



2 Bulwer Street  
PERTH WA 6000  
T: (+61) 8 9227 2600  
F (+61) 8 9227 2699  
[www.auroraenvironmental.com.au](http://www.auroraenvironmental.com.au)

# Marbelup Pork Works Approval Application 71 Redmond South Road, Redmond WA

Prepared For: Marbelup Pork  
71 Redmond South Road  
REDMOND 6327

Report Number: AP2017-010

Report Version: V1

Report Date: 15 February 2018

## DISCLAIMER

This document has been produced in accordance with and subject to an agreement between Aurora Environmental ("**Aurora**") and the client for whom it has been prepared ("**Client**"). It is restricted to those issues that have been raised by the Client in its engagement of Aurora and prepared using the standard of skill and care ordinarily exercised by Environmental / Occupational Health and Safety consultants in the preparation of such documents.

Any person or organisation that relies on or uses the document for purposes or reasons other than those agreed by Aurora and the Client without first obtaining the prior written consent of Aurora, does so entirely at their own risk and should not alter their position or refrain from doing so in reliance of this document. Aurora denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be suffered as a consequence of relying on this document for any purpose other than that agreed by Aurora.

## QUALITY ASSURANCE

Aurora Environmental has implemented a comprehensive range of quality control measures on all aspects of the company's operation.

An internal quality review process has been applied to each project task undertaken by us. Each document is carefully reviewed and signed off by senior members of the consultancy team prior to issue to the client.

Document No: MPO2017-001\_LICE\_001\_KM\_V1

Report No: AP2017-010

Author: Kate McCormack  
Senior Environmental  
Engineer

15 February 2018

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Reviewed by: Noel Davies  
Principal

15 February 2018

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## DISTRIBUTION

NO. OF COPIES	REPORT FILE NAME	REPORT STATUS	DATE	PREPARED FOR	INITIALS
1	MPO2017-001_LICE_001_KM_V1	Final	15 February 2018	Marbelup Pork	KM
1	MPO2017-001_LICE_001_KM_V1	Final	15 February 2018	DWER	KM

## TABLE OF CONTENTS

<b>ATTACHMENTS</b>	<b>8</b>
<b>LIST OF ABBREVIATIONS</b>	<b>9</b>
<b>1 INTRODUCTION</b>	<b>10</b>
1.1 PURPOSE	10
1.2 LICENSEE AND OPERATOR OF PREMISE	10
1.3 LOCATION, TENURE, ZONING AND LAND USE	11
<b>2 MARBELUP PORK OPERATIONS</b>	<b>12</b>
2.1 STOCK NUMBER	12
2.2 WASTEWATER TREATMENT INFRASTRUCTURE	14
2.3 OPERATIONS	14
2.3.1 Water Usage	14
2.3.2 Wastewater Effluent	14
2.3.3 Disposal of Carcasses	14
<b>3 EXISTING ENVIRONMENT</b>	<b>15</b>
3.1 CLIMATE	15
3.2 TOPOGRAPHY	15
3.3 GEOLOGY, LANDFORM AND SOILS	15
3.3.1 Acid sulfate soils	17
3.4 HYDROLOGY AND WETLANDS	18
3.5 HYDROGEOLOGY	18
3.6 FLORA AND VEGETATION	20
3.7 FAUNA	20
3.8 INDIGENOUS HERITAGE	21
3.9 SURROUNDING LAND USE	21
<b>4 PROPOSED SITE UPGRADES</b>	<b>22</b>
4.1 NEW ANAEROBIC POND	22
4.1.1 Design	22

4.1.2	Materials	22
4.1.3	PigBal Modelling	23
4.2	TREATMENT SYSTEM CAPACITY	24
4.2.1	Pond Cover and Flare	26
4.2.2	Sludge Drying Area	26
4.3	TREATMENT SYSTEM COMPLIANCE	26
4.4	IRRIGATION AREA	27
4.4.1	Buffer Requirements	28
4.4.2	Soil Characteristics	29
4.4.3	Nutrient Loading	30
<b>5</b>	<b>ENVIRONMENTAL RISKS AND MANAGEMENT</b>	<b>34</b>
5.1	RISK ASSESSMENT	34
5.1	WASTEWATER EFFLUENT MANAGEMENT	39
5.1.1	Objectives	39
5.1.2	Applicable Standards and Guidelines	39
5.1.3	Potential Environmental Impacts	39
5.1.4	Management and Mitigation Strategies	39
5.1.5	Contingency Measures	39
5.1.6	Targets and Limits	39
5.1.7	Environmental Risk	40
5.2	SOLID WASTE MANAGEMENT	40
5.2.1	Objectives	40
5.2.2	Applicable Standards and Guidelines	40
5.2.3	Potential Environmental Impacts	40
5.2.4	Management and Mitigation Strategies	40
5.2.5	Contingency Measures	40
5.2.6	Targets and Limits	40
5.2.7	Environmental Risk	40
5.3	ODOUR MANAGEMENT	40
5.3.1	Objectives	40
5.3.2	Applicable Standards and Guidelines	41
5.3.3	Emission/Risk Event, Pathway and Receptor	41
5.3.4	Controls	44

5.3.5	Contingency Measures	44
5.3.6	Targets and Limits	44
5.3.7	Risk Rating Determination	44
5.3.8	Acceptability of Risk Event	45
5.4	<b>FIRE MANAGEMENT</b>	<b>45</b>
5.4.1	Objectives	45
5.4.2	Applicable Standards and Guidelines	45
5.4.3	Potential Environmental Impacts	45
5.4.4	Management and Mitigation Strategies	45
5.4.5	Contingency Measures	45
5.4.6	Targets and Limits	45
5.4.7	Environmental Risk	45
<b>6</b>	<b>CONSTRUCTION EMISSIONS RISK ASSESSMENT</b>	<b>46</b>
6.1.1	Emission/Risk Event, Pathway and Receptor	46
6.1.2	Controls	46
6.1.3	Risk Rating Determination	46
6.1.4	Acceptability of Risk Event	47
<b>7</b>	<b>ENVIRONMENTAL MONITORING AND REPORTING</b>	<b>48</b>
7.1	MONITORING	48
7.2	REPORTING	48
<b>8</b>	<b>REFERENCES</b>	<b>49</b>

**TABLES IN TEXT**

Table A. Stock Numbers

Table B. Wastewater Infrastructure

Table C. Soil Sampling Results

Table D. Indicative Irrigation Schedule for 24.1ha Irrigation Area

Table E. Wastewater Treatment System Evaluation

Table F. Buffer and Separation Distances from Reuse Areas (NEGP)

Table G. Phosphorus Capacity of the Soil

Table H. Wastewater Quality

Table I. Annual Nutrient Loads for Application of 5.6 ML/Year OF Treated Effluent

Table J. Soil and Receiving Environment Risk Categories

Table K. Nutrient Application Rates for Soil/Receiving Environment Risk Categories

Table L. Nutrient Export from Site

Table M. Target Nutrient Application Rates

Table N. Emissions and Discharges Risk Assessment

Table O. Level 1 Odour Assessment Calculation for Receptors

Table P. Environmental Monitoring Program

**FIGURES IN TEXT**

Figure A. Local Groundwater Quality

Figure B. Water Levels in Facultative Pond

## ATTACHMENTS

### LIST OF FIGURES

Figure 1. Regional Location

Figure 2. Operational Layout

Figure 3. Site Layout

Figure 4. Surrounding Land Use

### LIST OF APPENDICES

Appendix 1: Wind Roses

Appendix 2: EPBC Act Protected Matters Report

Appendix 3: PigBal Summary

Appendix 4: Water Balance Calculations

Appendix 5: DWER's *Guidance Statement: Risk Assessment*



## LIST OF ABBREVIATIONS

AHD	Australian Height Datum
BGL	Below ground level
BOD	Biochemical Oxygen Demand
°C	degrees Celsius
DER	Department of Environment Regulation
DM	Dry Mass
DoW	Department of Water
DWER	Department of Water and Environmental Regulation
ESA	Environmentally Sensitive Area
HDPE	High density polyethylene
kL	kilolitre
km	kilometre
m	metre
mg/L	milligrams per litre
mm	millimetre
NH <sub>x</sub> -N	Ammonical Nitrogen
NO <sub>x</sub> -N	Nitrous - Nitrogen
SPU	Standard pig unit
t	tonne
TDS	Total dissolved solids
TN	Total Nitrogen
TP	Total Phosphorus
TS	Total solids

## **1 INTRODUCTION**

Aurora Environmental (Aurora) was commissioned by Mr. John Bunn, owner of Marbelup Pork Pty Ltd to prepare a works approval application for the his piggery operations. The piggery is located at 71 Redmond South Road, Redmond (the 'site'), and approximately 20 kilometres (km) north of Albany, Western Australia (Figure 1).

The site operates under Licence L8809/2014/1 under Schedule 1 of the *Environmental Protection Regulations 1987*, prescribed as Category 2: Intensive Piggery - premises on which pigs are fed, watered and housed in pens.

Marbelup Pork has operated as a conventional piggery at the site since 1987, becoming licenced under the current licence in 2014. The current licence has an approved premises capacity of 1,000 animals at any one time.

### **1.1 PURPOSE**

The purpose of this works approval application is for the construction of a new covered anaerobic wastewater treatment pond, to increase the level of onsite wastewater retention and treatment. Following the construction of the works associated with this application, a compliance report will be submitted and a licence amendment application will be lodged to reflect the site improvements. During the licence amendment stage, the proponent would like to clarify the approved premise capacity to facilitate a change in operation to a 900 sow breeder facility, where weaners will be moved offsite at 3 weeks of age. A small number of gilts will be kept back each week as replacement stock.

The basis of this application, the design of the wastewater treatment system and water balance for the site is based on a 900 sow breeder production.

### **1.2 LICENSEE AND OPERATOR OF PREMISE**

The licensee and operator is John Charles Bunn. The contact details for John Bunn are listed below:

Contact person:

John Bunn

Proprietor

Email: marbelupork@gmail.com

Phone: 0498 453 053

Premises and Postal Address:

71 Redmond South Road

REDMOND, WA 6327

### **1.3 LOCATION, TENURE, ZONING AND LAND USE**

The site is located in the City of Albany on a 75 hectare land parcel located at 71 (Lot 3426) Redmond South Road, Redmond WA, in the City of Albany. Under the City of Albany's Local Planning Scheme (No. 1) the site is zoned as priority agriculture. The current land use is agriculture (intensive piggery). The site has a railway reserve to the north east and all other bounding properties are also zoned priority agriculture.

Planning approval for the construction of the new wastewater treatment pond will be submitted and progressed in parallel with this application.

## 2 MARBELUP PORK OPERATIONS

### 2.1 STOCK NUMBER

The existing and proposed stock numbers<sup>1</sup> that will be present in the piggery are listed in Table A. This number will fluctuate seasonally and may increase by between 2.5% and 5%, to the maximum numbers listed. For licencing purposes it should be assumed that the premises capacity is the maximum number of animals 979 (excluding suckers), and over a one year period the site will have a mean total number of animals of 954 (excluding suckers).

**TABLE A: STOCK NUMBERS**

PIG CLASS	SPU FACTOR <sup>2</sup>	2017 STOCK NUMBERS		900 SOW BREEDER AVERAGE NUMBERS		900 SOW BREEDER MAXIMUM STOCK (2.5 to 5% GREATER THAN AVERAGE STOCK)	
		NUMBER OF ANIMALS	SPU	NUMBER OF ANIMALS	SPU	NUMBER OF ANIMALS	SPU
Dry/Gestating Sows	1.600	133	213	751	1202	770	1232
Lactating Sows	2.500	26	65	149	373	153	382
Boars	1.600	9.7	15	20	32	21	33
Gilts	1.800	9.7	17	35	63	36	65
Suckers	0.1	277	28	1,581	158	1660	166
Weaners	0.51	208	106	0	0	0	0
Porkers	1.08	0	0	0	0	0	0
Growers	1.48	208	308	0	0	0	0
Finishers	1.73	408	706	0	0	0	0
<b>Site Total</b>		<b>1277</b>	<b>1458</b>	<b>2,535</b>	<b>1734</b>	<b>2639</b>	<b>1781</b>
<b>Number Pigs (excluding suckers)</b>		<b>1000</b>		<b>954</b>		<b>979</b>	

\*SPU rounded to closest whole number

<sup>1</sup> Generic SPU Factors are presented in NGEP (APL, 2010) however for consistency we have included the more specific (> three decimal points) numbers used in PigBal modelling (see Appendix 3). PigBal calculates the number of pigs of the various classes accommodated in the piggery based on the data entered into the 'Herd Input' sheet.



## 2.2 WASTEWATER TREATMENT INFRASTRUCTURE

The current and proposed piggery infrastructure is shown on Figure 2 and listed in Table B.

**TABLE B: WASTEWATER INFRASTRUCTURE**

Infrastructure	Size	Dimensions
Holding Sump – Concrete Lined		
Proposed Sludge Drying Pad	225m <sup>2</sup>	15 x 15m
Proposed Anaerobic Pond 1- which includes HDPE cover and liner, a flare and underground pipework / cables and in-situ sludge removal	2,362m <sup>3</sup> (including freeboard)	70m x 12m and 5m depth
Facultative Pond (clay lined)	8,555m <sup>3</sup> (including freeboard)	Circular with 68m Diameter and 2m depth
Irrigation Area	24.1ha	

## 2.3 OPERATIONS

### 2.3.1 Water Usage

Clean water is required for drinking, cooling and for cleaning the pens, laneways and other internal infrastructure. The sheds are flushed regularly with recycled effluent (daily to weekly) depending on manure accumulation. Water is sourced from a bore located on the site. An extraction licence is not required for groundwater bores in this area.

### 2.3.2 Wastewater Effluent

Existing sheds at the site use slatted floors and either a flushing or a pull plug system. Effluent (faeces, urine, spilt water and feed) falls through the slatted floors and is regularly flushed (daily to weekly depending on effluent load). Material discharged from the sheds enters a sump and is then pumped to the facultative wastewater treatment pond. This works approval application requests the construction of a covered anaerobic pond to increase the level of treatment at the site. The proposed wastewater treatment system is shown in Figure 2.

### 2.3.3 Disposal of Carcasses

Approximately 18.7 t per annum of dead pigs will require disposal at full production. Dead pigs will be removed and deposited directly into the dedicated burial pits. Carcasses will be covered daily to prevent vermin and odour and a minimum of 500mm of sand/clay will be placed as a cover when each burial pit is closed.

### **3 EXISTING ENVIRONMENT**

#### **3.1 CLIMATE**

The Albany area is described as having a Mediterranean climate, characterised by hot dry summers and mild wet winters. Climate data has been sourced from the Bureau of Meteorology averages for the Albany Airport station (Station number 9741, located 10.5 km south east from the premises) for the period 1965 to 2014 (BOM, 2018). Although the long term averages for this site do not include the period since 2014, the proximity of the station to the site suggests that the data is the most applicable.

The mean annual maximum and minimum temperatures for the Albany Airport Weather Station are 20.3°C and 10.6°C, respectively. The highest temperatures are usually experienced in February, when the mean monthly maximum temperature is 24.9°C and the mean monthly minimum temperature is 14.5°C. Minimum temperatures occur in July, when the mean monthly maximum and minimum temperatures are 15.8°C and 7.5°C, respectively.

Rainfall in the area is seasonal and is generally confined to the winter months (May to August). Mean monthly rainfall is highest in July at 119 mm, with an average of 11 rain days. The lowest mean monthly rainfall is 22.3 mm in February, with an average of 4 rain days. The average annual rainfall is 798 mm, with an average of 83 rain days per year.

Winds in the area during the warmer months are typically characterised by easterly breezes during the morning followed by westerly to south-westerly breezes during the afternoon/evening. During the cooler months (May to August) winds are typically from the north/northwest during the morning, swinging to the west/northwest in the afternoon. Wind roses contained in Appendix 1 show the wind directions for February (representing the months from September to April), June (representing the months from May to August) and annually.

#### **3.2 TOPOGRAPHY**

The site elevation ranges between 85 metres Australian Height Datum (mAHD) and 95mAHD (Figure 3). The piggery is located at 90mAHD in the southern portion of the site. The topography grades offsite down to 85mAHD on the boundary adjoining the railway line to the east, and slopes down to 70mAHD at the Marbelup Brook located approximately 430m to the south of the wastewater treatment pond (Figure 3).

#### **3.3 GEOLOGY, LANDFORM AND SOILS**

The 1:250,000 Geology Mosaic of Western Australia (GSWA, 2016) indicates the majority of the premises is underlain by Sands (Czs). A portion in the northwest corner of the site is Alluvium (Cza) (Figure 4). These geological units are described as:

- Sand (Czs) – pale grey sand, fine to coarse-grained, angular to sub angular quartz, loose, moderately sorted, occasional pebbles of laterite.
- Alluvium (Cza) – white sand, medium to coarse-grained, sub angular quartz.

The premises are located in the Albany Sandplain Soil Landscape Zone described as a gently undulating plain dissected by a number of short rivers flowing south. Eocene marine sediments overlie Proterozoic granitic and metamorphic rocks. Soils are sandy duplex soils, often alkaline and sodic, with some sands and gravels (DPIRD, 2017).

Five soil samples (S1 to S5) were collected from the site in November 2017 at the locations shown in Figure 2. Topsoil samples were collected from the surface (0-100mm depth) and subsoil samples were collected from 400 to 500mm below the natural ground surface. Results of the sampling are summarised in Table C.

**TABLE C: SOIL SAMPLING RESULTS**

SITE	DEPTH	pH (CaCl2)	ECe	NOx- N	NH4-N	Colwell. P	Colwell K	PBI
	m		dS/m	mg/kg	mg/kg	mg/kg	mg/kg	
<b>S1</b>	0 to 0.1	5.6	0.051	2	8	24	158	119.9
	0.4 to 0.5	5.3	0.025	1	1	<2	99	43.4
<b>S2</b>	0 to 0.1	4.8	0.026	2	5	12	68	23.6
	0.4 to 0.5	4.8	0.014	2	1	8	36	163.8
<b>S3</b>	0 to 0.1	5.1	0.034	2	11	15	218	195.7
	0.4 to 0.5	5.5	0.021	<1	1	<2	95	252.7
<b>S4</b>	0 to 0.1	5.7	0.073	12	6	168	334	133.3
	0.4 to 0.5	5.8	0.023	<1	1	3	27	254.4
<b>S5</b>	0 to 0.1	5.2	0.077	2	14	204	263	97.3
	0.4 to 0.5	5.8	0.023	<1	1	4	44	136.9

Key findings from that soil sampling results include:

- pH across the site is acidic which is typical of soils in the region.
- Soil salinity is low in all sample results
- Nitrate nitrogen levels are very low in all soil samples, with the highest concentration of 12mg/kg found in the surface sample at S4.
- Ammonical nitrogen levels in all soil samples are very low, with the highest result of 14mg/kg found in the surface sample at S5.
- Colwell P results are low in all subsoil samples. The results of the surface samples vary across the site, with medium low results in S1, S2 and S3 and high concentrations of TP in the surface samples of S4 and S5. The reason for the elevation in the phosphorus at these sites is not



known, but is likely to be a results of the addition of nutrients through the form of manure and/or sludge over the life of the site.

- Colwell K results show high concentrations in the surface samples of S4 and S5, correlating with the high Colwell P results.
- PBI results range from low to medium across the site, indicating a good capacity for the soils to retain phosphorus. This can be seen in the sample results from S4 and S5 which show a high Colwell-P in the surface layer and low levels in the subsoil sample. This suggests that the nutrients are being bound in the soil and are not leaching through the soil profile.

It should be noted that the low levels of soil nitrogen found over the site are likely to inhibit the growth of effective pasture and crops on the premise without the application of additional nutrients.

Plate 1 shows the soil profile at S4 which was fairly typical of conditions across the site, showing a sandy grey topsoil layer of approximately 100mm depth, underlain by sandy gravel. The depth of vegetation roots should be noted suggesting removal of nutrients well into the soil profile.

**Plate 1: Typical Soil Profile (S4)**



### 3.3.1 Acid Sulfate Soils

A search of Australian Soil Resource Information System (ASIRS, 2018) was undertaken to determine the risk of ASS. Based on the National ASS Atlas there is a low probability of ASS occurring on the premises.

### 3.4 HYDROLOGY AND WETLANDS

The Department of Water and Environmental Regulation (DWER) Water Register (accessed 5 February 2018) indicates the piggery is located in the Denmark surface water area, and the Marbelup Brook subarea. No rivers or tributaries transverse the site, the nearest river, the Marbelup Brook, is located approximately 350 m to the west and 430m to the south of the wastewater treatment pond (Figure 4).

The Marbellup Brook Catchment Area has been recognised as a potential future drinking water supply for the City of Albany. The premises are located within the Marbellup Brook Catchment Area gazetted under the *Country Areas Water Supply Act 1947* on 21 December 2007. The proclaimed Marbellup Brook Catchment Area is also considered a Public Drinking Water Source Special Control Area under the City of Albany Local Planning Scheme No. 1.

