



Application for Licence

Division 3, Part V *Environmental Protection Act 1986*

Licence Number	L9253/2020/1
Licence Holder	Mardie Minerals Pty Ltd
ACN	152 574 457
File Number	DER2020/000168
Premises	Mardie Trial Project Legal description – Exploration Tenement E08/1849 as defined by the coordinates in Appendix 1
Date of Report	25 September 2020
Status of Report	Final

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1. Definitions of terms and acronyms

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

Table 1: Definitions

Term	Definition
AACR	Annual Audit Compliance Report
ACN	Australian Company Number
Category/ Categories/ Cat.	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
Decision Report	refers to this document.
Delegated Officer	an officer under section 20 of the EP Act.
Department	means the department established under section 35 of the <i>Public Sector Management Act 1994</i> and designated as responsible for the administration of Part V, Division 3 of the EP Act.
DWER	Department of Water and Environmental Regulation As of 1 July 2017, the Department of Environment Regulation (DER), the Office of the Environmental Protection Authority (OEPA) and the Department of Water (DoW) amalgamated to form the Department of Water and Environmental Regulation (DWER). DWER was established under section 35 of the <i>Public Sector Management Act 1994</i> and is responsible for the administration of the <i>Environmental Protection Act 1986</i> along with other legislation.
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EP Regulations	<i>Environmental Protection Regulations 1987 (WA)</i>
Licence	This Licence issued under Part V, Division 3 of the EP Act
Licence Holder	Mardie Minerals Pty Ltd
Minister	the Minister responsible for the EP Act and associated regulations
Occupier	has the same meaning given to that term under the EP Act.
Prescribed Premises	has the same meaning given to that term under the EP Act.
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report
Revised Licence	the amended Licence issued under Part V, Division 3 of the EP Act following the finalisation of this Review.
Risk Event	As described in <i>Guidance Statement: Risk Assessment</i>

2. Purpose and scope of assessment

2.1 Application details

BCI Minerals Pty Ltd submitted a licence application on 03 April 2020 on behalf of Mardie Minerals Pty Ltd (the Applicant). Mardie Minerals Pty Ltd is a wholly owned subsidiary of BCI Minerals Limited. The Applicant is proposing to undertake the Mardie Trial Project over a two year period to gather data to enable more accurate implementation of the full scale Mardie Project, which is outside the scope of this assessment. The Mardie Trial Project is located on exploration tenement E08/1849.

The Mardie Trial Project relates to the production of salt (NaCl); mixed potassium salts for further processing into sulphate of potash (K₂SO₄); and waste bitterns for characterisation.

The Mardie Trial Project is located approximately 100 km south-west of Karratha in the Pilbara region of Western Australia and aims to:

- Confirm the evaporation rates at each brine density stage during solar concentration and crystallisation;
- Calibrate the results using recorded atmospheric conditions to long term Bureau of Meteorology (BoM) records;
- Provide raw salt product samples for laboratory and pilot processing trials; and
- Produce samples of the resultant waste bitterns for characterisation.

The Applicant obtained works approval W6172/2018/1, granted on 04 January 2020 and has constructed the Mardie Trial Project infrastructure. During construction, the evaporation ponds were constructed in an alternative location; rather than being built on the low intertidal flats it was moved to the adjacent higher ground. In addition, the infrastructure layout was modified. The Applicant has advised these alterations were conducted in accordance with Condition 2 where such a departure does not increase risks to public health, public amenity or the environment, and where all other conditions of the works approval are still satisfied.

This Decision Report assesses emissions and discharges associated with the operation of the Mardie Trial Project only, as located in the new position. The full Mardie Project, is currently the subject of assessment by the EPA under Part IV of the EP Act.

Table 2 lists the documents submitted during the assessment process.

Table 2: Documents and information submitted during the assessment process

Document/information description	Date received
BCI Minerals Limited Part V Licence Application: Additional Information	03 April 2020
BCI Minerals Limited various electronic correspondence to update Premises boundary, clarify throughput and process controls and commissioning conducted under the Works Approval.	26 May 2020

Table 3 lists the prescribed premises categories that have been applied for.

Table 3: Prescribed Premises Categories

Classification of Premises	Description	Approved Premises production or design capacity or throughput
Category 14	Solar salt manufacturing: premises on which salt is produced by solar evaporation	137 tonnes per annum

2.2 Operational aspects

The Applicant proposes to construct a nominal 1:10,000 scale system of ponds and crystallisers to confirm the evaporation rates at each stage of the solar evaporation process on the Premises at the same time recording atmospheric conditions and to prepare raw salt for pilot scale processing off-site. The Mardie Trial Project involves the construction of a seawater inlet and 4.8 km high density polyethylene (HDPE) pipeline linking to the Mardie Trial Project ponds as (Figure 1).

