



Works Approval

Environmental Protection Act 1986, Part V

Works Approval Holder: Iluka Resources Limited

Works Approval Number: W5935/2015/1

Registered office: Level 23, 140 St Georges Terrace
 PERTH WA 6000

ACN: 008 675 018

Premises address: Cataby Mineral Sands Mine
 10437 Brand Hwy
 CATABY WA 6507
 Being tenements M70/194, M70/195, M70/196, M70/517, M70/518,
 M70/696, M70/760, M70/867, M70/868, M70/869, M70/1018 and
 M70/1086, as depicted in Schedule 1.

Issue date: Thursday, 10 March 2016

Commencement date: Monday, 21 March 2016

Expiry date: Thursday, 21 March 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	10,000,000 tonnes per annual period
6	Mine dewatering: premises on which water is extracted and discharged into the environment to allow the mining of ore.	50,000 tonnes or more per year	11,000,000 tonnes per annual period

Conditions

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

Date signed: 8 June 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 – PM₁₀ continuous direct mass method using a tapered element oscillating microbalance analyser*;

'AS 3580.9.11' means the Australian Standard AS 3580.9.11 *Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM₁₀ beta attenuation monitors*;

'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*;

'AS/NZS 5667.11' means the Australian Standard AS/NZS 5667.11 *Water Quality – Sampling – Guidance on sampling of groundwaters*;

'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 correspondence means;
Chief Executive Officer
Department administering the *Environmental Protection Act 1986*
Locked Bag 33
CLOISTERS SQUARE WA 6850
Email: 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;

'Dust Management Plan' means the document titled "Iluka Resources Limited – Dust Management Plan – Cataby Mineral Sands Project – Revision 2" prepared by Iluka Resources Ltd and dated October 2015;

'MUP' means in-pit Mining Unit Plant;

'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;

'PM₁₀' 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;

'SSP' means Surface Screening Plant;

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

'µm' and 'µg/m³' means micrometres and micrograms per cubic metre, respectively;

'µS/cm' means micro Siemens per centimetre;

'WCP' means the Wet Concentration Plant, with a wet high intensity magnetic separation plant;

'Works Approval' means this Works Approval numbered W5935/2015/1 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 shall construct the works in accordance with the documentation detailed in Table 1.2.1:

Document	Parts	Date of Document
Works Approval Application Form	All	26 October 2015
<i>Cataby Mineral Sands Project – Application for a Works Approval under Part V of the Environmental Protection Act 1986 – Supporting Documentation – Iluka-TR-1749701, prepared by Iluka Resources Ltd</i>	All, including diagrams and appendices	October 2015

Note 1: Where the details and commitments of the documents listed in condition 1.2.1 are inconsistent with any other condition of this works approval, the conditions of this works approval shall prevail.



- 1.2.2 The Works Approval Holder shall commission the MUPs, SSPs and the WCP circuits and associated equipment for a period not exceeding 6 months.
- 1.2.3 The Works Approval Holder shall commission the MUPs, SSPs and the WCP circuits and associated equipment with not more than 500,000 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.

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.

Table 2.2.1: Emission points to land		
Emission point reference	Description	Source including abatement
L1 – Pit 12	Disposal of clay fines/sand and sand tailings (by-products of wet commissioning), pumped as a slurry to a void opened up for Pit 12	Clay fines from the WCP, thickened and blended with sand tailings from the WCP
		Sand tailings from the WCP

2.3 Fugitive emissions

- 2.3.1 The Works Approval Holder shall ensure fugitive emissions are managed in accordance with the parts of the document specified in Table 2.3.1.

Table 2.3.1: Management plans		
Management plan reference	Parts	Date of document
Dust Management Plan	<ul style="list-style-type: none"> • 6.2 – Construction • 6.3.2 – Operational controls • 6.3.3 – Weather forecasting • 6.3.4 – Dust emission source and engineering controls • 6.3.5 – Wind erodible areas • 6.3.6 – Overburden handling and haulage • 6.3.7 – Light vehicle and other traffic • 6.3.8 – Dozer and grader activity 	Revision 2 – October 2015



3 Monitoring

3.1 General 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;
- (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.

Table 3.2.1: Monitoring of ambient air quality

Monitoring point reference	Parameter	Limit	Units	Averaging period	Frequency ¹	Method
AQ1 – AQ2	TSP	260	µg/m ³	24 hours	Weekly	AS 3580.9.3
	PM ₁₀	50			Continuous logging ²	AS 3580.9.8 or AS 3580.9.11

Note 1: To commence prior to the start of any construction works on the Premises.

Note 2: Availability ≥90% of the measurement interval on a monthly basis.

3.2.2 The Works Approval Holder shall ensure that the siting of ambient air monitoring equipment is in accordance with AS 3580.1.1.

3.2.3 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 the corresponding management action is taken.

Table 3.2.2: Management actions

Monitoring point reference	Event/action reference	Event	Management action
AQ1	EA1	Exceedance of a limit specified in Table 3.2.1	Undertake an investigation including collection of evidence to demonstrate that the exceedance is not attributed to operations on the Premises



Monitoring point reference	Parameter	Units	Averaging period	Frequency
GQ1 – GQ21 ¹	Standing water level ²	m AHD	Spot sample	Weekly
	pH ²	-		Monthly
	Electrical conductivity @ 25°C ²	µS/cm		
	Redox potential ²	Eh		
	Total dissolved solids ²	mg/L		
	Dissolved oxygen ²			
	Major ions, nutrients (N and P)			Quarterly
	Dissolved metals, speciation of Ferric Iron and Ferrous Iron			6 monthly

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

Note 2: In-field non-NATA accredited analysis permitted.

4 Improvements

4.1 Improvement program

4.1.1 The Works Approval Holder shall complete the improvements in Table 4.1.1 by the date of completion in Table 4.1.1.

4.1.2 The Works Approval Holder, for improvements not specifically requiring a written submission, shall write to the CEO stating whether and how the Works Approval Holder is compliant with the improvement within one week of the completion date specified in Table 4.1.1.

Improvement reference	Improvement	Date of completion
IR1	The Works Approval Holder shall submit to the CEO an updated Soil Management Plan. The updated plan shall include management measures for the discharge of mine water to ensure that acidic water is not discharged to the environment. The updated plan shall include the development of trigger levels for changes in pH and titratable acidity on the mine water discharge, and a plan to indicate the measures to be implemented in the event the triggers are exceeded.	To be submitted with the commissioning report required by condition 5.1.3

5 Information

5.1 Reporting

5.1.1 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.

5.1.2 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.

5.1.3 The Works Approval Holder shall submit a commissioning report to the CEO within 3 months of the completion of commissioning.



- 5.1.4 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 MUPs, SSPs, WCP circuit and thickener;
 - (iv) wet commissioning of the MUPs, SSPs, WCP circuit and thickener;
 - (v) testing the sand and ModCod 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.

5.2 Notification

5.2.1 The Works Approval Holder shall ensure that the parameters listed in Table 5.2.1 are notified to the CEO and are in accordance with the notification requirements of the table.