The DWER prepared the *Marbellup Brook Catchment Area Drinking Water Source Protection Plan* (the 'Plan') in 2007 (DoW, 2007) to report on the activities and risks to water quality within the Marbellup Brook Catchment Area. The piggery was identified in the Plan as a pre-existing approved use with potential risks to water quality identified from pathogens, nutrients, pesticides, hydrocarbons and chemicals. Improvements to the onsite treatment of wastewater will be beneficial in reducing the potential environmental impacts from the piggery on the local catchment.

A review of the Environmental Planning Tool (WALGA, 2018) and NationalMap (2018) indicated no significant wetlands are located on the premises.

### 3.5 HYDROGEOLOGY

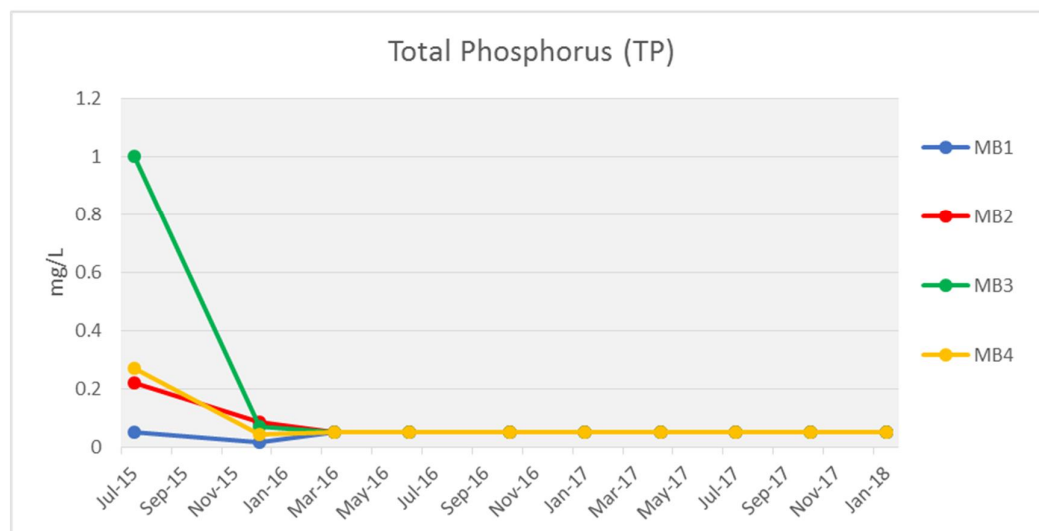
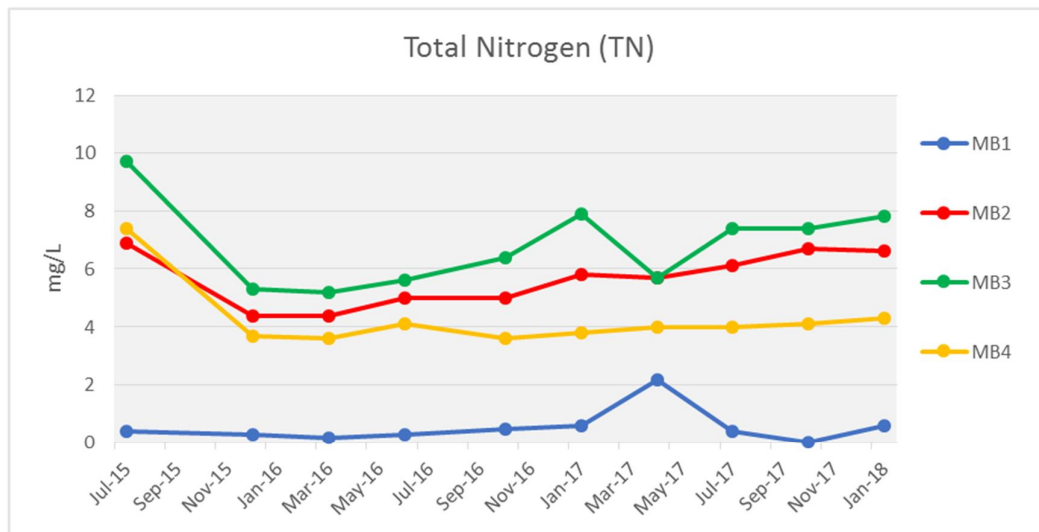
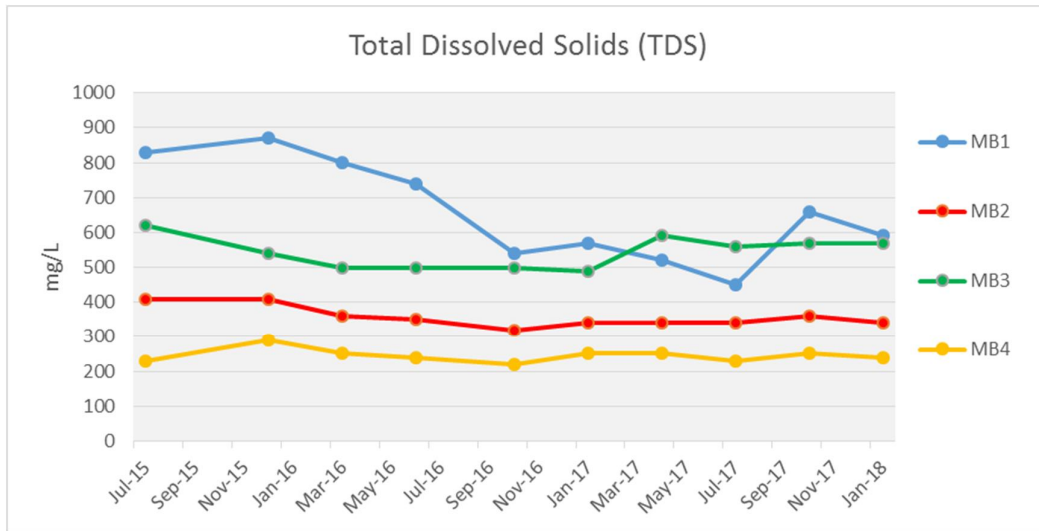
A search of the Environmental Planning Tool (WALGA, 2018) indicates the local groundwater aquifer is hosted in fractured and weathered rocks of low permeability. The piggery is located in the Karri groundwater area, and the Marbelup Brook subarea.

A search of the Water Information Reporting database (<http://wir.water.wa.gov.au/Pages/Water-Information-Reporting.aspx>) indicates eight groundwater/surface water sites are registered within 1 km of the premises. No information on water levels or quality was available for the listed sites.

Four groundwater bores (MB1 to MB4) are present on the site, with samples collected quarterly as a requirement of the current licence (Figure 2). Groundwater levels are not measured in MB1 as it is used as a production bore for the residence located onsite, but the levels in the other bores range from around 14m BGL in the vicinity of the existing wastewater treatment pond to 9m BGL in the western portion of the site with lower topographic elevation.

Water sampled from the bores is analysed for TDS, TN and TP with the results since 2015 summarised in the following figures. It should be noted that MB1 has a depth of 30m BGL and thus is likely to draw water from a different aquifer than the other bores onsite.

**FIGURE A: LOCAL GROUNDWATER QUALITY**



Key findings from that water quality monitoring results include:

- TN results are consistently lower in MB1 extraction bore.
- Some slight elevation in the TN concentrations of MB2, MB3 and MB4, with levels remaining below the highest concentration that was found in July 2015. Concentrations in these bores is typical of surficial groundwater in the area.
- TP results from all bores remain below the detection limit of 0.05mg/L in all sampling events excluding July 2015.

### 3.6 FLORA AND VEGETATION

The site is located in the Jarrah Forest biogeographical region, one of 89 bioregions recognized under the Interim Biogeographic Regionalisation for Australia (IBRA), within the Southern Jarrah Forest subregion (JAF02). The majority of the site is cleared with two patches of remnant vegetation (5.89 ha and 0.16 ha) present in the southern portion of the site. The remnant vegetation is mapped as Albany System consisting of Beard Vegetation Association 978: Low Forest with Jarrah (*Eucalyptus marginata*), Albany blackbutt (*Eucalyptus staeri*) and Sheoak (*Allocasuarina fraseriana*)(Beard et al, 2013).

Some planted vegetation exists surrounding the residence and to the east of the piggery sheds.

An EPBC Act Protected Matters Report (Appendix 2) was generated using a radial buffer of 1 km from the site on 6 February 2018. Six Threatened plant species were listed as potentially occurring onsite:

- *Banksia brownii* Brown's Banksia
- *Chordifex abortivus* Manypeaks Rush
- *Conostylis misera* Grass Conostylis
- *Drakaea micrantha* Dwarf Hammer-orchid
- *Isopogon uncinatus* Albany Cone Bush
- *Sphenotoma drummondii* Mountain Paper-heath

A search of NatureMap (DPaW, 2018) indicated no flora of conservation significance has been recorded within 1 km of the site.

### 3.7 FAUNA

An EPBC Act Protected Matters Report was generated using a radial buffer of 1 km from the site on 6 February 2018. Species of conservation significance that may potentially utilise the site are identified by the EPBC Act Protected Matters Report (Appendix 2). The following species of conservation significance have the potential to utilise the site:

- *Botaurus poiciloptilus* Australian Bittern
- *Calidris ferruginea* Curlew Sandpiper
- *Calyptorhynchus banksii naso* Forest Red-tailed Black Cockatoo
- *Calyptorhynchus latirostris* Carnaby's Black Cockatoo

- *Dasyornis longirostris* Western Bristlebird
- *Numenius madagascariensis* Eastern Curlew
- *Dasyurus geoffroyi* Chuditch
- *Parantechinus apicalis* Dibbler
- *Pseudocheirus occidentalis* Western Ringtail Possum

A search of NatureMap (DPaW, 2018) indicated no fauna of conservation significance has been recorded within 1 km of the site.

### **3.8 INDIGENOUS HERITAGE**

A search of the Department of Aboriginal Affairs' Aboriginal Heritage Inquiry System (<https://maps.daa.wa.gov.au/ahis/>) was undertaken on 5 February 2018. No registered sites were identified on the site, or adjacent to the site.

### **3.9 SURROUNDING LAND USE**

The premises is zoned 'Priority Agriculture' under the City of Albany Local Planning Scheme No. 1.

The Redmond township is 1.4 km north/northeast of the premises. The 2011 Census data indicated 295 people reside in the locality of Redmond (ABS, 2011).

Several rural residences are located within 2 km of the piggery (based on activity boundary, not site boundary, see Figure 4):

- 1052 Marbelup North Road, Redmond – located approximately 680m southwest.
- 62 Redmond South Road, Redmond – located approximately 695m north.
- 83 Pikes Road, Redmond – located approximately 906m east.
- 745 Redmond – Hay River Road, Redmond – located approximately 1 km north/northeast
- 916 Marbelup North Road, Redmond – located approximately 1.4 km southwest.
- 918 Marbelup North Road, Redmond – located approximately 1.5 km south.
- 881 Marbelup North Road, Redmond – located approximately 2 km southwest.

## 4 PROPOSED SITE UPGRADES

Upgrades to the site are proposed to improve the level of wastewater treatment. Upgrades will include the construction of a new covered anaerobic pond for the primary treatment of the wastewater exiting the piggery. Wastewater outflow from the anaerobic pond will then enter the existing facultative pond for secondary treatment. In order to ensure that sufficient capacity is maintained in the facultative pond, periodic irrigation events will be undertaken on a dedicated irrigation area onsite.

### 4.1 NEW ANAEROBIC POND

#### 4.1.1 Design

The proposed anaerobic pond will be 70m long be 12m wide with a total depth of 5.5m (including freeboard). Wastewater entering the piggery will gravity flow the PVC pipe to the new pond. The pond will have a HDPE liner of 1.5 mm thick and the edges will be buried in a trench 300 x1000 mm deep around the perimeter of the pond anchoring both the ground liner and cover and also sealing the pond airtight.

A 100 mm PVC pipe runs the full length of the pond on either side. This manifold will extract the biogas and will be the only pipe projecting through the cover. A vacuum pump will be installed in this line to produce a negative pressure on the cover to prevent wind from lifting the cover. Gas will be burned using a bio-gas in a flare. Access to the pond is via well access pipes at each end outside the cover going down 5 m with 300 mm HDPE pipe connecting the access pipe to the base of the channel. The inflow and outflow have one entry at the base and another 1 m from the top.

The pond will be constructed with *insitu* desludging, and as such the desludging operations can be carried out without the need for the pond to be taken off line. A stainless steel auger positioned inside a perforated PVC pipe will be anchored to the base and will run the length of the pond. The auger will be used to pull the sludge into the inflow access pipe where it is accessed by the vacuum tanker. The auger is driven through a right angle gearbox from the surface at 10 rpm with a torque of 100 nm.

Pond output will be directed into the facultative pond using a pump and float switch, similar to the existing pump used in the concrete sump.

#### 4.1.2 Materials

The new anaerobic pond will be constructed from low permeability HDPE synthetic liner in accordance with *Water Quality Protection Note 26: Liners for containing pollutants, using synthetic membranes* (DoW, 2013). WQPN 26 requires that HDPE liners have the following properties:

- a. minimum thickness of 0.75 mm (tolerance of up to 5%) for low hazard waste containment with mechanical jointing
- b. HDPE liners of 1.5 mm thickness are recommended for long-term containment facilities with heat welded joints
- c. specific gravity of 0.94 or more (ASTM method D1505)
- d. melt index of 0.05 g to 0.30 g in 10 minutes (ASTM method D1238, condition E 190/ 2.16)
- e. carbon black content of 2–3% (ASTM method D1603)
- f. minimum tensile strength at yield of 16 000 kN/m<sup>2</sup>

- g. minimum tensile strength at break of 550 kN/m<sup>2</sup> (ASTM method D638, type IV 2)
- h. minimum elongation at yield of 10%, and at break 300% (ASTM method D638).

In addition to complying with the liner material specification from WQPN 26, the liner will be fabricated to form the shape of excavation. All seams and joins made on site will be continuous. Panels of the liner will be overlapped by a minimum of 100mm, prior to heat welding or mechanical jointing. Any membrane welding materials will be supplied by the liner manufacturer, and will be identical with the liner membrane. All seams and joins will be constructed and tested as watertight over their full length using a vacuum test unit, air pressure testing or other approved method used in the HDPE membrane industry.

Trenching will be undertaken to install underground pipes and cables for transport of influent/effluent in and out of the anaerobic ponds, and gas out from the headspace above the pond to the flare. The location of the pipes and cables are shown on Figure 2. The flare will be located approximately 50m from the anaerobic pond (Figure 2) and will largely be obstructed from view by the site topography and the vegetation along the railway reserve. The flare will be at a height of 2-3m and the flare pad will be 6m by 6m. The flare will incorporate an auto ignition system and will be designed to minimise light overspill. The flare pad will be maintained to ensure no vegetation is present and will be fenced to prevent unauthorized access to the area with high thermal loadings..

#### 4.1.3 PigBal Modelling

PigBal 4 (v4.090) is a mass balance based model developed by Australian Pork Limited (APL). The model uses details herd composition, pig production and dietary information to obtain results which are typically used for:

- Designing piggery effluent treatment and reuse systems.
- Estimating the energy output and economic viability of piggery biogas collection and reuse systems.
- Estimating piggery greenhouse gas emissions for statutory purposes.
- Preparing applications for new and expanding piggery developments.

The model has been used to estimate waste production volumes at the site. Relevant details regarding the herd composition, piggery type and feed details specific to the Redmond operations were input to the model.

PigBal has a number of assumptions built into the model and provides default values for parameters if they are not specified by the user. These include data on a range of parameters including (but not limited to) water usage, feed wastage and diet composition. Where the model has been run using values that differ from the model default the rationale for the input is provided below.

- **Water Usage:** Water usage was derived from data collected from the supply bore for the piggery, whilst reuse data was estimated from the flushing tank volumes and flushing frequency used onsite.

The Pigbal model output for a 900 sow breeder facility predicts that the effluent generation from the piggery operations is 15.6ML/year (42.7kL/day). A summary of the PigBal modelling is provided in

Appendix 3. Based on this inflow, the minimum required volume for the covered anaerobic treatment is 1,844m<sup>3</sup> based on an annual desludging interval (Appendix 3). The one year desludging interval is appropriate as the anaerobic pond has in-situ sludge removal pipes that are used to extract the sludge on an ongoing basis. The PigBal recommended anaerobic volume is comprised of a 1,527m<sup>3</sup> of active volume and 317m<sup>3</sup> of sludge storage volume to treat the wastewater with an effective retention time of 43 days. Marbelup Pork proposed an anaerobic ponds with a total anaerobic treatment volume of 1,962kL which exceeds the PigBal recommended volume.

#### **4.2 TREATMENT SYSTEM CAPACITY**

Water balance calculations were undertaken to assess the capacity of the proposed system, including the new anaerobic ponds and the existing facultative ponds to manage the volume of wastewater generated from the piggery. The proposed system design is based on water being disposed of or re-used by evaporation from the pond surfaces, reuse through the piggery as wash-down water and onsite irrigation of pasture.

Two water balance scenarios were used to assess the system. These include:

- An annual water balance using the mean rainfall (BOM, Albany Airport: Station 9741) over the period 1965 to 2014; and
- An annual water balance using the adjusted annual 90th percentile rainfall (BOM, Albany Airport: Station 9741) over the period 1965 to 2014.

Evaporation data from DAFWA, *Evaporation Data for Western Australia*, Resource Management Technical Report No. 65 (1987) was used for the water balance.

The wastewater reuse rate assumed was 22.8kL/day (8.3ML/year) which is consistent with current reuse levels and the reuse levels expected with the 900 sow breeder operation. In order to maintain sufficient capacity in the ponds over the winter period, some water from the facultative pond will be directed to irrigation in accordance with a Nutrient and Irrigation Management Plan.

A total annual irrigation volume of 5.6ML is recommended to ensure sufficient capacity in the facultative pond over a 90<sup>th</sup> percentile high rainfall year. Table D provides an indicative irrigation schedule for the proposed irrigation area. Whilst irrigation will occur during the spring - autumn period, the irrigation schedule will remain flexible to allow for annual and seasonal variation in weather conditions. Irrigation volumes should also be variable to ensure that adequate water volumes are maintained in the facultative pond. It is important to maintain at least 30% of the water volume in the facultative pond to ensure continuation of treatment through active biological processes.

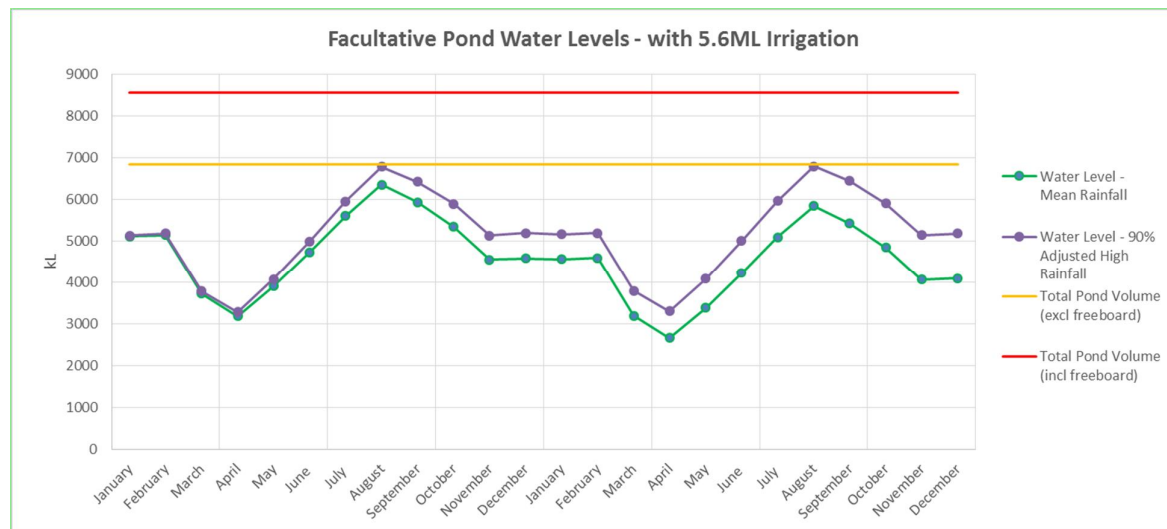


**TABLE D: INDICATIVE IRRIGATION SCHEDULE FOR 24.1HA IRRIGATION AREA**

Month	Irrigation Volume (kL)	Irrigation Depth (mm)
January	0	0
February	0	0
March	1600	6.64
April	1000	4.15
May	0	0
June	0	0
July	0	0
August	0	0
September	1000	4.15
October	1000	4.15
November	1000	4.15
December	0	0
<b>TOTAL</b>	<b>5,600kL</b>	<b>23.3mm</b>

Given the above irrigation schedule, the expected water levels in the facultative pond for both the mean rainfall and the 90<sup>th</sup> percentile annually adjusted monthly rainfall scenarios are shown in Figure B.

**FIGURE B: WATER LEVELS IN FACULTATIVE POND**



Water balance calculations indicate that based on a wastewater generation rate of 42.7m<sup>3</sup>/day (output from PigBal), a wastewater reuse rate of 22.8kL/day and an annual irrigation volume of 5.6ML, the upgraded system will satisfactorily manage the wastewater generated in a 90 percentile high rainfall

year without encroaching on the freeboard in the final pond. In the unlikely event that two successive 90 percentile high rainfall years occur, then the water level remain marginally below the allocated freeboard, and would not overtop the pond system. In a mean rainfall year, significantly capacity will be retained in the pond all year. Full copies of the water balance calculations are provided in Appendix 4.

