GOVERNMENT OF WESTERN AUSTRALIA

Environmental Protection Authority

EPA Referral Form

Form for the referral of a proposal to the Environmental Protection Authority under Section 38 of the *Environmental Protection Act 1986*

Referrer information			
Who is referring this proposal?		X Proponent	
Name: Ivan Vella		**Signature:**	
Position	Director	Organisation	Robe River Mining Co. Pty. Limited
Email			
Address	152 – 158 St Georges Terrace		
	Perth	WA	6000
Date	June 2017		

Does the referrer request that the EPA treat any part of the proposal information in the referral as confidential? *Provide confidential information in a separate attachment.*	X No

Referral declaration for organisations, proponents and decision-making authorities:

I, Ivan Vella, declare that I am authorised to refer this Proposal on behalf of Robe River Mining Co. Pty. Limited and further declare that the information contained in this form is true and not misleading.

Part A: Proponent and proposal description

Proponent information

Name of the proponent/s (including Trading Name if relevant)	Robe River Mining Co. Pty. Limited
Australian Company Number(s)	008 694 246
Contact for the proposal (if different from the referrer) *Please include: name; physical address; phone; and email.*	Melinda Brand Principal Advisor Environmental Approvals Rio Tinto 152-158 St Georges Tce, Perth WA 6000 Telephone (08) 6211 6991 Email: Melinda.brand@riotinto.com
Does the proponent have the legal access required for the implementation of all aspects of the proposal? *If yes, provide details of legal access*	X Yes Legal access to the Development Envelope is via ML248SA (section 104 and a portion of section 103) under the *Iron Ore (Robe River) Agreement Act 1964*.

authorisations / agreements / tenure. *If no, what authorisations / agreements / tenure is required and from whom?*	The Proposal overlaps with the co-existing Land Administration Act 1997 tenure: • Pastoral Lease N49500 held by Yarraloola Pastoral Station. Yarraloola Station is Robe Joint Venture (JV) controlled entity. • Pastoral Lease N49492 held by Yalleen Pastoral Station. Yalleen Station is held by Yalleen Pastoral Co. Pty. Limited which is a Robe Joint Venture (JV) controlled entity. Grants of additional tenure easements will be required for sections of infrastructure such as powerlines outside the existing ML248SA.
Proposal type	
What type of proposal is being referred? For a change to an approved proposal please state the Ministerial Statement number/s (MS No./s) of the approved proposal For a derived proposal please state the Ministerial Statement number (MS No.) of the associated strategic proposal	X significant – new proposal ☐ significant – change to approved proposal ☐ proposal under an assessed planning scheme ☐ strategic ☐ derived
For a significant proposal: • Why do you consider the proposal may have a significant effect on the environment and warrant referral to the EPA?	The Proposal may have a significant effect on the environment in the following ways: • Clearing of up to 2,200 ha of native vegetation generally in Good to Excellent condition. • Priority flora located in the Development Envelope including: - *Triodia* sp. Robe River [M.E. Trudgen et al. MET 12367] P3. - *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) P3. - *Rhynchosia bungarensis* P4. • Priority Ecological Communities occur within the Development Envelope: - *Subterranean invertebrate communities of mesas in the Robe Valley region* (P1). - *Subterranean invertebrate community of pisolitic hills in the Pilbara* (P1). • Removal of subterranean fauna habitat as a consequence of mining. • Dewatering of mine pits. • Surface discharge of surplus water.

For a proposal under an assessed planning scheme, provide the following details: • Scheme name and number For the Responsible Authority: • What new environmental issues are raised by the proposal that were not assessed during the assessment of the planning scheme? • How does the proposal not comply with the assessed scheme and/or the environmental conditions in the assessed planning scheme?	N/A
Proposal description	
Title of the proposal	Mesa H Proposal
Name of the Local Government Authority in which the proposal is located.	Shire of Ashburton
Location: a) street address, lot number, suburb, and nearest road intersection; or b) if remote the nearest town and distance and direction from that town to the proposal site.	16km south west of the township of Pannawonica (refer to Figure 1-1 of the Supplementary Information document)
Proposal description – including the key characteristics of the proposal *Provide as an attachment to the form*	Please refer to the attached supporting information document.
Have you provided electronic spatial data, maps and figure in the appropriate format? *Refer to instructions at the front of the form*	X Yes
What is the current land use on the property, and the extent (area in hectares) of the property?	The Proposal is located in the Shire of Ashburton. Existing land uses include pastoral activities (Yarraloola and Yalleen Stations), mineral exploration, mining activities and cultural / recreational activities (predominantly by Traditional Owners) such as camping, fishing and hunting.
Have you had pre-referral discussions with the OEPA? If so, quote the reference number and/or the OEPA contact.	Yes. OEPA contact is Peter Tapsell.
Part B: Environmental impacts	
Environmental factors	
What are the likely significant environmental factors for this proposal?	☐ Benthic Communities and Habitat ☐ Coastal Processes ☐ Marine Environmental Quality ☐ Marine Fauna

	X Flora and Vegetation ☐ Landforms X Subterranean Fauna ☐ Terrestrial Environmental Quality X Terrestrial Fauna X Hydrological Processes X Inland Waters Environmental Quality ☐ Air Quality X Social Surroundings ☐ Human Health

For the environmental factors identified above, complete the following table, or provide the information in a supplementary report. Please be sure to complete a separate table per factor identified above.

Potential environmental impacts

1	***EPA Factor***	Please refer to the attached supporting information document.
2	***EPA policy and guidance*** - What have you considered and how have you applied them in relation to this factor?	
3	***Consultation*** – Outline the outcomes of consultation in relation to the potential environmental impacts	
4	***Receiving environment*** - Describe the current condition of the receiving environment in relation to this factor.	
5	***Proposal activities*** – Describe the proposal activities that have the potential to impact the environment	
6	***Mitigation*** - Describe the measures proposed to manage and mitigate the potential environmental impacts.	
7	***Impacts*** - Assess the impacts of the proposal and review the residual impacts against the EPA objective.	
8	***Assumptions*** - Describe any assumptions critical to your assessment *e.g. particular mitigation measures or regulatory conditions.*	

Part C: Other approvals and regulation

State and Local Government approvals

Is rezoning of any land required before the proposal can be implemented? If yes, please provide details.	X No
If this proposal has been referred by a decision-making authority, what approval(s) are required from you?	

Proposal activities e.g. clearing, dewatering, mining, processing, dredging,	**Land tenure/access** e.g. Crown land – LA Act, Min Act, CALM Act specify type	**Type of approval** e.g. Native Vegetation Clearing Permit, licence, mining proposal,	**Legislation regulating the activity** e.g. *EP Act 1986* – Part V, *RiWI Act 1914*, *Mining Act 1979*
Clearing	State Agreement (ML248SA)	Native Vegetation Clearing Permit	*EP Act 1986* – Part V
Dewatering	State Agreement (ML248SA)	Licence	*RiWI Act 1914*
Mining	State Agreement (ML248SA)	State Agreement	*Iron Ore (Robe River) Agreement Act 1964*
Heritage	State Agreement (ML248SA)	Section 18 consent to disturb a protected site	*Aboriginal Heritage Act 1972*
Construction and operation of plant, camp and discharge of surplus water	State Agreement (ML248SA)	Works Approval and Licence	*EP Act 1986 – Part V*
Closure	State Agreement (ML248SA)	Closure Plan	*Mining Act 1978*

Commonwealth Government approvals

Does the proposal involve an action that may be or is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)?	X Yes
Has the proposed action been referred? If yes, when was it referred and what is the reference number (EPBC No.)?	X No
If referred, has a decision been made on whether the proposed action is a controlled action? If 'yes', check the appropriate box and provide the decision in an attachment.	X No ☐ Decision – controlled action ☐ Decision – not a controlled action
Do you request that this proposal be assessed under the bilateral agreement or as an accredited assessment?	X Yes - Bilateral X Or Yes - Accredited
Is approval required from other Commonwealth Government/s for any part of the proposal? *If yes, describe.*	X No Approval:

Rio Tinto

Section 38 referral – supporting information

Mesa H Proposal

RTIO-HSE-0310732

Robe River Mining Co. Pty. Limited

152-158 St Georges Terrace, Perth

GPO Box A42, Perth, WA 6837

June 2017

Rio Tinto

Disclaimer and Limitation

This report has been prepared by Rio Tinto's Iron Ore Group (Rio Tinto), on behalf of Robe River Mining Co. Pty. Limited (the Proponent), specifically for the Mesa H Proposal. Neither the report nor its contents may be referred to without the express approval of Rio Tinto, unless the report has been released for referral and assessment of proposals.

Document Status					
Rev	Author	Reviewer/s	Date	Approved for Issue	
				To Whom	Date
A	M Brand	Study team	8 May 2017		
B	M Brand	J English, F Sinclair	30 May 2017		
1	M Brand	T Savage P Royce H Scott C Richards	June 2017	OEPA	June 2017

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Tables

1. INTRODUCTION

Robe River Mining Co. Pty. Limited (the Proponent) operates the Robe Valley mining operations, which includes iron ore mines at Mesa J, Mesa K, Mesa A and Warramboo. The Mesa J and Mesa K mines are located approximately 16 km south west of Pannawonica in the Pilbara region of Western Australia (Figure 1-1). The Mesa H deposit is located adjacent to the Mesa J mine. The Proponent is seeking to develop the Mesa H deposit to sustain iron ore production from the Robe Valley.

The following terminology is used throughout this document:

- **Mesa J operation** – The Mesa J mine as approved under Ministerial Statement 208 (MS 208)
- **Mesa H deposit –** pisolite iron ore formation occurring as a partial mesa landform (also known as a Channel Iron Deposit).
- **Proposal** – the proposed activities (as detailed in Section 3) incorporating above water table (AWT) and below water table (BWT) mining of the Mesa H deposit.
- **Development Envelope** - the proposed boundary within which the Proposal will be contained.

1.1 Purpose of this Document

This document has been prepared to support the referral of the Proposal under section 38 of the *Environmental Protection Act 1986* (EP Act). It provides information on the Proposal characteristics, existing environment, potential environmental impacts and proposed management commitments. This document has been prepared in accordance with Part IV Division 1 of the EP Act and the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016*.

1.2 Proponent Details

The Proponent is the manager for the Robe River Iron Associates joint venture (RRIA) which is an unincorporated joint venture comprising the following participants:

- Robe River Mining Co. Pty. Limited (30% share);
- North Mining Limited (35% share);
- Mitsui Iron Ore Development Pty Ltd (20% share);
- Cape Lambert Iron Associates, a partnership carried on by Nippon Steel & Sumitomo Metal Australia Pty Ltd, Nippon Steel & Sumikin Resources Australia Pty Ltd and Mitsui Iron Ore Development Pty Ltd (5% share); and
- Pannawonica Iron Associates, a partnership carried on by Nippon Steel & Sumitomo Metal Australia Pty Ltd, Nippon Steel & Sumikin Resources Australia Pty Ltd (10% share).

