Government of **Western Australia**
Department of **Environment Regulation**

Decision Document

Environmental Protection Act 1986, Part V

Proponent: Water Corporation

Works Approval: W5805/2015/1

Registered office: 629 Newcastle Street
Leederville WA 6007

Premises address: Onslow Water Infrastructure Upgrade Project
Lot 556 on Plan 74894 within coordinates 301622E 7590552N, 302122E 7590552N, 302122E 7590244N, 301622 7590244, Lot 557 on Plan 74894 within coordinates 301622E 7590147N, 301622E 7590244N, 302122E 7590244N, 302122E 7590147N, Lot 561 on Plan 71346 within coordinates, 300941E 7590244N, 301622E 7590244N, 301622E 7590147N, 300925E 7590144N, 293564E 7592581N, 293375E 7592749N, Lot 519 on Plan 69198 within coordinates 300925E 7590144N, 302266E 7590147N, 302315E 7590024N, 302273E 7589994N, 300900E 7589994N, 292944 7592628, 292309E 7593953N, 291521E 7594708N, 291735E 7594711N, 292432E 7594042N, 292498E 7593904N, 292500E 7593766N, 292565E 7593767N, 293052E 7592751N.
ONSLOW WA 6710

Issue date: Thursday, 22 March 2017

Commencement date: Monday, 27 March 2017

Expiry date: Thursday, 26 March 2020

Decision

Based on the assessment detailed in this document the Delegated Officer, has decided to issue Works Approval. The Delegated Officer considers that in reaching this decision, all relevant considerations and legal requirements have been taken into account and that the Works Approval and its conditions will ensure that an appropriate level of environmental protection is provided.

Decision Document prepared by: Chris Slavin
Licensing Officer

Decision Document authorised by: Steve Checker
Delegated Officer

Contents

1 Purpose of this Document

This decision document explains how DER has assessed and determined the application and provides a record of DER's decision-making process and how relevant factors have been taken into account. Stakeholders should note that this document is limited to DER's assessment and decision making under Part V of the *Environmental Protection Act 1986.* Other approvals may be required for the proposal, and it is the proponent's responsibility to ensure they have all relevant approvals for their Premises.

2 Administrative summary

Administrative details		
Application type	Works Approval ☒ New Licence ☐ Licence amendment ☐ Works Approval amendment ☐	
Activities that cause the premises to become prescribed premises	**Category number(s)**	**Assessed design capacity**
	85B	0.74 gigalitres per annual period
Application verified Application fee paid	Date: 30/1/2015 Date: 16/2/2015	
Works Approval has been complied with Compliance Certificate received	Yes☐ No☐ N/A☒ Yes☐ No☐ N/A☒	
Commercial-in-confidence claim	Yes☐ No☒	
Commercial-in-confidence claim outcome		
Is the proposal a Major Resource Project?	Yes☒ No☐	
Was the proposal referred to the Environmental Protection Authority (EPA) under Part IV of the *Environmental Protection Act 1986*?	Yes☒ No☐	Referral decision No: Managed under Part V ☒ Assessed under Part IV ☐
Is the proposal subject to Ministerial Conditions?	Yes☐ No☒	Ministerial statement No: EPA Report No:
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the *Environmental Protection Act 1986*)?	Yes☐ No☒ Department of Water consulted Yes ☐ No ☐	
Is the Premises within an Environmental Protection Policy (EPP) Area Yes☐ No☒ If Yes include details of which EPP(s) here.		
Is the Premises subject to any EPP requirements? Yes☐ No☒ If Yes, include details here, eg Site is subject to SO_2 requirements of Kwinana EPP.		

3 Executive summary of proposal and assessment

The application details the following: *'In September 2011, Chevron Australia Pty Ltd (Chevron Australia) and the Department of State Development (DSD) signed the Ashburton North State Development Agreement that requires Chevron Australia to develop and execute a project that increases potable water supply to Onslow by 2 Megalitres per day (ML/d). This project is referred to as the Onslow Water Infrastructure Upgrade Project (OWIUP). The Water Corporation (WC), as end owner and operator of the facilities, is the proponent for this Works Approval. Chevron Australia and its subcontractors will fund, design, procure, construct and commission all elements of the OWIUP prior to hand-over of the assets to the Water Corporation. The OWIUP will consist of:*

- *A desalination plant and associated infrastructure (Water Treatment Plant) capable of producing 2 ML/d of potable water on Lot 556 approximately 18 km from Onslow.*
  - *The Water Treatment Plant (WTP) will include deep groundwater bores, cooling towers, pre-treatment filtration system, high pressure membrane systems, a post-treatment system, storage tanks, power supply infrastructure, civil works, facilities for operating employees (e.g. office and car parking) and other associated infrastructure. Raw water will be sourced from the Birdrong Aquifer by securing rights to an existing bore (MDW4) that was constructed by and is currently licensed to BHP Billiton (BHPB) and drilling a secondary stand-by bore on Lot 556 or drilling two new bores on Lot 556 if the existing bore is not fit for use on the project.*
- *A site access road from the Wheatstone Access Road (PR-1) (Lot 519) to the desalination plant site on Lot 556 through Lot 557.*
- *A Residual Saline Stream (RSS) pipeline and associated infrastructure. The RSS pipeline will be reticulated from the desalination plant on Lot 556 to Quick Mud Creek (QMC), an ephemeral drainage channel located west of Lot 556 via Lots 557 and 561.*
    - *The RSS is a chemically concentrated osmotic waste stream from the desalination plant and will be removed through a disposal pipeline and head works into QMC. The disposal point into QMC will be located in Lot 561 north of the Wheatstone Access Road (PR-1).*
- *A ~16 km underground potable water transfer pipeline and associated infrastructure reticulated from the desalination plant on Lot 556 via Lots 557, 558 and the existing and proposed expanded Onslow Road Main Roads WA Reserve to the boundary of the Water Corporation's fenced compound on Lot 185.*

There are no Ramsar listed wetlands within 200km of the proposed facility. The closest wetland of importance as listed by the Department of the Environment Protected Matters Search Tool from any part of the Project Area is 'Exmouth Gulf East', over 25 km to the southwest. There are no occurrences of Threatened or Priority Ecological Communities within 35 km of the Project Area. The nearest ecological community of conservation significance is the Priority 1 Peedamulla (Cane River) Swamp Community located 50 km away. The former Mt Minnie lease hold will be vested to the Department of Parks and Wildlife as an addition to the existing Cane River Conservation Park in 2015 and is currently under that department's management. It is located approximately 10 km south of the Project Area. Ground water in the Onslow area can range from 0.5 – 10 metres below ground level (mbgl).HCE and QMC are both ephemeral'.

Potential emissions of significance from construction and commissioning of this proposal have been identified as discharges to surface water and fugitive emissions. Hooley Creek Estuary (HCE), downstream of QMC, has fringing areas of algal mats, mangroves and other Benthic Primary Producer Habitat (BPPH).

