7)	1.0 (<1.0-1.1)	0.0 (7)
Total Organic Carbon	mg/L	-	<1	<1.0 (n/a)	0.0 (16)	1.1 (<1.0-1.2)	0.1 (7)	1.1 (<1.0-1.3)	0.1 (7)
Field Temperature	°C	-		26.1 (24.1-27.3)	0.9 (14)	23.5 (21.2-25.8)	1.9 (3)	23.9 (22.8-24.8)	0.7 (4)
Field pH	-	-		7.06 (6.79-7.69)	0.26 (14)	6.87 (6.77-7.08)	0.12 (4)	6.84 (6.73-6.96)	0.09 (4)
Field Dissolved Oxygen	mg/L	-		0.75 (0.1-2.1)	0.48 (14)	0.21	0 (1)	0.62	0 (1)
Field Conductivity	mS/m	-		12.2 (10.6-14.9)	1.3 (15)	108.5 (85.5-120.5)	14.2 (4)	77.8 (64.9-91.5)	9.6 (4)
Field ORP	mV	-		24 (-62-168)	63 (13)	-37 (-83-19)	38 (4)	-44 (-79-2)	29 (4)

(Table 6-1: Perth Groundwater Replenishment Scheme – Stage 1 – GWR-14 Leederville and Yarragadee Aquifer Baseline Water Quality Report.)

Table: Summary of the metals water quality data for the Leederville aquifer from the proposed monitoring bores

Parameter	Units	GWR Guideline	LOR	BNYP LMB1 - 02/12		BNYP LMB2 - 01/14		BNYP LMB3 - 01/15	
				Avg. (Min.–Max.)	Std. Dev. (n)	Avg. (Min.–Max.)	Std. Dev. (n)	Avg. (Min.–Max.)	Std. Dev. (n)
Al (Soluble)	mg/L	0.2	<0.005	0.007 (0.005-0.036)	0.007 (16)	0.006 (<0.005-0.012)	0.002 (7)	0.006 (<0.005-0.007)	0.001 (7)
Sb	mg/L	0.003	<0.0001	<0.0001 (n/a)	0.0 (16)	<0.0001 (<0.0001-0.0001)	0.0 (7)	<0.0001 (n/a)	0.0 (7)
Ba	mg/L	2	<0.002	0.008 (0.006-0.011)	0.002 (16)	0.11 (0.089-0.13)	0.01 (7)	0.12 (0.1-0.13)	0.01 (7)
Be	mg/L	0.004	<0.0001	<0.0001 (n/a)	0.0 (16)	<0.0001 (n/a)	0.0 (7)	<0.0001 (n/a)	0.0 (7)
B	mg/L	4	<0.02	0.09 (0.07-0.11)	0.01 (16)	0.03 (<0.02-0.04)	0.01 (7)	0.02 (<0.02-0.03)	0.0 (7)
Cd	mg/L	0.002	<0.0001	<0.001 (n/a)	0.0 (16)	<0.0001 (<0.0001-0.0001)	0.0 (7)	<0.0001 (n/a)	0.0 (7)
Cr	mg/L	0.05	<0.0005	<0.0005 (n/a)	0.0 (16)	<0.0005 (n/a)	0.0 (7)	<0.0005 (n/a)	0.0 (7)
Co	mg/L	0.001	<0.0001	<0.0001 (n/a)	0.0 (16)	0.0001 (<0.0001-0.0002)	0.0 (7)	<0.0001 (<0.0001-0.0001)	0.0 (7)
Cu	mg/L	2	<0.0001	0.0002 (<0.0001-0.0014)	0.0003 (16)	0.0001 (<0.0001-0.0003)	0.0001 (7)	0.0002 (<0.0001-0.0005)	0.0001 (7)
Fe (Soluble)	mg/L	-	<0.005	0.23 (0.12-0.4)	0.08 (16)	4.1 (0.54-6.3)	1.8 (7)	4.6 (2.4-6.1)	1.1 (7)
La	mg/L	-	<0.0001	<0.0001 (n/a)	0.0 (16)	0.0001 (<0.0001-0.0001)	0.0 (7)	<0.0001 (n/a)	0.0 (7)
Pb (Soluble)	mg/L	0.01	<0.0001	0.0002 (<0.0001-0.0008)	0.0002 (16)	<0.0001 (<0.0001-0.0001)	0.0 (7)	<0.0001 (n/a)	0.0 (7)
Li	mg/L	0.15	<0.0001	0.0052 (0.0033-0.0075)	0.0012 (16)	0.015 (0.012-0.017)	0.001 (7)	0.0103 (0.0095-0.012)	0.0008 (7)
Mn (Soluble)	mg/L	0.5	<0.001	0.007 (0.004-0.015)	0.003 (16)	0.074 (0.049-0.12)	0.024 (7)	0.051 (0.044-0.055)	0.003 (7)
Hg	mg/L	0.001	<0.0001	<0.0001 (n/a)	0.0 (16)	<0.0001 (n/a)	0.0 (7)	<0.0001 (n/a)	0.0 (7)
Mo	mg/L	0.05	<0.001	<0.001 (n/a)	0.0 (16)	0.001 (<0.001-0.002)	0.0 (7)	<0.001 (n/a)	0.0 (7)
Ni	mg/L	0.02	<0.001	<0.001 (n/a)	0.0 (16)	<0.001 (<0.001-0.001)	0.0 (7)	<0.001 (n/a)	0.0 (7)
Se	mg/L	0.01	<0.001	<0.001 (n/a)	0.0 (16)	<0.001 (n/a)	0.0 (7)	<0.001 (n/a)	0.0 (7)
Ag	mg/L	0.1	<0.0001	<0.0001 (n/a)	0.0 (16)	<0.0001 (n/a)	0.0 (7)	<0.0001 (n/a)	0.0 (7)
Sr	mg/L	4	<0.0001	0.009 (0.007-0.012)	0.002 (16)	0.14 (0.13-0.14)	0.00 (7)	0.12 (0.11-0.13)	0.01 (7)
Tl	mg/L	0.002	<0.0001	<0.0001 (n/a)	0.0 (16)	<0.0001 (n/a)	0.0 (7)	<0.0001 (n/a)	0.0 (7)
Sn	mg/L	14	<0.0001	<0.0001 (n/a)	0.0 (16)	<0.0001 (n/a)	0.0 (7)	<0.0001 (n/a)	0.0 (7)
U	mg/L	0.02	<0.0001	<0.0001 (n/a)	0.0 (16)	<0.0001 (n/a)	0.0 (7)	<0.0001 (n/a)	0.0 (7)
V	mg/L	0.015	<0.0001	0.0001 (<0.0001-0.0001)	0.0 (16)	0.0001 (<0.0001-0.0003)	0.0001 (7)	0.0001 (<0.0001-0.0003)	0.0001 (7)
Zn	mg/L	3	<0.005	0.012 (<0.005-0.033)	0.009 (16)	0.008 (0.006-0.01)	0.001 (7)	0.008 (<0.005-0.02)	0.005 (7)
Al (Total)	mg/L	-	<0.01	0.02 (<0.01-0.06)	0.01 (16)	0.03 (<0.01-0.07)	0.02 (7)	0.02 (0.01-0.04)	0.01 (7)
As (Total)	mg/L	0.01	<0.001	0.001 (<0.001-0.002)	0.0 (16)	<0.001 (n/a)	0.0 (7)	0.002 (<0.001-0.003)	0.001 (7)
As (III)	mg/L	-	<0.001	0.001 (<0.001-0.002)	0.0 (16)	<0.001 (n/a)	0.0 (7)	<0.001 (n/a)	0.0 (7)
As (V)	mg/L	-	<0.001	<0.001 (n/a)	0.0 (16)	<0.001 (n/a)	0.0 (7)	0.001 (<0.001-0.003)	0.001 (7)
Cr (Total)	mg/L	0.05	<0.001	<0.001 (<0.001-0.003)	0.0 (16)	<0.001 (n/a)	0.0 (7)	<0.001 (n/a)	0.0 (7)
Fe (Total)	mg/L	0.3	<0.01	0.26 (0.13-**0.42**)	0.08 (16)	**5.6** (**2.6**-**7.2**)	1.8 (7)	**5.3** (**4.2**-**6.1**)	0.5 (7)
Pb (Total)	mg/L	0.01	<0.0005	0.0005 (<0.0005-0.0007)	0.0001 (16)	0.0046 (<0.0005-**0.017**)	0.0064 (7)	<0.0005 (n/a)	0.0 (7)
Mn (Total)	mg/L	0.5	<0.0005	0.009 (0.005-0.018)	0.004 (16)	0.079 (0.056-0.14)	0.028 (7)	0.054 (0.049-0.058)	0.003 (7)

(Table 6-2: Perth Groundwater Replenishment Scheme – Stage 1 – GWR-14 Leederville and Yarragadee Aquifer Baseline Water Quality Report.)

Table: Summary of the nutrient water quality data for the Leederville aquifer from the proposed monitoring bores

Parameter	Units	GWR Guideline	LOR	BNYP LMB1 - 02/12		BNYP LMB2 - 01/14		BNYP LMB3 - 01/15	
				Avg. (Min.–Max.)	Std. Dev. (n)	Avg. (Min.–Max.)	Std. Dev. (n)	Avg. (Min.–Max.)	Std. Dev. (n)
NH_3 as N	mg/L	0.5	<0.01	0.12 (0.09-0.14)	0.02 (16)	0.19 (0.04-0.25)	0.06 (7)	0.21 (0.17-0.22)	0.02 (7)
FRP	mg/L	-	<0.01	0.20 (0.1-0.32)	0.06 (16)	<0.01 (<0.01-0.02)	0.00 (7)	<0.01 (n/a)	0.0 (7)
NO_3 as N	mg/L	11 (as N)	<0.01	<0.01 (n/a)	0.0 (16)	0.02 (<0.01-0.11)	0.03 (7)	<0.01 (n/a)	0.0 (7)
NO_2 as N	mg/L	1 (as N)	<0.01	<0.01 (n/a)	0.0 (16)	<0.01 (n/a)	0.0 (7)	<0.01 (n/a)	0.0 (7)
TKN	mg/L	-	<0.02	0.13 (0.06-0.19)	0.03 (16)	0.2 (0.04-0.24)	0.07 (7)	0.22 (0.17-0.23)	0.02 (7)
TN	mg/L	-	<0.02	0.13 (0.06-0.19)	0.03 (16)	0.22 (0.15-0.25)	0.03 (7)	0.22 (0.17-0.24)	0.02 (7)
TP	mg/L	-	<0.005	0.22 (0.12-0.33)	0.06 (16)	0.12 (0.039-0.22)	0.06 (7)	0.09 (0.07-0.1)	0.01 (7)

(Table 6-3: Perth Groundwater Replenishment Scheme – Stage 1 – GWR-14 Leederville and Yarragadee Aquifer Baseline Water Quality Report.)

Table: Summary of the major ions water quality data for the Leederville aquifer from the proposed monitoring bores

Parameter	Units	Recycled Water Guideline	LOR	BNYP LMB1 - 02/12		BNYP LMB2 - 01/14		BNYP LMB3 - 01/15	
				Avg. (Min.–Max.)	Std. Dev. (n)	Avg. (Min.–Max.)	Std. Dev. (n)	Avg. (Min.–Max.)	Std. Dev. (n)
Alkalinity as CaCO3	mg/L	-	<1	21.2 (16-24)	2.7 (6)	57.9 (54-67)	4.1 (7)	60.6 (56-67)	3.4 (7)
HCO_3	mg/L	-	<1	28.6 (20-41)	6.3 (16)	70.4 (66-81)	4.7 (7)	73.7 (68-82)	4.2 (7)
Br	mg/L	-	<0.02	0.02 (<0.02-0.03)	0.00 (16)	0.86 (0.72-1.1)	0.11 (7)	0.54 (0.27-0.75)	0.18 (7)
Ca	mg/L	-	<0.1	1.5 (1.1-2.0)	0.3 (16)	30.3 (27.6-32.7)	1.5 (7)	29.7 (26.8-31.9)	1.8 (7)
CO_3	mg/L	-	<1	<1.0 (<1.0-<1.0)	0.0 (6)	<1.0 (<1.0-<1.0)	0.0 (7)	<1.0 (<1.0-<1.0)	0.0 (7)
Cl	mg/L	250	<1	11.0 (9-15)	1.5 (16)	302.3 (270-361)	29.0 (7)	196.6 (171-265)	30.2 (7)
F	mg/L	1.5	<0.05	0.28 (0.13-0.34)	0.06 (16)	0.11 (0.08-0.13)	0.02 (7)	0.08 (0.07-0.1)	0.01 (7)
I	mg/L	0.1	<0.02	<0.02 (<0.02-<0.02)	0.0 (6)	0.03 (0.02-0.03)	0.00 (7)	0.03 (0.02-0.03)	0.00 (7)
Mg	mg/L	800	<0.1	1.3 (0.9-2.0)	0.3 (16)	16.6 (14.4-19.8)	1.9 (7)	9.8 (8.4-14.4)	1.9 (7)
K	mg/L	-	<0.1	3.1 (2.0-4.6)	0.3 (16)	12.0 (11.2-12.8)	0.6 (7)	9.7 (9.0-11.3)	0.7 (7)
Si as SiO_2	mg/L	-	<0.1	10.1 (9.0-11)	0.6 (16)	26.4 (22-28)	2.0 (7)	23.0 (21-26)	1.4 (7)
Na	mg/L	180	<0.1	17.2 (13.1-21.6)	2.3 (16)	148.3 (126-175)	16.8 (7)	93.2 (82.9-128)	14.6 (7)
SO_4	mg/L	500	<0.1	14.7 (12.4-16.5)	0.9 (16)	21.2 (15.8-28.1)	3.8 (7)	12.2 (9.9-18.3)	2.7 (7)

(Table 6-4: Perth Groundwater Replenishment Scheme – Stage 1 – GWR-14 Leederville and Yarragadee Aquifer Baseline Water Quality Report.)

(b) Yarragadee Aquifer

Table: Summary of the average metals water quality data for the Yarragadee aquifer from the proposed monitoring and nearby bores

Parameter	Units	GWR Guideline	YMB1#		YRB1^	WT97*	W7*	G17*	G7*	Comment
			Avg. (Min.–Max.)	Std. Dev. (n)						
Al (Soluble)	mg/L	0.2	<0.005 (<0.005-<0.005)	0.0 (12)	<0.005	<0.005	<0.005	<0.005	<0.005	
Sb	mg/L	0.003	<0.0001 (<0.0001-<0.0001)	0.0 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Ba	mg/L	2	**2.3 (2.1-2.5)**	0.1 (12)	1.6	0.91	0.8	0.73	0.22	Baseline concentrations in YMB1 above DoH guideline
Be	mg/L	0.004	<0.0001 (<0.0001-<0.0001)	0.0 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
B	mg/L	4	0.09 (0.07-0.11)	0.01 (12)	0.09	0.12	0.08	0.16	0.26	
Cd	mg/L	0.002	<0.0001 (<0.0001-<0.0001)	0.0 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Cr	mg/L	0.05	<0.0005 (<0.0005-<0.0005)	0.0 (12)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
Co	mg/L	0.001	<0.0001 (<0.0001-<0.0001)	0.0 (12)	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Cu	mg/L	2	<0.0001 (<0.0001-0.0001)	0.0 (12)	0.012	<0.0001	0.0001	<0.0001	<0.0001	
Fe (Soluble)	mg/L	-	0.033 (0.02-0.043)	0.006 (12)	0.06	<0.005	0.013	0.027	0.01	
La	mg/L	-	0.0007 (<0.0001-0.0011)	0.0003 (12)	0.0006	0.0003	0.0003	0.0003	<0.0001	
Pb (Soluble)	mg/L	0.01	<0.0001 (<0.0001-<0.0001)	0.0 (12)	0.0003	<0.0001	0.0001	<0.0001	<0.0001	
Li	mg/L	0.15	0.0018 (0.0012-0.002)	0.0001 (12)	0.0016	0.0027	0.0017	0.0047	0.0079	
Mn (Soluble)	mg/L	0.5	0.006 (0.004-0.007)	0.001 (12)	0.011	0.002	0.004	0.012	0.007	
Hg	mg/L	0.001	<0.0001 (<0.0001-<0.0001)	0.0 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Mo	mg/L	0.05	<0.001 (<0.001-<0.001)	0.0 (12)	<0.001	<0.001	<0.001	<0.001	0.002	
Ni	mg/L	0.02	<0.001 (<0.001-<0.001)	0.0 (12)	0.003	<0.001	<0.001	<0.001	<0.001	
Se	mg/L	0.01	<0.001 (<0.001-<0.001)	0.0 (12)	<0.001	<0.001	<0.001	<0.001	<0.001	
Ag	mg/L	0.1	<0.0001 (<0.0001-<0.0001)	0.0 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Sr	mg/L	4	0.11 (0.11-0.13)	0.01 (12)	0.11	0.1	0.077	0.13	0.092	
Tl	mg/L	0.002	<0.0001 (<0.0001-<0.0001)	0.0 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Sn	mg/L	14	<0.0001 (<0.0001-<0.0001)	0.0 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
U	mg/L	0.02	<0.0001 (<0.0001-<0.0001)	0.0 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
V	mg/L	0.015	<0.0001 (<0.0001-<0.0001)	0.0 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Zn	mg/L	3	0.007 (0.005-0.014)	0.003 (12)	0.009	0.006	0.02	0.007	0.006	
Al (Total)	mg/L	-	0.02 (<0.01-0.07)	0.02 12	<0.01	0.02	<0.01	0.03	0.02	
As (Total)	mg/L	0.01	<0.001 (<0.001-<0.001)	0.0 (12)	<0.001	<0.001	<0.001	<0.001	<0.001	
As (III)	mg/L	-	<0.001 (<0.001-<0.001)	0.0 (12)	<0.001	<0.001	<0.001	<0.001	<0.001	
As (V)	mg/L	-	<0.001 (<0.001-<0.001)	0.0 (12)	<0.001	<0.001	<0.001	<0.001	<0.001	
Cr (Total)	mg/L	0.05	<0.001 (<0.001-0.001)	0.0 (12)	<0.001	<0.001	<0.001	<0.001	<0.001	
Fe (Total)	mg/L	0.3	0.04 (0.02-0.11))	0.02 (12)	0.06	<0.01	0.01	0.03	0.01	
Pb (Total)	mg/L	0.01	0.0006 (<0.0005-0.0017)	0.0003 (12)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
Mn (Total)	mg/L	0.5	0.006 (0.004-0.008)	0.001 (12)	0.011	0.002	0.005	0.013	0.008	

(Table 5-2: Perth Groundwater Replenishment Scheme – Stage 1 – GWR-14 Leederville and Yarragadee Aquifer Baseline Water Quality Report.)

Table: Summary of the nutrient water quality data for the Yarragadee aquifer from the proposed monitoring and nearby bores

Parameter	Units	GWR Guideline	YMB1#		YRB1^	WT97*	W7*	G17*	G7*
			Avg. (Min.–Max.)	Std. Dev. (n)					
NH_3 as N	mg/L	0.5	0.27 (0.24-0.3)	0.02 (12)	0.28	0.38	0.33	0.42	0.35
FRP	mg/L	-	0.02 (<0.01-0.02)	0.01 (12)	0.03	0.04	0.01	0.01	0.01
NO_3 as N	mg/L	11 (as N)	<0.01 (<0.01-0.01)	0.0 (12)	<0.01	<0.01	<0.01	<0.01	<0.01
NO_2 as N	mg/L	1 (as N)	<0.01 (<0.01-<0.01)	0.0 (12)	<0.01	<0.01	<0.01	<0.01	<0.01
TKN	mg/L	-	0.29 (0.26-0.35)	0.02 (12)	0.4	0.38	0.33	0.5	0.38
TN	mg/L	-	0.30 (0.27-0.35)	0.02 (12)	0.4	0.38	0.33	0.5	0.38
TP	mg/L	-	0.03 (<0.01-0.065)	0.02 (12)	0.28	0.06	0.04	0.04	0.03

(Table 5-3: Perth Groundwater Replenishment Scheme – Stage 1 – GWR-14 Leederville and Yarragadee Aquifer Baseline Water Quality Report.)