The Rio Tinto contact person in relation to the environmental approvals process for the Proposal is:

Melinda Brand

Rio Tinto: Principal advisor environmental approvals

Telephone: (08) 6211 6991

Email: melinda.brand@riotinto.com

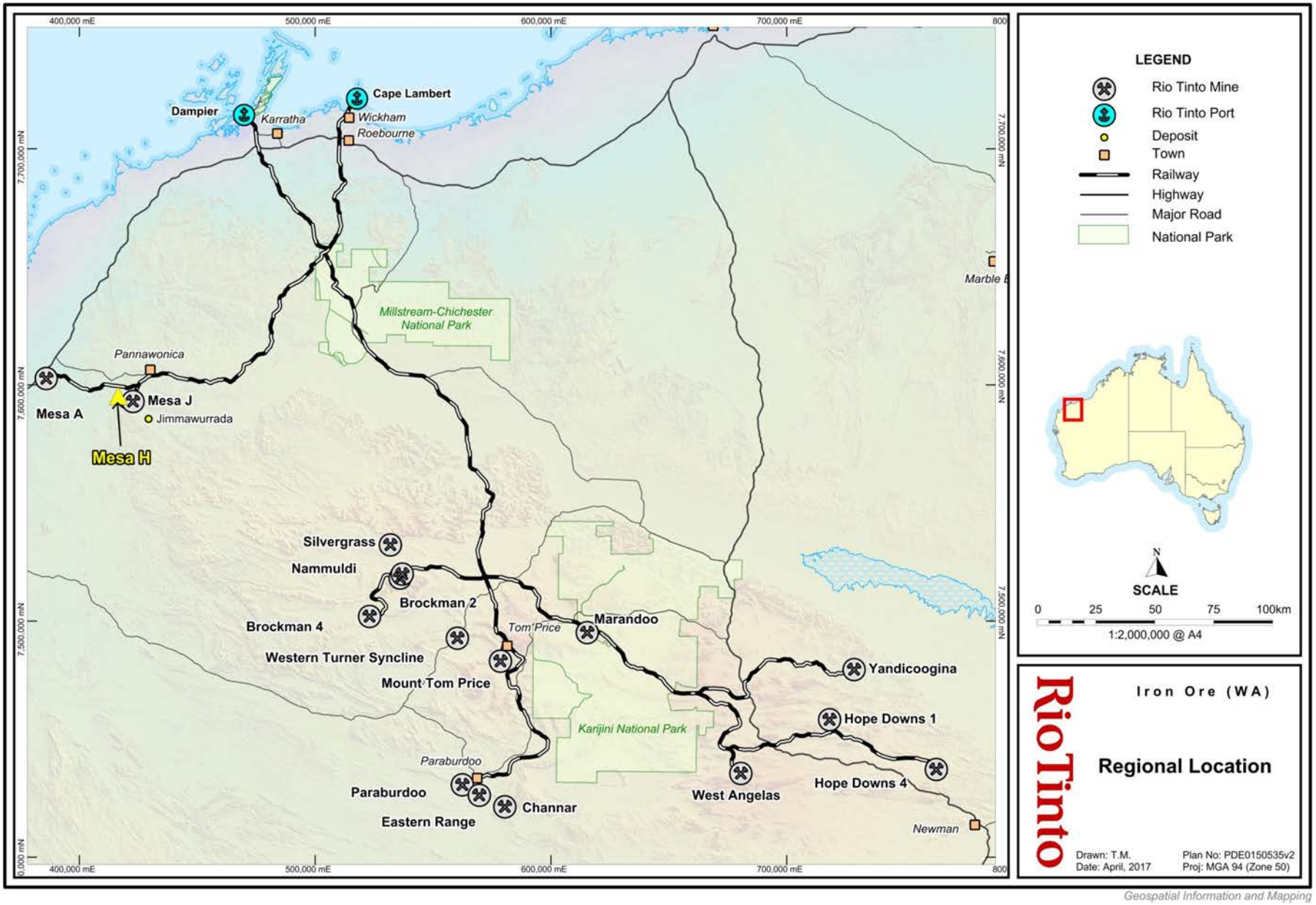

Figure 1-1: Regional Location

2. LAND USE AND TENURE

2.1 Land Use

The Proposal is located in the Shire of Ashburton, approximately 16 km south west of Pannawonica. Existing land uses in the Development Envelope include: pastoral activities (Yarraloola and Yalleen Stations); mineral exploration; mining activities; and cultural / recreational activities (predominantly by Traditional Owners) such as camping, fishing and hunting. The mesa landform / profiles of the Robe Valley are also used by Traditional Owners as landmarks when travelling though the countryside.

2.2 Tenure

The Robe Valley mining operations, including this Proposal, are predominantly located within the State Agreement Mineral Lease ML248SA granted pursuant to the *Iron Ore (Robe River) Agreement Act 1964*. ML248SA is appropriate tenure for mining and mining related infrastructure.

Existing tenure in and near the Development Envelope is shown in Figure 2-1. The Proposal pits, dumps and the majority of infrastructure are located within ML248SA (section 104 and a portion of section 103). A powerline to the east of Mesa J will require new tenure under the *Mining Act 1978*.

The main co-existing LAA tenure in the Development Envelope includes the Yarraloola Pastoral Station (Lease N49500) and the Yalleen Pastoral Station (Lease N49492). These pastoral leases are held by the RRIA.

2.3 Native Title

The Proposal lies within the Kuruma Marthudunera (K&M) Native Title Claim (WCD2016/006). The Proponent has a Participation Agreement and Indigenous Land Use Agreement with the K&M that includes an established consultation framework and ongoing engagement on relevant aspects of the Proponent's operations. These Agreements set obligations for processes such as: land access; tenure acquisition; heritage surveys; environmental management; mining benefit payments and reporting; and consultation and communication between the parties.

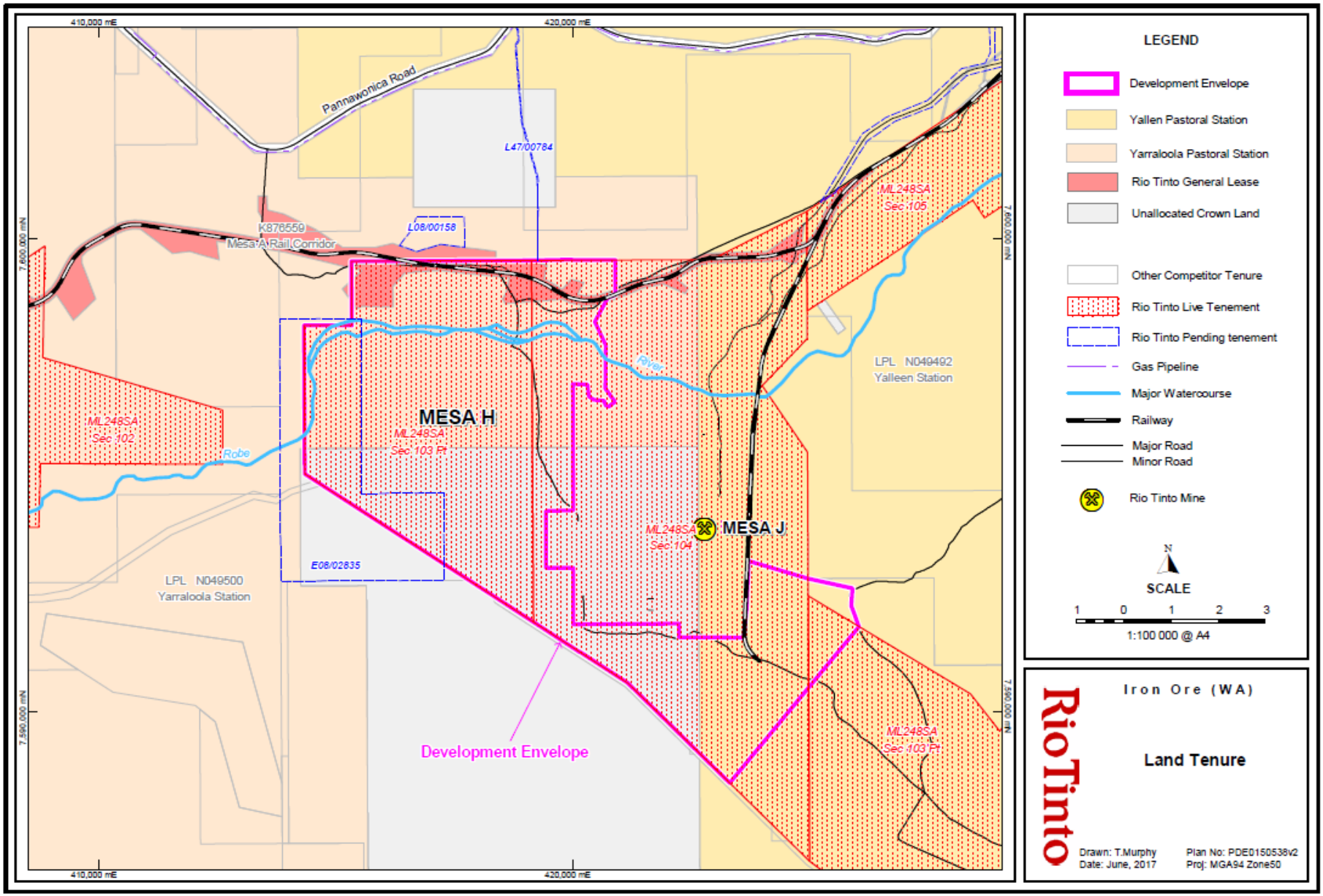

Figure 2-1: Land Tenure

3. MESA H PROPOSAL

3.1 Overview

A summary of the Proposal is provided in Table 3-1.

Table 3-1: Summary of the Proposal

Proposal Title	Mesa H Iron Ore Project
Proponent Name	Robe River Mining Co. Pty Limited
Short description	The Proposal is located approximately 16 km south west of Pannawonica in the Pilbara region of Western Australia, adjacent to the existing Mesa J mine. The Proposal includes development of above and below water table open cut iron ore pits and associated infrastructure, including water management infrastructure.

The Proposal consists of the following items and activities:

- **Mine pits** - development of open AWT and BWT iron ore pits
- **Dewatering and dewatering infrastructure** – including but not limited to bores, pipelines, and discharge outlet(s).
- **Surplus water management** – including but not limited to use in processing, on-site use and controlled discharge to the Robe River and tributaries.
- **Mineral waste management** – including but not limited to backfilling, ex-pit waste dumps, low grade ore dumps, topsoil and sub-soil stockpiles.
- **Processing facilities** – this Proposal will be supported by the existing processing facilities at Mesa J but may require other processing facilities including but not limited to waste fines storage facilities.
- **Support facilities** – including but not limited to workshops, power supply infrastructure, hydrocarbon storage, laydown areas, offices and waste water treatment plants.
- **Infrastructure for surface water management** – including but not limited to surface water diversion drains, levees and culverts.
- **Linear infrastructure** – including but not limited to heavy vehicle and light vehicle access roads, upgrades to existing vehicle access roads; pipelines and power (including sub-stations) and communications distribution networks.
- **Water supply** – utilising groundwater abstracted for dewatering, surface water that reports to pits, the existing Mesa J borefield (Southern Cutback borefield) and potentially additional bores.

Mined and processed ore will be railed to Rio Tinto's port operations at Dampier and/or Cape Lambert via the existing rail infrastructure.

The preliminary key characteristics for the Proposal are provided in Table 3-2.

An indicative conceptual mine layout is shown in Figure 3-1. Mine planning and engineering for the Proposal is currently still in progress therefore this layout is subject to change.

Table 3-2: Preliminary key characteristics of the Proposal

Element	Location	Proposed Extent
Physical Elements		
Mine and Associated Infrastructure	Figure 3-1	Clearing of no more than 2,200 ha within a Development Envelope of 4,930 ha.
Operational Elements		
Pit dewatering	-	Abstraction of no more than 10 GL/a of groundwater(including surface water run-off).
Surplus water management	-	Surplus water management options include use on site, and controlled discharge to the Robe River and tributaries.
Water supply	-	Supplied from an existing borefield within a current licence limit of 30 GL/a and surface water harvesting.
Ore Processing (waste)	-	In-pit disposal of waste fines at Mesa H and the adjacent Mesa J mine into in-pit waste fines storage facilities.

