



# Works Approval

## *Environmental Protection Act 1986, Part V*

**Works Approval Holder:** Doral Mineral Sands Pty Ltd

**Works Approval Number:** W5990/2016/1

**Registered office:** 1 Alumina Road  
 EAST ROCKINGHAM WA 6168

**ACN:** 096 342 451

**Premises address:** Yoongarillup Mineral Sands Mine  
 1192 Sues Road  
 YOONGARILLUP WA 6280  
 Being part of tenements M70/458 and M70/459, within Lots 1870, 1872,  
 1873 & 1874 on Plan 201690 and Lots 101 & 102 on Diagram 98906, as  
 depicted in Schedule 1.

**Issue date:** Monday, 5 December 2016

**Commencement date:** Monday, 12 December 2016

**Expiry date:** Wednesday, 11 December 2019

The following category/s from the *Environmental Protection Regulations 1987* cause this Premises to be a prescribed premises for the purposes of the *Environmental Protection Act 1986*:

Category number	Category description	Category production or design capacity	Approved premises production or design capacity
8	Mineral sands mining or processing: premises on which mineral sands ore is mined, screened, separated or otherwise processed.	5,000 tonnes or more per year	1,500,000 tonnes per annual period

**Conditions**

This Works Approval is subject to the conditions set out in the attached pages.

Date signed: 12 December 2016

.....  
 Tim Gentle  
 Manager Licensing (Resource Industries)

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



# Works Approval Conditions

## 1 General

### 1.1 Interpretation

1.1.1 In the Works Approval, definitions from the *Environmental Protection Act 1986* apply unless the contrary intention appears.

1.1.2 In the Works Approval, unless the contrary intention appears:

**'Act'** means the *Environmental Protection Act 1986*;

**'AS 3580.1.1'** means the Australian Standard AS 3580.1.1 *Methods for sampling and analysis of ambient air – Guide to siting air monitoring equipment*;

**'AS 3580.9.3'** means the Australian Standard AS 3580.9.3 *Methods for sampling and analysis of ambient air – Determination of total suspended particulates (TSP) – High volume sampler gravimetric method*;

**'AS 3580.9.8'** means the Australian Standard AS 3580.9.8 *Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM<sub>10</sub> continuous direct mass method using a tapered element oscillating microbalance analyser*;

**'AS/NZS 5667.1'** means the Australian Standard AS/NZS 5667.1 *Water Quality – Sampling – Guidance of the Design of sampling programs, sampling techniques and the preservation and handling of samples*;

**'averaging period'** means the time over which a limit or target is measured or a monitoring result is obtained;

**'CEO'** means Chief Executive Officer of the Department of Environment Regulation;

**'CEO'** for the purpose of notification means;

Chief Executive Officer  
Department Div.3 Pt.V EP Act  
Locked Bag 33 Cloisters Square  
PERTH WA 6850  
info@der.wa.gov.au;

**'Commissioning'** means the process of operation and testing that verifies works and all relevant systems, plant, machinery and equipment have been installed and are performing in accordance with the design specification set out in the works approval application;

**'Department'** means the department established under s.35 of the Public Sector Management Act and designated as responsible for administration of Division 3 Part V of the *Environmental Protection Act 1986*;

**'NATA'** means the National Association of Testing Authorities, Australia;

**'NATA accredited'** means in relation to the analysis of a sample that the laboratory is NATA accredited for the specified analysis at the time of the analysis;

**'PM'** means total particulate matter including both solid fragments of material and miniscule droplets of liquid;

**'PM<sub>10</sub>'** means particles with an aerodynamic diameter of less or equal to 10 µm;



**'Premises'** means the area defined in the Premises Map in Schedule 1 and listed as the Premises address on page 1 of the Works Approval;

**'quarterly'** means the 4 inclusive periods from 1 January to 31 March, 1 April to 30 June, 1 July to 30 September and 1 October to 31 December in the same year;

**'Schedule 1'** means Schedule 1 of this Works Approval unless otherwise stated;

**'spot sample'** means a discrete sample representative at the time and place at which the sample is taken;

**'TSP'** means total suspended particles each having an equivalent aerodynamic diameter of less than 50 micrometres;

**'µm' and 'µg/m<sup>3</sup>'** means micrometres and micrograms per cubic metre, respectively;

**'µS/cm'** means micro Siemens per centimetre;

**'Works Approval'** means this Works Approval numbered W5990/2016/1 and issued under the Act; and

**'Works Approval Holder'** means the person or organisation named as the Works Approval Holder on page 1 of the Works Approval.

1.1.3 Any reference to an Australian or other standard in the Works Approval means the relevant parts of the standard in force from time to time during the term of this Works Approval.

1.1.4 Any reference to a guideline or code of practice in the Works Approval means the current version of the guideline or code of practice in force from time to time, and shall include any amendments or replacements to that guidelines or code of practice made during the term of this Works Approval.

**1.2 General conditions**

1.2.1 The Works Approval Holder must ensure that the Works specified in Column 1 of Table 1.2.1 meet or exceed the specifications in Column 2 of Table 1.2.1 for the infrastructure in each row of Table 1.2.1.

1.2.2 The Works Approval Holder must not depart from the specifications in Column 1 and 2 for the infrastructure in each row of Table 1.2.1 except:

- (a) where such departure is minor in nature and does not materially change or affect the infrastructure;
- (b) where such departure improves the functionality of the infrastructure and does not increase risks to public health, public amenity or the environment; and
- (c) is in accordance with all other conditions in the Works Approval.

**Table 1.2.1: Works specifications**

<b>Column 1</b>	<b>Column 2</b>
<b>Infrastructure</b>	<b>Specifications (design and construction)</b>
Solar evaporation ponds, process water pond, drop out dam	<ul style="list-style-type: none"> <li>- Pond floors to be constructed with a minimum slope of 1:300;</li> <li>- Pond wall height to be at least 2.5 m above the floor for clay and overburden structures, and at least 3.0 m above the floor for tailing sand structures;</li> <li>- Ponds to be constructed with dry clay material/overburden or tailing sand and track rolled with D7 dozer, with angle of repose for the outer pond wall being 1.0v:1.5h;</li> <li>- Ponds to be constructed with a minimum width of 5.5 m for dry clay material/overburden and a minimum with of 6.5 m for tailing sand; and</li> <li>- If pond walls are to be modified as haul roads the running width must be at least 6.5 m for one-way traffic and 14 m for two-way traffic.</li> </ul>



1.2.3 The Works Approval Holder shall commission the feed preparation plant, wet concentration plant and associated infrastructure for a period not exceeding 4 months.

1.2.4 The Works Approval Holder shall commission the feed preparation plant, wet concentration plant and associated infrastructure with not more than 60,000 tonnes of heavy mineral concentrate (HMC).

### 1.3 Premises operation

1.3.1 The Works Approval Holder shall ensure that all pipelines containing clay fines/sand, sand tailings and return water are constructed with:

- (a) automatic cut-outs in the event of a pipe failure; or
- (b) secondary containment sufficient to contain any spill for a period equal to the time between routine inspections; or
- (c) telemetry systems and pressure sensors along pipelines to allow the detection of leaks and failures.

1.3.2 The Works Approval Holder shall ensure that all pipelines containing clay fines/sand, sand tailings and return water are:

- (a) inspected every 12 hours to check for any leakage; and
- (b) a written inspection log is maintained with each inspection signed off by the responsible person.

## 2 Emissions

### 2.1 General

2.1.1 The Works Approval Holder shall record and investigate the exceedance of any descriptive or numerical limit specified in any part of this Works Approval.

### 2.2 Emissions to land

2.2.1 The Works Approval Holder shall ensure that where waste is emitted to land from the emission points in Table 2.2.1 it is done so in accordance with the conditions of this Works Approval.

<b>Emission point reference</b>	<b>Description</b>	<b>Source including abatement</b>
L1	Disposal of sand tailings (by-products of wet commissioning), pumped as a slurry to partially excavated mine voids of mine blocks 14 & 15	Sand tailings from the WCP
L2	Disposal of clay fines (by-products of wet commissioning), pumped as a thickened slurry to SEP01 or SEP02	Clay fines from the WCP



## 2.3 Fugitive emissions

2.3.1 The Works Approval Holder shall ensure fugitive emissions are managed in accordance with the requirements specified in Table 2.3.1.

<b>Table 2.3.1: Fugitive emissions</b>	
<b>Description</b>	<b>Operation details</b>
Top soil stripping	<ul style="list-style-type: none"> <li>- Schedule to avoid periods of high winds from an unfavourable direction relative to receptors;</li> <li>- Schedule for when soil conditions are moist but not saturated;</li> <li>- Shall cease/suspend topsoil stripping operations during high wind conditions.</li> </ul>
Water carts/sprays	<ul style="list-style-type: none"> <li>- Shall operate when visible dust is generated from ground surfaces on the Premises;</li> <li>- Shall operate proactively subject to weather forecasting over a 24 hour period.</li> </ul>
Dust suppressant (other than water)	<ul style="list-style-type: none"> <li>- Shall apply proactively to stockpiles, noise control bunds and pond embankments;</li> <li>- Shall re-apply proactively subject to visual inspection and weather forecasting over a 24 hour period.</li> </ul>
Cessation of activities	<ul style="list-style-type: none"> <li>- Cease an activity causing visible dust lift-off where dust management measures have not prevented dust lift-off and there is a risk of dust affecting sensitive premises.</li> </ul>
Monitoring and trigger levels	<ul style="list-style-type: none"> <li>- Shall use meteorological data to assist in determining the potential for high dust generating activities, and take appropriate management action(s);</li> <li>- Shall set trigger levels on ambient air quality monitoring equipment to ensure the limits specified in Table 3.2.1 are not exceeded;</li> <li>- Shall reduce the trigger levels if necessary in response to complaints or other evidence of off-site impacts; and</li> <li>- Shall keep a log of dust trigger exceedance events including the identification of the sources of dust and action(s) taken to control dust.</li> </ul>

## 2.4 Noise

2.4.1 The Works Approval Holder shall establish a noise monitoring location:

- (a) in the vicinity of the north-west boundary of the Premises, in a location readily accessible to the Works Approval Holder and is representative of the noise levels received at the closest Noise Sensitive Premises to the west of the mine; and
- (b) in the vicinity of the north-east boundary of the Premises, in a location readily accessible to the Works Approval Holder that can be used to predict the noise levels received at the closest Noise Sensitive Premises to the east of the mine.

2.4.2 The Works Approval Holder shall implement a noise monitoring system that:

- (a) supplies continuous real-time data to allow real-time monitoring of noise emissions;
- (b) supplies spectral statistics; and
- (c) complies with Part 3 (as applicable) of the *Environmental Protection (Noise) Regulations 1997*.



### 3 Monitoring

- 3.1.1 The Works Approval Holder shall ensure that:
- (a) all water samples are collected and preserved in accordance with AS/NZS 5667.1;
  - (b) all groundwater sampling is conducted in accordance with AS/NZS 5667.11; and
  - (c) all laboratory samples are submitted to and tested by a laboratory with current NATA accreditation for the parameters being measured unless indicated otherwise in the relevant table.
- 3.1.2 The Works Approval Holder shall ensure that:
- (a) weekly monitoring is undertaken at least 4 days apart;
  - (b) monthly monitoring is undertaken at least 15 days apart;
  - (c) quarterly monitoring is undertaken at least 45 days apart; and
  - (d) 6 monthly monitoring is undertaken at least 5 months apart.
- 3.1.3 The Works Approval Holder shall ensure that all monitoring equipment used on the Premises to comply with the conditions of this Works Approval is calibrated in accordance with the manufacturer's specifications.
- 3.1.4 The Works Approval Holder shall, where the requirements for calibration cannot be practicably met, or a discrepancy exists in the interpretation of the requirements, bring these issues to the attention of the CEO accompanied with a report comprising details of any modifications to the methods.

#### 3.2 Ambient environmental quality monitoring

- 3.2.1 The Works Approval Holder shall undertake the monitoring in Tables 3.2.1 and 3.2.3 according to the specifications in those tables.

Monitoring point reference	Parameter	Limit	Units	Frequency	Sampling duration	Method
AQ1 – AQ4	TSP	260	µg/m <sup>3</sup>	Monthly	24 hours	AS 3580.9.3
AQ2, AQ4	PM <sub>10</sub>	50		Minimum of 2 samples, at least 4 weeks apart	Minimum 14 days continuous logging with 15 minute sample averages	AS 3580.9.8

Note 1: To commence prior to the start of any construction works on the Premises, during the period 1 October and ending 31 May the following year.

- 3.2.2 The Works Approval Holder is exempt from compliance with the limits specified in Table 3.2.1 if in the case of an event in Table 3.2.2:
- (a) the corresponding management action is taken; and
  - (b) there is sufficient evidence to demonstrate that the exceedance is not attributed to operations on the Premises.

Monitoring point reference	Event/action reference	Event	Management action
AQ1 – AQ4	EA1	Exceedance of a limit specified in Table 3.2.1	Undertake an investigation of the exceedance, including but not limited to: <ul style="list-style-type: none"> <li>(a) the root cause analysis for the exceedance; and</li> <li>(b) any common or contributory factors for the exceedance.</li> </ul>



- 3.2.3 The Works Approval Holder shall ensure the ambient air monitoring system:
- (a) supplies continuous real-time data to allow real-time monitoring for TSP and PM<sub>10</sub>;
  - (b) provides automatic feedback (SMS text message or equivalent) to the mine manager or supervisor if set trigger levels are reached; and
  - (c) complies with Australian Standard 3580.1.1.

