Appendix I

Groundwater Replenishment Regulatory Framework
Groundwater Replenishment Regulatory Framework

December 2012

Prepared by the Groundwater Replenishment Trial Interagency Working Group:

[Images and logos from Government of Western Australia and Department of Water]
Revision History

<table>
<thead>
<tr>
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<th>Prepared By</th>
<th>Date Issued</th>
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</thead>
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Status

The Groundwater Replenishment Framework is “Draft” until 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.
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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.
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).


**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

1. Characterise aquifer for Groundwater Replenishment Scheme – Water Corporation (WC)
2a. Identify Environmental Values (EV’s) of receiving environment (aquifer) – DoH, DEC, DoW and WC
2b. Identify Health and Environmental Guidelines that will protect EV’s – DoH, DEC, DoW and WC
3. Conduct Risk Assessment for treatment process and aquifer response to ensure protection of EV’s – WC
4. Review and Sign off Risk Assessment – DoH, DEC and DoW

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DoH Approval Process
Standard
- Approve construction of a Treatment Plant
For GWR
- GWRS DoH/WC MoU
- GWRS RWQMP
- Final approval to recharge based on Treatment Plant commissioning

Commence Recharge
Regulation during Operation
- Operate within MoU
- MoU Reporting Requirements

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EPA Part IV Approval Process

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DEC Part V Approval Process
Standard
- Issue Works Approval (construct)
- Issue Discharge Licence
Commence Recharge
Regulation during Operation
- Operate within the Licence
- Annual Audit Compliance Report
- Annual Environmental Report

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DoW Approval Process
Standard
- Issue 26D licence to construct recharge and monitoring bores
For GWR
- Agree in-principle GWR entitlement
- Licence GWR entitlement
Commence GWR Abstraction
Regulation during Operation
- Licence GW abstraction and GWR entitlement in WRMOS
- Annual WRMOS report (quantity)
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.
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.

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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 EVs 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 EVs.

**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 EVs 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

<table>
<thead>
<tr>
<th>Environmental Value</th>
<th>Water Quality Guideline that will protect the Environmental Value</th>
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<tbody>
<tr>
<td>Aquatic Ecosystems</td>
<td>DEC to establish water quality criteria(^2) which will be applied with assistance from DoW and DoH.</td>
</tr>
<tr>
<td>Primary Industries</td>
<td>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.</td>
</tr>
<tr>
<td>Recreation and Aesthetics</td>
<td>DoH and DEC to establish water quality criteria(^2) with assistance from DoW.</td>
</tr>
<tr>
<td>Drinking Water Resource</td>
<td>Recycled Water Quality Parameters and Recycled Water Quality Indicators identified by the DoH and defined in the GWR MoU.</td>
</tr>
<tr>
<td>Industrial Water</td>
<td>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.</td>
</tr>
<tr>
<td>Cultural and spiritual values</td>
<td>No water quality guidelines are provided for this environmental value. Water Corporation to continue to engage with Indigenous stakeholders.</td>
</tr>
</tbody>
</table>

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 resultant 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.
Groundwater Replenishment Regulatory Framework

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 By-laws 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.
References


DoW. (2011). Operational Policy 1.01 - Managed Aquifer Recharge in Western Australia. Western Australia.