4 Decision table

The overarching legislative framework of this assessment is the Environmental Protection Act 1986 (EP Act) and the Environmental Protection Regulations 1987 (EP Regulations). DER Guidance Statements which inform the assessment in accordance with the legislation include:

- *Guidance Statement: Regulatory Principles (July 2015)*
- *Guidance Statement: Setting Conditions (October 2015)*
- *Guidance Statement: Land Use Planning (October 2015)*
- *Guidance Statement: Licence Duration (November 2015)*
- *Guidance Statement: Decision Making (February 2017)*
- *Guidance Statement: Risk Assessment (February 2017)*
- *Guidance Statement: Environmental Siting (November 2016)*

Where other references have been used in making the decision they are detailed in the decision document.

DECISION TABLE			
Works Approval / Licence section	**Condition number** **W = Works Approval** **L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
General conditions	W1.2.1 - W1.2.4	**Construction and Commissioning** Condition 1.2.1 and 1.2.2 within the works approval define the specifications for the infrastructure that is required to be constructed at the premises. The specifications are generally consistent with those proposed in the application. The risk assessment sections contained in the following sections of this document set out how the specification of infrastructure will mitigate risks to the environment and public health from emissions and discharges Condition 1.2.4 has been added to the Works Approval to ensure that Water Corps completes all phases of commissioning within the specified timeframe of six months.	*Guidance Statement: Regulatory Principles (July 2015)* *Guidance Statement: Setting Conditions (October 2015)* *Guidance Statement: Decision Making (February 2017)* *Guidance Statement: Risk Assessment (February 2017)*

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
Point source emissions to air including monitoring	W2	**Construction** There will be no point source emissions to air during construction. No specific conditions relating to point source emissions to air including monitoring are not required to be added to the Works Approval for construction. **Commissioning and Operation** <u>Emission Description</u> *Emission:* Methane venting from bore water production bores. The bore water does contain a quantity of gas which is readily apparent at the surface on the existing bore. The flow of gas in the water is consistent and in the form of slugs. A test undertaken by Golder Associates (2013), measured the presence of certain gases and reported a composition of: • 89 mole percent methane • 7.1 mole percent nitrogen • 3.9 mole percent carbon dioxide. The most meaningful assessment of the gas composition and quantity was obtained in 2014 by separating gas in a pipe section and measuring gas volume as a percentage of water processed (Golder Associates 2014b). The values used as a design basis are: • An average methane concentration in bore water of 120 g/m^3;and • A peak methane concentration in bore water of 192 g/m^3. *Impact:* Reduction in local air quality, below NEPM standard. Nearest sensitive receptor a private residence 10km away. Emissions assessment suggests emission will not cause a breach of NEPM ambient air standards *Controls:* Abatement and maintenance procedures will be in place during commissioning. <u>Risk Assessment</u>	General Provisions of the *Environmental Protection Act 1986* *Environmental Protection (Unauthorised Discharges)* 2004 *Guidance Statement: Regulatory Principles (July 2015)* *Guidance Statement: Setting Conditions (October 2015)* *Guidance Statement: Decision Making (February 2017)* *Guidance Statement: Risk Assessment (February 2017)*

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		Consequence: Slight *Likelihood*: Unlikely *Risk Rating:* Low <u>Regulatory Controls</u> Commissioning conditions requiring the commissioning stages and expected timescales for commissioning; expected emissions and discharges during commissioning and the environmental implications of the emissions; how emissions and discharges will be managed during commissioning; the monitoring that will be undertaken during the commissioning period; how accidents or malfunctions will be managed; start up and shut down procedures; and reporting proposals including accidents, malfunctions and reporting against the commissioning plan. <u>Residual Risk</u> *Consequence:* Slight *Likelihood*: Unlikely *Risk Rating:* Low	
Point source emissions to surface water including monitoring	W2	**Construction** There are no point source emissions to surface water expected during the construction of the WTP. No specified conditions relating to point source emissions to surface water including monitoring are required to be added to the Works Approval for construction. **Commissioning and Operation** DER's assessment and decision making are detailed in Appendix B.	General Provisions of the *Environmental Protection Act 1986* *Environmental Protection (Unauthorised Discharges)* 2004 *Guidance Statement: Regulatory Principles (July 2015)*

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			Guidance Statement: Setting Conditions (October 2015) *Guidance Statement: Decision Making (February 2017)* *Guidance Statement: Risk Assessment (February 2017)*
Point source emissions to groundwater including monitoring	W2	**Construction, Commissioning and Operation** There will be no point source emissions to groundwater during the construction, commissioning and operation of the WTP. No specified conditions relating to point source emissions to groundwater including monitoring are required to be added to the Works Approval. Shallow groundwater in the vicinity of the Project Area is typically hypersaline, with TDS mostly between 60 000 mg/L and 170 000 mg/L, although some thin lenses of brackish groundwater exist in rainfall recharge zones. This shallow groundwater usually ranges between surface level and two metres beneath the surface. In the deeper formations there are several confined aquifers, including the Windalia Radiolarite, Mungaroo Formation and the Birdrong Sandstone. The Birdrong Aquifer is a major regional groundwater resource for industrial quality water. The Birdrong Sandstone is predominately glauconitic sandstone with minor siltstone and conglomerate, and typically yields for production bores range from 500–4500 kL/day across the Carnarvon Basin.	General Provisions of the *Environmental Protection Act 1986* *Environmental Protection (Unauthorised Discharges)* 2004 *Guidance Statement: Regulatory Principles (July 2015)*
Fugitive emissions	W2	**Construction and Commissioning** Emission Description *Emission:* Potential dust emissions (PM_{10}) from site preparation works, vehicle movement, wind blowing over cleared ground etc. *Impact:* Reduced local air quality due to dust emissions.	General provisions of the *Environmental Protection Act 1986* *Guidance Statement:*

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Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		Controls: Contractor Environmental Management Plan will be finalised prior to construction and will contain a number of Company management measures. The EMP will that take into account relevant legislation, corporate requirements and Contractor environmental policy. For example, a number of management measures relevant to dust emissions are: • Use of in vehicle monitoring system to ensure compliance with speed limits • Journey Management Plans for non-routine use of road vehicle on unsealed surfaces to be a requirement of the Permit to Work system for operating in dust prone environments • The use of bus services for the daily transport of construction works • Contractor to ensure that material with the potential to cause dust emissions is permanently stabilised with rock armouring, geo-fabric or vegetation, if temporary stabilisation methods are impractical • Company approved dust suppression agents are to be applied on areas that are exposed and generating dust. <u>Risk Assessment</u> *Consequence:* Slight. *Likelihood*: Rare. *Risk Rating:* Low. <u>Regulatory Controls</u> There will be no specified conditions relating to fugitive emissions, which required to be added to the Works Approval. <u>Residual Risk</u> *Consequence:* Slight *Likelihood:* Rare	*Regulatory Principles (July 2015)* *Guidance Statement: Setting Conditions (October 2015)* *Guidance Statement: Decision Making (February 2017)* *Guidance Statement: Risk Assessment (February 2017)*