Table: Summary of the nutrient water quality data for the Yarragadee aquifer from the proposed monitoring and nearby bores

Parameter	Units	GWR Guideline	YMB1#		YRB1^	WT97*	W7*	G17*	G7*
			Avg. (Min.–Max.)	Std. Dev. (n)					
Alkalinity as CaCO3	mg/L	-	129 (128-130)	1.0 (2)	127	n/a	n/a	n/a	n/a
HCO_3	mg/L	-	151 (141-158)	5.1 (12)	155	140	114	156	233
Br	mg/L	-	0.12 (0.1-0.15)	0.01 (12)	0.12	0.19	0.11	0.42	0.71
Ca	mg/L	-	9.5 (8.3-10.9)	0.8 (12)		9.1	7.3	9.9	7.1
CO_3	mg/L	-	<1.0 (<1.0-<1.0)	0.0 (2)	<1.0	n/a	n/a	n/a	n/a
Cl	mg/L	250	36.5 (35-38)	1.0 (12)	38	63	35	113	232
F	mg/L	1.5	0.27 (0.22-0.31)	0.02 (12)	0.26	0.33	0.22	0.48	0.92
I	mg/L	0.1	<0.02 (<0.02-<0.02)	0.0 (2)	<0.02	n/a	n/a	n/a	n/a
Mg	mg/L	800	4.7 (4.2.-5.6)	0.4 (12)	4.9	5.9	2.9	6.8	3.5
K	mg/L	-	7.2 (6.1-7.7)	0.4 (12)	7.6	8.5	5.6	11	7.3
Si as SiO_2	mg/L	-	19 (18-20)	0.5 (12)	18	22	21	18	21
Na	mg/L	180	54.4 (46.6-58.8)	3.1 (12)	53.7	66.4	47.5	112	**206**
SO_4	mg/L	500	1.1 (0.9-1.2)	0.1 (12)	0.7	1.2	<0.1	6.9	14.3

(Table 5-4: Perth Groundwater Replenishment Scheme – Stage 1 – GWR-14 Leederville and Yarragadee Aquifer Baseline Water Quality Report.)

Appendix 3: Summary of Applicant's Comments on Risk Assessment and Draft Conditions

Section	Comments received	DWER consideration
Water Corporation Response - Draft Decision Report		
Preface – Definitions and Terms	Typos: "Premises" should read Advanced Water **Recycling** Plant…"RWQI" should read Recycled Water Quality **Indicator**	Agreed and amended.
1 – Purpose and scope of assessment	Suggested wording of second paragraph should read: "The applicant submitted a **construction** compliance document…"	Agreed and amended.
1 – Purpose and scope of assessment	The Decision Report assessment should exclude the recharge of recycled water into the aquifers on the grounds of: 1.) This is inconsistent with W5571/2013/1 2.) The product of the Advanced Water Recycling Plant (AWRP) is 'recycled water' of drinking water quality standard and is not considered a discharge (under the *EP Act*) of treated sewage. 3.) The recharge of recycled water product and the potential impacts of recharge into the aquifers is already regulated under the *Rights in Water and Irrigation Act 1914* (RIWI Act) and *Health Act 1911* (Health Act). Third paragraph should read: "This assessment considers the environmental risks associated with the operation of the AWRP, excluding the waste disposal to the ocean outfall, which is regulated under Ministerial Statements 382 and 569 and the recharge of recycled water, which is regulated under Ministerial Statements 382 and 569 and the recharge of recycled water, which is regulated under the RIWI Act and the Health Act.	Noted. Under the Groundwater Replenishment Regulatory Framework, December 2012 (GWR Regulatory Framework) for the purposes of DWER's regulation of the AWRP and Groundwater Replenishment as a Prescribed Premises Category 54, the GWR Regulatory Framework states that "DWER may require the on-going monitoring of groundwater quality within the recharge management zone boundary as part of licensing conditions and the extent to which DWER may impose conditions on Part V licences for GWR Schemes will depend on the circumstances and facts of each groundwater recharge proposal. For most schemes, conditions relating to the specification of the Recycled Water quality and monitoring of the receiving groundwater are likely to be appropriate". As such, the regulation of the recharge of Recycled Water is consistent with the requirements of the GWR Regulatory Framework. In addition, under Section 62(1) of the EP Act, a works approval or licence may be granted subject to such conditions as the CEO considers to be necessary or convenient for the purposes of the Act relating to the

<table>
<tr><th>Section</th><th>Comments received</th><th>DWER consideration</th></tr>
<tr><td></td><td></td><td>prevention, control, abatement or mitigation of pollution or environmental harm.</td></tr>
<tr><td>2 – Table 1</td><td>Header of third column should read: “Nominal production capacity”.</td><td>Disagree. The assessment has been based on the specified throughput of 14GL/year. This is not considered to be a nominal capacity.

Should the Applicant wish to increase this throughput, further assessment would be required by DWER and evidence provided by the Applicant as to why an increase in throughput would not increase the risks associated with the Premises.</td></tr>
<tr><td>3.1 – Infrastructure</td><td>Suggested wording: “The AWRP is the Category 54 ‘Prescribed Premises’ component of the Groundwater Replenishment Scheme (GWRS). The components of the AWRP and associated components of the GWRS are listed in Table 2, with reference to the Site Plan. The associated components of the GWRS do not form part of this Licence.</td><td>Noted. The Premises map has been revised to reflect the area originally approved under the Works Approval.

Notwithstanding this, it is not necessary for the validity of licence conditions that the discharge outfalls be located within the defined premises and that conditions may still be validly imposed on the discharge components outside of this under sections 62 and 62A of the EP Act.</td></tr>
<tr><td>3.1 – Table 2</td><td>Suggested wording in table title and within table:

Table 2. AWRP facility- including associated components of the GWRS. (Note: several corrections have also been highlighted).

<table>
<tr><td colspan="3">AWRP Infrastructure – Advanced water recycling of secondary treated wastewater to meet Recycled Water Quality parameters</td></tr>
<tr><td></td><td>Prescribed Activity Category 54</td><td>Specifications</td></tr>
<tr><td>1.</td><td>AWRP building</td><td><s>Corrugated iron</s> Building enclosing treatment process equipment on a concrete hardstand with bunding and drainage.</td></tr>
</table></td><td>Noted, as above.

Administrative amendments have been made to Table 2 in the Decision Report. References to the Beenyup WWTP monitoring bores have been removed.</td></tr>
</table>

Section	Comments received			DWER consideration
	2.	Pre-treatment and mechanical screening	Include: Screens and pre-treatment filters.	
	3.	Ultrafiltration system	Includes: UF membranes ~~(0.05 to 0.1 microns)~~, hot water tank, recirculation pump and chemical dosing system, three critical control points (CCPs).	
	4.	Reverse Osmosis system	The RO system comprises: high pressure pumps, two stage array of RO membrane racks energy recovery devices, a chemical clean-in-place (CIP) system and **two** CCPs	
	5.	UV disinfection system	Includes two duty UV reactors operating in parallel alignment. There are three CCPs monitoring performance of the UV system. Water is diverted to waste if all operating criteria and CCPs are not met.	
	6.	Chemical storage, dosing and dilution facilities	Includes chemical dosing system. All chemicals and hazardous materials will be stored in accordance with AS 3780 and Water Corporations operational procedures for chemical use.	
	7.	Recycled Water Storage	The Recycled Water Storage Tank provides buffer storage for the recycled water between the plant and the recharge bores. The working tank volume provides 30 minutes of storage at the Stage 1 plant peak flow rate (1050 kL working volume).	

Section	Comments received			DWER consideration
	8.	Waste and residuals management facility	Waste retention sump (with a 30kL capacity) and drainage pipes connecting to the Beenyup WWTP Ocean Outfall.	
	Additional infrastructure components within the GWRS			
		Not requiring licensing and not within Prescribed Premises boundary.	**Specifications**	
	9.	Three recharge bores into confined aquifers within the Leederville formation: LRB1 LRB2 LRB3	LRB1-DN400 FRP casing. Screened at 122-224 metres below ground level (mbgl), with DN 250 stainless steel (0.5mm aperture).	
			LRB2-**DN500 FRP** casing. Screened at 134.3-238 mbgl with **DN400** stainless steel (0.5mm aperture) screen.	
			LRB3-**DN500 FRP** casing. Screened at 132.3 - 236 mbgl with **DN400** stainless steel (0.5mm aperture) screen.	
	10.	One recharge bore into confined aquifers within the Yarragadee formation	YRB1, DN400 FRP casing. Screened at: 390.5 – 444.5, 450.5 – 486.5, 603.5 – 675.5 and 690.5 – 744.5 mbgl **with DN250 stainless steel (0.5mm aperture) screen**.	
	11.	Pumping systems and pipework	Each of the **recharge** bores is fed by its own high-pressure pump and conveyance system.	
	12.	Ambient groundwater	***(Please remove reference to BNYP/05 and BNYP 12/08 as they do not form***	

Section	Comments received	DWER consideration
	monitoring bores: LMB1 LMB2 LMB3 YMB1 ~~**BNYP 05/08**~~ ~~**BNYP 12/08**~~	***part of this project and are not required to inform ambient groundwater monitoring).***
3.2 – Operation	Second paragraph should read: "The feedwater is pre-treated at the AWRP through screens and filters while also being chemically dosed with chloramine to prevent biological fouling of the Ultra-Filtration (UF) and Reverse Osmosis (RO) units. **The pH of the UF filtrate is adjusted to minimise scaling on the RO units**."	Agreed and amended.
	Final sentence on page 3 should read: "The RO system is the final high-pressure filtration system prior to **UV disinfection**".	Agreed and amended.
	Page 4, line 4 can be amended to "There are **two** CCPs monitoring performance of the RO system." (As agreed with the DoH within the MOU (previously provided to DER)).	Agreed and amended.
	Page 4, paragraph 2, line 1 should read "The Ultra Violet (UV) disinfection system provides the final barrier which **inactivates (or kills)** pathogens in the water."	Agreed and amended.
	Page 4, paragraph 2, line 2 should read "Water which does not meet the operating criteria of each CCP is prevented from continuing through the treatment process, either by diverting the flow to waste or shutdown of the **UV units**."	Agreed and amended.
4. Legislative context	Paragraph 2 Acronym corrections: • Groundwater Replenishment Scheme = (GWRS) • Groundwater Replenishment Regulatory Framework = (GWR Regulatory Framework) • Water Resource Management Operation Strategy =	Agreed and amended.

<table>
<tr><th>Section</th><th>Comments received</th><th>DWER consideration</th></tr>
<tr><td></td><td>(WRMOS)</td><td></td></tr>
<tr><td></td><td>Table 3 requires additional information related to the Health Act 1911. Suggested inclusion for Table 3:
<table>
<tr><th>Legislation</th><th>Unique Identifier</th><th>Entity</th><th>Approval</th></tr>
<tr><td>Health Act 1911</td><td>Construction and operation of the AWRP is regulated under Section 107a; Water quality output is regulated against Section 98</td><td>Water Corporation</td><td>The requirements to meet compliance with this legislation have been formalised within the Memorandum of Understanding between the Department of Health and the Water Corporation. The MOU is a legally binding agreement.</td></tr>
</table></td><td>Partially agreed and amended.</td></tr>
<tr><td>4.1.5 – The Delegated Officer has found:</td><td>Typo – should read: “The discharge of waste to the marine environment is currently regulated through MS 382 and MS 569…”</td><td>Agreed and amended.</td></tr>
<tr><td>4.3.3 – Department of Water</td><td>Paragraph 2 reads: “Under the Metropolitan Water Supply, Sewerage and Drainage Act (1909) there are two by-laws pertaining to the regulation of the AWRP recharging water into the aquifers within a Public Drinking Water Supply Area (PDWSA). By-laws 5.4.6 and 5.4.7 regulate the discharge of polluted water, or refuse or untreated sewage, effluent or other matter that may impact upon drinking water quality. DoW has determined that water produced through the AWRP does not meet this definition for the purposes of the by-laws. DoW has confirmed that</td><td>As above, DWER’s position to regulate the discharge of Recycled Water is consistent with the GWR Regulatory Framework.</td></tr>
</table>

Section	Comments received	DWER consideration
	administration of these by-laws will not be required for the approval of a GWR scheme." The DoW's position considers the recycled water product as not a 'discharge of polluted water' or 'other matter that may impact upon drinking water quality'. This is consistent with the position DER took when approving the Works Approval. This is now inconsistent with DER"s position within the Draft Licence and Decision Report. Given the DER and DoW have amalgamated, the inconsistencies between the Works Approval and Draft Licence, and the inconsistent views of the two former regulatory departments; the Water Corporation (WC) formally requests clarification from the Department of Water and Environmental Regulation (DWER) on its position related to the considerations of the recycled water product.	
4.3.3 – Department of Water	Typo – paragraph 3 – should read "… Monitoring and reporting in the vicinity **of** recharge as well as abstraction will be conditioned within the WRMOS."	Agreed and amended.
4.3.4 – Department of Health	Paragraph 4 reads: "The DoH does not have the legislative power to regulate emissions or discharges from the AWRP". This statement is incorrect. The product of the AWRP is not considered a discharge but is recycled water of drinking water quality standard. The DoH ***does*** have the legislative power to both regulate the construction and operation of the AWRP (under s107a of the *Health Act 1911*) as well as the recycled water product (regulated under s98 of the *Health Act 1911*). The MOU documents the requirements for compliance under the *Health Act 1911*.	Noted. As above, in accordance with the GWR Regulatory Framework, DWER is responsible for the regulation of emissions and discharges from Prescribed Premises in accordance with Part V of the EP Act which includes the regulation of the Recycled Water recharge. As stated previously, the DoH role is to protect health while DWER is responsible for environmental protection.
4.4.1 – Groundwater Replenishment Trial	Paragraph 2, sentence 2 should read: "Monitoring of groundwater impacts of recharge also included the Superficial aquifer to assess the risk of vertical leakage." Refer to comments in 6.4.	Noted. This section has been partially revised based on reports provided by WC relating to the Groundwater Replenishment Trial.
4.4.2 – AWRP Works	Paragraph 1, line 3 should read: "…to produce **a nominal** 14	Noted. As above, this assessment is based on a

Section	Comments received	DWER consideration
Approval	GL/year of recycled water to recharge the confined Leederville and Yarragadee aquifers…"	maximum throughput of 14 GL/year. Should the WC decide to increase this throughput, this will require further assessment as impacts may vary with increased throughput.
	Additional wording is required here to capture the inconsistency in DER's position on the recycled water product: Consistent with the DoW's positon on the recycled water product (see comments in Section 4.3.3), the DER's Works Approval Decision Document specified the recycled water product would not be considered a discharge through the following wording: "*The injection of treated wastewater that has been treated to meet Australian Drinking Water Guideline quality is not considered a discharge of waste rather a form of managed aquifer recharge (MAR) of potable water"* … "*No specified conditions relating to point source emissions to groundwater are required to be added to the works approval or licence".* This position is inconsistent with position presented within this Draft Licence and Decision Report in which the recycled water product is considered a discharge of treated sewage and given specified conditions relating to point source emissions to groundwater. The WC requests the DWER to clarify this change in position relating to the product form the AWPR.	Noted. As above, DWER will be regulating the discharge of Recycled Water, consistent with the GWR Regulatory Framework. The Decision Report has been revised to clarify DWER's position in accordance with the GWR Regulatory Framework.
4.4.3 – AWRP Licence	Following the comment above, suggest adding wording to confirm the DER's change in position relating to the product water being considered as treated sewage.	Agreed, the Decision Report has been revised to clarify DWER's position in accordance with the GWR Regulatory Framework.
	The WC does not consider the product recycled water as a discharge of treated sewage. The product recycled water has been treated to meet potable drinking water standards and is considered a drinking water source. 'Sewage' enters the Beenyup WWTP which is then processed into 'treated sewage'. The 'treated sewage' enters the AWRP which is then processed into a product: 'recycled water' of drinking water quality standard with the by-products returned to the sewage treatment plant ocean	Noted. As above, DWER will be regulating the discharge of Recycled Water under Part V of the EP Act as per the definition of Recycled Water and Waste in the GWR Regulatory Framework (Section 6).

Section	Comments received	DWER consideration
	outfall that is regulated under the EP Act.	
	Paragraph 4. Sentence 1 – suggested wording: "The recharge of **recycled water**…"	Noted and amended.
4.4.6 – Noise	DER has requested for GWRT vibration assessment information. This information was not required to be provided as part of the Works Approval compliance requirements or during previous requests for additional information during the acceptance and processing of the licence application. As stated within the licence application document, the GWRT verified there was no correlation between the operation of the AWRP and measurable vibration at the Beenyup site boundary.	Noted. The Delegated Officer considered it appropriate to require these reports to verify that the methods and measurements taken are compliant. The Decision Report and Licence have been revised to clarify requirements for noise and vibration assessments.
4.4.6 – Key findings	The key findings presented do not related to the information presented in 4.4.3. The 3 noise complaints listed in Table 4 relate only to construction noise. The text confirms "The DER Noise Regulation Branch" reviewed the information provided and confirmed compliance" with the *Environmental Protection (Noise) Regulations 1997*. • Item 1 states "Sound power ratings for equipment has not been verified". The WC does not understand how or why the Delegated Officer arrived at this conclusive statement. There is no relationship between this statement and the discussion presented in Section 4.4.5 and 4.4.6; there is no reference to sound power ratings within the discussion. This finding is invalid and should be removed. Item 2 states "Verification of low frequency noise levels will be needed to valid(ate) acceptability of levels for the 14GL/year AWRP (Stage 1)". Similarly with item 1, there is no relation between this statement and the discussion as to how this finding was derived. This finding is invalid and should be removed.	Partially agreed, this section has been revised to better justify the Delegated Officer's key findings in relation to noise emissions.
4.4.7 – Clearing	First sentence should read: "**Recharge** bores **LRB2** and LRB3, conveyance infrastructure **and associated monitoring bores**	Agreed. The Decision Report and Licence have been amended to reflect 'recharge' bores. This is consistent

Section	Comments received	DWER consideration
	LMB2 and LMB3 are located within Bush Forever Site 303…"	with the GWR Regulatory Framework.
	DER has incorrectly commented "The Applicant claims that the area ~~for~~ utilised for installation of the infrastructure was prescribed under item 1 of the (Clearing of Native Vegetation) Regulations 2004." The WC did not make such a claim. The locations for the Advanced Water Recycling Plant and its associated conveyance infrastructure and bores were specifically selected so as to avoid any clearing of native vegetation. There has been no clearing of native vegetation associated with the construction of the AWRP or conveyance infrastructure, recharge bores or monitoring bores.	Noted, this section has been revised as per the Application.
5.0 - Consultation	During the consultation process, the DER consulted with the OEPA and DoW as part of the licence application assessment. The consultation was to ensure there was no regulatory duplication and alignment in process and understanding. The DoW expressed concerns about regulatory duplication. The WC agrees with the DoW based on the regulatory approvals required to be obtained with the DoW and also the DoH. It is noted the DER did not consult with the DoH during the licence application process. Given the DER and DoW have amalgamated, the inconsistencies between the Works Approval and Draft Licence, and the inconsistent views on regulation duplication help by formed departments; the WC formally requests clarification from the DWER on its position related to the appropriate regulation of the AWRP without regulatory duplication. For more information see comments provided on Section 4.3.3 and 4.3.4.	As above, DWER's position to regulate the discharge of Recycled Water is consistent with the GWR Regulatory Framework.
5.1.1 – Inter-Agency Working Group	Acronym: Groundwater Replenishment Regulatory Framework = (GWR Regulatory Framework)	Agreed and amended. This is consistent with the GWR Regulatory Framework.
	Paragraph 2, sentence 2 reads: "DER's interest in the recharge management zone is articulated in the GRRF as it is the receiving	Noted and amended.