Appendix J – Stakeholder Consultation Table
<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Date/Description of Communication</th>
<th>Topics/Issues Raised</th>
<th>Proponent Response/Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Office of the Environmental Protection Authority (OEPA)</strong></td>
<td>19 April 2016</td>
<td>Meeting to discuss GWRS Stage 2 and Regulatory Framework including:</td>
<td>• OEPA recommended that EPA Section 16 advice on groundwater recharge needs to be considered during the assessment. The Corporation notes that this advice was withdrawn and archived for historical reference in January 2015.</td>
</tr>
<tr>
<td></td>
<td>Pre-referral meeting with OEPA at OEPA office</td>
<td>• Overview of the Proposal</td>
<td>• OEPA advised that if the alignment runs through Perry’s Paddock then Heritage is likely to be a preliminary environmental factor. Heritage is now included as a Key Environmental Factor in the Referral.</td>
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<tr>
<td></td>
<td></td>
<td>• Preliminary Key Environmental Factors</td>
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<td></td>
<td></td>
<td>• Key stakeholders</td>
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<td></td>
<td>27 June 2016</td>
<td>Meeting to discuss GWRS Stage 2 including:</td>
<td>• OEPA advised that all options to avoid impacts to the Banksia woodland area in Yellagonga Regional Park should be explored. The Corporation has since undertaken a thorough analysis of several alternative alignments, keeping the clearing of native vegetation to a minimum. This has been documented in the Referral.</td>
</tr>
<tr>
<td></td>
<td>Follow up referral meeting with OEPA at OEPA office</td>
<td>• Update on the Proposal</td>
<td>• An option for a subsequent stage following Stage 1 of the GWRS was documented in the previous Referral for Stage 1. The Corporation has outlined this in the Referral.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Preliminary Key Environmental Factors</td>
<td>• OEPA recommended that the Referral document include a consideration of all relevant EPA guidance statements and policies. The Corporation has completed this.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Key stakeholders</td>
<td>• The Referral to be formatted based on an API-A Environmental Review Document. The Referral has been developed in accordance with EAG 14.</td>
</tr>
<tr>
<td>Date</td>
<td>Event Description</td>
<td>Response/Action</td>
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<tr>
<td>14 July 2016</td>
<td>Email to General Manager</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
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<td></td>
<td></td>
<td>OEPAdvised they did not require any further briefing.</td>
<td></td>
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<tr>
<td>13 October 2016</td>
<td>Meeting with the OEPA at OEPA office</td>
<td>Final overview of GWRS Stage 2 Proposal ahead of submission of Referral.</td>
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<td>The Corporation provided a summary of:</td>
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<td>- The proposed Development Envelope and Construction Footprint, highlighting key areas of native vegetation being avoided through investigation of alternative options.</td>
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<td>- The GWR Regulatory Framework and outcomes to date.</td>
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<td></td>
<td>- The key environmental factors, potential impacts, significance and management.</td>
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<td>The OEPA advised that the Referral should include:</td>
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<td>- Information on previous projects involving horizontal direction drilling, and any assessment of potential impact to tree roots.</td>
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<td></td>
<td>A presentation to the EPA is tentatively scheduled for 17 November 2016 following referral of the proposal.</td>
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<tr>
<td>14 July 2016</td>
<td>Email to Chairmen of the EPA</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
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<tr>
<td></td>
<td></td>
<td>Nil.</td>
<td></td>
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<tr>
<td>Department of Water (DoW)</td>
<td>14 July 2016 Technical meeting with DoW and ECU at DoW Perth office</td>
<td>Meeting to discuss scope of wetland vegetation monitoring currently being undertaken by DoW and ECU.</td>
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<td></td>
<td></td>
<td>The Corporation is scoping a wetland vegetation study for GWRS Stage 2 and will consider survey work undertaken by DoW and ECU in the design of the scope.</td>
<td></td>
</tr>
<tr>
<td>14 July 2016</td>
<td>Email to Director General</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
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<tr>
<td></td>
<td></td>
<td>DoW advised that a briefing would be preferable. The Corporation to schedule a briefing on GWRS Stage 2. Briefing timing to be determined.</td>
<td></td>
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<tr>
<td>Department of Environment Regulation</td>
<td>21 April 2016 Meeting with DER</td>
<td>GWR Regulatory Framework discussion.</td>
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<td>Ongoing discussion with DER regarding GWR Regulatory Framework.</td>
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<td>Date</td>
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<td>Details</td>
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<tr>
<td>24 May 2016</td>
<td>Meeting with DER</td>
<td>DER provided a briefing on the licencing reform process. The Corporation provided a briefing on GWRS Stage 2 context, scope and timings. The Corporation noted the licencing reform process. DER advised preference in following a defined licencing process under Part V of the EP Act, and will provide advice to the OEPA in the process under Part IV of the EP Act.</td>
<td></td>
</tr>
<tr>
<td>14 July 2016</td>
<td>Email to Director General</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information. DER declined the offer for a briefing on GWRS Stage 2 as they will be receiving an application in relation to the Proposal.</td>
<td></td>
</tr>
<tr>
<td>14 August 2016</td>
<td>Letter from DER Director General to Corporation CEO</td>
<td>Response to email on Groundwater Replenishment Scheme expansion. No briefing required given DER will be receiving an application in relation to the Scheme.</td>
<td></td>
</tr>
<tr>
<td>29 June 2016</td>
<td>Meeting with DPaW at DPaW Swan Region Office, Perth</td>
<td>Meeting to discuss GWRS Stage 2 including: Proposed recharge pipeline route and recharge sites, Access to pine plantation for southern recharge site, Access to Woodvale Nature Reserve, Environmental impacts, Stakeholder consultation, Environmental approvals. DPaW concerned with impacts to native vegetation in bushland south of the proposed southern recharge site and suggested the Corporation consider alternative routes. DPaW also recommended that the Corporation send a letter to the DPaW Regional Manager Swan Region outlining relevant information on the GWRS Stage 2 Proposal and the request for access to two portions of DPaW managed reserves for the recharge pipeline alignment and the southern recharge site.</td>
<td></td>
</tr>
<tr>
<td>14 July 2016</td>
<td>Email to Director General</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information. Nil.</td>
<td></td>
</tr>
<tr>
<td>15 July 2016</td>
<td>Letter to Regional Manager Swan Region</td>
<td>Letter requesting access to Reserve 21176 and 30809 for purpose of GWRS Stage 2. Letter sent from the Corporation to DPaW Regional Manager Swan Region following meeting on 29 June 2016.</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Event Description</td>
<td>Details</td>
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<tr>
<td>3 August 2016</td>
<td>Letter from DPaW to the Corporation</td>
<td>In-principle support for use of Reserve 21176 and a small portion of Reserve 30809 for infrastructure relating to GWRS Stage 2.</td>
<td></td>
</tr>
<tr>
<td>17 August 2016</td>
<td>Email to Swan Region staff</td>
<td>Email advising of proposed survey and geotechnical works for proposed pipeline route.</td>
<td></td>
</tr>
<tr>
<td>19 August 2016</td>
<td>Meeting with Swan Region staff at Yellagonga Regional Park Pine Plantation</td>
<td>Location of access track through the pine plantation.</td>
<td></td>
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<tr>
<td>2 September 2016</td>
<td>Phone call and emails with Swan Region staff</td>
<td>Location of the proposed recharge pipeline through the pine plantation.</td>
<td></td>
</tr>
<tr>
<td>Department of Health (DoH)</td>
<td>17 May 2016</td>
<td>Phone call to DoH</td>
<td>DoH is supportive of GWRS Stage 2 as the next water source, and is ready to implement the GWR Regulatory Framework for the next stage.</td>
</tr>
<tr>
<td>14 July 2016</td>
<td>Email to Director General</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
<td></td>
</tr>
</tbody>
</table>
| Department of Aboriginal Affairs (DAA) | 14 July 2016  
Email to Director General | Email announcing the expansion of the GWRS offering a briefing for further information. | DAA advised that a briefing on GWRS Stage 2 would be preferred. The Corporation scheduled a briefing. |
|--------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                       | 18 August 2016  
Briefing with Director General at DAA Office | Briefing of proposed GWRS Stage 2 including:  
• Requirement for water sources, Water Forever strategy and climate change  
• GWR concept and GWRT  
• Safety of supply  
• Advantages of groundwater replenishment  
• Proposed pipeline route  
• Heritage survey and approvals (if required). | No concerns raised in the briefing. The Corporation will be undertaking a Heritage Survey for the GWRS Stage 2 Proposal once the pipeline route is finalised. |
| Main Roads Western Australia (MRWA)   | 5 August 2016  
Email to MRWA | Options for alignment of recharge pipeline along Wanneroo Road and in area of Wanneroo Road and Joondalup Drive intersection. | The Corporation is seeking MRWA consideration of proposed alignments for recharge pipeline route along Wanneroo Road and near the intersection of Wanneroo Road and Joondalup Drive. |
<table>
<thead>
<tr>
<th>Date</th>
<th>Sender/Recipient</th>
<th>Subject</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 August 2016</td>
<td>Email from MRWA</td>
<td>Alignment of recharge pipeline along Wanneroo Road, and in area of Wanneroo Road and Joondalup Drive intersection.</td>
<td>MRWA advised the Corporation that any pipeline infrastructure along Wanneroo Road should be located in the standard service corridor as close as practical to the road reserve boundary, and should have a depth to cover of at least 1.5 m below road level at the kerb face. MRWA also advised that the recharge pipeline crossing at Joondalup Drive should be located at a minimum of 300 m from the intersection to avoid impact from future upgrades at this intersection. Any alignment along the north side of Joondalup Drive should follow the standard service corridor alignment or as close as practical to the boundary of the MRS road reserve boundary. The Corporation has taken this advice into consideration in the design of the proposed recharge pipeline alignment.</td>
</tr>
<tr>
<td>18 August 2016</td>
<td>Email to WAPC</td>
<td>Email advising of proposed survey and geotechnical works for proposed pipeline route.</td>
<td>Nil.</td>
</tr>
<tr>
<td>Western Australian Planning Commission (WAPC)</td>
<td>18 August 2016 Email to WAPC</td>
<td>Email advising of proposed survey and geotechnical works for proposed pipeline route.</td>
<td>Nil.</td>
</tr>
</tbody>
</table>