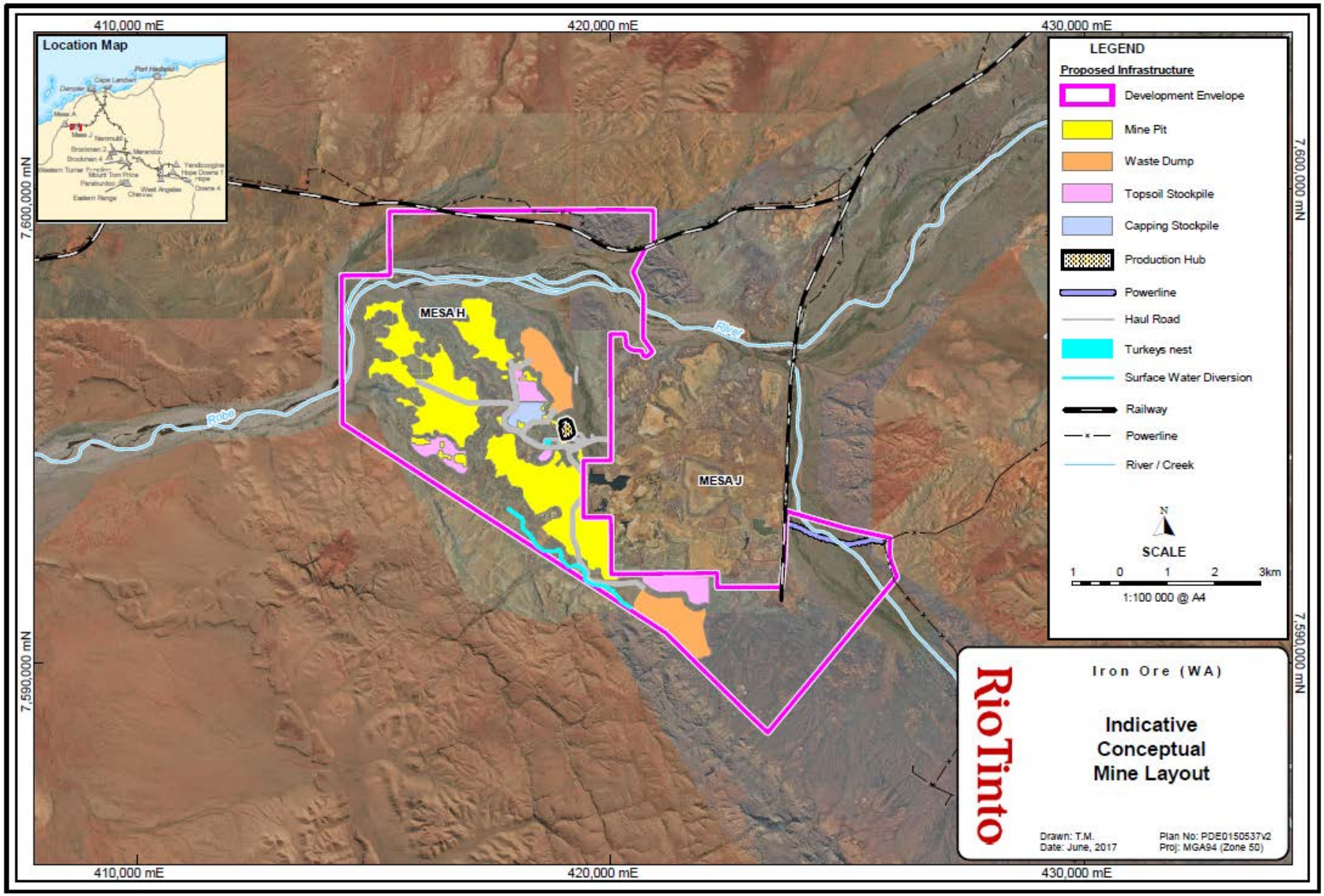

Figure 3-1: Indicative Conceptual Mine Layout

3.2 Proposal Description

3.2.1 Mining

The Mesa H deposit is a continuation of the Robe Pisolite iron ore deposit present at Mesa J, known more generally as a Channel Iron Deposit (CID).

The Proposal includes development of new open cut mine pits at Mesa H with approximately 20% of ore proposed for mining occurring BWT.

Ore will be mined using open cut mining methods comprising conventional drill, blast, load and haul as currently used in the adjacent Mesa J operations.

3.2.2 Exclusions

Exclusions from the scope of the Proposal comprise the following:

- Activities and additional infrastructure at the Mesa J operation approved under MS 208.
- Low impact activities within the Development Envelope prior to Part IV approval of the Proposal (to be subject to relevant provisions under Part V [Land Clearing] of the EP Act), including drilling and associated activities (such as upgrades to existing roads/tracks) for the purposes of resource evaluation, geotechnical assessment and hydrogeological investigation.
- Establishment of a construction camp to support the construction phase of the Proposal (to be subject to relevant provisions under Part V [Land Clearing and Works Approvals/Licensing] of the EP Act).
- Establishment of temporary services (communications, water supply, power), temporary concrete batch plant, site offices, access roads, laydown areas, and borrow pits to support establishment of a construction camp (to be subject to relevant provisions under Part V [Land Clearing and Works Approval/Licensing] of the EP Act).
- Facility upgrades in Pannawonica to support the expanded workforce.
- Power network upgrades at Pannawonica, and a 9 km section of overhead power line between the Pannawonica switchyard and the Mesa A/J tee-off (to be subject to relevant provisions under Part V [Land Clearing and Works Approval/Licensing] of the EP Act).

3.2.3 Ore handling and transport

Haul roads will be developed to enable haulage of ore from the Proposal to the Mesa J operation for dry and wet processing. Ore will then be transported to the ports via the existing Mesa J rail line.

3.2.4 Mineral waste

The Proposal mine plan has incorporated a pit sequence that enables progressive in-pit backfill of the majority of waste, using both the Proposal and the adjacent Mesa J pits. Where pit sequencing and scheduling do not allow waste to be used for backfilling, out-of-pit waste dumps will be utilised. Currently, two locations have been identified for out-of-pit waste dumps that minimise direct impact to significant environmental and heritage areas. Out-of-pit storage for competent material, low grade ore, sub-soil and topsoil will also be required.

Wet processing of low grade ore from the Proposal will generate waste fines. The mine plan will incorporate the use of pits within the Development Envelope and at the Mesa J operation for in-pit waste fines storage facilities (WFSF) over the life of the Proposal.

3.2.5 Surface water management

Surface water management will be required for the watercourses draining local catchments from the Buckland Hills south of the Proposal which intersect the southern pits. A drainage diversion is required during operations south of the southern pits, directing flow to the watercourse between the northwest and southern pits, and subsequently into the Robe River. The diversion will not be maintained post closure.

3.2.6 Pit dewatering

Approximately 20% of the ore proposed for mining at Mesa H is below the current water table. Dewatering to access the BWT ore is therefore required at an average rate of 3 GL/a and peak rate of 10 GL/a. Dewatering is currently expected to commence in approximately 2025 and will be via sump pumping, powered by diesel generators. Groundwater abstracted for dewatering purposes will contribute to meeting operational demands for the Proposal and Mesa J operation, primarily wet processing, however the timing for BWT pit dewatering and average dewatering rate will not be sufficient to meet these processing demands, hence an additional water supply will be required for the Proposal as detailed in Section 3.2.7.

3.2.7 Water supply and surplus water discharge

Water is required for the Proposal to enable:

- construction activities;
- general mining activities;
- dust suppression on haul roads; and
- potable water supply.

Mine pit dewatering for the Proposal of an average of 3 GL/a (peak up to 10 GL/a) will not be sufficient to meet operational demands, requiring continued operation of the existing Mesa J water supply borefield (Southern Cutback borefield) located immediately to the south of the Mesa J operations. The total abstraction from this water supply borefield (to include the requirements for this Proposal) is not expected to require an increase to the current abstraction licence limit.

The site water demand for the Proposal and continuation of the Mesa J operation is estimated to be approximately 11 GL/a, which is similar to the existing Mesa J water demand.

Based on water balance estimates, and depending on fluctuations in site water usage requirements and seasonal fluctuations, limited surplus water is expected to be generated from mine pit dewatering. After large rainfall events however, significant ponding would result in a requirement to discharge. In these circumstances, and combined with temporal variability in mine water use, up to a peak of 10 GL/a may be required to be discharged.

Any surplus water discharge will be predominantly via the existing Mesa J operation discharge points, in Jimmawurruda Creek east of Mesa J or West Creek, between the Proposal and the Mesa J operation. Additional discharge points may be established if required, pending further hydrological studies to support options to manage the identified values of the Robe River ecosystem.

3.2.8 Mine support facilities and infrastructure

Additional power supply to the Mesa J operation is required as part of the Proposal, comprising a powerline of approximately 2.5 km in length from the existing Coastal Water Supply powerline to Mesa J (Figure 3-1).

A production hub will be established at the Proposal comprising: truck park up; laydown; offices; ablutions; waste water treatment plant; and other facilities as required to support the operation. A power line will connect the production hub to the Mesa J power network.

A turkey's nest will be established near the production hub to provide water for dust suppression.

Communications systems will be extended to the Proposal including installation of fibre optic cables.

The Proposal will utilise the existing Mesa J rail infrastructure.

3.2.9 Workforce

The Proposal will be operated as an extension to the existing Mesa J operation and will require an increase in the operational workforce. The workforce will continue as mixed residential / FIFO workforce, housed in existing accommodation in Pannawonica. Some facilities in Pannawonica will be upgraded and expanded (not part of this Proposal).

The construction workforce is proposed to be accommodated in a 'dry hire' mobile construction camp north of the Proposal (not part of this proposal).

3.2.10 Timing

Under the current project schedule, construction activities are planned to commence in Quarter 4 2018 once all required internal and external approvals are granted.

4. ENVIRONMENTAL STUDIES

Environmental baseline studies and compliance monitoring have been completed in the vicinity of the Development Envelope as described in Table 4-1.

Table 4-1: Environmental studies completed in the vicinity of the Development Envelope

Study	Description
Flora and vegetation	
Biota Environmental Sciences (2011). *Baseline Flora and Vegetation Assessment of Robe Valley Mesas (Mesas B, C, D, E, F, H and I)*. Unpublished report prepared for Rio Tinto Iron Ore, April 2011.	Survey conducted in October 2010 documenting flora, vegetation units and conservation listed flora in the Development Envelope.
Astron (2016*). Mesa H Level 2 Vegetation and Flora Assessment.* Unpublished report prepared for Rio Tinto Iron Ore, May 2016.	Surveys conducted in September / October 2014 and May and July 2015 documenting vegetation units and conservation listed flora in the Development Envelope.
Astron (2016*). Mesa H Riparian Vegetation Baseline Monitoring.* Unpublished report prepared for Rio Tinto Iron Ore, June 2016.	Monitoring transects established across riverine vegetation in the Robe River in May-June 2016.
Astron (2016) *Mesa H Riparian Community Assessment*. Unpublished report prepared for Rio Tinto Iron Ore, June 2016.	Level 2 vegetation and flora assessment of the Robe River riparian community, and a Level 1 fauna assessment desktop assessment, including database searches and literature review of available resources, vegetation and flora assessment, fauna and fauna habitat assessment and baseline aquatic assessment.
Rio Tinto (2017). *Assessment of Groundwater Dependent Vegetation distribution on the Robe River - Targeted Riparian Vegetation Survey.* Unpublished report prepared by Rio Tinto Iron Ore, May 2017.	Detailed survey and spatial mapping of the distribution of Robe River Groundwater Dependent Vegetation (GDV). Interpretation of the significance and sensitivity of these communities to potential hydrological change – providing an interpreted risk map throughout the Development Envelope and immediate surrounds.
Other	
Various targeted surveys associated with Rio Tinto exploration and pastoral activities.	Flora/vegetation and fauna surveys conducted in localised areas subject to Native Vegetation Clearing Permit applications.
Terrestrial fauna	
Streamtec (1991 - 2016). Aquatic Ecosystems Study (annual monitoring).	Annual aquatic ecosystems monitoring survey to assess potential environmental impacts of the Mesa J Operation on the adjacent and downstream aquatic ecosystem. The survey is an integrated assessment of biological parameters including aquatic fauna (macroinvertebrates and fish), channel/pool morphology, riparian vegetation condition and water quality.