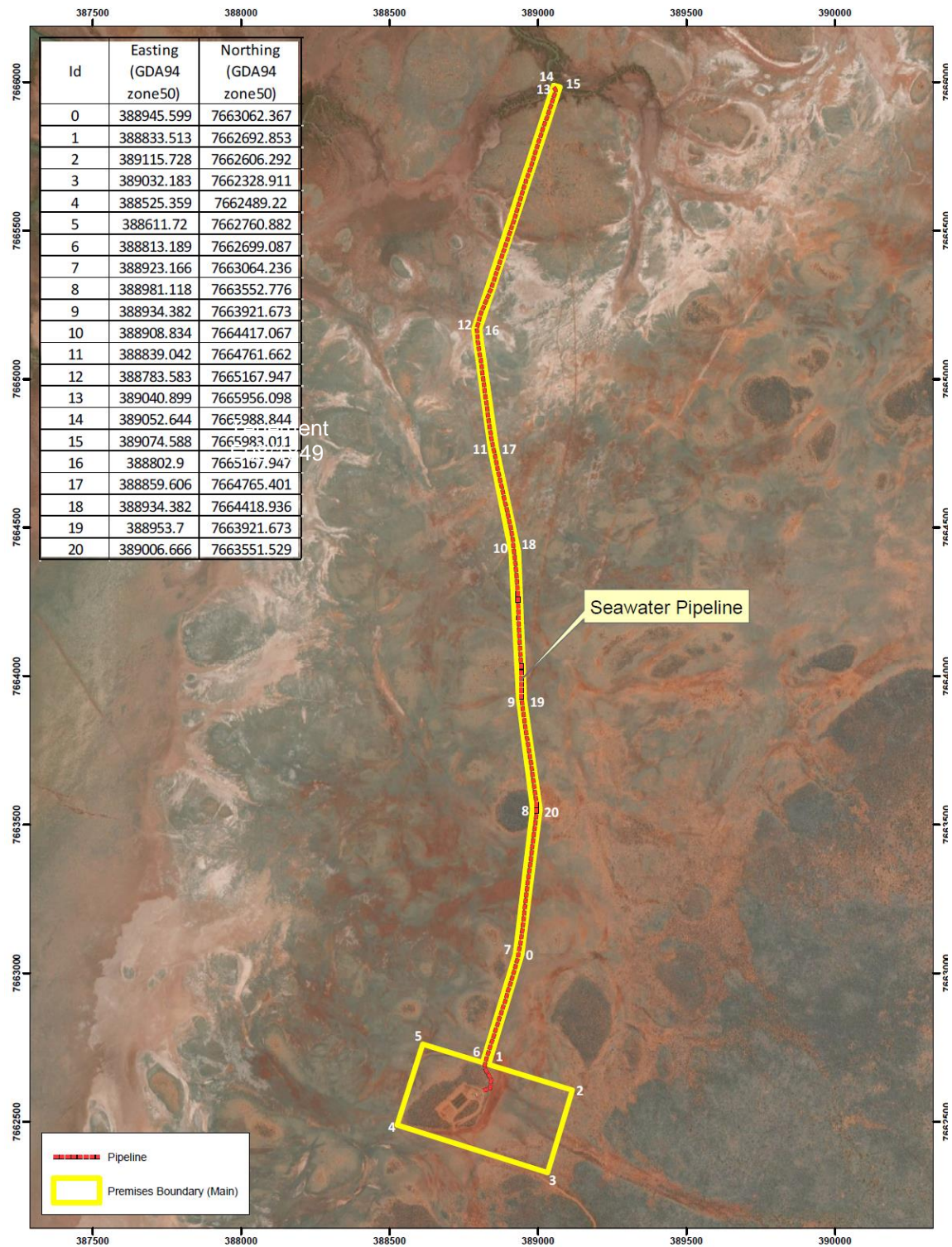


Figure 1: Mardie Trial Project

The Mardie Trial Project ponds (processing site), will comprise of eight evaporation ponds (P1 to P8) and 11 crystallisers (C1 to C11) as shown in Figure 2.

Ponds P1 to P7 will be compacted clay at the foot of the walls to ensure there is a clay seal between the wall and underlying salt flats. Ponds P1 to P7 will be unlined, while P8 and all the crystallisers will be lined with 1 mm thick HDPE to prevent leakage and to allow the precipitated salts to be collected. The construction cross section is shown in Figure 3.

21 pan evaporators will be made of stainless steel to BoM specifications and used to simulate pond evaporation conditions and to facilitate weather data collection. The pan evaporators will measure freshwater, seawater and brine solutions representative of each pond and crystallisers step proposed for the full Mardie Project (BCI, 2018c).

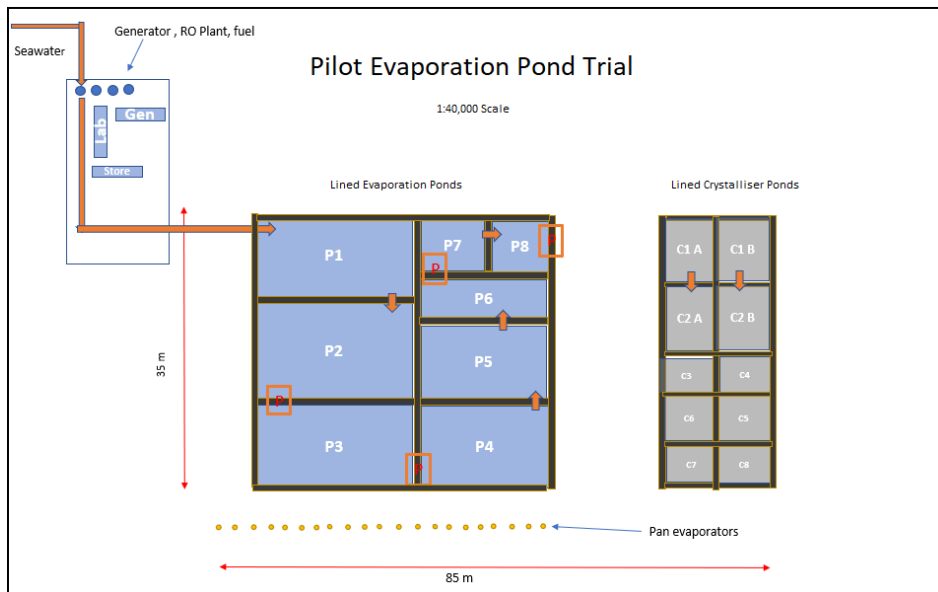


Figure 2: Layout of the Mardie Trial Project ponds

During operation seawater will be pumped into ponds P1 to P8 from the seawater inlet, filling the ponds to a depth of 500 mm. Approximately 22 000 m³ of seawater is expected to be abstracted each year. As evaporation occurs, brine densities will increase in each pond. As each pond density reaches its design density it will be maintained by transferring brine from up and down stream ponds, using diesel powered pumps. Pond P8 will have a brine density just lower than when NaCl begins to precipitate. At this point the brine will be transferred from P8 to crystallisers C1 and C2 where high purity NaCl will be precipitated.

Figure 2 shows two parallel C1 (A and B) and C2 (A and B) crystallisers. This is to allow 50% of the crystalliser to be drained to C3 and allow the salt to be dry harvested using shovels and wheel barrows. The wheel barrow will move the salts to the location of the site bobcat, which will transfer the salt to plastic containers ready for loading onto a truck for transport to the off-site laboratory.