**IAWG**

<table>
<thead>
<tr>
<th>Date</th>
<th>Sender/Recipient</th>
<th>Subject</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 May 2016</td>
<td>Email to IAWG</td>
<td>IAWG meeting requirements and indicative frameworks.</td>
<td>Commence the planning of IAWG meetings for GWRS Stage 2.</td>
</tr>
<tr>
<td>DoH, DoW, DER</td>
<td>19 May 2016 Email to IAWG</td>
<td>IAWG meeting requirements and indicative frameworks.</td>
<td>Commence the planning of IAWG meetings for GWRS Stage 2.</td>
</tr>
<tr>
<td>DoH, DoW</td>
<td>31 May 2016 IAWG Meeting #1</td>
<td>Introduction and scoping meeting.</td>
<td>Proceed with application of GWR Regulatory Framework.</td>
</tr>
<tr>
<td>DoH, DoW</td>
<td>15 July 2016 Email</td>
<td>Update on GWRS Stage 2 and notification of Minister for Water’s formal announcement of GWRS Stage 2.</td>
<td>Nil.</td>
</tr>
<tr>
<td>Date</td>
<td>Event Description</td>
<td>Notes</td>
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<tr>
<td>8 August 2016</td>
<td>Update on GWRS Stage 2 including upcoming workshop on EVs.</td>
<td>Workshop on EVs to be planned.</td>
<td></td>
</tr>
<tr>
<td>22 August 2016</td>
<td>Workshop with IAWG to identify EVs relevant to GWRS Stage 2.</td>
<td>Four EVs defined for Leederville and Yarragadee aquifer for GWRS Stage 2.</td>
<td></td>
</tr>
<tr>
<td>14 September</td>
<td>Workshop with IAWG for Risk Assessment.</td>
<td>Risk Assessments were presented before reviewing for endorsement.</td>
<td></td>
</tr>
</tbody>
</table>