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		Risk rating: Low	
Noise	W2	**Construction, Commissioning and Operation** *Emission Description* *Emission:* Noise emissions from construction of WTP. Noise emissions were modelled for the adjacent Onslow Power Infrastructure Upgrade Project. The main source of noise emissions on the OWIUP are from pumps (Lot 556, Lot 185), two 15 kW cooling towers, conveyors, mixers and a scraper. The nearest sensitive noise receptors to the OWIUP are the ANSIA Industrial boundary (1.15 km) and the Wheatstone Accommodation Village (4 km). According to the Noise Regulations, the ANSIA is defined as Industrial and Utility premises, with a higher assigned noise level than the Wheatstone Accommodation village, which according to the regulations is defined as a Noise Sensitive Premise. *Impact:* Unacceptable noise emissions affecting environment, health and wellbeing of people at nearest sensitive receptor and adjacent industry. All receptors are far enough away from the OWIUP (10km) such that there will be no noise related impacts. *Controls:* WC has a statutory responsibility to comply with the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations). *Risk Assessment* *Consequence:* Minor *Likelihood:* Rare *Risk Rating:* Low *Regulatory Controls* No specific conditions to regulate noise emissions during construction and Commissioning from the Premises are considered necessary. The provisions of the Noise Regulations will apply. *Residual Risk*	General provisions of the *Environmental Protection Act 1986* *Environmental Protection (Noise) Regulations 1997* *Guidance Statement: Decision Making (February 2017)* *Guidance Statement: Risk Assessment (February 2017)*

DECISION TABLE			
Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		Consequence: Minor *Likelihood:* Rare *Risk rating:* Low	
Monitoring general	W3.1.1 – W3.1.5	**Construction and Commissioning** Monitoring will occur under condition 3.1.3 for the RSS and the Sea Water Reverse Osmosis (SWRO) Brine when it is discharged to QMC so there will be specific general monitoring conditions on the Works Approval to allow this monitoring. Please refer to appendix B for further detail regarding the SWRO.	*Guidance Statement: Regulatory Principles (July 2015)* *Guidance Statement: Setting Conditions (October 2015)*
Monitoring of inputs and outputs	W3	**Commissioning** Monitoring of the RSS discharged into QMC will be required during commission and is outlined in the Commissioning Plan. **Operation** A condition is proposed in the Licence to require monitoring of inputs and outputs to determine compliance with throughput limits and validate annual fee submissions.	*Guidance Statement: Regulatory Principles (July 2015)* *Guidance Statement: Setting Conditions (October 2015)*
Information	W4.1.1 – W4.1.5 W4.2.1	**Construction and Commissioning** Condition 4.1.1 has been included in the works approval which requires the occupier to submit a compliance document once construction works have been completed and prior to any operations commencing. Condition 4.1.2 has been included in the works approval to ensure the compliance document contains certification that all works have been undertaken that all works have been undertaken in accordance with the works approval and is required to be authorised by a representative of the occupier. This condition is also required in order for the occupier to provide further infrastructure specifications of the screens and stackers, which include details of dust suppression systems. These specifications are anticipated to be adopted as a regulatory control on the licence.	*Guidance Statement: Regulatory Principles (July 2015)* *Guidance Statement: Setting Conditions (October 2015)* *Guidance Statement: Decision Making (February 2017)* *Guidance Statement:*

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		Condition 4.1.3 has been added to the works approval, which requires the occupier to provide to DER a list of departures from Table 1.2.1. This will conditions allow for verification that all works have been constructed as authorised and assessed through the works approval process and have been constructed to reduce the impact of emissions and discharges from the premises. Condition 4.1.4, which requires the Works Approval holder to submit to the CEO within one month of the completion of commissioning the commissioning report. Condition 4.1.5 outlines the information required within the commissioning report. WC has requested that commissioning occur during the Works Approval. Condition 4.2.1 has been drafted onto the Works Approval, which requires the Works Approval holder to notify the CEO of the commencement of commissioning seven days prior to the start and seven days after completion. **Operation** Conditions are proposed to be included on the licence to: • set out the requirements for any records that are required under this licence, such as ensuring they are legible and retained for 6 years to facilitate the analysis and investigation of trends and incidents. • require the occupier to undertake an audit of their operations against the conditions of the licence and to report on this compliance in an Annual Audit Compliance Report (AACR). This condition assists DER in regulating the occupier's compliance with licence conditions and allows and opportunity for DER to review the occupier's environmental performance. • require a complaints management system to be implemented where the occupier can internally address any issues that arise from premises operations. This condition is required as per the risk assessments	*Risk Assessment (February 2017)*

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Works Approval / Licence section	**Condition number W = Works Approval L= Licence**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		conducted above for nuisance emissions. DER will review these complaints as reported in the Annual Environmental Report (AER) and will consider whether a reassessment of any regulatory controls is required to address any complaints. • require the licensee to submit an AER. The AER is required to include a summary of any complaints received. The AER is also required to provide results for the monitoring of inputs/output, monitoring of asbestos content of recycled products and a summary of malfunction of pollution control equipment or any environmental incidents. Data provided in the AER is used to assess compliance with the licence conditions and to monitor potential impacts from the operations at the Premises. • require the licensee to notify the CEO if there is a breach of any licence limit (i.e. processing limits). The notifications required under this condition gives DER appropriate notice of any environmental impacts at the premises so that DER can determine if any further action is required to address the incident.	
Works Approval Duration	N/A	The Delegated Officer has determined the construction and commissioning of the WTP will present a low environmental risk. Accordingly the Works Approval will be issued for three years.	*Guidance Statement: Licence Duration (November 2015)*

5 Advertisement and consultation table

Date	Event	Comments received/Notes	How comments were taken into consideration
23/02/2015	Application advertised in the West Australian	No comments received	N/A
23/02/2015	Application referred to the Shire of Ashburton	No comments received	N/A
23/02/2015	Application referred to the Department of Water	No comments received	N/A
06/07/2015	Application referred to Department of Health		
10/08/2015	Proponent sent a copy of draft instrument	Comments received on 2 November 2015 regarding 1: 1. Prescribed premises to limited to Lot 556 on Plan 74894 as this is where the plant will be located and discharge brine. 2. Condition 2.1.1 amended to state 'Brine produced from the Sea Water Reverse Osmosis (SWRO) plant within the adjacent Wheatstone Construction Village lease discharged into QMC only during construction, pre commissioning and commissioning period of the OWIUP'. 3. Condition 3.1.1 (a) and (b) amended to outline water and wastewater samples collected and persevered in accordance AS/NZS 5667.1 and AS/NZS 5667.10 4. Minor grammatical and technical amendments.	1. Prescribed premises to remain as is as construction works will be included on the lots listed. 2. Condition 2.1.1 amended in accordance with proponent's request. 3. Condition 3.1.5 includes footnotes to allow the *in situ* non-NATA accredited analysis of pH due to restricted holding times. 4. Changes made accordingly in accordance with proponent's request.

6 Risk Assessment

Note: This matrix is taken from the DER Corporate Policy Statement No. 07 - Operational Risk Management

Table 1: Emissions Risk 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

Appendix A Facility Description and Plant Processes

The OWIUP was referred to the Department of the Environment (DOTE) for assessment under the EPBC Act on the 15 September 2014. On 30 October 2014 DOTE determined that the proposed action is 'not a controlled action'. This means that the project can proceed without further assessment or approval under the EPBC Act.