The brine will continue to be transferred to the downstream crystallisers C3 to C11, where salts will continue to be precipitated in a way that is representative of the full scale Mardie Project. The residual liquor will be transferred to containers and analysed off-site for potential by-products. The continuous flow of brine through the ponds and crystallisers will be monitored daily and seawater added into pond P1 to retain pond levels. No chemicals will be used in the process.

A reverse osmosis (RO) plant will be used to supply freshwater at a rate of 20 litres (L) per hour (L/hour), with the brine from this unit fed into the evaporation ponds.

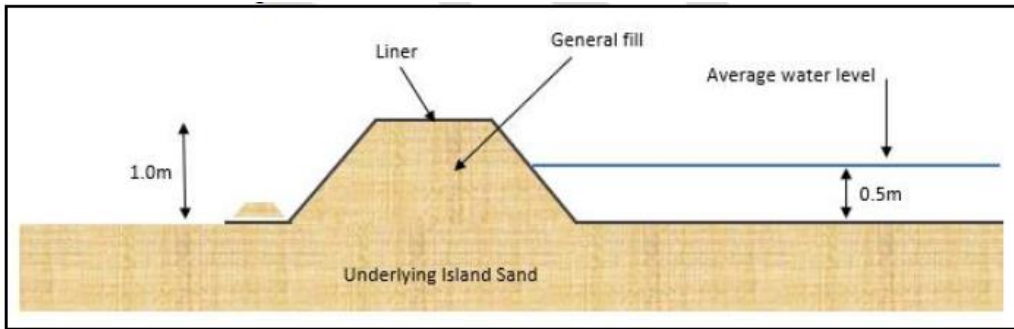


Figure 3: Bund wall cross sections

The NaCl and mixed potassium and magnesium salts generated will be transported to Perth for testing in 1 tonne bulka bags, intermediate bulk containers or sealed 20 L plastic drums. Approximately 60 tonnes of waste NaCl and magnesium salts will be produced during the Mardie Trial Project, with these removed off site for analysis for potential by-products.

The Mardie Trial Project will also test the solar evaporation of seawater to a brine density of 1.328, which is past the density of bitterns (typically around 1.25) discharged from solar pond operations along the Western Australian coast.

Commissioning of the Mardie Trial Project was authorised under the Issued Works Approval for a 3 month period following submission of the compliance report.

2.3 Infrastructure

The infrastructure as it was constructed is detailed in Table 4.

Table 4: Mardi Trial Project infrastructure

Infrastructure/ Equipment	Design and Construction
Pump and seawater inlet system	<ul style="list-style-type: none"> Seawater inlet and pumping system located within a creek bed A single layered 1mm fine screen Flow meter A submersible electric pump powered by a diesel generator located above the calculated storm inundation water level of 3.5 m AHD Level switch to prevent the pump from running without 600 mm of water
Pipeline	50mm diameter HDPE pipeline
Pilot evaporation ponds and crystallisers	<ul style="list-style-type: none"> Located above the calculated storm inundation water level of 3.5 m AHD 8 x evaporation ponds all lined with 1 mm thick HDPE on top of compacted sandy clay base. 9 x HDPE lined crystalliser ponds lined with 1 mm thick HDPE membrane Ponds constructed with a wall height of 750 mm and operated to maintain a freeboard of 300 mm.
Pan evaporators	21 x stainless steel pan evaporators Manufactured to the Bureau of Meteorology specifications.
Supporting infrastructure	Administration, laboratory and stores infrastructure, generator, freshwater tanks and amenities all installed on ground above maximum flood level.
Water cart	Bitterns will be pumped from the crystalliser ponds and either sent to Perth in 1000 L Intermediate Bulk Containers (IBC) for testing or used as a dust suppressant on the Mardie trial access road and the trial pond operations. A water cart with dribble bars will be used for dust suppression.

3. Legislative context

3.1 Part IV of the EP Act

While the full Mardie Project has been referred to the EPA and is the subject of a current assessment (assessment number 2167), the EPA have advised the Mardie Trial Project is not subject to assessment under Part IV of the EP Act, and that the EPA considers the works subject to this Licence are approved via 'early works'.

3.2 Part V of the EP Act

Applicable regulations, standards and guidelines

The overarching legislative framework of this assessment is the EP Act and EP Regulations.

The guidance statements which inform this assessment are:

- *Guidance Statement: Regulatory principles (July 2015)*
- *Guidance Statement: Setting conditions (October 2015)*
- *Guidance Statement: Publication of Annual Audit Compliance Reports (May 2016)*
- *Guidance Statement: Licence duration (August 2016)*
- *Guidance Statement: Environmental Standards (September 2016)*
- *Guidance Statement: Environmental Siting (November 2016)*
- *Guidance Statement: Land Use Planning (February 2017)*
- *Guidance Statement: Risk Assessments (February 2017)*
- *Guideline: Decision Making (June 2019)*
- *Guideline: Industry Regulation Guide to Licensing (June 2019)*
- *Guideline: Odour Emissions (June 2019)*

Works approval history

Table 5 summarises the Works Approval for the premises.

Table 5: Works approval history

Instrument	Issued	Nature and extent of Works Approval or amendment
W6172/2018/1	04/01/2019	Works Approval granted for construction and commissioning of Mardi Trial Project

The Applicant has advised that the infrastructure as approved under the Works Approval was modified at the time of construction. The modified infrastructure is the subject of this assessment.

Clearing

Department of Mines and Industry Regulation granted Program of Works for Clearing (ID 76118) on 3 October 2018.

The Applicant has advised clearing for the new infrastructure location falls under Item 25 of regulation 5 of the *Environmental Protection (Clearing of Native Vegetation) Regulations*, where clearing that is the result of carrying out prospecting or exploration under an authority granted under the *Mining Act 1978* is exempt from requiring a clearing permit.

3.3 Other approvals

Table 6 summarises approvals relevant to the assessment.