<b>Table 3.2.3: Monitoring of ambient groundwater quality</b>				
<b>Monitoring point reference<sup>2</sup></b>	<b>Parameter</b>	<b>Units</b>	<b>Averaging period</b>	<b>Frequency</b>
GQ1 – GQ27	Standing water level <sup>1</sup>	m AHD	Spot sample	Monthly
	pH <sup>1</sup>	-		
	Electrical conductivity @ 25°C <sup>1</sup>	µS/cm		
	Total dissolved solids <sup>1</sup>	mg/L		Quarterly
	Major ions: bicarbonate, calcium, carbonate, chloride, magnesium, nitrate, potassium, sodium, sulfate			
GQ3, GQ4, GQ7, GQ9, GQ19, GQ21, GQ23, GQ24	Total titratable acidity (TTA)	µg/L	6 monthly	
	Total alkalinity (TAlk)			
	Cadmium, zinc, selenium, uranium, arsenic, cobalt, chromium, mercury			
	Monomeric acrylamide			Quarterly

Note 1: In-field non-NATA accredited analysis permitted.

Note 2: See cross reference of monitoring point reference with Doral bore ID in Schedule 1.

## 4 Information

### 4.1 Reporting

- 4.1.1 The Works Approval Holder shall submit a compliance document to the CEO, following the construction of the works and prior to commissioning of the same.
- 4.1.2 The compliance document shall:
- (a) certify that the works were constructed in accordance with the conditions of the works approval;
  - (b) be signed by a person authorised to represent the Works Approval Holder and contain the printed name and position of that person within the company.
- 4.1.3 The Works Approval Holder shall submit a commissioning report to the CEO within 3 months of the completion of commissioning.
- 4.1.4 The commissioning report shall include:
- (a) a summary of the commissioning timeframes and volume of ore processed during wet commissioning;
  - (b) a summary of the monitoring results recorded under condition 3.2.1;
  - (c) a list of any original monitoring reports submitted to the Works Approval Holder from third parties for the commissioning period;
  - (d) a summary of the environmental performance of all plant and equipment as installed, including but not limited to:
    - (i) hydro-testing of pipelines and pump system functions testing;
    - (ii) commissioning of the raw water system;
    - (iii) dry commissioning of the MUP, WCP circuit and thickener;
    - (iv) wet commissioning of the MUP, WCP circuit and thickener;
    - (v) testing the clay/sand tailings system; and
    - (vi) commissioning of the process control system;
  - (e) a review of performance against the design specification set out in the works approval application; and



- (f) where they have not been met, measures proposed to meet the design specification and/or works approval conditions, together with timescales for implementing the proposed measures.

#### 4.2 Notification

4.2.1 The Works Approval Holder shall ensure that the parameters listed in Table 4.2.1 are notified to the CEO and are in accordance with the notification requirements of the table.

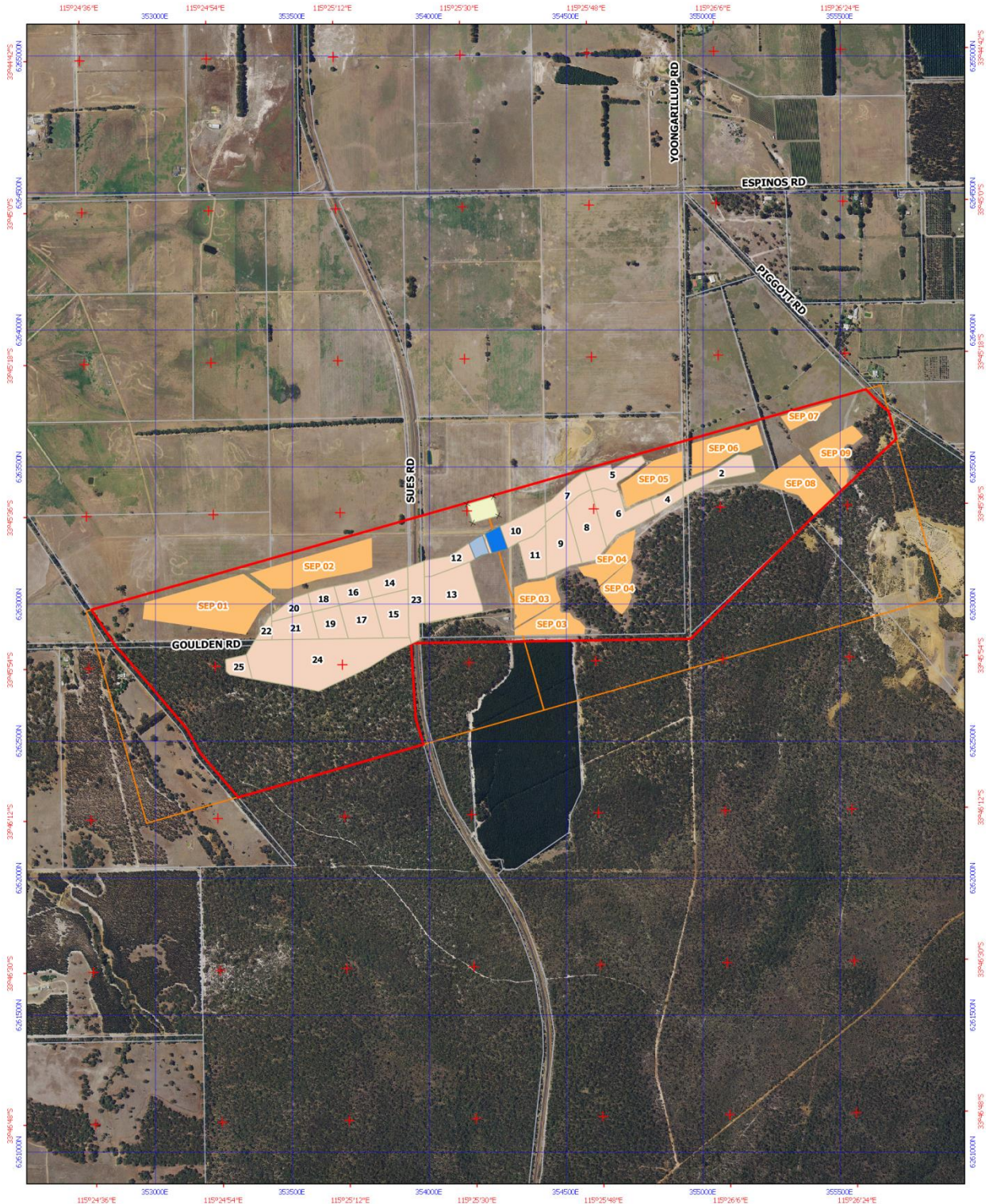
<b>Table 4.2.1: Notification requirements</b>			
<b>Condition</b>	<b>Parameter</b>	<b>Notification requirement</b>	<b>Format or form</b>
1.2.3	Commencement of commissioning	7 days prior to start	None specified
	Completion of commissioning	7 days after completion	
2.1.1	Breach of any limit specified in the Works Approval	Part A: As soon as practicable but no later than 5pm of the next usual working day	N1
		Part B: As soon as practicable	



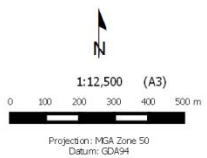
# Schedule 1: Maps

## Premises map

The Premises is shown in the map below. The red line depicts the Premises boundary.



Legend	
	W5990 premises boundary
	Mining tenements
	South West Cadastre
	Mining blocks
	Solar evaporation ponds
Infrastructure	
	Drop out dam
	Process water dam
	Concentrator plant



Produced by Daniel Har, Department of Environment Regulation

Government of Western Australia  
Department of Environment Regulation

Job Ref: W5990/2016/1  
Produced at 09:58 AM on November 11, 2016





**Monitoring point references**

A cross reference of the monitoring point locations listed in Table 3.2.3 with corresponding Doral ID are shown in the table below.

<b>Groundwater monitoring point references</b>							
<b>Monitoring point reference</b>	<b>Doral ID</b>	<b>Coordinates (GDA94)</b>		<b>SWL, pH, EC, TDS</b>	<b>Major ions TTA, TAlk</b>	<b>Metals</b>	<b>ACM</b>
		<b>y</b>	<b>x</b>				
GQ1	YMLB11	6263707	355612	Monthly	Quarterly		
GQ2	YMB16D	6263330	355400				
GQ3	YMB14S	6263360	354925			6 monthly	Quarterly
GQ4	YMB17S	6263690	354900			6 monthly	Quarterly
GQ5	YMB18S	6263665	354487				
GQ6	YMB18D	6263665	354487				
GQ7	YMB06S	6263373	354298			6 monthly	Quarterly
GQ8	YMB06D	6263376	354298				
GQ9	YMB04S	6263125	354527			6 monthly	Quarterly
GQ10	YMB04D	6263106	354476				
GQ11	YMB02D	6262505	354549				
GQ12	YMLB13	6262955	354291				
GQ13	YMB15D	6262612	354139				
GQ14	YMB13S	6262880	354002				
GQ15	YMLB14	6262911	353927				
GQ16	YMB12S	6262750	353780				
GQ17	YMB11S	6262680	353600				
GQ18	YMB10S	6262710	353360				
GQ19	YMB03S	6262872	353339			6 monthly	Quarterly
GQ20	YMB03D	6262871	353409				
GQ21	YMB05S	6263262	353380			6 monthly	Quarterly
GQ22	YMB05D	6263260	353380				
GQ23	YMB08B	6263010	352890			6 monthly	Quarterly
GQ24	YMB08S	6262865	352870			6 monthly	Quarterly
GQ25	YMB09S	6262605	353030				
GQ26	YMB09D	6262605	353030				
GQ27	YMLB08	6262817	352693				



Works Approval: W5990/2016/1  
Form: N1

WA Holder: Doral Mineral Sands Pty Ltd  
Date of breach:

**Notification of detection of the breach of a limit.**

These pages outline the information that the operator must provide.  
Units of measurement used in information supplied under Part A and B requirements shall be appropriate to the circumstances of the emission. Where appropriate, a comparison should be made of actual emissions and authorised emission limits.

**Part A**

Works Approval Number	
Name of operator	
Location of Premises	
Time and date of the detection	

<b>Notification requirements for the breach of a limit</b>	
Emission point reference/ source	
Parameter(s)	
Limit	
Measured value	
Date and time of monitoring	
Measures taken, or intended to be taken, to stop the emission	

**Part B**

Any more accurate information on the matters for notification under Part A.	
Measures taken, or intended to be taken, to prevent a recurrence of the incident.	
Measures taken, or intended to be taken, to rectify, limit or prevent any pollution of the environment which has been or may be caused by the emission.	
The dates of any previous N1 notifications for the Premises in the preceding 24 months.	

Name	
Position	
Signature on behalf of Doral Mineral Sands Pty Ltd	
Date	



# Decision Document

## *Environmental Protection Act 1986, Part V*

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**Applicant:** **Doral Mineral Sands Pty Ltd**

**Works Approval:** **W5990/2016/1**

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**Registered office:** 1 Alumina Road  
EAST ROCKINGHAM WA 6168

**ACN:** 096 342 451

**Premises address:** Yoongarillup Mineral Sands Mine  
1192 Sues Road  
YOONGARILLUP WA 6507  
Being part of tenements M70/458 and M70/459, within Lots 1870, 1872,  
1873 & 1874 on Plan 201690 and Lots 101 & 102 on Diagram 98906

**Issue date:** Monday, 5 December 2016

**Commencement date:** Monday, 12 December 2016

**Expiry date:** Wednesday, 11 December 2019

### **Decision**

Based on the assessment detailed in this document the Department of Environment Regulation (DER), has decided to issue a works approval. DER considers that in reaching this decision, it has taken into account all relevant considerations and that the Works Approval and its conditions will ensure that an appropriate level of environmental protection is provided.

Decision Document prepared by: Daniel Hartnup  
Licensing Officer

Decision Document authorised by: Tim Gentle  
Delegated Officer



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## 1 Purpose of this Document

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



## 2 Administrative summary

Administrative details		
Application type	Works Approval <input checked="" type="checkbox"/>	
	New Licence <input type="checkbox"/>	
	Licence amendment <input type="checkbox"/>	
	Works Approval amendment <input type="checkbox"/>	
Activities that cause the premises to become prescribed premises	<b>Category number(s)</b>	<b>Assessed design capacity</b>
	8: Mineral sands mining or processing	1,500,000 tonnes per annual period
Application verified	Date: 16/09/2016	
Application fee paid	Date: 20/09/2016	
Works Approval has been complied with	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Compliance Certificate received	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	N/A <input checked="" type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Commercial-in-confidence claim	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Is the proposal a Major Resource Project?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Was the proposal referred to the Environmental Protection Authority (EPA) under Part IV of the <i>Environmental Protection Act 1986</i> ?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
		Referral decision No: 1938 Managed under Part V <input type="checkbox"/> Assessed under Part IV <input checked="" type="checkbox"/>
Is the proposal subject to Ministerial Conditions?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
		Ministerial statement No: 1030 EPA Report No: 1552 (July 2015)
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the <i>Environmental Protection Act 1986</i> )?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
	Department of Water consulted Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
Is the Premises within an Environmental Protection Policy (EPP) Area	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Is the Premises subject to any EPP requirements?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>



### 3 Executive summary of proposal and assessment

This report sets out DER's assessment and decision making in relation to a concurrent application for works approval and licence under Division 3, Part V of the *Environmental Protection Act 1986* for the proposed Yoongarillup Mineral Sands Project (the project).