There are a number of conservative assumptions inherent in the water balance modelling, which suggest that the water levels in the final evaporation pond may be lower than those forecast in Figure B. These include:

- The first evaporation pond is assumed to be 75% full at the commencement of January when the model period commences. It is likely that losses through evaporation over the summer period in conjunction with the scheduled irrigation would reduce the level in this pond, providing extra storage capacity within the treatment system.

#### **4.2.1 Pond Cover and Flare**

The anaerobic pond will be lined with 1.5mm HDPE and covered with 2mm HDPE to form a gas tight enclosure that excludes atmospheric oxygen and contains the generated biogas. The cover will be constructed in accordance with the manufacturer's specifications, and will include safety measures, including automatic venting in the event that excessive pressure builds up under the cover.

Biogas generated from the anaerobic pond generally consists of 60 – 75% Methane (CH<sub>4</sub>), 25 – 30% Carbon Dioxide (CO<sub>2</sub>), 0 – 1% Nitrogen (N<sub>2</sub>), 5% water (H<sub>2</sub>O) and 2,000 – 4,000 parts per million (ppm) Hydrogen Sulphide (H<sub>2</sub>S). The gas is extracted from the pond using gas blowers, which create a negative pressure in the enclosed headspace above the effluent surface.

Biogas is transported through underground pipes to the flare pad. The biogas is re-pressurized at the flare skid. Automatic controls on the gas management system will direct the gas to the flare, as required. The flare will combust all gasses originating from the pond significantly reducing the potential odour emissions when compared with a traditional uncovered anaerobic pond.

#### **4.2.2 Sludge Drying Area**

Sludge drying will take place on the dedicated pad area adjacent to the anaerobic pond. Sludge will be periodically be removed from the pond using the *insitu* auger and will be transported through pipes to the drying pad. Here the sludge will either be screened, and/or placed in drained skip bins to achieve a spadeable consistency. Once spadeable consistency has been achieved, sludge will be removed from site to be used by a third party.

The sludge drying pad will be bunded to ensure no surface flow travels over the pad and will drain to a sump which will be pumped to the concrete holding tank, returning any leachate to the wastewater treatment system.

### **4.3 TREATMENT SYSTEM COMPLIANCE**

A number of publications are available that provide guidance for the construction of wastewater treatment systems that are applicable to a piggery operation. These include: *New Design Guidelines for Anaerobic Ponds* (APL, 2015a), *Water Quality Protection Note 39: Ponds for Stabilising Organic*

*Material* (WQPN) (DoW, 2009) and *National Environmental Guidelines for Piggeries* (NEPG) (APL, 2010). In addition, PigBal 4 (Version 4.090) is a mass balance approach to piggery waste production model which can be used for the design and review of piggery effluent treatment and reuse systems. The proposed treatment system has been assessed in the context of these resources, with the results summarised in Table E and the details of the PigBal 4 (Version 4.094) evaluation included in Section 4.1.3.

**TABLE E: WASTEWATER TREATMENT SYSTEM EVALUATION**

GUIDELINE	WQPN 39 (DOW, 2009b)	NEGP (APL, 2010)	COMMENT
Topography	Slope less than 1:10	-	Conforming
Depth to Groundwater	-	2m from excavated base at all times	Conforming
Recommended Freeboard	400mm	500mm	Conforming
Liner Permeability	$1 \times 10^{-9}$ m/s	$1 \times 10^{-9}$ m/s for 300mm	Conforming
Anaerobic Pond Depth	2 – 6m	2 – 5m	Conforming – 5m
Anaerobic Retention Time	7 – 10 days	-	Conforming – 200 days in Facultative Pond
Facultative Pond Depth	1.2 – 2m	2 – 3m	Conforming
Treatment System Capacity	-	Design capacity so overtopping does not occur more than once every 10 years.	Conforming – with the use of regular irrigation

The proposed treatment system conforms to all design guidelines outlined in *WQPN 39: Ponds for Stabilising Organic Material* (DoW, 2009b) and the *National Environmental Guidelines for Piggeries* (APL, 2010).

The pond system has been designed with a 0.5 m freeboard in all ponds. Freeboard is an allowance to accommodate high rainfall events and wave action in the ponds, and to ensure capacity in the ponds in the event of a blockage in one of the pipes.

#### 4.4 IRRIGATION AREA

An important part of the wastewater treatment system at the site is the irrigation of treated wastewater. A 24.1ha area has been selected, with consideration to the soil characteristics and required buffer distances. Irrigation is scheduled to generally take place in spring and autumn to best match the nutrient needs of the vegetation. Irrigation of the perennial grasses that are already established at the site, including kikuyu and rye grass is proposed, with the grass to be harvested for silage and removed from the site in during late spring.

#### 4.4.1 Buffer Requirements

As detailed in Section 4.2, reuse of the treated wastewater through irrigation is required to manage the wastewater associated with the piggery operations onsite. In order for irrigation to be undertaken in a manner which will provide minimal impact on the local environment, a number of criteria must be achieved. The DER *draft Separation Distances Guidance Statement* (DER, 2015) buffer requirement for premises on which liquid waste is stored or irrigated (Category 61: 1km for noise and odour) or solid waste facility where waste is discharged onto land (Category 61A: 500 m for noise, dust and odour).

The National Environmental Guidelines for Piggeries (NEGP) (APL,2010) provide recommendations for buffer distances from reuse areas to sensitive land uses based on the way the effluent is applied, as indicated in Table F. The Marbelup Pork reuse area is compliant with the buffer areas recommended for Category 2, which is consistent application method proposed using a tractor and spreader and/or low spray irrigators to disperse the effluent evenly over the 24ha irrigation area.

**TABLE F: BUFFERS AND SEPARATION DISTANCES FROM REUSE AREAS (NEGP)**

FEATURE	CATEGORY 1 (M)	CATEGORY 2 (M)	CATEGORY 3 (M)	COMPLIANCE STATUS
Major Water Supply	800	800	800	The proposed reuse area complies with these setback guidelines
Watercourse	100	50	25	
Town	1000	750	300	
Rural residential area	600	400	150	
Rural dwelling	300	200	100	
Public road carrying more than 50 vehicles per day	50	25	0	
Public road carrying less than 50 vehicles per day	25	15	0	
Property boundary	25	20	0	

Source: APL, 2010

Category definitions for application in reuse areas:

##### Category 1

- Effluent is discharged or projected to a height in excess of 2 metres above ground level
- Separated solids or sludge that remain on the soil surface for more than 24 hours (i.e. are not immediately ploughed in)
- Spent bedding that is spread immediately (i.e. is not stockpiled/composted) and remains on the soil surface for more than 24 hours (i.e. is not immediately ploughed in)

- Flood irrigation systems.

#### Category 2

- Mechanical spreaders and downward discharge nozzles. The discharged material shall not be projected to a height in excess of 2 metres above ground level
- Spent bedding that has been stockpiled before spreading.

#### Category 3

- Discharge by injection directly into the soil (to a depth of not greater than 0.4 metres) and at a rate not exceeding either the hydraulic or N, P and K limits determined for the local soil type(s)
- Spent bedding/solids that have been composted
- Application of effluent/spent bedding/solids in combination with immediate incorporation of material into the soil.
- Where more than one category is used the more (or most) stringent category controls will apply.

#### 4.4.2 Soil Characteristics

Soil sampling was undertaken onsite in November 2017. In order to determine the areas suitable for irrigation, and the appropriate nutrient loadings that may be applied, the existing nutrient status in the soil was considered. Nitrogen levels in all samples were low and likely to be inhibiting the production of high quality grasses and crops at the site. In contrast, the phosphorus concentrations varied across the site. Table G shows the Colwell P results and the relevant PBI values soil sampling results against the 95% Optimum P Absorption values given the PBI of each soil type. Three of the five soil sampling sites showed significant phosphorus deficiencies in the soil at the surface and the subsurface layers. These areas were considered suitable for irrigation with nutrient rich wastewater.

**TABLE G: PHOSPHORUS CAPACITY OF SOIL**

SITE	DEPTH	PBI	PBI Class (DAFWA)	95% Optimum P Absorption (mg/kg)	Colwell P Results (mg/kg)
S1	0 to 0.1	119.9	Low	34	24
	0.4 to 0.5	43.4	Very low	29	<2
S2	0 to 0.1	23.6	Very very low	26	12
	0.4 to 0.5	163.8	Moderate	40	8
S3	0 to 0.1	195.7	Moderate	40	15
	0.4 to 0.5	252.7	Moderate	40	<2
S4	0 to 0.1	133.3	Low	34	168
	0.4 to 0.5	254.4	Moderate	40	3
S5	0 to 0.1	97.3	Low	34	204
	0.4 to 0.5	136.9	Low		4

It should be noted that whilst the phosphorus concentrations in S4 and D5 are high, the levels in the subsoil remain low, suggesting that is still significant capacity within the soil profile for phosphorus adsorption without risk to the groundwater.

#### 4.4.3 Nutrient Loading

Nutrient loading to the irrigation areas aims to apply nutrients at such a rate that they will be utilised by the existing vegetation and minimise leaching of nutrients below the root zone. Sampling of the both the raw and treated wastewater was completed in December 2017. Results of this sampling together with results obtained from a sample collected in October 2016 are provided in Table H.

**TABLE H: WASTEWATER QUALITY**

SITE	pH	TDS (mg/L)	TN (mg/L)	NOx-N (mg/L)	NH4-N (mg/L)	TP (mg/L)	BOD (mg/L)
Raw – Dec 17	7.3	3300	1500	<0.01	130	130	4900
Facultative Pond Outlet – Oct 16	-	-	900	-	-	51	-
Facultative Pond Outlet – Dec 17	7.6	2500	1000	<0.01	100	48	250
Design Water Quality	7.5	2500	1000	<0.01	100	50	250

Key points regarding the wastewater treatment at the site and the treated water quality include:

- pH levels are neutral to slightly alkaline
- 90% of the total nitrogen remains in the organic form.
- Low levels of nitrogen reduction are being achieved though the existing treatment system which is indicative of insufficient aerobic treatment capacity.
- Good level of biological breakdown is currently being achieved with BOD levels reducing from 4,900mg/L in the raw wastewater to 250mg/L in the treated water.

The design water quality criteria adopted for assessing the required irrigation area are based on the existing water quality results with no allowance for improvements as a result on the installation of the new covered anaerobic pond. The design criteria are shown in the final row in Table H. On this basis and assuming a maximum of 5.6 ML of treated waste water is irrigated in any year, the total application of N and P is summarised in Table I

**TABLE I: ANNUAL NUTRIENT LOADS FOR APPLICATION OF 5.6 ML/YEAR OF TREATED EFFLUENT**

CHARACTERISTICS OF IRRIGATION WATER	ANNUAL APPLICATION RATE (kg)
Total Nitrogen	5600
Total Phosphorous	280

The two key parameters that are expected to improve as a results of the construction of the new anaerobic pond is the final BOD and the total nitrogen concentrations. The existing system is achieving a good level of biological breakdown of BOD, and a relatively low reduction in TN. With the construction of the new system, the BOD reduction will largely take place in the new anaerobic pond allowing for significantly improved rates of nitrification and denitrification to occur in the existing facultative pond. APL (2016) suggest that typical TN concentrations for treated piggery effluent is 600mg/L. For the purposes of demonstrating that the site is capable of managing the effluent associated with the piggery operation, it is assumed that no further reduction in the TN concentration is achieved compared with the current water quality. This is a very conservative assumption, as generally, the effluent strength originating from breeder facilities has generally lower concentrations of organic and nutrient compared with farrow to finish operations. As such, the design TN concentration of 1000mg/L is likely to be an overestimate of treated wastewater strength.

The Western Australian Department of Water’s *Water Quality Protection Note 22 – Irrigation with Nutrient Rich Wastewater* (DoW,2011) provides a framework for the permissible nutrient application rates for irrigation for different soil types and receiving environments. The framework allocates a risk category for a site depending on the potential for adverse environmental impacts to occur as a result of nutrient application through irrigation. Table J summarises the criteria for the risk category classifications.

**TABLE J: SOIL AND RECEIVING ENVIRONMENT RISK CATEGORIES**

CHARACTERISTICS OF IRRIGATED SOILS	EUTROPHICATION RISK OF SURFACE WATERS WITHIN 500 METRES OF IRRIGATION SITE	RISK CATEGORY
Coarse grained soils e.g. sands and gravels	Significant	A
	Low	B
Fine grained soils (PBI above 100) e.g. loams, clays, clay	Significant	C
	Low	D

Based on the risk category classification of a site, the Department of Water recommends a maximum nutrient application rate for nitrogen and phosphorus. These values are provided in Table K. Based on the soil characteristics of the Marbelup site and the distance to nearby sensitive water the site is allocated a Risk Category of C. As such, the recommended loading rates in accordance with *WQPN 22* (DoW,2011) would be 300kg/ha of N and 50kg/ha of P

**TABLE K: NUTRIENT APPLICATION RATES FOR SOIL/RECEIVING ENVIRONMENT RISK CATEGORIES**

RISK CATEGORY	MAXIMUM INORGANIC NITROGEN (AS TN)	MAXIMUM REACTIVE PHOSPHORUS (AS TP)
	APPLICATION RATE (KG/HA.YR)	APPLICATION RATE (KG/HA.YR)
A	140	10
B	180	20
C	300	50
D	480	120

Using the design loads listed in Table I and the application rates listed for Category sites in WQPN 22 (DoW,2011) for a Category C site, the required irrigation area would be 18.667 Ha to accommodate the 5600 kg of Total Nitrogen. Only 5.6 ha of irrigation area would be required to handle the Phosphorous Load.

The NSW DEC document *Environmental Guidelines: Use of Effluent by Irrigation* (DECNSW,2003) has also been used to assess nutrient loading of the wastewater application to land. Using the formula:

$$A = \frac{C \times Q}{L_x}$$

where

- A = land area (m<sup>2</sup>)
- C = concentration of N or P in effluent (mg/L)
- Q= treated wastewater flow rate (L/d)
- L<sub>x</sub>= critical loading rate (uptake rate) for N or P for a specific crop (mg/m<sup>2</sup>/d)

The critical loading rates for nitrogen (L<sub>n</sub>) and phosphorus (L<sub>p</sub>) are based on the ability of vegetation to use these nutrients before they pass through the root zone. For example, the L<sub>n</sub> for perennial pasture varies between 18 and 36 mg/m<sup>2</sup> /day, while L<sub>p</sub> varies between 2 and 4 mg/m<sup>2</sup> /day.

Using a L<sub>x</sub> loading of 36mg/m<sup>2</sup>/day for N and 4mg/m<sup>2</sup>/day for P, the above calculations, indicate an irrigation area of 21.3ha for nitrogen and 19.2ha for phosphorus application would be required. As such, the available 24.1ha irrigation area is sufficient to meet with the minimum requirements set by the NSW EPA.

Due to the export of silage from the site, nutrients will be removed on an annual basis. Table L provides an estimate of the total N and P removed from the site for dryland and irrigated pasture and winter cereal hay. Silage removes the higher proportion of nutrients from a site when compared with grain and hay, due to a higher nutrient content in the green plant. As such, the removal of nutrients through silage from the Marbelup Pork site is likely to be higher than that of typical dryland cut pasture and lower than the high end of the irrigated pasture and winter cereal hay.



**TABLE L: NUTRIENT EXPORT FROM SITE**

	<b>YIELD</b>	<b>NITROGEN</b>	<b>PHOSPHORUS</b>
Dryland Pasture (cut)	1 – 4 DM t/ha	20-80 kg/ha	3-12 kg/ha
Irrigated Pasture (cut)	8-20 DM t/ha	160-400 kg/ha	24-60 kg/ha
Winter Cereal Hay	1-20 DM t/ha	200-400 kg/ha	30 – 60kg/ha

Source: APL (2015b)

Based on a total irrigation volume of 5.6ML and the design water quality criteria shown in Table H, the target nutrient application rates for across the site as shown in Table M. As shown, both the WQPN and the NSW guideline are complied with.

**TABLE M: TARGET NUTRIENT APPLICATION REQUIREMENTS**

	<b>TOTAL NITROGEN</b>	<b>TOTAL PHOSPHORUS</b>	<b>BOD</b>
WQPN 22: Recommended Limit	300 kg/ha (18.667 ha) <sup>1</sup>	50 kg/ha (5.6 ha) <sup>1</sup>	25kg/ha/day
NSW (2004) Minimum Areas Requirements	21.3ha	19.2ha	-
Target Loading	Max 193kg/ha <sup>2</sup> over 24.1ha	Max 11.6 kg/ha over 24.1ha	16.6 kg/ha/day <sup>3</sup>

1. Required Area to accommodate 5.6 ML/year
2. Assumes 20% loss of nitrogen through volatilisation during spreading.
3. Assuming highest proposed monthly irrigation of 1.6ML is undertaken on a single day.

Based on the nutrient export rates shown in Table L, the application of nutrients through the irrigation of wastewater will closely match the nutrients removed from site in the form of silage and/or winter cereal hay.

## **5 ENVIRONMENTAL RISKS AND MANAGEMENT**

### **5.1 RISK ASSESSMENT**

A risk analysis has been undertaken for all aspects of the operation of the piggery, in accordance with the procedures outlined in the *Australian and New Zealand Standards AS/NZS ISO 31000:2009 Risk Management—Principles and Guidelines* and *HB 203:2012 (Managing Environment-Related Risk)*, using DWER's *Guidance Statement: Risk Assessment* (DER,2017) (Appendix 5).

Qualitative risk analysis was used to evaluate the significance of emissions and discharges (Table N). The risk analysis was undertaken assuming the proponent controls were in place. The consequence and likelihood descriptors used in Table N are the same as those presented in *Table 1 – Risk Criteria Table* in DWER (2017) guidance. Aurora has determined the risk rating based on the consequence and likelihood of the risk event/emission occurring.

**TABLE N: EMISSIONS AND DISCHARGES RISK ASSESSMENT**

SOURCES OF EMISSION AND DISCHARGE		PATHWAY	RECEPTOR	PROPONENT CONTROLS	POTENTIAL IMPACT	CONSEQUENCE ON RECEPTOR	LIKELIHOOD	RISK RATING
Emission (type and quantity)	Emission event (normal/upset)							
Wastewater discharge.	Overflow of anaerobic and evaporation ponds.	Water	Groundwater >9 m BGL.	<ul style="list-style-type: none"> <li>Pond designs of sufficient size to contain wastewater generated.</li> <li>The wastewater treatment systems will be regularly monitored, at least every second day to ensure any pipe blockages are detected and cleared.</li> </ul>	Elevated concentrations of nutrients in the vicinity of the overflow site. Highly unlikely to affect receptors or ecosystem function.	Slight	Rare	Low
	Leak/crack in drainage line.	Water	Groundwater >9 m BGL.	<ul style="list-style-type: none"> <li>Inspection of drainage lines every daily.</li> <li>Immediately contain leak and prevent further discharge.</li> <li>Test soil in spill location for evidence of contamination.</li> <li>If contaminated dispose of affected material to an appropriate landfill.</li> </ul>	Elevated concentrations of nutrients in the vicinity of the overflow site. Highly unlikely to affect receptors or ecosystem function.	Slight	Rare	Low
Wastewater discharge.	Leak in pond liner.	Water	Groundwater >9 m BGL.	<ul style="list-style-type: none"> <li>Wastewater treatment system is fit for purpose.</li> </ul>	Elevated concentrations of nutrients in the vicinity of	Slight	Unlikely	Low

				<ul style="list-style-type: none"> <li>The wastewater treatment systems will be regularly monitored, at least every second day.</li> <li>Quarterly groundwater monitoring of bores.</li> </ul>	the discharge. Highly unlikely to affect receptors or ecosystem function.			
Solid waste discharge.	Nutrients released from decomposing buried pig carcasses.	Water	Groundwater >2 m BGL.	<ul style="list-style-type: none"> <li>Pig carcasses are buried above the maximum groundwater table on elevated portions of the site.</li> <li>All carcasses will be covered immediately after being disposed of in a burial pit.</li> </ul>	Elevated concentrations of nutrients in the soils associated with the burial pit. Highly unlikely to affect receptors or ecosystem function.	Slight	Unlikely	Low
	Sludge drying and temporary storage.	Water	Groundwater >2 m BGL.	<ul style="list-style-type: none"> <li>Drying beds are lined to achieve a permeability less than <math>10^{-9}</math> m/s.</li> <li>Sludge will be dried and removed from site as soon as spadable consistency is achieved.</li> <li>Sludge removal will be scheduled over the summer months to expedite the drying process.</li> </ul>	No detectable impacts to amenity are expected to residents, once the controls are implemented.	Slight	Unlikely	Low
Odour emissions	Odour from anaerobic ponds, sludge,	Air	Residences located >680 m from the activity boundary.	<ul style="list-style-type: none"> <li>Keeping the pigs clean and dry. Maintaining pig health to minimize</li> </ul>	No detectable impacts to amenity are expected to	Slight	Unlikely	Low

	and piggery modules.			<p>loose stools, and providing clean and hygienic conditions within the sheds.</p> <ul style="list-style-type: none"> <li>• Frequently and regularly clean flooring and other dirty and dusty surfaces.</li> <li>• Regularly emptying flushing sheds. Use of sufficient water to clean pits and remove manure solids.</li> <li>• Collecting mortalities, afterbirth and foreign materials promptly.</li> <li>• Maintaining drainage lines with a minimum slope of 1-2% to ensure they are self-cleaning.</li> <li>• Anaerobic ponds were designed such that they are adequate for the capacity of the wastewater volume produced.</li> <li>• Managing desludging events, to minimize drying time.</li> <li>• Removing dried sludge promptly from site.</li> <li>• Monitoring salinity and pH of the anaerobic</li> </ul>	residents, once the controls are implemented.			
--	----------------------	--	--	--	---	--	--	--

Marbelup Pork  
Works Approval Application

				<p>ponds to ensure pond chemistry is suitable for treatment microorganisms.</p> <ul style="list-style-type: none"> <li>• Pig carcasses will be covered immediately after being disposed of in a burial pit.</li> </ul>				
Noise emissions	Operation of the piggery.	Air	Residences located >680m from the activity boundary.	<ul style="list-style-type: none"> <li>• Noise assessment suggests the operation will comply with the <i>Environmental Protection (Noise) Regulations 1997</i> with no additional controls required.</li> </ul>	No detectable impacts to amenity are expected to residents.	Slight	Unlikely	Low
Smoke emissions from a bushfire	Bushfire	Land Air	Residences located >1 km from the site boundary.	<ul style="list-style-type: none"> <li>• Firebreaks around the property which are regularly maintained.</li> <li>• Firefighting equipment available onsite and maintained.</li> <li>• Firefighting training for onsite personnel.</li> </ul>	Any fires that start will be managed within minutes and it is expected that any damage to vegetation would be minimal.	Slight	Unlikely	Low

## **5.1 WASTEWATER EFFLUENT MANAGEMENT**

### **5.1.1 Objectives**

To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.