**Local Government Authorities**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
<th>Notes</th>
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<tbody>
<tr>
<td>14 July 2016</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
<td>Nil.</td>
</tr>
<tr>
<td>16 August 2016</td>
<td>Email advising of proposed survey and geotechnical works for proposed pipeline route.</td>
<td>Nil.</td>
</tr>
<tr>
<td>26 August 2016</td>
<td>Briefing of proposed GWRS Stage 2 including:</td>
<td>CoW is supportive of GWR as a water source. CoW will need to be consulted in relation to the recharge pipeline route once finalised. CoW queried the recharge pipeline route to the north-east of Lake Joondalup in the region of the proposed dual use bike path that is unfinished. The Corporation to consider recharge pipeline route and proposed dual use path route.</td>
</tr>
<tr>
<td>City of Wanneroo (CoW)</td>
<td>Briefing with CoW staff</td>
<td></td>
</tr>
<tr>
<td>26 August 2016</td>
<td>Information and spatial data on dual use path around Lake Joondalup.</td>
<td>Spatial data used for consideration by The Corporation in proposed recharge pipeline alignment.</td>
</tr>
<tr>
<td>Date</td>
<td>Action</td>
<td>Notes</td>
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<tr>
<td>30 August 2016</td>
<td>Email from Special Project Planner at CoW Development Application processes – no Development Application process required under District Planning Scheme No. 2. Further consultation required under clause 6(3) of the Planning and Development Act 2007.</td>
<td>Approvals information noted by the Corporation.</td>
</tr>
<tr>
<td>1 September 2016</td>
<td>Phone call to Environmental Planner at CoW Seeking information from City of Wanneroo on known location of Rainbow Bee Eater (Merops ornatus) along Scenic Drive in Wanneroo.</td>
<td>Spatial information taken into consideration by the Corporation for proposed recharge pipeline alignment, and included in CEMF.</td>
</tr>
<tr>
<td>19 September 2016</td>
<td>Email to CoW representative Email to CoW with summary of briefing minutes from 1 September 2016, and invite to set up a meeting to discuss pipeline route in further detail.</td>
<td>Nil.</td>
</tr>
<tr>
<td>7 October 2016</td>
<td>Meeting at CoW office Meeting to discuss final proposed alignment for GWRS Stage 2 infrastructure with CoW staff.</td>
<td>An interactive meeting where the Corporation used Google Earth to demonstrate the location of the proposed AWRP site, pipeline route and recharge sites. No major issues raised and the CoW generally satisfied with the location of the proposed infrastructure. Topics of discussion included construction methods, stakeholder consultation, environmental surveys and impact assessment and approvals. The Corporation and CoW to remain in contact throughout the duration of the project.</td>
</tr>
<tr>
<td>City of Joondalup (CoJ)</td>
<td>14 July 2016 Email to CEO and Mayor Email announcing the expansion of the GWRS offering a briefing for further information.</td>
<td>Briefing to COJ council requested and actioned by the Corporation.</td>
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<tr>
<td>Date</td>
<td>Event</td>
<td>Description</td>
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<tr>
<td>17 August 2016</td>
<td>Email to CoJ management</td>
<td>Email advising of proposed survey and geotechnical works for proposed pipeline route.</td>
</tr>
</tbody>
</table>
| 31 August 2016 | Briefing with CoJ staff at Operations Centre | Briefing of proposed GWRS Stage 2 including:  
- GWR concept and GWRT  
- Proposed works within City of Wanneroo (pipeline, recharge sites)  
- Environmental impacts  
- Construction methods  
- Community and environmental opportunities  
Development Application process and relevant environmental approvals.  
CoJ generally supportive of GWRS Stage 2. Another meeting would be held to discuss the pipeline route in more detail once finalised. |
<p>| 19 September 2016 | Email to CoJ representative | Email to CoJ with summary of briefing minutes from 31 August 2016, and invite to set up a meeting to discuss pipeline route in further detail. Detailed pipeline route discussion scheduled for 18 October 2016. |
| 18 October 2016 | Meeting | Meeting with CoJ representatives to discuss pipeline route through CoJ area in further detail. Intramaps and physical maps were used to demonstrate the location of the proposed infrastructure within the CoJ, and broader CoW area. Discussion included construction techniques and alternatives, alternative considerations for the pipeline route, environmental impacts and assessment, reinstatement of roads and interruption to residents and the community. The Corporation is to provide the CoJ with more detailed drawings on the pipeline once complete and an options analysis, to obtain further feedback on the alignment. Consultation with the CoJ is ongoing. Minutes were provided to the CoJ on 21 October 2016. |</p>
<table>
<thead>
<tr>
<th>Environmental Groups</th>
<th>14 July 2016</th>
<th>Email announcing the expansion of the GWRS offering a briefing for further information.</th>
<th>Briefing to CoS staff may be likely in the future.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friends of Yellagonga (FoY)</td>
<td>15 July 2016</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
<td>Nil.</td>
</tr>
<tr>
<td></td>
<td>21 September 2016</td>
<td>Email to offer briefing</td>
<td>A briefing has been scheduled for 31st October 2016.</td>
</tr>
<tr>
<td>Urban Bushland Council (UBC)</td>
<td>15 July 2016</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
<td>Nil.</td>
</tr>
<tr>
<td></td>
<td>20 September 2016</td>
<td>Email to offer a briefing with an attached map of the proposed pipeline route and recharge sites.</td>
<td>Briefing scheduled for 14 October 2016.</td>
</tr>
<tr>
<td></td>
<td>14 October 2016</td>
<td>Briefing at scheduled committee meeting to provide an overview of GWRS Stage 2 including the process of GWR, construction techniques, potential environmental impacts and environmental management.</td>
<td>Discussion included alternative options to avoid the need for infrastructure within Bush Forever Sites, alternative route options, potential impacts to tree roots from tunnelling, construction techniques, investigations and potential management of ASS, revegetation and weed impacts, and assessment of impacts to the Banksia Woodland TEC. The Corporation to consider an alternative alignment at the Mitchell Freeway crossing to avoid any impact to Bush Forever site 407. Minutes were provided to the UBC on 21 October 2016 with maps and the Revegetation Plan for the Beenyup facility, as requested.</td>
</tr>
<tr>
<td>Wetland Conservation Society (WCS)</td>
<td>20 September 2016</td>
<td>Email to offer a briefing with an attached map of the proposed pipeline route and recharge sites.</td>
<td>Briefing scheduled for 19 October 2016.</td>
</tr>
<tr>
<td>Date</td>
<td>Agency</td>
<td>Action/Communication</td>
<td>Response/Details</td>
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<tr>
<td>19 October 2016</td>
<td>Briefing at scheduled committee meeting</td>
<td>Briefing on GWRS Stage 2 to provide an overview of GWRS Stage 2, including GWR process, construction techniques, potential environmental impacts and environmental management.</td>
<td>The WCS did not indicate any major concerns with the proposal but queried construction techniques, management of ASS and dieback, capacity of the WWTP at Beenyup, future expansion to the GWRS and offsets. A summary of the meeting to be provided by the Corporation to the WCS. No further follow up required.</td>
</tr>
<tr>
<td>Wetlands Research Association (WRA)</td>
<td>18 October 2016 Email to WRA</td>
<td>Email advising of the expansion of the GWRS with a map showing proposed alignment of pipelines and infrastructure.</td>
<td>Nil.</td>
</tr>
<tr>
<td>Friends of Craigie Bushland (FoCB)</td>
<td>15 July 2016 Email to FoCB</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
<td>Nil.</td>
</tr>
<tr>
<td>Conservation Council of WA (CCWA)</td>
<td>15 July 2016 Email to CCWA Director</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
<td>Nil.</td>
</tr>
<tr>
<td></td>
<td>20 September 2016 Email to CCWA Director</td>
<td>Email to offer briefing.</td>
<td>Nil.</td>
</tr>
<tr>
<td></td>
<td>27 October 2016 Phone call with CCWA Director</td>
<td>Phone call to discuss the proposed expansion of the GWRS in follow up to emails of July and September 2016.</td>
<td>Discussion included community support for GWR, expansion to include offsite recharge, construction of infrastructure from the Beenyup facility along the east of Lake Joondalup, impact to Bush Forever sites and consultation with the UBC, conservation areas, offset requirements, aquifer characterisation and risk assessment and referral under the EPBC Act. CCWA indicated that a formal briefing was not required, and that they did not expect a formal level of assessment under the EP Act.</td>
</tr>
<tr>
<td>Yellagonga Regional Park Community Advisory Committee (YRPCAC)</td>
<td>15 July 2016 Email to Executive Officer</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
<td>Requested a briefing which was undertaken on 1 September 2016.</td>
</tr>
<tr>
<td>Date</td>
<td>Event/Action</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>1 September 2016</td>
<td>Briefing to YRPCAC</td>
<td>Briefing at scheduled committee meeting on overview of GWR Stage 2, proposed recharge pipeline route and recharge sites, impacts in Yellagonga Regional Park, opportunities and stakeholder consultation processes. The Corporation to consider proposals from the YRPCAC for environmental opportunities within the Yellagonga Regional Park including revegetation and biofiltration programs. Minutes from the Corporation summarising the briefing were sent to YRPCAC on 16 September 2016.</td>
<td></td>
</tr>
<tr>
<td>19 September 2016</td>
<td>Email to Executive Officer</td>
<td>Email YRPCAC with summary of minutes from the briefing on 1 September 2016 and a map of proposed pipeline route.</td>
<td>Nil.</td>
</tr>
<tr>
<td>14 July 2016</td>
<td>Email to ACE</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
<td>Nil.</td>
</tr>
<tr>
<td>Alliance for a Clean Environment (ACE)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 July 2016</td>
<td>Brief overview at scheduled Whadjuk meeting</td>
<td>The Corporation met with the Whadjuk Native Title Claim Group and provided a brief overview of the GWRS Stage 2.</td>
<td>The Corporation reassured the Claim Group that the processes and conditions of the Noongar Standard Heritage Agreement would be followed and that they expected that there would be a series of Aboriginal Heritage Surveys undertaken to ensure any works associated with the project did not impact negatively on Aboriginal heritage values. At the request of the Whadjuk, SWALSC (the legal representative of the Whadjuk Native Title Claim Group) the Corporation will attend the next Whadjuk meeting in November to provide further information on the project including finalised routes of the proposed pipeline and an update on any Aboriginal Heritage Surveys undertaken since the July meeting.</td>
</tr>
<tr>
<td>Whadjuk Native Title Claim Group (Whadjuk)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 July 2016</td>
<td>Email to SWALSC</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
<td>Nil.</td>
</tr>
<tr>
<td>South West Aboriginal Land and Sea Council (SWALSC)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Aboriginal Heritage Action Alliance (AHAA)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Description</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 July 2016</td>
<td>Email to AHAA</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
<td>Nil.</td>
</tr>
</tbody>
</table>