Table 5.2.1: Notification requirements			
Condition or table	Parameter	Notification requirement	Format or form
1.2.2	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

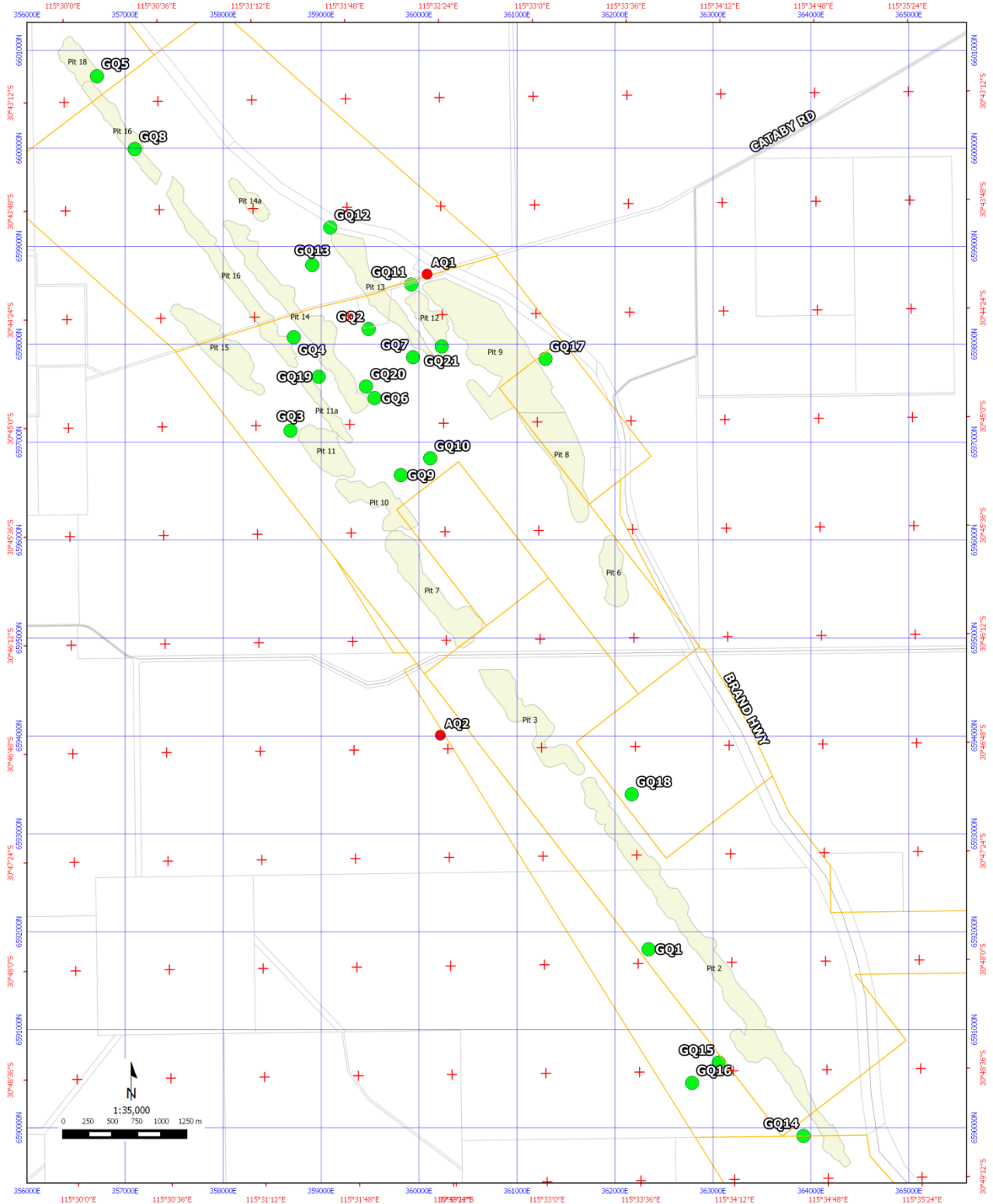
The Premises is shown in the map below. The red line depicts the Premises boundary. The orange lines depict the mining tenements associated with the project.





Map of monitoring locations

The location of the monitoring points listed in Tables 3.2.1 and 3.2.3 are shown below. The green dots depict the groundwater monitoring points (see cross reference with Iluka IDs on page 10).. The red dots depict the air quality monitoring points.





Monitoring point references

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

Table 3.2.2 - Groundwater monitoring point references						
Monitoring point reference	Iluka ID	Coordinates (GDA94)	SWL	pH, EC, Redox, TDS, DO	Major ions, nutrients	Metals
GQ1	CM08S_Pit	362343, 6591819	Weekly	Monthly	Quarterly	6 monthly
GQ2	CM17S_Pit	359488, 6598155				
GQ3	CM23S_Pit	358691, 6597114				
GQ4	CM24S_Pit	358723, 6598067				
GQ5	CM26S_Pit	356713, 6600735				
GQ6	CM32S_Pit	359546, 6597449				
GQ7	CM34S_Pit	359938, 6597867				
GQ8	MB03P12S_Pit	357098, 6599993				
GQ9	Pit_MW_14S_Pit	359814, 6596663				
GQ10	Pit_MW_15S_Pit	360114, 6596835				
GQ11	Pit_MW_16S_Pit	359920, 6598610				
GQ12	Pit_MW_17S_Pit	359093, 6599192				
GQ13	Pit_MW_18S_Pit	358910, 6598809				
GQ14	Pit_MW_19S_Pit	363924, 6589915				
GQ15	Pit_MW_20S_Pit	363059, 6590664				
GQ16	Pit_MW_21S_Pit	362787, 6590456				
GQ17	Pit_MW_22S_Pit	361290, 6597850				
GQ18	529_206_Pit	362171, 6593404				
GQ19	CPB6_Pit	358976, 6597667				
GQ20	CPB7_Pit	359458, 6597568				
GQ21	CPB8_Pit	360231, 6597976				



Works Approval: W5935/2015/1
 Form: N1

Works Approval Holder: Iluka Resources 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	

Notification requirements for the breach of a limit	
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	
Post	
Signature on behalf of Iluka Resources Ltd	
Date	



Decision Document

Environmental Protection Act 1986, Part V

Proponent: Iluka Resources Ltd

Works Approval: W5935/2015/1

Registered office: Level 23, 140 St Georges Terrace
PERTH WA 6000

ACN: 008 675 018

Premises address: Cataby Mineral Sands Mine
10437 Brand Hwy
CATABY WA 6507
Being tenements M70/194, M70/195, M70/196, M70/517, M70/518,
M70/696, M70/760, M70/867, M70/868, M70/869, M70/1018 and M70/1086

Issue date: Thursday, 10 March 2016

Commencement date: Monday, 21 March 2016

Expiry date: Thursday, 21 March 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



Contents

Decision Document	1
Contents	2
1 Purpose of this Document	2
2 Administrative summary	3
3 Executive summary of proposal and assessment	4
4 Decision table	5
5 Advertisement and consultation table	11
6 Risk Assessment	12
Appendix A	13
A1 Scope of works	13
A2 Surface water management	14
A3 Containment of processing wastes	16
A4 Acid sulfate soils	18
A5 Point source emissions to groundwater	21
A6 Emissions to land	23
A7 Fugitive emissions (dust)	25
A8 Noise	29

1 Purpose of this Document

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



2 Administrative summary

Administrative details		
Application type	Works Approval <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	Category number(s)	Assessed design capacity
	8: Mineral sands mining or processing	10 Mt per annual period
	6: Mine dewatering	11 GL per annual period
Application verified	Date: 20/11/2015	
Application fee paid	Date: 15/12/2015	
Works Approval has been complied with	Yes <input type="checkbox"/>	No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>
Compliance Certificate received	Yes <input type="checkbox"/>	No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>
Commercial-in-confidence claim	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Commercial-in-confidence claim outcome		
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"/>
Is the proposal subject to Ministerial Conditions?	Yes <input checked="" type="checkbox"/>	Referral decision No: Managed under Part V <input type="checkbox"/>
		Assessed under Part IV <input checked="" type="checkbox"/>
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"/>	Ministerial statement No: 1017 (supersedes statement No. 720)
		EPA Report No: Bulletin 1555 (supersedes Bulletin 1212)
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"/>	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 assessment sets out DER's decision making in relation to the proposed Cataby Mineral Sands Mine (Cataby) under Part V of the *Environmental Protection Act 1986*.

Iluka Resources Ltd (Iluka) proposes to establish a large scale, low grade heavy mineral sands mine near Cataby, Shire of Dandaragan, approximately 150 km north of Perth. The Cataby project will form a continuation of mineral sands mining for Iluka on the northern Swan Coastal Plain, and will support its existing South West and Mid West operations by providing heavy mineral concentrate (HMC) feedstock to the mineral separation plants at Capel and Narngulu.

The original proposal for Cataby was formally assessed by the Environmental Protection Authority (EPA) in 2005 at the level of an Environmental Protection Statement (EPS), and was approved by the Minister for Environment in April 2006 (Statement 720). The project did not immediately proceed due to market conditions; amendments to Statement 720 were subsequently approved in October 2015 through the issue of Statement 1017.