Section	Comments received	DWER consideration
	environment for the discharge of treated sewage (recycled water) from the prescribed premises (AWRP).” WC does not consider the recycled water as ‘treated sewage’. Suggest removal of words ‘treated sewage’ and replaced with ‘recycled water’.	
	Comment: As this section mentions the DER withdrawing from the Inter-Agency Working Group to maintain its function for the regulation of emissions and discharges to the environment, additional wording is required here to clarify DWER’s position related to the consideration of the recycled water to be a ‘treated sewage’ discharge, requiring regulation. Refer to comments in Section 4.4.2.	Agreed, the Decision Report has been revised to reflect DWER’s regulation in accordance with the GWR Regulatory Framework.
6.4 – Groundwater and water sources	Typo – second sentence should read “The regional groundwater flow within the Leederville aquifer is **generally** described…”	Agreed and amended.
	Typos in Table 8: Column 3, second row: “The Leederville aquifer is identified by the DoW **as a** water supply for Perth”… Column 2, last row: “The recycled water is recharged into the Yarragadee aquifer at one location.”	Agreed and amended.
	Table 8, column 2, row 2, paragraph 3: The text reads: “Water Corporation Leederville abstraction bore WT45 is located approximately 3km north. Based upon the GWRT results it may take approximately 26 years to achieve “full breakthrough”. The WC would like to understand where this comment and timing was derived.	Noted, this section of the Decision Report has been revised to remove references to 26 years. DWER’s internal experts note that radiocarbon work carried out by the Geological Survey in the 1990s suggested that groundwater flow rates in the Leederville aquifer were of the order of a few metres per year under natural hydraulic gradients and this will probably increase to a few tens of metres per year under the steep hydraulic gradients present in the recharge area, but flow rates would rapidly decrease with distance from the recharge area.
	Last paragraph reads “Figure 4 is an east to west cross section of	Noted, the wording in this paragraph has been

<table>
<tr><th>Section</th><th>Comments received</th><th>DWER consideration</th></tr>
<tr><td></td><td>the lithology relevant to the proposed groundwater replenishment. It shows that the confining layer known as the Pinjar seal between the Superficial and Leederville aquifers thins to the west. This may increase the possibility of areas with greater permeability within the confining aquitard occurring.”

Comment: The WC disagrees with this conclusion. The thinning of the confining unit between the Leederville aquifer and the Superficial “Pinjar Seal”, while it thins to the west, there will be a reduced head in the Leederville aquifer further away from the recharge bores. While there is a possibility for upward flow further from the recharge bores, this is mitigated by the reduced head with distance from the bore, the horizontal travel time within the aquifer, and the extent and thickness of sediments overlying the recharge zone. The Leederville aquifer head must be raised to above the Superficial aquifer water levels. Preferential flow will likely be horizontal rather than vertical. 3D partial tracking using DoW/WC model PRAMS3.4 indicated it would be unlikely for recycled water to move into the Superficial aquifer. At a distance of 500m (1 PRAMS grid cell) from the recharge bore, the estimated vertical travel time would increase to 700 years at a recharge rate of 14GL/yr (Water Corporation, 2013).

A 3D visualisation of the steady state solute transport based on PRAMS3.4 PMPATH for recharge at 14GL/yr to the Leederville aquifer is shown in Water Corporation, 2013 – Figure 7.29. This indicates that recharged water does not move out of the Leederville aquifer. This result is consistent with the long travel times predicted for upward flow at a site scale, and highlights the conservative nature of the analytic approach which does not include lateral flow in the overlying sediments. No mitigating actions are required, as the confining layer separating the Leederville and Superficial aquifers is sufficient to prevent the recycled water from moving upward.

<table>
<tr><th>Recharge (GL/yr)</th><th>ML/d</th><th>Travel Time (years) to base of the Superficial aquifer</th></tr>
</table>
</td><td>amended. The Delegated Officer considers that WC’s comments are reasonable provided that the confining bed is laterally continuous and there is no direct hydraulic connection between the superficial and Leederville aquifers.</td></tr>
</table>

<table>
<tr><th>Section</th><th>Comments received</th><th>DWER consideration</th></tr>
<tr><td></td><td>
<table>
<tr><td>3.5</td><td>9.6</td><td>1500</td></tr>
<tr><td>7</td><td>19.2</td><td>600</td></tr>
<tr><td>10</td><td>27.4</td><td>440</td></tr>
<tr><td>14</td><td>38.4</td><td>250</td></tr>
</table>
Therefore the Groundwater Replenishment Technical Reference Group (GWR-TRG), assessed vertical movement away from the recharge bore as low risk.

[Note: GWR-TRG consisted of a team of hydrogeological experts from the CSIRO, Department of Water, Curtin University, Rockwater Ptd and the Water Corporation formed to progress the groundwater objectives of the Trial, and to assess the feasibility and potential hazards of GWR from available hydrogeological, water quality and geophysical data generated from the Trial and Yarragadee investigations. Refer to previously provided report:

• Water Corporation, (2013). Perth Groundwater Replenishment Scheme – Stage 2A Aquifer Risk Assessment Report (Leederville and Yarragadee Aquifers).</td><td></td></tr>
<tr><td></td><td>Page 17: “DER internal expert advice has indicated that chemically oxidising conditions are likely to be present in the portion of the confined aquifers where recharge takes place whereas surrounding groundwater will have reducing conditions”. The WC requests a copy of the internal expert advice referred to.</td><td>Agreed. The DWER Internal Technical Advice Report has been included as an attachment to this Decision Report.</td></tr>
<tr><td></td><td>Comment: Through laboratory experiments, the WC demonstrated that oxidising conditions will occur around the recharge bore, however during the GWRT and 1.5Gl Scheme, due to the highly reducing conditions in the Leederville aquifer, dissolved oxygen was not conclusively detected at monitoring bores located at 20m distances from the recharge bore. The GWRT and lab</td><td>Noted. The DWER Internal Technical Advice Report now included as an attachment to this Decision Report acknowledges that:

“The interface between oxidising and reducing conditions will act as a geochemical barrier for many</td></tr>
</table>

Section	Comments received	DWER consideration
	experiments, identified metals that have the potential to mobilise, if oxidising conditions were to occur, and the buffering capacity in the aquifer and recycled water had been consumed. The GWR-Technical Reference Group assessed this as a low risk. These metals are included in the groundwater monitoring program with results provided to DoH and DoW as part of regulatory reporting requirements under the Health Act and RIWI Act. Supporting references (previously provided to the DER): • Water Corporation, (2013). *Perth Groundwater Replenishment Scheme – Stage 2A Aquifer Risk Assessment Report (Leederville and Yarragadee Aquifers).* • Water Corporation, (2012). *Groundwater Report 2012*. *Groundwater Replenishment Trial* • Water Corporation, (2009). *Site Characterisation Report. Groundwater Replenishment Trial.*	*(but not all) chemical constituents that are released from sediments by aquifer-wastewater reactions and will probably limit lateral groundwater transport of many constituents in the confined aquifer. This may not be the case if substantial upward leakage from the Leederville to the superficial aquifer takes place in the MAR scheme, as chemically oxidising conditions may extent throughout the superficial aquifer where a large amount of groundwater use takes place".*
	Comment: The WC agrees that oxidising conditions occur in parts of the Superficial aquifer, however the GWR-TRG assessed the risk of movement from Leederville aquifer to the Superficial aquifer as low. Refer to comments provided in S6.4. Supported by reference: • Department of Water, (2010), *Hydrogeochemical assessment of the Superficial aquifer – Perth Metropolitan area – Hydrogeological record series.* Report no. HG37, August 2010.	Noted. The attached DWER Internal Technical Advice Report suggests that oxidising conditions may extend throughout the superficial aquifer where a large amount of groundwater use takes place.
6.4.1 – Technical feasibility	Typo – second sentence "All technical issues from the **trial** were documented…"	Agreed and amended.
6.4.1 – Community Engagement	Typo – "Undertaking a multifaceted **approach** to community and stakeholder engagement…"	Agreed and amended.

Section	Comments received	DWER consideration
6.4.1 – Regulation (pertaining to regulation under the EP Act(1986))	The recycled water produced from the AWRP is not considered a discharge or emission but a product of drinking water quality standard. Regulation of the drinking water quality product is not required to be regulated under the EP Act, but is required to be regulated under the *Health Act 1911*. The regulation of the recycled water product into the aquifers is regulated by the DoH under s107a and S98 of the *Health Act 1911*. If the AWRP product water is not deemed of drinking water quality and is seen as "wastewater", the WC is in violation of S98 and is subject to a Part IV penalty under the *Health Act 1911*. The DoH has the ultimate regulatory responsibility for the protection of human health through the protection of the integrity of the drinking water source aquifers. In doing this they protect the value of the aquifer as a drinking water source for now and in the future. Refer to comments in 4.3.4. The MOU between the DoH and the WC specifies the monitoring and reporting requirements required to comply with in order to be compliant with the *Health Act 1911*. The DoW also manages the abstraction of groundwater under the RIWI Act and regulates the groundwater recharge through *Operation Policy 1.01 – Managed aquifer recharge in Western Australia,* which includes groundwater replenishment under the RIWI Act. Additional regulation of the recycled water and of the monitoring of the aquifer is considered regulatory duplication. In accordance with guidance statement 5 of *Setting Conditions – Guidance Statement* (DER, 2015):"Conditions will not unnecessarily duplicate requirements imposed on licensees directly by the EP Act or another written law".	Noted, as detailed above, the Department intends to regulate groundwater replenishment activities in line with the previously agreed GWR Regulatory Framework. The GWR Regulatory Framework sets out the roles and relevant responsibility, including administration of legislation of each Agency involved in the regulation of such proposals. The Department therefore considers that the approach proposed in the draft Licence and Decision Report for Stage 1, is appropriate and required to ensure the Department fulfils all of its statutory obligations. Sections 107a and 98 of the *Health Act 1911* relate to the construction of the AWRP infrastructure only and are not relevant to the operational requirements of the AWRP under Part V of the EP Act. Regulation by the DoH through the Memorandum of Understanding (MoU) is focused on managing potential health risks from the AWRP and not environmental impacts. The Department's Regulatory Services (Water) will manage the annual groundwater recharge and abstraction quantities via *Operational Policy 1.01 – Managed Aquifer Recharge in Western Australia* and the *Rights in Water Irrigation Act 1914* (RIWI Act 1914), whereby the groundwater reuses abstraction will be negotiated annually in addition to a baseline groundwater allocation. The Department therefore considers that regulation of the environmental impacts of the AWRP under Part V of the EP Act is not duplicating the regulation of other Departments or regulatory areas within DWER.
6.4.2 – Recharge Management Zone (RMZ)	The recycled water must meet the Recycled Water Quality Parameter Guidelines as listed in the MOU between the DoH and	Noted. As above, regulation by the DoH only relates to public health impacts and does not consider potential

Section	Comments received	DWER consideration
	the WC. A water quality event detail in the MoU includes – Event level 2 A groundwater sampling result, taken from the compliance monitoring bores located within the recharge management zone (at a distance of 50-100m from the recharge bore) which exceeds a Recycled Water Quality Parameter, subject to identified background levels not exceeding Recycled Water Quality Parameter values. Details on the RMZ are available in: • GWR-Technical Reference Group. (2012). *GWR Management Zone and Monitoring Requirements*.	environmental impacts resulting from the recharge of Recycled Water.
6.4.2 - Key finding:	Item 2 – reads: "*Comparatively limited information is available on the fate, transport, and geochemical reaction of the injected water within the Yarragadee aquifer".* Agreed, the WC has not commenced GWR into the Yarragadee aquifer. However, assessments have been made by the GWR-Technical Reference Group (DoW, CSIRO, Curtin University, Rockwater Hydrogeological Consultants and WC) from analysis and interpretation of Yarragadee core samples collected at the Beenyup site, seismic reflection, and drilling and testing of a Yarragadee recharge and monitoring bores. The GWR-TRG have assessed risks to the Yarragadee aquifer as low. Our knowledge of the aquifer will be improved via ongoing monitoring, developed in associated with the GWR-TRG and as agreed with the DoW. Monitoring results will be reported as part of regulatory requirements associated with compliance with the RIWI Act and Health Act. • Supporting references: Patterson, B.M., Prommer, H., Donn, M., Torkzaban, S., Harris, B., Wendling, L., Ginige, M., (2014). *Characterisation and quanitification fo water quality evolution during recharge of recycled water into the Yarragadee aquifer.* October 2014, Report to the Water Corporation of Western Australia.	Noted.

Section	Comments received	DWER consideration
	• Water Corporation (2013), *Perth Groundwater Replenishment Scheme – Stag 2A – Aquifer Risk Assessment Report*, April 2013, Water Corporation. • Water Corporation (2012) *Yarragadee Aquifer – Preliminary Risk Asessment*, August 2011, Water Corporation.	
6.4.3 – Baseline Groundwater Quality	Paragraph 1 reads: "Table 10 compares the water quality parameters determined by the Delegated Officer as suitable indicators of performance of the AWRP in treating the water to a standard set by DoH to protect human health and of parameters that may indicate geochemical reactions within the aquifer matrix." The WC does not agree with the selected indicators presented in Table 10 as appropriate as indicators to assess risks of geotechnical reactions within the aquifers, particularly with reference to Chlorate and N-Nitrosodimethylamine. The WC requests the DER provide the technical reports to support this statement. Supporting reference: • Water Corporation (2013), *Perth Groundwater Replenishment Scheme – Stage 2A – Aquifer Risk Assessment Report,* April 2013, Water Corporation.	Noted, additional indicators including chlorate and N-Nitrosodimethlamine were selected as appropriate chemical signatures given the parameters are likely to only be present in the AWRP. These parameters were considered appropriate as indicators of the Recycled Water and may be used to validate the modelling undertaken by the Applicant. The Delegated Officer considers it reasonable for these parameters to be removed.
	General comment: The water quality of the recycled water product and aquifer integrity forms monitoring requirements under the Health Act and RIWI Act (administered by the DoH and DoW) – refer to comments provided in 4.3.3 and 4.3.4. The monitoring program is designed to monitor both the water quality of the recycled water to ensure its quality for recharge, as well as the aquifer response to monitor potential geochemical reactions that may occur.	Noted. Setting conditions relating to the specification of the Recycled Water quality) and monitoring of the receiving groundwater are consistent with the GWR Regulatory Framework and the regulation of emissions and discharges under Part V of the EP Act.
6.4.3 – (a) Leederville Aquifer Water Quality	Sentence 3 reads "Numerous technical reports state the quality of most parameters is below the Australian Drinking Water Guidelines, NHMRC, 2004 guidelines (ADWG), with the	Noted, this section has been revised.

<table>
<tr><th>Section</th><th>Comments received</th><th>DWER consideration</th></tr>
<tr><td></td><td>exceptions of Nickel, Cadmium and Lead across certain sediment types”. The WC requests the DER provide technical reports referred to.</td><td></td></tr>
<tr><td>6.4.3 – Baseline Groundwater Quality – (b) Yarragadee Aquifer Water Quality</td><td>Parameters were selected based on DER internal expert advice. As with comment above, WC would like to request a copy of this advice.</td><td>Agreed. The DWER Internal Technical Advice Report has been included as an attachment to the Decision Report.</td></tr>
<tr><td>6.4.3 – Baseline Groundwater Quality</td><td>Typos:
End of first paragraph: “…and of parameters that may indicate geochemical reactions within the aquifer”.
(a) Leederville Aquifer Water Quality: “The tables in Appendix 2 summarise the water quality monitoring undertaken for the establishment…”
(b) Yarragadee Aquifer Water Quality: “The tables in Appendix 2 summarise…”
(b) Yarragadee Aquifer Water Quality: “The sampling for the Yarragadee aquifer was undertaken over 6 other nearby bores, to better characterise the aquifer.”</td><td>Agreed and amended.</td></tr>
<tr><td>6.4.3 – Table 10</td><td>Table 10 AWRP Performance data:<table><tr><th>Parameter</th><th>Guideline Level</th><th>Result at SP259 10/5/2017</th></tr><tr><td>Nitrate as nitrogen</td><td>11 mg/L as N</td><td>1.3</td></tr><tr><td>pH</td><td>6.0-8.5</td><td>6.9</td></tr><tr><td>FRP</td><td>N/A</td><td><0.01 mg/L</td></tr></table></td><td>Noted. The Decision Report has been revised to include this performance data.</td></tr>
</table>

<table>
<tr><th>Section</th><th>Comments received</th><th>DWER consideration</th></tr>
<tr><td></td><td>
<table>
<tr><td>TDS</td><td>500 mg/L</td><td>27</td></tr>
<tr><td>Lead</td><td>0.01 mg/L</td><td>27</td></tr>
<tr><td>Boron</td><td>4mg/L</td><td>0.10</td></tr>
<tr><td>Cadmium</td><td>0.002 mg/L</td><td><0.0001</td></tr>
<tr><td>Copper</td><td>2 mg/L</td><td>0.006</td></tr>
<tr><td>Chlorate</td><td>0.7 mg/L</td><td><0.010</td></tr>
<tr><td>Sulfate</td><td>500 mg/L</td><td><0.1</td></tr>
<tr><td>Uranium</td><td>0.02 mg/L</td><td><0.0001</td></tr>
<tr><td>NDMA</td><td>100 mg/L</td><td><2.0</td></tr>
<tr><td>Zinc</td><td>3 mg/L</td><td><0.005</td></tr>
<tr><td>EC</td><td>N/A</td><td>4.0 mS/m</td></tr>
</table>
Note 1: DO is not a DoH requirement at the AWRP discharge point. Average DO concentration for GWRT is around 8.2 mg/L

Note 2: There are no guideline values for EC or FRP as these parameters are not considered RWQP</td><td></td></tr>
<tr><td>6.4.3 – Key Findings</td><td>Item 1 reads: “Comparing GWR guideline values to those of background water sampling summary results, injected water may exceed the background concentrations of numerous parameters.” The wording in this finding is confusing, please consider rewording.

Comment: Some background parameters are already above guideline limits in the aquifer prior to recharge. An endorsed</td><td>Agreed, this key finding has been revised,</td></tr>
</table>

<table>
<tr><th>Section</th><th>Comments received</th><th>DWER consideration</th></tr>
<tr><td></td><td>memorandum from the DoH acknowledges the parameters that already exceed MOU requirements.

Comment: All water recharged within the GWRT (and operation of 1.5 GL/year plant) were within guideline limits. Supporting reference:
Water Corporation, (2012). Groundwater Report 2012. Groundwater Replenishment Trial.</td><td></td></tr>
<tr><td>6.5 – Soil Type</td><td>Comment: The soil type described refers to the description of the immediate land the AWRP is built on. This is not relevant for the soil types at the recharge intervals.</td><td>Agreed. This section has been revised to also reflect the relevant soil types at the recharge intervals.</td></tr>
<tr><td>7.1 – Table 11 – Noise Emissions</td><td>WC disagrees with the conclusions related to Noise within Table 11. As described in the WC’s comments relating to Section 4.4.6, the Key Findings concluded by the Delegated Officer related to noise are invalid. Section 4.4.6 of the Decision report indicates that DER Noise Regulation Branch confirmed compliance with Environmental Protection (Noise) Regulations (1997). There should be no requirement for a continued risk assessment for this potential emission.