### State Heritage Office (SHO)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Description</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 July 2016</td>
<td>Email to SHO</td>
<td>Email announcing the expansion of the GWRS offering a briefing for further information.</td>
<td>Nil.</td>
</tr>
<tr>
<td>7 September 2016</td>
<td>Meeting</td>
<td>Proposed pipeline route through Perry’s Paddock.</td>
<td>Heritage Council requested that the Proposal be referred to assess any impact to European Heritage through Perry’s Paddock.</td>
</tr>
<tr>
<td>9 September 2016</td>
<td>Email Referral</td>
<td>Email to State Heritage Office referring Proposal to Heritage Council for assessment and advice on potential impacts to European Heritage values through Perry’s Paddock.</td>
<td>Response from the State Heritage Office received via email on 23 September 2016. The State Heritage Office do not have any objections to the Proposal.</td>
</tr>
</tbody>
</table>

### Residents, Landowners and Community

<p>| Date                   | Event                                | Description                                                                 |
|------------------------|--------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 15 July 2016           | Email to surrounding residents via existing database | Email announcing the expansion of the GWRS offering a briefing for further information. | Nil.                                                                     |
| 14 July 2016           | Email to Beenyup CRG members          | Email announcing the expansion of the GWRS offering a briefing for further information. | An update was provided to the CRG at their regular meeting by a Corporation representative on 17 October 2016. The Corporation continues to update the CRG on construction and operation matters. |</p>
<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Correspondence Details</th>
<th>Corporation Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident along Scenic Drive</td>
<td>29-31 August 2016</td>
<td>Email correspondence from local resident to the Corporation's Community Engagement Officer.</td>
<td>The Corporation responded to the resident via email on 6 September 2016 advising that the proposed pipeline route has been designed to avoid disturbance to the known nesting area. The Corporation contacted the CoW for spatial data of the location of the nesting sites and has incorporated this data into the design of the Development Envelope, to ensure these particular areas are avoided and/or timing of construction is managed to avoid impacting these areas.</td>
</tr>
<tr>
<td>Drovers Market Place, Wanneroo</td>
<td>17 August 2016</td>
<td>Email to Drovers. Email to advise of the proposed pipeline route and impending survey and geotechnical work.</td>
<td>The Corporation will undertake ongoing consultation with these private landowners.</td>
</tr>
<tr>
<td>Wanneroo Residents Association (WRA)</td>
<td>30 September 2016</td>
<td>Email with information on the proposed GWRS Stage 2</td>
<td>A briefing has been scheduled for 31st October 2016.</td>
</tr>
</tbody>
</table>
Appendix K