The project involves dry mining of the heavy mineral resource and the subsequent production of HMC through wet screening and gravity separation. The project has a large disturbance footprint (1,942 ha), of which the majority comprises cleared farming land. The heavy mineral resource will be mined progressively over approximately 9 years, at a nominal processing rate of up to 10 million tonnes per annum (Mtpa). A further 3 years is expected to complete final rehabilitation works.

Pits will be progressively mined using a combination of scrapers, front-end loaders, excavators and haul trucks. Mining will occur to a maximum depth of 60 metres below ground level (mbgl) and ore will be mined using in-pit dozers pushing to in-pit Mining Unit Plants (MUPs). Ore will be conveyed to an out-of-pit surface screening plant where it will be slurried and pumped to a wet concentration plant (WCP) located centrally in the operations. The WCP will use a combination of wet gravity and magnetic techniques to separate magnetic and non-magnetic HMC from the screened ore. The magnetic fraction will be transported by articulated road trains to the North Capel plant for further processing; the non-magnetic fraction will be transported by road to the Eneabba mine site, and then by rail to the Narngulu plant for further processing.

Many of the pits will be mined to a basement level below the natural groundwater table and dewatering will be required to enable dry mining to occur. Groundwater levels will be controlled through a combination of dewatering bores that pump from the shallow aquifers hosting the mineral sands, and through the implementation of in-pit drains and sumps to collect and remove groundwater that flows into the pits. A water balance has been prepared for the project, which predicts up to 11 GL per year of dewatering water may require disposal, via in-pit infiltration and/or direct aquifer re-injection, in any 12 month period.

Clay fines will be thickened and blended with sand tailings for modified co-disposal into completed mine voids; sand tailings will be blended with clay fines for co-disposal, pumped to completed mine voids as a slurry, or stacked adjacent to the WCP for later placement in mine voids. Rehabilitation of the sand tails will commence once the material has dried and consolidated.

The key emissions and discharges from operations will include noise emissions and ambient air quality (fugitive dust) from continuous (24/7) operations; disposal of excess dewatering water to the environment; managing acid sulfate soils; and the disposal of tailings into mine voids. Noise emissions have been determined to be a key environmental factor by the EPA, and in addition to surface water management, are regulated through Statement 1017; as such the works approval or licence will not include conditions relating to this aspect of the proposal. Fugitive dust, the controlled discharge of dewatering water and the disposal of tailings have been conditioned in the licence to ensure an acceptable level of environmental protection.



4 Decision table

All applications are assessed in line with the *Environmental Protection Act 1986*, 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
General conditions	W1.2.2 – W1.2.3	Construction Iluka intend on commissioning plant and equipment following installation/construction, namely the mining unit plants (MUPs), surface screening plants (SSPs) and the wet concentration plant (WCP) circuits and associated equipment. Conditions have been added to the works approval to limit the scope of commissioning works to a nominal 6-month period (W1.2.2), and no more than 500,000 tonnes of HMC to be processed as part of wet commissioning works (W1.2.3). This is primarily to ensure that mining operations do not commence under the pretext of 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	Construction & Operation Vegetation protection (including surface water ecosystems) was listed as a key environmental factor in the Part IV assessment ¹ and is regulated under Ministerial Statement 1017. To avoid unnecessary duplication, specified conditions relating to surface water management have not been added to the works approval or proposed in the licence. DER's assessment and decision making on Surface Water Management is detailed in Appendix A2.	¹ EPA Bulletin 1212 (2006)
Premises operation	W1.3.1	Construction 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, W1.3.1 has been added to the works approval to require industry standard safeguards ¹ for uncontrolled spills, leaks and pipeline failures.	¹ ASME Code B31.4 <i>Pipeline Transportation Systems of Liquids and Slurries</i>
	L – conditions	Operation Conditions will be included on the licence to: <ul style="list-style-type: none"> specify the authorised infrastructure on the premises for the containment of processing wastes and the minimum infrastructure requirements; 	



DECISION TABLE			
Works Approval / Licence section	Condition number W = Works App L = Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
		<ul style="list-style-type: none"> require adequate safeguarding of pipelines carrying slurries of ore and tailings to prevent uncontrolled discharges in the event of an incident or malfunction; and require daily inspections of all containment infrastructures for leaks, integrity and freeboard requirements. <p>DER's assessment and decision making on Containment of Processing Wastes are detailed in Appendix A3.</p>	
	L – conditions	<p>Operation Acid sulfate soils (ASS) investigations involving drilling and soil sampling across the site detected the presence of pyrite in sediments to be excavated during mining operations. Additional material located off the premises was identified as being at risk of becoming oxidised as a result of dewatering drawdown. Conditions are proposed on the licence to manage this activity.</p> <p>DER's assessment and decision making on ASS is detailed in Appendix A4.</p>	
Emissions general	W2.1.1	<p>Construction Descriptive and numerical limits have been set through conditions of the works approval and therefore condition W2.1.1 has been included to require recording and investigation of limit exceedances.</p>	
	L – conditions	<p>Operation Descriptive and numerical limits are proposed for the licence and therefore conditions regarding recording and investigation of exceedances of limits will be included on the licence.</p>	
Point source emissions to air including monitoring	W – no conditions L – no conditions	<p>Construction & Operation The only point source air emissions expected during mine construction/commissioning works and subsequent mining operations are from diesel and petrol combustion engines and electricity use. As such, no significant point source emissions to air are expected or authorised, and no specified conditions relating to point source emissions to air or the monitoring of these emissions are required on the works approval or licence.</p>	



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 surface water including monitoring	W – no conditions L – no conditions	Construction & Operation There are no planned direct discharges to waterways or wetlands. Discharge of excess dewatering water is proposed via in-pit evaporation and infiltration and reinjection bores (See Point Source Emissions to Groundwater). As such, no significant point source emissions to surface water are expected or authorised during mine construction works or subsequent mining operations, and no specified conditions relating to point source emissions to surface water or the monitoring of these emissions are required on the works approval or licence.	
Point source emissions to groundwater including monitoring	W – no conditions	Construction There are no point source emissions to groundwater proposed in the application during mine construction or commissioning works.	
	L – conditions	Operation Groundwater will be abstracted from the Superficial Aquifer to allow dry mining to occur. Groundwater will be pumped from dewatering bores to a clean water dam, which will provide makeup water to the processing plant (via the process water dam). Excess water from the clean water dam will be disposed via infiltration basins located within mining pits, or via re-injection into bores located away from the active mining area. The discharge of mine water to groundwater has the potential to impact on environmental values through groundwater mounding and/or changes in water quality. Conditions are proposed for the licence to manage this activity. DER's assessment and decision making on Point Source Emissions to Groundwater is detailed in Appendix A5.	
Emissions to land including monitoring	W2.2.1	Construction Sand tailings and clay fines produced during commissioning of the WCP will be returned to the mining void. W2.2.1 has been added to the works approval to specify the nominated mine void as an authorised disposal area for this material. DER's assessment and decision making on Emission to Land is detailed in Appendix A6.	