The excerpt row from Table 11 relating to ‘Noise Emissions’ should read:
<table>
<tr><th>Potential Emission or Discharge</th><th>Potential Receptor</th><th>Potential Pathway</th><th>Potential Adverse Impacts</th><th>Continue to detailed Risk Assessment</th><th>Reasoning</th></tr>
<tr><td>Noise emissions</td><td>Nearest sensitive receptor is a residential premises located approximately 200 metres to the west</td><td>Air / wind dispersion</td><td>None</td><td>No</td><td>In accordance with Section 4.4.6, DER Noise Regulation Branch confirms Noise Verification Assessment of AWRP operation is compliant with Environmental Protection (Noise) Regulations (1997).</td></tr>
</table></td><td>Disagree; a risk assessment is still required as considered a reasonably foreseeable risk of the operations.</td></tr>
<tr><td>7.1 – Table 11 – Injected</td><td>Comment: The WC notes the DER refers to the recycled water product as “Injected recycled waste water” potential emission or</td><td>Noted. As above, under the Groundwater Replenishment Regulatory Framework for the purposes</td></tr>
</table>

<table>
<tr><th>Section</th><th>Comments received</th><th>DWER consideration</th></tr>
<tr><td rowspan="3">recycled Water</td><td>discharge. This is incorrect. The AWRP produces ‘recycled water’ which is of drinking water standard, and it is not considered to be a discharge of waste. Refer to WC comments for section 4.4.2 and 4.4.3.</td><td>of regulation as Prescribed Premises category 54, Recycled Water from the AWRP will always be considered to be treated sewage irrespective of the water quality achieved.</td></tr>
<tr><td>In addition to the above comment, the WC disagrees with the classification of the potential receptor of the recharged recycled water as an aquifer. An aquifer is not a receptor, but is the medium or potential pathway to which humans are the receptor through their consumption of the water within the aquifer for beneficial use.

The excerpt rows from Table 11 relating to ‘Injected recycled water’ should read:</td><td>Noted. As above, the Groundwater Replenishment Regulatory Framework (December 2012) details that DWER has an interest in the Recharge Management Zone in so far as it is the receiving environment for the discharge of treated sewage (Recycled Water) from the Prescribed Premises.</td></tr>
<tr><td colspan="2"><table>
<tr><th>Potential Emission or Discharge</th><th>Potential Receptor</th><th>Potential Pathway</th><th>Potential Adverse Impacts</th><th>Continued to detailed Risk Assessment</th><th>Reasoning</th></tr>
<tr><td rowspan="2">Recycled water for recharge*</td><td rowspan="2">Human receptors and consumers of Perth’s Integrated Water Supply Scheme (IWSS)</td><td>Contaminated Leederville and Yarragadee aquifers as a result of quality of recharged recycled water.</td><td>Human health impacts from exposure of contaminated groundwater supply.</td><td>No</td><td>Product water and potential impacts on aquifer integrity is regulation under Health Act 1911 and RIWI Act.</td></tr>
<tr><td>Contaminated Leederville and Yarragadee aquifers as a result of geochemical reactions caused by recharged</td><td>Human health impacts from exposure of contaminated groundwater supply.</td><td>No</td><td>Product water and potential impacts on aquifer integrity is regulation under Health Act 1911 and RIWI Act.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Section</th><th colspan="6">Comments received</th><th colspan="2">DWER consideration</th></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td></td><td>water.</td><td colspan="2"></td><td></td><td></td></tr>
<tr><td>Industrial and domestic users of the Superficial aquifer and groundwater dependent ecosystems.</td><td>Contaminated Superficial aquifer as a result of groundwater dynamics, recharged water breaching the Pinjar seal.</td><td colspan="2">Impact on beneficial use of the Superficial aquifer.</td><td>Yes</td><td>See Section 7.6</td></tr>
<tr><td colspan="7">*Note: The recycled water is not considered a discharge or emission and is therefore not required to be assessed further as a risk event.</td></tr>
<tr><td rowspan="3">7.1 – Table 11 – Sewage or chemical pipes and storage tanks</td><td colspan="5">The WC disagrees with the DER’s assessment that a detailed risk assessment is warranted for “Sewage or chemical pipes and storage tanks”. The AWRP has been constructed in accordance with Works Approval requirements. Any related failure in containment infrastructure or spillages can be adequately regulated by the General provisions of the Environmental protection Act 1986 and the Environmental Protection (Unauthorised Discharges) Regulations 2004.
The excerpt row from Table 11 relating to ‘Sewage or chemical pipes and storage tanks’ should read:</td><td colspan="2">Disagree. The Delegated Officer considers that failure in containment infrastructure or spillages present a reasonable Risk Event that could occur from the Premises and as such, further risk assessment is warranted.</td></tr>
<tr><td>Potential Emission or Discharge</td><td>Potential Receptor</td><td>Potential Pathway</td><td colspan="2">Potential Adverse Impacts</td><td>Continued to detailed Risk Assessment</td><td>Reasoning</td></tr>
<tr><td>Rupture of pipes / breach of containment tanks resulting in treated sewage or</td><td>Vegetation, soils and groundwater adjacent to discharge area.</td><td>Direct discharge to land</td><td colspan="2">Soil contamination inhibiting vegetation growth and survival. Contamination of superficial groundwater.</td><td>No.</td><td>Failure in containment infrastructure or spillages can be adequately regulated by the General provisions of the Environmental Protection Act 1986</td></tr>
</table>

Section	Comments received	DWER consideration
	chemical discharge to land	and the *Environmental Protection (Unauthorised Discharges) Regulations 2004*.
7.4 Risk Assessment – Noise emissions from the AWRP	In accordance with WC comments provided under Section 7.1, and the process of establishing a risk event described by Section 7.1, there is no *Risk Event* associated with this emission. A detailed risk assessment for noise emissions is thus not warranted. Section 7.4 can be deleted.	Disagree. The Delegated Officer considers that noise emissions present a reasonable Risk Event that could occur from the Premises and as such, further risk assessment is required.
7.5 – Risk Assessment – Injected recycled water causing geochemical reactions within the Leederville or Yarragadee aquifer that impact on its beneficial use.	In accordance with WC comments provided under Section 7.1, and the process described by Section 7.1, the water quality of the product and its potential impacts on the aquifers are already regulated through other mechanisms – the *Health Act 1911*, *RIWI Act* and *Metropolitan Water Supply, Sewerage and Drainage Act (1909)*. A detailed risk assessment of the recharged recycled water causing geochemical reactions within the Leederville or Yarragadee aquifer is not warranted. Section 7.5 can be deleted.	Noted. As above, the assessment and regulation of the recharge of the Recycled Water and its impacts on the aquifer are consistent with the GWR Regulatory Framework.
7.6 – Risk Assessment – Groundwater quality changes in the superficial aquifer form upward seepage of injected recycled water	Paragraph 2 reads: "DER internal technical advice suggested that potential over-pressurisation of the Leederville aquifer or over-abstraction from the superficial aquifer may cause enough difference in pressure to allow the recharge water to permeate to the lower layers of the superficial aquifer, the Pinjar Seal confining layer." WC requests a copy of the internal technical advice received. Refer to comments in 6.4.	Agreed. The technical expert advice report has been included as an attachment to the Decision Report.
7.6 – Risk Assessment – Groundwater quality changes in the superficial aquifer from upward seepage of injected recycled water	The WC does not agree with the findings described in Section 7.6. Due to drying climate, public and private abstraction water levels, heads have declined within the Leederville aquifer. With the recharge of recycled water, heads in the Leederville aquifer will increase, to levels likely lower than those that historically occurred. Therefore the confining layer can withstand the increased recharge pressures. In addition to this horizontal	Noted, the wording in this section of the Decision Report has been revised. As above, the Delegated Officer considers the Applicant's comments to be reasonable provided that the confining bed is laterally continuous and there is no direct hydraulic connection between the Superficial and

Section	Comments received	DWER consideration
	hydraulic conductivities within the Leederville aquifer are orders of magnitude greater than the vertical hydraulic conductivities of the confining unit; therefore recycled water will preferentially flow horizontally rather than vertically. The recycled water is low ionic strength, its reaction with clay layers may cause clay swelling and colloid dispersion, reducing the permeability even further. Refer to comments in 6.4.	Leederville aquifers. The Delegated Officer has since reviewed a copy of the Water Corporation Report *Groundwater Replenishment Scheme – GWR-14 – Leederville and Yarragadee Aquifer Risk Assessment* (provided by DWER's Environmental Regulation (Water) branch) and accepts that the heads resulting from recharging at the maximum instantaneous rate of 48ML/d (~16ML/d per bore) into three Leederville recharge bores, for five years, would be well below the 180m maximum based on the MAR guidelines.
7.6.2 – criteria for Assessment	Typo – full-stop at end of second paragraph.	Agreed and amended.
	"Based on DER technical advice" – The WC requests a copy of this technical advice.	Agreed, as above, DWER's Internal Expert Advice Report has been included as an attachment to the Decision Report.
	The WC disagrees with this assessment, as per WC comments in Section 7.6.	Noted.
7.6.3 – Table 17	Site Plan has been provided in licence application and "As Constructed" drawings provided in the Works Approval Compliance Report.	Noted.
7.6.4 – Key Findings	The WC does not accept these findings, refer to comments in 6.4.	Noted.
7.6.5 – Consequence	The Delegated Officer has determined that the impact of affecting the current or potential beneficial use of the superficial aquifer will be "minimal across a wider scale". The WC has completed more work assessing the vertical movement risk, particularly for the proposed Stage 2. Consistent with comments provided in 6.4 and consistent with the consequence ratings found for the impacts to Leederville and Yarragadee aquifers, the WC determined the consequence to be "Minimal at the local scale". Any potential impacts to the superficial aquifer will also be at the local scale.	Noted.

<table>
<tr><th>Section</th><th>Comments received</th><th>DWER consideration</th></tr>
<tr><td></td><td>Thus the consequence rating should be changed to Minor.
Supporting reference:
Water Corporation, (2016). Perth Groundwater Replenishment Scheme – Stage 2 – Preliminary Aquifer Risk Assessment Report. September 2016.</td><td></td></tr>
<tr><td>7.6.7 - Overall rating of geochemical reactions in the superficial aquifer, from upward seepage of the injected recycled water occurring.</td><td>Based on comments provided in 7.6.5 overall risk event would be Low.</td><td>Noted.</td></tr>
<tr><td>7.7 – Risk Assessment – Rupture of pipes/breach of containment tanks resulting in treated sewage or chemical discharge to land</td><td>In accordance with WC comments provided under Section 7.1, and the process described by Section 7.1, this emission can be adequately regulated by the General provisions of the EP Act 1986 and the Environmental Protection (Unauthorised Discharges) Regulations 2004. A detailed risk assessment is not warranted. Section 7.7 can be deleted.</td><td>Noted. The Delegated Officer considers that a risk assessment is warranted as this is a reasonably foreseeable risk associated with the Premises activities.</td></tr>
<tr><td>7.8 – Table 20</td><td>Table 20 requires updating based on comments provided in Section 7:
<table>
<tr><th rowspan="2"></th><th colspan="4">Description of Risk Event</th><th rowspan="2">Applicant Controls</th><th rowspan="2">Risk Rating</th><th rowspan="2">Acceptability with controls (conditions on instrument)</th></tr>
<tr><th>Emission</th><th>Source</th><th>Pathway</th><th>Receptor</th></tr>
<tr><td>1</td><td>Recycled water for recharge*</td><td>AWRP</td><td>Contaminated Superficial aquifer as a result of groundwater dynamics, recharged water breaching the Pinjar seal.</td><td>Industrial and domestic users of the Superficial aquifer and groundwater dependent ecosystems</td><td>Infrastructure and management controls</td><td>Minor consequence
Rare Likelihood
Low risk</td><td>Acceptable, generally not controlled.</td></tr>
</table></td><td>Noted.</td></tr>
</table>

Section	Comments received	DWER consideration
8. Regulatory Controls	In accordance with WC comments provided in Sections 7.1 – 7.8, there are no risk events that warrant a requirement for regulatory controls.	Noted, as above.
9. Appropriateness of conditions	This section will require amending based on comments provided in Section 7 and the comments provided on the Conditions within the Draft Instrument (Attachment 2).	Noted.
Water Corporation Response – Draft Licence		
Draft Licence Page	WC notes the intent of the DER to include conveyance infrastructure and recharge bores within the prescribed premises boundary. This is inconsistent with the Works Approval and also licence application. WC has provided the prescribed premises boundary as part of the Licence application documentation and contains only the AWRP –the Category 54 component of the Groundwater Replenishment Scheme and not the recharge bores or conveyance infrastructure.	Noted. As above, it is not necessary for the validity of licence conditions that the discharge outfalls be located within the defined premises and that conditions may still be validly imposed on the discharge components outside of this under sections 62 and 62A of the EP Act.
Definitions and Interpretation	Reportable Event – Please clarify wording in definition of 'Reportable Event'. Definition currently refers to "Column 4 of Table 6, in tables 4, 5 and 6", which is incorrect. This definition also refers to 'target limit'. WC suggests wording is kept consistent as either 'Limit' or 'Action Criteria', to avoid confusion. WC recommends having 'limit' and 'action criteria' defined clearing within definitions section and consistently applied within conditions, where appropriate.	Partially agreed. The definition for reportable event in the Licence has been revised.
Licence Conditions		
1. Emissions	This condition will need to be amended based on the comments provided in Section 7 of the Decision Report. There is no requirement for noise emissions to be considered a "Specified Emission". Operational noise has been verified as	Noted. As per the Delegated Officer's risk assessment and section 62 of the EP Act, the Delegated Officer considers it appropriate that controls are applied to the

Section	Comments received	DWER consideration
	compliant with the Noise Regulations. Recycled water is not considered an emission or discharge of treated wastewater as it is water of drinking water quality standard. Drinking water quality and aquifer integrity is regulated by the Department of Health under the *Health Act 1911* and by Department of Water (now DWER) under the Operational Policy 1.01 – Managed aquifer recharge under the *RIWI Act 1914*. In accordance with guidance statement 5 of *Setting Conditions – Guidance Statement* (DER, 2015): "Conditions will not unnecessarily duplicate requirements imposed on licensees directly by the EP Act or another written law", no specific conditions are required. Typo – "Subject to compliance with Ministerial **Statements** 382 and 569".	Licence to ensure that noise emissions are controlled to maintain compliance with the Noise Regulations. As above, the regulation of treated wastewater recharge is in accordance with the GWR Regulatory Framework. Administrative amendments have been made to the Decision Report in accordance with the above.
2. Infrastructure and Equipment (Noise Verification) "The Licence Holder must within three m months of the AWRP being fully operational, or by 1 November 2017, retain the services of a competent acoustic consultant to undertake model validation measurements at the three locations indicated in the Noise Validation Survey locations in Schedule 2…"	Condition not valid. Refer to comments provided in Decision Report – Sections 4.4.6, 7.1, 7.4 and 8 (Attachment 3).	Noted, as above, the Decision Report has been revised to better justify the inclusion of noise validation monitoring in the Licence.
3. Infrastructure and Equipment "The Licence Holder must	Condition not valid or outcome-based. Refer to comments provided in Decision Report – Sections 7.1, 7.7 and 8 (Attachment 3).	Noted. The Delegated Officer considers this condition to be necessary under Section 62 of the EP Act for the prevention, control, abatement or mitigation of pollution

Section	Comments received	DWER consideration
ensure that the infrastructure and equipment specified in Column 1 of Table 3…"		or environmental harm.
4. Process Monitoring (AWRP discharge point) "The Licence Holder must undertake process monitoring…"	Condition requires modification. - Agree to measuring volumes of: o Inflow to AWRP; o Outflow from AWRP; and o Reject water disposal. - Column 3 – keep units consistent (all ML/d) - Column 6 – remove 14 GL/year as a "Limit". This is a nominal value only, not a limit. - Column 7 – remove '(WWQMS)' this is not correct/ relevant. - Typos – numbering of rows is incorrect. - Row 2 and 3 – replace "Advanced Treated Wastewater" with "recycled water" - Column 7, Row 4 "AWRP Reject Water Outflow Meter" – delete the word "Meter". There is no flow meter installed on the discharge line that connects to the Beenyup Ocean Outfall. Instead, the waste outflow is determined by the sum of individual waste flows from each of the components in the AWRP. There is also a meter on the Beenyup Ocean Outlet that captures all flows (i.e. the AWRP and the Beenyup WWTP) to the ocean. - Removal of Item 6 ("AWRP Discharge Sampling Point") – refer to comments for section 4.3.4, 4.4.2, 5, 6.4.1, 7 and 8 of the Decision report (Attachment 3): o Product is not a discharge; o Unnecessarily duplicate requirements imposed	Noted. Administrative amendments have been made consistent with the Applicant's comments. As above, the 14GL/year limit has not been removed as the Delegated Officer's assessment is based on a maximum throughput of 14GL/year. This is also consistent with DoH approvals. References to 'advanced treated wastewater' have been amended to 'Recycled Water'.

Section	Comments received	DWER consideration
	upon licensee by another law (*Health Act 1911; RIWI Act 1914)*. In accordance with guidance statement 5 of *Setting Conditions – Guidance Statement* (DER, 2015): "Conditions will not unnecessarily duplicate requirements imposed on licensees directly by the EP Act or another written law".	
5. Ambient Groundwater Monitoring Program (Ambient Pressure monitoring) "The Licence Holder must undertake ambient aquifer pressure monitoring…"	Condition not valid: Refer to comments for Section 4.3.4, 4.4.2, 5, 6.4.1, 7 and 8 of the Decision Report (Attachment 3): - Product water is not a discharge - Unnecessarily duplicate requirements imposed upon licensee by another law (*Health Act 1911; RIWI Act 1914*). In accordance with guidance statement 5 of Setting Conditions – Guidance Statement (DER, 2015): "Conditions will not unnecessarily duplicate requirements imposed on licensees directly by the EP Act or another written law".	Disagree. As above, regulation of the discharge of Recycled Water is consistent with the GWR Regulatory Framework and is not considered to be duplicative of other requirements.
6. Ambient Groundwater Monitoring Program (Ambient water quality monitoring) "The Licence Holder must undertake ambient groundwater quality monitoring…"	Condition not valid: refer to comments for Section 4.3.4, 4.4.2, 5, 6.4.1, 7 and 8 of the Decision Report (Attachment 3): • Product water is not a discharge • Unnecessarily duplicate requirements imposed upon licensee by another law (*Health Act 1911; RIWI Act 1914*). In accordance with guidance statement 5 of Setting Conditions – Guidance Statement (DER, 2015): "Conditions will not unnecessarily duplicate requirements imposed on licensees directly by the EP Act or another written law".	Disagree, as above.
7. Ambient Groundwater Monitoring Program "The Licence Holder must ensure that if monitoring	Condition not valid: refer to comments for Section 4.3.4, 4.4.2, 5, 6.4.1, 7 and 8 of the Decision Report (Attachment 3): • Product water is not a discharge	Disagree, as above.