Table 6: Relevant approvals and tenure

Legislation	Number	Approval
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	EPBC 2018/8236	The Mardie Salt Project was originally submitted for assessment under the EPBC Act on 4 April 2018 (EPBC 2018/8183). This referral was subsequently withdrawn on 7 May 2018 as the project was amended to incorporate the proposed trestle jetty and to change the name to the Mardie Project. The application was resubmitted on 6 July 2018 (EPBC 2018/8236) and is still under assessment.
<i>Mining Act 1978</i>	Programme of Works (PoW) No. 75407 and PM450-316706 for the Mardie Project	Submitted for approval to the Department of Mines, Industry Regulation and Safety (DMIRS). Approval pending.
	Registration ID: 76118 for the Mardie Trial Ponds	Application submitted to DMIRS on 3 August 2018. The proposed activities have been deemed exploration as they are required to determine the volumes of material and efficiency of the process (DMIRS, 2018). PoW for use of ground disturbing equipment on E08/1849 and E08/2740 granted 3 October 2018.
	E08/1849	An application was submitted to DMIRS on 8 September 2020 requesting an extension to the expiry date of the tenement set to occur on 20 November 2020. Approval was granted on 23 September 2020 to extend the expiry date of the tenement until 20 November 2022.

4. Consultation

The application was advertised on the DWER website on 5 August 2020 and in the West Australian on 10 August 2020 for a public consultation period closing on 26 August 2020. No submissions were received.

A letter inviting comment was sent to the City of Karratha on 10 August 2020. The shire advised on 21 August 2020 that the proposed works, should they remain within a granted Mining Tenement, will not require Development Approval from the City of Karratha in accordance with City's Local Planning Scheme No.8. The City supports the purpose of the works, being for the Mardie Trial Project, on the understanding all relevant environmental approvals and conditions issued for this project are adhered to by Mardie Minerals Pty Ltd.

DWER referred the draft Licence and Decision Report to the Applicant on 1 September 2020. The Applicant advised on 21 September 2020 that they hold no concerns with the draft licence.

5. Potential receptors

5.1 Siting context

The Premises is located approximately 100 km south-west of Karratha on the Pilbara coastline (Figure 4). The Premises overlies the Mardie Pastoral lease (Crown Lease CL453-1984), which is owned by CITIC Pacific Limited. The solar salt evaporators and concentrators are located approximately 5 km inland of the Indian Ocean. The workforce will consist of 1-2 people, who will be accommodated at either Mardie Station or at the Fortescue Roadhouse.

5.2 Residential and sensitive Premises

There are no human receptors located within a 5 km radius of the Premises boundary.

5.3 Specified ecosystems

Specified ecosystems are areas of high conservation value and special significance that may be impacted as a result of activities at, or emissions and discharges from the Premises. Table 7 below provides a summary of environmental receptors, in proximity to the Premises, which have the potential to be impacted from the activities considered in this Decision Report. The risk assessment in section 9 considers these environmental receptors in the context of emissions and potential pathways. The table has been modified to align with the *Guidance Statement: Environmental Siting*.

Table 7: Environmental values

Specified ecosystems	Distance from the Premises
Threatened Ecological Communities and Priority Ecological Communities	Phoenix (2018) states the no Threatened Ecological Communities or Priority Ecological Communities listed under the EPBC Act or <i>Wildlife Conservation Act 1950</i> are present within the Mardie Trial Project area.
Threatened/Priority Fauna	Phoenix (2018) reported that the following were not identified in the survey but may exist in the Mardie Trial Project area: <ul style="list-style-type: none">• Lakeland Down Mouse (<i>Leggadina lakedownensis</i>) - Priority 4;• Fork-tailed Swift (<i>Apus pacificus</i>) - Migratory bird;• Grey Falcon (<i>Falco hypoleucos</i>) – Vulnerable; and• Peregrine Falcon (<i>Falco peregrinus</i>) - Specially Protected Fauna.

6. Potential pathways

Emissions and discharges can follow pathways that lead from the Premises to the receptors mentioned above. Pathways identified within the local area include groundwater and surface water, soil type, prevailing winds and rainfall. Further detail is provided on some of these pathways below.

6.1 Groundwater and surface water

The distances to groundwater and water sources are shown in Table 8.

Table 8: Groundwater and water sources

Groundwater and water sources	Distance from Premises	Environmental value
Groundwater	The Applicant reports that the depth to groundwater varies between 0.3 – 0.8 m below ground level (mbgl), with salinity up to three times the level of seawater and ranging from 130,000 – 210,000 microsiemens per centimetre ($\mu\text{S}/\text{cm}$). The nearest bore lies approximately 2 km south-east of the Mardie Trial Project area based on DWER's data.	Water is not used for potable or industrial use. Marine water inundation occurs on the Premises.
Major watercourses or waterbodies	The Indian Ocean lies approximately 5 km from the Mardie Trial Project ponds. The inlet from which seawater is to be drawn is 4.5 km north of the Mardie Trial Project ponds. The Mardie Trial Project area lies within the Saline Coastal Flat.	Marine and mangrove ecosystems.

6.2 Soil type

DWER's dataset identifies the soil type across the Mardie Trial Project area as salt flats, tidal swamps, and coastal dune sands: chief soils are saline loams with shelly sands. Small areas of calcareous earths and shallow loams are associated with marls (Northcote, 1960-68).

6.3 Prevailing winds

Prevailing wind patterns can provide a direct pathway for transmission of dust and odours by air, so the prevailing wind patterns that may carry these emissions to sensitive receptors have been considered. The closest Bureau of Meteorology (BoM) weather station which records wind frequency data is Mardie weather station (BoM site 005008). Prevailing winds are from the east to south west in the mornings, and from the west and the north in the afternoons (Figure 4). It is important to note that these wind roses show historical wind speed and wind direction data for Mardie weather station and should not be used to predict future data.