26D Licences for Recharge and Monitoring Bores
# LICENCE TO CONSTRUCT OR ALTER WELL

Granted by the Minister under section 26D of the Rights in Water and Irrigation Act 1914

<table>
<thead>
<tr>
<th>Licensee(s)</th>
<th>Water Corporation</th>
</tr>
</thead>
</table>
| **Description of Water Resource** | Perth  
Perth - Yarragadee North. |
| **Location of Well(s)** | Lot 500 On Plan 64576 - Volume/Folio Lr3159/411 - Lot 500 Wanneroo Rd Wanneroo  
Lot 800 On Plan 52636 - Volume/Folio 2719/728 - Lot 800 Wanneroo Rd Neerabup  
Lot 10284 On Plan 13529 - Volume/Folio Lr3048/732 - Lot 10284 Lysander Dr Heathridge  
Lot 12520 On Plan 192531 - Volume/Folio Lr3086/993 - Lot 12520 Connolly Dr Tamala Park |
| **Authorised Activities** | **Activity**  
Construct 1 artesian well(s).  
Construct 1 artesian well(s).  
Construct 1 artesian well(s).  
Construct 1 monitoring well(s).  
Construct 1 artesian well(s).  
Construct 1 monitoring well(s). |
| **Location of Activity** | Lot 10284 On Plan 13529 - Volume/Folio Lr3048/732 - Lot 10284 Lysander Dr Heathridge  
Lot 12520 On Plan 192531 - Volume/Folio Lr3086/993 - Lot 12520 Connolly Dr Tamala Park  
Lot 500 On Plan 64576 - Volume/Folio Lr3159/411 - Lot 500 Wanneroo Rd Wanneroo  
Lot 800 On Plan 52636 - Volume/Folio 2719/728 - Lot 800 Wanneroo Rd Neerabup |
| **Duration of Licence** | From 12 July 2016 to 11 July 2018 |

This Licence is subject to the following terms, limitations and conditions:

1. The well must be constructed by a driller having a current class 3 water well drillers certificate issued by the Western Australian branch of the Australian Drilling Industry Association or equivalent certification recognised nationally by the Australian Drilling Industry Association.

2. The licensee shall construct the well(s) to the specifications provided with the application for this licence dated 2 June 2016.

End of terms, limitations and conditions

This Licence is granted subject to the Rights In Water and Irrigation Regulations 2000.
LICENCE TO CONSTRUCT OR ALTER WELL
Granted by the Minister under section 26D of the Rights in Water and Irrigation Act 1914

<table>
<thead>
<tr>
<th>Licensee(s)</th>
<th>Water Corporation</th>
</tr>
</thead>
</table>
| Description of Water Resource | Perth  
Perth - Leederville. |
| Location of Well(s) | Lot 9472 On Plan 11393 - Volume/Folio Lr3047/494 - Lot 9472 Gradient Way Beldon  
Lot 500 On Plan 64576 - Volume/Folio Lr3159/411 - Lot 500 Wanneroo Rd Wanneroo  
Lot 800 On Plan 52636 - Volume/Folio 2719/728 - Lot 800 Wanneroo Rd Neerabup |

<table>
<thead>
<tr>
<th>Authorised Activities</th>
<th>Activity</th>
<th>Location of Activity</th>
</tr>
</thead>
</table>
|                       | Construct 1 artesian well(s).  
Construct 1 monitoring well(s). | Lot 500 On Plan 64576 - Volume/Folio Lr3159/411 - Lot 500 Wanneroo Rd Wanneroo |
|                       | Construct 1 artesian well(s).  
Construct 1 monitoring well(s). | Lot 800 On Plan 52636 - Volume/Folio 2719/728 - Lot 800 Wanneroo Rd Neerabup |
|                       | Construct 1 artesian well(s). | Lot 9472 On Plan 11393 - Volume/Folio Lr3047/494 - Lot 9472 Gradient Way Beldon |

Duration of Licence: From 12 July 2016 to 11 July 2018

This Licence is subject to the following terms, limitations and conditions:

1. The well must be constructed by a driller having a current class 3 water well drillers certificate issued by the Western Australian branch of the Australian Drilling Industry Association or equivalent certification recognised nationally by the Australian Drilling Industry Association.

2. The licensee shall construct the well(s) to the specifications provided with the application for this licence dated 21 June 2016.

End of terms, limitations and conditions

This Licence is granted subject to the Rights in Water and Irrigation Regulations 2000.
Appendix L

State Heritage Office Response Letter
21 September 2016

Mr Daniel Stevens
Water Corporation

By email: Daniel.Stevens@watercorporation.com.au

Dear Daniel

PERRY’S PADDOCK, COTTAGE AND STABLES
New underground pipe

Thank you for your correspondence of 9 September 2016 regarding the proposed development at Perry’s Paddock, Cottage and Stables.

We received the following:

2 aerial images showing location of proposed subterranean pipeline

The proposed development has been considered in the context of the identified cultural significance of the place and the following comments are given:

Findings

- Perry’s Paddock, Cottage and Stables has cultural heritage significance as the first land grant in Wanneroo, largely retaining its original spatial and functional characteristics.
- The proposal is for a Ground Water Replenishment Scheme project, which comprises an underground pipeline which will run from Beenup wastewater treatment plant to a ground water injection site in the City of Wanneroo. The proposed pipe will traverse the northern portion of Perry’s Paddock, Cottage and Stables, and travel near P2674 Buckingham House, which is on the State Register of Heritage Places.
- On the basis that the proposed pipe will follow an existing sewer main, it is unlikely that it will impact negatively on the archaeological significance of the place.