This Project was referred to the Office of the Environmental Protection Authority (OEPA) under Section 38(1) of the *Environmental Protection Act 1986* (EP Act). The OEPA determined that the Project did not require an environmental impact assessment.
Appendix A of the OEPA Notice identified the following preliminary environmental factors relevant to the OWIUP.

- Inland Waters Environmental Quality
- Terrestrial Fauna.

Further information on these environmental factors and proposed management measures has been provided within the Works Approval application. This includes an Environmental Risks from Ionising Radiation in the Environment (ERICA) assessment to evaluate the potential risk of impacts to waterbirds in the permanently inundated stretches of QMC.

To satisfy the conditions of Part V of the EP Act and to allow for preliminary geotechnical investigations, a Native Vegetation Clearing Permit (NVCP) was applied for and granted on the 17 October 2013 by the Department of Environmental Regulation (DER). An additional NVCP will be required for the construction of the OWIUP and will be in place prior to any ground disturbance works.

As required by Section 11 of the *Rights in Water and Irrigation Act 1914* (WA) a Bed and Banks Permit will be in place prior to the commencement of project construction. This permit will be applied for through the Department of Water (DoW).

On 5 August 2014 the Water Corporation submitted an application to the DoW for a 5C licence to take 1.2 GL per annum of groundwater from the Birdrong Aquifer under Section 5C of the *Rights in Water and Irrigation Act 1914*. On 24 November 2014 the DoW sent a letter to the Water Corporation which confirmed a licence to take water from the Birdrong Aquifer for the OWIUP will be granted subject to Water Corporation confirming it has legal access to Lot 556 (refer to Section **Error! Reference source not found.**).

Chevron Australia's Engineer, Procure and Construct (EPC) contractor is responsible for obtaining a licence under section 26D of the *Rights in Water and Irrigation Act 1914* to construct either one or two new bores into the Birdrong Aquifer on Lot 556. The 26D and 5C licences will be in place as required prior to the commencement of any work or activity covered by the licence.

Figure 1 and 2 provide an overview of the location and layout of the OWIUP respectively.