DECISION TABLE			
Works Approval / Licence section	Condition number W = Works App L= Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
	L – conditions	<p>Operation Clay fines produced by the WCP will be thickened and blended with sand tailings for co-disposal into completed mine voids. Sand tailings produced by the WCP will be pumped to completed mine voids as a slurry, or blended with clay fines for co-disposal. Conditions are proposed for the licence to specify the authorised mine voids for disposal of these materials.</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>Construction & Operation Due to the large disturbance area, proximity of receptors (including the Brand Hwy and Cataby roadhouses) and prevailing strong easterly/south westerly winds in the area, there is a high risk of fugitive dust emissions during mine construction works and subsequent mining operations to impact on nearby sensitive land uses.</p> <p>Ambient air quality (i.e. dust) was determined to be a key environmental factor in the original (2006) Part IV assessment (Bulletin 1212)¹ and Ministerial Statement 720 required the submission of a Dust Management Plan². During the EPA's review of the project in 2015³, it was determined that dust could be managed under Part V and conditions relating to dust were not included in the updated Ministerial Statement 1017. As such, W2.3.1 has been included in the works approval, and a similar condition proposed for the licence, to require dust management in accordance with the Dust Management Plan².</p> <p>DER's assessment and decision making on Fugitive Dust is detailed in Appendix A7.</p>	<p>¹EPA Bulletin 1212 (2006)</p> <p>²Cataby Dust Management Plan (October 2015)</p> <p>³EPA Bulletin 1555 (2015)</p>
Odour	W – no conditions L – no conditions	<p>Construction & Operation Odour is not expected during mine construction works or subsequent mining operations at a mineral sands mine. No specified conditions relating to odour emissions or the monitoring of these emissions have been added to the works approval or licence.</p>	
Noise	W – no conditions L – no conditions	<p>Construction & Operation Noise was determined to be a key environmental factor in the Part IV assessment¹, and is regulated under Ministerial Statement 1017. To avoid unnecessary duplication, conditions relating to noise and the monitoring of noise have not been added to the works approval or proposed in the licence.</p> <p>DER's assessment and decision making on Noise is detailed in Appendix A8.</p>	¹ EPA Bulletin 1555 (2015)



DECISION TABLE			
Works Approval / Licence section	Condition number W = Works App L = Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
Monitoring general	W3.1.1 – W3.1.4 L – conditions	Construction & Operation 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 (W3.1.1), minimum timeframes for sampling frequency (W3.1.2), and calibration requirements for instruments used by the proponent (W3.1.3 – W3.1.4).	
Monitoring of inputs and outputs	W – no conditions L – no conditions	Construction & Operation Monitoring of inputs and outputs are 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.	
Process monitoring	W – no conditions L – no conditions	Construction & Operation Process monitoring is not required to adequately manage emissions during construction/ commissioning works or subsequent mining operations. Reject materials containing monazite will not be returned to Cataby for disposal; it will be consolidated with other monazite-bearing materials and disposed at the Eneabba Monazite Disposal Pit. Reporting of annual production volumes will be included in the Annual Environmental Report (See Information section). No specified conditions relating to process monitoring have been added to the works approval or licence.	
Ambient quality monitoring	W3.2.1 – W3.2.3	Construction 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 continuous monitoring of TSP and PM ₁₀ levels at the closest and highest risk receptor (Cataby roadhouse), and at a fixed background location (Cataby AWS) during mine construction works (See Fugitive Emissions). 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 2004. The table reflects the extensive groundwater monitoring program ¹ approved by the Department of Water, and includes monitoring of groundwater levels and quality in selected existing and new groundwater monitoring bores in the vicinity of mine pits (See Point Source Emissions to Groundwater and Emissions to Land). W3.2.2 specifies the standard in which ambient air monitoring equipment must be sited.	¹ Cataby Groundwater Operating Strategy (May 2015)



DECISION TABLE			
Works Approval / Licence section	Condition number W = Works App L = Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
	L – conditions	Operation It is proposed to continue the ambient monitoring programs commenced under the works approval on the operating licence.	
Meteorological monitoring	W – no conditions L – no conditions	Construction & Operation The Dust Management Plan ¹ for the site includes the use of local area weather forecasting to predict the short-term (72 hour) local forecasting of wind speed, wind direction, inversion potential and rainfall, to provide early warning and preparation for potential high dust emission conditions. As conditions already require management in accordance with the Dust Management Plan, which includes meteorological monitoring, there is no need to duplicate this requirement in a separate condition.	¹ Cataby Dust Management Plan (October 2015)
Improvements	W4.1.1 – W4.1.2	Construction An improvement condition has been added to the works approval (IR1) to require an update to the Cataby Soil Management Plan, including management measures for the discharge of mine water to ensure that acidic water is not discharged to the environment (See Appendix A4 Acid Sulfate Soils).	
	L – no conditions	Operation No improvements required.	
Information	W5.1.1 – W5.1.4 W5.2.1	Construction Reporting and notification conditions have been included on the works approval, to require submission of a compliance document prior to commissioning works (W5.1.1 – W5.1.2), and a commissioning report (W5.1.3 – W5.1.4), detailing the environmental performance of the as-built plant. W5.2.1 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.	
	L – conditions	Operation Conditions relating to minimum record keeping requirements, annual reporting and notification requirements are proposed in the licence.	
Approval Duration	N/A	In accordance with DER Guidance Statement: <i>Licence Duration</i> (May 2015), the works approval will be issued for a period of 3 years.	DER Guidance Statement: <i>Licence duration</i> (May 2015)



5 Advertisement and consultation table

Date	Event	Comments received/Notes	How comments were taken into consideration
21/12/2015	Application advertised in West Australian newspaper	Nil.	N/A.
21/12/2015	Application referred to the Shire of Dandaragan	No response received.	N/A.
11/02/2016	Proponent sent a copy of draft instrument	<ul style="list-style-type: none">- Request for removal of premises operation condition that references automatic cut-outs on tailings pipelines;- Request to have the option of utilising TEOM and BAM instrumentation for measuring fugitive dust levels;- Further clarification sought on reporting conditions and requirements;- Other minor clarification/ correction/ suggestions provided.	<ul style="list-style-type: none">- The subject condition is a typical condition imposed on licences where pipelines containing environmentally hazardous materials are transferred around the premises. The reference to automatic cut-outs is listed in the condition as an option only, i.e.it is not a requirement if other measures are used to detect leaks and spills;- Option of utilising TEOM and BAM instrumentation for measuring fugitive dust levels has been added;- Further clarification provided on reporting conditions and requirements;- Other minor clarifications addressed where necessary.



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 14 months and includes:

- Site boundary demarcation;
- Vegetation clearing;
- Topsoil and subsoil stripping and stockpiling;
- Construction of infrastructure including:
 - dewatering bores and commencement of dewatering;
 - skid-mounted, in-pit mining unit plants (MUPs);
 - surface screening plants (SSPs) and slurry pipelines, pumps and stackers;
 - wet concentration plant (WCP), wet high intensity separation plant and upcurrent classifier;
 - 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. laboratory, administration buildings, contractor's workshops, wastewater treatment plant and irrigation area);
- Construction of the water management and distribution network, including storage tanks, the process water dam, surface drainage structures, stormwater dams, discharge point/s and associated pipelines and pumps;
- Excavation and stockpiling of overburden and ore to create voids for the installation of in-pit MUPs, and the initial sand tailings and clay fines disposal cell; and
- Construction of earthen noise bunds.

The WCP, currently at the Eneabba Mineral Sands Mine, will be relocated to the premises and upgraded with a wet high intensity magnetic separation plant to provide additional magnetic separation. The WCP will be located centrally to the deposits at the process plant.

2. Commissioning

Commissioning will be carried out over approximately 6 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 MUPs, SSPs, WCP circuit and thickener;
- Wet commissioning of the MUPs, SSPs, WCP circuit and thickener;
- Testing the sand and ModCod tailings system; and
- Commissioning the process control system.

To wet commission the MUPs, SSPs and WCP circuits and associated equipment, it will be necessary to process a volume of ore. Approximately 500,000 tonnes of ore will be processed, with the HMC stored at the HMC stockpiles. The sand tailings and clay fines produced during commissioning will be returned to the mining void.



A2 Surface water management

For the mining sector, one of the main catalysts of contaminated discharge from mining areas relates to the effective control of stormwater. The key aspects of an effective stormwater control strategy involve isolation of dirty water sources, such as workshop areas where oil may become mixed with surface water, and the collection and containment of stormwater to allow maximum re-use in processing.

Emission Risk Assessment – Construction & Operation

Emission Description

Emission: Uncontrolled stormwater runoff, contaminated with suspended solids, hydrocarbons and 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 Guidelines¹ for physical and chemical stressors.

Two drainage lines flow in a south-westerly direction across the premises: the Minyulo Brook in the north and Cataby Brook in the central part of the project. These brooks are generally understood to be surface water features fed by rainfall runoff and overland flow crossing the scarp and are perched above the water table on low permeability clay lenses and more extensive laterite horizons. They are ephemeral and endorheric (inland draining).