#### Background

Doral Mineral Sands Pty Ltd proposes to establish a small-to-medium scale heavy mineral sands mine in the locality of Yoongarillup, City of Busselton, approximately 250 km south of Perth. The project will form a continuation of mineral sands mining for its' Western Australian operations, by providing heavy mineral concentrate (HMC) feedstock to its mineral separation plant (MSP) located at Picton.

#### Proposed activities

The life-of-mine is expected to be 3 years, including an initial pre-mine development phase, mining and processing, backfilling of mine pits, and mine closure and rehabilitation. Operations will principally occur 24 hours a day, 7 days a week over the life-of-mine. Mining will be staged to minimise the area of disturbance at any one time.

The total resource for the deposit is 4 million tonnes (Mt) with an average grade of 12 – 15% heavy mineral. Ore will be mined progressively via a series of open-cut pits using dry mining techniques, to a maximum depth of 20 metres below ground level (mbgl). Groundwater inflows into the pit will be passively dewatered (i.e. sump pumping at the lowest point) to enable dry mining to occur. A projected water balance indicates the mine process water requirements will far exceed the volume of water collected onsite from dewatering, rainfall and stormwater runoff. As such, offsite discharge of mine water is not predicted to be a routine event, however infrastructure will be in place to allow water to discharge through a series of constructed channels off the premises, should a significant rainfall event exceed the site's water holding capacity.

Processing of ore will occur in-pit and slurry will be pumped from a feed preparation plant to a wet concentration plant (WCP) for further processing. Clay fines and sand tailings (quartz) will be combined and backfilled into the mine voids using co-flocculation where possible. Up to nine solar evaporation ponds (SEPs) are proposed to be constructed over the life-of-mine for the drying of clay fines, and to allow recycling of entrained water back to the process water pond, prior to being co-disposed into mine voids. Mined areas will then be back-filled and rehabilitated back to pre-mining land use.

HMC produced at the WCP will be stockpiled onsite prior to off-site transport to the Picton MSP for secondary processing. Target valuable minerals include zircon, ilmenite and leucoxene. Sand tailings (from processing Yoongarillup HMC) at the Picton MSP will be returned to the mine and blended with mine sand tailings, prior to backfilling into mine voids.

#### Other approvals and consultation

In 2015 the project was subject to an Environmental Impact Assessment (EIA) under Part IV of the *Environmental Protection Act 1986* (EP Act), at the level of Public Environmental Review (PER). The project was subsequently approved by the Minister for Environment in June 2016 (Statement 1030). The main environmental factor assessed through the EIA was flora and vegetation, as the original proposal included clearing of up to 20 hectares (ha) of the adjoining State Forest, which comprises regionally significant flora and vegetation values of the Whicher Scarp native forest ecosystem. Statement 1030 permits the clearing of a reduced area (8.9 ha), subject to the implementation of an offset.

Amenity (noise and dust) was also identified as a key environmental factor in the EIA. Ministerial conditions were not imposed for this factor following DER advice that noise and dust can be regulated under Part V of the EP Act.

The project was also referred to the Federal Department of the Environment and Energy for assessment under the *Environment Protection and Biodiversity Conservation Act 1999*, due to the potential to affect



listed threatened species and communities (threatened flora: Long-leaved Daviesia and Long-stalked Featherflower; threatened fauna: Forest red-tailed Cockatoo, Baudin's Black Cockatoo and Carnaby's Black Cockatoo; and migratory bird species: Rainbow Bee-eater); and wetlands of international importance (under the Ramsar Convention): Vasse-Wonnerup wetland system. The outcomes of the assessment have resulted in an increase to the size of the offset under Statement 1030, and additional groundwater monitoring to ensure the mine does not impact on the values of the Vasse-Wonnerup wetland system.

### **Siting and location**

The project is located on two mining tenements, on a strand of heavy mineral deposit that has been extensively mined. Yoongarillup will become the southern-most mine on the ancient shoreline strand that has also hosted the Tutunup, Yoganup, Gwindinup and Dardanup series of mineral sands mines.

Development of the mine will disturb 95.71 ha of mostly cleared agricultural land, including 8.9 ha of native vegetation within the adjoining State Forest. Surrounding land uses are predominantly farming and State Forest/National Park.

A number of farm houses are located around the site, including 9 within 1 km of the proposed mining pits, the closest 5 being within 400 – 600 m. A further 17 receptors are located within a 2.2 km radius, primarily to the north-east, of the proposed mining pits (total 26 receptors within 2.2 km).

The project is located on the lower/mid slopes of the Whicher Scarp, on the southern Swan Coastal Plain, southern Perth Basin. The superficial aquifer contains an unconfined groundwater lens in the Bassendean Sand towards the top and the sandy beds of the Yoganup Formation towards the base – the latter containing the mineral sand ore zones to be targeted by the project, and where most of the groundwater interception during mining will take place. Pit inflow is also likely to include indirect up-flow from the underlying sandstones and shales of the Leederville aquifer (Mowen Member), and from downslope drainage off the Whicher Scarp.

### **Public health and environmental risks**

The key public health and environmental risks that may directly result from the project include:

- emissions to air (noise and dust emissions);
- emissions to surface water (offsite discharge of excess mine water); and
- emissions to land (disposal of tailings to mine voids).

Other risks that may indirectly result from the project include:

- impacts on ambient surface and groundwater quality from:
  - oxidation of potential acid sulfate soils (PASS) material in the Superficial aquifer as a consequence of groundwater drawdown;
  - leaching of contaminants and radionuclides into groundwater from the disposal of MSP tailings that contain naturally occurring radioactive materials (NORMs);
  - spills or leaks of pipelines carrying slurries of sand, ore and clay slimes;
  - contaminated stormwater (high turbidity) from disturbed areas;
  - acrylamide leaching (from flocculants) in settling ponds;
- impacts to native vegetation from:
  - mounding of groundwater beneath containment dams;
  - spills or leaks of pipelines carrying slurries of sand, ore and clay slimes; and
- impacts on adjacent receptors from light overspill.

### **Risk assessment and decision**

On the basis of the information provided within the application, the Delegated Officer has determined the public health and the environmental risks associated with the project are acceptable, if the proposed controls are implemented. As such, a licence will be granted subject to compliance with the works approval and validation of the completed works.



## 4 Decision table

All applications are assessed in line with the *Environmental Protection Act 1986* (EP Act), the *Environmental Protection Regulations 1987* and DER's Operational Procedure on Assessing Emissions and Discharges from Prescribed Premises. Where other references have been used in making the decision they are detailed in the decision document.

DECISION TABLE			
Works Approval / Licence section	Condition number W = Works App L = Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
Occupier	N/A	Under the EP Act, works approvals and licences can only be granted to the occupier of the premises. The applicant is the holder of mining tenements M70/458 and M70/459, which covers freehold land, road reserve and crown land, and expires on 25 March 2035. The applicant has provided in-principle consent from all landholders. The Delegated Officer is satisfied the applicant is the occupier of the premises.	
General conditions	W1.2.1 – W1.2.2	<b>Construction</b> Conditions have been added to the works approval to define the specifications for the infrastructure that is required to be constructed at the premises. The specifications are generally consistent with those proposed in the application and are in line with the regulatory controls proposed for the risk of Containment of Processing Wastes.	
	W1.2.3 – W1.2.4	<b>Construction</b> The applicant intends to commission plant and equipment following installation/construction, namely the feed preparation plant and the WCP circuits and associated equipment. Conditions have been added to the works approval to limit the scope of commissioning works to a 4 month period, and no more than 60,000 tonnes of HMC to be processed as part of wet commissioning works. This is primarily to ensure that mining operations do not commence under the works approval. A full description of the scope of works under this application is included in Appendix A1.	
	W – no conditions L – no conditions	<b>Construction &amp; Operation</b> Bunding and drainage will be constructed to divert surface water flows away from the mining area, and to minimise impacts on natural surface water flows. Stormwater falling within the mine footprint will be harvested for operational water requirements. The risk of surface water contamination from mining activities is considered to be low and therefore no controls have been imposed on the works approval or proposed for the licence.  DER's assessment and decision making on Surface Water Management is detailed in Appendix A2.	



<b>DECISION TABLE</b>			
<b>Works Approval / Licence section</b>	<b>Condition number W = Works App L= Licence</b>	<b>Justification (including risk description &amp; decision methodology where relevant)</b>	<b>Reference documents</b>
<b>Premises operation</b>	W1.3.1	<p><b>Construction</b></p> <p>The works approval application contains limited information on the design, location and standard of construction and operation of pipelines carrying slurries of sand, ore and clay slimes. As such, a control has been added to the works approval to require pipelines to be contained within bunding to contain any leakage or spillage and/or constructed with telemetry and automatic leak detection. There will also be a requirement for pipelines to be inspected for integrity every 12 hours, with an inspection log to be kept, with each inspection record signed by the responsible person.</p>	
	L – conditions	<p><b>Containment of Processing Wastes Risk</b></p> <p><b>Operation</b></p> <p>Conditions will be included on the licence to:</p> <ul style="list-style-type: none"> <li>• specify the authorised infrastructure on the premises for the containment of processing wastes and the minimum infrastructure requirements;</li> <li>• require adequate safeguarding of pipelines carrying slurries of ore and tailings to prevent uncontrolled discharges in the event of an incident or malfunction; and</li> <li>• require daily inspections of all containment infrastructures for leaks, integrity and freeboard requirements, with a log book to be kept with each inspection record to be signed by the responsible person.</li> </ul> <p>DER's assessment and decision making on Containment of Processing Wastes are detailed in Appendix A3.</p>	
	L – conditions	<p><b>Acid Sulfate Soils Risk</b></p> <p><b>Operation</b></p> <p>Acid sulfate soils (ASS) investigations involving drilling and soil sampling across the site detected the presence of pyrite within dark coloured (grey to black) sandy clay materials, located below the maximum depth of mining. It is unlikely this material will be directly disturbed by mining, however it has been identified as being at risk of becoming oxidised as a result of dewatering drawdown. Controls are proposed for the licence to mitigate this risk.</p> <p>DER's assessment and decision making on ASS is detailed in Appendix A4.</p>	



<b>DECISION TABLE</b>			
<b>Works Approval / Licence section</b>	<b>Condition number W = Works App L= Licence</b>	<b>Justification (including risk description &amp; decision methodology where relevant)</b>	<b>Reference documents</b>
<b>Emissions general</b>	W2.1.1	<b>Construction</b> Descriptive and numerical limits have been set through conditions of the works approval and therefore a control has been included to require recording and investigation of limit exceedances.	
	L – conditions	<b>Operation</b> Descriptive and numerical limits are proposed for the licence. Controls are proposed for the licence regarding recording and investigation of exceedances of limits.	
<b>Point source emissions to air including monitoring</b>	W – no conditions L – no conditions	<b>Construction &amp; Operation</b> There are no point source emissions to air proposed in the application during mine construction or commissioning works, or subsequent mining operations.	
<b>Point source emissions to surface water including monitoring</b>	W – no conditions	<b>Construction</b> There are no point source emissions to surface water proposed in the application during mine construction or commissioning works.	
	L – conditions	<b>Operation</b> Dewatering of mining areas will occur passively, via in-pit sumps located at the deepest point of the pit. Groundwater will be pumped from the sump to a drop-out pond, which will provide makeup water to the WCP (via the process water pond). As the operational water requirements of the mine are predicted to exceed the volume of water collected onsite from dewatering, rainfall and stormwater runoff, routine offsite discharge is not expected. However, in the event all water storages are at capacity and prolonged heavy rainfall occurs within the pit catchment area, controlled discharge of surplus mine water will occur via cut-off drains and constructed channels, to divert water into an existing paddock drain that flows to the existing roadside drain along Yoongarillup Rd. The discharge of mine water to surface water has the potential to impact on offsite environmental values through changes in water flows and quality. Controls are proposed for the licence to mitigate this risk.  DER's assessment and decision making on Point Source Emissions to Surface Water is detailed in Appendix A5.	