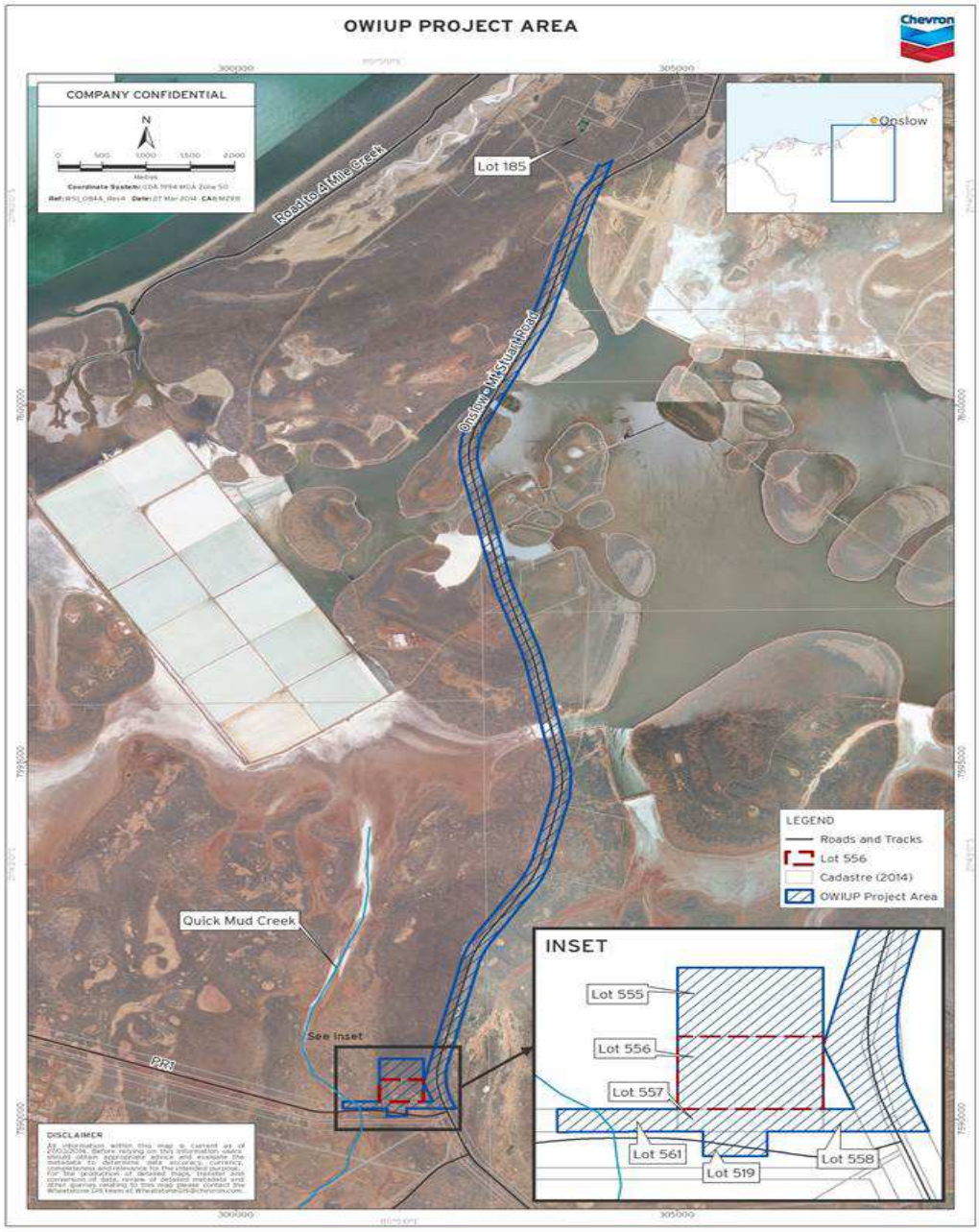

Figure 1: OWIUP location

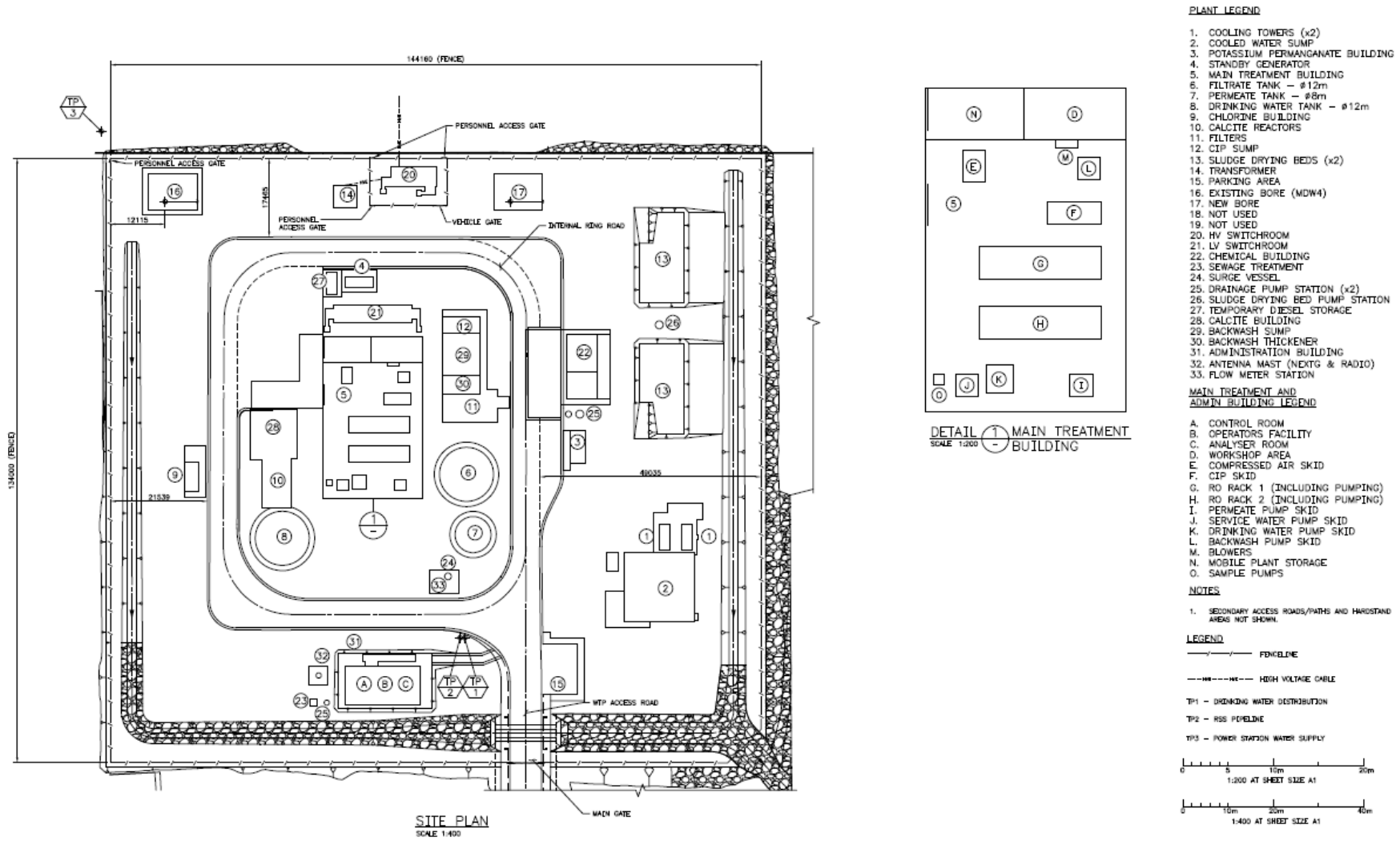

Figure 2: OWIUP layout plan

Figure 3 details the steps of treatment for the water treatment process at Lot 556. The proponent has provided a description of each step in the following sections noting that technical details may be subject to change during the EPC process or to allow adaptive management during the construction and commissioning periods. The proponent has committed that DER will be notified should these changes result in an increase to environmental risk or potential change to environmental impact.

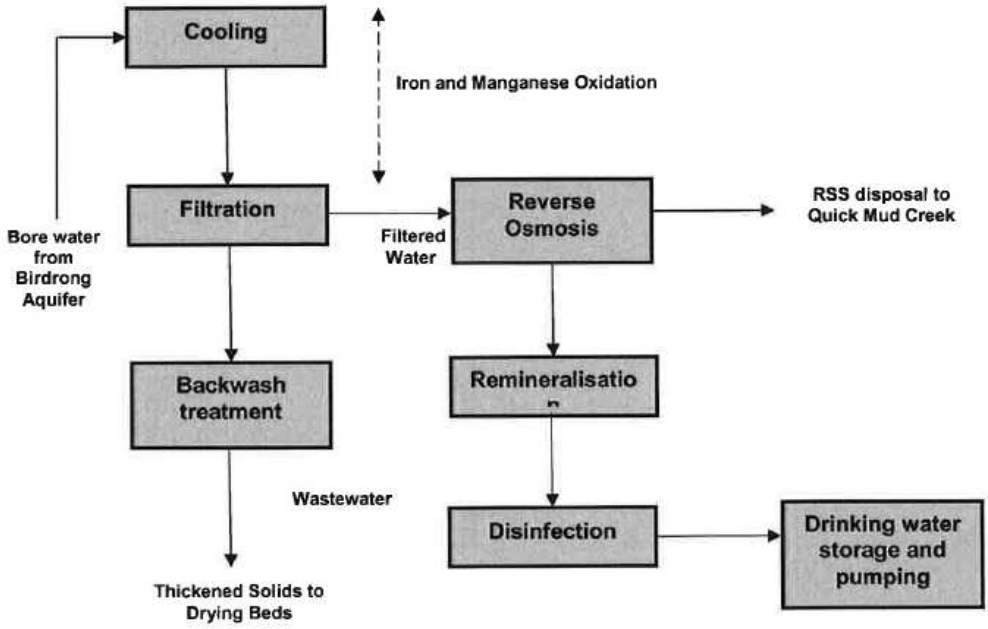

Figure 3: Treatment process

Raw water is provided by two production bores accessing the Birdrong Aquifer via submersible pumps installed in each bore. It is estimated that 3 ML/d of water is required from the aquifer to produce 2 ML/d of drinking water, which is the production capacity of the WTP. A flow meter will be installed after the cooling towers. Abstraction from the bores will be monitored at this point. Accurate measurement prior to the cooling towers is not possible due to the dual phase flow. A mathematical algorithm in the control system will calculate evaporation loss in the cooling towers and will be added to the measured flow to enable reporting of water abstraction. The water quality from the artesian aquifer was tested during a sampling program from May to September 2013 (Worley Parsons 2014). The average raw water quality results from the bore under low flow and high flow conditions are provided in Table 1. The design of the WTP was based on the ability to operate and produce drinking water of the required specifications over the range of raw water quality from the aquifer.