Section	Comments received	DWER consideration
undertaken in accordance with Condition 6 Table 6 indicates an exceedance of the Action Criterion…"	• Unnecessarily duplicate requirements imposed upon licensee by another law (*Health Act 1911; RIWI Act 1914*). In accordance with guidance statement 5 of Setting Conditions – Guidance Statement (DER, 2015): "Conditions will not unnecessarily duplicate requirements imposed on licensees directly by the EP Act or another written law".	
8. Ambient Groundwater Monitoring Program "The Licence Holder must develop then implement a groundwater monitoring program that…"	Condition not valid: refer to comments for Section 4.3.4, 4.4.2, 5, 6.4.1, 7 and 8 of the Decision Report (Attachment 3): • Product water is not a discharge • Unnecessarily duplicate requirements imposed upon licensee by another law (*Health Act 1911; RIWI Act 1914*). In accordance with guidance statement 5 of Setting Conditions – Guidance Statement (DER, 2015): "Conditions will not unnecessarily duplicate requirements imposed on licensees directly by the EP Act or another written law".	Disagree, as above.
9. Record-keeping and reporting "The Licence Holder must submit to the CEO…"	Condition requires modifications based on comments to Conditions 1-8.	Noted.
10. Record-keeping and reporting "The Licence Holder must maintain accurate and auditable Books…"	Condition requires modification based on comments to Conditions 1-9. The WC questions the relevance of this Condition.	Noted. This condition is relevant and necessary to ensure records are maintained by the Licence Holder for the periods specified.
11. Record-keeping and reporting "The Licence Holder must record the number and	Condition acceptable.	Noted.

Section	Comments received	DWER consideration
details of any complaints…"		
12. Record-keeping and reporting "The Licence Holder must submit to the CEO…"	Condition acceptable.	Noted.
13. Record-keeping and reporting "The Licence Holder must comply with a Department Request…"	Condition not valid – unnecessary duplicate requirements imposed on licensee directly by the *Environmental Protection Act 1986* (Section 90)	Disagree. This condition is considered appropriate as it provides flexibility to the Department and includes some requirements in addition to those specified under section 90 of the EP Act.
Schedule 1 – Maps		
Premises Map	Previously provided with licence application documentation.	Noted and amended.
Noise Validation Survey Locations	Not required – refer to comments provided for Condition 2	Noted. The justification for the inclusion of noise validation monitoring has been revised in the Decision Report.
Premises Boundary	Coordinates previously provided with licence application documentation.	Noted and amended.
Schedule 2 Primary Activities		
Table 5: Primary Activities	Change "Approved premises production capacity" to "Nominal production capacity"	Disagree. As above, this is not a nominal capacity; it is the capacity at which the Delegated Officer's assessment is based. Further assessment would be required to increase this capacity.
Infrastructure and Equipment	Table numbers will require amending. Refer to Decision Report for list of infrastructure.	Noted.
Site Layout	Acceptable.	Noted

Section	Comments received	DWER consideration
Monitoring Locations	Previously provided in licence application documentation	Noted.
Additional comments received 10 October 2017		
Draft Licence		
Table 1 Definitions – Reportable Event Definition	Administrative error – incorrectly references 'Frequency' not limit or action criteria columns.	Agreed and amended.
Condition 1 – Table 2: Col 1, Row 2	"Emission/**Discharge Type***"* The injection of recycled water product into the Leederville and Yarragadee aquifers does not constitute an emission, but a discharge. Amendment needed to clarify that the items listed in Column 1 consist of emissions and discharge.	Agreed and amended.
Condition 1 – Table 2: Specified Emissions/Discharges – Recycled Water recharged into the Leederville and Yarragadee aquifers	Administrative error – there is no Condition 0.	Agreed and amended - this should have referenced to Condition 9.
Condition 1 Table 2: Waste stream from the Advanced Water Treatment Plant (AWRP) to ocean outfall within Marmion Marine Park	Change "Waste stream from the Advanced Water Treatment Plant…" to "**Reject Water** waste stream…" Consistency with operational terminology.	Agreed and amended.
Condition 3 Table 3: Pre-treatment and	"~~The feed water pH must be adjusted to minimise scaling potential and~~ a drinking **water** approved anti-scalant must be dosed to the	Agreed and amended.

Section	Comments received	DWER consideration
Mechanical screening system	RO feed water to inhibit scaling". Condition is not outcome based – Adjustment of the pH is required because of the anti-scalant currently used. In the future we may use a different anti-scalant which does not require pH adjustment.	
Condition 3 Table 3: Ultrafiltration system	"Consisting of ultrafiltration membranes, hot water tank, re-circulation pump and chemical dosing system and ~~three~~ critical control points (CCPs)" The number of CCPs for each treatment process is determined by a number of factors including: industry best practice, risk management and current available technology. Advancements in technology can allow the number of CCPs at each location to be revised. It is preferable to have CCPs acknowledge in the treatment process, but omit the number required.	Agreed and amended.
	"Low-pressure membrane process must be capable of separating colloidal and suspended particles in the range of 0.05 – 0.10 microns." – Delete text. Condition not outcome based – We do not separate out colloidal particles into a range but filter with a UF system which has a nominal pore size. The UF membranes used on this plant have a nominal pore size of 0.03µm. Our objective is to maintain the operation of the UF system in accordance with the PCT for achieving the log removal credit and meeting CCP.	Agreed and amended.
	"Ultrafiltration membranes are to be chemically cleaned at least every two weeks using a hot water tank, recirculation pump and chemical dosing system" – Delete text. Condition is not outcome based – Cleaning frequency is determined based on residual fouling. Unnecessary clearing causes premature aging and should be avoided. The UF system is continuously monitored by the CCPs and the operating requirements of the UF system are outlined in the Process Control	Agreed and amended.

Section	Comments received	DWER consideration
	Table. Ensuring the UF System adheres to the Process Control Table (and therefore the CCPs) enables the maintenance and cleaning practices of the UF system to be determined based on operational performance. This is industry best practice for cleaning requirements for membranes and the frequency of cleaning should not be dictated by the Licence.	
Condition 3 Table 3 – Reverse Osmosis System	"The RO membranes must be chemically cleaned during operation at least every 8 weeks using a hot water tank, recirculation pump and chemical dosing system" – Delete text. Condition not outcome based – The RO is not operated to a set cleaning frequency, rather operational data is used to assess the condition of the asset. Unnecessary cleaning causes premature aging and should be avoided. The RO system is continuously monitored by the CCP's and the operating requirements of the RO system are outlined in the Process Control Table. Ensuring the RO system adheres to the Process Control Table (and therefore the CCPs) enables the maintenance and cleaning practices of the RO system to be determined based on operational performance. This is industry best practice for cleaning requirements for membranes and the frequency of cleaning should not be dictated by the licence.	Agreed and amended.
	"~~Two~~ CCP's must be utilised for monitoring performance of the RO system…" Removal of number of CCPs as per previous comments.	Agreed and amended.
Condition 3 Table 3: Ultra Violet disinfection system	"UV disinfection system must be capable of ~~removing~~ **inactivating** pathogens from the ~~feed~~ **process** water". Technical error – UV does not remove pathogens but inactivates them. The UV system does not treat the feedwater but is the final barrier step prior to process water reaching recycled water quality.	Agreed and amended.
	"~~Three~~ CCPs **must be utilised for** monitoring performance of the	Agreed and amended.

Section	Comments received	DWER consideration
	UV system and water must be diverted to waste if all operating criteria and CCPs are not met". Removal of number of CCPs as per previous comments.	
Condition 3 Table 3: Recycled water storage	"Capable of providing buffer storage for the ~~treated sewage~~ **recycled water** between the plant and recharge bores". Clarification – a change in terminology from treated sewage is requested for consistency throughout the document (e.g. with Column 1, and Table 2) and with operational terminology).	Agreed and amended.
Condition 3 Table 3: Three recharge bores into confined aquifers within the Leederville Formation LRB1, LRB2, LRB3	"LRB2 – DN ~~400~~**500** FRP casing. Screened at 134.**3**-**236** mbgl with DN ~~250~~ **400** stainless steel (0.5mm aperture) screen". Technical error – Incorrect details.	Noted and amended.
	"LRB3 - DN ~~400~~**500** FRP casing. Screened at 132.3**-**236 mbgl with DN ~~250~~**400** stainless steel (0.5mm aperture) screen" Technical error – Incorrect details.	Noted and amended.
Condition 3 Table 3: Three recharge bores into confined aquifers within the Leederville formation LRB1, LRB2, LRB3	BNYP 5//08 and BNYP 12/08 These bores should not be included as they are monitoring bores for the superficial aquifer. They are also not referenced in Column 1 or elsewhere in the licence.	Agreed and amended.
Condition 5 Table 4, Row 1	To allow flexibility in the operation of the AWRP, WC request that the recharge volume be regulated on a daily recharge rate. Specification of a daily average and maximum daily limit will enable the WC to achieve the recharge approximately 14GL/year whilst provided flexibility in how this is achieved. Modelling was undertaken to assess hydraulic heads required in the recharge bores and to assess the risk of damaging the overlying confining layer between the Superficial and Leederville	Noted. The Delegated Officer's assessment has been based on an annual throughput of 14 GL/year, consistent with the Part IV approval. The Delegated Officer considers that an annual limit of 14GL/year provides flexibility to WC to adjust their daily recharge rates as required. No changes have been made as a result.

<table>
<tr><th>Section</th><th>Comments received</th><th>DWER consideration</th></tr>
<tr><td></td><td>aquifers. Rates up to 30ML/d per Leederville recharge bore were modelled. To ensure protection of the confining layer, a maximum pressure of 190m head above ground (~200mAHD) is recommended. To ensure this pressure is not reached, the maximum recharge theoretically is 25ML/d per Leederville bore.

Additional modelling was undertaken to assess the risk of vertical leakage from the Leederville to the Superficial. This modelling assumed the entire production of Stage 1 (14GL/yr) was recharge to the top of the Leederville aquifer and assumed vertical flow only, no horizontal flow. This resulted in a 250yr travel time to the base of the Leederville aquifer.

The current recharge pump design allows for maximum aquifer recharge well below the 25ML/day:
• Leederville aquifer: ~15ML/d per bore
• Yarragadee aquifer: ~12ML/d per bore</td><td></td></tr>
<tr><td></td><td colspan="2"><table>
<tr><th colspan="2">Emission point reference</th><th>Parameter</th><th>Units</th><th>Frequency</th><th>Averaging period</th><th>Limit</th></tr>
<tr><td>1</td><td>Recycled water injected into LRB1, LRB2, LRB3, YRB1</td><td>Volume</td><td>ML</td><td>Continuous</td><td>Daily</td><td>48 ML/day (sum of all bores)</td></tr>
<tr><td>2</td><td>Recycled water injected into LRB1, LRB3, LRB3, YRB1</td><td>Volume</td><td>ML</td><td>Continuous</td><td>Cumulative Daily</td><td>25ML/day at each bore</td></tr>
</table></td><td></td></tr>
<tr><td>Condition 5

Table 4 Row 2 Column 1</td><td>“~~Treated Wastewater~~ Feed Water received into the AWRP (Feed Water SP251)”

To ensure condition is enforceable – change to ensure requirements for compliance are clear by ensuring wording is consistent with operational terminology and sample point numbering.</td><td>Agreed and amended.</td></tr>
</table>

Section	Comments received	DWER consideration
Condition 5 Table 4 Row 1 – Entire row	Change in reference point is requested to ensure condition is enforceable – change to ensure requirements for compliance are clear by ensuring wording is consistent with operational terminology and sample point numbering. Current terminology is causing internal confusion with waste discharge point. To ensure condition is outcome based – WC has established monitoring requirements based on regular monitoring of recycled water quality indicators that represent a range of recycled water quality parameters. **3. Appendix A: Additional information for monitoring the AWRP process** Operation of the AWRP within the operational requirements outlined in the Process Control Table also requires a suite of parameters, known as the Recycled Water Quality Parameters (RWQP) to be sampled at the compliance sampling point (SP259) to demonstrate that the recycled water produced by the AWRP is of a suitable water quality to achieve the guideline values as outlined in the MoU. Rather than measuring the full suite of RWQP, the concept of using Recycled Water Quality Indicators (RWQI) to measure the water quality at a higher frequency than the RWQP has been applied to the AWRP. RWQI are chemical or microbial parameters that can be used to measure the effectiveness of a process. These indicators are selected to represent characteristics of a family or group of hazards that are relevant to fate, transport and removal; they need to provide conservative assessments for removal. RWQI have the purpose of demonstrating safety of the recycled water with respect to specific chemical grouping and therefore removal of parameters they represent. They provide additional confidence that all chemical and microbiological hazards are being mitigated. To provide assurance of the relationship between the RWQI and RWQP, the RWQP are also monitored but at a lower frequency. The draft licence for the AWRP provides a mixture of RWQI and RWQP. Based on the discussion above, we request the sampling requirements for of the recycled water (at sample point SP259) is changed to reflect the relationship between the RWQI and the RWQP. The sampling frequency (and the MoU requirements) for SP259 are shown as follows:	DWER has made the following changes in response to WC comments following consultation with DWER internal experts: • Row 4, Column 1 has been renamed 'Recharge Pump Station (Recycled Water SP259); and • Dissolved oxygen has been removed and replaced with redox potential as this is considered more appropriate to assess environmental impacts within the aquifer, Lead, cadmium, copper, zinc, sulfate, uranium and electrical conductivity have not been removed as requested by WC. Whilst these parameters are not RWQI, these parameters are necessary as indicators of environmental impacts occurring from the addition of the recycled water into the aquifer. The frequency of monitoring of these parameters has been revised to annually. Additional parameters recommended by WC have not been included as they relate to public health risks and not for the specific environmental risks DWER is assessing and regulating.

Section	Comments received	DWER consideration

Parameter	DWER reasoning	WC Response
Nitrate as Nitrogen	Indicator of performance of the AWRP	Agree - no change requested.
TDS	Determined to a strong indicator of the presence of injected water and used to validate monitoring assumptions.	Agree – no change requested
Dissolved Oxygen	A parameter that is currently absent within both aquifers that will facilitate geochemical reactions.	**Disagree** - Dissolved oxygen is not included in the MoU requirements as a RWQP so should be removed.
Lead (soluble)	A metal present in the aquifer sediments that may become soluble and mobile.	**Disagree** - Lead is not a RWQI and should be removed from the table. Boron is used as the RWQI for metals, and as such should be used to indicate the efficacy of the process. If lead is to be included in Table 4 it is requested the frequency aligns with current RWQP monitoring frequency. For the metals sample group which this is annually.
Boron	Indicator of performance of the AWRP	Agree – no change requested
Cadmium	A metal present in the aquifer sediments that may become soluble and mobile.	**Disagree** - Cadmium is not a RWQI. Boron is used as the RWQI for metals, and has such should be used to indicate the efficacy of the process. If cadmium is to be included in Table 4 it is requested the frequency aligns with current RWQP monitoring frequency. For the metals sample group which this is annually.
Copper	A metal present in the aquifer sediments that may become soluble and mobile.	**Disagree** - Copper is not a RWQI. Boron is used as the RWQI for metals, and as such should be used to indicate the efficacy of the process. If copper is to be included in Table 4 it is requested the frequency aligns with current RWQP monitoring frequency. For the metals sample group this is annually.
Zinc	A metal present in the aquifer sediments that may become soluble and mobile.	**Disagree** - Zinc is not a RWQI. Boron is used as the RWQI for metals, and as such should be used to indicate the efficacy of the process. If zinc is to be included in Table 4 it is requested the frequency aligns with current RWQP monitoring frequency. For the metals sample group this is annually.

Section	Comments received	DWER consideration

Phosphate (filterable reactive)	An indicator of dissolution of crandallite and similar mineral sediments	**Disagree** - Phosphate is not included in the MoU requirements as a RWQP so should be removed.
Sulfate	Indicator of performance of the AWRP	**Disagree** - Sulfate is not an indicator of performance of the AWRP, and is a RWQP. The performance of the AWRP is reflected in the RWQI and as such this parameter should be removed as a requirement.
Uranium	Indicator of performance of the AWRP	**Disagree** - Uranium is not a RWQI and should be removed from the table. Boron is used as the RWQI for metals, and as such should be used.
pH	A parameter within both aquifers that will facilitate geochemical reactions.	Agree – No change requested.
Electrical Conductivity	Determined to be an efficient indicator of the presence of injected water within the Leederville aquifer.	**Disagree** - Electrical conductivity is not included in the MoU requirements as a RWQP so should be removed.
		Additional RWQI have been included in line with current RWQI that are monitored at SP259.

Water Corporations proposed monitoring of AWRP process to replace Table 4 Row 4. (changes in bold)

Emission Point Reference		Parameter	Units	Frequency	Avg Period	Limit	Method
4	**Recharge Pump Station (Recycled Water SP259)**	Boron	mg/L	Monthly	Spot samples	4	AS/NZS 5667.11
		Nitrate as N	mg/L	Monthly		11 (as N)	
		N-nitrosodimethlyamine)	**ng/L**	**Monthly**		**100**	
		Chlorate	**mg/L**	**Quarterly**		**0.7**	
		1,4-dioxane	**µg/L**	**Monthly**		**50**	
		Chloroform	**µg/L**	**Monthly**		**200**	
		1,4-dichlorobenzene	**µg/L**	**Monthly**		**40**	
		Fluorene	**µg/L**	**Biannually**		**140**	
		Carbamazepine	**µg/L**	**Monthly**		**100**	
		Estrone	**ng/L**	**Quarterly**		**200**	
		EDTA	**µg/L**	**Monthly**		**250**	
		Diclofenac	**µg/L**	**Monthly**		**1.8**	
		Trifluralin	**µg/L**	**Quarterly**		**90**	
		Octadioxin	**pg./L**	**Biannually**		**9000**	
		MS2 coliphage	**pfu/100mL**	**Monthly**		**<1**	
		Gross alpha activity	**mBq/L**	**Quarterly**		**500**	
		Gross beta activity (-K40)	**mBq/L**	**Quarterly**		**500**	
		pH	pH units	Continuous	n/a	6.0 – 8.5	

<table>
<tr><th>Section</th><th>Comments received</th><th>DWER consideration</th></tr>
<tr><td></td><td>Suggested changes to RWQP monitoring the removal of these parameters is not accepted.
<table>
<tr><th colspan="2">Emission Point Reference</th><th>Parameter</th><th>Units</th><th>Frequency</th><th>Avg Period</th><th>Limit</th><th>Method</th></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Recycled Water (SP259)</td><td>Lead (soluble)</td><td>mg/L</td><td>Annually</td><td rowspan="4">Spot Samples</td><td>0.01</td><td rowspan="4">AS/NZS 5667.11</td></tr>
<tr><td>Cadmium</td><td>mg/L</td><td>Annually</td><td>0.002</td></tr>
<tr><td>Copper</td><td>mg/L</td><td>Annually</td><td>2.0</td></tr>
<tr><td>Zinc</td><td>mg/L</td><td>Annually</td><td>3.0</td></tr>
</table></td><td></td></tr>
<tr><td>Condition 6
Table 5 Column 5</td><td>“Potentiometric potential must not exceed a maximum recharge head of <s>73m above ground level</s> 200mAHD”.

Condition is not risk based – Requested change to 180 m above ground level instead of 73 m above ground in the reinjection wells. The risk assessment in the decision document concluded that an increases in pressure of 180m above ground level (or 200m AHD) may impact the confining layer between the Leederville and Superficial aquifer. As such, this is the limit that should be set in order to protect the confining layer and not based on operational requirements. We also note that injection pumps are not capable of delivering a pressure capable of reaching 180m above ground level.

Change in units has been requested for consistency with column 3.</td><td>Additional information has been provided by WC suggesting a pressure limit of 135mAHD measured in the recharge wells for both the Yarragadee and Leederville aquifers to protect the aquifers/confined units and recharge well infrastructure. The 135mAHD is an average of maximum predicted head increases between 20-25ML/day assuming varying skin factors (reductions in bore/aquifer permeability.