The Minyulo Brook divides into two branches west of the premises; the northern branch flows into a number of permanent wetlands, one being Emu Lake – the largest, permanent freshwater lake in the Jurien-Dandaragan-Lancelin region and is of regional and local significance for its values as habitat for a number of conservation significant fauna species. The Cataby Brook flows into the Enemunga Nature Reserve, which contains remnant riparian vegetation that is known to provide important habitat for several conservation significant fauna species.

Controls: The proponent has proposed the following management measures, outlined in the Cataby Surface Water Management Plan (April 2015), submitted prior to ground disturbance activities as required by Ministerial Statement 1017:

- Runoff from undisturbed catchments upstream of, and within, the mine site will be diverted away from mine pits, infrastructure and other operational areas into existing drainage lines through bunding and local drains on the upstream side of the haul road. In particular, flood bunding around Pit 16 – Minyulo Brook and Pit 8, Pit 6 and Pit 5 – Cataby Brook will allow the majority of flows from the upstream catchments to flow through existing natural drainage pathways;
- 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 management system;
- Surface water runoff generated in disturbed sub-catchments (e.g. stockpiles, roads and rehabilitated areas) will be diverted to stormwater management infrastructure (i.e. dams, ponds and drains) that will be sized to contain a 1:10 Annual Exceedance Probability (AEP), 6 hour storm event;
- In events greater than a 1:10 AEP, 6 hour storm event, overflow from sedimentation ponds will be directed to mine pits where it will infiltrate and/or be used in the mine water management system.

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



Key mine stormwater management infrastructure will consist of a large sedimentation pond and two stormwater dams that will operate over the life of mine, in addition to several temporary basins that will be constructed alongside infrastructure as the mine progresses. The sedimentation pond will capture runoff from the mine infrastructure area and the two Run of Mine stockpiles. Overflow will be directed to the stormwater ponds, which will also collect runoff from the adjacent road infrastructure. Storm events that exceed the capacity of the stormwater ponds will be designed to overflow into the adjacent mine pits.

Risk Assessment

The likely consequence of contaminated stormwater runoff entering the Minyulo or Cataby Brooks would be the potential for long-term impacts to sensitive ecosystems (Major). The likelihood of this consequence occurring under typical mine construction works and/or subsequent mining operations is Possible (could occur at some time), with a combined risk rating of High.

Consequence: Major.

Likelihood: Possible.

Risk Rating: High.

Regulatory Controls

Vegetation protection has been identified as a key environmental factor by the EPA in their assessment of the proposal, which includes an assessment of surface water management with respect to the protection of surface water ecosystems. Conditions have been included on Ministerial Statement 1017 with regards to the submission of a Surface Water Management Plan prior to ground disturbance activities (to be prepared in consultation with DoW), with the objective of ensuring the integrity of surface water ecosystems (flow regimes, water quality and ecosystem health) is maintained; and the implementation of the management plan, which includes stormwater management.

To avoid unnecessary duplication, conditions relating to stormwater management have not been included on the Part V works approval or licence.

Residual Risk

With the above regulatory controls imposed, the likelihood of contaminated stormwater runoff entering and causing long-term impacts to sensitive ecosystems has been downgraded to Unlikely (unlikely to occur). The residual risk rating has also been downgraded to Moderate.

Consequence: Major.

Likelihood: Unlikely.

Risk Rating: Moderate.



A3 Containment of processing wastes

The clay fines component (nominally $\leq 53 \mu\text{m}$), will be thickened (through addition of a non-toxic flocculent at the thickener) and mixed with a pre-determined amount of sand tailings, prior to being pumped to mined voids for disposal. Excess sand tailings will be pumped to sand stacking locations either in-pit or adjacent to the wet concentration plant (WCP) overburden stockpile.

Dirty water from the WCP, return water from the in-pit sumps and water from the sedimentation dam will be pumped to the drop-out dam for reuse as process water. Water reclaimed from the mine pits and sand tailings storages will be pumped to the sand tailings return water tank then pumped to the drop-out dam, which is engineered to promote sedimentation of particles, prior to overflowing to the process water dam. In-pit dewatering using mobile pumps and pipelines will also be required, with the water fed into the process water system via the sand tailings return water tank.

Slurried materials will be transferred around the mine site using high-density polyethylene pipelines that will utilise a combination of fully welded and 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, which at the Cataby project will travel over a number of internal roads and surface water features.

Emission Risk Assessment – Operation

Emission Description

Emission: Sand tailings from primary screening, clay fines (thickener underflow) from processing, 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.

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.

A number of ephemeral streams or brooks flow across the scarp and form important wetlands and groundwater-dependent ecosystems (GDEs) near the premises (e.g. the Minyulo, Cataby and Caren Caren Brooks). These brooks are generally understood to be surface water features fed by rainfall runoff and overland flow crossing the scarp and are perched above the water table on low permeability clay



lenses and more extensive laterite horizons. Spills or leaks may impact on these systems.

- Controls:* The following controls are proposed for all slurry lines:
- All slurry pipes will be contained within a pipe-trace;
 - Where slurry pipes cross roads/water features they will be fully welded with secondary containment. The type of secondary containment will be risk assessed to ensure it is fit for purpose;
 - Slurry line integrity will be protected through strategic use of air bleed vales and pressure sensors;
 - Monitoring of slurry flow and pump performance; and
 - Performance trigger alarms (line pressure, slurry flow) provide for operator intervention to ensure line failure and spillage is minimised.

Risk Assessment

The likely 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 medium to long term impacts (Moderate). The likelihood of this consequence occurring is Unlikely (not expected to occur), with a combined risk rating of Moderate.

Consequence: Moderate.

Likelihood: Unlikely.

Risk Rating: Moderate.

Regulatory Controls

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, through the use of secondary containment, or telemetry and pressure sensors to allow detection of leaks and failures.

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 daily 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 medium to long-term impacts to environmental values is not likely to change even 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.



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 soils².

Sulfidic sediments may also occur at depths greater than 3 m on the coastal plains, which can be disturbed by large scale sand mining operations³. Although the general principles for managing deeper sulfidic sediments are similar to the management of shallow ASS, the scale of mining operations and characteristics of these deeper sediments can cause additional hazards that require careful management to prevent environmental problems taking place.

Most heavy mineral sands mining in the State is carried out from pits kept dry by groundwater dewatering, which poses a particularly high risk of triggering the oxidation of pyrite. This is due to the cone of depression of the water table required to maintain a dry pit typically extending well beyond the margins of the pit excavation footprint. Mining at Cataby is proposed to extend 60 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.

The proponent has conducted ASS investigations in the Cataby area since 2004, where pyrite has been observed to occur in localised lenses of black to dark-grey lagoonal clays and sandy clays along the western margin of the project area (corresponding with the location of low-lying sumplands that have shallow groundwater and an abundance of organic matter). Approximately 1 million cubic metres (m³) of potential acid sulfate soils (PASS) is estimated to occur within the nominated pit shells, and an additional 3 million m³ within the soil profile surrounding the pits at risk of being affected by groundwater drawdown during mine dewatering.

Emission Risk Assessment – Operation

Emission Description

Emission: Disturbance of Actual ASS (AASS, highly acidic soils that have previously been oxidised) and/or 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.

Approximately 1 million m³ of PASS is estimated to occur within the proposed mining pits, in addition to a further 3 million m³ in soil surrounding the pits.

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.

As most sand deposits are located in regions where there are also significant groundwater resources, groundwater quality in the immediate vicinity of the mine is considered to be a significant receptor, and is the principle pathway for contamination by sulfide mineral oxidation products. Other receptors for this contamination include groundwater dependent ecosystems, wetlands and surface waters of conservation significance, and groundwater bores used for irrigation or water supply.

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

³ 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)



The extent and severity of groundwater or surface water contamination (caused by acidic leachate) is dependent on the amount of pyrite present in the sediments – the more pyrite present, the more significant the acidification on oxidation.