Table 1: Measured Average Raw Water Quality from the Birdrong Aquifer

Parameter	Unit	Low Production	High Production
pH		6.34	6.34
Temperature	°C	48	48
Colour	Hazen units	2	2
ORP	mV	< 0	< 0
Dissolved oxygen	mg/L	0.1	0.1
Total suspended solids	mg/L	2	2
Dissolved organic carbon	mg/L	1	1
Radon 222	Bq/L	2.8	2.8
Radium 226	Bq/L	4.1	3.6
Radium 228	Bq/L	6.8	6.1
Thorium 228	Bq/L	0.6	0.41
Organic nitrogen -N	mg/L	1	0.4
Ammonium	mg/L	8.6	9.6
Sodium	mg/L	4,323	5,100
Potassium	mg/L	140	190
Calcium	mg/L	320	350
Magnesium	mg/L	188	160
Barium	mg/L	2.5	2.6
Strontium	mg/L	8.2	8.9
Iron	mg/L	0.98	1.1
Manganese	mg/L	0.15	0.16
Chloride	mg/L	7,604	8,300
Bromide	mg/L	26	29
Iodide	mg/L	1.5	1.6
Sulphate	mg/L	5	5
Bicarbonate	mg/L	568	460
Fluoride	mg/L	1.0	0.97
Boron	mg/L	5	4
Silica	mg/L	24	23.0
Copper	mg/L	0.027	0.007
Lead	mg/L	0.001	<0.001
Nickel	mg/L	0.017	0.005
Zinc	mg/L	0.045	<0.005
Aluminium	mg/L	0.005	0.005
Total Dissolved Solids	mg/L	13,226	14,535

Cooling Towers

The temperature of the raw water from the Birdrong aquifer is around 48 ^{0}C and has to be cooled to a temperature acceptable for introduction into the RO system and to satisfy the Water Corporation's drinking water specification. The RO process requires a feed water temperature not exceeding 40 ^{0}C. In addition to reducing the water temperature, which is the prime requirement of the cooling system, other factors to be considered are:

- Increasing the dissolved oxygen concentration of the raw water;
- Stripping carbon dioxide from the raw water; and

- Stripping gases from the raw water.

A concrete sump will collect cooled water from the cooling towers. A recirculation pump provides operational flexibility to recirculate water back through the cooling tower if necessary. A sample of cooled water will be sent to a sample panel that monitors for a range of quality parameters.

Filtration

Pressure filters will be installed to remove particulates from the raw water and precipitate generated during the oxidation step. The filtration process consists of vertical pressure filters located outdoors and operating in parallel. Filtered water from each filter is collected in a manifold and transferred to the filtrate tank. The filters have to provide the required flow to the RO plant (2906 m^3/day) and in addition sufficient filtrate volume for the backwash operation. Filters require regular backwashing to maintain the filter bed in good condition and to remove the solids retained in the filter media. It has been assumed that the filters will be backwashed every 24 hours of operation. Around 50 m^3 of backwash water will be required from the filtration tank over a relatively short period and around 140 m^3 each day will report to the backwash tank. The filter media does not need to be replaced at frequent intervals. Annual media losses due to backwashing operation are generally estimated at 3% for the anthracite and 2% for the sand. Media removal is carried out manually using vacuum trucks and disposed of to an approved landfill facility.

Reverse Osmosis System

The Reverse Osmosis (RO) system is the principal technology in the overall desalination plant. The pre-treatment section of the plant is essentially conditioning the water so that it is suitable for feed to the RO system. The ionic composition of the bore water is provided in Table 2. Long term variation in aquifer water chemistry could result in a change in water salinity. The design and operation of the RO system should be able to accommodate a change in water salinity without adverse effect on permeate production and recovery.

Configuration

A simplified flow schematic for each RO system is shown in Figure 4. The Low Pressure (LP) booster pump is a fixed speed pump that provides a pressurised supply to the High Pressure (HP) pump. It is also used in the start-up sequence to spill filtrate to the RSS discharge until the pre-treatment system has reached steady state operation and is suitable for feeding to the RO membranes.

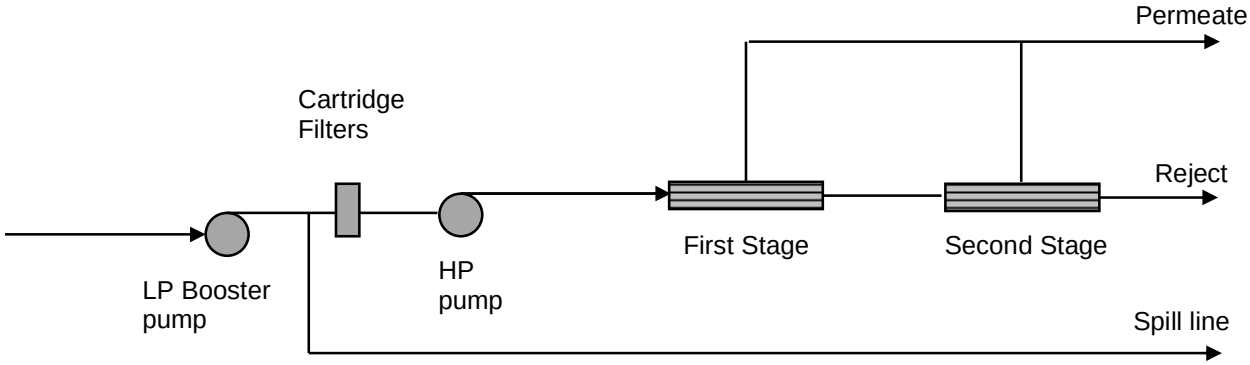

Figure 4: Schematic of RO System

The main focus areas in respect to drinking water quality are achieving:

- A total dissolved solids concentration after stabilisation of less than 500 mg/L;
- A boron concentration of less than 2 mg/L;

- A bromide concentration of less than 0.3 mg/L; and
- A radionuclide activity of less than 0.4 Bq/L.

The stabilisation system results in an increase in the permeate salinity of approximately 80 mg/L. Consequently the required total dissolved solids concentration of permeate from the RO system has to be less than 420 mg/L.

Permeate Quality

The permeate quality is dependent upon the feed water salinity and the water temperature. The permeate quality that is expected under the following simulated scenarios and is shown in Table 3:

- Case A with a water temperature of 34 °C and five year old membranes to give the highest permeate salinity
- Case B with a water temperature of 26 °C and three year old membranes to give the average permeate salinity
- Case C with a water temperature of 20 °C and new membranes to give the lowest permeate salinity.

Table 2: Predicted Permeate Quality with Current Feed Water Quality:

	Units	Permeate Quality		
		Case A	Case B	Case C
pH		5.3	5.2	5.1
Temperature	°C	34	26	20
Ammonium	mg/L	0.17	0.09	0.05
Sodium	mg/L	59	32	17
Potassium	mg/L	3.3	1.8	1.0
Calcium	mg/L	1.144	0.615	0.335
Magnesium	mg/L	0.53	0.3	0.16
Barium	mg/L	0.01	0.005	0.003
Strontium	mg/L	0.03	0.02	0.01
Chloride	mg/L	95	51	28
Bromide	mg/L	0.3	0.17	0.1
Sulphate	mg/L	0.1	0.05	0.03
Bicarbonate	mg/L	6.8	3.9	2.4
Carbon dioxide	mg/L	29	28	27
Fluoride	mg/L	0.02	0.01	0.005
Boron	mg/L	1.2	0.7	0.4

	Units	Permeate Quality		
		Case A	Case B	Case C
Silica	mg/L	0.6	0.3	0.18
Total	**mg/L**	**168**	**91**	**50**

Australian Drinking Water Guidelines (ADWG) quality water quality will be obtained under all environmental conditions.

Remineralisation

Remineralisation of the permeate stream is achieved by passing permeate through calcite contactors. The dissolution of calcium carbonate, in the form of calcite increases the water pH, hardness and alkalinity to achieve the desired water quality target. The water quality targets in respect to remineralisation are:

- Alkalinity greater than 50 mg/L as $CaCO_3$;
- pH between 7.5 and 8.0; and
- Langelier Saturation Index (LSI) between 0 and -0.5.