DWER accepts the pressure limit of 135mAHD and has amended the Licence accordingly.</td></tr>
<tr><td>Condition 7
Table 6</td><td>The below requested changes are to ensure condition is outcome based.</td><td>DWER has accepted and made the following changes based on WC’s comments:
change to monitoring frequency for all parameters from monthly for the first 12 months, to quarterly for the second 12 month period and biannually after 24 months of recharge.
limits to TDS for the Leederville bores have been amended as requested.
frequency of monitoring for pH has been</td></tr>
</table>

Section	Comments received	DWER consideration
	4. Appendix B Additional information for monitoring groundwater 	Parameter	DWER reasoning	WC Response and proposed change
Nitrate as Nitrogen	Indicator of performance of the AWRP	Agreed
TDS	Determined to a strong indicator of the presence of injected water and used to validate monitoring assumptions.	Agreed
Dissolved Oxygen	A parameter that is currently absent within both aquifers that will facilitate geochemical reactions.	Agreed - no change requested.
Lead (soluble)	A metal present in the aquifer sediments that may become soluble and mobile.	Agreed – no change requested
Boron	Indicator of performance of the AWRP	Agree – no change requested
Cadmium	A metal present in the aquifer sediments that may become soluble and mobile.	Agreed – no change requested
Copper	A metal present in the aquifer sediments that may become soluble and mobile.	Agreed – no change requested
Zinc	A metal present in the aquifer sediments that may become soluble and mobile.	Agreed – no change requested
Phosphate (filterable reactive)	An indicator of dissolution of crandallite and similar mineral sediments	Agreed
Sulfate	Indicator of performance of the AWRP	Disagree –Sulfate is not a RWQI and therefore not an indicator of performance of the AWRP.
Uranium	Indicator of performance of the AWRP	Disagree – not a RWQI, an indicator of dissolution of crandallite and similar mineral sediments
pH	A parameter within both aquifers that will facilitate geochemical reactions.	Agreed		changed from continuous to monthly; and • a lower limit for pH of 6.0 has been included. DWER has not removed sulfate and uranium from the ambient monitoring suite as requested by WC. Based on internal expert advice, these parameters act as indicators of chemical reactions occurring within the aquifer and are appropriate to determine environmental impacts from the discharge of recycled water into the aquifer. In addition to the above changes, Dissolved Oxygen has been removed as a parameter and replaced with Redox potential. DWER internal experts consider that redox potential is more appropriate to assess the environmental impacts within the aquifer.

Section	Comments received	DWER consideration

Water Corporation proposed monitoring to replace Table 6: Ambient Groundwater Monitoring (changes in bold and justifications below)

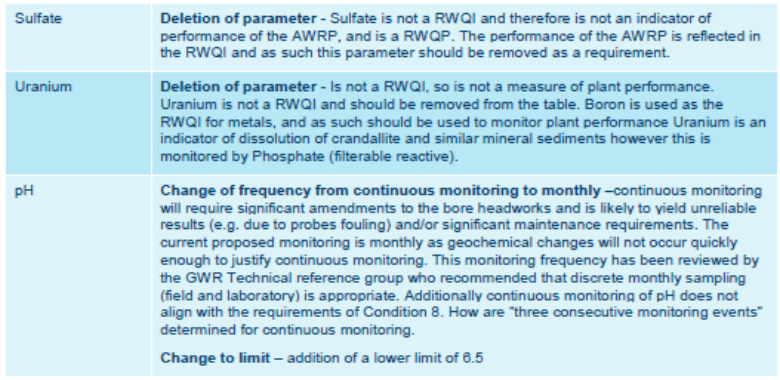
Emission Point Reference		Parameter	Units	Frequency	Avg Period	Limit	Method
1	LMB1, LMB2, LMB3, YMB1	Nitrate as Nitrogen	Mg/L	**Monthly[1], Quarterly[2], Biannual[3]**	Spot Samples	11	AS/NZS 5667.11
		TDS				**500 (YMB1) 1320 (LMB1, LMB2, LMB3)**	
		Dissolved Oxygen				n/a	
		Lead (soluble)				0.01	
		Boron				4.0	
		Cadmium				0.002	
		Copper				2.0	
		Zinc				3.0	
		Phosphate (filterable reactive)				**n/a**	
		pH				**6.0**-8.5	

1- Monitoring frequency for first 12 months of recharge

2- Monitoring frequency for second 12 month period of recharge

3- Monitoring frequency after 24 months of recharge

Parameter	Justification for changes
All parameters	**Change to frequency** - A reduction in monitoring frequency is requested to align with the already established monitoring program that has been agreed with other regulatory agencies. This program involves monthly monitoring for the first year, quarterly monitoring for the second year, before reducing to biannual monitoring each year after that. In the event that monitoring results would be reviewed by the GWR technical reference group which may suggest corrective actions such as increased frequency if the results indicate this is necessary.
TDS	**Change to Limit** - Background groundwater quality is greater than 500 mg/L in LMB2 and LMB3. This means we will be non-compliant with this limit prior to recharge occurring. The 500 mg/L value is based on DoH guidelines. DoH acknowledge TDS is naturally high in the Leederville aquifer, so have allowed a guideline of 1320mg/L based on 110% of baseline concentrations. As such we believe this value is more appropriate to monitor the aquifer.
Phosphate (filterable reactive)	**Change to limit** – WC questions the justification of the 0.32 mg/L limit and would prefer that this data does not have a limit but instead the results are reviewed by the GWR Technical Reference group.

Section	Comments received	DWER consideration
	 Sulfate: **Deletion of parameter** - Sulfate is not a RWQI and therefore is not an indicator of performance of the AWRP, and is a RWQP. The performance of the AWRP is reflected in the RWQI and as such this parameter should be removed as a requirement. Uranium: **Deletion of parameter** - Is not a RWQI, so is not a measure of plant performance. Uranium is not a RWQI and should be removed from the table. Boron is used as the RWQI for metals, and as such should be used to monitor plant performance Uranium is an indicator of dissolution of crandallite and similar mineral sediments however this is monitored by Phosphate (filterable reactive). pH: **Change of frequency from continuous monitoring to monthly** –continuous monitoring will require significant amendments to the bore headworks and is likely to yield unreliable results (e.g. due to probes fouling) and/or significant maintenance requirements. The current proposed monitoring is monthly as geochemical changes will not occur quickly enough to justify continuous monitoring. This monitoring frequency has been reviewed by the GWR Technical reference group who recommended that discrete monthly sampling (field and laboratory) is appropriate. Additionally continuous monitoring of pH does not align with the requirements of Condition 8. How are "three consecutive monitoring events" determined for continuous monitoring. **Change to limit** – addition of a lower limit of 6.5	
Condition 8	"The Licence Holder must ensure that if monitoring undertaken in accordance with Condition ~~6~~**7**, Table 6 indicates an exceedance of the ~~Limit or~~ Action Criteria in any ambient groundwater monitoring bore for three consecutive monitoring events" Administrative error – Table 6 forms a part of Condition 7 and does not specify "Limits".	Agreed and amended.
	"The CEO is notified in writing within 10 working days **of becoming aware** of the third consecutive exceedance and any actions taken to correct the exceedance specified". To ensure condition is enforceable – Laboratory results may not be available within 10 working days of the exceedance.	Agreed and amended.
Condition 9	"The Licence Holder must develop then implement a groundwater monitoring program that validates modelling assumptions over the ultimate extent of the injected water within six months of the Licence being granted". WC wishes to confirm that this condition requires: • Development of a monitoring program within 6 months of the licence being granted	Noted, the intent of this condition is for the monitoring program to be developed and implemented. It does not require the groundwater program to be completed/ validated in this time. The wording in this condition has been revised to clarify this.

Section	Comments received	DWER consideration
	And • Implementation of the monitoring program must commence within 6 months of licence being granted. WC do not believe that 6 months would provide sufficient data to complete model validation.	
	"(a) representative sampling of the Yarragadee, Leederville and Superficial aquifers, to the satisfaction of ~~a Contaminated Sites auditor, accredited by DWER under the Contaminated Sites Act 2003~~ the **Groundwater Replenishment Technical Reference Group**". WC welcomes DWER's commitment to participate in the interagency working group. In line with this commitment, WC's preference would be for validation of the groundwater fate and transport model to be done to the satisfaction of the Technical Reference group that has been established to inform the IAWG regarding hydrogeological/groundwater matters. This group consists of hydrogeological experts from DoW, CSIRO and Curtin University and Rockwater. If this amendment is not accepted, WC wishes to confirm the following in regard to the intent of the condition 9(a): • The role of the contaminated sites auditor is to validate that the proposed sampling program would obtain representative samples of the aquifers. • The role of the contaminated sites auditor is NOT to endorse the overall program, final monitoring data, or report.	Agreed and amended.
Comments on Decision Report		
Use of 'treated sewage' terminology throughout document.	Whilst classifying potable recycled water product as 'treated sewage' is consistent with the IAWG Regulatory Framework, WC believe this is not the optimal outcome for the future of these schemes and have serious concerns in regards to the implications	Agreed, the terminology has been amended to reflect 'recycled water' throughout the decision report and licence and a definition for recycled water included.

Section	Comments received	DWER consideration
	in relation to the future direction for these schemes. WC believe this is a gap in the current policy and regulatory framework. WC welcomes the opportunity to continue discussions with your department about the future classification and regulation of these schemes through the IAWG to develop policy that is consistent with the risk and beneficial outcomes for the state. In the interim, WC request that the Decision Report is amended to refer to the product as "recycled water" and define recycled water as: • "secondary treated sewage from the Beenyup WWTP that has undergone further treatment through the AWRP to achieve drinking water standards".	
Section 6.2, Page 12	WC have provided comments and suggested amendments to the parameter selection as detailed above (refer to Condition 7, Table 6 comments).	Noted, as above.
Section 6.2, Page 13	"Comparing GWR guideline values to those of background water sampling summary results, some background concentrations in the aquifers are already above guideline limits prior to recharge occurring" WC agrees with this finding but notes that, despite this, DWER have set action criteria for ambient groundwater monitoring using guideline values that natural background levels already exceed. This places Water Corporation in a position that is unable to comply with the criteria regardless of whether recharge is occurring.	Noted, action criteria have been revised in accordance with the action criteria levels provided in Appendix B of WC's response.
Section 6.4, Key Finding 5 (page 16)	"There is ambiguity of the RMZ water quality criteria and it is unclear how compliance at the RMZ will be demonstrated". The water quality criteria used are those in the DoH MoU. Comparison against these criteria will occur on samples taken at the monitoring bores located ~50m from the recharge bores.	Noted, the wording of this key finding has been revised.

Section	Comments received	DWER consideration
	Research with the GWR Technical Reference Group will collect additional samples at the boundary of the LRB1 RMZ (GWRT 240N bores) to validate the Reactive Transport Model and confirm if a RMZ of 250m is appropriate for the GWR.	
Section 9.1, Page 23	"In undertaking its risk assessment, DWER will identify potential emissions pathways and potential receptors to establish whether there is a Risk Event which requires detailed risk assessment. To establish a Risk Event, there must be an emission…" WC does not agree with the classification of recycled water product as an emission but does agree that the aquifer injection can be regulated as a discharge to the environment. This is consistent with the position outlined in DWER's letter dated 14 September and the GWR Regulatory framework which states: • That "recharge of recycled water meeting the Drinking Water specification to groundwater does not meet the definition of an emission under the EP Act". WC note that if recycled water does not constitute an emission, applying this text from the decision document and DWER's *GS: Risk Assessment (2017)*, the injection of recycled water product would not constitute a risk event as it is not an emission and therefore would be screened out. WC note that DWER do have powers to regulate discharges (including the injection of recharge water) and that this is a gap in policy. WC request the wording is changed to clarify that the injection of recycled water is not being treated as a risk event because it is an emission or waste but is being assessed as a discharge.	Agreed and amended. As already noted by WC, it is considered appropriate for the risks associated with the discharge of recycled water to also be considered as part of this assessment. The wording in this section has been revised to acknowledge this.
Section 9.1, Table 12, Row 4 and Row 5 Section 9.5	For the reasons stated earlier, WC request that: • Wording is changed to clarify that the injection of recharge water is not being classified as a risk event due to it being	Agreed, as above.

Section	Comments received	DWER consideration
Section 9.6 Section 9.8, Table 20 (page 38) Row 2 and Row 3	an emission or waste but is assessed as a discharge. • A change in terminology from treated sewage to recycled water.	
Section 9.5.2 (page 30)	WC requests the text to be altered as follows: "**Recycled Water** from the Beenyup WWTP is further processed through the AWRP to meet **the Recycled Water Quality Indicators (RWQI) and** Recycled Water Quality Parameters (RWQP) set by the Department of Health".	Partially agreed. Consistent with the proposed definition for Recycled Water, the feed water entering the AWRP has been referred to as secondary treated wastewater.
Section 9.5.4 (page 31)	The selected indicators are a mixture of RWQI and RWQP. For consistency with other regulatory monitoring, WC request the parameters are altered as outlined previous (comments for Licence conditions 5 and 7).	Noted, as above.
Section 9.5.6 (page 31)	WC's current assumption is that if the concentrations at monitoring bores are met, they will be met at the boundary. During Stage 1, additional research monitoring and modelling to validate this assumption and confirm the 250m RMZ and close monitoring bores are appropriate.	Noted.
Section 9.5.6 Key finding 2 (page 32)	"The Applicant has not identified groundwater concentrations from the monitoring bores which initiate a "corrective measure" response to meet the objectives at the RMZ". Exceedance of a parameter in the MoU will trigger a corrective measure (e.g. further research, additional monitoring, or amendment of the recycled water). Data will also be reviewed by the GWR Technical Reference Group and Risk Assessment Process may initiate a "corrective measure". Corrective measures to be implemented will depend on the scenario but may include research, additional monitoring, or amendment of the recharge water.	Noted. The key finding has been revised.
Section 9.6.3 (page 33)	"Physio chemical changes in the superficial aquifer may impact	Noted, this reference has been removed.

Section	Comments received	DWER consideration
	upon its current and future beneficial uses (as described in section 6.2)". Should this read "*as described in Section 9.6.2"*? Section 6.2 only mentions baseline monitoring in the Leederville and Yarragadee aquifers, not the superficial.	
Section 10.1.2 (Table	Table with reasons for parameter selection – refer to earlier comments.	Noted, as above.

Attachment 1: Issued Licence L9034/2017/1

Attachment 2: GWR Regulatory Framework

Groundwater Replenishment Regulatory Framework

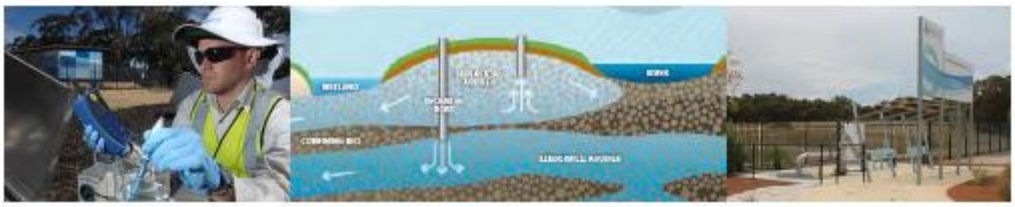
December 2012

Prepared by the Groundwater Replenishment Trial Interagency Working Group:

Government of Western Australia Department of Health | Department of Environment and Conservation | Government of Western Australia Department of Water

and

WATER CORPORATION



Revision History

Version	Prepared By	Date Issued	Issued to	Comments Received
Final Draft v1	Adrian Parker, Ruth Dowd, Richard Theobald, Clemencia Rodriguez, Nick Turner, Vanessa Moscovis and Tran Huynh	05/12/12	GWRT IAWG	Comments received from Alan Sands, Director Environmental Regulation.
Final Draft v1A	Tran Huynh	10/12/12	GWRT IAWG and Signatories for endorsement.	

Status

The Groundwater Replenishment Framework is "Draft" untill all signatories have signed it off for final release.

A "Draft" document should not be used for any purpose other than to be reviewed with the intention of generating a "Final" version

Table of Contents

Revision History i
Table of Contents ii
Endorsement iii
Definitions v
1 Introduction 1
2 Background 1
3 Scope of the Document 2
4 Purpose of the Regulatory Framework 2
5 Roles and responsibilities 4
5.1 Department of Health 4
5.2 Department of Environment and Conservation 4
5.3 Department of Water 4
5.4 Water Corporation 4
6 Definition of Recycled Water and Waste 5
7 Purpose of the Recharge Management Zone 6
8 Groundwater Replenishment Regulatory Framework 7
8.1 Initial Assessment of a Groundwater Replenishment Scheme 7
8.1.1 Step One: Aquifer Characterisation 8
8.1.2 Step Two: Environmental Values, Management Objectives and Water Quality Guidelines 8
8.1.3 Step Three: Risk Assessment 10
8.1.4 Step Four: Agency Evaluation 11
8.2 Approvals Process 11
8.2.1 Environment Protection Authority 11
8.2.2 Department of Environment and Conservation 11
8.2.3 Department of Health 12
8.2.4 Department of Water 13
8.3 Regulating an Operational Scheme 16
8.3.1 Department of Health 16
8.3.2 Department of Environment and Conservation 16
8.3.3 Department of Water 16
9 Conclusion 17
References 18

Figure 4-1: Groundwater Replenishment Framework 3

Endorsement

This document was developed by the Groundwater Replenishment Trial Interagency Working Group which consisted of:

1. **Department of Health** of 189 Royal Street, East Perth, Western Australia
2. **Department of Environment and Conservation**, of 168 St Georges Terrace, Perth, Western Australia
3. **Department of Water**, of 168 St Georges Terrace, Perth, Western Australia
4. **Water Corporation**, a statutory body corporate established under the Water Corporation Act 1995, of 629 Newcastle Street, Leederville, Western Australia

In endorsing this document, the Department of Health (DoH), Department of Environment and Conservation (DEC), Department of Water (DoW) and the Water Corporation agree to comply with the Groundwater Replenishment Regulatory Framework.

This document will be reviewed by the DoH, DEC, DoW and Water Corporation, five (5) yearly from the commencement date.

Signed for
Department of Health

19th December, 2012

Dr Tarun Weeramanthri
Executive Director
Public Health and Clinical Services Division

Date

Signed for
Department of Environment and Conservation

13 December 2012

Mr Keiran McNamara
Director General

Date

Signed for
Department of Water

17 December 2012

Ms Maree De Lacey
Director General

Date

Signed for
Water Corporation

17 December 2012

Ms Sue Murphy
Chief Executive Officer

Date

Definitions

Advance Water Recycling Plant (AWRP) is a multi-step treatment process which produces recycled water for the purpose of Groundwater Replenishment.

ANZECC Guidelines means the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000a).

Australian Guidelines for Water Recycling (AGWR) Guidelines means the Australian Guidelines for Water Recycling: Managing Health and Environmental Risk (Phase 1) (2006), the Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) Augmentation of Drinking Water Supplies (2008) and the Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) Managed Aquifer Recharge (2009) published by the National Health and Medical Research Council.

Commencement Date means the date on which the last party signs the GWR Regulatory Framework.

Drinking Water means water intended primarily for human consumption, which also has other domestic uses.

Environmental Values is the term applied to particular values or uses of the environment that are important for a healthy ecosystem or for public benefit, welfare, safety or health.

Groundwater Replenishment process by which secondary treated wastewater undergoes advanced treatment to produce water which meets Australian guidelines for Drinking Water prior to being recharged to an aquifer for later use as a Drinking Water source.

Groundwater Replenishment Regulatory Framework defines the approvals pathway required to develop, approve and provide ongoing regulation for a Groundwater Replenishment Scheme.

GWR MoU means the Groundwater Replenishment Memorandum of Understanding between the DoH and the Water Corporation.

GWRT MoU means the Groundwater Replenishment Trial Memorandum of Understanding between the Department of Health and the Water Corporation. *The GWRT MoU will be superseded by the GWR MoU.*

Interagency Working Group (IAWG) comprising of Departments of Health, Environment and Conservation and Water and the Water Corporation to oversee the Groundwater Replenishment Trial.