### **5.1.2 Applicable Standards and Guidelines**

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, 2000).
- *Environmental Protection (Unauthorised Discharges) Regulations 2004*.
- National Environmental Guidelines for Piggeries - second Edition (APL, 2010).
- New Design Guidelines for Anaerobic Ponds (APL, 2015a)
- Piggery Manure and Effluent Management and Reuse Guidelines (APL, 2015b)
- WQPN 39: Ponds for Stabilising Organic Matter (DoW, 2009)

### **5.1.3 Potential Environmental Impacts**

The key risks posed to soil, ground or surface water is an unplanned release from the wastewater treatment system (e.g. anaerobic ponds, evaporation pond etc.) or pipework conveying and wastewater from the piggery or between ponds. In addition, some risk is involved with the irrigation of treated wastewater to the dedicated irrigation area.

The potential impact will be an increase in nutrient concentrations in the soils, surface water and groundwater at the discharge location and potentially offsite. The extent of impact will depend on the volume spilt and the efficiency of the clean-up program. Excessive irrigation loading may result in high levels of nutrient in the soil with the potential that they will be exported offsite.

A further risk is the possibility of excessive odour emissions should the ponds be overloaded.

### **5.1.4 Management and Mitigation Strategies**

Effective retention and treatment of wastewater is a key to the environmental integrity of the operations at the site. Section 3 of this report details the design of the wastewater treatment system with the new pond to be constructed in accordance with this Works Approval Application.

Irrigation is to be undertaken in accordance with an approved Nutrient and Irrigation Management (NIMP) Plan, with cumulative loadings determined throughout the irrigation season.

### **5.1.5 Contingency Measures**

The following option may be implemented as contingency measures if required:

- Removing water from site using a liquid waste contractor.

### **5.1.6 Targets and Limits**

No overflow of wastewater ponds at any time during operations.

No detectable odours at the nearest sensitive premises.

### **5.1.7 Environmental Risk**

Based on the modelling, the proposed wastewater treatment system will have sufficient capacity to treat and hold wastewater generated from the piggery operation. Therefore the risk to groundwater and surface water quality is low. Similarly the risk of significant odour emission is assessed as being very low.

## **5.2 SOLID WASTE MANAGEMENT**

### **5.2.1 Objectives**

To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.

### **5.2.2 Applicable Standards and Guidelines**

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, 2000).
- *Environmental Protection (Unauthorised Discharges) Regulations 2004*.
- National Environmental Guidelines for Piggeries - second Edition (APL, 2010).
- Piggery Manure and Effluent Management and Reuse Guidelines (APL, 2015a)

### **5.2.3 Potential Environmental Impacts**

Exposed pig carcasses are known to attract feral animals and can also cause odour problems. Nutrients and bacteria from the decomposing carcasses can leach into the groundwater if the base of the burial pit is not sufficiently separated from the water table or if the base of the burial pits is not appropriately sealed.

### **5.2.4 Management and Mitigation Strategies**

The following solid waste management measures are implemented:

- The burial pits will be used to dispose of pig carcasses. Carcasses buried onsite will be covered with soil immediately after disposal onsite. All carcasses will be buried 500mm below ground level.

### **5.2.5 Contingency Measures**

Should pig carcasses be exposed by scavenging feral animals, Marbelup Pork will place a thicker soil cover over the burial pit.

### **5.2.6 Targets and Limits**

No exposed pig carcasses on the ground surface.

### **5.2.7 Environmental Risk**

Following the implementation of management measures the risk to groundwater is low.

## **5.3 ODOUR MANAGEMENT**

### **5.3.1 Objectives**

The objective of managing odour emissions is to ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory



requirements and acceptable standards. Construction of a new evaporation pond is unlikely to impact on the odour emissions from the site, and will remove any potential odour issues that resulted from the irrigation of treated wastewater.

### 5.3.2 Applicable Standards and Guidelines

- EPA Guidance Note No 47: Guidance for the Assessment of Environmental Factors- Assessment of Odour impacts from New Proposals (2002) (Now withdrawn but not replaced).
- Minimising Odour from Piggeries (APL, 2015c).

### 5.3.3 Emission/Risk Event, Pathway and Receptor

The generation of odour impacts is directly related to the strength or odour concentration associated with the source, its characteristics (if it is offensive or pleasant), frequency of occurrence, and duration of exposure and also the size of the odour source. The extent to which odour becomes a nuisance to a neighbour is also related to the separation distance between the source and the neighbour.

The main odour sources from the piggery are:

- Pig sheds – Dirty pigs smell as their body warmth encourages anaerobic breakdown of the manure on their skins (APL, 2015).
- Treatment ponds (mainly the anaerobic pond, although the facultative pond can become odorous if it is overloaded).

The NEGP (APL, 2010) states that an odour assessment aims to establish whether odour emissions from a piggery will have an unreasonable impact on offsite receptors. It is assumed by the authors of the NEGP that if the distance between a piggery and a receptor is less than the calculated separation distance, than an unreasonable impact may occur.

The Level 1 and Level 1.5 Assessment is described further in Section A5 (page 113) of APL (2010). The method used to conduct the Level 1 assessment is the calculation method (Section A5.2 on page 114).

The calculation method uses the formula:

$$\text{separation distance (D)} = N^{0.55} \times S1 \times S2 \times S3$$

N = number of standard pig units (SPU)

0.55= piggery size exponent determined using the results of modelling.

S1= piggery design factor for estimating the relative odour potential for the piggery design selected for a particular site (S1 = effluent removal factor, S1R x effluent treatment factor, S1T).

S2 = piggery siting factor for estimating the relative odour dispersion potential for the selected piggery site (S2 = receptor type factor, S2R x surface roughness factor, S2S).

S3 = terrain weighting factor for estimating the potential changes to odour dispersion, in situations where meteorological conditions may be influenced by local terrain influences.

Aurora has calculated the required separation distance from the piggery and the Redmond township and rural dwellings (Table O).

The location of the nearest rural residences are shown in Figure 4 and described in Section 1.9.

**Table O: Level 1 Odour Assessment Calculations for Receptors**

Direction of receptor	Number of SPU	S1 Piggery Design Factor	S2 Piggery Siting Factor	S3 Terrain Weighting Factor	Required Separation distance (m)	Number of Receptors within the Separation Distance
North – Redmond Township	1821	1 x 0.5 = <b>0.5</b> conventional sheds x impermeable pond cover	25 x 0.85 = <b>21.25</b> Town of Redmond x Level wooded country	1 sloping terrain 1-2%) upslope of site	660	0
North – Rural Dwellings	1821	1 x 0.5 = <b>0.5</b> conventional sheds x impermeable pond cover	11.5 x 1.0 = <b>11.5</b> Rural Dwelling x Limited ground cover / short grass	1 flat terrain	357	0
East – Rural Dwellings	1821	1 x 0.5 = <b>0.5</b> conventional sheds x impermeable pond cover	11.5 x 0.68 = <b>7.82</b> Rural Dwelling x Significant hills and valleys	N/A Hilltop upslope of site	243	0
South – Rural Dwellings	1821	1 x 0.5 = <b>0.5</b> conventional sheds x impermeable pond cover	11.5 x 0.85 = <b>9.775</b> Rural Dwelling x Level wooded country	1.6 Broad valley / drainage, downslope of site (0.1 – 1%)	486	0
West – Rural Dwellings	1821	1 x 0.5 = <b>0.5</b> conventional sheds x impermeable pond cover	11.5 x 1.0 = <b>11.5</b> Rural Dwelling x Limited ground cover / short grass	1 flat terrain	357	0

Based on calculation, the piggery is compliant with the recommended separation distances of 660 m to the town of Redmond (Figure 4), which is located 1.4 km away. No rural dwellings are located within the calculated S-factor buffer of from the piggery.

Regardless of the separation distances, the management of potential odour impacts as outlined in Section 5.3.4 will be implemented.

#### **5.3.4 Controls**

Best practice odour management for piggeries as outlined in *Minimising Odour from Piggeries* (APL, 2015) has been reviewed. Management and mitigation measures at the piggeries will include:

##### Piggery Modules

- Keeping the pigs clean and dry. Maintaining pig health to minimize loose stools, and providing clean and hygienic conditions within the sheds.
- Minimising feed wastage and dust.
- Frequently and regularly clean flooring and other dirty and dusty surfaces.
- Regularly flushing / emptying of pull plug pits. Use of sufficient water to clean pits and remove manure solids.
- Collecting mortalities, afterbirth and foreign materials promptly.

##### Anaerobic Pond

- The design of the anaerobic pond is such that they have adequate capacity for the wastewater volume produced (refer to Section 3).
- Covering the pond will reduce the odour emissions to the atmosphere.

#### **5.3.5 Contingency Measures**

In the event an odour complaint is received, Marbelup Pork will conduct an investigation into the source of the odour, and identify corrective or preventative measures to reduce the odour. Marbelup Pork will notify the complainant of the actions taken to rectify the odour issue. All details of the complaint, actions taken and communications with neighbours will be documented in the complaints register which will be included in the Annual Environmental Report.

#### **5.3.6 Targets and Limits**

No complaints regarding odour from surrounding neighbours.

#### **5.3.7 Risk Rating Determination**

In accordance with DER (2017) where appropriate to do so, specific criteria has been used to determine the consequence at the receptor most affected by the emission (i.e. surrounding residents). Therefore Aurora considers the 'Specific Consequence Criteria' to be the DWER odour criteria. As this odour criteria is predicted to be easily met, the consequence has been deemed 'slight'. The likelihood of affecting receptors is considered 'rare'.

The risk rating for the risk event of odour impacting residents is assessed as 'Low'.

#### **5.3.8 Acceptability of Risk Event**

The risk event of odour emissions impacting amenity of residential receptors is considered 'Acceptable'

### **5.4 FIRE MANAGEMENT**

#### **5.4.1 Objectives**

To prevent fire from occurring and to effectively extinguish any fires.

#### **5.4.2 Applicable Standards and Guidelines**

Relevant Building Design Codes for fire control.

#### **5.4.3 Potential Environmental Impacts**

The sources of ignition at the piggeries are associated with failure of mechanical equipment (e.g. ventilation fans or plant). Bushfire may also occur from naturally occurring events (e.g. lightning strikes). A fire that is started at the Site has the potential to cause damage and loss of surrounding vegetation on neighbouring lots, and to potentially injury or kill local residents. Damage to their property may also occur.

#### **5.4.4 Management and Mitigation Strategies**

Fire prevention measures to be implemented are:

- Firebreaks around the property which are regularly maintained.
- Firefighting equipment available onsite and maintained.
- Firefighting training for onsite personnel.

#### **5.4.5 Contingency Measures**

In the unlikely event that a fire occurs, Marbelup Pork employees will, if present on site and it safe to do so, attack the fire with extinguishers and/or mobile firefighting equipment. It is envisaged that this would be sufficient in most circumstances and ensure that any fire would be minor in nature.

#### **5.4.6 Targets and Limits**

No bushfires attributed to the operation of the piggery.

#### **5.4.7 Environmental Risk**

Any fires that start on the premises should be managed within minutes of starting and it is expected that any damage to vegetation would be minimal. The risk is considered very low.

## 6 CONSTRUCTION EMISSIONS RISK ASSESSMENT

### 6.1.1 Emission/Risk Event, Pathway and Receptor

Noise and dust emissions will be generated during construction of the new evaporation pond.

Noise is a 'vibration of any frequency, whether transmitted through air or any other physical medium'. It is commonly recognised as an emission of sound but may also include ground or structure-borne vibration (DER, 2016). Noise emissions can affect amenity, and in extreme cases human health through damage or injury to ears / hearing ability or permanent deafness. Most commonly noise affects amenity, especially if the noise contains tonal or annoying characteristics.

Dust particles are dispersed in air. Human health effects of dust tend to be associated with particles with an aerodynamic diameter of 10um or less ( $\leq PM_{10}$ ). These particles tend to remain suspended in the air for longer periods and can penetrate into the lungs (DEC, 2011).

The nearest sensitive receptor to noise and dust emissions is a rural residence located on Lot 7779, approximately 1.0 km south of the proposed location of the new evaporation pond.

Therefore the risk event is dust emissions impacting human health of rural residential receptors.

### 6.1.2 Controls

Noise will be managed through the implementation of the following controls:

- Construction completed between 7:00am and 5:00pm on weekdays and between 7:00am and 2:30pm on Saturdays only.
- Modern well-maintained equipment used.

Dust will be managed through the implementation of the following controls:

- Exposed soil will be wetted down prior to and during construction activities.
- In the event significant dust is generated, construction activities will cease until additional controls can be implemented or any unusual weather conditions abate.

### 6.1.3 Risk Rating Determination

Construction noise is expected to be intermittent within a one month period, however the likelihood of noise emissions impacting residential receptors is 'Rare' given the residential receptors are greater than 1.0 km away from source.

The noise emissions will have a 'Minor' consequence as the sound onsite will be low levels, minimal offsite impacts and low level impacts to amenity.

The likelihood of dust emissions impacting residential receptors is 'Rare' given the residential receptors are greater than 1.0 km away from the source and over this distance  $\leq PM_{10}$  particulate concentrations are unlikely to be distinguishable from background concentrations.

Similarly the limited scale of construction operations and the proposed controls will limit dust generation, therefore the likelihood of dust emissions impacting adjacent industrial premise is 'Rare'.

The dust is unlikely to move offsite, will have minimal on-site impact, and minimal impacts to amenity, therefore the consequence is considered to be 'slight'.

The risk rating is assessed as 'Low'.

#### **6.1.4 Acceptability of Risk Event**

The risk event of noise and dust emissions impacting amenity of rural residential receptors is considered 'Acceptable'.

## 7 ENVIRONMENTAL MONITORING AND REPORTING

### 7.1 MONITORING

Environmental monitoring is a key component in the success of the overall environmental performance at the site. The proposed monitoring program is summarized in Table P.

Groundwater monitoring of the four bores onsite will continue in accordance with the current licence. With the commencement of irrigation onsite, monthly samples of the irrigation water (S1) will be collected when irrigation, and cumulative irrigation loadings determined to ensure nutrient targets are not exceeded. Annual soil sampling from the three sites located within the irrigation area is also recommended.

**TABLE P: ENVIRONMENTAL MONITORING PROGRAM**

LOCATION	PARAMETERS	FREQUENCY
MB1	Static water level, pH, TDS, TP, TN	Quarterly
MB2		
MB3		
MB4		
L1 (Surface Water at Irrigation Point)	pH, NO <sub>x</sub> -N, NH <sub>4</sub> -N, TN, TP, BOD, TDS	Monthly while Irrigating
S1, S2, and S3.	pH, EC, NO <sub>x</sub> -N, NH <sub>3</sub> -N, Colwell P, PBI	Annually

Marbelup Pork are committed to the ongoing environmental monitoring program including the groundwater bores, and completion of the Annual Environmental Report and the Annual Audit Compliance Reports as specified in the licence.

### 7.2 REPORTING

On completion of construction of the new anaerobic pond, Marbelup Pork will prepare and submit a compliance document to the DWER which is signed and certifies that the works were constructed in accordance with the conditions of the works approval. Following this, a licence amendment application will be prepared to update the licence to include the additional infrastructure and irrigation areas.



## 8 REFERENCES

- Australian Bureau of Statistics (ABS) (2011)** 2011 Census QuickStats, available at:  
[http://www.censusdata.abs.gov.au/census\\_services/getproduct/census/2011/quickstat/SSC50675?opendocument&navpos=220](http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/SSC50675?opendocument&navpos=220)
- Australian and New Zealand Environment and Conservation Council and Agricultural and Resource Management Council of Australian and New Zealand (ANZEC and ARMCANZ) (2000)** *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*
- Australian Pork Limited (APL) (2010)** *National Environmental Guidelines for Piggeries*, available at:  
<http://australianpork.com.au/industry-focus/environment/national-environmental-guidelines-for-piggeries/>.
- Australian Pork Limited (APL) (2015a)** *New Design Guidelines for Anaerobic Ponds National Environmental Guidelines for Piggeries*, available at: [http://australianpork.com.au/wp-content/uploads/2013/10/BMP03\\_NDGA\\_04\\_lr.pdf](http://australianpork.com.au/wp-content/uploads/2013/10/BMP03_NDGA_04_lr.pdf)
- Australian Pork Limited (APL) (2015b)** *Piggery Manure and Effluent Management and Reuse Guidelines*, available at: [http://australianpork.com.au/wp-content/uploads/2013/10/PMEG\\_2014\\_14\\_lr.pdf](http://australianpork.com.au/wp-content/uploads/2013/10/PMEG_2014_14_lr.pdf)
- Australian Pork Limited (2015c)** *Minimising Odour from Piggeries*, available at:  
[http://australianpork.com.au/wp-content/uploads/2013/10/BMP02\\_MOFP\\_2015\\_06\\_lr.pdf](http://australianpork.com.au/wp-content/uploads/2013/10/BMP02_MOFP_2015_06_lr.pdf).
- Australian Pork Limited (2016)**, *PigBal4 V4.0.94*, <http://australianpork.com.au/industry-focus/environment/waste-management-pigbal/>
- Australian Soil Resource Information System (ASRIS) (2018)** *Maps*, available at:  
<http://www.asris.csiro.au/mapping/viewer.htm>
- Beard, J.S., Beeston, G.R., Harvey, J.M., Hopkins, A.J.M. and Shepherd, D.P. (Beard et al) (2013)** *The vegetation of Western Australia at the 1:3000000 scale Explanatory Memoir Second Edition*. In: *Conservation Science Western Australia – Volume 9*.
- Bureau of Meteorology (BOM) (2017)** *Climate statistics for Australian locations*, available at:  
[http://www.bom.gov.au/climate/averages/tables/cw\\_009500.shtml](http://www.bom.gov.au/climate/averages/tables/cw_009500.shtml)
- Department of Agriculture and Food, Western Australia (DAFWA) (1987)** *Evaporation Data for Western Australia*. Resource Management Technical Report No. 65. Available at:  
<http://researchlibrary.agric.wa.gov.au/cgi/viewcontent.cgi?article=1058&context=rmtr>
- Department of Environment and Conservation (DEC) (2011)** *A guidelines for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities*.
- Department of Environment and Conservation NSW (DECNSW), (2003)**, *Use of Effluent by Irrigation*, available at: <http://www.environment.nsw.gov.au/resources/water/effguide.pdf>

**Department of Environment Regulation (DER) (2015)** The DER *draft Separation Distances Guidance Statement* [www.dwer.wa.gov.au](http://www.dwer.wa.gov.au)

**Department of Environment Regulation (DER) (2017)** *Guidance Statement: Risk Assessments*, available at [www.der.wa.gov.au](http://www.der.wa.gov.au)

**Department of Environment Regulation (DER) (2016)** Draft Guideline on Environmental Noise for Prescribed Premises.

**Department of Water (DoW) (2007)** Marbellup Brook Catchment Area Drinking Water Source Protection Plan Lower Great Southern Town Water Supply. Report No. 67 Water Resource Protection Series.

**Department of Water (DoW) (2011)** *Water Quality Protection Note 22: Irrigation with Nutrient Rich Wastewater*, available at:  
[https://www.water.wa.gov.au/\\_\\_data/assets/pdf\\_file/0005/4100/82324.pdf](https://www.water.wa.gov.au/__data/assets/pdf_file/0005/4100/82324.pdf).