Study	Description
Biota Environmental Sciences (2011). *Robe Valley Mesas Fauna Report*. Unpublished report prepared for Rio Tinto Iron Ore, March 2011.	Survey conducted in October 2010 documenting terrestrial fauna, fauna habitats, species of conservation significance and habitats that may require specific management.
Astron (2015). *Level 2 Terrestrial Fauna Surveys: Mesa H*. Unpublished report prepared for Rio Tinto Iron Ore, November 2015.	Surveys conducted in May and September 2015 documenting terrestrial fauna, fauna habitats, species of conservation significance and habitats that may require specific management.
Astron (2016). *Mesa H Ghost Bat, Macroderma gigas – Contextual Study.* Unpublished report prepared for Rio Tinto Iron Ore, June 2016.	Contextual analysis for the conservation significant Ghost Bat (*Macroderma gigas*) within the vicinity of the Mesa H Development Envelope, including desktop review and field survey involving mapping of potential habitat and targeted survey for the Ghost Bat.
WRM (2017) Mesa H Project: Baseline Aquatic Ecosystem Survey. Wet Season Sampling 2016. Unpublished report prepared for Rio Tinto Iron Ore, April 2017.	Baseline wet season sampling program undertaken to document the current ecological condition of the Robe River for aquatic ecosystems, with a focus on permanent and semi-permanent pools and sampling of sites upstream and downstream of Mesa H.
Bat Call WA (2017). *Robe Valley Mesa H Ghost Bat roost cave assessment.* Unpublished report prepared for Rio Tinto, April 2017.	Extensive search for Ghost Bat presence at Mesa H conducted in April 2017, including assessment of the conservation value of caves associated with the presence of Ghost Bats.
Bat Call WA (2017). *Robe Valley Mesa A to Mesa 2405A, assessment of mining on Ghost Bat presence and activity.* Unpublished report prepared for Rio Tinto, April 2017.	Assessment of impact of mining on Ghost Bat viability in the broader Robe valley including a desktop and field review of historical mined areas, current mining operations and proposed mining developments.
Subterranean fauna	
Biota Environmental Sciences (2006). Mesa A and Robe Valley Mesas Troglobitic Fauna Survey. Unpublished report prepared for Robe River Iron Associates, March 2006).	Surveys conducted November 2004 to January 2005, April to May 2005, July to September 2005 documenting subterranean fauna and assessing subterranean fauna habitat.
Biota Environmental Sciences (2017). *Mesa H Subterranean Fauna Assessment.* Unpublished report prepared for Rio Tinto.	Surveys conducted June to August 2015 and August to October 2015 documenting subterranean fauna and assessing subterranean fauna habitat.
Hydrological Processes and Inland Waters Environmental Quality	
Rio Tinto (2016) *Mesa H Chemistry and Isotopes.* Unpublished report prepared by Rio Tinto Iron Ore, 2016.	Groundwater and surface water chemical and isotope analysis aiming to assess groundwater dependency of the Robe River pools.
Rio Tinto (2016) *Mesa H Chemistry and Isotopes.* Unpublished report prepared by Rio Tinto Iron Ore, 2016.	Groundwater and surface water chemical and isotope analysis aiming to assess groundwater dependency of the Robe River pools.
Rio Tinto (2016). *Mesa H 2016 Pre-Feasibility Study Hydrogeological Drilling Program Completion Report.* Unpublished report prepared by Rio Tinto Iron Ore, 2016.	Report detailing drilling and installation of 19 monitoring bores and 4 water bores, and test pumping of all completed water bores.
Rio Tinto (2016). *Mesa H Hydrogeological Conceptual Model Report.* Unpublished report prepared by Rio Tinto Iron Ore, 2016.	Mesa H hydrogeological conceptual model report to support the development of the groundwater numerical model.

Study	Description
Rio Tinto (2016). *Mesa H Dewatering, Water Supply and Impact Assessments*. Unpublished report prepared by Rio Tinto Iron Ore, 2016.	Groundwater numerical model to support the Mesa H Proposal assessing dewatering requirements, water supply strategy and impact prediction.
Rio Tinto (2016). *AMD Risk Assessment Summary for the Robe Valley.* Unpublished report prepared by Rio Tinto Iron Ore, 2016.	A review of the AMD risk assessment for the Robe Valley including Mesa H.
Rio Tinto (2016). *Mesa H Order of Magnitude Design Flood Estimation and Floodplain Mapping.* Unpublished report prepared by Rio Tinto Iron Ore, Feb 2016.	Investigation to provide design flood estimates and floodplain mapping for the Mesa H deposit to inform the development of surface water management options.
Rio Tinto (2017). *Mesa H PFS Surface Water Management.* Unpublished report prepared by Rio Tinto Iron Ore, March 2017.	Study describing the interaction between natural surface water runoff, the local environment and the Mesa H study area and proposed water management measures.
Rio Tinto (2017). *Surplus water discharge extent assessment: Mesa H*. Unpublished report prepared by Rio Tinto Iron Ore, March 2017.	Study was to estimate the extent of impact of surplus water discharge along the proposed watercourses based on discharge location options.
Rio Tinto (2017) Mesa H H3 Hydrogeological Level Assessment. Unpublished report prepared by Rio Tinto Iron Ore, 2017.	Report detailing the Mesa H and J hydrogeological conceptualisation, numerical model predictions, aquifer impact assessment, monitoring program and proposed GW management.

Environmental studies that are still in progress relevant to the Proposal are described in Table 4-2.

Table 4-2: Environmental studies in progress relevant to this Proposal

Study	Description
Flora and vegetation	
Astron.	Baseline Monitoring – Phase II (Monitoring transects established across riverine vegetation in the Robe River).
Rio Tinto (in prep).	Assessment of Groundwater Dependent Vegetation distribution on the Robe River - Targeted Riparian Vegetation Survey.
Subterranean fauna	
Biota Environmental Sciences (in prep).	Surveys conducted June to August 2015, August to October 2015 and January to March 2016 documenting subterranean fauna and assessing subterranean fauna habitat.
Aquatic fauna	
Streamtec Aquatic Ecosystems Study	Ongoing annual aquatic fauna monitoring as part of existing Mesa J Operations.
WRM.	Baseline Aquatic Fauna Monitoring – Phase II.
Visual impact assessment	
Rio Tinto (in prep).	Visual impact assessment considering vantage points along Pannawonica Road, the Robe River and sites of heritage significance.

5. ASSESSMENT OF PRELIMNARY KEY ENVIRONMENTAL FACTORS

The environmental factors and objectives adopted by the Environmental Protection Authority (EPA) are listed in the EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2016). The Proponent has identified the following preliminary key environmental factors that are relevant to the Proposal:

- Flora and Vegetation
- Terrestrial Fauna
- Subterranean Fauna
- Hydrological Processes
- Inland Waters Environmental Quality
- Social Surroundings

The above factors are discussed in sections 5.1 to 5.5. The Proponent considers that the remaining environmental factors identified in (EPA 2016) are either not relevant to the Proposal or will not result in a significant impact (refer to Section 6).

5.1 Flora and Vegetation

5.1.1 EPA objective

The EPA objective for Flora and Vegetation is *to protect flora and vegetation so that biological diversity and ecological integrity are maintained.*

5.1.2 Potential environmental impact

Consideration of the potential impacts relevant to Flora and Vegetation is captured in Table 5-1.

Table 5-1: Consideration of potential environmental impacts – Flora and Vegetation

Potential environmental impacts	
EPA policy and guidance - What have you considered and how have you applied them in relation to this factor?	The following EPA guidelines and technical guidance have been considered for the proposal in relation to Flora and Vegetation in order to meet the EPA's objectives as outlined above: EPA Statement of Environmental Principles, Factors and Objectives (2016). • EPA Environmental Factor guideline (Land): *Environmental Factor Guideline – Flora and Vegetation* (2016). • EPA Technical Guidance (Land): *Flora and Vegetation Surveys for Environmental Impact Assessment* (2016). Flora and vegetation surveys have been, and will continue to be, undertaken consistent with The EPA's technical guidance for this factor. Any survey limitations relative to the technical guidance will be noted in the flora and vegetation survey report. The Proposal and supporting studies focus on presenting the current state of knowledge, and defines significant flora and vegetation communities within the Development Envelope and the immediate surrounding region. The Proposal has been designed such that activities and pathways which may have the potential to impact on priority flora or locally significant vegetation communities have been avoided or minimised where possible via the application of the mitigation hierarchy. Any survey limitations relative to the guidance will be noted in the flora and vegetation survey report.
Consultation – Outline the outcomes of consultation in relation to the potential environmental impacts	**Office of the Environmental Protection Authority (OEPA)** A summary of the Mesa H Proposal was provided pre-referral. • Proponent to complete studies and prepare referral documentation. • DMA consult to be undertaken with key agencies.
	Department of Parks and Wildlife (Parks and Wildlife) An outline of the scope of the Mesa H proposal was provided, including the status of surveys and an overview of survey results. • Proponent should seek confirmation from Parks and Wildlife whether the vegetation community that is analogous to the Triodia sp. Robe River PEC is actually the PEC or is possibly a new / subset of the PEC. • If the community is a PEC then further surveys may be required to define the community more rigorously.
	Department of Water (DoW) Refer to consultation notes summarised in Section 5-4.

Potential environmental impacts	
Receiving environment - Describe the current condition of the receiving environment in relation to this factor.	Numerous Flora and Vegetation surveys have been undertaken across the Development Envelope and surrounds. During the more recent two phase seasonal survey effort (2015-2016) across the Development Envelope, 38 vegetation associations were described, none of which represent a TEC. All but three vegetation associations recorded are well represented beyond the Development Envelope and do not support assemblages of species that are unique, on restricted landforms, or of high conservation significance. • One vegetation association is considered to represent the Priority 3 Priority Ecological Community (PEC) '*Triodia sp. Robe River assemblages of mesas of the West Pilbara'*. Vegetation representing this PEC accounted for 14.6 ha within the Development Envelope. • One vegetation association (ChAsppGOrGsppPlSsTeTw) contained all three of the recorded Priority flora species. This vegetation was associated with drainage lines comprising approximately 135 hectares (3%) of the Development Envelope. Similar vegetation has been recorded from other regional surveys. • The riparian vegetation association containing MaEcCv, represents approximately 174 hectares (3%) of the Development Envelope, and is considered a groundwater dependent ecosystem as it is characterised by the obligate phreatophyte *Melaleuca argentea*. MaEcCv was mapped on the fringes of permanent and semi-permanent water pools both in and outside the Development Envelope and the main flow channels of the Robe River, and as such supported a number of species that were unique to this habitat. Approximately 60% of the Priority 4 species *Rhynchosia bungarensis* P4 occurred in MaEcCv in the Development Envelope. The families and genera recorded in the Riverine and Drainage lines are typical of what would be expected in riparian vegetation of major drainage lines in the Pilbara. No Threatened taxa were recorded. There were 23 weed species recorded within the riparian habitats. None of the weed species recorded is listed as a declared pest for the Shire of Ashburton or a Weed of National Significance. Vegetation condition ranged from 'very poor' to 'excellent' with approximately 67% of the Development Envelope classified as being in 'excellent' condition. The area is also subject to a history of pastoral activity with cattle grazing evident on the plains, floodplains and drainage lines. There were 310 vascular flora species from 53 families and 150 genera recorded in the Development Envelope. The most represented families were Fabaceae, Poaceae and Malvaceae. No Threatened flora were recorded during the survey or are expected to occur. Three State-listed Priority flora were identified: *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) P3, *Triodia* sp. Robe River (M.E. Trudgen et al. MET 12367) P3 and *Rhynchosia bungarensis* P4.
Proposal activities – Describe the proposal activities that have the potential to impact the environment.	The following aspects of the Proposal may affect flora and vegetation values: • Clearing of vegetation in mining and infrastructure development areas including vegetation communities of local significance and Priority Flora species. • Mining and ore transportation may increase dust emissions causing localised stress of adjacent vegetation. • Vehicle and earth movements may result in spread of existing weeds and/or introduction of new weeds. • Groundwater abstraction, surplus water discharge, and surface water diversions could potentially impact environmental values, including flora and vegetation, as discussed in section 5.4.