Point of recharge is where recycled water has met all the critical control points i.e., a step or procedure at which controls can be applied and a hazard can be prevented, eliminated or reduced to acceptable (critical) levels and is ready to be recharged to the aquifer.

Public Drinking Water Source Areas (PDWSA's) are underground pollution control areas, water reserves and catchment areas that have been identified as current or future sources of Drinking Water.

Recharge Management Zone (RMZ) defines the minimum distance between recharge of recycled water and abstraction of groundwater for public Drinking Water supplies.

Recycled Water in the case of GWR is produced by further treatment of secondary treated wastewater by the Advanced Water Recycling Plant (AWRP) to meet Drinking Water quality standards before being recharged into an aquifer.

Wastewater Catchment means the wastewater collection system that delivers inflows to wastewater treatment plants.

1 Introduction

Groundwater replenishment (GWR) is the process by which secondary treated wastewater undergoes advanced treatment to produce recycled water which meets Australian guidelines for Drinking Water prior to being recharged to an aquifer for later use as a Drinking Water source.

The Water Corporation intends on implementing Groundwater Replenishment to provide a public Drinking Water source for Perth, Western Australia.

The Water Corporation has been working with the Department of Health (DoH), Department of Environment and Conservation (DEC), Department of Water (DoW) to assess the viability of Groundwater Replenishment.

2 Background

Groundwater Replenishment was initially considered as a viable recycled water option for Western Australia in 2005. Successful GWR Schemes for Drinking Water sources (indirect potable reuse) occurred internationally, however, there was a lack of National and State guidance for the planning, design, commissioning, operation, use and regulation of these schemes.

Under Section 16(e) of the *Environmental Protection Act (1986)*, the Environmental Protection Authority (EPA) advises the Minister for the Environment on strategic environmental matters. Advice provided under Section 16(e) also guides the proponent on the type and extent of further work that will be required for environmental approval.

In 2005 the EPA assessed the potential for Groundwater Replenishment to be conducted in the Perth metropolitan area. The EPA supported further investigation of the approach on a staged basis "*starting with trials and projects of low risk*" (EPA, 2005).

Based on this advice, the Water Corporation developed the Groundwater Replenishment Trial. The DoH, DEC, DoW and the Water Corporation entered into a Groundwater Replenishment Trial Interagency Agreement in March 2007 (IAWG, 2007) and formed the Interagency Working Group (IAWG). The Objectives of this Agreement were to allow:

1. The Water Corporation to conduct the Groundwater Replenishment Trial to assess technical feasibility and gauge community support for Groundwater Replenishment; and
2. The DoH, DEC and DoW to review information from the Water Corporation's Groundwater Replenishment Trial in order to:
   a) Develop a GWR Regulatory Framework.
   b) Inform government policy relating to Groundwater Replenishment, specifically by addressing issues identified by the IAWG in April 2008 (IAWG, 2008).
   c) Assess Groundwater Replenishment as a Drinking Water source for Perth, Western Australia.

By December 2012 the IAWG will have successfully achieved objectives 2a and 2b through the delivery of the GWR Regulatory Framework document and addressed the gaps in Policy and Regulation, which will have informed the GWR Regulatory Framework.

Assessment of Groundwater Replenishment as a Drinking Water source for Perth (Objectives 1 and 2c) will be complete in early 2013.

3 Scope of the Document

This document outlines the GWR Regulatory Framework.

It is important to note that Groundwater Replenishment will be used as a Drinking Water source. Therefore this document only addresses the indirect potable reuse of water and does not address any other use for recycled water.

This document is not intended and does not affect any of the statutory responsibilities of the DoH, DEC, DoW or the Water Corporation.

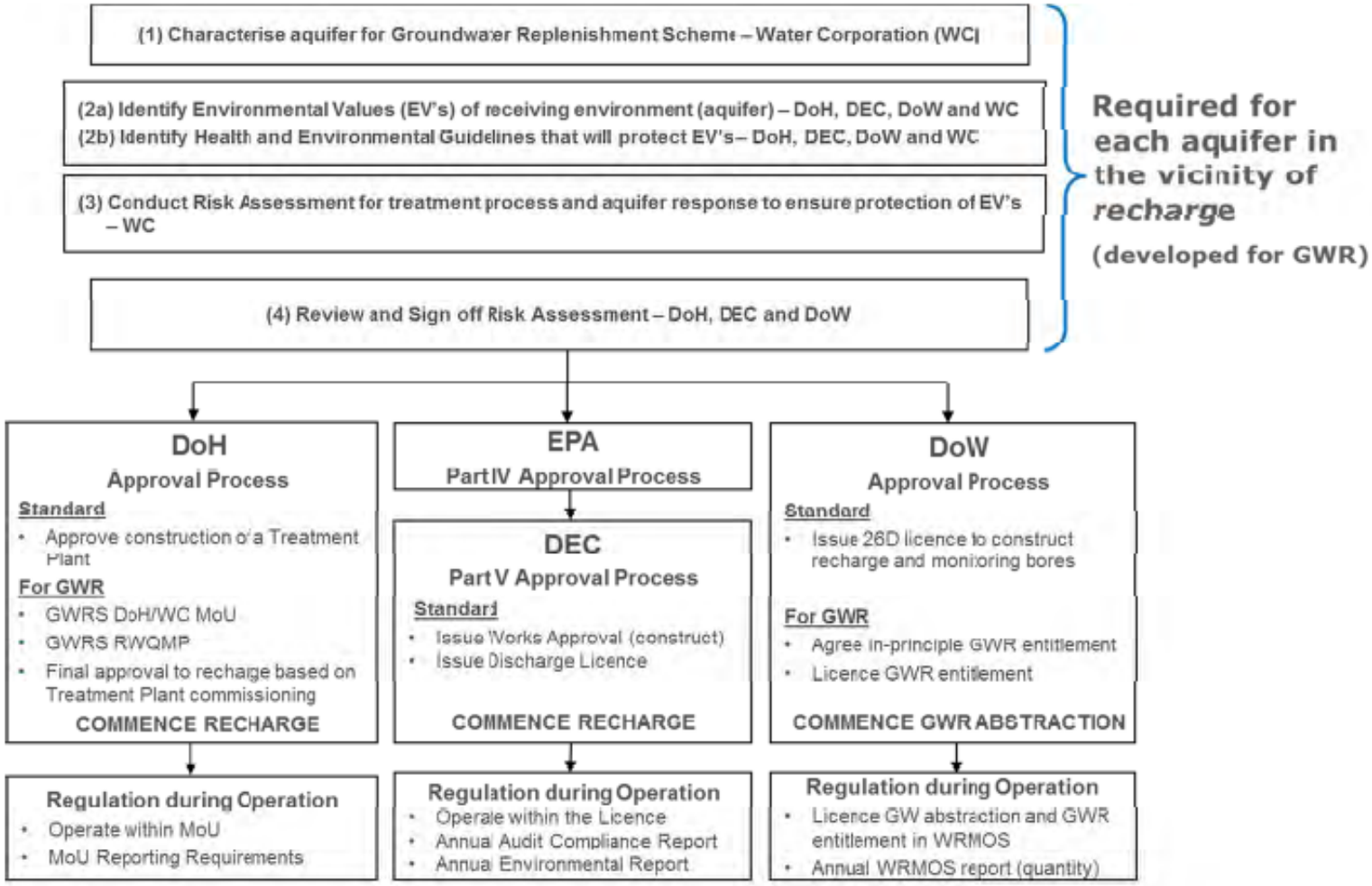
4 Purpose of the Regulatory Framework

The GWR Regulatory Framework defines the approvals pathway required to develop, approve commencement of recharge and provide ongoing regulation for a Groundwater Replenishment Scheme.

The GWR Regulatory Framework was developed utilising existing legislation, AGWR Guidelines and ANZECC Guidelines and a directive from the Western Australian Environmental Protection Authority (EPA) to implement a risk-based approach.

Figure 4-1 illustrates the GWR Regulatory Framework.

Figure 4-1: Groundwater Replenishment Framework



5 Roles and responsibilities

The government agencies that have a role in providing initial assessment, approval and ongoing regulation of a GWR Scheme are as follows:

5.1 Department of Health

The DoH is responsible for administering the legislation concerning health regulation in Western Australia under the *Health Act 1911*.

The DoH's role is to:

i. Minimise human exposure to environmental health hazards that pose or have the potential to pose a health risk.
ii. Reduce the incidence and impact of communicable disease.
iii. Guide, assess and approve all water recycling schemes to safeguard public health.

5.2 Department of Environment and Conservation

DEC is responsible for administering the legislation concerning environmental regulation in Western Australia under the *Environmental Protection Act 1986* (the EP Act). Under Part V of the EP Act, DEC regulates emissions and discharges from prescribed premises.

DEC will consider Groundwater Replenishment under Part V of the *EP Act.*

5.3 Department of Water

The DoW manages water quality issues by using powers provided through the *Metropolitan Water Supply, Sewerage and Drainage Act 1909 (WA)* and the *Country Areas Water Supply Act 1947 (WA)* and associated By-laws under these Acts.

The DoW also manages abstraction of groundwater under the *Rights in Water and Irrigation Act (RIWI Act) 1914.*

5.4 Water Corporation

The Water Corporation provides water services across Western Australia, under the *Water Corporation Act 1995* and administers the *Water Agencies (Powers) Act 1984.*

The Water Corporation will seek approval for construction and operation of future Groundwater Replenishment Schemes in accordance with this Groundwater Replenishment Regulatory Framework.

6 Definition of Recycled Water and Waste

Recycled water is usually treated wastewater which is further treated to varying qualities that is "fit for purpose" for its intended use. In the case of GWR, recycled water is produced by further treatment of secondary treated wastewater by an Advanced Water Recycling Plant (AWRP) to meet Drinking Water quality standards before being recharged into an aquifer.

Current legislation does not adequately define recycled water for the purposes of Groundwater Replenishment. The DoH, DEC, and DoW were required to consider the definition of recycled water produced by an AWRP for the purposes of Groundwater Replenishment as part of the Trial. The definitions are as follows:

Department of Health
The DoH considers *recycled water as "sewage" until it is appropriately treated to a level considered to be Drinking Water quality or above. The water passing through the AWRP is sewage up until the point of recharge.*

Department of Environment and Conservation
For the purposes of DEC's regulation of the AWRP and Groundwater Replenishment as a prescribed premises category 54, recycled water from the AWRP will always be considered to be treated sewage irrespective of the recycled water quality achieved.

The Trial has demonstrated that DEC is able to effectively manage the recharge of treated sewage from the Beenyup AWRP into the Leederville aquifer, by regulating the AWRP and confirming the specification of recycled water quality prior to it entering the recharge bore, so as to achieve the objectives and purposes of the EP Act.

In relation to the above circumstances, DEC has considered the extent to which 'matter', as referred to in the definition of 'waste' under section 3(1) of the EP Act - being in this case treated sewage (recycled water) arising from the Beenyup AWRP - ought to be regulated under the EP Act. DEC has concluded that recycled water meeting the Drinking Water specification ceases to be 'waste'.

An 'emission' under section 3(1) of the EP Act is defined to include a discharge of waste. Under section 56(1) of the EP Act, an occupier of prescribed premises who, among other things, causes an emission from the premises commits an offence unless having done so in accordance with a licence issued in relation to the premises. In view of DEC's conclusion above, the recharge of recycled water meeting the Drinking Water specification to groundwater does not meet the definition of an emission under the EP Act.

Department of Water
The DoW has taken advice from the DoH and consider *recycled water as "sewage" until it is appropriately treated to a level considered to be Drinking Water quality or above. The water passing through the AWRP is*

sewage up until the point of recharge. DoW will adopt this definition in the administration of their relevant acts, regulation and by-laws.

7 Purpose of the Recharge Management Zone

A Recharge Management Zone (RMZ) defines the minimum distance between recharge of recycled water and abstraction of groundwater for public Drinking Water supplies. It also defines the boundary at which groundwater must meet the water quality guidelines required to protect the identified environmental values. Environmental values are always preserved and the recharged water becomes part of the environment beyond the RMZ boundary.

The IAWG have agreed that a RMZ is a requirement of any GWR Scheme. They have defined that:

- A RMZ should be applied to all Groundwater Replenishment Schemes recharging into the confined aquifers in Perth.
- The RMZ boundary is a radial distance of 250m from the recharge bore for all confined aquifers at the Beenyup site, subject to final assessment of the Yarragadee aquifer.
- The principles for a groundwater monitoring plan within the RMZ. A groundwater monitoring plan should demonstrate protection of the environmental values of the receiving groundwater environment and be derived from the groundwater risk assessment (section 8.1.3).

In addition to defining the RMZ, the DoH, DEC, and DoW were required to consider their Agency's ongoing role in regulating the RMZ as an output of the Trial. This is summarised as follows:

Department of Health
DoH will regulate the RMZ within the GWR MoU. The DoH requires that the groundwater quality meets the Recycled Water Quality Parameters and Recycled Water Quality Indicators as defined in the GWR MoU at the RMZ boundary.

Department of Environment and Conservation
DEC has an interest in the RMZ in so far as it is the receiving environment for the discharge of treated sewage (recycled water) from the prescribed premises (AWRP).

DEC may require the on-going monitoring of groundwater quality within the RMZ, as part of licencing conditions. This is to ensure that the regulatory controls applied to the prescribed premises are effectively preventing pollution and environmental harm occurring as a result of the discharge of treated sewage (recycled water) and that the environmental values of the groundwater are being protected.

Department of Water
DoW have advised that the appropriate mechanism to manage groundwater quality is through the GWR MoU which is administered by the DoH.

The DoW's Operational Policy 1.01 – Managed aquifer recharge in Western Australia (DoW, 2011) makes reference to the establishment of "managed aquifer recharge management zones" (MAR management zones) to facilitate the management of groundwater quality and quantity in the vicinity of MAR schemes. These zones are used as an internal management tool by the DoW to ensure the location of MAR schemes is considered in the processing of other groundwater abstraction licence applications in the area.

The RMZ meets the DoW requirement for this internal management tool and will be mapped on the DoW's geographical information system (GIS) for internal use.

8 Groundwater Replenishment Regulatory Framework

The purpose of the GWR Regulatory framework is defined in section 3.

8.1 Initial Assessment of a Groundwater Replenishment Scheme

The first four steps of the GWR Regulatory Framework involve collaboration between the DoH, DEC, DoW and Water Corporation to conduct an initial assessment of the GWR scheme prior to entering into each Agency's formal approval process.

This approach was developed for Groundwater Replenishment utilising a risk management approach recommended by the AGWR Guidelines ((NRMMC-EPHC-AHMC, 2006) (NRMMC-EPHC-NHRMC, 2008) (NRMMC-EPHC- NHRMC, 2009) and the ANZECC Guidelines (ANZECC and ARMCANZ, 2000a). This approach recognises and protects water quality to maintain or enhance an environment which will support an ecosystem or use for public benefit, welfare, safety or health.

The benefits of applying this approach are:

- To gain agreement between the three regulating agencies and the Water Corporation of the values of the receiving groundwater environment.
- To gain agreement between the three regulating agencies and the Water Corporation of the water quality guidelines that will protect the values of the receiving groundwater environment early in the development of the GWR scheme.

- Support the EPA's environmental impact assessment of the proposed GWR Scheme under Part IV for the EP Act 1986[1].

Prior to commencing the Initial Assessment of a Groundwater Replenishment Scheme, the Water Corporation must undertake Planning of a GWR scheme. Planning must consider the scale and location of the scheme and suitability of source water quality and the receiving groundwater environment.

This information can then be used to undertake the initial assessment.

8.1.1 Step One: Aquifer Characterisation

This step requires the Water Corporation to characterise the receiving groundwater environment such that appropriate environmental values can be defined.

Information used to characterise the aquifer can be derived from, but is not limited to, existing knowledge of groundwater systems and models that can predict pressure, fate and solute transport. Site investigations may also be carried out to inform this step. The extent of the investigations will depend on the amount of background knowledge that is available to the receiving groundwater environment at the vicinity of recharge.

The Water Corporation will obtain all approvals necessary to undertake site investigations.

Previous experience with the Groundwater Replenishment Trial, subsequent schemes and Table 4.2 in chapter 4 of the Australian Guidelines for Water Recycling: Managed Aquifer Recharge (Phase 2) (NRMMC-EPHC- NHRMC, 2009) will define the key issues to consider at this stage of project development.

8.1.2 Step Two: Environmental Values, Management Objectives and Water Quality Guidelines

This step involves:

1. Defining the Environmental Values (EV) for the receiving groundwater environment in the vicinity of recharge.
2. Establishing a set of broad management objectives for the relevant environmental values.
3. Determining appropriate water quality guidelines or criteria.

[1] The Water Corporation will refer all GWR Schemes to the EPA for assessment under Part IV of the EP Act.

Environmental Values
'Environmental values' is the term applied to particular values or uses of the environment that are important for a healthy ecosystem or for public benefit, welfare, safety or health. The ANZECC Guidelines recognise six environmental values:

- Aquatic ecosystems
- Primary industries (irrigation and general water uses, stock Drinking Water, aquaculture and human consumers of aquatic foods)
- Recreation and aesthetics
- Drinking water resource
- Industrial water
- Cultural and spiritual value

The DoH, DEC, DoW and Water Corporation will convene to identify the EVs relevant to the receiving groundwater environment.

Management Objectives
The environmental management objectives reflect the desired state for EV's identified as relevant to the receiving groundwater environment, such as "maintain for current and future use".

The DoH, DEC, DoW and Water Corporation will convene to identify the management objectives for the relevant EV's.

Water Quality Guidelines
Associated with each environmental value are 'guidelines' or 'trigger values' for substances that might potentially impair water quality (e.g. pesticides, metals or nutrients). If these values are exceeded, they may be used to trigger an investigation or initiate a management response. Where two or more agreed environmental values apply to a water body, the more conservative, or stringent, of the associated guidelines should be selected as the water quality guideline.

Determining the EV's and associated water quality guidelines provides a clear pathway for assigning Agency responsibilities where multiple agencies can regulate a GWR Scheme. Water quality guidelines appropriate for the protection of EVs are described in Table 9.1.

Table 8-1: Water quality guidelines appropriate for the protection of EVs

Environmental Value	Water Quality Guideline that will protect the Environmental Value
Aquatic Ecosystems	DEC to establish water quality criteria[2] which will be applied with assistance from DoW and DoH.
Primary Industries	Given the unrestricted access to potable (drinking) water for the purpose of primary industry, the Drinking Water Resource EV water quality guidelines will be applied.
Recreation and Aesthetics	DoH and DEC to establish water quality criteria[2] with assistance from DoW.
Drinking Water Resource	*Recycled Water Quality Parameters* and *Recycled Water Quality Indicators* identified by the DoH and defined in the GWR MoU.
Industrial Water	Given the unrestricted access to potable (drinking) water for the use in industrial processes, the Drinking Water Resource EV water quality guidelines will be applied.
Cultural and spiritual values	No water quality guidelines are provided for this environmental value. Water Corporation to continue to engage with Indigenous stakeholders.

Representatives from the DoH, DEC, DoW and Water Corporation will convene to identify the water quality guidelines required to protect the relevant EV's.

8.1.3 Step Three: Risk Assessment

The Water Corporation will undertake a risk assessment from the wastewater catchment to the boundary of the Recharge Management Zone by applying the process described in the AGWR Guidelines to evaluate whether the GWR Scheme is able to protect the EVs. The risk assessment will consider whether the:

1. Management approaches in wastewater catchments are adequate to mitigate risks to feed quality for the treatment process.
2. Recycled water produced by the treatment process meets the required water quality guidelines at the point of recharge.
3. Potential aquifer risks to ensure that water quality continues to meet the water quality guidelines at the boundary of the Recharge Management Zone.