**Department of Water (DoW) (2013)** *Water Quality Protection Note 26: Liners for containing pollutants, using synthetic membranes*, available at:  
[https://www.water.wa.gov.au/\\_\\_data/assets/pdf\\_file/0012/4062/84590.pdf](https://www.water.wa.gov.au/__data/assets/pdf_file/0012/4062/84590.pdf)

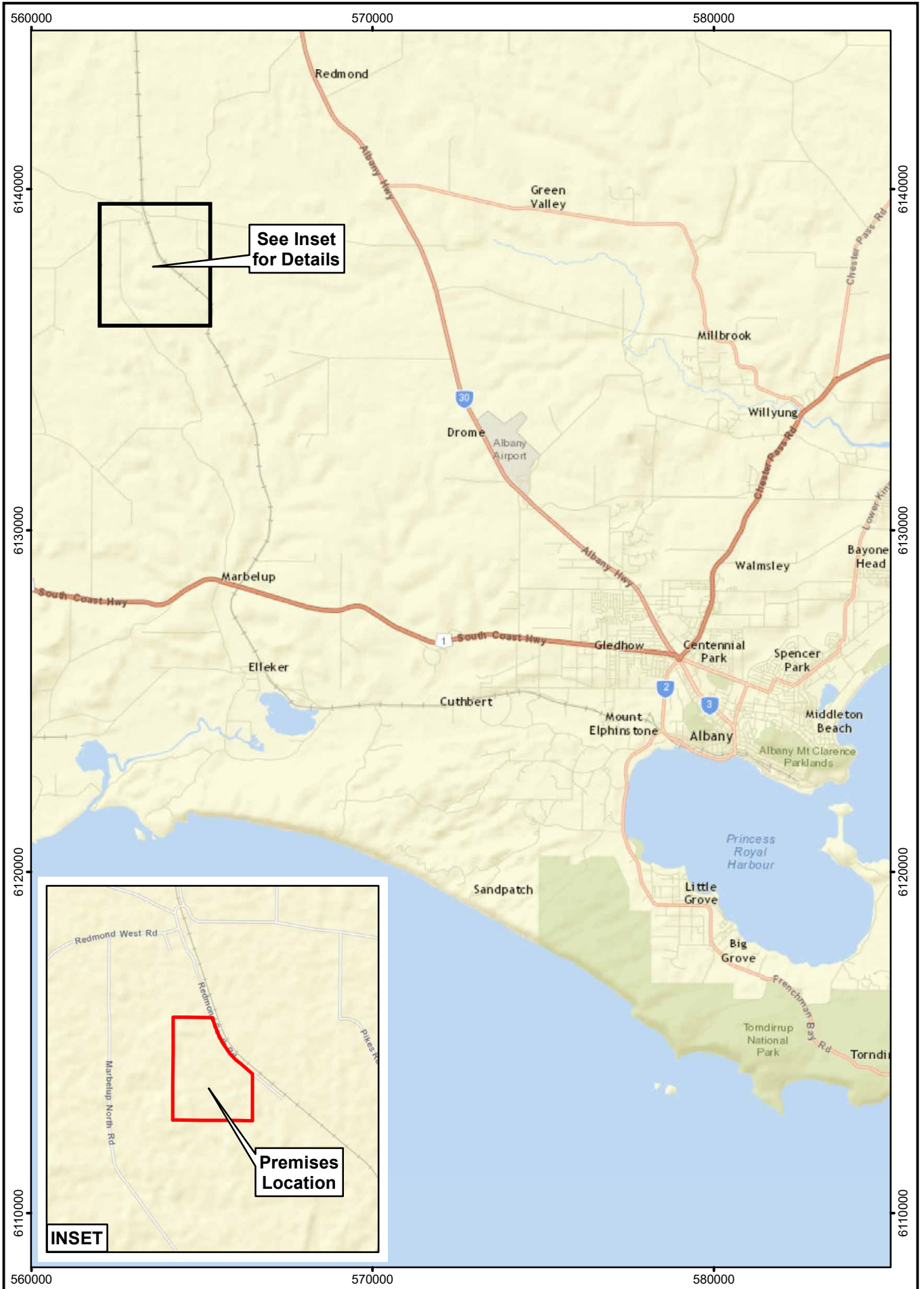
**Department of Water (DoW) (2009)** *Water Quality Protection Note 39: Ponds for Stabilising Organic Material*, available at: [https://www.water.wa.gov.au/\\_\\_data/assets/pdf\\_file/0005/4100/84601.pdf](https://www.water.wa.gov.au/__data/assets/pdf_file/0005/4100/84601.pdf).

**Geological Survey of Western Australia (GSWA) (2016)** 1:250,000 Geology Mosaic of Western Australia.

**NationalMap (2018)** NationalMap, available at: <https://nationalmap.gov.au/>

**Western Australian Local Government Association (WALGA) (2018)** Environmental Planning Tool, available at: <http://walga.asn.au/Subscription-Services/Environmental-Planning-Tool.aspx>

## FIGURES

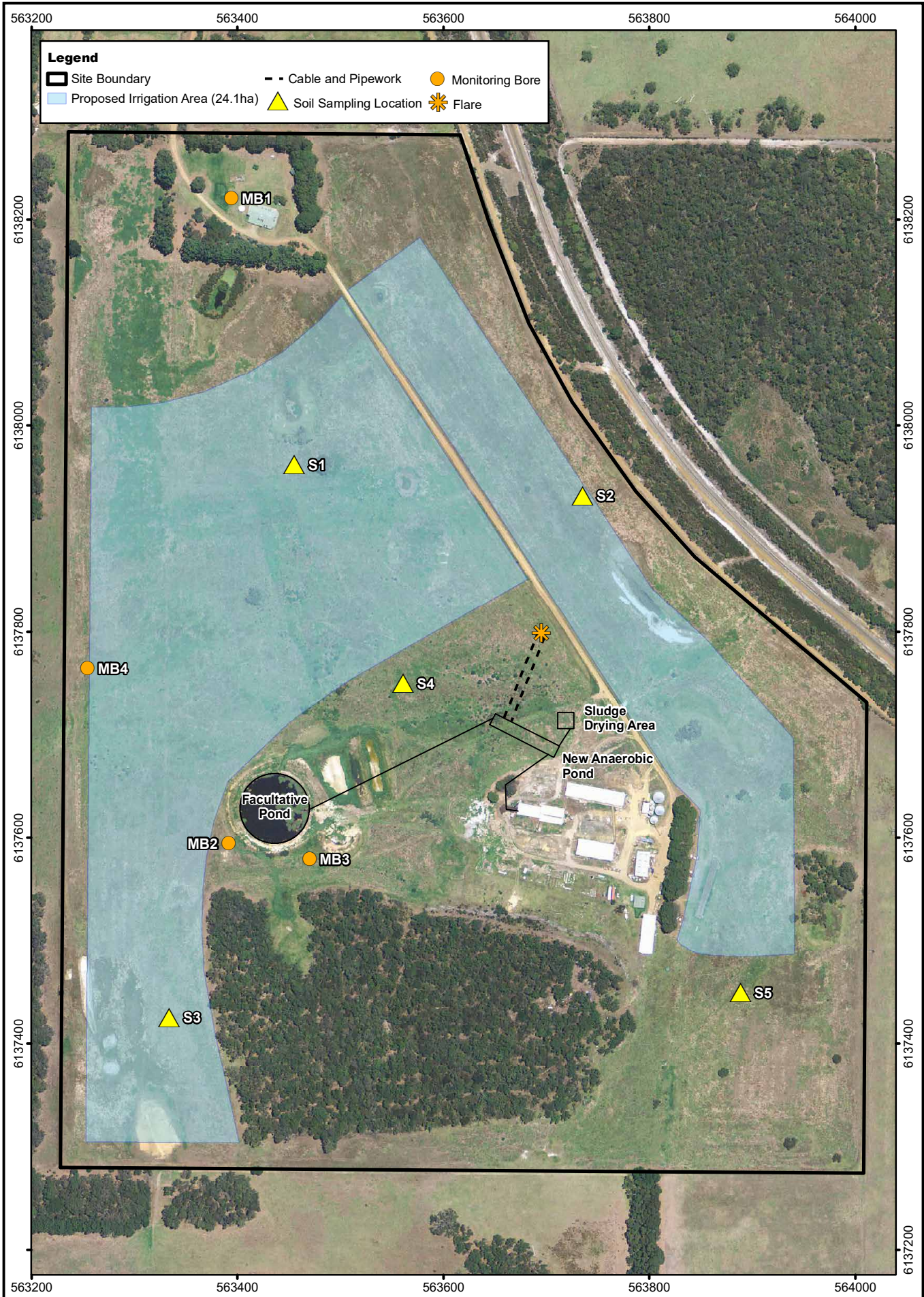


N  
 0 1.5 3 km  
 Scale: 1:150,000  
 MGA94 (Zone 50)  
 CAD Ref: a2584\_F001  
 Date: Nov 2017

**Aurora**  
 environmental  
ASSESS • ADVISE • APPLY  
 Author: K. McCormack AU Ref: MPO/2017/001  
 Drawn: CAD Resources ~ www.cadresources.com.au  
 Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

71 Redmond South Road, Redmond  
**Regional Location**

Figure:  
**1**



**Legend**

- Site Boundary
- Cable and Pipework
- Monitoring Bore
- Proposed Irrigation Area (24.1ha)
- ▲ Soil Sampling Location
- ✱ Flare

N  
 0 40 80 m  
 Scale: 1:5,000  
 MGA94 (Zone 50)

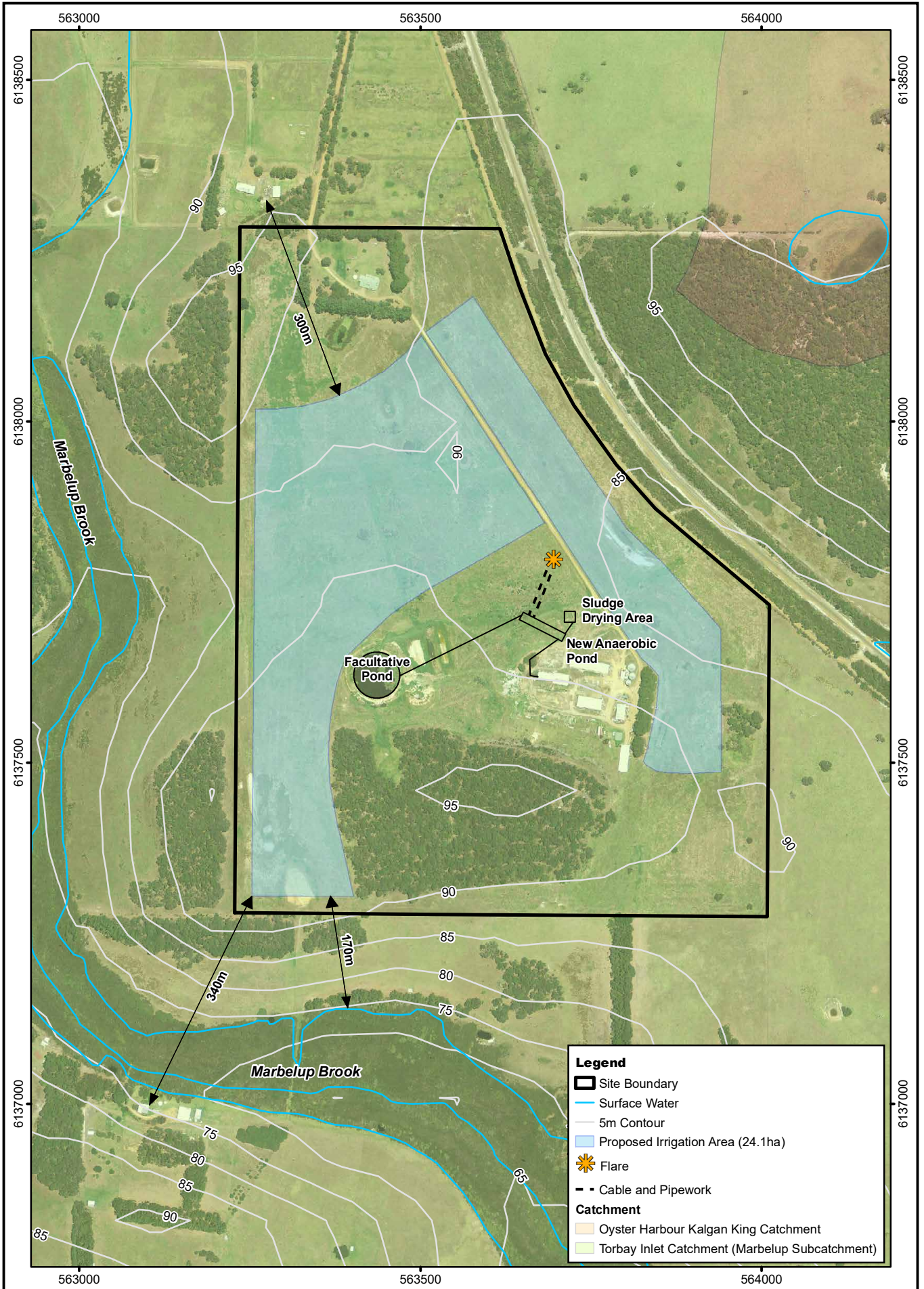
CAD Ref: a2584\_F002  
 Date: February 2018

**Aurora**  
 environmental  
ASSESS • ADVISE • APPLY

Author: K. McCormack | AU Ref: MPO/2017/001  
 Drawn: CAD Resources ~ www.cadresources.com.au  
 Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

71 Redmond South Road, Redmond  
**Operational Layout**

Figure:  
2

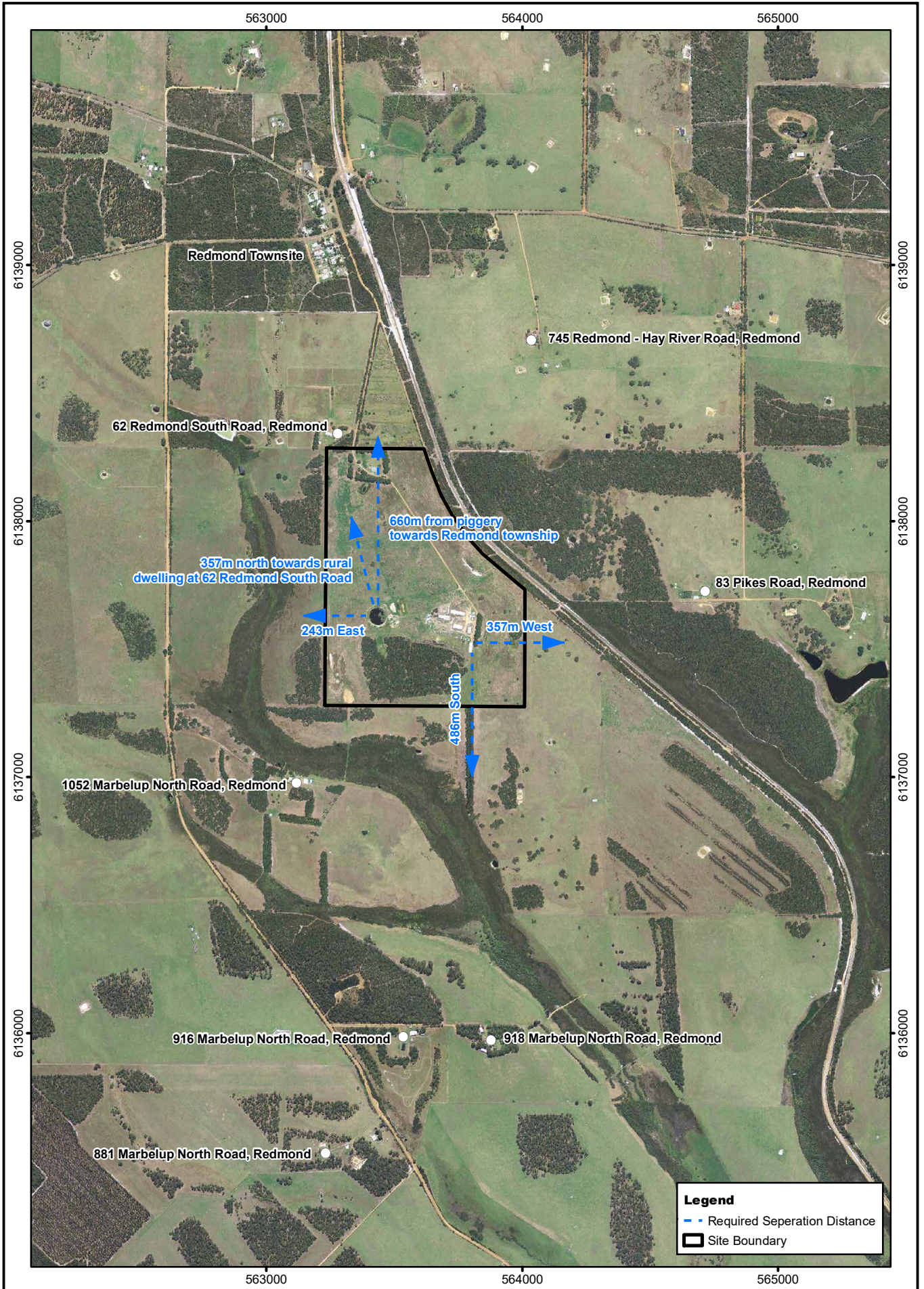


N  
 0 50 100 m  
 Scale: 1:7,500  
 MGA94 (Zone 50)  
 CAD Ref: a2584\_F003  
 Date: February 2018  
 Rev: A | A4

**Aurora**  
 environmental  
ASSESS • ADVISE • APPLY  
 Author: K. McCormack | AU Ref: MPO/2017/001  
 Drawn: CAD Resources ~ www.cadresources.com.au  
 Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

71 Redmond South Road, Redmond  
**Site Layout**

Figure:  
**3**



**Legend**  
 - - - Required Separation Distance  
 [ ] Site Boundary

N  
 0 150 300 m  
 Scale: 1:20,000  
 MGA94 (Zone 50)

CAD Ref: a2584\_F004  
 Date: February 2018

Rev: A | A4

**Aurora**  
 environmental  
ASSESS • ADVISE • APPLY

Author: K. McCormack | AU Ref: MPO/2017/001  
 Drawn: CAD Resources ~ www.cadresources.com.au  
 Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

71 Redmond South Road, Redmond  
**Surrounding Land Use**

Figure:  
**4**

# **APPENDIX 1**

## Wind Roses



# Rose of Wind direction versus Wind speed in km/h (12 Apr 1965 to 25 Feb 2014)

Custom times selected, refer to attached note for details

## ALBANY AIRPORT COMPARISON

Site No: 009741 • Opened Jan 1942 • Closed Feb 2014 • Latitude: -34.9414° • Longitude: 117.8022° • Elevation 68m

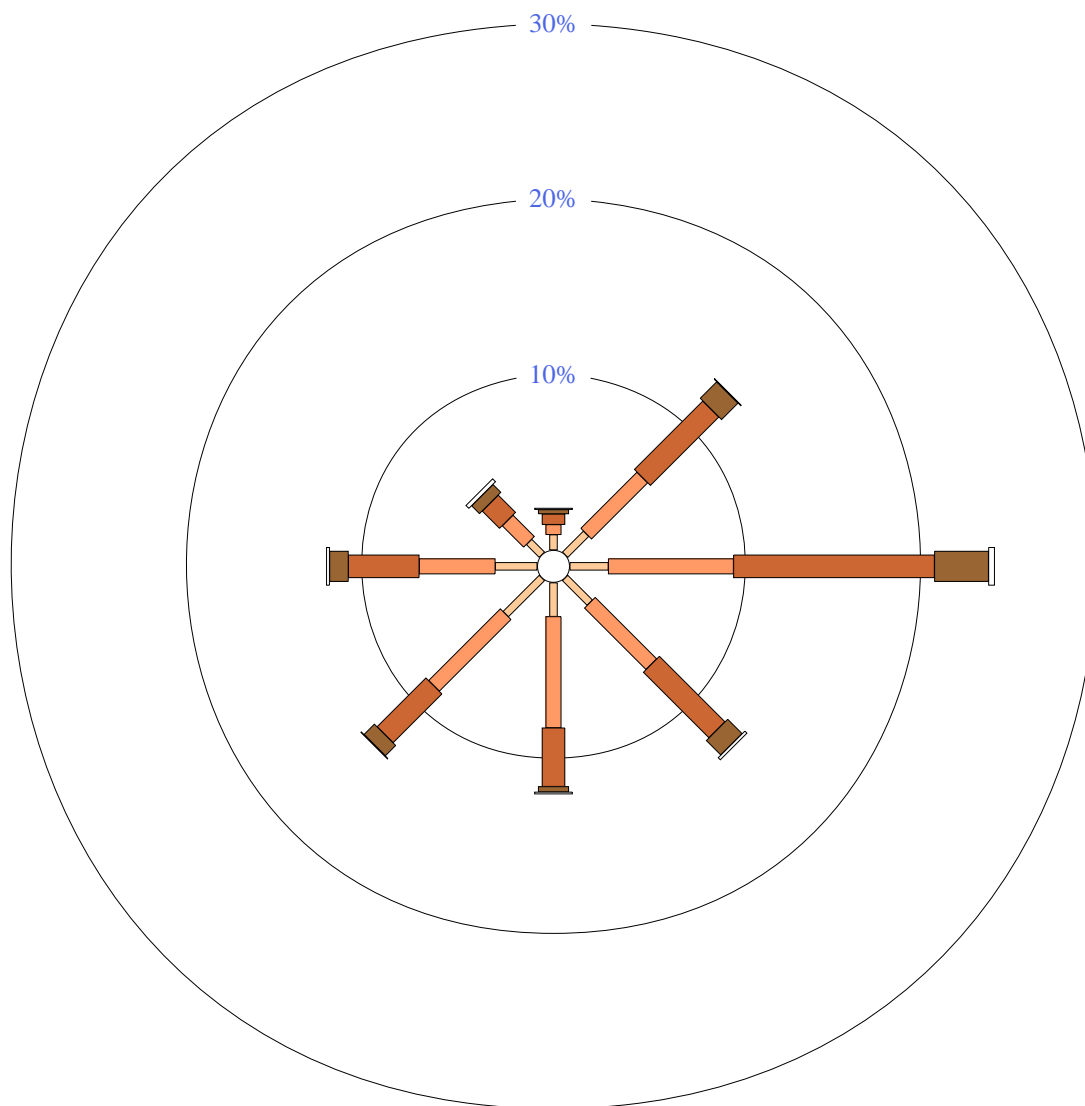
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Jan  
1515 Total Observations