Disinfection

The chlorine dosing will be flow paced to the permeate stream. The residual chlorine will be measured by a chlorine analyser also part of the standard module. The control system will additionally make allowance for the chlorine demand for reaction with ammonium. The method of assessing the ammonium demand is based on the permeate conductivity. The chlorine dose rate has considered the concentration of ammonium in the permeate and the necessity to achieve breakpoint chlorination using a chlorine to ammonia mass ration of 10:1.
The chlorine dose rate includes the contribution of the chlorine demand of ammonia as well as the required set point free chlorine residual. The approximate usage of chlorine gas will be 7.4 kg/day at maximum dose rate.
Chlorine will be monitored at the following locations:

- Chlorine concentration at the outlet of the WTP
- Chlorine concentration at the Water Corporation tank site Lot 185.

A summary of the predicted annual inputs and outputs is provided within Table 3.

Table 3: Summary of the Predicted Annual Inputs and Outputs during the operation of the WTP:

Parameter	Annual Volume
Inputs	
Raw water	1.096 GL
Potassium permanganate	1570 kg
98% Sulphuric acid	15 450 L
Antiscalant	12 000 L
Polyelectrolyte	160 kg
Chlorine	2700 kg

Outputs	
Potable water	0.732 GL
RSS	0.320 GL
Methane gas	130 tonnes
Sludge	5840 kg

Appendix B

Point source emissions to surface water including monitoring

The RSS is a chemically concentrated osmotic waste stream from the desalination plant and will be removed through a disposal pipeline and head works into QMC. QMC is hypersaline with few ecological receptors. Hooley Creek Estuary (HCE), downstream of QMC, has fringing areas of algal mats, mangroves and other Benthic Primary Producer Habitat (BPPH). In-flow from QMC, supratidal flats and potentially the Ashburton River, combined with the tidal movement in the HCE, will distribute RSS constituents onto the supra-tidal flats or flush remobilised RSS out to sea. Assuming maximum plant production (2 ML/d potable water) for 365 days per year, approximately 320 000 m^3 of RSS will be discharged. This is around 880 m^3/day. Included in this figure are: the RO reject stream, a small contribution from the sludge drying beds underflow (2 m^3/day) and around 50 m^3 of spent RO cleaning chemicals.

An estimation of the RSS chemistry and constituent mass is provided in Table 1. The estimation is based on the lowest temperature (20°C) and a membrane age of zero years (i.e. start of production) to obtain the highest rejection of the membranes and therefore the worst RSS quality. Should efficiencies to the RO system be obtained, it is likely that this will lead to an increase in RSS concentrations and decrease in mass.

Table 2: Quantitative Assessment of RSS Composition

RSS Parameter	Concentration		Mass	
	Units	Value	Units	Value
Temperature	°C	20 - 34	-	-
pH		6 - 9	-	-
Dissolved Organic Carbon	mg/L	3.47	kg/year	1110.4
Anti-scalant	mg/L	56	kg/year	17 920
Radium 226	Bq/L	13.7	MBq/year	4384
Radium 228	Bq/L	22.7	MBq/year	7264
Thorium 228	Bq/L	2	MBq/year	640
Organic nitrogen-N	mg/L	3.47	kg/year	1110
Ammonium	mg/L	33.52	kg/year	10 727
Sodium	mg/L	17 838	kg/year	5 708 160
Potassium	mg/L	667	kg/year	213 440
Calcium	mg/L	1225	kg/year	392 000
Magnesium	mg/L	653	kg/year	208 960
Barium	mg/L	9.11	kg/year	2915
Strontium	mg/L	31.16	kg/year	9971.2
Chloride	mg/L	29 002.05	kg/year	9 280 656
Bromide	mg/L	101.20	kg/year	32 383

RSS Parameter	Concentration		Mass	
	Units	Value	Units	Value
Iodide	mg/L	5.60	kg/year	1792
Phosphate	mg/L	0.02	Kg/year	6.4
Sulphate	mg/L	181.95	kg/year	58 224
Bicarbonate as $CaCO_3$	mg/L	1940	kg/year	620 800
Fluoride	mg/L	3.31	kg/year	1059.2
Boron	mg/L	16.2	kg/year	5184
Silica as SiO_2	mg/L	80.09	kg/year	25 629
Copper	mg/L	0.09	kg/year	29
Lead	mg/L	0.003	Kg/year	1
Nickel	mg/L	0.057	kg/year	18.2
Aluminium	mg/L	0.02	kg/year	6.4
Total Dissolved Solids	mg/L	51 175.73	kg/year	16 376 234
Iron Suspended Solids	mg/L	0.44	kg/year	141
Manganese Suspended Solids	mg/L	0.1	kg/year	32
Inert Suspended Solids	mg/L	0.09	kg/year	29.0

Fresh water supply during the construction, pre-commissioning and commissioning phase will be sourced from the Sea Water Reverse Osmosis (SWRO) plant within the adjacent Wheatstone Construction Village (CV) lease. The CV is located 2km from the proposed plant, and as such noise, dust and odour are not expected to impact the CV. Brine produced from the SWRO plant will be stored at the existing CV storage ponds on the Wheatstone lease. Should the water level in the storage pond reach the freeboard trigger level, brine produced to supply potable water to the OWIUP will be trucked to a discharge point on QMC. The SWRO is not licensed by DER as the design capacity is less than 10GL/year.

The worst case scenario requires all brine produced to be discharged (approximately 11 KL per day) into QMC for the duration the OWIUP construction. It is expected approximately 5 ML of brine will be produced over 15 months. Brine is expected to pool in the hypersaline QMC bed, where there are few (if any) environmental receptors. Stream in-flow may remobilise RO brine or accumulated RO salts onto the supratidal flats, where again there are few receptors. Table 8 details the water quality for the brine produced from the SWRO.

Table 8: SWRO Brine Water Quality

Parameter	Unit	Upper Limit Recorded
pH	-	8.1
Salinity	mg/L	53 000
Turbidity	NTU	6.9
DO	mg/L	7.4
Fluoride	mg/L	1.2
Chlorine	mg/L	Below limit of reporting
Chloride	mg/L	31 000
Sulphate (SO4)	mg/L	4400
Hydrocarbons	mg/L	Below limit of reporting

Parameter	Unit	Upper Limit Recorded
Nitrate (NO2)	mg/L	Below limit of reporting
Nitrite (NOX)	mg/L	0.005
Ammonia (NH4)	mg/L	0.087
Total Nitrogen (TN)	mg/L	0.42
Filterable Reactive Phosphate (FRP)	mg/L	0.015
Total Phosphorous (TP)	mg/L	0.19
Aluminium (Al)	µg/L	190
Barium (Ba)	µg/L	21
Boron (Bo)	µg/L	10 000
Zinc (Zn)	µg/L	Below limit of reporting
Calcium (Ca)	mg/L	760
Magnesium (Mg)	mg/L	2400
Potassium (K)	mg/L	850
Silica (SiO2)	mg/L	1.7
Sodium (Na)	mg/L	1900

Two components of the RSS chemistry may potentially impact receptors downstream of QMC; Naturally Occurring Radioactive Material (NORMs) and nutrients (in the form of Nitrogen bearing compounds such as Ammonium). The composition of the RSS is displayed in Table .