DECISION TABLE			
Works Approval / Licence section	Condition number W = Works App L = Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
Point source emissions to groundwater including monitoring	W – no conditions L – conditions	<p><b>Construction &amp; Operation</b></p> <p>There are no point source emissions to groundwater proposed in the application during mine construction or commissioning works, or subsequent mining operations.</p> <p>Discharge of surplus mine water (if required) is proposed via surface drains (See Point Source Emissions to Surface Water).</p>	
Emissions to land including monitoring	W2.2.1	<p><b>Construction</b></p> <p>Sand tailings and clay fines produced during wet commissioning of the WCP will be returned to the mining void. A control has been imposed on the works approval to specify the nominated mine voids as an authorised disposal area for this material.</p> <p>DER's assessment and decision making on Emission to Land is detailed in Appendix A6.</p>	
	L – conditions	<p><b>Operation</b></p> <p>Dried clay tailings will be removed from the SEPs during the dry periods and blended with sand tailings for co-disposal into completed mine voids. Sand tailings produced by the WCP will be returned to completed mine voids as a slurry, or blended with clay fines for co-disposal. Tailings will comprise quartzose sands, minor clay and unrecovered heavy mineral, and trash mineral tailings from secondary processing (Picton tails). The Picton tails will contain monazite, a naturally occurring radioactive material (NORM), and will be blended with mine site tailings to achieve radiation levels at or below pre-mining levels, prior to disposal. (Radiation management is regulated by the Department of Mines and Petroleum).</p> <p>DER's assessment and decision making on Emissions to Land is detailed in Appendix A6.</p>	
Fugitive emissions	W2.3.1 L – conditions	<p><b>Dust Emissions Risk</b></p> <p><b>Construction &amp; Operation</b></p> <p>Amenity (dust) was assessed as a key environmental factor during the EIA<sup>1</sup> due to the potential for impacts on nearby residents, however, based on the advice of DER that fugitive dust can be regulated, monitored and enforced under Part V of the EP Act, no ministerial conditions were imposed.</p> <p>Due to the proximity of receptors (including Sues Rd) and prevailing easterly/south westerly winds in the area, there is a potential risk of fugitive dust emissions during mine construction works and subsequent mining operations impacting on nearby sensitive land uses. Conditions have been imposed on the works approval, and are proposed for the licence, to mitigate this risk. The controls</p>	<p><sup>1</sup>EPA Report 1552 (2015)</p> <p><sup>2</sup>Yoongarillup Mineral Sands Project Public Environmental Review Response to Environmental Submissions Final Issue (Doral Mineral</p>



DECISION TABLE			
Works Approval / Licence section	Condition number W = Works App L= Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
		<p>are consistent with commitments made by the applicant with respect to dust management measures, in its response to submissions on the PER<sup>2</sup>.</p> <p>DER's assessment and decision making on Fugitive Dust is detailed in Appendix A7.</p>	Sands, 2015)
	L – conditions	<p><b>Light Emissions Risk</b></p> <p><b>Operation</b></p> <p><u>Emission Description</u>  <i>Emission:</i> Light overspill from outdoor lighting, luminance diffusion, reflection from existing surfaces or atmospheric scattering.  <i>Impact:</i> Nuisance value, affecting amenity of nearby receptors, or potentially creating safety hazards on adjacent roads. A public submission has raised concerns about the potential for light to impact on sleeping patterns of nearby residents.  <i>Controls:</i> The location and orientation of artificial lighting will be managed in accordance with AS 4282, such as specially designed lighting equipment to minimise the spread of, near to, or above the horizontal, prevention of over-lighting, and ensuring the angle of the main light beam and any observer is &lt; 70°.</p> <p><u>Risk Assessment</u>  <i>Consequence:</i> Minor.  <i>Likelihood:</i> Unlikely.  <i>Risk Rating:</i> Moderate.</p> <p><u>Regulatory Controls</u>            A condition will be imposed on the licence to require outdoor lighting to comply with AS 4282.</p> <p><i>Consequence:</i> Minor.</p>	



DECISION TABLE			
Works Approval / Licence section	Condition number W = Works App L = Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
		<i>Likelihood:</i> Unlikely. <i>Risk Rating:</i> Moderate.	
<b>Odour</b>	W – no conditions L – no conditions	<b>Construction &amp; Operation</b> Odour is not expected during mine construction or commissioning works, or subsequent mining operations. These activities do not involve the processing of chemicals, wastes or other organic compounds that may generate malodours.	
<b>Noise</b>	W2.4.1 – W2.4.2 L – conditions	<b>Construction &amp; Operation</b> Amenity (noise) was assessed as a key environmental factor during the EIA <sup>1</sup> due to the potential for impacts on nearby residents, however, based on the advice of DER that it will regulate the mine to ensure compliance with the Noise Regulations, no ministerial conditions were imposed. Due to the proximity of receptors (including Sues Rd) and the continuous (24/7) operation of the mine, there is a potential risk of noise emissions during mine construction works and subsequent mining operations impacting on nearby noise sensitive premises. Conditions have been imposed on the works approval, and are proposed for the licence, to mitigate this risk. The controls are consistent with commitments made by the applicant with respect to noise management measures in the PER <sup>2</sup> , its response to environmental submissions on the PER, and the works approval application.  DER's assessment and decision making on Noise is detailed in Appendix A8.	<sup>1</sup> EPA Report 1552 (2015) <sup>2</sup> Yoongarillup Mineral Sands Project Public Environmental Review Response to Environmental Submissions Final Issue (Doral Mineral Sands, 2015)
<b>Monitoring general</b>	W3.1.1 – W3.1.4 L – conditions	<b>Construction &amp; Operation</b> Conditions have been applied to the works approval to prescribe the minimum monitoring requirements. They relate to the minimum requirements for sampling and analysis of samples, minimum timeframes for sampling frequency, and calibration requirements for instruments used by the applicant. All these requirements will be duplicated on the licence.	
<b>Monitoring of inputs and outputs</b>	W – no conditions L – no conditions	<b>Construction &amp; Operation</b> Monitoring of inputs and outputs is not required to adequately manage emissions from the Premises during mine construction works or subsequent mining operations. No specified conditions relating to the monitoring of inputs and outputs have been added to the works approval or licence.	
<b>Process monitoring</b>	W – no conditions L – conditions	<b>Construction &amp; Operation</b> Conditions are proposed for the licence to require monthly monitoring of the amount and location of tailings returned from the Picton MSP disposed on the Premises (See Emissions to Land section). Reporting of annual production volumes will be included in the Annual Environmental Report (See Information section).	



<b>DECISION TABLE</b>			
<b>Works Approval / Licence section</b>	<b>Condition number W = Works App L = Licence</b>	<b>Justification (including risk description &amp; decision methodology where relevant)</b>	<b>Reference documents</b>
<b>Ambient quality monitoring</b>	W3.2.1 – W3.2.3	<p><b>Construction</b> W3.2.1 has been added to the works approval to require monitoring in accordance with Tables 3.2.1 and 3.2.3. Table 3.2.1 requires monitoring of TSP and PM<sub>10</sub> levels at up to 4 locations on the premises boundary during the period October – May in each year during mine construction works (See Fugitive Emissions section). Table 3.2.2 provides for an exemption of compliance with the ambient air quality limits if it can be demonstrated the exceedance was not attributed to mine construction works. Table 3.2.3 formalises, and expands on, the existing baseline groundwater monitoring program that has been ongoing since 2012. The table references parts of the extensive groundwater monitoring program<sup>1</sup> approved by the Department of Water, specifically the monitoring of groundwater levels and quality in selected existing and new groundwater monitoring bores in the vicinity of SEPs and mine pits (See Emissions to Land section).</p>	<sup>1</sup> Groundwater Operating Strategy – Yoongarillup Mineral Sands Project (July 2016)
	L – conditions	<p><b>Operation</b> It is proposed to continue the ambient monitoring programs commenced under the works approval on the operating licence.</p>	
<b>Improvements</b>	W – no conditions L – no conditions	<p><b>Construction &amp; Operation</b> The Delegated Officer has determined that no improvements are required at this stage on the basis that all controls in the works approval and licence are considered appropriate and sufficient to mitigate the risk of emissions and discharges expected during mine construction works and subsequent mining operations.</p>	
<b>Information</b>	W4.1.1 – W4.1.4 W4.2.1	<p><b>Construction</b> Reporting and notification conditions have been included on the works approval, to require submission of a compliance document prior to commissioning works, and a commissioning report, detailing the environmental performance of the as-built plant. A condition has been included to require notification of the commencement and completion of commissioning works, and in the event of a breach of any descriptive or numerical limit specified in the works approval.</p>	
	L – conditions	<p><b>Operation</b> Conditions relating to minimum record keeping requirements, annual reporting and notification requirements are proposed for the licence, and are necessary to demonstrate compliance with other licence requirements.</p>	
<b>Approval</b>	N/A	In accordance with DER Guidance Statement: <i>Licence Duration</i> (May 2015), the works approval will	DER Guidance



<b>DECISION TABLE</b>			
<b>Works Approval / Licence section</b>	<b>Condition number W = Works App L= Licence</b>	<b>Justification (including risk description &amp; decision methodology where relevant)</b>	<b>Reference documents</b>
<b>Duration</b>		be issued for a period of 3 years. Mining tenements M70/458 and M70/459 expire on 25 March 2035. The licence will be issued to align with this expiry.	Statement: <i>Licence duration (May 2015)</i>



## 5 Advertisement and consultation table

Date	Event	Comments received/Notes	How comments were taken into consideration
26/09/2016	Application advertised in West Australian newspaper	Two public submissions were received. A summary of the issues raised is provided at Appendix B.	DER's response to the submissions is provided at Appendix B.
	Application referred to City of Busselton	The applicant should develop and implement management plans for dust and odour, noise and light, to ensure the development does not affect adjoining properties or road traffic along Sues Rd.	Management plans for dust, noise and light have been submitted with the works approval application. Controls for these aspects have been imposed in the works approval and are proposed for the licence, to address the risk of impacts on human health and the environment.
		Groundwater drawdown should not adversely impact adjoining landowners or native vegetation.	Impacts from the groundwater abstraction activity are regulated by DoW under the GOS.
14/11/2016	Application referred to DoW	-	-
02/12/2016	Applicant sent a copy of preliminary drafts	Comments received to clarify SEP design details, logistics of noise monitoring, and clarification of groundwater monitoring analytes (radon, cobalt, radium, thallium)	Clarification provided and changes made to conditions where relevant.
06/12/2016	Applicant sent a copy of finalised drafts	Comments received regarding logistics of noise and dust monitoring.	Minor changes made to wording of relevant conditions.



## 6 Risk Assessment

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

**Table 1: Emissions Risk Matrix**

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



## Appendix A

### A1 Scope of works

Mine establishment activities included within the scope of this works approval application include:

#### 1. Construction

Construction works will be carried out over approximately 4 months and include:

- Sub-soil drainage of paddocks;
- Vegetation clearing;
- Topsoil and subsoil stripping and stockpiling;
- Construction of infrastructure including:
  - skid-mounted, in-pit mining unit plant (MUP);
  - slurry pipelines, pumps and stackers;
  - wet concentration plant (WCP);
  - heavy mineral concentrate (HMC) product stockpile pad and stackers;
  - run-of-mine (ROM) stockpile pads;
  - sand tailings and clay fines system (pipelines, pumps, stackers);
  - infrastructure corridors (electrical/water/roads)
  - other ancillary works (e.g. amenities buildings, offices, contractor's workshop, ablutions – septic and leach drain);
- Construction of the water management and distribution network, including the process water dam, drop-out pond, surface drainage structures, stormwater dams, discharge point/s and associated pipelines and pumps;
- Excavation and stockpiling of overburden and ore from blocks 14 and 15 for initial processing,
- Construction of the two SEPs located west of Sues Rd; and
- Construction of the earthen noise bunds along the northern boundary.

The WCP from the Dardanup Mineral Sands Mine will be relocated to the premises and located centrally to the deposits at the process plant, immediately east of Sues Rd.

#### 2. Commissioning

Commissioning will be carried out over approximately 2 months, at the completion of which the mine will be operational, and includes:

- Hydro-testing of pipelines and pump systems functions testing;
- Commissioning the raw water system;
- Dry commissioning of the MUP, WCP circuit and thickener;
- Wet commissioning of the MUP, WCP circuit and thickener; and
- Commissioning the process control system.

To wet commission the MUPs and WCP circuits and associated equipment, it will be necessary to process a volume of ore. Approximately 60,000 tonnes of ore will be processed, with the HMC stored at the HMC stockpiles. The clay fines produced during commissioning will be disposed into a SEP constructed on the west of Sues Rd. Sand tailings will be returned to the partially excavated mining void on blocks 14 and 15.



## **A2 Surface water management**

The key aspects of an effective stormwater control strategy at mineral sand mines involve isolation of dirty water sources, collection and containment of stormwater to allow maximum re-use in processing, and minimising the risk of stormwater runoff picking up and transferring sediment from disturbed areas.

### ***Emission Risk Assessment – Construction & Operation***

#### Emission Description

**Emission:** Uncontrolled stormwater runoff, contaminated with suspended solids, hydrocarbons or dissolved solids from areas disturbed by construction works and subsequent operational areas.

**Impact:** Contamination of surface water ecosystems with the potential for water quality exceeding background concentrations and Australian Water Quality Guidelines<sup>1</sup> for physical and chemical stressors.

The Vasse-Wonnerup wetland system is located 14 km downstream of the mine. There are no other surface water systems of significance (e.g. rivers, creeks, etc.) in proximity to the mine.

The watershed between the Vasse and Sabina rivers is located approx. 1.5 km south of the mine, from which the headwaters of two minor ephemeral drainage lines arise and flow down-gradient in a north-westerly direction, through the State Forest and proposed mining area, and onto cleared farming land. These drainage lines have been heavily modified to divert surface water off paddocks towards existing roadside drains, along Sues Rd and Yoongarillup Rd. Downstream flow goes to the Vasse Diversion Drain and out through to Geographe Bay. It does not flow to the Vasse-Wonnerup Wetlands Ramsar site.

Sheet flow or flow within the paddock drains may occur during periods of heavy rainfall. Because of the small volumes, the applicant expects the majority of stormwater flowing to these drains to sit until it evaporates.

**Controls:** The applicant has proposed the following management measures:

- Runoff from the undisturbed catchment upstream of the mine site will be diverted away from mine pits and other operational areas into existing drainage lines through bunding and local drains; and
- Surface water runoff generated in active pits and non-rehabilitated areas will be collected via sumps within the pits and pumped to the process water dam for use in processing.

#### Risk Assessment

The likely consequence of contaminated stormwater runoff entering the ephemeral drainage lines would be insignificant off-site impacts at a local scale (Insignificant). The likelihood of this consequence occurring under typical mine construction works and/or subsequent mining operations is Unlikely (unlikely to occur), with a combined risk rating of Low.

**Consequence:** Insignificant.

**Likelihood:** Unlikely.

**Risk Rating:** Low.

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<sup>1</sup> Australian Water Quality Guidelines for Fresh and Marine Waters, ANZECC/ARMCANZ (2000)



Regulatory Controls

Due to the low risk rating, no controls are proposed on the works approval or licence.