Controls: The proponent has developed a conceptual model for the site, including a description of local hydrogeological conditions, the 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 Cataby Soil Management Plan (October 2015, Revision 1). The strategy is based on:

- Identification and mapping of ASS materials;
- Understanding the potential environmental impacts from exposing ASS materials;
- Disposing unoxidised ASS material below the water table; and
- Ensuring the processing of Actual ASS is conducted in a manner that does not create current or future environmental issues.

Any material with a $pH_{FOX} \leq 3.5$ and/or $S_{CR} \geq 0.03\% S$ will be considered to be ASS and managed accordingly:

- Overburden – all black/dark-grey clays and sandy clays will be presumed to be ASS and will be managed by disposal below the water table, prior to the sediments oxidising;
- Oversize will be routinely disposed below the water table;
- Ore will be processed through the wet separation plant as soon as possible to minimise the risk of stockpiled materials oxidising and producing contaminated leachates;
- HMC will be stockpiled on a compacted limestone pad with leachate collection; and
- Backfill (including tailings) will be treated with lime, prior to disposal in mined voids.

Mine pit dewatering will be managed in accordance with the GOS, and bores will only be operated as necessary to dry mine and backfill active pits. The groundwater monitoring program (See A5 Point source emissions to groundwater) will be undertaken to detect changes in groundwater quality that could be attributed to dewatering and off-site ASS. Monitoring will facilitate the on-going verification and refinement of the conceptual ASS risk model, and provide early indication of adverse effects of ASS on local groundwater, both during operations and during closure.

Risk Assessment

The consequence of disturbing ASS could lead to acid mine drainage, causing severe and long-term impacts on the environment at a local level (Moderate). The likelihood of this consequence occurring is Possible (could occur), with a combined risk rating of Moderate.

Consequence: Moderate.

Likelihood: Possible.

Risk Rating: Moderate.

Regulatory Controls

DER is satisfied the proponent 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 acid drainage from disturbance of ASS, conditions are proposed on the licence to manage ASS in accordance with the Cataby Soil Management Plan (October 2015). In addition, conditions are proposed to formalise the requirement for monitoring of process water quality and groundwater quality



in the vicinity of the mine voids and off-site areas identified as being at high risk of being affected by groundwater drawdown during mine dewatering.

As the project involves the direct discharge of dewatering water back to the groundwater, monitoring and management measures are required on the discharge to ensure that acidic water is not discharged back to the environment. As such, an improvement condition has been included on the works approval to require the development of trigger levels for changes in pH and titratable acidity on the mine water discharge, and a plan to indicate the measures to be implemented in the event the triggers are exceeded.

Residual Risk

The likelihood of acid mine drainage occurring is not likely to change even 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.



Emissions & Monitoring

A5 Point source emissions to groundwater

As discussed in previous sections, dewatering is required to facilitate dry mining conditions. Where the dewatering rate exceeds the project's water demand, excess dewatering water will require disposal. The proposed disposal methods comprise in-pit infiltration and aquifer reinjection via bores. Both methods involve the return of water to the Yoganup Formation, via the Superficial Aquifer.

The rate of dewatering water disposal will vary throughout the life of mine, with the maximum volume in any given 12 month period predicted to peak around 11 GL. Groundwater abstraction will be managed in accordance with the Cataby Project Groundwater Operating Strategy (GOS) (May 2015), 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 surface water and groundwater dependent ecosystems and native vegetation, it also includes the monitoring of groundwater levels (i.e. mounding) and changes in water quality as a result of the discharge activity.

Emission Risk Assessment – Operation

Emission Description

Emission: Groundwater will be abstracted from the Superficial Aquifer to supply process water and for mine dewatering. Water in excess of site requirements (estimated to peak at 11 GL per year) is proposed to be returned to the Superficial Aquifer via reinjection bores or infiltration basins.

Impact: As discussed in previous sections, there are a number of regionally significant surface water and groundwater dependent ecosystems and native vegetation areas within proximity to the mine. The values of these systems may be impacted from groundwater mounding or changes in water quality.

Controls: The primary focus of the proponent's groundwater management strategy is managing the potential impacts of mine dewatering and excess water disposal on GDEs. The operating strategies for managing the potential impacts are outlined in the Cataby Groundwater Dependent Ecosystems Management Plan (June 2015), which was a requirement of Ministerial Statement 1017 with respect to managing the impact of groundwater drawdown on vegetation. The key elements of this plan have been incorporated in the GOS and include:

- GDE risk assessment;
- Groundwater level and quality monitoring program;
- Surface water monitoring program;
- Vegetation monitoring program; and
- Tiered trigger-response management framework.

The GDE Management Plan identifies the GDEs potentially at risk, establishes a monitoring program with early-warning trigger values and outlines a tiered management response to breaches of trigger values. If a monitoring trigger is breached, this will initiate detailed investigations to better define the significance of the threatening process and devise the most appropriate management action required (in consultation with DoW). If deemed appropriate by the investigations and further monitoring there will be a deployment of the direct management action. The proponent has made provisions for the release of excess water (of appropriate quality) to recharge and maintain the hydrological regimes of GDEs, if required.



Risk Assessment

The likely consequence of environmental values being impacted from groundwater mounding or changes in water quality from the discharge (infiltration or reinjection) of dewatering water would be short-term impact to high value or sensitive ecosystems and off-site impacts at a local scale (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

A robust groundwater monitoring program is required under the GOS and GDE Management Plan, with respect to monitoring and managing the potential impacts on surface water and groundwater dependent ecosystems and native vegetation. As discussed, the objectives of the OEPA and DoW are to ensure the proposal is implemented in a manner that minimises the impact of the groundwater abstraction activity, and conditions set by these agencies with respect to monitoring, assessment and reporting have a focus on this aspect of the proposal. As such, conditions are proposed on the licence to manage the potential impacts of the discharge activity, as this aspect is not adequately covered by Ministerial Statement 1017 or the groundwater licence.

Conditions are proposed in the licence to specify the authorised discharge points for dewatering water, meaning that any discharge to a location other than the specified sites may not provide a defence against proceedings for causing pollution. A continuation of the ambient groundwater monitoring program commenced under the works approval is proposed, to monitor for changes in groundwater levels around mine pits that would suggest groundwater level mounding is occurring; or changes in water quality that could migrate off-site and potentially contaminate regional groundwater aquifers.

Residual Risk

The likelihood of environmental values being impacted from groundwater mounding or changes in water quality from the discharge (infiltration or reinjection) of dewatering water is not likely to change even 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.



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 Cataby mine, these waste materials will be disposed below the natural ground level, in previously mined out open pits (in-pit), through a combination of co-disposal of clay fines/sand (e.g. Modified Co-disposal, ModCod) and sand stacking.

ModCod is a proprietary modification to the co-disposal practice of sand/clay mine waste products. It involves modifying co-disposed tailings with the addition of flocculant at the deposition point to provide for more efficient water recovery and faster tails consolidation times.

ModCod pits will generally be filled to the original ground level and will be allowed to consolidate. Decanted water will be pumped back to the process water dam for reuse in the concentration process. Excess sand will be pumped to sand stacking locations either in-pit or adjacent to the WCP overburden stockpile. For in-pit disposal, sand tailings will be pumped to the in-pit disposal area, dewatered at the pit edge and dry-stacked directly back into the mining void.

Slurry density in the field pipeline circuit is estimated to be a nominal 34.4% solids by weight. Water recovery from ModCod pits will be collected via sump pumps within the pit void located downstream from the deposition point.

As mentioned, only the non-magnetic fraction of the heavy mineral concentrate (HMC) will be sent to the Narngulu plant for further processing. Reject materials from secondary processing at Narngulu will not be returned to Cataby. The reject waste stream from processing Cataby HMC, which includes naturally occurring radioactive material (NORM) in the form of the rare earth mineral monazite, is a potential saleable product and will be transported to Eneabba for long-term disposal.

Emission Risk Assessment – Construction & Operation

Emission Description

Emission: Sand tailings from primary screening, and clay fines (thickener underflow) from processing. These wastes 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.