Calm 5%



# Rose of Wind direction versus Wind speed in km/h (12 Apr 1965 to 25 Feb 2014)

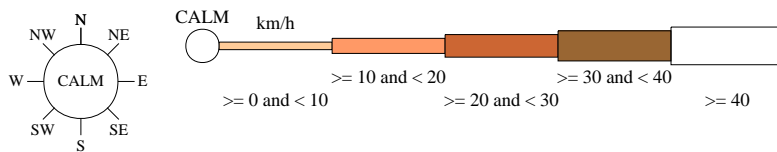
Custom times selected, refer to attached note for details

## ALBANY AIRPORT COMPARISON

Site No: 009741 • Opened Jan 1942 • Closed Feb 2014 • Latitude: -34.9414° • Longitude: 117.8022° • Elevation 68m

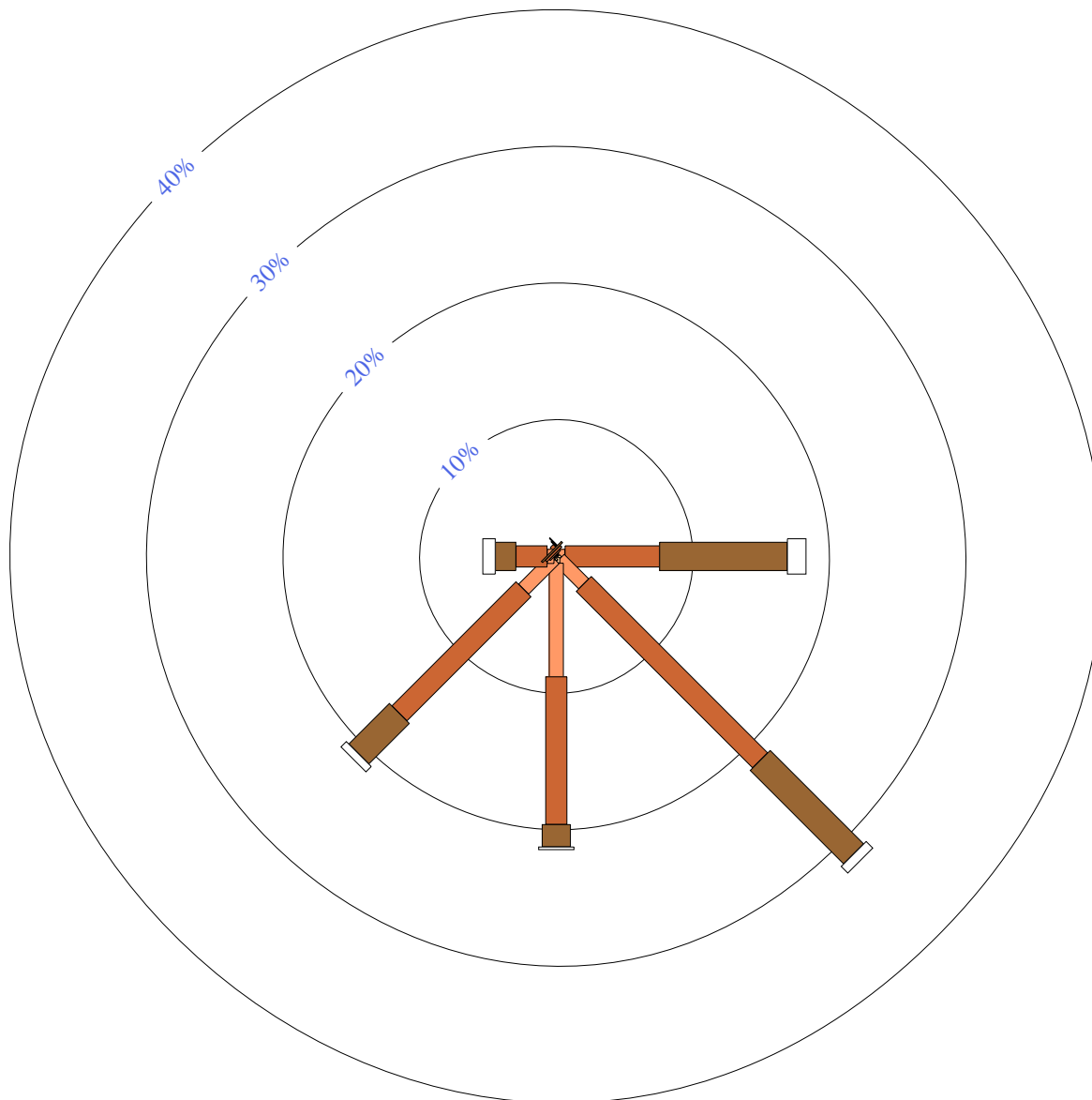
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Jan  
1515 Total Observations

Calm \*



# Rose of Wind direction versus Wind speed in km/h (12 Apr 1965 to 25 Feb 2014)

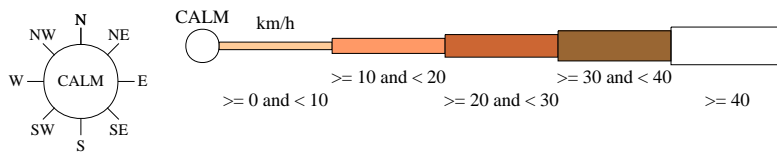
Custom times selected, refer to attached note for details

## ALBANY AIRPORT COMPARISON

Site No: 009741 • Opened Jan 1942 • Closed Feb 2014 • Latitude: -34.9414° • Longitude: 117.8022° • Elevation 68m

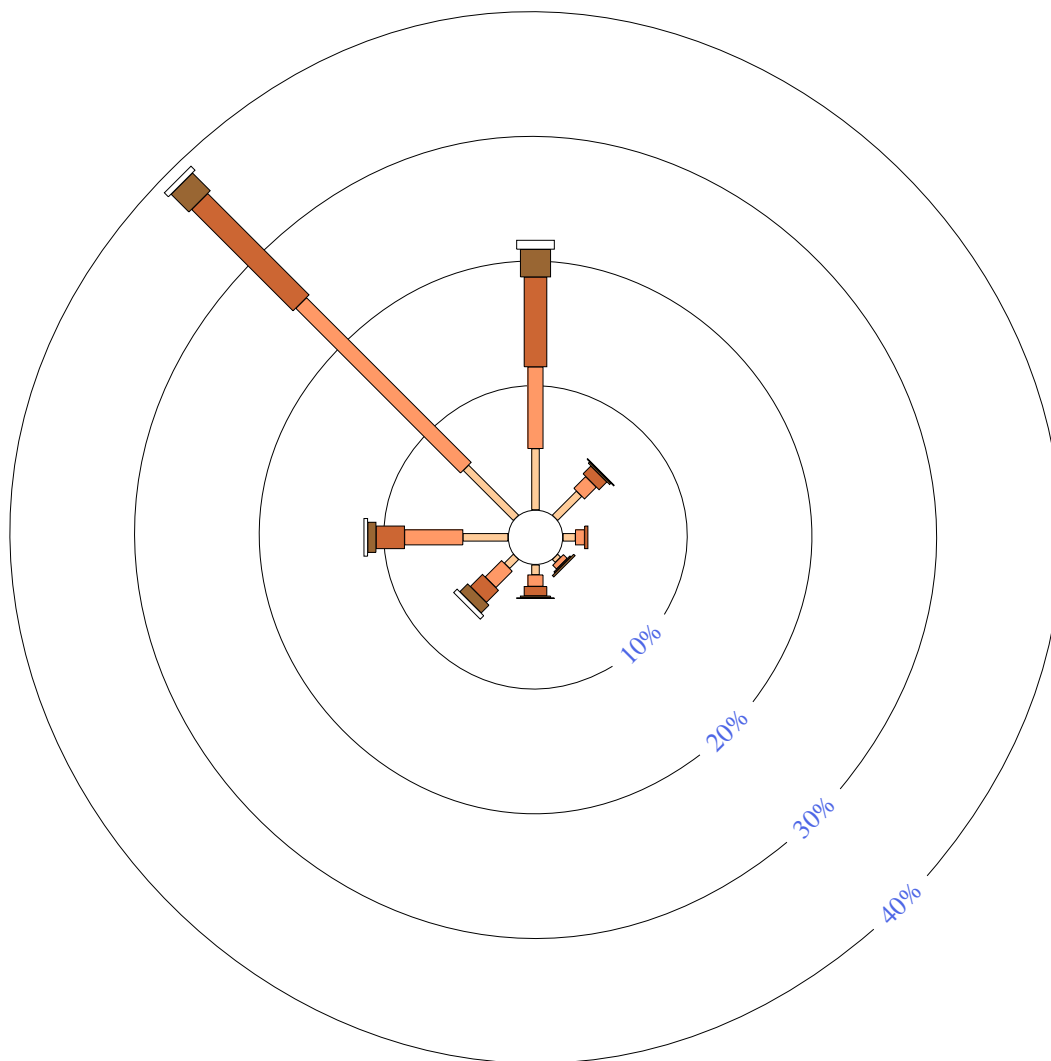
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Jul  
1518 Total Observations

Calm 11%



# Rose of Wind direction versus Wind speed in km/h (12 Apr 1965 to 25 Feb 2014)

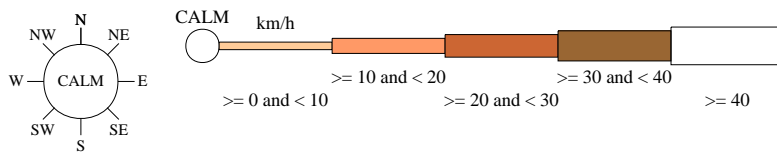
Custom times selected, refer to attached note for details

## ALBANY AIRPORT COMPARISON

Site No: 009741 • Opened Jan 1942 • Closed Feb 2014 • Latitude: -34.9414° • Longitude: 117.8022° • Elevation 68m

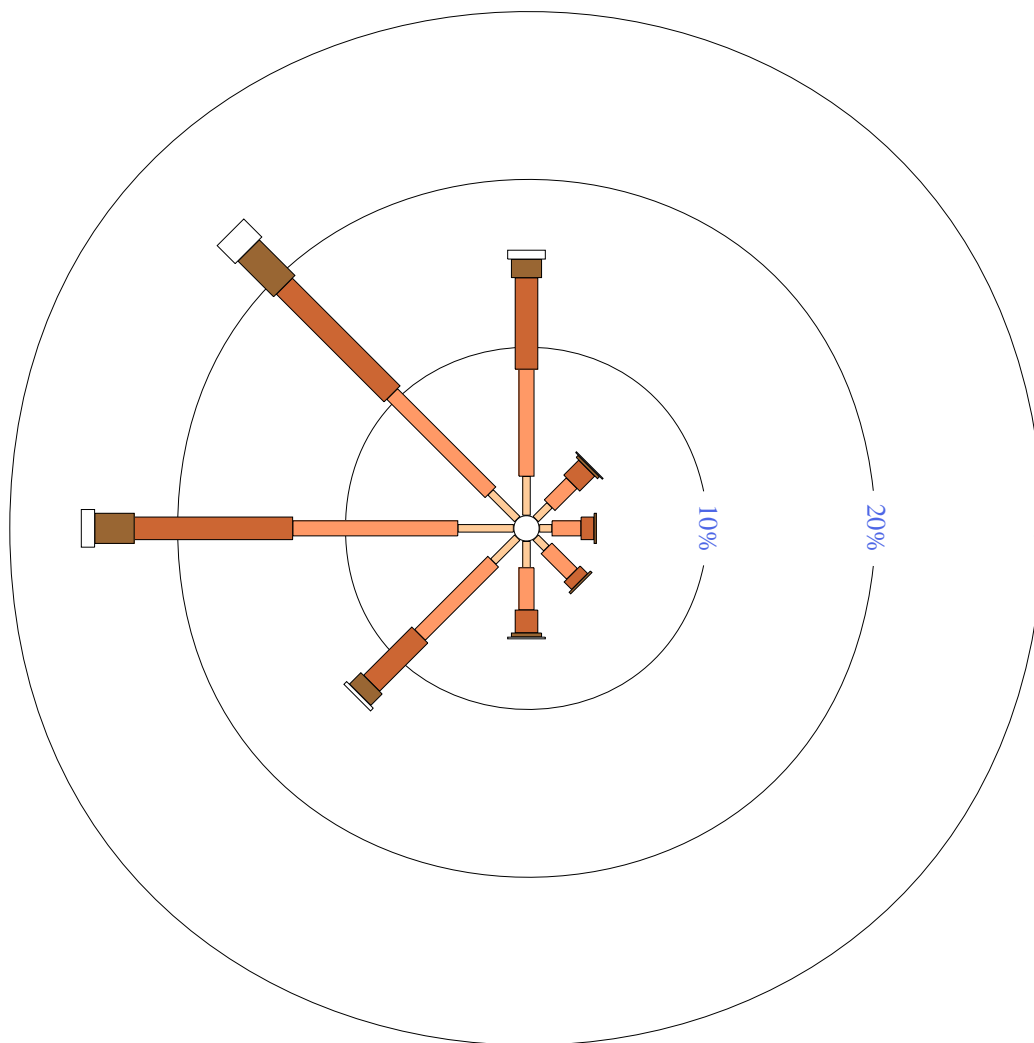
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Jul  
1517 Total Observations

Calm 4%



## **APPENDIX 2**

EPBC Act Protected Matters Report



# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 06/02/18 17:47:41

[Summary](#)

[Details](#)

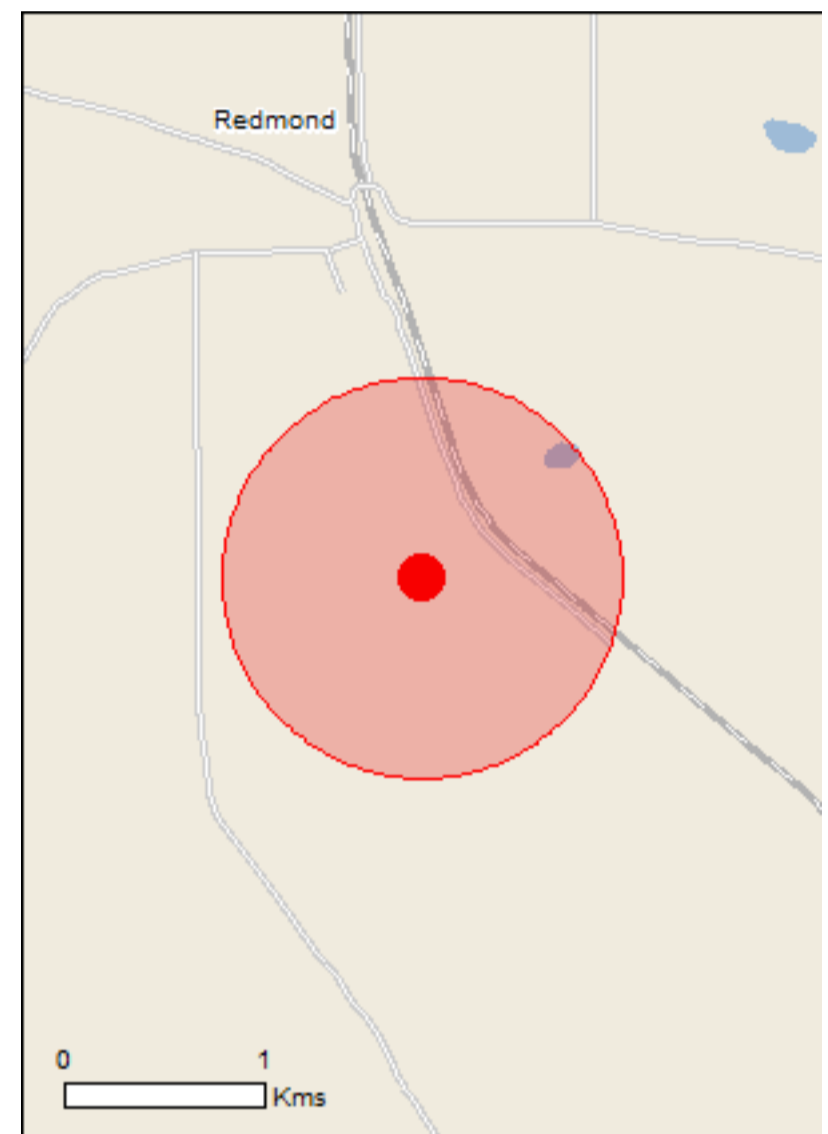
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

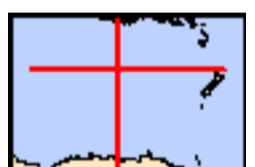
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 1.0Km



# Summary

## Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	17
<a href="#">Listed Migratory Species:</a>	9

## Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

<a href="#">Commonwealth Land:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	13
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Commonwealth Reserves Marine:</a>	None

## Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

<a href="#">State and Territory Reserves:</a>	None
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	22
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

Listed Threatened Species		[ Resource Information ]
Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Botaurus poiciloptilus</a> Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calyptorhynchus banksii naso</a> Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Calyptorhynchus baudinii</a> Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Breeding likely to occur within area
<a href="#">Calyptorhynchus latirostris</a> Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
<a href="#">Dasyornis longirostris</a> Western Bristlebird [515]	Vulnerable	Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<b>Fish</b>		
<a href="#">Nannatherina balstoni</a> Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat may occur within area
<b>Mammals</b>		
<a href="#">Dasyurus geoffroii</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Parantechinus apicalis</a> Dibbler [313]	Endangered	Species or species habitat likely to occur within area
<a href="#">Pseudocheirus occidentalis</a> Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Vulnerable	Species or species habitat may occur within area
<b>Plants</b>		
<a href="#">Banksia brownii</a> Brown's Banksia, Feather-leaved Banksia [8277]	Endangered	Species or species habitat may occur within area



Name	Status	Type of Presence
<a href="#">Chordifex abortivus</a> Manypeaks Rush [64868]	Endangered	Species or species habitat may occur within area
<a href="#">Conostylis misera</a> Grass Conostylis [21320]	Endangered	Species or species habitat likely to occur within area
<a href="#">Drakaea micrantha</a> Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area
<a href="#">Isopogon uncinatus</a> Albany Cone Bush, Hook-leaf Isopogon [20871]	Endangered	Species or species habitat likely to occur within area
<a href="#">Sphenotoma drummondii</a> Mountain Paper-heath [21160]	Endangered	Species or species habitat may occur within area

### Listed Migratory Species [ [Resource Information](#) ]

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat may occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

## Other Matters Protected by the EPBC Act

### Listed Marine Species [ [Resource Information](#) ]

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Actitis hypoleucos</a>		
Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a>		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a>		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
<a href="#">Ardea ibis</a>		
Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a>		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a>		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a>		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Haliaeetus leucogaster</a>		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<a href="#">Merops ornatus</a>		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a>		
Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a>		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a>		
Osprey [952]		Species or species habitat may occur within area
<a href="#">Tringa nebularia</a>		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

## Extra Information

### Invasive Species

[ [Resource Information](#) ]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
<b>Birds</b>		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
<b>Mammals</b>		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
<b>Plants</b>		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large- leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

# Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

# Coordinates

-34.90058 117.69539

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

## **APPENDIX 3**

### PigBal Summary

## 1. Cover

# PigBal 4

## A model for estimating piggery waste production

Version 4.094 - November 2016

The PigBal 4 model uses a mass balance approach to estimate piggery waste production (solids and nutrients) based on detailed dietary data.

PigBal 4 modelling results are typically used for:

- Designing piggery effluent treatment and reuse systems.
- Estimating the energy output and economic viability of piggery biogas collection and use systems.
- Estimating piggery GHG emissions for statutory reporting purposes.
- Preparing applications for new and expanding piggery developments.