Residual Risk

The residual risk rating is Low.

*Consequence: Minor.*

*Likelihood: Rare.*

*Risk Rating: Low.*



### A3 Containment of processing wastes

The clay fines component will be thickened (through addition of a flocculant at the thickener) and pumped to settling dams for solar drying (solar evaporation ponds, SEPs). Excess sand tailings will be pumped directly to mined voids for disposal, or stored in a discrete sand tails SEP until disposal.

Dirty water from the WCP, return water from the SEPs and water reclaimed from the mine pits will be pumped to the drop-out dam, which is engineered to promote sedimentation of particles, prior to overflowing to the process water dam, for reuse as process water.

Slurried materials will be transferred around the mine site using high-density polyethylene pipelines with flanged sections (butt flange welded to the end of the line and bolted to a corresponding flange). As with most mining operations, there is an inherent environmental risk associated with the design and operational practices of transferring slurries under pressure through pipelines.

#### ***Emission Risk Assessment – Operation***

##### Emission Description

*Emission:* Clay fines (thickener underflow) from processing, pumped to SEPs for solar drying. Sand tailings from primary screening, pumped from the WCP to mine voids for disposal. Return water from in-pit sumps, pumped back to the drop-out dam for reuse in processing.

Sand tailings and clay fines comprise the coarse-grained (typically quartz sand) and fine-grained (typically silt-sized clay material) solid material remaining after the heavy mineral concentrate has been separated from the mined ore, respectively, slurried with process water to facilitate transfer. Return water and dewatering water predominantly comprise clean water, with the potential to still contain some fines.

A polyacrylamide (PAM)-based flocculant will be used for flocculation purposes. PAM is adsorbed onto the clay slime material and disposed into SEPs to allow entrained water to be reclaimed. Once absorbed it is not released into the water phase and will remain with the slime material for disposal into the mine void.

*Impact:* Spills or leaks (due to pipeline failure) of sand tailings and/or clay fines can lead to contamination of nearby surface waters through sedimentation, being both an increased concentration of suspended sediments (i.e. turbidity) and an increased accumulation of fine sediments, where they are undesirable.

The deposition of coarse sediment (e.g. sand tailings) into minor waterways, such as creeks and brooks, or wetlands can cause bank erosion and channel instabilities, cause the loss of essential aquatic habitats, increase the weed infestation of creeks, and increase maintenance costs for stormwater assets. The release of fine sediments (e.g. clay fines) and turbid water can adversely affect the health and biodiversity of aquatic life, adversely affect fish numbers and breeding, increase the concentration of nutrients and metals, reduce light penetration into pools, and increase the frequency, cost and damage of de-silting operations.

There are no surface water systems of significance (e.g. rivers, creeks, etc.) in close proximity to the mine. The applicant considers that any spills or leaks of sand tailings and/or clay fines will be localised and contained on the premises.



- Controls:* The applicant proposes the following controls for all feed, return water and slurry lines:
- All pumps and pipelines will be operated and monitored using the process control Citect system, which has inbuilt low flow/high amp alarms to alert operators of potential issues with pumps and pipe flows;
  - All slurry pipes will be laid within bunds designed to direct contents back into open voids, sumps or other on-site containment areas in the event of failure; and
  - Where the above is not practical, pipelines will be fully welded and double-skinned, the double-skin terminating where the above is achievable.

### Risk Assessment

The likely physical consequence of spills or leaks of sand tailings and/or clay fines from pipeline failure would constitute a potential or actual alteration of the environment, with the potential for off-site impacts at a local scale (Minor). The likelihood of this consequence occurring is Possible (could occur at some time), with a combined risk rating of Moderate.

*Consequence:* Moderate.

*Likelihood:* Possible.

*Risk Rating:* Moderate.

### Regulatory Controls

A condition (W1.3.1) has been added to the works approval to formalise the requirement for the installation of industry standard safeguards for all pipelines containing tailings and tails return water, such as the use of automatic cut-outs, secondary containment, or telemetry and pressure sensors to allow detection of leaks and failures. Doral will also be required to visually inspect pipelines for integrity every 12 hours and to maintain an inspection log with each inspection signed off by the responsible person.

Conditions are proposed on the licence to specify the authorised infrastructure on the Premises for the containment of material that would otherwise pose a threat to the environment. The conditions will expand into the standard of design and operation to ensure the risk of uncontrolled seepage or spills from containment infrastructure is minimised. A freeboard requirement is also proposed to prevent overtopping, in addition to 12 hourly inspections of containment infrastructure and pipelines, to enable early detection and proactive management of leaks and integrity issues.

### Residual Risk

The likelihood of spills or leaks of sand tailings and/or clay fines, causing off-site impacts is not likely to change with the above regulatory controls imposed through the works approval and licence. The residual risk rating is therefore Moderate.

*Consequence:* Moderate.

*Likelihood:* Possible.

*Risk Rating:* Moderate.

### Public submission

A public submission has raised the possibility of public health and environmental risks associated with the use of polyacrylamide-based flocculants.

Although acrylamide polymers are considered environmentally benign and are widely used as flocculants, monomeric acrylamide, which is used in the manufacture of these polymers, may occur as a contaminant and is toxic, carcinogenic and mutagenic. Soil microbes normally break down this compound within a few hours to days. However recent research indicates that, under some specific conditions, the biodegradation of this material is impeded, for example at pH values of less than 6.



The Delegated Officer has determined to require monitoring of acrylamide monomer levels in groundwater at the site as a precautionary measure.



## A4 Acid sulfate soils

Acid sulfate soils (ASS) are naturally occurring soils, sediments and peats that contain iron sulfide minerals, predominantly as the mineral pyrite. These materials are typically found at shallow depth (less than 3 m deep) in low-lying areas near the coast and are benign when undisturbed, but have the potential to cause environmental problems due to the release of sulfuric acid when exposed to oxygen by drainage, dewatering or excavation of soils<sup>2</sup>.

The Yoongarillup deposit is located at the southern extent of the Yoganup shorelines, a series of ancient alluvial marine beach placers (strandlines) that have been extensively mined on the southern Swan Coastal Plain. The Superficial aquifer comprises the Bassendean Sand and the Yoganup Formation, which are sandy soils that typically contain trace amounts of pyrite and have poor acid buffering capacity. A combination of highly reactive pyrite and the extremely low pH buffering capacity of these soils make them prone to acidification, even after only short exposure (less than a week) to air during temporary excavation or dewatering.

Mining at Yoongarillup is proposed to extend 20 mbgl, with the majority of pits designed to extend below the current groundwater table. As such, dewatering is required in order for dry mining to occur. Dewatering poses a particularly high risk of triggering the oxidation of pyrite, due to the cone of depression of the water table required to maintain a dry pit extending beyond the margins of the pit excavation footprint.

The applicant has conducted a site investigation<sup>3</sup> to verify whether ASS are present based on soil characteristics. A total of 1,445 soil samples from 72 drill holes were taken across the site, in areas to be directly disturbed by mining, or potentially indirectly disturbed by mining-related groundwater drawdown<sup>4</sup>, and to a depth 2 m below the maximum depth of mining. The field pH ( $pH_F$ ) ranged from pH 4.29 to pH 8.2, and the field pH after oxidation ( $pH_{FOX}$ ) ranged from pH 1.98 to pH 7.79, with 86 samples (5.9%) having  $pH_{FOX} < 3.0$ .

The drill holes that returned  $pH_{FOX} < 3.0$  were determined to be uniformly concentrated within dark coloured (grey to black) sandy clay materials encountered approximately 1 – 3 m below the maximum depth of mining, in mine blocks 5 & 7. Although these locations will not be directly disturbed by mining, there is some risk they may be indirectly disturbed through dewatering drawdown.

### ***Emission Risk Assessment – Operation***

#### Emission Description

*Emission:* The disturbance of 'actual' ASS (AASS, acidic soils that have previously been oxidised) and/or 'potential' ASS (PASS, soils containing sulfidic materials which have not been exposed to air and oxidised) through the excavation, draining and/or exposure by lowering of the water table, in which the sulfides would react with oxygen to form sulfuric acid.

The site specific assessment<sup>3</sup> identified the following in regard to sources of pyrite oxidation hazard at the site:

- No soil samples contain  $pH_F < 4.0$ , indicating the absence of AASS, but PASS may still be present;
- Less than 10% of soil samples contain  $pH_{FOX} < 3.0$ , indicating a low number of samples testing positive for the presence of PASS; and
- Less than 10% of soil samples from below the current water table to the depth of the predicted drawdown contain  $pH_{FOX} < 3.0$ .

<sup>2</sup> Identification and investigation of acid sulfate soils in acidic landscapes, Department of Environment Regulation (June 2015)

<sup>3</sup> Yoongarillup Deposit ASS Survey (Version C), Soil Water Consultants (2012)

<sup>4</sup> With the exception of the State Forest, as this was not accessible during the investigation.



**Impact:** The physical disturbance of ASS from mining operations can cause significant acidification on oxidation and leach contaminants (i.e. sulfuric acid and soluble metals) at levels of environmental concern into groundwater or surface waterways.

There are no direct environmental receptors of groundwater down hydraulic gradient within the vicinity of the mine; however several domestic bores are located within several kilometres down gradient.

Groundwater in the Superficial aquifer in the vicinity of the mine is currently acidic (i.e. groundwater has levels of titratable acidity that exceed alkalinity levels) and therefore could contain concentrations of metals and some other inorganic contaminants at levels that exceed relevant water quality criteria to protect sensitive environmental receptors.

**Controls:** The applicant has developed a conceptual model for the site, including a description of local hydrogeological conditions, the spatial distribution of sulfide minerals and the presence of environmental receptors. A risk management strategy has been prepared on the basis of the conceptual model, outlined in the Yoongarillup Environmental Acid Sulfate Soils Management Plan (ASSMP)<sup>5</sup>.

As the ASS hazard at the site is not considered to be significant, active management of soil is not required during mining activities. However, due to the risk of PASS oxidation in undisturbed soils by dewatering drawdown, the applicant proposes the following management measures:

- Management of dewatering to ensure that unnecessary groundwater drawdown is avoided;
- Management of dewatering effluent to ensure the pH and total acidity values are pH >6.0 and total alkalinity > total acidity;
- Treatment of ore to maintain a stable pH of 6 to assist in processing;
- Addition of lime sand into the pit hopper during the excavation of ore, to increase pH and buffering capacity of the dewatering water;
- Constructing drainage channels around the perimeter of each mine pit to divert groundwater inflows and re-infiltrate the superficial aquifer;
- Monthly monitoring of groundwater levels, both during and after pit dewatering at all locations of the groundwater monitoring network;
- Monthly monitoring of groundwater quality (field and laboratory) of 5 selected bores for PASS parameters (pH, EC, TTA, TAlk, SO<sub>4</sub><sup>2-</sup>, Cl<sup>-</sup>, sodium, dissolved metals (Al, Fe, Mn));
- Development of trigger values on PASS bores, calculated using the mean ± 2 x standard deviation of the background data set;
- Contingency actions in response to exceedances of the trigger values, involving an initial response (establish context of exceedance and subsequent actions) and secondary responses (such as increased monitoring frequency, prepare contingency action plan in consultation with DER and DoW).

Mine pit dewatering will be managed in accordance with the Groundwater Operating Strategy (GOS) required by DoW. The groundwater monitoring program (See A5 Point source emissions to surface water) will be undertaken to detect changes in groundwater quality that could be attributed to dewatering and off-site ASS. Monitoring will provide early indication of adverse effects of ASS on local groundwater, both during operations and during closure.

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<sup>5</sup> Yoongarillup Mineral Sands Project – Acid Sulfate Soils Environmental Management Plan – V1, Doral Mineral Sands Pty Ltd (August 2016).



### Risk Assessment

The Delegated Officer has reviewed the site investigation and is satisfied it has been developed using suitable investigation methods, and the risk assessment and management techniques are consistent with the draft DER guidelines for assessing ASS issues at mineral sands deposits<sup>6</sup>. The low number of samples that tested positive for the presence of pyrite suggests that the issue is manageable at the site.

The Delegated Officer therefore considers that the risk of further ASS disturbance by mining activities at the site, leading to acid mine drainage, causing long-term impacts on the environment at a local level (Moderate) is Unlikely, resulting in a combined risk rating of Moderate.

*Consequence:* Moderate.

*Likelihood:* Unlikely.

*Risk Rating:* Moderate.

### Regulatory Controls

The Delegated Officer is satisfied the applicant has adequately identified the pyrite content and distribution in sediments across the site, has in place an acceptable dewatering strategy, and a strategy for preventing or minimising acid drainage from both the direct and indirect (i.e. groundwater drawdown from dewatering) disturbance of ASS. In order to formalise the requirement of managing the risk of ASS, the management measures listed in the *Controls* section have been conditioned in the licence.

In addition, conditions have been added to the licence to formalise the requirement for monitoring of groundwater quality in the vicinity of the mine voids and areas identified as being at higher risk of being affected by groundwater drawdown during mine dewatering.

On the basis of the sensitive receptors identified in the ASSMP and the relative mobility of a number of chemical constituents that may be present at elevated concentrations under the geochemical conditions that are likely to be present in treated groundwater, the following parameters have been included in the groundwater quality monitoring suite for the site: cadmium, zinc, selenium, uranium, arsenic, cobalt, chromium, and mercury. Uranium is included as a potential chemical toxicant.

Note: management of Naturally Occurring Radioactive Materials (NORMs) is regulated by the Department of Mines and Petroleum.