[2] Water quality guidelines may be derived from existing guidelines where appropriate.

8.1.4 Step Four: Agency Evaluation

The Water Corporation will present the GWR Scheme risk assessment to the Agencies, including risk mitigation strategies.

The DoH, DEC and DoW will evaluate and provide written advice regarding the acceptability of the risk assessment process and resultants risks.

8.2 Approvals Process

8.2.1 Environment Protection Authority

The Environment Protection Authority (EPA) undertakes the environmental impact assessment (EIA) of proposals and schemes referred to it under Part IV of the Environmental Protection Act 1986 (EP Act). EIA is a systematic and orderly evaluation of a proposal and its impact on the environment. This evaluation includes considering ways in which the proposal, if implemented, could avoid or reduce any impact on the environment.

Further details on submitting a proposal can be found on the EPA website.

The Water Corporation will refer a proposal under Part IV of the EP Act for a GWR scheme to the EPA.

The EPA will make its decision on whether or not to assess a GWR Scheme based on the potential impact(s) to the environment. It will advise the Water Corporation and relevant Decision Making Authority (DMA) of its decision on whether or not to assess the GWR Scheme, once all requests for information have been met to the EPA's satisfaction.

If the EPA determines a formal level of assessment, the GWR Scheme project proposal will then be assessed by the EPA under Part IV of the EP Act and managed according to the Ministerial Conditions applied to it. Further approvals will also be required under Part V of the EP Act. If the EPA finds the proposal does not require assessment, the Part V approvals will still be required. Approvals under Part V are administered by the Department of Environment and Conservation.

8.2.2 Department of Environment and Conservation

8.2.2.1 Works Approval

To meet the requirements of Part V of the EP Act, Water Corporation is required to undertake any work or construction in relation to an AWRP and GWR scheme (that will cause the premises to become or capable of being a prescribed premises) in accordance with a works approval issued by DEC.

Water Corporation will be required to make an application for a works approval to DEC and provide supporting information to allow DEC to determine whether all necessary measures to protect the environment will be taken to ensure emissions and discharges from the prescribed premises do not present an unacceptable risk.

A key area of interest for DEC will be the treatment processes and process controls including measurement, critical control and feedback systems that will be used to manage the performance of the AWRP and GWR process, to the extent that they impact on recycled water quality and emissions and discharges from the Premises.

DEC assesses works approval applications in accordance with all relevant principles and objectives of the EP Act and will, where a decision is made to issue a works approval, impose conditions on the works approval in accordance with Section 62A of the EP Act, to prevent, control, abate or mitigate pollution or environmental harm.

Following completion of the works authorised by the works approval, Water Corporation will be required to submit a compliance document to DEC. This compliance document is required to verify that the works have been completed in accordance with the conditions of works approval and that commissioning has demonstrated that the AWRP is operating to its design specification. Section 57 (3)(b) of the EP Act, prevents DEC issuing a licence where works have not been completed as per the conditions of a works approval.

8.2.2.2 Licence

Water Corporation will require a licence under Part V of the EP Act to operate an AWRP and GWR scheme. DEC will impose conditions on any licence issued in accordance with Section 62A of the EP Act, to prevent, control, abate or mitigate pollution or environmental harm.

The extent to which DEC may impose conditions on Part V licences for GWR Schemes will depend on the circumstances and facts of each GWR proposal. For most schemes, conditions relating to the specification of the treated sewage (recycled water quality) and monitoring of the receiving groundwater are likely to be appropriate.

8.2.3 Department of Health

The following requirements must be addressed by the Water Corporation in gaining approval for a GWR Scheme.

8.2.3.1 Approve construction of a Treatment Plant

According to the *Health Act* 1911, recycled water is considered to be sewage, until such time it appropriately treated to a level considered to be Drinking Water quality or above. Therefore, an Advanced Water Recycling Plant (AWRP) is considered to be an infrastructure

which treats sewage and *requires an application to construct or install an apparatus for the treatment of sewage* in accordance with the *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974*.

8.2.3.2 Memorandum of Understanding

The DoH will enter into a Memorandum of Understanding (MoU) with the Water Corporation to describe requirements for water quality, monitoring, review, notification, compliance and audit. A MoU enables the DoH to assess and scrutinise recycled water quality to ensure protection of public health and the Drinking Water resource.

8.2.3.3 Recycled Water Quality Management Plan

The Recycled Water Quality Management Plan is designed to manage recycled water quality from catchment to tap by incorporating an integrated quality assurance framework. A 12 element risk management framework for the management of recycled water quality describes a process for developing and implementing preventative risk management systems for recycled water use. This management framework is referenced in the AGWR Guidelines.

A GWR Scheme will be managed through the implementation of a Recycled Water Quality Management Plan. The Plan together with details of a monitoring plan for the Scheme must be endorsed by the DoH prior to commencing recharge.

8.2.3.4 Treatment Plant Commissioning

The DoH will review AWRP commissioning data prior to providing final approval to commence recharge.

8.2.4 Department of Water

The DoW have developed a new policy, *Operational Policy 1.01 – Managed aquifer recharge in Western Australia* (DoW, 2011) to aid the approval of socially and environmentally acceptable managed Aquifer Recharge (MAR) proposals under the *RIWI Act 1914*. Policy 1.01 was utilised to provide guidance in the development of the following DoW approvals required for a GWR Scheme:

8.2.4.1 26D licence to construct recharge and monitoring bores

Construction of recharge bores will need to be licensed under Section 26D of the *RIWI Act 1914*. The license when issued will contain terms and conditions specific to the construction requirements of the bore. The Water Corporation must apply for a 26D licence prior to commencing construction.

8.2.4.2 In-principle GWR entitlement

As noted in Section 6.2 of the DoW Operational Policy 1.01, *water that is recharged into the natural groundwater system is vested in the Crown (i.e. when the recharge water enters the groundwater*

system, the proponent does not retain ownership of that water). Therefore the proponent of a GWR Scheme has the same rights as other licence holders and must apply for a licence to recover the recharge water. Typically, DoW will grant licence entitlement to abstract water to the proponent undertaking recharge operations.

The DoW have granted the Water Corporation a 1:1 recharge and recovery ratio of a GWR Scheme (i.e., 7 GL/yr, Stage 1). An annual licence to recoup GWR recharged water is outlined below.

8.2.4.3 Licence GWR entitlement

The DoW manages annual groundwater abstraction via a five (5) yearly Water Resource Management Operating Strategy (WRMOS) for the Integrated Water Supply Scheme (IWSS) (Water Corporation, 2012). The process by which GWR water is recouped aligns with established operating procedures detailed in the IWSS WRMOS.

Prior to the commencement of each water year, the Water Corporation will submit a 5C application to abstract water that will specify the anticipated groundwater abstraction and proposed location (including GWR water). As the licence will be issued for a limited tenure, an addendum to the IWSS WRMOS will be prepared.

The GWR entitlement of the 5C licence will be based on the forecast recharge for that year. The location of abstraction will be determined in accordance with the operating rules for groundwater abstraction that include the environmental sensitivity principles described in the IWSS WRMOS.

Matters relating to water quality can be submitted as an addendum to the IWSS WRMOS, once the results of the Trial have been analysed against the identified environmental values within the defined management zone and the level of protection achieved.

8.2.4.4 Permission and exemption of By-Laws under the EP Act

The DoW is responsible for protecting Public Drinking Water Source Areas (PDWSA's) under the *Metropolitan Water Supply, Sewerage and Drainage (MWSSD) Act 1909*. There is currently no differentiation with regards to recharging into an unconfined or confined PDWSA and therefore, all associated By-laws under the *MWSSD Act 1909* apply.

Specifically, there are two By-laws under *MWSSD Act 1909* that relate to the approval of a GWR Scheme proposal. These By-laws are administered by the DoW, and are as follows;

By-law 5.4.6
In a pollution area or a part of a pollution area, a person shall not dispose of or discharge onto or into the ground, or into any lake, swamp or drain industrial wastes, chemicals, radioactive material, petroleum or petroleum products, polluted water, or refuse unless that person has been granted permission in writing by the Commission to do so.

By-law 5.4.7
A person shall not discharge into any well or observation well any chemical, industrial waste, treated or untreated sewage, effluent or other matter which in the opinion of the Commission may pollute the underground water.

Based on the definition of recycled water (section 6), GWR recycled water is not considered to be *polluted water, or refuse* or *untreated sewage, effluent or other matter* pertaining to the above By-laws. The DoW will not require the administration of these Bylaws for the approval of a GWR Scheme. Therefore, the Water Corporation will not be required to seek permission or exemption from these By-laws for a GWR Scheme.

8.3 Regulating an Operational Scheme

8.3.1 Department of Health

The DoH provides protection of public and the Drinking Water resource by regulating the recycled water quality in a GWR Scheme. This is managed via a GWR MoU (section 8.2.3.2).

The Health Advisory Committee, consisting of the DoH and Water Corporation was established for the GWR Trial and will remain in place after the Trial. The Committee, chaired by the Water Corporation, meets monthly to review treatment performance and recycled water quality to ensure protection of public health and the Drinking Water resource. Both organisations are committed to the ongoing work of this Committee to ensure safe Recycled Water.

8.3.2 Department of Environment and Conservation

Water Corporation must manage, operate, monitor, report and undertake any relevant actions in relation to an operational GWR scheme in accordance with the conditions of the EP Act licence. The licence will require Water Corporation to produce an Annual Audit Compliance Report (AACR) that sets out the extent to which licence conditions have been complied with over the previous year and an Annual Environmental Report (AER). The licence will require the AER to include information relating to any complaints and/or incidents at the premises together with a summary of relevant process/operational data, monitoring data and an assessment of monitoring results against any targets or limits in the licence.

DEC will regulate operational GWR Schemes through a series of inspections and audits and by the review and assessment of AACRs, AERs and other submissions that may be required by the licence.

8.3.3 Department of Water

The DoW will manage the annual groundwater recharge and abstraction quantities via the IWSS WRMOS. The GWR abstraction will be negotiated annually in addition to a baseline groundwater allocation.

For water accounting purposes, the Water Corporation will add water replenishment volumes to standard monthly and annual reporting. The overall "banked" volume will also be reported. This is the cumulative difference between recharge and abstraction calculated over the life of the scheme.

9 Conclusion

The IAWG have developed the GWR Regulatory Framework which defines the initial assessments pathway required to develop, approve commencement of recharge and provide ongoing regulation for a Groundwater Replenishment Scheme.

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Attachment 3: DWER Technical Internal Advice Report

Government of Western Australia
Department of Environment Regulation

REPORT

Assessment of water quality issues associated with a proposed managed aquifer recharge (MAR) scheme at the Beenyup wastewater treatment plant

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March 2017

Document control

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Date	Name	Role
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1/03/17	Andrew Miller	Reviewer

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Questions regarding this report should be directed to:
Department of Environment Regulation
Locked Bag 33 Cloisters Square
PERTH WA 6850
Phone: +61 8 6467 5000
Fax: +61 8 6467 5562
Email: info@der.wa.gov.au
Web: www.der.wa.gov.au

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Contents

Assessment of water quality issues associated with a proposed managed aquifer recharge (MAR) scheme at the Beenyup wastewater treatment plant.....1
Document control.....i
Document version history.....i
Corporate file information.....i
1. Introduction.....4
2. Framework for assessing MAR risks.....4
3. Release of chemical constituents from aquifer sediments.....5
4. Potential measures for managing environmental risks.....6
Signatures.....7

1. Introduction

The Water Corporation intends to implement a managed aquifer recharge (MAR) scheme in the vicinity of the Beenyup wastewater treatment plant to enable up to 14 Gl/year of highly treated wastewater to be injected into both the Leederville and Yarragadee aquifers to increase the water supply available for pumping in the area. It is understood that that wastewater will be treated by reverse osmosis to meet the Australian drinking water guideline values for a wide range of chemical constituents before the water is recharged to the confined aquifers beneath the area.

Based on the results of trial injection program at the site, Water Corporation undertook a risk assessment of the proposed MAR scheme in 2013 (Water Corporation, 2013), and this has recently been submitted to DER as part of the approvals process for scheme.

This report provides a review of the risk assessment that was undertaken by Water Corporation using data that was provided on the results of the groundwater replenishment trial that was undertaken by Water Corporation (Water Corporation, 2012). This report has been prepared at the request of Industry Regulation.

2. Framework for assessing MAR risks

The national guidelines for managed aquifer recharge (NHMRC, 2009) have provided a framework for assessing the human and, to a lesser extent, the environmental risks that may associated with the operation of an MAR scheme (Fig. 1). Figure 1 shows that an MAR scheme in a confined aquifer is comprised of a number of components, many of which can act as critical control points for assessing and managing water quality issues associated with the scheme.

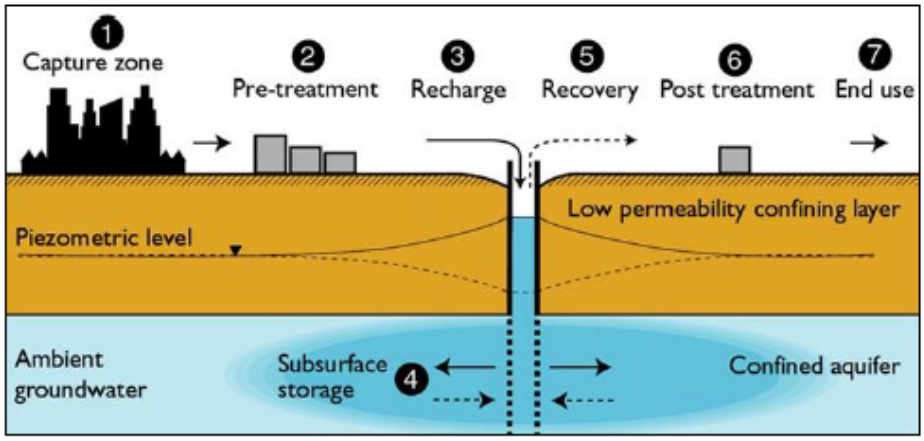

Figure 1. Components of an MAR scheme in a confined aquifer (NHMRC, 2009).

Using this framework, it can be seen that Water Corporation is primarily managing potential health risks associated with the proposed MAR scheme by ensuring that wastewater will meet drinking water criteria before it is recharged to the confined aquifers near the Beenyup site (critical control point marked as "2" in Fig.1). This factor together with monitoring (and, if necessary, additional treatment) of water that is recovered by pumping (critical control point marked as "6" in Fig.1) would ensure that there would be negligible health risks associated with a potable water supply produced from the proposed MAR scheme. Consequently, from the perspective of managing potential impacts on human health, I agree with the results of the risk assessment that was undertaken by Water Corporation for the proposed MAR scheme (Water Corporation, 2013).

However, the risk assessment undertaken by Water Corporation has not excluded the possibility that chemical constituents released by reactions between the treated wastewater and aquifer sediments could affect other environmental receptors. This issue is discussed in the following section.

3. Release of chemical constituents from aquifer sediments

Laboratory-based investigations and geochemical modelling that was undertaken for Water Corporation by CSIRO Land and Water have indicated chemical constituents including cobalt, phosphorus and fluoride are mobilised leached into groundwater as a result to the reaction of the recharge water with aquifer sediments in the Leederville aquifer. Laboratory testing with sediments collected from boreholes on the Beenyup site suggested that some other metals including thallium could be released on at least a short-term basis by the reaction of treated wastewater with aquifer sediments.

The principle source of cobalt and other metals released into groundwater was found to be from the oxidation of pyrite in the aquifer sediments. The phosphorus and fluoride was thought to be from the dissolution of crandallite and similar phosphate minerals in the aquifer sediments. CSIRO considered that the dissolution of carbonate and of feldspar minerals is likely to have buffered groundwater from significant pH changes that might be associated with pyrite oxidation.

The extent to which chemical constituents released from aquifer sediments would have the potential to affect environmental receptors would depend on a number of factors including:

- ***The rate of release chemical constituents from sediments*** – this has been thoroughly characterised for sediments from a limited number of borehole samples, but the assumption that the content of reactive minerals such as pyrite and crandallite will be uniform across the entire MAR scheme may not be valid. Consequently, concentrations of some chemical constituents in groundwater that are released from aquifer sediments may be highly variable across the proposed MAR scheme;

- ***Effectiveness of groundwater capture by pumping bores*** – Production bores that will be constructed near recharge bores will have well defined "capture zones" which will draw in a significant proportion of the recharged wastewater. However, a residual component of wastewater-affected groundwater will bypass the pumping bores and will have the potential to be transported away from the MAR scheme. The extent to which this will take place has not been well-characterised for the proposed MAR scheme;

- ***Extent to which changes in geochemical conditions in the aquifer will form a barrier to the transport of chemical constituents*** – Chemically oxidising conditions are likely to be present in the portion of the confined aquifers where recharge takes place whereas surrounding groundwater will have highly reducing conditions. The interface between oxidising and reducing conditions will act as a geochemical barrier for many (but not all) chemical constituents that are released from sediments by aquifer-wastewater reactions and will probably limit lateral groundwater transport of many constituents in the confined aquifers. This may not be the case if substantial upward leakage from the Leederville to the Superficial aquifer takes place in the MAR scheme, as chemically oxidising conditions may extend throughout the Superficial aquifer where a large amount of groundwater use takes place.

  In order to reduce the release of some metals from aquifer sediments by reactions with recharged wastewater, Water Corporation may increase the alkalinity of the wastewater. Although this would reduce the solubility of many metals, this has the potential to increase the mobility of uranium through the formation of highly soluble uranyl carbonate complexes. Uranium is often present at high concentrations in crandallite and similar phosphate minerals in sediments. Further laboratory testing under a range of alkalinities would be required to determine whether this issue would be of concern for the proposed MAR scheme;

- ***Groundwater flow rates and proximity of receptors*** – groundwater flow rates in the confined aquifers are generally much lower than in the Superficial aquifer due to a lower hydraulic hydraulic conductivity of the sediments. Similarly, there are less groundwater users to be affected by potential contaminants in the confined aquifers that the Superficial aquifer. A number of environmental receptors such as groundwater dependent wetlands also occur in the Superficial aquifer that are not associated with the confined aquifers. As a consequence of these factors, the risk of environmental harm occurring as a result of the release of chemical constituents from sediments in the confined aquifers is considered to be low unless there is significant upward seepage into the Superficial aquifer.

4. Potential measures for managing environmental risks

The information presented in the previous section suggests that environmental risks associated with the operation of the proposed MAR scheme are likely to be low provided that there is no upward leakage from the confined aquifers into the Superficial aquifer. Measures that could be implemented to further minimise the risks associated with upward leakage into the Superficial aquifer include:

- ***Maintain downward potentiometric heads*** – the risks of upward leakage taking place would be negligible provided that the potentiometric head in the Superficial aquifer is maintained at a higher level than in the confined aquifers. This could be managed by controlling the rate and overall volume of wastewater that is recharged to the confined aquifers;

- ***Restrict recharge to the Yarragadee aquifer*** – upward leakage to the Superficial aquifer would be highly unlikely to take place if recharge of wastewater were only to take place for the Yarragadee aquifer due to the long groundwater flowpaths and the aquitards that exist between these two aquifers; and

- ***Installation of monitoring bores in the Superficial aquifer*** – the installation of a monitoring bore screened near the base of the Superficial aquifer at the site of each recharge bore would enable changes in water quality to be detected that are associated with upward leakage from the recharge zone in confined aquifers. This would enable a management response to the issue.

References

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Signatures

Author Name	Signature
Position	Date
Reviewer Name	Signature
Position	Date