Impact: The primary environmental impacts from in-pit tailings 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 GDEs and 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 use of ModCod, which is designed to allow for faster agglomeration of solids closer to the point of deposition. ModCod promotes a greater release of water from the slurry suspension upon deposition, with water balance calculations estimating up to 66% of tailings water will be recovered through in-pit sumps and pumped back to the process water dam for reuse in concentration.



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 proponent to undertake investigations and, if necessary, 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 Likely (probably occur in most circumstances), with a combined risk rating of High.

Consequence: Moderate.

Likelihood: Likely.

Risk Rating: High.

Regulatory Controls

Approximately 500,000 tonnes of ore will be processed during wet commissioning of the WCP. The sand tailings and clay fines produced will be disposed into a void opened up for Pit 12. W2.2.1 has been added to the works approval to specify this as the authorised discharge location for tailings during commissioning works. Ambient groundwater monitoring has been included on the works approval in order to gather baseline data (groundwater levels and quality) around proposed mine voids over the life of mine.

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 and GDE Management Plan.

Residual Risk – Normal operation

With the above regulatory controls imposed, the likelihood of groundwater impacts from tailings seepage has been downgraded to Possible (could occur at some time). 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 the Brand Hwy, 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 and stockpiling of soil, excavation of overburden and ore for the installation of in-pit MUPs and creation of the tailings cell (Pit 12), 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 (PM₁₀). The majority of dust generated during the development and operation of mineral sands mines is CPM, being comprised of unprocessed mineral oxide particles.

Atmospheric dispersion modelling was carried out for worst case mining scenarios, specifically the period whilst mining the pits closest to the nearest sensitive receptors (i.e. Cataby roadhouses). Results indicated that, without dust controls, there would be numerous exceedances of the Air NEPM⁴, with wind erosion from stockpiles and open areas and overburden movement the most significant contributors to potential exceedances.

Impact: Dust emissions can be harmful to human health and the environment. Elevated TSP levels can impact ambient environmental quality resulting in amenity impacts and can smother vegetation. PM₁₀ or PM_{2.5} can be drawn deep into the lungs causing human health impacts.

The Mid West region experiences a mild Mediterranean climate with hot/dry summers and mild/wet winters. The climate is strongly influenced by wind patterns, with the local area known for its strong off and onshore winds (summer sea breezes frequently reach 46 km/hr or more).

Twenty-two residents have been identified within a 4 km radius of the premises boundary, which include properties owned by the proponent, private residences and commercial properties (two roadhouses). In addition the Brand Hwy, being a primary road and major transport route, runs both through and immediately adjacent to the boundary (the Brand Hwy is considered to be a sensitive land use). Six residences have been identified as being at high risk to impact from nuisance dust during strong prevailing winds from the south to south-west, and one residence is at risk when the winds are from a north to westerly direction.

The majority of modelled exceedances were under the influence of strong easterly winds that typically occur during summer mornings. Receptors most at risk are those located adjacent to mine pits 6, 8, 9, 12 and 13, with the northern Cataby roadhouse being at the greatest risk due to the prevailing strong southerly winds.

⁴ National Environment Protection Measure for Ambient Air Quality (Air NEPM), Australian Government



Controls: Impacts to high risk receptors will be ameliorated through site-specific technical studies, landholder agreements and control measures that are additional to those used under normal operating conditions. In addition, impacts will be minimised through mine planning and progressive rehabilitation. Dust control measures are outlined in the Cataby Dust Management Plan (October 2015).

During mine construction works, dust emissions are likely to be localised and temporary. Controls include the regular watering of unsealed roads, exposed surfaces and active construction areas. Cleared areas that will not be sealed/built upon/actively used for construction will be stabilised with suitable soil binders. Vehicle movements will be restricted to construction areas.

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

- Formation of a Dust Management Working Group, to review: dust incidents and complaints, the appropriateness of internal air quality monitoring, the performance of the local-area weather forecasting, the mining schedule to identify areas that have potential to cause dust, the effectiveness of the control measures, and the dust control equipment utilisation and availability;
- Operational controls, consisting of: planned clearing with review and assessment through an internal ground disturbance permit system, the use of short-term weather forecasting to guide the timing of clearing activities and appropriate dust control measures, internal monitoring of work areas, dedicated water/slimes carts for each operational area;
- Weather forecasting, to facilitate prompt proactive dust control measures for impending changes in weather conditions, including short-term (72 hour) local forecasting of conditions to provide for early warning and preparation for potential high dust emission conditions;
- Dust emission source and engineering controls, including a focus on: wind erodible areas, overburden handling and movement, light vehicle and other traffic, dozer and grader activity, front end loader activity associated with mining, and topsoil and subsoil stripping activities.

Monitoring of ambient air quality will be ongoing over the life of mine, to validate the performance of the dust control measures. Monitoring of TSP and PM₁₀ will be undertaken at fixed locations (northern Cataby roadhouse and a background station) and will utilise real time monitoring. Data will be monitored continuously (24 hours per day) and alarm triggers will be integrated into the system to warn operators of possible exceedances. Mobile monitoring equipment will also be utilised during seasonally high wind conditions.

Risk Assessment

Managing the impacts of dust at the Cataby project will be of high priority, given that in addition to off-site receptors, there are independent, sensitive receptors located within the mine footprint. This situation is uncommon for the mining sector and will likely prove to be very challenging for the proponent, especially when considering the recommended separation distance for activities such as mineral sands mines to sensitive land uses is 1,000 – 2,000 m⁵.

The risk assessment of fugitive dust can be broken into the impacts of TSP and PM₁₀ emissions, and relevant operational scenarios (normal/abnormal operating conditions).

⁵ Guidance for the assessment of environmental factors – Separation distances between industrial and sensitive land uses, no. 3 (EPA, June 2005)



- TSP emissions (normal operating conditions)

The consequence of TSP impacting on sensitive receptors located both on- and off-site or on the Brand Hwy, 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 (could occur at some time), 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. unfavourable meteorological conditions) is Likely (probably occur in most circumstances), with a combined risk rating of Moderate.

Consequence: Minor.
Likelihood: Likely.
Risk Rating: Moderate.
- PM₁₀ emissions (normal operating conditions)

The consequence of PM₁₀ emissions impacting on sensitive receptors located both on- and off-site or on the Brand Hwy, 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 Possible (could occur at some time), with a combined risk rating of Moderate.

Consequence: Moderate.
Likelihood: Possible.
Risk Rating: Moderate.
- PM₁₀ emissions (abnormal operating conditions)

The likelihood of this consequence occurring under abnormal operating conditions (e.g. unfavourable meteorological conditions) is Likely (probably occur in most circumstances), with a combined risk rating of High.

Consequence: Moderate.
Likelihood: Likely.
Risk Rating: High.

Regulatory Controls

Ministerial Statement 720 (2005) required the implementation of the proponent's environmental management commitments for the project, which included a commitment to prepare a dust management plan prior to ground disturbance works. During the EPA's review of the project in 2015, this commitment was not included in the revised Ministerial Statement 1017, as it was considered dust could be managed via the dust management plan under the provisions of a Part V works approval and licence.

A high level of regulatory control is required through the works approval and licence as the premises does not meet the recommended separation distance to sensitive land uses, and air quality modelling indicates the potential for significant impacts to the closest sensitive receptors during strong easterly and south-westerly wind conditions.



Conditions have been added to the works approval to formalise the requirement of managing dust in accordance with the Cataby Dust Management Plan (October 2015) (W2.3.1) and the continuous monitoring of TSP and PM₁₀ emissions at fixed locations (northern Cataby roadhouse and a background location (AWS) (Table 3.2.1)).

Given the proximity to sensitive receptors (including the Brand Hwy), ambient air quality criteria (i.e. limits) has 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 PM₁₀ (human health) have been imposed at the northern Cataby roadhouse, as this is considered to be the highest risk receptor for dust emissions and an appropriate location for representing the level of impact to receptors from mining operations during the prevailing southerly winds.