### Residual Risk

The likelihood of acid mine drainage occurring is not expected to change with the above regulatory controls imposed through the works approval and licence. The residual risk rating is therefore Moderate.

*Consequence:* Moderate.

*Likelihood:* Unlikely.

*Risk Rating:* Moderate.

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<sup>6</sup> Investigation and management of acid sulfate soil hazards associated with silica and heavy mineral sand mining operations, Department of Environment Regulation, Contaminated Sites Division (Draft, 2012)



## Emissions & Monitoring

### A5 Point source emissions to surface water

The projected water balance of the mine indicates the operational water requirements will exceed the volume of water collected from mine dewatering, rainfall and stormwater runoff, and that additional process water will be required from production bores. The possibility for surplus water is therefore likely to be only as a result of direct rainfall.

In the unlikely event that all water storages are at full capacity and prolonged heavy rainfall occurs within the pit catchment area, the applicant proposes to undertake a controlled discharge of water rather than have the process water pond overflow in an uncontrolled manner. Based on the assumption that all storages (i.e. mine voids, process water pond, SEPs and drains) are at capacity and a 1:100 year 72 hour storm event occurs, it is conservatively estimated that up to 228,000 kL of site runoff may require offsite discharge.

A primary discharge point has been nominated that is central to the WCP, to allow overflow from the process water pond into a constructed channel off the premises and into an existing paddock drain on the west of Sues Rd, before reaching an existing roadside drain. A secondary discharge point has been nominated on the eastern flank of the mine for when mining occurs in the area, and there is no capacity in the drop-out pond or process water pond and when it is not possible to gravity feed water to the process water pond. An additional secondary discharge point has also been nominated on the western flank of the mine, and discharge will occur into an existing ephemeral drainage line.

Groundwater abstraction for processing or mine dewatering requirements will be managed in accordance with the Yoongarillup Mineral Sands Project Groundwater Operating Strategy (GOS) (July 2016), administered by the Department of Water (DoW) under the *Rights in Water and Irrigation Act 1914*. Although the GOS has a focus on monitoring and managing the potential impacts of the groundwater abstraction activity on the local groundwater resource and native vegetation, it also includes the monitoring of any offsite discharges.

### ***Emission Risk Assessment – Operation***

#### Emission Description

**Emission:** The offsite discharge of mine water. Any water that would be discharged off the mine could include a mixture of groundwater, surface inflow, direct rainfall, SEP and sand tails returns and surface water runoff collected from the mine, and has the potential to be turbid in nature (due to the presence of fines).

The volume of water will vary depending on the capacity of the process water pond and return water lines at the time of the rainfall event, and depending on the amount of water to be discharged at that time. Discharge will not occur until specific water quality control criteria are met to the requirements of DER and DoW.

**Impact:** As discussed in previous sections, there are no surface water systems of significance (e.g. rivers, creeks, etc.) in proximity to the mine. The existing paddock drains and roadside drains are highly modified surface water systems that are ephemeral in nature, and contain little to no ecological values that can be potentially impacted from changes in water quality.

The existing roadside drains join the Vasse River approx. 6 km downstream. Once discharged, water will move through ephemeral drainage lines (paddock drains) north of the mine, where water is likely to sit until it evaporates. Paddock drains are



separate to major diversion drains in the region, therefore it is unlikely for any water discharged from the mine to reach the Vasse River.

*Controls:* The mine water circuit has also been developed such that only enduring rainfall events will trigger the need for water release from the nominated discharge points.

To manage the potential for impacts on the receiving environment, the applicant will test excess water prior to discharge and adhere to acceptable water quality criteria to the requirement of DoW and DER. If excess water does not meet discharge criteria, discharging will cease until measures are implemented to improve water quality.

In addition, diversion drains will be constructed to ensure stormwater does not flow into the mining area and potentially impede the natural surface water flows.

### Risk Assessment

Given the highly disturbed nature of the receiving environment, the likely consequence of environmental values being impacted from the offsite discharge of potentially turbid mine water would be minor off-site impacts at a local scale (Minor). The likelihood of this consequence occurring is Unlikely (not expected to occur), with a combined risk rating of Moderate.

*Consequence:* Minor.

*Likelihood:* Unlikely.

*Risk Rating:* Moderate.

### Regulatory Controls

Conditions are proposed for the licence to specify the authorised discharge points for mine water discharges, meaning that any discharge to a location other than the specified sites may not provide a defence against potential offences of causing pollution/environmental harm. Monitoring of ambient surface water quality both upstream and downstream of the discharge point(s) is proposed for the licence during periods of flow and discharge, and DER will review this data annually in conjunction with DoW, and introduce discharge criteria (i.e. limits) if determined to be warranted.

### Residual Risk

The likelihood of environmental values being impacted from the offsite discharge of potentially turbid mine water is not likely to change with the above regulatory controls imposed through the licence. The residual risk rating is therefore Moderate.

*Consequence:* Minor.

*Likelihood:* Unlikely.

*Risk Rating:* Moderate.



## **A6 Emissions to land**

Apart from the mining overburden, most of the waste arising from the mining and primary processing of mineral sands is in the form of oversize material (rocks, etc.), sand tailings and clay fines. For the Yoongarillup mine, oversize material will be backfilled into mine voids or re-used on internal roads; clay fines will be thickened and pumped to SEPs for solar drying, before being disposed into mine voids; and sand tailings will either be disposed directly back into mine voids or stored in a sand tails SEP until disposal.

During the dry periods, dried clay tails will be removed from the SEPs and placed in-pit with sand tailings. Where possible, co-disposal of tailings will be undertaken during mining whereby the clay tails are disposed with the sand tails into the pit voids to provide a more heterogeneous distribution of soil particle sizing and to improve the hydraulic conductivity and permeability of the returned soil profile.

Wastes generated from secondary processing at the Picton Mineral Separation Plant will be returned to the mine site to be mixed with clay fines for burial to the mine void. Wastes from the MSP include: the final tails streams of ilmenite, leucoxene and zircon; oversize (scats); sand tailings; clay fines; and airborne dust collected from the baghouse. The monazite-rich material, a naturally occurring radioactive material (NORM), will be captured in the middlings product stream and stored at the Picton site for export. As such, radionuclide concentrations within the tailings to be returned to the mine site will be kept below 1 Bq/g. Regulation of NORM is the responsibility of the Department of Mines and Petroleum.

### ***Emission Risk Assessment – Construction & Operation***

#### Emission Description

*Emission:* Process tailings and unrecovered heavy mineral. Waste tailings from secondary processing at the Picton MSP will be added to the tailings stream, which may contain low level NORMs (below the range 140 – 180 ppm Th and U).

Waste tailings comprise the coarse-grained (typically quartz sand) and fine-grained (typically silt-sized clay material) solid material remaining after the HMC has been separated from the mined ore, respectively, slurried with process water to facilitate transfer. The approximate total amount of sand and clay tailings from the mine is 1,190,000 bank cubic meters (BCM), which will all be reburied in the mine voids yielded during the life of mine.

*Impact:* The primary environmental impacts from disposal relates to the potential for changes to groundwater levels outside the pit, through mounding of groundwater below and adjacent to the pit, and changes to groundwater levels, altering flow gradients and directions; changes to aquifer characteristics through altering aquifer permeability and flow patterns; and changes to groundwater chemistry from seepage, potentially impacting on other groundwater users.

Seepage flow through the tailings is inevitable; tailings water quality will be generally different to the ambient groundwater quality. If the tailings water quality is worse than ambient, seepage can deteriorate the groundwater quality of aquifers around the pit.

*Controls:* The method for pit backfilling the land to be rehabilitated back to pre-mining land use includes:

- Hydraulically returning sand tails/co-disposed tailings into previously mined voids to within 1 m of the final rehabilitation surface;
- Final backfilling with solar dried clay fines and clayey overburden, removed from advancing pit development, to within 1 m of the final surface;
- The void is then capped with sub-soil and topsoil.



Groundwater monitoring will be carried out in bores located both up- and down-hydraulic gradient of the mine voids, to detect and manage potential impacts from changes in groundwater levels and groundwater quality. Internal monitoring triggers will be defined for each monitoring site (based on drawdown and mounding thresholds), and are designed to indicate substantial deviation from expected or predicted impacts or to provide an early warning of an impact that hasn't been predicted.

The monitoring data will be used to update the groundwater model and re-forecast predicted impacts, and will provide an early warning system in order for the applicant to undertake investigations and, if necessary, to execute management interventions to prevent unacceptable impacts.

### Risk Assessment

The likely consequence of groundwater impacts from tailings seepage would constitute a potential or actual alteration of the environment, with off-site impacts at a local level (Moderate). The likelihood of this consequence occurring is Possible (could occur at some time), with a combined risk rating of Moderate.

*Consequence:* Moderate.

*Likelihood:* Possible.

*Risk Rating:* Moderate.

### Regulatory Controls

#### **Construction**

Approximately 60,000 tonnes of ore will be processed during wet commissioning of the WCP. The sand tailings produced will be disposed into the partially excavated mine void of blocks 14 and 15, while the clay fines will be pumped to the SEP located west of Sues Rd. W2.2.1 has been added to the works approval to specify these as the authorised discharge locations for tailings during commissioning works. Ambient groundwater monitoring has been included on the works approval in order to continue baseline data (groundwater levels and quality) around proposed mine voids.

#### **Operation**

Conditions are proposed on the licence to specify the authorised mine voids for ongoing disposal of tailings. Ambient groundwater monitoring conditions are proposed to continue through to the licence, to measure the operational performance of the tailings disposal activity, and to enable early detection and proactive management in accordance with the GOS.

### Residual Risk

The likelihood of groundwater impacts from tailings seepage will remain unchanged with the above regulatory controls applied. The residual risk rating is therefore Moderate.

*Consequence:* Moderate.

*Likelihood:* Possible.

*Risk Rating:* Moderate.



## A7 Fugitive emissions (dust)

Dust generated from mine construction works and subsequent mining operations has the potential to impact on the health, welfare and amenity of local residents and users of Sues Rd, impact on the health of animals and deposit on surrounding native vegetation.

During mine construction works, dust is likely to be generated during clearing of vegetation, removal/handling/stockpiling of soil, excavation of overburden and ore within blocks 14 & 15, creation of the SEPs located west of Sues Rd, construction of noise bunds, machinery movements and lift-off from exposed surfaces.

During mining operations, sources may include fugitive dust from exposed mining areas, open areas or rehabilitated surfaces; overburden/ topsoil/ product/ waste stockpiles; movement of vehicles along haul roads and tracks; and the crushing, screening, loading and transportation of ore.

### ***Emission Risk Assessment – Construction & Operation***

#### Emission Description

*Emission:* Dust, or total suspended particulate matter (TSP) is comprised of coarse particulate matter (CPM), which is generally comprised of particles greater than 10 µm in diameter, and the respirable fraction comprised of particles less than 10 µm in diameter (PM<sub>10</sub>). The majority of dust generated during the development and operation of mineral sands mines is CPM, being comprised of unprocessed mineral oxide particles.

*Impact:* Dust emissions can be harmful to human health and the environment. The type and size of a dust particle determines how harmful the dust is. The possible harm is mostly determined by the amount of dust in the air and length of exposure. Dust particles small enough to be inhaled (PM<sub>10</sub> or PM<sub>2.5</sub>) may cause irritation of the eyes, coughing, sneezing, and asthma attacks. Dust in the form of CPM can cause nuisance and affect aesthetic values.

The South West region experiences a mild Mediterranean climate with hot/dry summers and mild/wet winters. The prevailing winds are from the east in the mornings, and south/south-west in the afternoons. In the winter months, strong westerly and north-westerly winds are prevalent.

There are 26 farm houses located within 2.2 km of the premises boundary. Four are located on the premises boundary, within 600 m of the proposed mine voids, and are considered to be the most susceptible to dust impacts. In addition Sues Rd, being a primary distributor<sup>7</sup> road, runs through the premises and is considered a sensitive land use.

A public submission on the application advises the local area is subject to excessive winds throughout times of the year, and that some residents in close proximity already suffer from asthma and hay fever and that dust from the mine may exacerbate this. In addition, concerns were raised about the potential for dust to impact on local amenity (hanging out washing, entertaining outdoors, etc.), and concerns about the response time of the applicant to resolve excessive dust when receptor is being/has already been impacted. Issues raised are considered in Appendix B.

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<sup>7</sup> Road hierarchy for Western Australia, Main Roads Western Australia



**Controls:** During mine construction works controls will include the regular watering of unsealed roads, exposed surfaces and active construction areas.

During active mining operations, in addition to the standard use of water carts for dust suppression, dust will be managed through a number of mechanisms including:

- Covering stockpiles, noise bunds and pond embankments with fine clay solution or water bound polymer-based dust suppressants;
- Minimising the number and size of stockpiles;
- Maintaining HMC stockpiles between 5 – 9 % moisture content;
- Use of full height shade cloth attached to fencing that separates mining operations from the State Forest to the south, to prevent dust impacts from the mine affecting State Forest native vegetation.

Monitoring of ambient air quality will be ongoing over the life of mine, to validate the performance of the dust control measures. Monitoring for TSP will be undertaken monthly from September to March, at up to four locations around the mine. Monitoring for PM<sub>10</sub> at two locations, alternating at either end of the operation and relative to the operation at the time, will be conducted on a monthly basis during the summer months. PM<sub>10</sub> dust monitoring will be undertaken continuously over the 24 hours period in real time, and alarm triggers will be integrated into the system to warn operators of possible exceedances.