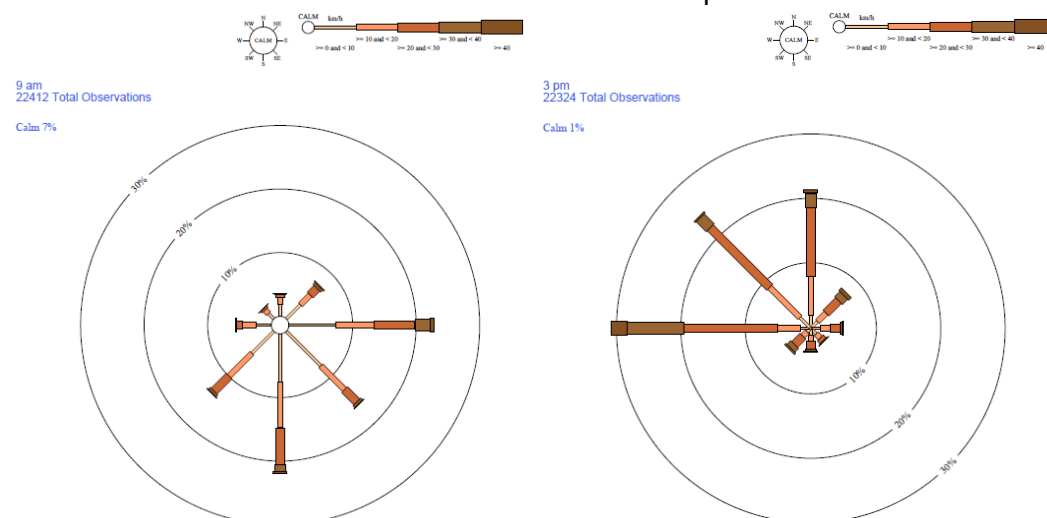


Figure 4: Annual wind rose for 9am and 3 pm at Mardie weather station site 005008.

6.4 Rainfall

Rainfall as stormwater can contribute to emissions where it becomes contaminated after coming into contact with wastes, then exits the Premises via overland flow, potentially contaminating receptors in close proximity to the Premises, or exits via leachate to groundwater potentially contaminating groundwater. Rainfall events that may carry these emissions to sensitive receptors have been considered. The closest Bureau of Meteorology (BoM) weather station which records rainfall data is Mardie weather station (BoM site 005008). Maximum average rainfall is received from January to June annually. Minimum average rainfall is received from September to November annually (Figure 5).

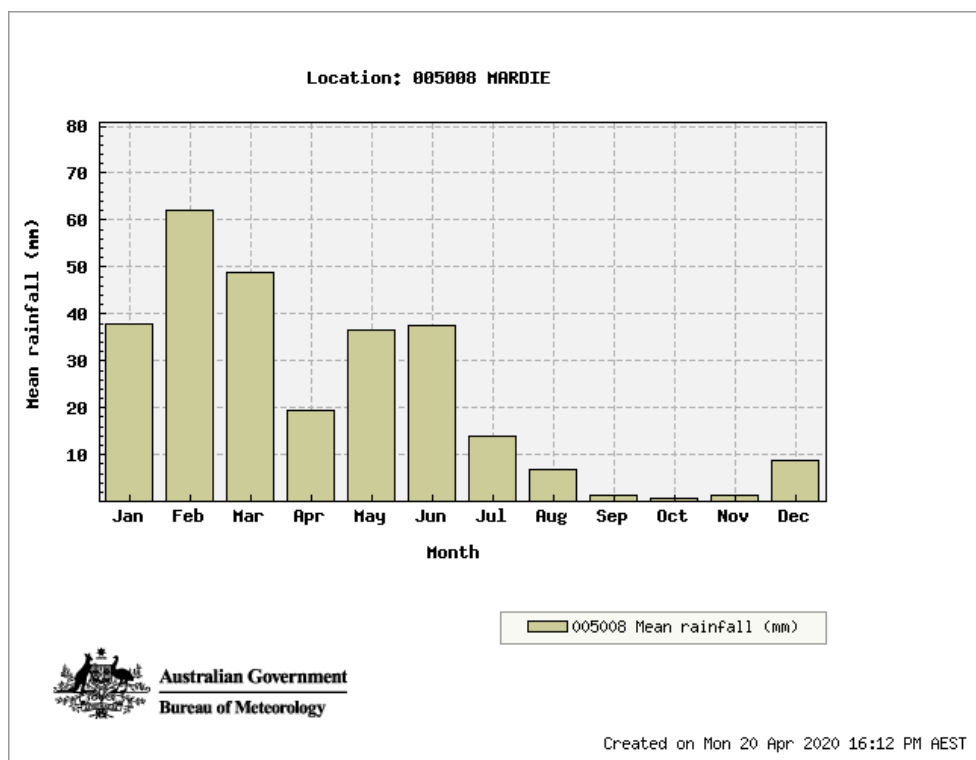


Figure 5: Average annual rainfall (mm) at Mardie weather station site 005008.

7. Modelling and monitoring data

7.1 Acid sulphate soils

The Premises overlies a high to moderate ASS risk area based on DWER's dataset. Construction of the proposed evaporation ponds for the Mardie Trial Project requires excavation of gravelly surface soils to 700 mm depth.

Stantec Australia Pty Ltd (Stantec) were commissioned by the Applicant to undertake a Stage A - ASS investigation to identify the potential presence/absence of ASS and facilitate planning for future assessment (Stage B) if required (Stantec, 2017). A preliminary site inspection involved logging, sampling and analysis (field pH (pH_F) and field pH peroxide (pH_{FOX}) of 18 'near surface' soil profiles within potential disturbance areas associated with the project. The profiles were sampled to a maximum depth of 1 mbgl.

Stantec, 2017 states that field analysis of soil pH_F indicated all soil profiles were circum-neutral to strongly alkaline, and were consistent in pH_F throughout the sample locations and with depth (to 1 mbgl).

It is stated within Stantec, 2017 that "*the highly alkaline conditions indicate that the surface soil profiles within the Project area are not likely to be classed as Potentially Acid Sulfate Soils*

(PASS). Although an extreme reaction to the pH_{FOX} test was observed for the majority of samples, the reaction was likely to have been associated with other soil constituents such as organic matter or manganese, and is not considered to be problematic with respect to ASS as it caused samples to become more alkaline rather than acidic. Due to the low ASS risk of surface soils within the Project area, further investigations into the presence of ASS is not considered necessary, unless disturbance is planned at greater depths (>1 mbgl) or outside the current area of investigation”.