PigBal 4 was developed by Skerman *et al.* (2013b) with funding assistance from Australian Pork Limited (APL) under Project No 2010/1011.334: Validation and development of the PigBal model . Stage 2 (Skerman *et al.* , 2013a).

PigBal 4 supersedes the original version of the model which was developed by Casey *et al.* (1996), and all subsequent versions.

Detailed guidance on the use of this model is provided in the User Manual (Skerman *et al.*, 2013c).

### Enquiries:

Phone: DAF Customer Service Centre 13 25 23  
Contact: Alan Skerman (Principal Environmental Engineer)  
Email: [alan.skerman@daf.qld.gov.au](mailto:alan.skerman@daf.qld.gov.au)





## 5. Herd details

Pig class	Pigs accommodated in piggery			Shed type (waste management system)	Pig age			Pig live weight			SPU factor Live weight regression (SPU.pig <sup>-1</sup> )	No of SPUs Live weight regression (SPU)
	Calculated values	Entered values	Adopted values		In	Out	Average	In	Out	Average		
	(pigs. stage <sup>-1</sup> )	(pigs. stage <sup>-1</sup> )	(pigs. stage <sup>-1</sup> )		(weeks)	(weeks)	(weeks)	(kg. pig <sup>-1</sup> )	(kg. pig <sup>-1</sup> )	(kg. pig <sup>-1</sup> )		
Gilts	35		35	Flushing	24.0	28.0	26.0	115.2	160.0	137.6	1.80	62
Boars	20		20	Flushing	24.0	180.4	102.2	115.2	300.0	207.6	1.60	32
Gestating sows	751		751	Flushing				160.0	215.0	187.5	1.60	1,201
Lactating sows	149		149	Pull plug / Static pit				215.0	160.0	187.5	2.50	372
Suckers	1,581		1,581	Pull plug / Static pit	0.0	3.7	1.9	1.4	6.7	4.1	0.10	154
Weaner	0		0	Flushing	3.7	10.0	6.9	0.0	30.0	15.0	0.42	0
Porker	0		0	Flushing	10.0	14.0	12.0	0.0	55.0	27.5	0.75	0
Grower	0		0	Flushing	14.0	18.0	16.0	0.0	80.0	40.0	1.03	0
Finisher	0		0	Flushing	18.0	22.0	20.0	0.0	104.0	52.0	1.25	0
Unallocated	0		0		0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
Unallocated	0		0		0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
<b>Totals:</b>	<b>2,535</b>		<b>2,535</b>									<b>1,821</b>

Pig class	Pigs purchased		Pig mortalities		Pigs sold			Pigs in piggery (kg live weight)
	Number	Mass	Number	Mass	Number	Live weight	Dressed weight	
	(pigs. yr <sup>-1</sup> )	(kg. yr <sup>-1</sup> )	(pigs. yr <sup>-1</sup> )	(kg. yr <sup>-1</sup> )	(pigs. yr <sup>-1</sup> )	(kg. yr <sup>-1</sup> )	(kg. yr <sup>-1</sup> )	
Gilts	0	0	5	567	41	6,480	4,925	4,767
Boars	0	0	0	100	6	1,900	1,444	4,152
Gestating sows			38	6,005	360	57,600	43,776	140,742
Lactating sows			7	1,606			0	27,892
Suckers			2,584	10,463	20,903	140,049	106,438	6,403
Weaner	0	0	0	0	0	0	0	0
Porker	0	0	0	0	0	0	0	0
Grower	0	0	0	0	0	0	0	0
Finisher	0	0	0	0	0	0	0	0
Unallocated	0	0	0	0	0	0	0	0
Unallocated	0	0	0	0	0	0	0	0
<b>Totals:</b>	<b>0</b>	<b>0</b>	<b>2,634</b>	<b>18,741</b>	<b>21,310</b>	<b>206,029</b>	<b>156,582</b>	<b>183,956</b>

## 9. Water

### Drinking water and wastage

Pig class	No of pigs (pigs. stage <sup>-1</sup> )	Feed ingested (as fed) (kg. pig <sup>-1</sup> . day <sup>-1</sup> )	Wf <sup>1</sup>	Tf <sup>1</sup>	Calculated water intake			Drinking water wastage			Water intake + wastage		Cooling water flowrate <sup>2</sup> (mL. hr <sup>-1</sup> . pig <sup>-1</sup> )	Cooling water use (L. yr <sup>-1</sup> )
					(L. pig <sup>-1</sup> . day <sup>-1</sup> )	(L. day <sup>-1</sup> )	(L. yr <sup>-1</sup> )	(%)	(L. pig <sup>-1</sup> . day <sup>-1</sup> )	(L. yr <sup>-1</sup> )	(L. pig <sup>-1</sup> . day <sup>-1</sup> )	(L. yr <sup>-1</sup> )		
Glts	35	2.50	2.5	1.2	7.50	260	94,845	25%	1.88	23,711	9.38	118,557	300	5,613
Boars	20	2.30	2.5	1.2	6.90	138	50,370	25%	1.73	12,593	8.63	62,963	300	3,240
Gestating sows	751	2.30	2.8	1.2	7.73	5,801	2,117,302	25%	1.93	529,325	9.66	2,646,627	300	121,601
Lactating sows	149	4.50	2.8	1.6	20.16	2,999	1,094,603	25%	5.04	273,651	25.20	1,368,253	300	24,098
Suckers	1,581	0.02	2.5	1.2	0.05	85	31,161	25%	0.01	7,790	0.07	38,952	0	0
Weaner	0	0.00	2.5	1.2	0.00	0	0	25%	0.00	0	0.00	0	0	0
Porker	0	0.00	2.5	1.2	0.00	0	0	25%	0.00	0	0.00	0	0	0
Grower	0	0.00	2.5	1.2	0.00	0	0	25%	0.00	0	0.00	0	0	0
Finisher	0	0.00	2.5	1.2	0.00	0	0	25%	0.00	0	0.00	0	0	0
Unallocated	0	0.00	2.5	1.2	0.00	0	0		0.00	0	0.00	0	0	0
Unallocated	0	0.00	2.5	1.2	0.00	0	0		0.00	0	0.00	0	0	0
<b>Totals:</b>	<b>2,535</b>					<b>9,283</b>	<b>3,388,281</b>			<b>847,070</b>		<b>4,235,352</b>		<b>154,552</b>

<sup>1</sup> Wiedemann *et al.* (2012)

<sup>2</sup> Taylor, Kruger and Ferrier (1994)

### Cleaning water

Daily flushing volume **24,000** L. day<sup>-1</sup>  
 Daily hosing volume **10,000** L. day<sup>-1</sup>

Cleaning system **Medium flush**  
 Shed effluent TS conc 2.0% %  
 Recycled effluent TS conc 0.5% %

Shed effluent TS 634 kg. day<sup>-1</sup>  
 Total effluent out of shed 31,690 L. day<sup>-1</sup>  
 Total water out of shed 31,056 L. day<sup>-1</sup>

Manure TS 438 kg. day<sup>-1</sup>  
 Waste feed TS 196 kg. day<sup>-1</sup>  
 Manure moisture content 93% %  
 Manure water 5,813 L. day<sup>-1</sup>  
 Waste feed moisture content 12% %  
 Waste feed water 27 L. day<sup>-1</sup>  
 Drinker waste water 2,321 L. day<sup>-1</sup>  
 Flushing / hosing water 34,000 L. day<sup>-1</sup>  
 12.41 ML. yr<sup>-1</sup>  
 13 L. pig<sup>-1</sup>. day<sup>-1</sup>

% flushing / hosing water supplied from recycled effluent **67%** %

### Spray and drip cooling water

Water cooling operation time **540** hr. yr<sup>-1</sup>

### Clean water requirement

	(ML. yr <sup>-1</sup> )	(L. day <sup>-1</sup> )
Drinking	3.39	9,283
Drinker waste	0.85	2,321
Cleaning	4.10	11,220
Cooling	0.15	423
<b>Total:</b>	<b>8.49</b>	<b>23,247</b>

### Effluent discharged to primary anaerobic pond

	(ML. yr <sup>-1</sup> )	(L. day <sup>-1</sup> )
Flushing / hosing water	12.41	34,000
Manure	2.28	6,250
Waste feed	0.08	223
Drinker waste water	0.85	2,321
<b>Total:</b>	<b>15.62</b>	<b>42,794</b>

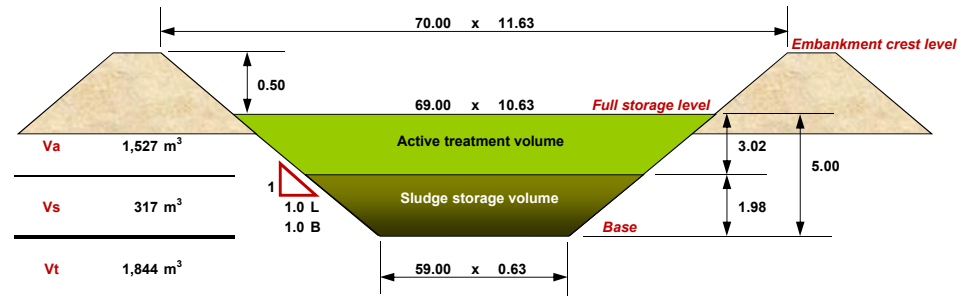
## 11. Anaerobic pond design

Effluent TS entering primary pond	634	kg TS. day <sup>-1</sup>
Effluent VS entering primary pond	501	kg VS. day <sup>-1</sup>
Piggery State	<b>Western Australia</b>	
Piggery locality	<b>Albany</b>	
Suggested anaerobic pond activity ratio, k	0.70	(based on selected locality)
Climate (Table 12.1 NEGP)	<b>Warm</b>	
Suggested anaerobic pond activity ratio, k	0.80	(based on selected climate)
User selected anaerobic pond activity ratio, k	<b>0.82</b>	

**Latitude Longitude**  
 (dec degrees)  
 -35.02 117.52  
 Warm

Pond design philosophy	<b>Covered anaerobic pond</b>	
Suggested baseline VS loading rate	0.400	kg VS. m <sup>-3</sup> . day <sup>-1</sup>
Suggested adjusted VS loading rate	0.328	kg VS. m <sup>-3</sup> . day <sup>-1</sup>
User selected VS loading rate	<b>0.328</b>	kg VS. m <sup>-3</sup> . day <sup>-1</sup>
Adopted anaerobic pond VS loading rate	0.328	kg VS. m <sup>-3</sup> . day <sup>-1</sup>
Required active treatment volume, <b>V<sub>a</sub></b>	1,527	m <sup>3</sup>
Minimum hydraulic retention time (HRT)	36	days
Sludge accumulation rate	<b>0.00137</b>	m <sup>3</sup> . kg TS <sup>-1</sup>
Desludging interval	<b>1.0</b>	years
Required sludge storage volume, <b>V<sub>s</sub></b>	317	m <sup>3</sup>
Required treatment + sludge volume, <b>V<sub>t</sub></b>	1,844	m <sup>3</sup>
Maximum hydraulic retention time (HRT)	43	days
Min anaerobic pond VS loading rate	0.272	kg VS. m <sup>-3</sup> . day <sup>-1</sup>

Total storage depth	<b>5.00</b>	m
Batter - lengthwise, (1 vertical : Z horizontal)	<b>1.00</b>	
Batter - breadthwise, (1 vertical : Z horizontal)	<b>1.00</b>	
Freeboard - full storage level to crest	<b>0.50</b>	m
Length - at embankment crest	<b>70.00</b>	m
Breadth - at embankment crest	11.63	m
Length - at full storage level	69.00	m
Breadth - at full storage level	10.63	m
Length - at base	59.00	m
Breadth - at base	0.63	m
Max sludge depth - above base	1.98	m
Min depth to top of sludge - below bywash level	3.02	m
Liner area - to bywash level	1,022	m <sup>2</sup>



**Note:**

Effluent which overflows from primary anaerobic ponds is unsuitable for direct discharge into the environment or natural watercourses. Overflow from primary ponds should generally be directed into a secondary treatment or holding pond where the effluent is temporarily stored prior to carefully managed irrigation onto land growing crop or pasture. Most conventional piggeries require at least one anaerobic treatment pond and one secondary treatment or holding pond. In some cases, the overflow from the secondary pond may be directed into one or more subsequent ponds for further treatment or to provide additional effluent holding capacity. The final pond in the effluent treatment / storage system may be referred to as a wet weather storage pond.

In general, the second and any subsequent ponds should be designed to store all effluent discharged from the primary pond until the land is sufficiently dry to receive the irrigated effluent, or until agronomic conditions are favourable. In winter-dominant rainfall areas, secondary / holding ponds may be required to store all effluent discharged from the primary pond for a period of up to six months, from late autumn until early spring. Secondary / holding ponds are generally designed using a (preferably daily) water balance approach, based on limiting overflows from secondary / holding ponds to a minimum interval of 10 years, on average, using historical rainfall and evaporation data for the piggery site. Various computer models may be used for this purpose. At environmentally sensitive sites, the minimum overflow interval may be increased to further reduce the potential for environmental harm.

Cover additional anchorage allowance	<b>3</b>	m
Cover area - trenched into bank	1,379	m <sup>2</sup>

## **APPENDIX 4**

### Water Balance Calculations

**MARBELUP PORK**

Water Balance - 900 Sow Breeder Operation

**INPUT DATA**

Centralised data input sheet

Input data to blue cells only

**Treatment System Dimensions**

Daily Inflow to Pond 1 (kL/day) **42.8** (from PigBal )  
 16 ML/year

Name	Length (m)	Width (m)	Sideslope (1:X)	Depth to N Freeboard	Total Depth	Wastewater Extracted (kL/day)	Wastewater Extracted (ML/year)	% Depth at Start of Timeseries
Anaerobic Pond 1	70	12	1	5	0.5	5.5	0	100
Facultative	68		1	2	0.5	2.5	22.7	100

\* Circular Pond

**Evaporation Data**

	Days/Month	Monthly Evap mm	Daily Evap mm
Jan	31	213	8.81
Feb	28	175.1	8.75
Mar	31	157.4	6.90
Apr	30	105.9	4.10
May	31	69.6	2.55
Jun	30	48.9	1.80
Jul	31	55.9	1.68
Aug	31	76.1	2.42
Sep	30	97.3	3.13
Oct	31	131	4.61
Nov	30	157.3	6.60
Dec	31	196.7	8.58
Total	365	1816	

Evap Calculator	Dept Ag - Alban	BOM	
		mm/day	mm/month
207.6	213	6.6	204.6
175.1	165	6.2	173.6
157.4	145	5	155
105.9	88	3.3	99
69.6	61	2.2	68.2
48.9	45	1.9	57
55.9	47	1.9	58.9
76.1	64	2.3	71.3
97.3	81	2.8	84
131	102	3.6	111.6
157.3	145	4.7	141
196.7	193	6	186
1478.8	1816		1410.2

**Rainfall Data**

BOM Station Number 9741

BOM Station Name Albany Airport

Data Period 1965 to 2014

**Data Used in Water Balance**

	Days/Month	Monthly Rainfall mm	Daily Rainfall mm
Jan	31	23.60	0.76
Feb	28	22.30	0.80
Mar	31	33.60	1.08
Apr	30	61.30	2.04
May	31	89.80	2.90
Jun	30	108.00	3.60
Jul	31	119.30	3.85
Aug	31	106.80	3.45
Sep	30	88.50	2.95
Oct	31	70.80	2.28
Nov	30	47.00	1.57
Dec	31	27.80	0.90
Total	365	798.8	

	Days/Month	Monthly Rainfall 90% ile Rain mean	Monthly Rainfall AA 90%ile
Jan	31	23.6	28.4
Feb	28	22.3	26.8
Mar	31	33.6	40.4
Apr	30	61.3	73.6
May	31	89.8	107.9
Jun	30	108	129.7
Jul	31	119.3	143.3
Aug	31	106.8	128.3
Sep	30	88.5	106.3
Oct	31	70.8	85.1
Nov	30	47	56.5
Dec	31	27.8	33.4
Total	365	798.10	959.64

**MARBELUP PORK**

Feb-18

**Faculative Pond**

Blue figures are user defined

Rainfall Data - Bureau of Meteorology - Station 009741 Albany Airport

Evaporation Data - DAFWA 1987 - Albany

Assumptions

- Inflow overflow from Anerobic Pond 1 only

**Rainfall Runoff**

Overflow from Pond 1 Only

Runoff Coefficient - direct rainfall 1 - direct rainfall into ponds

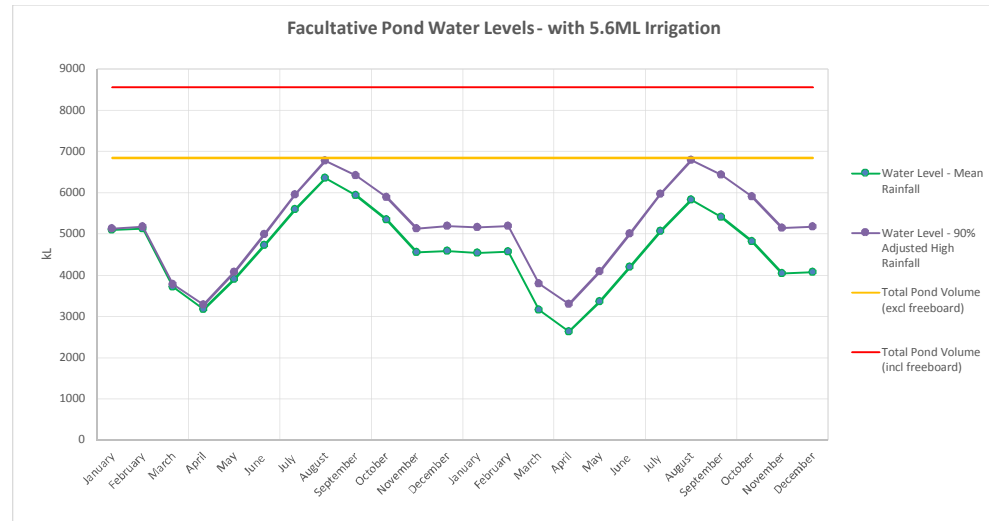
Initial Evap Pond Volume (m3) 5133.362396 - 100% Capacity

Initial pond surface area (m2) 3525.652355

Evaporation Reduction Factor (%) 0% \*\*Assumes no surface crust/debris

Maximum Pond Volume (m3) (excl freeb 6844.483195

Maximum Pond Volume (m3) (incl freeb 8555.603993



Jan-00

Date	Rainfall mm	Direct Rainfall IN m3	IN from Pond 1 m3	TOTAL IN	Evaporation mm	Evap OUT m3	Reuse OUT m3	Irrigation m3	TOTAL OUT m3	Water Level - Mean Rainfall	POND VOLUME AFTER OVERFLOW m3	OVERFLOW VOLUME m3	Total Pond Volume (excl freeboard)	Total Pond Volume (incl freeboard)
January	23.60	88.25	1326.80	1415.05	213.00	750.96	703.70	0	1454.66	5094	5094	0	6844.483195	8555.603993
February	22.30	83.39	1198.40	1281.79	175.10	617.34	635.60	0	1252.94	5123	5123	0	6844.483195	8555.603993
March	33.60	125.64	1326.80	1452.44	157.40	554.94	703.70	1600	2858.64	3716	3716	0	6844.483195	8555.603993
April	61.30	229.22	1284.00	1513.22	105.90	373.37	681.00	1000	2054.37	3175	3175	0	6844.483195	8555.603993
May	89.80	335.79	1326.80	1662.59	69.60	238.12	703.70	0	941.82	3896	3896	0	6844.483195	8555.603993
June	108.00	403.84	1284.00	1687.84	48.90	172.40	681.00	0	853.40	4730	4730	0	6844.483195	8555.603993
July	119.30	446.10	1326.80	1772.90	55.90	197.08	703.70	0	900.78	5603	5603	0	6844.483195	8555.603993
August	106.80	399.36	1326.80	1726.16	76.10	276.37	703.70	0	980.07	6349	6349	0	6844.483195	8555.603993
September	88.50	330.93	1284.00	1614.93	97.30	353.36	681.00	1000	2034.36	5929	5929	0	6844.483195	8555.603993
October	70.80	264.74	1326.80	1591.54	131.00	475.75	703.70	1000	2179.45	5341	5341	0	6844.483195	8555.603993
November	47.00	175.75	1284.00	1459.75	157.30	571.26	681.00	1000	2252.26	4549	4549	0	6844.483195	8555.603993
December	27.80	103.95	1326.80	1430.75	196.70	693.50	703.70	0	1397.20	4582	4582	0	6844.483195	8555.603993
January	23.60	88.25	1326.80	1415.05	213.00	750.96	703.70	0	1454.66	4543	4543	0	6844.483195	8555.603993
February	22.30	83.39	1198.40	1281.79	175.10	617.34	635.60	0	1252.94	4572	4572	0	6844.483195	8555.603993
March	33.60	125.64	1326.80	1452.44	157.40	554.94	703.70	1600	2858.64	3165	3165	0	6844.483195	8555.603993
April	61.30	229.22	1284.00	1513.22	105.90	362.30	681.00	1000	2043.30	2635	2635	0	6844.483195	8555.603993
May	89.80	335.79	1326.80	1662.59	69.60	238.12	703.70	0	941.82	3356	3356	0	6844.483195	8555.603993
June	108.00	403.84	1284.00	1687.84	48.90	167.30	681.00	0	848.30	4196	4196	0	6844.483195	8555.603993
July	119.30	446.10	1326.80	1772.90	55.90	197.08	703.70	0	900.78	5068	5068	0	6844.483195	8555.603993
August	106.80	399.36	1326.80	1726.16	76.10	268.30	703.70	0	972.00	5822	5822	0	6844.483195	8555.603993
September	88.50	330.93	1284.00	1614.93	97.30	353.36	681.00	1000	2034.36	5402	5402	0	6844.483195	8555.603993
October	70.80	264.74	1326.80	1591.54	131.00	475.75	703.70	1000	2179.45	4815	4815	0	6844.483195	8555.603993
November	47.00	175.75	1284.00	1459.75	157.30	554.59	681.00	1000	2235.59	4039	4039	0	6844.483195	8555.603993
December	27.80	103.95	1326.80	1430.75	196.70	693.50	703.70	0	1397.20	4072	4072	0	6844.483195	8555.603993

Total Irr Vol 5600.0

## **APPENDIX 5**

DWER's Guidance Statement Risk Assessment



# **Risk Assessments**

*Part V, Division 3, Environmental Protection Act 1986*

**Version: Final**

February 2017





## Document Version History

Date	Author	Version	Approved by
February 2017	Strategy and Reform	Final, V2	Jason Banks, Director General
November 2016	Strategy and Reform	Final, V1	Jason Banks, Director General
December 2015	As above	Draft released for consultation	As above

### Produced and published by

Department of Environment Regulation  
168 St Georges Terrace, Perth, Western Australia

February 2017

### Copyright © State of Western Australia 2017

All material is the copyright of the State of Western Australia. Permission is not given for any commercial use or sale of this material. No part of the contents of the publication may be reproduced by any process, electronic or otherwise, distributed, adapted, broadcast, performed in public or communicated to the public without the written consent of Department of Environment Regulation, except as permitted under the *Copyright Act 1968*.