### Risk Assessment

During morning easterly winds throughout most of the year, the two closest receptors on the western boundary are considered to be the most susceptible to impacts from fugitive dust whilst mining activities are occurring in the mine blocks west of Sues Rd (i.e. mine blocks 14 – 25). The State Forest, which is situated between the mine and these residences, will provide some protection from the impacts of fugitive dust.

During the afternoon prevailing westerly winds throughout the summer months, the closest receptors to the north-east of the mine are considered to be the most susceptible to impacts from fugitive dust whilst mining activities are occurring in the mine blocks east of Sues Rd (i.e. mine blocks 2, 4 – 11).

The risk assessment of fugitive dust can be broken into the impacts of TSP and PM<sub>10</sub> emissions, and relevant operational scenarios (normal/abnormal operating conditions).

- TSP emissions (normal operating conditions)

The consequence of TSP impacting on sensitive receptors located off-site or on Sues Rd would be of nuisance value (minor reversible impacts), causing local concern and complaints (Minor). The likelihood of this consequence occurring during mine construction works and subsequent mining operations under normal operating conditions is Possible, with a combined risk rating of Moderate.

*Consequence:* Minor.

*Likelihood:* Possible.

*Risk Rating:* Moderate.

- TSP emissions (abnormal operating conditions)

The likelihood of this consequence occurring under abnormal operating conditions (e.g. strong summer winds) is Likely (will probably occur), with a combined risk rating of Moderate.

*Consequence:* Minor.

*Likelihood:* Likely.

*Risk Rating:* Moderate.



- PM<sub>10</sub> emissions (normal operating conditions)

The consequence of PM<sub>10</sub> emissions impacting on sensitive receptors located both off-site or on Sues Rd would be exposure to a hazard with short-term adverse health effects (requiring treatment) and impact to amenity for short periods (Moderate). The likelihood of this consequence occurring during mine construction works and subsequent mining operations under normal operating conditions is Unlikely, with a combined risk rating of Moderate.

*Consequence:* Moderate.

*Likelihood:* Unlikely.

*Risk Rating:* Moderate.

- PM<sub>10</sub> emissions (abnormal operating conditions)

The likelihood of this consequence occurring under abnormal operating conditions (e.g. strong summer winds) is Possible (could occur), with a combined risk rating of Moderate.

*Consequence:* Moderate.

*Likelihood:* Possible.

*Risk Rating:* Moderate.

### Regulatory Controls

Amenity (dust) was identified as a key environmental factor by the EPA in its assessment<sup>8</sup> of the proposal. Ministerial conditions have not been set in Statement 1030 on advice from DER that dust emissions can be regulated, monitored and enforced under Part V Division 3 of the EP Act.

A high level of regulatory control is required through the works approval and licence as there are a number of receptors (residences) within 1 km of the proposed mine pits, and there is the potential for the receptors to be impacted during strong easterly and south-westerly wind conditions.

Conditions have been added to the works approval to formalise dust mitigation measures listed in the Yoongarillup Environmental Dust Management Plan (August 2016), including the continuous monitoring of TSP and PM<sub>10</sub> emissions during the summer months.

Given the proximity to sensitive receptors (including Sues Rd), ambient air quality criteria (i.e. limits) have been deemed necessary for the protection of human health and to provide assurance over the effectiveness of dust management at the site during mine construction works and subsequent mining operations. As such, limits for TSP (nuisance value) and PM<sub>10</sub> (human health) have been imposed at the north-east and north-west corners of the premises, as these are considered to be the appropriate locations for representing the level of impact to receptors from mining operations during the prevailing seasonal winds.

The limit for TSP has been determined using reference to the Kwinana EPP<sup>9</sup>, which is considered by DER to be an equivalent standard for ambient air quality at all sand mining and related operations where an environmental standard does not exist for the subject area. Given the location and distance to receptors, the Area B standard (260 µg/m<sup>3</sup>, 24-hour average) is considered the most relevant.

The limit for PM<sub>10</sub> has been determined using reference to the Air NEPM<sup>10</sup> for particles as PM<sub>10</sub> (50 µg/m<sup>3</sup>, 24 hour average). Although DER does not consider the Air NEPM to be an appropriate regulatory standard, it is considered to be an equivalent standard in the absence of an environmental standard for the subject area.

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<sup>8</sup> EPA Report 1552 (July 2015)

<sup>9</sup> *Kwinana Environmental Protection (Kwinana)(Atmospheric Wastes) Policy 1999*

<sup>10</sup> National Environment Protection (Ambient Air Quality) Measure, National Environment Protection Council (1998)



The provision for an exceedance of the specified limits has also been included in the works approval, in the event of an exceedance an appropriate investigation is undertaken and proof can be provided to demonstrate the exceedance is not attributed to operations on the premises (W3.2.3).

The conditions imposed in the works approval are proposed to be duplicated on the licence.

#### Residual Risk

With the above regulatory controls imposed through the works approval and licence, the residual risk rating of TSP and PM<sub>10</sub> emissions impacting on sensitive receptors or on Sues Rd under all operating conditions is Moderate.

- TSP emissions (normal operating conditions)  
*Consequence:* Minor.  
*Likelihood:* Unlikely.  
*Risk Rating:* Moderate.
- TSP emissions (abnormal operating conditions)  
*Consequence:* Minor.  
*Likelihood:* Possible.  
*Risk Rating:* Moderate.
- PM<sub>10</sub> emissions (normal operating conditions)  
*Consequence:* Moderate.  
*Likelihood:* Unlikely.  
*Risk Rating:* Moderate.
- PM<sub>10</sub> emissions (abnormal operating conditions)  
*Consequence:* Moderate.  
*Likelihood:* Possible.  
*Risk Rating:* Moderate.



## **A8 Noise emissions**

Noise emissions from mine construction works and subsequent mining operations have the potential to impact on nearby residents, affecting their health by increasing stress levels and decreasing their amenity.

During mine construction works, noise generating activities will include the construction of mine infrastructure and bulk earthworks using typical heavy earthmoving equipment (e.g. scrapers, dozers, trucks, front-end loaders). Once commissioning is complete, the mine will transition from a 12 hours per day, seven days per week construction site to a continuous (24 hours per day, seven days per week) operating mine.

Once operational, noise will be generated from the operation of mobile equipment and fixed plant for mining and processing activities. Mining, screening and processing of ore will occur continuously (24 hours per day), while all other activities will be restricted to normal day time working hours (7:00am – 7:00pm, Monday to Saturday).

The applicant has modelled the noise impact of the proposed mine construction and operations using SoundPlan, which the Delegated Officer, on advice of DER noise specialists, accepts as a suitable model. The selection of input data and assumptions made have been reviewed and accepted as presenting reliable conclusions on the predicted noise levels and compliance with the assigned levels at noise sensitive receptors under all likely scenarios.

### ***Emission Risk Assessment – Construction***

#### Emission Description

*Emission:* Noise from heavy machinery during mine construction works (i.e. plant and equipment construction, land clearing, top-soil stripping), overburden removal and stockpiling of ore for commissioning, and movement of vehicles. Construction activities are proposed during normal day time working hours (7:00 AM – 7:00 PM), Monday to Saturday.

The Noise Impact Assessment (NIA)<sup>11</sup> indicates the noise emission levels from day time mine construction works are predicted to exceed the assigned noise levels specified by the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) by up to 8.2 db(A) at nearby sensitive receptors, depending on the type of activity and prevailing wind conditions.

*Impact:* Noise emissions can cause nuisance and a reduced quality of life and health for human populations, particularly when the source is located near sensitive receptors. Noise can affect the psychological status of human population nearby in terms of emotional stress, anger and physical symptoms. Frequency, intensity, duration, meteorological conditions and distance to receptor are all factors which may affect the impact of noise emissions on sensitive receptors.

There are 26 farm houses (noise sensitive receptors) within 2.2 km of the premises boundary. Four are located on the premises boundary, within 600 m of the mine voids, and are considered the highest risk of being impacted by noise emissions during mine construction works.

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<sup>11</sup> Environmental Noise Impact Assessment of Yoongarillup Mining Operations, SVT Engineering Consultants (Rev 5-5 September 2016).



*Controls:* The applicant has prepared an Environmental Noise Management Plan (ENMP)<sup>12</sup> to outline its approach to managing noise emissions arising from mine construction works. In addition to undertaking works in accordance with Regulation 13 of the Noise Regulations, management measures identified in the plan include:

- Restricting earthmoving construction activities, including construction of the process water pond, access roads, SEPs and noise bunds to a day shift basis;
- Maintaining liaison with affected residents;
- Implement a public comment and complaints communication system; and
- Continuously monitor noise, to record noise levels and tonality to allow real time data for site management.

### Risk Assessment

Although a number of noise mitigation and management measures have been proposed, and despite the applicants' experience in managing noise emissions from mine sites, the Delegated Officer considers it unlikely that, even if fully implemented, the measures will result in noise levels during mine construction works being below the assigned noise levels, due to the proximity of the neighbouring noise sensitive premises.

The consequence of noise emissions exceeding the assigned noise levels at noise sensitive premises during mine construction works would be mid-level impact to amenity on local scale (Moderate). The likelihood of this consequence occurring under worst case conditions is Likely (will probably occur), with a combined risk rating of High.

*Consequence:* Moderate.

*Likelihood:* Likely.

*Risk Rating:* High.

### Regulatory Controls

Construction work is proposed between 7:00 AM and 7:00 PM Monday to Saturday. Under Regulation 13 of the Noise Regulations, noise from construction work on construction sites need not comply with the assigned noise levels set under Regulation 7 when the work is carried out between these hours (excluding public holidays), is conducted in accordance with AS 2436, and the equipment used is the quietest reasonably available.

For noise to be exempted under Regulation 13, the site also must meet the definition of a *construction site* and the work must meet the definition of *construction work*. Although the mine would usually be regarded as a construction site during the initial construction phase, the work being conducted needs to be strictly construction work for the exemption to apply. It is noted that some activities proposed during mine development works may not meet the definition of construction work under Regulation 13, as they are considered part of the mining activity rather than construction, e.g. overburden removal and stockpiling of ore for commissioning. This also includes the progressive building of earthen noise bunds after the construction phase (as the mine develops), as at this stage the principal activity on the site becomes mining operations and not the carrying out of construction work.

Given the potential for noise levels to exceed the assigned levels at nearby sensitive receptors during mining operations, the Delegated Officer has determined that monitoring of noise levels is required. As such, conditions have been imposed on the works approval to require the installation of a noise monitoring system that is capable of providing continuous, real-time noise measurements from either of two locations at either extent of the mine, with monitoring to be carried out at the most affected (noisiest) of the two locations, having regard to the location of noise sources and current wind conditions. The system is to be installed prior to the start of construction works, and monitoring is to

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<sup>12</sup> Yoongarillup Mineral Sands Project – Noise Environmental Management Plan, Doral Mineral Sands Pty Ltd (September 2016).



be carried out during the construction period. In the event excessive noise levels are detected, activities will be modified to ensure noise levels are acceptable. This may require temporary shutdown of the noisy activities.

### Residual Risk

With the above monitoring and management measures in place, the likelihood of excessive noise is reduced from Likely (probably occur in most circumstances) to Possible (could occur at some time), resulting in an overall risk rating of Moderate.

*Consequence:* Moderate.

*Likelihood:* Possible.

*Risk Rating:* Moderate.

### ***Emission Risk Assessment – Operation***

#### Emission Description

*Emission:* Noise from mining equipment (fixed and mobile), processing and transport activities. The main source of noise will be mobile equipment (scrapers, dozers, front-end loaders, trucks, etc.). Mining and ore processing is proposed 24 hours per day, seven days per week.

The NIA indicates that noise compliance during some operational scenarios will be marginal. The applicant has proposed several control measures to address the potential for noise non-compliance (listed in *Controls* section).

*Impact:* Noise emissions can cause nuisance and a reduced quality of life and health for human populations, particularly when the source is located near sensitive receptors. Noise can affect the psychological status of human population nearby in terms of emotional stress, anger and physical symptoms. Frequency, intensity, duration, meteorological conditions and distance to receptor are all factors which may affect the impact of noise emissions on sensitive receptors.

The closest receptor on the western boundary of the premises is considered to be the most susceptible to noise impacts, with the Noise Impact Assessment predicting the potential for noise non-compliance at this receptor during native vegetation clearing works in mine blocks 24 & 25 (scenario 3a) and easterly wind conditions.

A public submission on the application has expressed concerns about the noise impacts of the mine, based on opinion the mine is too close to receptors, and that the noise modelling is flawed and should not be relied upon. All issues raised have been considered by the Delegated Officer shown through Appendix B1.