Comments

1. If the proposed route of the pipe changes, the proposal will need to be reconsidered by the State Heritage Office.
2. If archaeological artefacts are discovered, work is to stop, and the State Heritage Office is to be contacted for advice.
3. Disturbed landscape to be returned to condition prior to excavation, or as close as is possible.
Please note that these comments are provided to assist the owner in its application to the decision-making authority and are not provided under the provisions of Section 11 of the Heritage of Western Australia Act 1990. These comments do not replace the need for any required approvals from the decision-making authority.

Should you have any queries regarding this advice please contact Janine Symons at janine.symons@stateheritage.wa.gov.au or on 6552 4167.

Yours sincerely

[Signature]

Harriet Wyatt
A/DIRECTOR DEVELOPMENT & INCENTIVES
Appendix M

DoW Letter – Perth Groundwater Replenishment Scheme
Stage 2 – Aquifer Risk Assessment Evaluation, October 2016
Mrs Sue Murphy  
Chief Executive Officer  
Water Corporation  
PO Box 100  
LEEDERVILLE WA 6902

ATTENTION: Vanessa Moscovis

Dear Sue

**PERTH GROUNDWATER REPLENISHMENT SCHEME, STAGE 2 – AQUIFER RISK ASSESSMENT EVALUATION, OCTOBER 2016**

The Department of Water understands that the Water Corporation intends to refer the above proposal to recharge up to 28GL/yr of highly treated recycled water into the confined Leederville and Yarragadee aquifers to the Office of the Environmental Protection Authority in accordance with Section 38 of the *Environmental Protection Act (1986)*.

The purpose of this letter is to confirm the Department’s position regarding the scheme, and to advise the adequacy of the assessment information provided by the Water Corporation. The Department’s key consideration in this regard is to ensure that the identified environmental and resource values of the aquifers are maintained.

Consistent with the *Groundwater Regulatory Framework (December 2012)*, the Department has assisted the Water Corporation to establish the environmental values and conduct the risk assessment for the expanded groundwater replenishment scheme.

The Department is satisfied the proposed water recycling and recharge management systems and procedures will adequately protect the agreed environmental values of the target aquifers.

Furthermore, the Department is able to effectively manage groundwater resource impacts and abstraction under the water licensing provisions of the *Rights in Water and Irrigation Act 1914*.

If you have any enquiries regarding this matter please John Connolly on telephone 6364 6640.

Yours sincerely

Mike Rowe  
DIRECTOR GENERAL

18 October 2016
Appendix N

DoH Letter
Your ref: CMS16292  
Our ref: F-AA-22477/02  
Enquiries: Natalia Shishkina (9388 4938)

Mr Anthony Sutton  
Director  
Assessment and Compliance Division  
Environmental Protection Authority  
Locked Bag 10  
East Perth WA 6892

Dear Mr Sutton

WATER CORPORATION - PERTH GROUNDWATER REPLENISHMENT SCHEME STAGE 2 (GWRS)

I refer to your letter of 5 December 2016 seeking the Department of Health (DOH) comments on the Stage 2 of the Perth GWRS which involves the duplication of the existing Advanced Water Recycling Plant (AWRP) at the Beenyup facility, resulting in a total recharge to the Leederville and Yarragadee aquifers of approximately 28 GL of recycled water per annum.

I understand that the proposal has been referred to the Environment Protection Authority (EPA) by the Water Corporation (WC) under section 38 of the Environment Protection Act 1986.

The DOH is an approval authority for the construction and installation of the Beenyup AWRP infrastructure for both stage 1 and 2 as per the Health Act 1911. The DOH approval to operate the AWRP will be also required in accordance with the Interagency Working Group - Groundwater Replenishment Regulatory Framework (December 2012).

The DOH has no objections to the GWRS Stage 2 subject to the approval packages being submitted by the WC to this Department for review and approval to demonstrate that the AWRP is operating as designed and the water quality meets drinking water standards prior to injection into the Leederville and Yarragadee aquifers.

I trust this information is of assistance to you. Should you wish to discuss any of the above matters, please do not hesitate to contact the Water Unit of the Health Department on (08) 9388 4999.

Yours sincerely,

[Signature]

Richard Theobald  
Manager Water Unit  
ENVIRONMENTAL HEALTH DIRECTORATE  
PUBLIC HEALTH DIVISION  
6 January 2017  
W:\Public Health\EHD\Water Unit\WASTEWATER  
MANAGEMENT\RECYCLING\Publications\Projects\GGRS\Typing\GWRS EPA Letter 170106.docx
Appendix O

Water Corporation
PO Box 100
LEEDERVILLE WA 6902
ATTENTION: Deanne McDonald

Dear Deanne,

_Perth Groundwater Replenishment Scheme - Stage 2 Hydrogeological Report modified, June 2016_

The Department of Water has reviewed the Water Corporation’s _Perth Groundwater Replenishment Scheme - Stage 2 Hydrogeological Report modified, June 2016_ (GWRS Stage 2) received on 4 July 2016.

The Department confirms that it is satisfied with the technical content of the report for proposed off-site locations of new recharge and abstraction bores for the reinjection and recovery of up to 28 Gigalitres from the Leederville and Yarragadee aquifers based on Perth Regional Aquifer Modelling System (PRAMS) scenarios.

I also confirm the Department’s in-principle support for a 1:1 allocation ratio for GWRS Stage 2 based on the recharge and recovery scenario identified through the above mentioned technical report and acknowledge that Water Corporation will use this confirmation to initiate the project.