### Accessibility

This document is available in alternative formats and languages on request.

## Objective

To provide guidance on the Department of Environment Regulation's (DER) regulatory framework and the application of regulatory controls for works approvals and licences granted under Part V, Division 3 of the *Environmental Protection Act 1986* (EP Act).

DER will apply a risk-based approach to its regulatory functions to ensure that there is not an unacceptable risk of harm to public health or the environment. Licensing and approval decisions, including conditions imposed on works approval or licence, will be proportionate to the level of risk (consequence and likelihood) that the activity poses to public health and the environment.

## Background

DER undertakes regulatory functions under Part V of the EP Act. The *Guidance Statement: Regulatory Principles* establishes and sets out how DER will apply principles of good regulatory practice

DER's risk assessment process has been developed to ensure a systematic approach in assessing risk and applying regulatory controls which are proportionate to the risk. The application of regulatory controls guides DER in the setting of appropriate conditions for works approvals and licences.

DER's risk assessment process has been developed generally in accordance with the following Australian/New Zealand Standards:

- AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines;
- AS/NZS 4360:2004 Risk Management; and
- HB 203:2012 Managing environment-related risk.

## Legislation and other Guidance Statements

This Guidance Statement is principally related to DER's regulatory functions relating to works approvals and licences under Part V, Division 3 of the EP Act. This Guidance Statement should be read together with DER's *Guidance Statement: Decision Making*.

## Scope

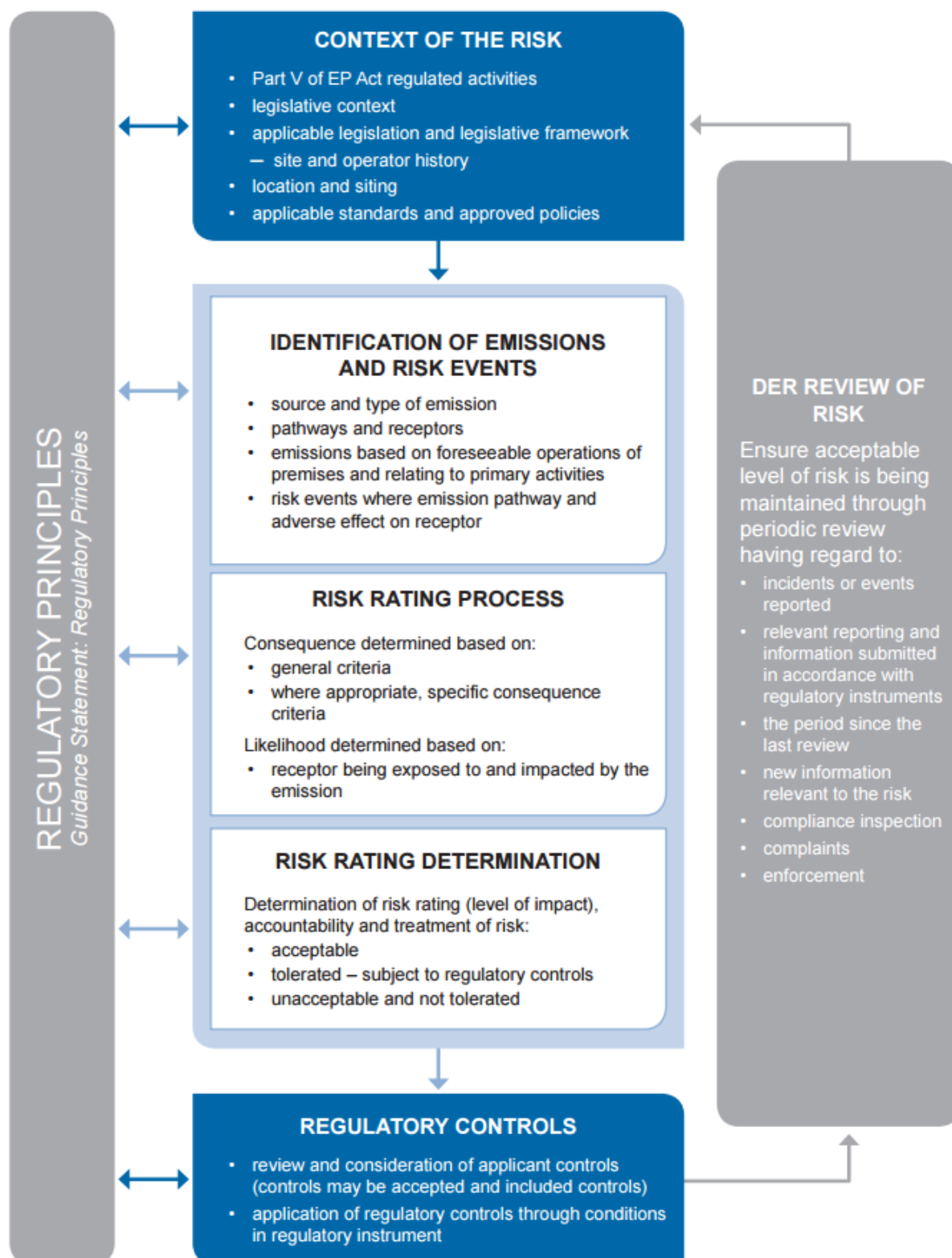
This Guidance Statement relates to DER's risk-based approach for assessing prescribed premises under Part V, Division 3 of the EP Act.

## Guidance Statement

### Overview of Risk Assessment Process

1. DER will undertake an assessment of the risks of emissions from prescribed premises and will identify the potential source, pathway and impact to receptors.
2. DER's risk assessment process for prescribed premises under Part V of the EP Act is depicted in Figure 1 below and involves DER's consideration of the following:
  - (a) establishing the context of the risk;
  - (b) identification of emissions;
  - (c) identification of risk events through source-pathway-receptor analysis;
  - (d) risk rating process by application of consequence and likelihood criteria;
  - (e) determination of risk rating; and
  - (f) determination of regulatory controls.

Figure 1 – DER Risk Assessment Process



3. DER will periodically review the risk of a site and the appropriateness of controls applied to regulatory instruments. The timing of reviews will be determined based upon the relative risk of a site.
4. DER will undertake its risk assessment:
  - (a) in accordance with the *Guidance Statement: Environmental Siting*;
  - (b) for specific categories of prescribed premises or types of emissions, in accordance with the relevant *Environmental Standards*;
  - (c) for other emissions, in accordance with the relevant *Guideline on Emissions*; and
  - (d) with regard to advice from relevant internal and external experts.

### Context of the Risk

5. In establishing the context of the risk, DER will:
  - (a) have regard to the legislative context for the premises including relevant statutory approvals, such as approvals under Ministerial Statements issued under Part IV of the EP Act;
  - (b) identify applicable standards including environmental standards, prescribed standards and applicable approved policies;
  - (c) identify site and operator history under Part V of the EP Act for existing prescribed premises;
  - (d) identify the location of the prescribed premises;
  - (e) give consideration to relevant environmental site features including topography, geology and soils; and
  - (f) identify relevant meteorological conditions.

### Identification of Emissions from Prescribed Premises

6. DER will identify the emissions from the prescribed premises and the sources of those emissions, having regard to information provided in the application, site inspections (for existing premises), similar premises, and any available monitoring data.
7. Where possible, DER will identify the type, volume, concentration and duration of the emission.

8. DER will identify likely emissions arising from:
  - (a) the expected operations and infrastructure of the prescribed premises, in the context in which the premises are situated;
  - (b) the foreseeable operations and expected infrastructure, equipment and operational failures at the prescribed premises which may, from time to time, give rise to higher emission levels or different emissions than during normal operations, for example as a result of plant start up or shut down for maintenance; and
  - (c) the primary activities which fall within the description of the category of prescribed premises in Schedule 1 of the *Environmental Protection Regulations 1987* and may be subject to specific conditions in regulatory instruments. Primary activities include directly related activities that give rise to emissions and discharges.

### Identification of Pathways and Receptors

9. In identifying pathways, DER will have regard to topography, available data, and meteorological information.
10. DER will consider separation and environmental siting factors in determining the extent to which emissions may impact a receptor.
11. In identifying potential receptors, DER will exclude employees, visitors, or contractors of the Licence Holder, as protection of these parties often involves different exposure risks and prevention strategies and is provided for under other State legislation.

### Risk Events

12. DER will identify risk events, being events which involve all of the following:
  - (a) an emission occurring; and
  - (b) a receptor being exposed to the emission through an identified actual or likely pathway; and
  - (c) potential adverse effects to the receptor from exposure to the emission.
13. Where the prescribed premises are situated in areas which have known and relevant geological or meteorological conditions (e.g. known flooding potential), this context will be taken into account by DER in identifying risk events.
14. DER will consider risk events that are reasonably foreseeable, including risk events which are outside normal operating parameters.

15. **DER will exclude rare or unforeseeable risk events and risk events which arise from an intervening cause. The general provisions of the EP Act may apply to any such events.**
16. **In respect of risk events which are risks to public health, DER:**
  - (a) **may refer public health risks to the Department of Health for advice; and**
  - (b) **may have regard to the Department of Health's published guidance on health risk and impact assessment.**

### **Consequence and Likelihood of Risk Event**

17. **DER will undertake an assessment of the consequence and likelihood of the risk event in accordance with the Risk Criteria Table specified below.**
18. **In determining the consequence and likelihood of a risk event, DER will have regard to applicant controls. Where applicant controls lower the assessed likelihood or consequence of a risk event, these controls will be conditioned in the regulatory instrument.**

**Table 1 – Risk Criteria Table**

Consequence		
The following criteria will be used to determine the consequences of a risk event occurring:		
	Environment	Public Health* and Amenity (such as air and water quality, noise, and odour)
<b>Severe</b>	<ul style="list-style-type: none"> <li><b>on-site impacts:</b> catastrophic</li> <li><b>off-site impacts local scale:</b> high level or above</li> <li><b>off-site impacts wider scale:</b> mid level or above</li> <li>Mid to long term or permanent impact to an area of high conservation value or special significance<sup>^</sup></li> <li>Specific Consequence Criteria (for environment) are significantly exceeded</li> </ul>	<ul style="list-style-type: none"> <li>Loss of life</li> <li><b>Adverse health effects:</b> high level or ongoing medical treatment</li> <li>Specific Consequence Criteria (for public health) are significantly exceeded</li> <li><b>Local scale impacts:</b> permanent loss of amenity</li> </ul>
<b>Major</b>	<ul style="list-style-type: none"> <li><b>on-site impacts:</b> high level</li> <li><b>off-site impacts local scale:</b> mid level</li> <li><b>off-site impacts wider scale:</b> low level</li> <li>Short term impact to an area of high conservation value or special significance<sup>^</sup></li> <li>Specific Consequence Criteria (for environment) are exceeded</li> </ul>	<ul style="list-style-type: none"> <li><b>Adverse health effects:</b> mid level or frequent medical treatment</li> <li>Specific Consequence Criteria (for public health) are exceeded</li> <li><b>Local scale impacts:</b> high level impact to amenity</li> </ul>
<b>Moderate</b>	<ul style="list-style-type: none"> <li><b>on-site impacts:</b> mid level</li> <li><b>off-site impacts local scale:</b> low level</li> <li><b>off-site impacts wider scale:</b> minimal</li> <li>Specific Consequence Criteria (for environment) are at risk of not being met</li> </ul>	<ul style="list-style-type: none"> <li><b>Adverse health effects:</b> low level or occasional medical treatment</li> <li>Specific Consequence Criteria (for public health) are at risk of not being met</li> <li><b>Local scale impacts:</b> mid level impact to amenity</li> </ul>
<b>Minor</b>	<ul style="list-style-type: none"> <li><b>on-site impacts:</b> low level</li> <li><b>off-site impacts local scale:</b> minimal</li> <li><b>off-site impacts wider scale:</b> not detectable</li> <li>Specific Consequence Criteria (for environment) likely to be met</li> </ul>	<ul style="list-style-type: none"> <li>Specific Consequence Criteria (for public health) are likely to be met</li> <li><b>Local scale impacts:</b> low level impact to amenity</li> </ul>
<b>Slight</b>	<ul style="list-style-type: none"> <li><b>on-site impact:</b> minimal</li> <li>Specific Consequence Criteria (for environment) met</li> </ul>	<ul style="list-style-type: none"> <li><b>Local scale:</b> minimal impacts to amenity</li> <li>Specific Consequence Criteria (for public health) criteria met</li> </ul>

Likelihood	
The following criteria will be used to determine the likelihood of the risk event occurring.	
<b>Almost Certain</b>	The risk event is expected to occur in most circumstances
<b>Likely</b>	The risk event will probably occur in most circumstances
<b>Possible</b>	The risk event could occur at some time
<b>Unlikely</b>	The risk event will probably not occur in most circumstances.
<b>Rare</b>	The risk event may only occur in exceptional circumstances

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

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

“on-site” means within the prescribed premises boundary



## Consequence Rating of Risk Event

19. DER will rate the consequence of a risk event:
  - (a) in accordance with the general Consequence Criteria set out in the Risk Criteria Table; or
  - (b) where appropriate to do so, in accordance with specific criteria for consequences to the environment or public health (Specific Consequence Criteria). DER will expressly state in its decision documentation the basis upon which Specific Consequence Criteria have been determined.
  
20. In determining Specific Consequence Criteria:
  - (a) DER will apply prescribed standards and approved policies under the EP Act;
  - (b) DER may have regard to the published documents set out in Appendix 1;
  - (c) DER will undertake a site-specific assessment; and
  - (d) DER will consider information provided by the applicant including any Specific Consequence Criteria derived from baseline data or reference sites.
  
21. To determine the consequence rating of a risk event, DER will apply Consequence Criteria:
  - (a) at the receptor most affected by the emission and having regard to the nature, value and sensitivity of the receptor; and
  - (b) where possible, having regard to baseline and reference data which are representative of the receiving environment.

## Likelihood Rating of Risk Event

22. DER will rate the likelihood of a risk event in accordance with the Likelihood Criteria in the Risk Criteria Table.
  
23. In applying the Likelihood Criteria, DER may have regard to:
  - (a) the compliance and operational history of an applicant;
  - (b) records of historical events;
  - (c) monitoring data;
  - (d) expert opinions and published research;
  - (e) previous experience of similar activities; and

- (f) **predictive modelling involving detailed mathematical models (including groundwater models, surface water models, noise models and air dispersion models).**

### Risk Rating Determination

24. DER will determine a risk rating (level of impact) for the risk event in accordance with the Risk Rating Matrix table set out below.

**Table 2 – Risk Rating Matrix**

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

### Acceptability and Treatment of Risk Event

25. DER will determine:

- (a) **whether a risk event is acceptable and tolerated, or unacceptable and not tolerated; and**
- (b) **the appropriate treatment and degree of regulatory control,**  
in accordance with the Risk Treatment table below.

**Table 3 – Risk Treatment table**

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

Rating of Risk Event	Acceptability	Treatment
Low	Acceptable, generally not controlled	Risk event is acceptable and will generally not be subject to regulatory controls.

26. DER will determine regulatory controls having regard to the adequacy of controls proposed by an applicant. Regulatory controls may include applicant controls.
27. DER will determine regulatory controls appropriate for the risk event and having regard to the categories of controls described in Table 4. The categories in Table 4 are not exhaustive and other types of controls may be appropriate in the circumstances.

**Table 4 – Regulatory Controls table**

Control	Description of regulatory control
Siting of Infrastructure	Where the location of infrastructure is specified to avoid or minimise the impact of emissions on receptors.
Infrastructure Design or Construction Requirements	Where the design and construction of infrastructure or equipment to an engineering or construction standard is specified to prevent, control, abate or mitigate pollution or environmental harm.
Emissions Limits	Where specified limits cannot be exceeded for specified emissions to air, land, surface and groundwater.
Monitoring	Where monitoring is required to validate performance within limits, to ensure or validate effectiveness of other controls (e.g. Infrastructure Requirements), to obtain baseline data to inform DER's ongoing assessment of the risk.
Requirements regarding Operation of Infrastructure	Where the operation and/or maintenance of infrastructure is specified (e.g. freeboard, storage volumes, physical or chemical parameters of abatement equipment) for control of emissions.
Specified Actions	Where specific, short term, or one-off actions are required (e.g. collection of data, installation of additional controls).
Volume/Scale Limits	Where production, throughput or acceptance is constrained.
Restriction on Input	Where the inputs (e.g. feedstock) in relation to the activity are specified (type or limit) for the premises or for a specified process.
Specifications on Product or Materials	Where pathogen or contamination limits are specified in products, or specifications are required for materials (e.g. dust extinguishment moisture levels for bulk commodities).

28. DER will set conditions to give effect to determined regulatory controls. Conditions will be applied in accordance with the *Guidance Statement: Setting Conditions*.
29. Where regulatory controls include applicant controls, DER will set conditions reflecting appropriate applicant controls in the instrument.

## Review of Risk

30. Once the risks have been determined and instrument granted, DER will undertake periodic reviews of the risks of a prescribed premises when appropriate to do so, having regard to relevant matters including:
  - (a) incident or event reporting under section 72 of the EP Act;
  - (b) relevant reporting and information submitted in accordance with regulatory instruments;
  - (c) the period since the last review of the prescribed premises;
  - (d) new information which is relevant to the risk assessment for the prescribed premises;
  - (e) compliance inspections;
  - (f) complaints received; and
  - (g) enforcement action taken.
31. In undertaking a review of risks, DER acknowledges that risk assessments are point in time assessments, and additional information may become available which further informs the risk assessment. In undertaking a review, DER:
  - (a) may change controls to ensure that they remain effective and efficient in both design and operation;
  - (b) may require further information from the instrument holder;
  - (c) may identify additional risks; or
  - (d) may identify changes to the context or risks, which may result in a revision of risk ratings and regulatory controls.
32. DER may give effect to a review of risks of prescribed premises by amendments to the instrument or other actions.

## Implementation

DER's risk-based approach to assessments will be implemented in accordance with this Guidance Statement for all:

- new reviews; and
  - new applications accepted,
- after the date of commencement.

The CEO may also apply this Guidance Statement to existing matters as the CEO considers appropriate, having regard to ensuring an orderly transition.

## Commencement

This Guidance Statement is to take effect from 10 November 2016.

## Review

This Guidance Statement is to be reviewed no later than as soon as practicable following the fifth year of its commencement.

## Appendix 1 – Specific Consequence Criteria

DER may have regard to the following published documents in determining appropriate Specific Consequence Criteria for public health and environment impacts:

- ANZECC & ARMCANZ (2000), [Australian and New Zealand Guidelines for Fresh and Marine Water Quality](#), which provides for water quality guidelines on a range of toxicants for the protection of fresh and marine waters based on the desired level of protection;
- NHMRC & ARMCANZ (2011), [Australian Drinking Water Guidelines](#), which provides for a range of water quality parameters for the protection of drinking water source areas for public health;
- NHMRC & ARMCANZ (2006), Australian Guidelines for Water Recycling Managing Health and Environmental Risk;
- DoH (2012), Western Australian guidelines for biosolids management;
- DoH (2014), [Contaminated Sites Ground and Surface Water Chemical Screening Guidelines](#);
- [National Environment Protection \(Ambient Air Quality\) Measure](#);
- National Environment Protection (Air Toxics) Measure; and
- [Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales](#) (Department of Environment and Conservation (DEC) NSW, 2005).