The ASS investigation undertaken by Stantec, was referred to DWER's Contaminated Sites who advised that the soil investigations were undertaken in general accordance with the DWER guidelines for identification and investigation of ASS. “In view of the minimal field heterogeneity, the chosen sampling locations and densities are acceptable for the pilot plant study”. “Field pH ranged from 6.9 to 9.8 and pH in 30% peroxide ranged from 6.5 to 9.6. These observations demonstrate significant amounts of acid generating materials, such as pyrite, are not present in the investigated surface soils. Further laboratory based analysis on these soils for sulphides is not warranted” (DWER, 2018).

DWER, 2018 states that based on the information provided, ASS requiring acidity management are not present in the surface soils. However, the finding of this investigation do not rule out occurrence of PASS material below the one metre depth of investigation.

8. Licence Holder Controls

The Licence Holder has implemented various construction requirements and proposed operational control methods to minimise emissions and discharges from the Premises. These controls include:

- The seawater inlet system contains a single layered 1mm fine screen;
- A submersible electric pump powered by a diesel generator will be located above the calculated storm inundation water level of 3.5 m AHD, which will both be removed prior to cyclonic activity;
- 50mm diameter HDPE pipeline;
- Evaporation ponds, crystallisers and pan evaporators are located above the calculated storm inundation water level of 3.5 m AHD;
- Embankment walls of the evaporation ponds and crystallisers are 750 mm high;
- Evaporation ponds and crystallisers will be operated to maintain a freeboard of 300 mm;
- Evaporation ponds and crystallisers are lined with 1 mm thick HDPE membrane;
- Pan evaporators are fabricated from stainless steel to the Bureau of Meteorology specifications;
- Bitterns discharging as a dust suppressant via a water cart with dribble bars;
- Diesel for the pump system will be stored within a 110L tank and located upon a 220L bunded pallet, will be piped to the pump automatically and the facility inspected prior to commencing pumping and twice daily during operation;
- Diesel for the office generator will be stored in a 400L tank and located upon a 1 100L bunded pallet, will be piped to the generator automatically and the facility inspected twice daily during operation; and
- Hydrocarbon spill kits will be located at the electric pump and at the office generator.

The associated residual risks after implementation of these controls are discussed in section 9 below.

9. Risk assessment

In undertaking this risk assessment, DWER will assess all potential emissions pathways and potential receptors previously identified to establish whether there is a Risk Event.

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event. In addition, where an emission has an actual or likely pathway and a receptor which may be adversely impacted, but that emission is regulated through other legislative mechanisms, that emission will not be risk assessed further and will be screened out through Table 9.

The linkage from the source of emissions, via pathways towards receptors to determine Risk Events are set out in Table 9 below.

Table 9. Emissions, pathways and receptors during operation

Risk Events					Reasoning	
Sources/Activities	Potential emissions	Potential pathway	Potential receptors	Potential adverse impacts		
Solar salt manufacturing	Operation of generators and pumps	Noise	Air / wind dispersion	No residences in proximity	None	There are no receptors in close proximity to the Premises therefore the Delegated Officer considers there will not be any adverse impacts from noise emissions. No further risk assessment is required.
		Post combustion emissions	Air / wind dispersion	No residences in proximity	Reduced air quality	There are no receptors in close proximity to the Premises therefore the Delegated Officer considers there will not be any adverse impacts from combustion emissions. No further risk assessment is required.
		Diesel spills from generators	Direct discharges to land or marine ecosystem	Ecosystems adjacent to where the spillage occurred	Contamination of soil and groundwater	The Applicant will utilise two diesel generators for the inlet pump and office, both will be located above the storm water inundation level of 3.5 m AHD, the diesel tanks are stored upon banded pallets with sufficient storage to contain spills, diesel is automatically piped to the generators, hydrocarbon spill kits are available, and the tanks are removed prior to cyclonic activity. After implementation of the above Applicant controls the Delegated Officer considers that hydrocarbon spills to discharge to land are unlikely. As this risk is mitigated by adequate maintenance of this infrastructure, the Delegated Officer shall enforce these controls via operating conditions on the Licence. No further risk assessment is required. Discharges of hydrocarbons may also be subject to the provisions of the <i>Environmental Protection (Unauthorised Discharges) Regulations 2004</i> .
	Seawater pipeline	Spillage of seawater through leaks, pipeline rupture or failure	Direct discharges to land and infiltration to groundwater	Terrestrial and/or marine ecosystems adjacent to the pipeline Groundwater	None	The Applicant has advised the pipeline will transfer seawater in an unmodified state from the creek, across the mudflats to the ponds. The mudflats are inundated by seawater several times per month at high tide. As there is no modification to the seawater during piping, the Delegated Officer considers that should a leak or spill occur it is unlikely to create an adverse impact to the mudflat environment. No further risk assessment is required.

Risk Events					Reasoning	
Sources/Activities	Potential emissions	Potential pathway	Potential receptors	Potential adverse impacts		
	Evaporation and crystalliser ponds	Pond overflows and inflows	Direct discharges to land and infiltration to groundwater	Terrestrial ecosystems and groundwater	Elevated salinity in underlying soils and groundwater	See Section 9.3.
		Pond seepage	Infiltration to groundwater	Terrestrial ecosystems and groundwater	Elevated salinity in underlying soils and groundwater	<p>The Applicant has constructed the evaporation ponds and crystallisers with a 1 mm thick HDPE membrane liner. The pan evaporators are fabricated from stainless steel.</p> <p>After implementation of the above Applicant controls during construction, the Delegated Officer considers seepage to groundwater will be unlikely.</p> <p>As this risk is mitigated by adequate maintenance of this infrastructure, the Delegated Officer shall enforce these controls via operating conditions on the Licence.</p> <p>No further risk assessment is required.</p>
		Airborne salt particulates from dry harvesting	Air / wind dispersion Discharges to land	No residences in proximity	None	<p>There are no receptors in close proximity to the Premises therefore the Delegated Officer considers there will not be any adverse impacts from airborne salt emissions.</p> <p>No further risk assessment is required.</p>
		Hypersaline water	Direct ingestion	Birds and other fauna	Ingestion of water would be toxic to birds and other wildlife due to the high level of total dissolved solids (TDS)	<p>The salinity of the mudflats varies between approximately 71,500 mg/L and 115,500 mg/L TDS with the Mardie seawater averaging 69,000 µS/cm or approximately 37,950 mg/L TDS. It has been determined that wildlife will not drink hypersaline water greater than 50,000 milligram per litre (mg/L) (TDS) (MERIWA, Report No. 273).</p> <p>Although the consequence of fauna consuming saline water in a once off event would be minor, the Delegated Officer considers it a rare likelihood of occurrence and therefore risk of emissions of hypersaline water are considered low.</p> <p>No further risk assessment is required.</p>
	Dust suppression with brine water	Brine	Air / wind dispersion	Terrestrial and/or marine ecosystems adjacent to the Premises	Elevated salinity in underlying soils and groundwater	See Section 9.4.