Potential environmental impacts	
Mitigation - Describe the measures proposed to manage and mitigate the potential environmental impacts.	Strategies to minimise the impacts to vegetation include: • Minimising the disturbance footprint during the study and mine planning phase. • Preferentially avoiding flora and vegetation of elevated conservation significance. • The mesa escarpment at Mesa H will be retained, through establishment of a Mining Exclusion Zone (MEZ). The majority of the '*Triodia sp. Robe River assemblages of mesas of the West Pilbara'*, occur along the margins of the Mesa escarpment, and will be protected from direct disturbance by the MEZ. • Minimal direct disturbance to the Robe River riparian vegetation which comprises the important Riverine habitat vegetation associations (ChAsppGOrGsppPlSsTeTw - containing all three of the recorded Priority flora species and MaEcCv). • The proposed development is located outside the 1% AEP (Annual Exceedance Probability) floodplain of the adjacent Robe River. • Conducting flora and vegetation surveys in all parts of the Development Envelope. • Detailed mapping of riparian vegetation and assessment of risk related to groundwater dependency to support water monitoring and water management approach. • Monitoring riparian vegetation along the Robe River for the duration of abstraction, discharge, and as required post closure during water table recovery. • Development of a monitoring and management plan, with trigger and threshold levels and actions, to ensure no significant detrimental impact to the identified environmental values of the Robe River ecosystem due to groundwater abstraction and discharge. This plan will consider precautionary mitigation options for groundwater drawdown, such as supplementary water supply to the Robe River ecosystem via controlled discharge. • Implementing vehicle hygiene procedures to prevent the introduction and spread of weeds. • Mapping and controlling weed species as necessary to protect conservation values. • Undertaking progressive rehabilitation where practicable.
Impacts - Assess the impacts of the proposal and review the residual impacts against the EPA objective.	The Proposal is expected to result in the progressive clearing of up to 2,200 ha of native vegetation. The Proposal is not expected to alter the conservation status or viability of any Priority Flora species or have a significant effect on the representation of vegetation at a local or regional level. No TECs, Environmentally Sensitive Areas or Declared Rare Flora will be affected by the Proposal as none have been recorded in the Development Envelope. Vegetation units of high local significance, associated with drainage lines (riparian habitat containing phreatophytic vegetation), are present along the Robe River. Dewatering at Mesa H may result in temporary, seasonal stress, particularly to the vegetation units containing obligate phreatophytic vegetation (e.g. *Melaleuca Argentea*) within the extent of drawdown. However, groundwater abstraction and surplus water discharge as a result of the Proposal are considered unlikely to have significant impacts on the identified environmental values of the Robe River and Jimmawurrada Creek ecosystems (including riparian vegetation), as discussed in section 5.4. The Proponent considers that the Proposal is likely to meet the EPA objective for Flora and Vegetation.

Potential environmental impacts	
Assumptions - Describe any assumptions critical to your assessment *e.g. particular mitigation measures or regulatory conditions.*	Key assumptions are related to the extent of information collected and degree of seasonal variability naturally experienced in an arid environment. The assessment of sensitivity of the riparian vegetation species to changes to water availability is based on scientific publications and responses recorded at other Rio Tinto mine sites. These assumptions are detailed in the supporting vegetation and flora studies. Assumptions regarding hydrogeological modelling, that informs assessment of the potential impacts of groundwater drawdown on the Robe River ecosystem are detailed in section 5.4. Surveys and studies have been undertaken by specialist consultants to ensure an appropriate level of independent rigour and ensure that EPA guidance, methodologies and industry standards have been adopted.

5.2 Terrestrial Fauna

5.2.1 EPA objective

The EPA objective for Terrestrial Fauna is *to protect terrestrial fauna so that biological diversity and ecological integrity are maintained.*

5.2.2 Potential environmental impact

Consideration of the potential impacts relevant to Terrestrial Fauna is captured in Table 5-2.

Table 5-2: Consideration of potential environmental impacts – Terrestrial Fauna

Potential environmental impacts	
EPA policy and guidance - What have you considered and how have you applied them in relation to this factor?	The following EPA guidelines and technical guidance have been considered for the proposal in relation to Terrestrial fauna in order to meet the EPA's objective as outlined above: • EPA Statement of Environmental Principles, Factors and Objectives (2016). • EPA Environmental Factor guideline (Land): *Environmental Factor Guideline – Terrestrial Fauna* (2016). • EPA Technical Guidance (Land): *Terrestrial Fauna Surveys* (2016). • EPA Technical Guidance (Land): *Sampling methods for terrestrial vertebrate fauna* (2016). • EPA Technical Guidance (Land): *Sampling of Short Range Endemic invertebrate fauna* (2016). Terrestrial Fauna surveys (including sampling for Short range endemic fauna) have been, and will continue to be, undertaken consistent with the EPA's technical guidance for this factor. Any survey limitations relative to the technical guidance will be noted in the terrestrial fauna survey report. The Proposal and supporting studies focus on presenting the current state of knowledge, defines significant terrestrial fauna species within the Development Envelope and surrounds. The Proposal has been designed such that activities which may have the potential to impact on significant fauna have been avoided or minimised where possible via the application of the mitigation hierarchy. Any survey limitations relative to the guidance will be noted in the terrestrial fauna survey report.
Consultation – Outline the outcomes of consultation in relation to the potential environmental impacts	**OEPA** A summary of the Mesa H proposal was provided pre-referral. • Proponent to complete studies and prepare referral documentation. • DMA consult to be undertaken with key agencies.
	Parks and Wildlife An outline of the scope of the Mesa H Proposal was provided, including the status of surveys and an overview of survey results. • Parks and Wildlife indicated that additional Ghost Bat work would be prudent to undertake (as planned) given the recent EPBC listing. Requested further information regarding the Pilbara Leaf-nose Bat roost location estimated 10km to the south (if this was the known 'super-roost') and habitat usage in the Robe River.

Potential environmental impacts	
Receiving environment - Describe the current condition of the receiving environment in relation to this factor.	**Vertebrate Fauna** Seven broad fauna habitat types were recorded in the Development Envelope: Riverine; Drainage Line; Gorge; Breakaway; Rocky Hills; Low Hills and Slopes; and Loamy/Stony Plain. The Gorge, Riverine and Breakaway habitats in the Development Envelope are considered important for fauna due to the microhabitats they provide such as caves and water pools; the Gorges and Breakaway habitats represent an important site of refuge due to their location close to the Robe River and as habitat for conservation listed fauna. There were 169 vertebrate fauna species recorded within the Development Envelope, including two amphibian species, 55 reptile species, 85 bird species and 27 mammal species (including four introduced species). The faunal assemblage recorded is considered typical of the Hamersley Range subregion extending from near Pannawonica to Mt Brockman. Eight conservation listed fauna species have been recorded in the Development Envelope: Pilbara Olive Python (VU; S3) (*Liasis olivaceus barroni*); Northern Quoll (EN; S2) (*Dasyurus hallucatus*); Pilbara Leaf-nosed Bat (VU; S3) (*Rhinonicteris aurantia*); Ghost Bat (VU; S3) (*Macroderma gigas*); Rainbow Bee-eater (Mi; S5) (*Merops ornatus*); Eastern Great Egret (Mi; S5) (*Ardea modesta*); Lined Soil-crevice Skink (P4) (*Notoscincus butleri*); and Western Pebble-mound Mouse (P4) (*Pseudomys chapmani*). Four of the eight recorded conservation listed species are classified under the *Environment Protection and Biodiversity Act* 1999 (EPBC Act) as Matters of National Environmental Significance (MNES) species: the Pilbara Olive Python; Northern Quoll; Ghost Bat; and Pilbara Leaf-nosed Bat. • A single juvenile Pilbara Olive Python and two Pilbara Olive Python scats were recorded within the Riverine and the Breakaway habitat type within the Development Envelope. • The Northern Quoll was recorded 27 separate times comprising: six capture records; 19 remote camera location records; and from two scats within the Breakaway, Riverine and Gorge habitat types in and immediately outside the Development Envelope. • The Ghost Bat was recorded twice through scat collections and acoustic recordings. Eleven caves were identified within the Development Envelope during the surveys during detailed assessments undertaken by Bat Call WA (2017), including two potential diurnal roost caves and nine nocturnal roost shelters based on their size, complexity and the presence of Ghost Bats and /or scats. The two diurnal caves were assessed as being maternity cave candidates although no evidence of intensive Ghost Bat use for this purpose was found during the survey. • The Pilbara Leaf-nosed Bat was recorded at eight of the 14 SM2 bat detector locations, all at low activity levels apart from one location (BAT 14) located outside the Development Envelope which recorded 257 calls. Further data and analysis of the BAT 14 sites confirmed that the Pilbara Leaf-nosed Bats originated from a known roost site approximately 10 kms south of the Development Envelope. Table 5-3 provides a summary of conservation listed species recorded or likely to be recorded in the Development Envelope.

Potential environmental impacts	
	Short Range Endemic Invertebrate Fauna The Loamy/Stony Plains habitat supported some Short Range Endemic (SRE) species however this habitat type is widespread in the Development Envelope and is considered unlikely to restrict dispersal in SRE fauna. The Breakaway, Gorge and Riverine habitats (most suited to SRE species), did not support rich SRE communities. Consequently, prospective SRE habitats within the Development Envelope are not considered restricted at the local, sub-regional or regional scale. A total of 36 specimens belonging to at least 14 invertebrate morphospecies were collected from the Development Envelope. Scorpions were the most diverse group with seven species and 12 specimens, followed by slaters (three species; 16 specimens), pseudoscorpions (two species; four specimens) and spiders (two species; four specimens). No centipedes, harvestmen, millipedes or snail specimens (aquatic or terrestrial) were collected during the current survey. No listed invertebrate species were collected during the survey. Nine of the species (64%) were not considered to be, or are unlikely to be, SRE's. No confirmed SRE species were collected; however, five species (36%) were classified as potential SRE species, primarily in the scorpion (three species), spider (two species) and slater (one species) faunas.
Proposal activities – Describe the proposal activities that have the potential to impact the environment	The following aspects of the Proposal may affect terrestrial fauna values: • Clearing of vegetation in mining and infrastructure development areas will directly disturb fauna habitat and may result in the loss of individuals. • Vibration from mining operations may damage the integrity of Ghost Bat roosts on Mesa H. • Noise and dust from mining and ore transportation may disturb Ghost Bat roosts. • Vehicle movements may result in the loss of individuals. • Groundwater abstraction, surplus water discharge, and surface water diversions could potentially impact environmental values, including fauna habitat, as discussed in section 5.4.
Mitigation - Describe the measures proposed to manage and mitigate the potential environmental impacts.	Strategies to minimise the impacts to terrestrial fauna include: • Minimising the disturbance footprint during the mine planning phase. • The mesa escarpment at Mesa H will be retained, through establishment of a MEZ. The majority of the important Gorge and Breakaway Habitats, and all of the Ghost Bat roosts, occur in the Mesa escarpment, and will be protected from direct disturbance by retention of the MEZ. • Similarly, the Northern Quoll and Pilbara Olive Python habitats (Gorge, Breakaway and Riverine) will be protected by retention of the MEZ and limited disturbance to the creekline. • Minimal direct disturbance to the Robe River riparian vegetation which comprises the important Riverine habitat. • Maintaining appropriate speed limits for vehicles.

Potential environmental impacts	
Impacts - Assess the impacts of the proposal and review the residual impacts against the EPA objective.	The Proposal is expected to result in the progressive clearing of up to 2,200 ha of native vegetation (incorporating fauna habitat). It is recognised that the escarpments of Mesa H adjacent to the Robe River are some of the most significant habitat features in the Development Envelope for both vertebrates and SREs. The mesa escarpment adjacent to the Robe River will be retained through establishment of a MEZ, ensuring that these habitats continue to be available to a range of fauna. Note that Mesa landform only occurs in the northern area of the deposit. Refer to Section 6. Semi-permanent and permanent pools and riparian vegetation of the Robe River adjacent to Mesa H are considered significant habitat features. Groundwater abstraction and surplus water discharge as a result of the Proposal are considered unlikely to have significant impacts on the identified environmental values of the Robe River and Jimmawurrada Creek ecosystems (including terrestrial fauna habitat), as discussed in section 5.4. The area of potential impact is a small proportion of the total terrestrial fauna habitat on these creekline ecosystems. Based on the above considerations, it is unlikely that the Proposal will significantly affect the regional distribution of terrestrial fauna habitat or the conservation status of any fauna species. The Proponent considers that the Proposal is likely to meet the EPA objective for Terrestrial Fauna.
Assumptions - Describe any assumptions critical to your assessment *e.g. particular mitigation measures or regulatory conditions.*	Key assumptions are related to the extent of information collected and seasonal variability – these assumptions are detailed in the supporting terrestrial fauna studies. Assumptions regarding hydrogeological modelling, that informs assessment of the potential impacts of groundwater drawdown on the Robe River ecosystem are stated in section 5.4. These surveys and studies have been undertaken by specialist consultants to ensure an appropriate level of independent rigour and ensure that EPA guidance, methodologies and industry standards have been adopted. Where significant uncertainty exists, a 'worst case scenario' will presented in the impact assessment and options of mitigation will be considered.