Given the dynamic nature of the source-pathway-receptor relationship pertaining to RSS discharge into QMC and the subsequent potential for downstream impacts, RSS has been discussed in terms of annual mass balance, rather than temporal constituent concentrations. The ephemeral nature of QMC is manifest in the baseline conditions that vary immensely due to evapo-concentration and the extreme range of streamflow. Downstream receptors are well adapted to large variations in RSS constituent concentrations, but may be impacted by large accumulation of salts, metals or nutrients.

The RSS salt accumulation in QMC was modelled to occur over a maximum period of about two years during drought. Minerals and NORMs from the RSS remain associated with the salt layer in the QMC low flow channel. The environmental heads created by the salinity gradient in the underlying aquifers show an upwards vertical flow. In these conditions, the RSS would have limited interaction with the water table.

NORM and radiation issues are regulated by the Radiological Council of Western Australia, under the Water Corporations approved Radiation Management Plan and are not assessed or regulated under this approval.

Following evaluation of all non-NORM constituents in the RSS, only nitrogen (Total Nitrogen) was identified as Medium risk, elevated from Very Low or Low and as such representing a potential environmental factor for receiving environments in the HCE. The updated risk assessment demonstrated that potential impacts to receptors in the HCE are unlikely due to the dilution, attenuation and adsorption of accumulated nitrogen when mixing the QMC flow and Ashburton River in-flow.

The risk assessment identified that BPPH such as the fringing algal mats on the supra-tidal flats have the potential to be a net exporter of nitrogen to the HCE and other near-shore environments. The lack of natural eutrophication of near shore environments, demonstrates the adaptability of this habitat and the high levels of adsorption and dilution processes occurring naturally in the intertidal zone. The very high turbidity of the HCE further limits the possibility of eutrophication. Impacts to BPPH arising from the temporary nature of the RSS inputs into the HCE are therefore unlikely.

Emission Risk Assessment –Commissioning

Emission Description
Emission: RSS and SWRO Brine discharged to QMC during commissioning.
Impact: Contamination of surrounding local surface water quality and drainage systems. Potential impacts on ecology of surface water from the addition of nutrients and heavy metals.
Controls: The worst case scenario requires all SWRO Brine produced to be discharged approximately 11 KL per day) into QMC for the duration the OUIUP construction. It is expected approximately 5 ML of brine will be produced over 15 months. Emissions modelling provided by the proponent suggests emission will not cause a significant impact.
Brine produced from the SWRO plant will be stored at the existing CV storage ponds on the Wheatstone lease. Should the water level in the storage pond reach the freeboard trigger level, brine produced to supply potable water to the OUIUP will be trucked to a discharge point on QMC. The water shall be pumped directly from the truck through the flexible pipe and be discharged onto the existing rip rap. The SWRO brine water will be tested and monitored weekly by the SWRO plant operator located at the CV and test results made available for compliance reporting. When construction, pre-commissioning and commissioning is complete and water is no longer required the temporary discharge pipeline to QMC will be removed.

Risk Assessment
Consequence: Minor
Likelihood: Unlikely
Risk Rating: Moderate

Regulatory Controls
Commissioning conditions W1.2.3 and W1.2.4 requiring the commissioning be conducted according to the 'Commissioning and Performance Testing' section of the document titled "Onslow Water Infrastructure Upgrade (OWIUP) Works Approval Application Document No: 12074258 (15 April 2015)" and commissioning is to only occur for 6 months. Condition 4.1.3 requires the Works Approval Holder shall submit a commissioning report for the WTP, to the CEO within one month of the completion of commissioning. Condition 4.1.4 requires the report shall ensure the report includes; a summary of the monitoring results, a list of any original monitoring reports submitted to the Works Approval holder from third parties for the commissioning period, a summary of the environmental performance of the WTP as installed, against the design specification set out in the Works Approval application, a review of performance against the Works Approval conditions and where they have not been met, measures proposed to meet the design specification and/or Works Approval conditions, together with timescales for implementing the proposed measures.

The following monitoring under condition 3.1.5 is proposed for SWRO brine discharge to QMC during construction, pre-commissioning and commissioning:

- Discharge volumes and cumulative total volumes
- Salinity
- Turbidity
- Dissolved oxygen
- Hydrocarbons
- Selected metals such as but not exclusively aluminium, barium, boron, magnesium and zinc.
- Nutrients (Nitrogen, Phosphorus and related compounds).

Residual Risk
Consequence: Minor

Likelihood: Rare
Risk Rating: Low

Emission Risk Assessment – Operation

Emission Description

Emission: RSS discharged to QMC under normal operation.
Impact: Contamination of surrounding land and surface water drainage systems. Potential impacts on ecology of surface water from the addition of nutrients and heavy metals. Hooley Creek Estuary (HCE), downstream of QMC, has fringing areas of algal mats, mangroves and other Benthic Primary Producer Habitat (BPPH). Groundwater at the site can range from 0.5m – 2m below ground level.
Controls: During operation of the OWIUP, WC (as the proponent) have committed to undertaking surface water and groundwater monitoring. This will be conducted to validate the modelling that supports this Works Approval application. The aim of monitoring will be to establish whether the constituent parameters are on target to be within the annual mass balance threshold specified in Table 7, taking into account the differing RSS production rate at that particular time. In the event of RSS sampling not indicating compliance with predicated annual mass balance, discharge may be further diluted by Birdrong feed water. A number of water quality and environmental parameters will be monitored in QMC during operation including:

- Surface water flow rates
- Salinity
- Turbidity
- Selected metals such as but not exclusively aluminium, barium, copper, lead, nickel, strontium and zinc
- Nutrients (Nitrogen, Phosphorus and related compounds) [Mass balance per year]

A surface water flow gauge, installed to provide baseline data on QMC will provide continuous surface water monitoring. Monitoring of these above constituents is proposed by the proponent to occur in parallel with the monitoring of NORMs and at the same locations. Testing will also occur after rainfall of more than 20 mm in 48 hours or until it can be demonstrated that no significant ecological risk can be identified.
Water Corporation is currently in consultation with Onslow Salt Pty Ltd to define a detailed monitoring program to be implemented during operations. This monitoring program will be confirmed within a memorandum of understanding (MoU). This MoU will be submitted to the DER once sign off has been achieved.

Risk Assessment
Consequence: Minor
Likelihood: Possible
Risk Rating: Moderate

Regulatory Controls
The Licence will contain limits and/or targets for RSS quality. The Licence will also contain monitoring conditions for RSS to be sampled at regular intervals. Radium 226, Radium 228 and Thorium 228 will be monitored and regulated by the Radiological Council of Western Australia, as per the Works Approval Holder's Radiation Management Plan.

Residual Risk
Consequence: Minor
Likelihood: Unlikely
Risk Rating: Moderate