9.1 Consequence and likelihood of risk events

A risk rating will be determined for risk events in accordance with the risk rating matrix set out in Table 10 below.

Table 10: Risk rating matrix

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

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 11 below.

Table 11: Risk criteria table

Likelihood		Consequence		
The following criteria has been used to determine the likelihood of the Risk Event occurring.		The following criteria has been used to determine the consequences of a Risk Event occurring:		
			Environment	Public health* and amenity (such as air and water quality, noise, and odour)
Almost Certain	The risk event is expected to occur in most circumstances	Severe	<ul style="list-style-type: none"> onsite impacts: catastrophic offsite impacts local scale: high level or above offsite impacts wider scale: mid-level or above Mid to long-term or permanent impact to an area of high conservation value or special significance[^] Specific Consequence Criteria (for environment) are significantly exceeded 	<ul style="list-style-type: none"> Loss of life Adverse health effects: high level or ongoing medical treatment Specific Consequence Criteria (for public health) are significantly exceeded Local scale impacts: permanent loss of amenity
Likely	The risk event will probably occur in most circumstances	Major	<ul style="list-style-type: none"> onsite impacts: high level offsite impacts local scale: mid-level offsite impacts wider scale: low level Short-term impact to an area of high conservation value or special significance[^] Specific Consequence Criteria (for environment) are exceeded 	<ul style="list-style-type: none"> Adverse health effects: mid-level or frequent medical treatment Specific Consequence Criteria (for public health) are exceeded Local scale impacts: high level impact to amenity
Possible	The risk event could occur at some time	Moderate	<ul style="list-style-type: none"> onsite impacts: mid-level offsite impacts local scale: low level offsite impacts wider scale: minimal Specific Consequence Criteria (for environment) are at risk of not being met 	<ul style="list-style-type: none"> Adverse health effects: low level or occasional medical treatment Specific Consequence Criteria (for public health) are at risk of not being met Local scale impacts: mid-level impact to amenity
Unlikely	The risk event will probably not occur in most circumstances	Minor	<ul style="list-style-type: none"> onsite impacts: low level offsite impacts local scale: minimal offsite impacts wider scale: not detectable Specific Consequence Criteria (for environment) likely to be met 	<ul style="list-style-type: none"> Specific Consequence Criteria (for public health) are likely to be met Local scale impacts: low level impact to amenity
Rare	The risk event may only occur in exceptional circumstances	Slight	<ul style="list-style-type: none"> onsite impact: minimal Specific Consequence Criteria (for environment) met 	<ul style="list-style-type: none"> Local scale: minimal to amenity Specific Consequence Criteria (for public health) met

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

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

"onsite" means within the Prescribed Premises boundary.

9.2 Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment Table 12 below:

Table 12: Risk treatment table

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

9.3 Risk Assessment – Pond overflows

9.3.1 Description of pond overflows and seepage

During normal operation of the ponds, there will be no direct emissions to land or water.

The Mardie Trial Project will be located atop an existing naturally formed raised island surrounded by mud flats. The mud flat component is periodically inundated via the following:

- Tidal cycles for short periods on the highest tides several times per month; and
- Extreme rainfall events/cyclone/storm surge.

Pond overflows due to a breach of the bund wall and/or pump failure may result in the release of brine and waste bitterns into soils and water.

9.3.2 Identification and general characterisation of emission

Release of brine with a high salinity concentration, and residual brine (bitterns) containing high concentrations of chlorides and sulfates of magnesium and potassium into soils and water.

9.3.3 Description of potential adverse impact from the emission

BCI, 2018a states that the Mardie Trial Project will test the solar evaporation of seawater to a brine density of 1.328, well past the density of bitterns discharged from solar pond operations along the Western Australian coast, which are typically around 1.25.

9.3.4 Applicant controls

Table 13 outlines the Applicant's controls for the Mardie Trial Project associated with pond overflows and seepage.

Table 13: Applicant’s proposed controls for pond overflows

Infrastructure/ Equipment	Design and Construction
Pilot evaporation ponds and crystallisers	<ul style="list-style-type: none">• Located above the calculated storm inundation water level of 3.5 m AHD;• 8 x evaporation ponds all lined with 1 mm thick HDPE on top of compacted sandy clay base;• 9 x HDPE lined crystalliser ponds lined with 1 mm thick HDPE membrane;• Ponds constructed with a wall height of 750 mm and operated to maintain a freeboard of 300 mm.
Pan evaporators	21 x stainless steel pan evaporators; Manufactured to the Bureau of Meteorology specifications.

9.3.5 Consequence

The Mardie Trial Project is located in an area that will be periodically inundated by seawater. BCI, 2018a states that the salinity in the area varies between 130,000 µS/cm and 210,000 µS/cm, or up to 3 times the salinity of Mardie seawater which averaged 69,000 µS/cm.

The Delegated Officer notes the following:

- If the overflow is due to an extreme rainfall event/cyclone/storm surge, then the TDS in the water released will be diluted due to the significant volume of rainwater;
- Ponds P1 to P7 contain concentrated seawater the average of which, will not exceed the salinity of the underlying groundwater; and
- There are no TECs or PECs listed under the EPBC Act or Wildlife Conservation Act 1950 present within the Mardie Trial Project area.

If pond overflows of brine and waste bitterns occurs, the Delegated Officer has determined that the impact of elevated salinity occurring in underlying soils and groundwater may result in low level on-site impacts occurring. Therefore, the Delegated Officer considers the consequence of pond overflows to be **minor**.