Table 5-3: Conservation listed species recorded or likely to be recorded in the Development Envelope

Common name	Scientific name	Conservation status		Likelihood of occurrence
		WC Act	EPBC Act	
Northern Quoll	*Dasyurus hallucatus*	S 2	Endangered	Confirmed
Pilbara Leaf-nosed Bat	*Rhinonicteris aurantia* (Pilbara form)	S 3	Vulnerable	Confirmed
Pilbara Olive Python	*Liasis olivaceus barroni*	S 3	Vulnerable	Confirmed
Ghost Bat	*Macroderma gigas*	S 3	Vulnerable	Confirmed
Western Pebble-mound Mouse	*Pseudomys chapmani*	P 4	-	Confirmed
Lined Soil-crevice Skink	*Notoscincus butleri*	P 4	-	Confirmed
Rainbow Bee-eater	*Merops ornatus*	S 5	Migratory	Confirmed
Eastern Great Egret	*Ardea modesta*	S 5	Migratory	Confirmed
Blindsnake	*Anilios ganei*	P 1	-	High
Cattle Egret	*Ardea ibis*	S 5	Migratory	Moderate
Fork-tailed Swift	*Apus pacificus*	S 5	Migratory	Moderate
Letter-winged Kite	*Elanus scriptus*	P 4	-	Moderate
Australian Painted Snipe	*Rostratula benghalensis (sensu lato)*	S 5	Endangered	Moderate
Common Sandpiper	*Actitis hypoleucos*	S 5	Migratory	Moderate
Sharp-tailed Sandpiper	*Calidris acuminata*	S 5	Migratory	Moderate
Wood Sandpiper	*Tringa glareola*	S 5	Migratory	Moderate
Common Greenshank	*Tringa nebularia*	S 5	Migratory	Moderate
Oriental Pratincole	*Glareola maldivarum*	S 5	Migratory	Moderate
Long-tailed Dunnart	*Sminthopis longicaudata*	P 4	-	Moderate
Short-tailed Mouse, Karekanga	*Leggadina lakedownensis*	P 4	-	Moderate
Brush-tailed Mulgara	*Dasycercus blythi*	P 4	-	Moderate
Greater Bilby, Dalgyte	*Macrotis lagotis*	S 3	Vulnerable	Low
Northern Marsupial Mole	*Notoryctes caurinus*	-	Endangered	Low
Eastern Osprey	*Pandion cristatus*	S 5	Migratory	Low
Oriental Plover	*Charadrius veredus*	S 5	Migratory	Low
Greater Sand Plover	*Charadrius leschenaultii*	S 5	Migratory	Low
Whimbrel	*Numenius phaeopus*	S 5	Migratory	Low
Barn Swallow	*Hirundo rustica*	S 5	Migratory	Low

5.3 Subterranean Fauna

5.3.1 EPA objective

The EPA objective for subterranean fauna is *to protect subterranean fauna so that biological diversity and ecological integrity are maintained*.

5.3.2 Potential environmental impacts

Consideration of the potential impacts relevant to Terrestrial Fauna is captured in Table **5-4**

Table 5-4: Consideration of potential environmental impacts – Subterranean Fauna

Potential environmental impacts	
EPA policy and guidance - What have you considered and how have you applied them in relation to this factor?	The following EPA guidelines and technical guidance have been considered for the proposal in relation to Subterranean fauna in order to meet the EPA's objective as outlined above: • EPA Statement of Environmental Principles, Factors and Objectives (2016). • EPA Environmental Factor guideline (Land): *Environmental Factor Guideline – Subterranean Fauna* (2016). • EPA Technical Guidance (Land): *Sampling methods for subterranean fauna* (2016). • EPA Technical Guidance (Land): *Subterranean Fauna Survey* (2016). Subterranean fauna surveys are being undertaken consistent with the EPAs technical guidance for this factor. The design of the subterranean fauna surveys is consistent with the requirements of the EPA technical guidance as is the level of survey effort. Vouchering and lodgement of specimens is underway consistent with the guidance. The Proposal and supporting studies focus on presenting the current state of knowledge and defines subterranean species within the Development Envelope and surrounds. The Proposal has been designed to minimise impact to and maintain viable habitat for subterranean fauna via the application of the mitigation hierarchy. Any survey limitations relative to the technical guidance will be noted in the subterranean fauna survey report.
Consultation – Outline the outcomes of consultation in relation to the potential environmental impacts	**OEPA (Terrestrial Ecosystems Branch)** An outline of the scope of the Mesa H proposal was provided, including a summary of troglofauna sampling and results; conceptual proposed troglofauna habitat retention areas; and singleton avoidance areas. • Justification for the areas, volumes and widths selected as habitat retention zones in terms of suitability for troglofauna to be included in the EIA. • Clearly show which holes were sampled during each of the 6 phases of sampling including null results and which holes were resampled. • Data from troglofauna sampling at Mesa A and analysis of habitat aspects (downhole humidity and temperature data) would help to support approach to habitat retention.
	Parks and Wildlife An outline of the scope of the Mesa H Proposal was provided, including the status of surveys and an overview of survey results, and a discussion of the subterranean fauna PEC's. Parks and Wildlife suggested that there may be a need to context troglofauna habitat cumulatively between Mesas H and J.
	DMP An outline of the scope of the Mesa H Proposal for closure was provided. Clarification sought whether different or similar subterranean fauna species recorded on each mesa and whether contextual survey work for subterranean fauna and other fauna had been undertaken on remaining mesas. Contextual information to be provided in the EIA and considered in the closure plan.
	DoW Refer to consultation notes summarised in Section 5.4.

Potential environmental impacts	
Receiving environment - Describe the current condition of the receiving environment in relation to this factor.	Three Priority 1 PECs relevant to subterranean fauna are present in (or overlap with) the Development Envelope namely: • *Subterranean invertebrate communities of mesas in the Robe Valley region*; • *Subterranean invertebrate community of pisolitic hills in the Pilbara*; and • *Stygofaunal Community of the Bungaroo Aquifer.* **Troglofauna** Subterranean fauna assessments have identified troglofauna from the proposed mining area. Some species recorded at Mesa H appear to be restricted to the mesa. A total of 27 troglobitic taxa recorded from the survey at Mesa H are regarded as potential SRE fauna. Of these, 19 taxa are represented by singleton records. Two potential SRE species recorded from a previous survey occur within the Mesa H development envelope, *Paradraculoides* sp. nov. 'Mesa H' and *Troglarmadillo* sp. 1. Three taxa have been recorded from both inside and outside of the Development Envelope, with the remaining 24 taxa recorded only from within the Mesa H Development Envelope. **Stygofauna** Stygofauna have been recorded in the Development Envelope and the surrounding area. A total of 337 stygofauna specimens were recorded over the four phases of sampling, comprising at least 34 species-level taxa, with 6 taxa representing singleton records. Two Amphipoda species of conservation significance have been recorded within the Development Envelope during previous surveys: *Nedsia hurlberti* and *Nedsia sculptilis*, both of which are Schedule 3 species. An additional species of conservation significance was also recorded from a previous survey within 1 km of the Mesa H Development Envelope: Blind Cave Eel (*Ophisternon candidum* – Vulnerable; Schedule 3). All but 4 of the 15 potential SRE stygofauna taxa recorded are known to occur outside Development Envelope and impact area.
Proposal activities – Describe the proposal activities that have the potential to impact the environment.	The following aspects of the Proposal may affect subterranean fauna values: • Mining will result in physical loss and or degradation of a proportion of troglofauna habitat within the Development Envelope and loss of individuals. • Groundwater abstraction will temporarily reduce stygofauna habitat. • Surplus water discharge may temporarily increase the extent and connectivity of stygofauna habitat. • Spills of hydrocarbons or waste water may degrade the subterranean environment. • Localised seepage from placement of waste fines in-pit at Mesa H may result in minor local loss or impact to stygofauna habitat.

Potential environmental impacts	
Mitigation - Describe the measures proposed to manage and mitigate the potential environmental impacts.	Strategies to minimise the impacts to subterranean fauna include: • Characterising the troglofauna and stygofauna habitat present in the conceptual footprint. • Characterising the local and regional conservation significance of troglofauna and stygofauna in the impact area and Development Envelope. • Establishing Mining Exclusion Zones (MEZ) to retain troglofauna habitat. • Undertaking further troglofauna sampling. • Maintaining groundwater and surface water quality by managing erosion, sedimentation and contamination (e.g. hydrocarbon spills). • Undertaking monitoring of stygofauna habitat (via hydrological parameters) through the life of the mine. • Undertaking backfilling of mine pits to assist in protecting troglofauna habitat retention zones.
Impacts - Assess the impacts of the proposal and review the residual impacts against the EPA objective.	The Proposal may result in direct mortality and reduction in available habitat due to pit excavation and groundwater drawdown. Potential impacts will be localised to the proposed pit area and the groundwater drawdown zone during mining operations – however is not expected to significantly impact subterranean fauna species persistence. The risk of pollutants being transported into the subterranean habitat is low and is likely to be locally restricted. The connectivity of the habitat maintained in the alluvial aquifers together with proposed habitat retention in the CID maintains habitat viability for subterranean fauna populations during and post mining. **Troglofauna** Loss of troglofauna habitat will occur as a consequence of excavation from mining. Many troglofauna recorded appear to be restricted to Mesa H and are unlikely to occur more widely. Significant volumes of troglofauna habitat at Mesa H is proposed to be retained via establishment of a MEZ. Examples of existing and historical mining operations and the ongoing representation of troglofauna species has been investigated at Mesa K and ongoing sampling at Mesa A (currently still in operation) supports this approach. **Stygofauna** Dewatering of pits and abstraction of groundwater water will temporarily reduce stygofauna habitat in the CID until the water table recovers following cessation of water abstraction. The majority of the stygofauna taxa recorded at Mesa H are known to occur outside the Development Envelope and additional habitat is present in the alluvials and basement aquifers. The results of hydrogeological modelling will provide greater certainty regarding the extent of potential impacts. Based on the proposed management approach and the anticipated residual impacts, the Proponent considers that the Proposal is likely to meet the EPA objective for Subterranean Fauna.

Potential environmental impacts	
Assumptions - Describe any assumptions critical to your assessment *e.g. particular mitigation measures or regulatory conditions.*	Key assumptions are related to the extent of information collected and seasonal variability, and limitations of sampling in the subterranean environment – these assumptions are detailed in the supporting subterranean fauna studies. These surveys and studies have been undertaken by specialist consultants to ensure an appropriate level of independent rigour and ensure that EPA guidance, methodologies and industry standards have been adopted. Outcomes of the subterranean fauna habitat characterisation work at the nearby Mesa K and Mesa A Projects are considered analogous and applicable to the Mesa H Proposal based on having the same geology and habitat features.

5.4 Hydrological Processes and Inland Water Environmental Quality

5.4.1 EPA objective

The EPA objective for Hydrological Processes is *to maintain the hydrological regimes of groundwater and surface water so that environmental values are protected*.

The EPA Objective for Inland Waters Environmental Quality is *to maintain the quality of groundwater and surface water so that environmental values are protected.*

5.4.2 Potential environmental impacts

Consideration of the potential impacts relevant to Hydrological Processes and Inland Waters Environmental Quality is captured in Table 5-5.