However, while recognising the preliminary scientific studies undertaken to date, it is important to note that further technical work may be necessary to allow the Department to complete an assessment of future applications for a 5C water licence, this may include but are not limited to the following:

- A hydrogeological report with the additional scientific information for precise aquifer characteristics and management at the selected locations.
- Preparation and submission of an enhanced IWSS monitoring program that includes GWRS Stage 2.
- Revisions to the IWSS Water Resource Management Operating Strategy where appropriate (eg. Revision to the IWSS bore abstraction plan to include GWRS Stage 2 recharge bores and water accounting).

It should be noted that when GWRS Stage 2 is commissioned both the recharge and recovery of groundwater will be re-evaluated each year consistent with requirements of the IWSS Water Resource Management Operation Strategy. A yearly review is essential as it will allow for an adaptive management approach that considers IWSS system constraints, adjustments to volumes and pattern of abstraction to limit impacts on environmentally sensitive areas and other users. This evaluation will be part of the joint annual review of the IWSS bore abstraction plan.
This evaluation will be part of the joint annual review of the IWSS bore abstraction plan.

GWRS Stage 2 will also need to be included in the triennial IWSS Water Monitoring Reviews to evaluate performance against the modelled scenarios presented in the report using latest monitoring data. Re-evaluation builds our understanding of the groundwater resources whilst aiding refinement and optimisation of the IWSS recharge and abstraction plan to mitigate potential impacts to environmentally sensitive areas and other users.

I look forward to continued collaboration to ensure groundwater remains a viable, sustainable part of the IWSS supply mix and I would also like to confirm that the Department is fully committed towards meeting its obligations of the Interagency Technical Working Group as part of developing the regulatory approvals pathway for Stage 2 GWRS.

Should you have any further enquires on this matter please contact Matt Viskovich on telephone 6364 6869.

Yours sincerely

Paul Brown
Executive Director, Regional Delivery & Regulation
13 July 2016
Appendix P

Vegetation Associations within the Proposed Development Envelope – 360 Environmental
<table>
<thead>
<tr>
<th>Vegetation Association Code</th>
<th>Description</th>
<th>Area within the Proposed Development Envelope (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Af</td>
<td>Allocasuarina fraseriana</td>
<td>0.005</td>
</tr>
<tr>
<td>Ba</td>
<td>Banksia attenuata</td>
<td>0.007</td>
</tr>
<tr>
<td>BmJf</td>
<td>Banksia menziesii over Jacksonia furcellata and Thysanotus dichotomus.</td>
<td>0.002</td>
</tr>
<tr>
<td>Cc</td>
<td>Corymbia calophylla</td>
<td>0.090</td>
</tr>
<tr>
<td>CcEmBa</td>
<td>Woodland of Corymbia calophylla, Eucalyptus marginata, Banksia attenuata, Banksia menziesii and Allocasuarina fraseriana over Hibbertia hypericoides, Xanthorrhoea preissii, Macrozamia riedlei, Mesomelaena pseudostygia, Jacksonia sternbergiana, Jacksonia furcellata, Hibbertia racemosa and Desmocladus flexuosus.</td>
<td>0.470</td>
</tr>
<tr>
<td>Eg</td>
<td>Eucalyptus gomphocephala</td>
<td>0.059</td>
</tr>
<tr>
<td>EgEt</td>
<td>Woodland of Eucalyptus gomphocephala, Eucalyptus todtiana, Eucalyptus calophylla, Non-endemic Eucalyptus sp. and Banksia over Hardenbergia comptoniana and introduced species.</td>
<td>0.071</td>
</tr>
<tr>
<td>EgPe</td>
<td>Eucalyptus gomphocephala over Pteridium esculentum.</td>
<td>0.017</td>
</tr>
<tr>
<td>Em</td>
<td>Eucalyptus marginata</td>
<td>0.006</td>
</tr>
<tr>
<td>EmAf</td>
<td>Low Woodland of Eucalyptus marginata, Allocasuarina fraseriana, Banksia attenuata, Banksia prionotes over Xanthorrhoea preissii, Macrozamia riedlei, Hibbertia hypericoides and *Ehrharta calycina.</td>
<td>0.072</td>
</tr>
<tr>
<td>EmJf</td>
<td>Eucalyptus marginata over Jacksonia furcellata and Macrozamia riedlei.</td>
<td>0.006</td>
</tr>
<tr>
<td>Er</td>
<td>Eucalyptus rudis</td>
<td>0.032</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>Value</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>ErG</td>
<td><em>Eucalyptus rudis</em> over garden species.</td>
<td>0.003</td>
</tr>
<tr>
<td>G</td>
<td><em>Garden/non-endemic species</em></td>
<td>0.461</td>
</tr>
<tr>
<td>Jf</td>
<td><em>Jacksonia furcellata</em></td>
<td>0.017</td>
</tr>
<tr>
<td>Mr</td>
<td><em>Melaleuca raphiophylla</em> isolated trees.</td>
<td>0.036</td>
</tr>
<tr>
<td>MrLI</td>
<td>Low woodland of <em>Melaleuca raphiophylla</em> and <em>Eucalyptus rudis</em> over <em>Baumea articulata</em> and <em>Lepidosperma longitudinale</em>.</td>
<td>0.063</td>
</tr>
<tr>
<td>Mrpe</td>
<td>Low woodland of <em>Melaleuca raphiophylla</em> over <em>Pteridium esculentum, Acacia saligna</em> and <em>Acacia rostellifera</em>.</td>
<td>0.422</td>
</tr>
<tr>
<td>PP</td>
<td><em>Pinus pinaster</em></td>
<td>0.2</td>
</tr>
<tr>
<td>Rehab</td>
<td>Areas of rehabilitation/revegetation.</td>
<td>0.323</td>
</tr>
<tr>
<td>To</td>
<td><em>Typha orientalis</em></td>
<td>0.385</td>
</tr>
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