*Controls:* In addition to the standard mine site noise mitigation measures (e.g. silencers on exhaust systems, broadband reversing alarms, restriction of noisiest machinery in worst case wind conditions, preventative maintenance schedules, employee education, etc.), the applicant has committed to the following noise control measures during mining operations, as listed in the ENMP:

- Establishing amenity agreements with adjacent landowners;
- Continuing real-time monitoring of noise emissions of the system established under the works approval;
- Implementing the recommendations of the Noise Impact Assessment:
  - 6.5 m high noise bund is in place along the western edge of mine block 25;
  - 5.5 m high noise bunds are in place along the north and eastern edges of mine block 2;



- Topsoil stockpiles are located on the outside of pits to act as noise bunds and range in height from 2.5 to 4 m;
- Overburden removal only occurs during day time (Mon-Sat) and overburden fleet and ore fleet do not operate simultaneously in the same pit at any one time;
- Cat 980H front end loaders (Lw 102.8 dB(A)) or better (quieter) will be used;
- One silenced 8" diesel dewatering pump operates at one pit at any one time;
- The mining unit will be located within the mining pit, below the natural ground level;
- The water cart only operates when required;
- Construction of additional 3 m noise bunds within the paddock areas west of Sues Rd;
- A 2 m noise bund adjacent to the pit dewatering pump;
- Increased height of the wall of SEP06 from 3 m to 6 m;
- Increased height of the wall of SEP08 from 3 m to 5 m; and
- Temporary noise bunds 2.5 m high within pits 7 & 8;
- Review weather conditions and plan alternative operations/ cease operations when NE, E and SE winds occur (i.e. whenever the wind is blowing towards the closest receptors on the western boundary;
- Relocate equipment if noise monitoring indicates exceedances of the assigned noise levels, and shut down operations if this fails to bring noise levels back into compliance;
- Utilise supplementary feeder at the feed preparation plant to continue production without the operating mining unit;
- From a line south down the eastern boundary of mining blocks 20 and 21 and south through mining block 24, will be operated during day time hours only (7 am – 7 pm); and
- Prior to clearing taking place, formal discussions will be undertaken with the western residents to develop a plan for mitigating potential amenity impacts during the period of clearing.

The Delegated Officer notes the sound power level quoted for the Cat 980H front end loader in the September 2016 NIA of 102.3 dB(A) is substantially lower than manufacturer's specification of 108 dB(A) and the sound power level quoted for the same equipment in the assessment submitted with the PER (April 2015), of 109.9 dB(A). The consultant for the applicant advised that 108 dB(A) is the noise limit for this type of equipment under the EU standard<sup>13</sup>, however the actual sound power level should be much lower. The Delegated Officer notes the standard sound power level of this machine is 112 – 113 dB(A)<sup>14</sup>, and even with an optional low sound attachment (reducing to 107 – 109 dB(A)), the quoted sound power level may be too low.

### Risk Assessment

Mineral sands mines are complex sites involving many different activities that produce different types of noise that vary depending on the time of day and type and location of the mining activities. In addition mineral sands mining, in general, is a progressive process whereby new pits are opened and as the mine progresses, old pits are backfilled. Given the temporary nature of the mining process, the impact of noise on any one particular receptor is unlikely to be constant/ consistent throughout the life of mine as the mine path progresses.

During day time operations, noise emissions from the mine are predicted to comply with the assigned levels at nearby noise sensitive receptors under most operational scenarios and worst case weather conditions with the abovementioned controls in place. As discussed above, the only noise non-compliance is predicted at the closest receptor on the western boundary of the mine during the removal

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<sup>13</sup> EU Directive 2005/88/EC

<sup>14</sup> 980H Wheel Loader Specifications –Caterpillar (2014)



and relocation of native vegetation and topsoil in mine blocks 24 & 25 using a bulldozer, excavator and trucks. The applicant has also modelled the same scenario using quieter equipment (i.e. carry graders), which predicts marginal compliance at the closest receptor. The Delegated Officer notes this mining scenario is expected to occur over a maximum two week period, and the applicant has committed to undertaking formal discussions with the closest receptor about mitigating amenity impacts during this short period.

During night time operations, noise emissions from the mine are also predicted to comply with the assigned levels at nearby noise sensitive receptors under all operational scenarios and worst case weather conditions with the above mentioned controls in place. However, the Delegated Officer notes the existing background noise levels are low, being a rural agricultural area, and that any significant increase in noise emissions from background levels (even if deemed to be compliant with the Noise Regulations) may impact on the amenity of local residences, particularly where it disturbs sleep at night.

The consequence of noise emissions exceeding the assigned noise levels at noise sensitive premises during mining operations, at any one time, could potentially result in a significant impact on amenity, causing concern and complaints (Moderate). The likelihood of this consequence occurring under worst case conditions is therefore Possible (could occur), with a combined risk rating of Medium.

*Consequence:* Moderate.

*Likelihood:* Possible.

*Risk Rating:* Medium.

#### Regulatory Controls

Operational noise was identified as a key environmental factor by the EPA in its assessment of the proposal<sup>15</sup>, however ministerial conditions were not imposed in Statement 1030 on advice from DER that noise emissions can be regulated, monitored and enforced under Division 3, Part V of the EP Act.

In consideration of the above, the Delegated Officer has determined that controls are required on the licence in order to protect the amenity of nearby residents from noise impacts associated with the mining operation, including:

- Ensuring that mining operations comply with the prescribed standard for noise emissions, as set out in Regulation 7 of the Noise Regulations, at all times;
- Ensuring proactive management of noise emissions in high risk operational scenarios, i.e. operations are adjusted to avoid noise non-compliance situations; and
- Formalising commitments made by the applicant in the PER and works approval application.

Conditions have therefore been added to the licence to formalise noise mitigation measures listed in the ENMP, including the continuous monitoring of noise emissions on the boundary, at locations representative of the closest receptors.

#### Residual Risk

Even with the above noise controls in place, the likelihood of noise during mining operations causing concern and complaints to nearby residents remains Possible (could occur at some time), and the residual risk rating is Moderate. The Delegated Officer notes this risk can be further minimised if backed up by amenity agreements.

*Consequence:* Moderate.

*Likelihood:* Possible.

*Risk Rating:* Moderate.

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<sup>15</sup> EPA Report 1552 (July 2015)



## Appendix B

### B1 Summary of public submission 1

Comment	DER Response
<p>The submitter has raised concerns about the acceptability of the proposal, given:</p> <ul style="list-style-type: none"> <li>- The two closest receptors are well within the minimum separation distance recommended in EPA Guidance Statement No.3; and</li> <li>- The Noise Impact Assessment predicts noise non-compliance at the two closest receptors during 3 of the 6 modelled scenarios.</li> </ul>	<ul style="list-style-type: none"> <li>- EPA Guidance Statement No.3 provides general guidance on separation distances and also provides for site-specific assessment of emissions within separation distances. In this instance, site-specific assessment of noise emissions from the mine predicts that operations will comply with the Noise Regulations, if the proposed controls are adopted.</li> <li>- The Noise Impact Assessment predicts compliance with the Noise Regulations (albeit borderline in some scenarios) for all mining scenarios, if the proposed controls are adopted. Scenario 1 pertains to mine construction works, which are exempted from the Noise Regulations. Scenario 3 has been updated (3a) to predict marginal day time compliance following the installation of a 6.5 m noise bund, and if operations cease during easterly wind conditions. Scenario 4 predicts marginal night time compliance with the 6.5 m noise bund in place.</li> </ul>
<p>The submitter has raised concerns about the following aspects of the proposal in terms of noise:</p> <ul style="list-style-type: none"> <li>- The annoyance factor of the mine in terms of background noise in a quiet rural area;</li> <li>- The reliability/accuracy of the noise assessment, given it uses a generic computer model with data supplied by Doral, and does not appear to consider the site specific environment of the local area;</li> <li>- The effectiveness of empty sea containers for noise bunding;</li> <li>- Noise and light impacts from machinery and lighting with respect to the pumps on the solar evaporation ponds;</li> <li>- Checks and balances on the proposed complaints management process; and</li> <li>- Being impacted during the period after a non-compliance is identified and measures are taken to bring noise back into compliance.</li> </ul>	<ul style="list-style-type: none"> <li>- The Noise Regulations take the factor of background noise levels into consideration (known as an influencing factor). The Delegated Officer acknowledges that noise impacts on amenity may still exist in areas with very low levels of background noise, even if the assigned levels are being met. One of the EPA's objectives in EPA Guidance Statement No. 13 is that industries are to ensure that impacts are reduced as low as reasonably practicable. In the case of this proposal, it may be accepted that it is not reasonably practicable for the applicant to reduce its noise emissions to a level significantly below the assigned noise levels at the closest receptors, due to the nature and scale of the operation and the short separation distance.</li> <li>- The Delegated Officer has examined the reliability of the noise modelling. SoundPlan 7.4 with CONCAVE algorithm is a widely used and accepted computer software package for modelling environmental noise. The Delegated Officer considers the inputs of the modelling, such as topographical information, meteorological data, the major equipment items and their sound power levels, and the operational scenarios, are all site-specific to this application.</li> <li>- The Delegated Officer considers that sea containers can provide very high noise attenuation, regardless of if they are empty or not. Sea containers have been widely used as temporary noise barriers in many applications (e.g. the 'Big Day Out' music festival).</li> <li>- The applicant has advised there will be no lights or night-time operations on the</li> </ul>



	<p>solar evaporation ponds.</p> <ul style="list-style-type: none"> <li>- DER is the regulatory agency that will deal with noise complaints. A condition of licence will require an effective complaints management system.</li> <li>- The impact period will depend on how quickly the potential noise non-compliance event can be detected and how quickly the remedial actions can be taken. Controls will be imposed on the licence to require noise monitoring with real-time data transmission at the furthest extent of the operations and relative to the nearest residents, which should allow the applicant to avoid noise non-compliance situations.</li> </ul>
<p>The submitter has raised concerns about the following aspects of the proposal in terms of water:</p> <ul style="list-style-type: none"> <li>- The reliability of predicted impacts on the local groundwater resource as the data used is from 1936 reports and rainfall is much less now;</li> <li>- Impacts on the local groundwater resource in terms of quality and quantity due to the water requirements of the mine.</li> </ul>	<p>These matters fall under the jurisdiction of the DoW and will be addressed by that agency.</p>
<p>The submitter has raised concerns about the following aspects of the proposal in terms of dust:</p> <ul style="list-style-type: none"> <li>- The closest receptors are the most susceptible to dust impacts including dust accumulation on roofs, contamination of rainwater supplies, the ability to hang out washing, outdoor entertaining, etc.;</li> <li>- Construction occurring during summer, i.e. the driest possible months;</li> <li>- The downtime between Doral identifying high dust levels and action being taken; and</li> <li>- Health impacts on the closest receptors, whom already suffer from asthma and hay fever.</li> </ul>	<ul style="list-style-type: none"> <li>- The Delegated Officer has determined the risk of impacts from fugitive dust on nearby receptors requires a high level of regulatory control. The controls are consistent with commitments made by the applicant in the PER, which are considered by the Delegated Officer to be appropriate, and if adopted, should prevent impact on amenity such as those listed in the submission.</li> <li>- The risk of impacts from fugitive dust has been assessed under worst case weather conditions, i.e. dry and windy conditions. The applicant will be required to conduct regular monitoring of environmental performance, and demonstrate compliance with air quality criteria.</li> <li>- The impact period will depend on how quickly the high dust level event can be detected and how quickly the remedial actions can be taken. Controls will be imposed on the licence to require noise monitoring with real-time data transmission at the furthest extent of the operations and relative to the nearest residents, which should allow the applicant to avoid noise non-compliance situations.</li> <li>- Controls imposed on the licence target both human health and nuisance dust levels.</li> </ul>



<p>The submitter has raised concerns about the following aspects of the proposal in terms of other matters:</p> <ul style="list-style-type: none"> <li>- Impact of lighting on sleeping patterns;</li> <li>- Impacts on the structural integrity of the closest dwellings from vibration;</li> <li>- Damage to resident's gardens/crops/trees from wildlife escaping the State Forest;</li> <li>- Decrease in property values;</li> <li>- Increased risk of dieback in the State Forest;</li> <li>- Risk of disturbing acid sulfate soils;</li> <li>- The life of mine being extended further beyond the current 3 year timeframe;</li> <li>- Road safety on Sues Rd; and</li> <li>- Emergency exits due to the closure of Goulden Rd (west).</li> </ul>	<ul style="list-style-type: none"> <li>- A control will be imposed on the licence to require outdoor lighting to comply with AS 4282 – <i>Control of the obtrusive effects of outdoor lighting</i>.</li> <li>- DER has no regulatory role with respect to structural integrity of dwellings, damage to vegetation from native animals or property values.</li> <li>- Under MS 1030, the applicant is required to prepare a forest management plan for clearing/mining in the State Forest. The plan, which includes management of dieback, is to be prepared in consultation with the Department of Parks and Wildlife, and must be approved prior to ground disturbing activities.</li> <li>- Based on the information provided in the ASS management plan, the Delegated Officer had determined the risk of ASS disturbance by mining activities at the site is low (Refer to Appendix A4 – Acid Sulfate Soils).</li> <li>- MS 1030 does not permit the applicant to exceed the authorised extent of the proposal as defined in the application. The applicant advises there are no plans at this stage to extend the life of mine beyond the current projected life of 3 years.</li> <li>- The applicant has submitted a Traffic Management Plan to Main Roads WA regarding the realignment of Sues Rd.</li> <li>- The applicant has submitted a Traffic Management Plan to the City of Busselton regarding Goulden Rd west. The applicant advises it is committed to assisting neighbours by escorting them through the mine site, if required in the event of an emergency.</li> </ul>
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**B2 Summary of public submission 2**

Comment	DER Response
<p>The submitter has raised concerns on the use of polyacrylamide-based flocculants, including:</p> <ul style="list-style-type: none"> <li>- There is scientific literature that indicates acrylamide can disseminate into surface and/or groundwater from the use of polyacrylamide flocculants in mineral processing;</li> <li>- The composition of the material to be left on-site should be properly ascertained, disclosed and subject to human health and environmental risk assessment to confirm the site will not be a source of harm or classified as a contaminated site that could potentially subject the site to land use restrictions; and</li> <li>- Acrylamide should be included on the groundwater monitoring suite.</li> </ul>	<ul style="list-style-type: none"> <li>- As a precautionary measure a condition will be imposed in the works approval requiring quarterly monitoring of acrylamide in groundwater.</li> <li>- The issue will also be addressed in the operating licence.</li> </ul>