Table 5-5: Consideration of potential environmental impacts – Hydrological Processes and Inland Waters Environmental Quality

Potential environmental impacts	
EPA policy and guidance - What have you considered and how have you applied them in relation to this factor?	The following EPA guidelines have been considered for the proposal in relation to Hydrological Processes and Inland Waters Environmental Quality in order to meet the EPA's objectives as outlined above: EPA Statement of Environmental Principles, Factors and Objectives (2016). EPA Environmental Factor guideline (Water): Environmental Factor Guideline – Hydrological Processes (2016). • EPA Environmental Factor guideline (Water): *Environmental Factor Guideline – Inland Waters Environmental Quality* (2016). The Proposal identifies the environmental values supported by hydrological processes and inland waters environmental quality, and their significance including water dependent ecosystems, amenity, cultural values, recreation, and agricultural use of water, and the chemical, physical, biological and aesthetic characteristics of inland waters. The Proposal and supporting studies focus on presenting the current state of knowledge, defines environmentally significant water dependant ecosystems and focusses on activities and pathways that can impact on hydrological processes and inland waters environmental quality – with the application of the mitigation hierarchy in the design of the Proposal in order to avoid and minimise impacts to hydrological processes / inland waters environmental quality and associated environmental values, where possible.
Consultation – Outline the outcomes of consultation in relation to the potential environmental impacts	**OEPA** A summary of the Mesa H Proposal was provided pre-referral. Proponent to complete studies and prepare referral documentation. DMA consult to be undertaken with key agencies.
	DoW A summary of the hydrogeological drilling and monitoring program in the Robe Valley was presented including conceptual hydrogeological models for Mesa H. A field trip to the Robe Valley was also completed. • The proposed consultant for peer review of the hydrogeological models was discussed and agreed. • H3 report to be included with the EIA. • Cumulative impact assessment required for the lower Robe River in the EIA. • Further conceptualisations and testing of the connectivity between the CID and the alluvium. • Quantification of impacts to stygofauna in the drawdown impact area and cumulatively. • Quantification of impacts to riparian vegetation from both drawdown and discharge and current monitoring and management program. • Discussion of limited impacts to the semi-permanent and permanent pools predicted, and proposed mitigation options (if required) to address any significant uncertainties in the modelling to be presented in the EIA.
	DMP An outline of the scope of the Mesa H Proposal for closure was provided. Clarification sought whether the diversion controls being considered will apply for operation only or will they remain post closure, and if pooling/damming of surface flow occur. Further modelling and consideration being undertaken for closure requirements.

Potential environmental impacts	
Receiving environment - Describe the current condition of the receiving environment in relation to this factor.	Mesa H lies within the Robe River catchment which has a catchment area of approximately 7,500 km^2. Major watercourses occurring within the catchment include the Robe River and the Jimmawurrada, Bungaroo and Mungarathoona Creek's. The major water courses generally flow from the southeast to the northwest through high relief areas of the Hamersley Ranges on to the more gently sloping areas of the coastal plain before discharging into the ocean approximately 150 km south of Dampier. For the majority of its course, the Robe River is ephemeral with a wide, shallow flood plain which carries a significant underflow in its alluvial bed. This sub-surface flow maintains permanent pools in the river channel, and these pools play an important role in the river ecosystem. During the dry season water is often restricted to a series of permanent pools that are maintained by sub-surface flow (Bowman *et al* 1991). Surface water and groundwater in the Mesa H locality has been modified and managed for a number of years (since the mid 1990s) by the Mesa J mining operation. This includes pit dewatering and groundwater abstraction, and discharge of surplus water to Jimmawurrada Creek.
Proposal activities – Describe the proposal activities that have the potential to impact the environment	The following aspects of the Proposal may affect hydrological processes and inland waters environmental quality: **Groundwater abstraction:** • Modelling has considered the cumulative impact of dewatering and groundwater abstraction for this Proposal, the Mesa J operation and the Coastal Water Supply borefield. • Groundwater abstraction for water supply and pit dewatering will result in localised groundwater drawdown in the CID and basement aquifers that may have some connectivity to the Robe River alluvial aquifer and the Jimmawurrada creek alluvial aquifer. • Hydrogeological modelling indicates the potential for limited reduction in water levels in the Robe River alluvial aquifer and pools, with recovery of the groundwater table over time once water abstraction ceases. The predicted limited reduction in water levels in the alluvial aquifers is considered unlikely to have significant impacts on the identified environmental values of the Robe River, including riparian vegetation, terrestrial and aquatic fauna, and associated habitats. • Hydrogeological modelling indicates that ongoing dewatering and groundwater abstraction for the Proposal may potentially further extend drawdown in the Jimmawurrada Creek and will extend the timeframe for the predicted groundwater recovery once water abstraction ceases. This may result in changes to structure and composition of riparian vegetation and temporary localised impacts to aquatic and stygofauna; however riverine ecosystem function is expected to be maintained. • Further hydrogeological investigations and modelling will be undertaken to confirm findings to date. **Discharge:** • Discharge of surplus water may be required from Mesa H into an existing discharge point in Jimmawurrada Creek, and /or the Robe River and tributaries. • Discharge is modelled to extend no further than 8 km from the discharge point under natural no-flow conditions (or ~19km during discharge during flood events). • Discharge could potentially reduce water quality via increased sediment loads and contamination via hydrocarbons. • Discharge could result in stress in riparian vegetation due to waterlogging, and increase in distribution and proliferation of weeds. However discharge water is expected to be of similar quality, and of lower volumes, than has historically occurred from the Mesa J mine, which ongoing monitoring indicates has not had significant impacts on the identified environmental values of the Robe River ecosystem. **Minor creek diversions and flood protection structures:** • Alteration to natural surface drainage regimes has the potential to affect downstream vegetation. Of the three local catchments diverted, two are already intersected by pits at Mesa J operation.

Potential environmental impacts	
Mitigation - Describe the measures proposed to manage and mitigate the potential environmental impacts.	Strategies to minimise the impacts to Hydrological Process and Inland Environmental Waters Quality include: • Minimal direct disturbance to the Robe River and Jimmawurrada Creek. • Infrastructure and pit designs avoid disruption of natural flood flows where possible. • Undertaking further hydrogeological investigations and modelling to improve understanding of the potential impacts of groundwater abstraction, including the cumulative effects of the Mesa J mine (including the Southern Cutback Borefield) and the Coastal Water Supply Borefield. • Monitoring groundwater water levels and abstraction rates during operations with ongoing validation of the hydrogeological modelling. • Undertaking aquatic fauna surveys in the Robe River pools, and ongoing monitoring during operations. • Establishing a baseline of seasonal water levels and water quality in the Robe River pools, and ongoing monitoring during operations. • Groundwater to be discharged to the Robe River is generally of good quality; additional water samples will be collected to confirm water quality. • Limiting surplus water discharge to the Robe River by preferential use on site for operational purposes. Preferential use of existing Mesa J discharge outlets, if new discharge locations are required, surface water management structures will be installed to prevent erosion and sediment transport. • Hydrocarbon bunding and hydrocarbon treatment facilities will be installed to prevent hydrocarbons contaminating surface water and groundwater. • Development of a monitoring and management plan, with trigger and threshold levels and actions, to ensure no significant detrimental impact to the identified environmental values of the Robe River and Jimmawurrada creek ecosystems due to groundwater abstraction and discharge. This plan will consider precautionary mitigation options for groundwater drawdown, such as supplementary water supply to the Robe River ecosystem via controlled discharge. Management strategies for potential impacts to flora and vegetation, terrestrial fauna, subterranean fauna and social surrounds arising from hydrological processes are discussed in sections 5.1, 5.2, 5.3, and 5.5.

Potential environmental impacts	
Impacts - Assess the impacts of the proposal and review the residual impacts against the EPA objective.	**Groundwater abstraction:** Modelling has considered the cumulative impact of dewatering and groundwater abstraction for the Mesa H Proposal, the Mesa J mine and the Coastal Water Supply Borefield. Modelling has adopted a conservative approach to current hydrogeological uncertainties, generally applying more pessimistic parameters to test a 'worst case' scenario. Dewatering for water supply and pit dewatering will result in localised groundwater drawdown in the CID and basement aquifers that may have some connectivity to the Robe River alluvial aquifer and the Jimmawurrada Creek alluvial aquifer. Hydrogeological modelling indicates the potential for limited reduction in water levels in the Robe River alluvial aquifer and pools, with recovery of the groundwater table over time once water abstraction ceases. The predicted reduction in groundwater levels in the alluvial aquifer is considered unlikely to have significant impacts on the identified environmental values of the Robe River ecosystem (including riparian vegetation and terrestrial and aquatic fauna). Hydrogeological modelling indicated that ongoing dewatering and groundwater abstraction for the Proposal may potentially further extend drawdown in the Jimmawurrada Creek area, and extend the timeframe for predicted groundwater recovery once groundwater abstraction ceases. This may result in changes to structure and composition of riparian vegetation, and temporary, localised impacts to aquatic and stygofauna, however riverine ecosystem function may be maintained. The predicted reduction in water levels due to the Proposal is not considered to have significant impacts on the identified environmental values of the Jimmawurrada Creek ecosystem. Further hydrogeological investigations and modelling will be undertaken to confirm findings to date. **Discharge:** Discharge of surplus water may be required from Mesa H into the Robe River and tributaries. Discharge will extend no further than 8 km from the discharge point under natural no-flow conditions, and 19km if emergency discharge, resulting from surface water flooding of the pits, is required. Discharge is expected to be of similar quality, and of lower volumes, than has historically occurred from the Mesa J mine, that ongoing monitoring indicates has not had significant impacts on the identified environmental values of the Robe River ecosystem (including riparian vegetation, and terrestrial and aquatic fauna). **Drainage:** Acid rock drainage risk has been assessed as low due to the geology. Site drainage will be designed to minimise or eliminate surface runoff into areas where activities with a potential risk of hydrocarbon contamination occur. Management of waste dumps will ensure that risks of contamination of surface and groundwater are minimised. Anticipated residual impacts to flora and vegetation, terrestrial fauna, subterranean fauna and social surrounds arising from hydrological processes are discussed in sections 5.1, 5.2, 5.3 and 5.5. The Proponent considers that the Proposal is likely to meet the EPA objective for Hydrological Processes and Inland Environmental Water Quality.
Assumptions - Describe any assumptions critical to your assessment *e.g. particular mitigation measures or regulatory conditions.*	Key assumptions are related to the extent of information collected and calibration of existing systems to support hydrogeological and hydrological conceptualisations – these assumptions are detailed in the supporting hydrogeological / hydrological studies. These studies have been peer reviewed to ensure appropriate methodologies and industry standards in approach have been adopted. Hydrogeological modelling has adopted a conservative approach to current uncertainties, generally applying more pessimistic parameters to test a 'worst case' scenario to inform the environmental impact assessment. The Proposal assumes no 3rd party changes to the local hydrogeological regime.

5.5 Social Surroundings

5.5.1 EPA objective

The EPA objective for Social Surroundings is *to protect social surroundings from significant harm.*

5.5.2 Potential environmental impacts

Consideration of the potential impacts relevant to Social Surroundings is captured in Table 5-6.

Table 5-6: Consideration of potential environmental impacts – Social Surroundings

Potential environmental impacts	
EPA policy and guidance - What have you considered and how have you applied them in relation to this factor?	The following EPA guidelines and technical guidance have been considered for the proposal in relation to Subterranean fauna in order to meet the EPA's objective as outlined above: • EPA Statement of Environmental Principles, Factors and Objectives (2016). • EPA Environmental Factor guideline (People): *Environmental Factor Guideline – Social Surroundings* (2016). The Proposal and supporting studies focus on presenting the current state of knowledge and defines the aesthetic, cultural (physical and biological), economic and/or social values which may be impacted within the Development Envelope. The Proposal has been designed to minimise impact to social surroundings via the application of the mitigation hierarchy. Any limitations relative to the work undertaken will be noted in the impact assessment and supporting studies.
Consultation – Outline the outcomes of consultation in relation to the potential environmental impacts.	**Traditional Owners (Kuruma Marthudunera)** The Proponent maintains ongoing regular consultation with the K&M through multiple forums, including the Local Implementation Committee (LIC) meetings, KMAC Heritage Sub-Committee (HSC) meetings, and heritage surveys. The Proponent has provided a copy of this referral to the K&M people concurrently with this submission; The Mesa H proposal has been discussed on multiple occasions with the K&M, and consultation will continue. Key outcomes of consultation to date comprise: • The highly significant ethnographic site *Jirti Thalu*, and a significant quarry site, will be protected. • The mesa escarpment has significant cultural value, particularly where adjacent to the Robe River, and will be retained via a MEZ. • The proposed location and design (height restricted) of the northern waste dump location was agreed as the preferred option to minimise visual impact. • Agreement to obtain precautionary Section 18 consents under the *Aboriginal Heritage Act 1972* (Heritage Act) for rock shelters in the mesa escarpment that may be impacted by blasting vibrations. • The Robe River and pools are of high cultural significance, and are regularly used for cultural and recreational activities. • Watercourses other than the Robe River are also of cultural importance. • Agreement to retain the central watercourse through the mesa and main gullies on the western side of the mesa (protected by establishment of a MEZ). • The project footprint will directly impact multiple archaeological sites as discussed with the K&M. Consent under the Heritage Act will be required to disturb these sites. **Yarraloola and Yalleen Stations** • Further consultation as part of existing subleasing arrangement; and • Update on Mesa H Proposal, planned activities, scope of the proposal and dates/ timeframes.