9.3.6 Likelihood

The Delegated Officer has determined that the likelihood of elevated salinity occurring in underlying soils and groundwater will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of elevated salinity occurring to be **unlikely**.

9.3.7 Overall rating of pond overflows

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 10) and determined that the overall rating for the risk of pond overflows is **medium**.

9.4 Risk Assessment – Dust suppression with brine water

9.4.1 Description of dust suppression

The Applicant intends on using the waste brine produced during evaporation as a dust suppressant on roads.

9.4.2 Identification and general characterisation of emission

Release of brine with a high salinity concentration, and residual brine (bitterns) containing high concentrations of chlorides and sulfates of magnesium and potassium into soils and water.

Groundwater studies have shown existing salinity levels are up to three times that of seawater and ranging from 130,000 – 210,000 microsiemens per centimetre ($\mu\text{S}/\text{cm}$).

9.4.3 Description of potential adverse impact from the emission

BCI, 2018a states that the Mardie Trial Project will test the solar evaporation of seawater to a brine density of 1.328, well past the density of bitterns discharged from solar pond operations along the Western Australian coast, which are typically around 1.25.

9.4.4 Applicant controls

A water cart with dribble bars will be used when brine water is used for dust suppression to ensure water spray is directed only upon the road surface and prevented from overspray onto adjacent vegetation.

9.4.5 Consequence

If brine water is used for dust suppression, the Delegated Officer has determined that the impact of elevated salinity occurring in underlying soils and groundwater may result in low level on-site impacts occurring. Therefore, the Delegated Officer considers the consequence of pond overflows to be **minor**.

9.4.6 Likelihood

The Delegated Officer has determined that the likelihood of elevated salinity occurring in underlying soils and groundwater will probably not occur in most circumstances. Therefore, the Delegated Officer considers the likelihood of elevated salinity occurring to be **unlikely**.

9.4.7 Overall rating of dust suppression with brine water

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 10) and determined that the overall rating for the risk of using brine water for dust suppression is **medium**.

10. Regulatory controls

10.1 Licence controls

The risk assessment has determined that additional controls will be applied to the Licence in order to manage identified operational risks. Licence conditions are as follows:

- Condition 1 provides production limits;
- Conditions 2 and 3 require maintenance and repair of the Premises infrastructure;
- Condition 4 ensures emissions of brine occurs only within the Premises boundary;
- Condition 5 requires monitoring of waste outputs from the Premises;
- Conditions 6 to 9 require accurate recording of complaints, books and reporting.

11. Determination of Licence conditions

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

The *Guidance Statement: Licence Duration* has been applied and the issued Licence expires upon the date of tenement expiry being 20 November 2022.

Table 14 provides a summary of the conditions to be applied to this Licence.

Table 14: Summary of conditions to be applied

Condition Reference	Grounds
Production limits Condition 1	This condition is valid, risk based and consistent with the EP Act.
Infrastructure and Equipment Conditions 2 and 3	These conditions are valid, risk based and contain appropriate controls.
Emissions Condition 4	This condition is valid, risk based and contains appropriate controls.
Monitoring Condition 5	These conditions are valid, risk based and consistent with the EP Act.
Records and reporting Conditions 6, 7, 8 and 9	These conditions are valid and necessary administration and reporting requirements to ensure compliance.

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

12. Decision

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

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

A/MANAGER WASTE INDUSTRIES REGULATORY SERVICES

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

Appendix 1: Premises boundary

The premises boundary is defined by the coordinates in Table 15.

Table 15: Premises boundary coordinates

Easting	Northing	Zone
388945.599	7663062.367	50
388833.513	7662692.853	50
389115.728	7662606.292	50
389032.183	7662328.911	50
388525.359	7662489.22	50
388611.72	7662760.882	50
388813.189	7662699.087	50
388923.166	7663064.236	50
388981.118	7663552.776	50
388934.382	7663921.673	50
388908.834	7664417.067	50
388839.042	7664761.662	50
388783.583	7665167.947	50
389040.899	7665956.098	50
389052.644	7665988.844	50
389074.588	7665983.011	50
388802.9	7665167.947	50
388859.606	7664765.401	50
388934.382	7664418.936	50
388953.7	7663921.673	50
389006.666	7663551.529	50

Appendix 2: Key documents

	Document title	In text ref	Availability
1.	Works Approval W6172/2018/1 – Mardie Minerals Pty Ltd – Mardie Trial Project	W6172/2018/1	accessed at www.dwer.wa.gov.au
2.	DER, July 2015. <i>Guidance Statement: Regulatory principles</i> . Department of Environment Regulation, Perth.	DER 2015a	
3.	DER, October 2015. <i>Guidance Statement: Setting conditions</i> . Department of Environment Regulation, Perth.	DER 2015b	
4.	DER, May 2016. <i>Guidance Statement: Publication of Annual Audit Compliance Reports</i> . Department of Environment Regulation, Perth.	DER 2016a	
5.	DER, August 2016. <i>Guidance Statement: Licence Duration</i> . Department of Environment Regulation, Perth.	DER 2016b	
6.	DER, September 2016. <i>Guidance Statement: Environmental Standards</i> . Department of Environment Regulation, Perth.	DER 2016c	
7.	DER, November 2016. <i>Guidance Statement: Environmental Siting</i> . Department of Environment Regulation, Perth.	DER 2016d	
8.	DER, February 2017. <i>Guidance Statement: Land Use Planning</i> . Department of Environment Regulation, Perth.	DER 2017a	
9.	DER, February 2017. <i>Guidance Statement: Risk Assessments</i> . Department of Environment Regulation, Perth.	DER 2017b	
10.	DWER, June 2019. <i>Guideline: Decision Making</i> . Department of Water and Environmental Regulation, Perth.	DWER 2019a	
11.	DWER, June 2019. <i>Guideline: Industry Regulation Guide to Licensing</i> . Department of Water and Environmental Regulation, Perth.	DWER 2019b	
12.	DWER, June 2019. <i>Guideline: Odour Emissions</i> . Department of Water and Environmental Regulation, Perth.	DWER 2019c	

Attachment 1: Issued Licence L9253/2020/1