The limit for TSP has been determined using reference to the *Kwinana Environmental Protection (Kwinana)(Atmospheric Wastes) Policy 1999* (Kwinana EPP), 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/m³, 24-hour average) is considered the most relevant.

The limit for PM₁₀ has been determined using reference to the National Environment Protection Measure for Ambient Air Quality (Air NEPM) for particles as PM₁₀ (50 µg/m³, 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.

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 PM₁₀ emissions impacting on sensitive receptors located both on- and off-site or on the Brand Hwy under all operating conditions is Moderate.

- TSP emissions (normal operating conditions)
Consequence: Minor.
Likelihood: Possible.
Risk Rating: Moderate.
- TSP emissions (abnormal operating conditions)
Consequence: Minor.
Likelihood: Possible.
Risk Rating: Moderate.
- PM₁₀ emissions (normal operating conditions)
Consequence: Moderate.
Likelihood: Possible.
Risk Rating: Moderate.
- PM₁₀ emissions (abnormal operating conditions)
Consequence: Moderate.
Likelihood: Possible.
Risk Rating: Moderate.



A8 Noise

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. Noise emissions also have the potential to impact on nearby fauna.

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. Screening and processing of ore will occur continuously (24 hours per day), while all other activities will generally be restricted to normal day time working hours (7:00am – 7:00pm, Monday to Saturday).

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 to occur during normal day time working hours, typically 7:00am – 7:00pm, seven days per week.

A Noise Impact Assessment carried out by SVT in February 2015 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 7 db(A) at nearby sensitive receptors, depending on the meteorological conditions and presence of tonality.

Works to establish Pit 12, which is required for the commissioning of the WCP and mining units, will also be undertaken during the works approval period. Noise emissions during this period are expected to be similar to typical day time mining operations, and this scenario has been included in the modelling to ascertain the constraints of constructing this pit during the evening and night time periods. Noise emission levels are predicted to exceed the assigned noise levels by up to 18 dB(A) at nearby receptors, depending on the meteorological conditions and presence of tonality.

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.

Twenty-two noise sensitive receptors have been identified within a 4 km radius of the premises boundary (excluding 2 receptors within the mine path to be relocated and 3 residences owned by the proponent to be vacated). Three receptors are located within the premises boundary and within close proximity to the mine voids, including two roadhouses, both of which have on-site residential accommodation for workers (one is also operating a licensed hotel/motel). These receptors are the highest risk of being impacted by noise emissions during mine construction works.



Controls: The proponent has prepared a Construction Noise Management Plan (CNMP, Version 3, December 2015) to outline its approach to managing noise emissions arising from mine construction works. Management measures identified in the plan include:

- Pre-shift planning of works, to ensure the noisiest activities are undertaken during daytime hours or when attenuating wind conditions are favourable;
- Use of a predictive tool to predict noise levels at receptors given specific plant and equipment configurations;
- Site design and planning;
- Control at source, e.g. noise bafflers, exhaust mufflers, modification of engines; and
- Continuously monitoring noise from two fixed monitoring locations, to record noise levels and tonality to allow real time data for site management.

The proponent has also committed to providing noise attenuation of residential properties if noise mitigation and management measures cannot limit noise to below the residential noise limits, and entering into amenity agreements with owners and occupiers of residences within close proximity to the mine.

Risk Assessment

Although a number of noise mitigation and management measures have been proposed, DER considers it highly unlikely that, even if fully implemented, the measures will be able to bring the noise levels during mine construction works into full compliance with 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 localised, short-term impact, and causing concern and complaints to a small population (Minor). The likelihood of this consequence occurring under worst case conditions⁶ is Almost Certain (expected to occur in most circumstances), with a combined risk rating of High.

Consequence: Minor.

Likelihood: Almost Certain.

Risk Rating: High.

Regulatory Controls

Noise has been identified as a key environmental factor by the EPA in its assessment of the proposal⁷, as full compliance with the assigned noise levels specified in the Noise Regulations cannot be demonstrated. The EPA noted the high risk of noise non-compliance; however recognised the proponent's commitments and considered if agreement was made with, and there being no objection from, nearby noise sensitive receptors, the project could be managed to meet its objective of ensuring that noise resulting from the construction and operation of the mine will comply with the Noise Regulations and acceptable standards. Conditions have been imposed through Ministerial Statement 720 (and maintained in Statement 1017) to ameliorate the impacts of noise, including the submission and implementation of a Noise Management Plan (in consultation with DER) prior to ground-disturbing activities. To avoid unnecessary duplication, conditions relating to noise have not been included on the works approval.

Construction work is proposed between 7:00am and 7:00pm, seven days a week. Under Regulation 13 of the Noise Regulations, noise from construction work on construction sites need not comply with the

⁶ When winds are strongest, directly downstream from operating machinery, and mobile machinery working at full capacity in the pit located closest to a receptor.

⁷ EPA Bulletin 1212 (2005)



assigned noise levels when the work is conducted between 7:00am and 7:00pm from Monday to Saturday (excluding public holidays), or carried out in accordance with a CNMP approved by the Chief Executive Officer of DER. As mentioned, the proponent has submitted a construction noise management plan, as construction work is proposed on Sundays and public holidays. This plan was approved by DER on 6 January 2016.

For noise to be exempted under Regulation 13, the site 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 construction work for the exemption to apply. It is noted that some activities proposed in the CNMP 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 principle activity on the site becomes mining operations and not the carrying out of construction work.

Residual Risk

With the above regulatory controls imposed through Ministerial Statement 1017, which includes the implementation of the noise control measures listed above and reaching agreement with nearby residences through amenity agreements, the likelihood of noise during mine construction works causing concern and complaints to nearby residents has been downgraded to Likely (will probably occur in most circumstances). The residual risk rating has therefore been downgraded to Moderate.

Consequence: Minor.

Likelihood: Likely.

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.). Ore processing is proposed for 24 hours per day, seven days per week, with mining expected to occur during normal day time working hours, typically 7:00am – 7:00pm, seven days per week.

A Noise Impact Assessment carried out by SVT in February 2015 indicates the noise emission levels from mining operations are predicted to exceed the assigned noise levels by up to 18 db(A) at nearby sensitive receptors, depending on the operational scenario, meteorological conditions, time of day and presence of tonality.

Impact: The physical and emotional impact of noise emissions during mine operations would be comparable to the impacts listed for mine construction works.

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 mining process whereby new pits are opened and as the mine progresses, old pits are backfilled. As such, DER considers that, 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.

Controls: The proponent has prepared a Noise Management Plan (NMP, Version 2, September 2015) to outline its approach to managing noise emissions arising from mining



operations. Management measures identified in the plan are similar to those listed in the CNMP (see above for construction works).

Risk Assessment

Although a number of noise mitigation and management measures have been proposed, DER considers it highly unlikely that, even if fully implemented, the measures will be able to bring the project into full compliance with the assigned noise levels specified in the Noise Regulations, 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 mining operations would be localised, short-term impact, and causing concern and complaints to a small population (Minor). The likelihood of this consequence occurring under worst case conditions⁸ is Almost Certain (expected to occur in most circumstances), with a combined risk rating of High.

Consequence: Minor.

Likelihood: Almost Certain.

Risk Rating: High.

Regulatory Controls

As mentioned, noise has been identified as a key environmental factor by the EPA and conditions have been included in Ministerial Statement 1017 to require the implementation of the NMP, which includes noise control measures, amenity agreements, continuous real time noise monitoring with management triggers and contingency actions. To avoid unnecessary duplication, conditions relating to noise are not proposed for the Part V licence.

Residual Risk

With the above regulatory controls imposed through Ministerial Statement 1017, which includes the implementation of the noise control measures listed above and reaching agreement with nearby residences through amenity agreements, the likelihood of noise during mining operations causing concern and complaints to nearby residents has been downgraded to Likely (will probably occur in most circumstances). The residual risk rating has therefore been downgraded to Moderate.

Consequence: Minor.

Likelihood: Likely.

Risk Rating: Moderate.

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⁸ When winds are strongest, directly downstream from operating machinery, and mobile machinery working at full capacity in the pit located closest to a receptor.