Potential environmental impacts	
Receiving environment - Describe the current condition of the receiving environment in relation to this factor.	Existing land uses in the Development Envelope include pastoral activities (Yarraloola and Yalleen Stations), mineral exploration, mining activities and cultural / recreational activities (predominantly by Traditional Owners) such as camping, fishing and hunting. The mesa landform / profiles are also used by Traditional Owners as landmarks when travelling though the countryside. The Proposal falls within the K&M native title claim (WCD2016/006). The K&M People have a Claim Wide Participation Agreement and Indigenous Land Use Agreement with Rio Tinto. The agreements commit Rio Tinto and the K&M People to work together to manage and maintain the areas in which Rio Tinto operates. The agreements set clear requirements for processes such as land access, tenure, heritage and environmental approvals, mining benefit payments and reporting and communication requirements. All of the archaeological survey work and the majority of the ethnographic survey work has been completed for the Proposal. Heritage sites of high significance in the vicinity of the Proposal Area and broader Development Envelope are ethnographic sites (including mythological locations, named pools and places of importance due to current use); the Robe River, and the mesa profiles which are used as landmarks within the landscape. The Proposal is located at the centre of a series of pisolite mesa formations associated with the Robe River. These mesas punctuate a landform of plains and low angle talus slopes that generally fall away to the Ashburton Plain in the west. In the Development Envelope, the land rises into the adjacent Hamersley Ranges, where more robust formations create more rugged and highly dissected landforms. Mesa H forms a mesa ridge on its north west margin where it abuts the Robe River, and merges into the footslope of the Buckland Hills in the south-east, with a smaller less prominent gully dissecting central part of the formation. The Pannawonica Road is the main travel route though the area, that is used predominantly by Robe Valley mining operations personnel to access Pannawonica (a closed town) and the Mesa J Operation. Other roads are generally unformed pastoral access roads. Long distance views of the surrounding country are available at certain locations along the Pannawonica Road, due to the open nature of the landforms and sparse vegetation; however views become confined close to, and between, mesa formations, in gullies and near the riverine vegetation. Mesa H is approximately 5 km south of the Pannawonica Road and is visible in the distance from approximately a 6.8 km section of the road. Mesa H lies within the Robe River catchment with major watercourses including the Robe River and the Jimmawurrada, and Mungarathoona Creek's. The Robe River is the major watercourse in the Development Envelope which contains semi-permanent and permanent pools in the river channel. The pools and the riparian ecosystem within the Development Envelope are utilised by the K&M for cultural and recreational activities, by the public for recreation, and by Yaraloola and Yalleen Stations. Surface water and groundwater in the Mesa H locality has been modified and managed for a number of years (since the mid 1990s) by the Mesa J Operations. The Proposal also overlaps with the Yarraloola and Yalleen Pastoral Leases which are currently active pastoral stations running cattle in the lower plains and riverine areas.
Proposal activities – Describe the proposal activities that have the potential to impact the environment	• Ground disturbance for the Proposal could directly impact heritage sites. • Blasting vibrations could indirectly impact heritage sites. • Groundwater abstraction and surplus water discharge could potentially have limited impact on water levels in the Robe River alluvial aquifer and pools, however significant impacts on the identified environmental values of the Robe River ecosystem are considered unlikely, as discussed in section 5.4. • Mining activities will result in external waste dumps retained in the landscape and will remove the central core of the mesa formation.

Potential environmental impacts	
Mitigation - Describe the measures proposed to manage and mitigate the potential environmental impacts.	• Biological survey work for the Proposal, and more generally in the Robe Valley, has included K&M involvement. • Heritage surveys are undertaken with participation of the K&M. • Heritage sites will be avoided where practicable. Where heritage sites cannot practically be avoided, the Proponent will consult with the K&M and seek appropriate approval under the Heritage Act. • The Proponent has an established internal system for managing all ground disturbing activities to ensure compliance with heritage commitments and regulatory requirements. • The project footprint has been modified to protect the highly significant ethnographic site *Jirti Thalu*, and a significant quarry site, in consultation with the K&M. • The culturally significant mesa escarpment will be retained via establishment of a MEZ, as discussed with the K&M. Pit designs will incorporate the outcomes of geotechnical investigations to ensure the long-term stability of the retained escarpment, and appropriate blast management will be applied during operations. • The proposed location and design (height restricted) of the northern waste dump location was agreed with the K&M as the preferred option to minimise visual impact. • Rockshelters within the mesa escarpment will not be directly impacted by mining but may be impacted by blasting vibration, requiring Heritage Act consents as agreed with the K&M. • Additional hydrogeological investigations and modelling will be undertaken to confirm the current predictions of limited impact due to this Proposal on the Robe River alluvial aquifer and pools and the Jimmawurrada Creek area. • The central watercourse through the mesa and main gullies on the western side of the mesa are protected from direct mining impacts by the MEZ. • Groundwater abstraction and surplus water discharge from the Proposal are considered unlikely to have significant impacts on the identified environmental values of the Robe River and Jimmawurrada ecosystems. A monitoring and management plan, with trigger and threshold levels and actions will ensure no significant detrimental impact to the identified environmental values of the Robe River and Jimmawurrada Creek ecosystems. This plan will consider precautionary mitigation options for groundwater drawdown, such as supplementary water supply to the Robe River ecosystem via controlled discharge.

Potential environmental impacts	
Impacts - Assess the impacts of the proposal and review the residual impacts against the EPA objective.	**Heritage values** • The project footprint has been modified to protect the highly significant ethnographic site *Jirti Thalu*, and a significant quarry site, in consultation with the K&M. • The culturally significant mesa escarpment will be excluded from mining as discussed with the K&M. • Rockshelters within the mesa escarpment will not be directly impacted by mining but may be impacted by blasting vibration, requiring Heritage Act consents as agreed with the K&M. • The project footprint will directly impact multiple archaeological sites. Consent under the Heritage Act will be required to disturb these sites. • Groundwater abstraction and surplus water discharge as a result of the Proposal are considered unlikely to have significant impacts on the identified environmental values of the Robe River and Jimmawurrada ecosystems. Further hydrogeological investigations and modelling will be undertaken to confirm findings to date. • Further consultation will be undertaken with the K&M regarding the physical and biological cultural values of the Robe River and Jimmawurrada Creek ecosystems and how these interrelate with management of the identified environmental values. **Visual Amenity** • The Proposal will not have a significant impact to visual amenity due to the retention of the mesa escarpment, and location and design (height restriction) of external waste dumps. **Pastoral** • The mine pit is located in an area not normally utilised by cattle for grazing activities, hence limited impacts to pastoral activities are anticipated. The Proponent considers that the Proposal is likely to meet the EPA objective for Social Surroundings.
Assumptions - Describe any assumptions critical to your assessment *e.g. particular mitigation measures or regulatory conditions.*	Key assumptions are related to the extent of consultation and information collected in combination with the degree of seasonal variability naturally experienced in an arid environment – these assumptions are detailed in the supporting studies. Assumptions regarding the potential for impacts of groundwater drawdown on the Robe River ecosystem are outlined in previous sections. Consultation has been undertaken with the K&M regarding cultural values of the Robe River and pools, and the impact assessment considers cultural values in the context of where they relate to the identified physical and biological values of the ecosystem. Further discussion will be undertaken with the K&M on this relationship. Surveys and studies have been undertaken by specialists in conjunction with key K&M group representatives to ensure an appropriate level of rigour and ensure that EPA guidance, methodologies and industry standards have been adopted. Where significant uncertainty exists, a 'worst case scenario' will be considered in the impact assessment and mitigation options to prevent significant impacts will be provided.

6. OTHER ENVIRONMENTAL FACTORS

The following factors, although not considered key, are relevant to the Proposal:

- Landforms
- Air Quality

Table 6-1 outlines the consideration of the above factors relevant to the Proposal.

All other factors (Benthic Communities and Habitat, Coastal Processes, Marine Environmental Quality, Marine Fauna, Terrestrial Environmental Quality and Human Health) are not considered to be relevant to the Proposal.

Table 6-1: Consideration of factors unlikely to be key environmental factors

EPA Objective & policy / Guideline consideration	Potential impact	Management	Anticipated residual impact
Air Quality			
To maintain air quality and minimise emissions so that environmental values are protected. The following EPA guidelines and technical guidance have been considered for the proposal in relation to Air in order to meet the EPA's objective as outlined above: • EPA Statement of Environmental Principles, Factors and Objectives (2016). • EPA Environmental Factor guideline (Air): *Environmental Factor Guideline – Air Quality* (2016).	• Dust will be generated by construction, mining, processing, ore handling and transportation and vehicle movements • Greenhouse gas emissions will be generated by the Proposal. Estimates are currently being calculated, however it is anticipated that emissions will be reduced due to utilisation of existing infrastructure and facilities at the Mesa J Operations.	• Use of dust extraction, water sprays and dust suppressants as applicable. • Clearing work areas only where required. • Rehabilitation of disturbed areas, especially following construction activities, to reduce potential dust lift-off from open areas. • Designing and operating the Proposal to maximise energy efficiency and minimise greenhouse gas emissions.	No significant dust impacts are anticipated due to the proposed management controls and remote location of the Proposal. Greenhouse gas emissions are not considered to be significant and will partly replace the current greenhouse gas emissions from the Mesa J mine as mining transitions from Mesa J to Mesa H. The Proponent considers that the Proposal is likely to meet the EPA objective for Air Quality.
Landforms			
To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected. • EPA Statement of Environmental Principles, Factors and Objectives (2016). • EPA Environmental Factor guideline (Land): Environmental Factor Guideline – Landforms (2016).	• There is limited potential for impact to the mesa landforms as the Mesa H landform comprises escarpments only on the NW margins, adjacent to the Robe River. This escarpment will be retained / avoided during mining.	• Retention of the mesa escarpment. • location and design (height restriction) of external waste dumps to minimise visual • Pit designs will incorporate the outcomes of geotechnical investigations to ensure the long-term stability of the retained escarpment, and appropriate blast management will be applied during operations. • Continuing to locate infrastructure in previously disturbed areas where possible.	The Development Envelope is adjacent to an existing mining operation at Mesa J with similar components to those of the Proposal. No significant additional impacts are anticipated. The Proponent considers that the Proposal is likely to meet the EPA objective for Landforms.

7. PRINCIPLES OF ENVIRONMENTAL PROTECTION

The principles of environmentally sustainable development are incorporated into Section 4A of the EP Act. These principles have been considered for the Proposal as summarised in Table 7-1.

Table 7-1: Environmental principles of the EP Act

Principle	Consideration given in the Proposal
1. Precautionary principle Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: (a) Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and (b) An assessment of the risk-weighted consequences of various options.	Comprehensive biological surveys have already been undertaken and others are well underway. The results of the biological surveys are being used to guide the design phase of the Proposal. Where significant potential environmental impacts are identified measures have been, and will continue to be, incorporated into the Proposal design and management to avoid or minimise these impacts where practical.
2. Intergenerational equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	The Proposal will make a long-term contribution to the economic prosperity of Western Australia. The Proposal will not compromise current or foreseeable future land use options in the area. The Proposal can be effectively managed through avoidance, management and mitigation measures to ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
3. Improved valuation, pricing and incentive mechanisms (a) Environmental factors should be included in the valuation of assets and services. (b) The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement. (c) The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. (d) Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentives structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	The Proposal will be subject to a Mine Closure Plan prepared in accordance with the DMP and EPA *Guidelines for Preparing Mine Closure Plans* (May 2015) and the Rio Tinto Closure Standard. This will provide the basis for ensuring that post-mining land use objectives are identified (through a consultative process) and can be met. The Proponent will undertake land rehabilitation activities to underpin the mine closure process.

Principle	Consideration given in the Proposal
4. Conservation of biological diversity and ecological integrity. Conservation of biological diversity and ecological integrity should be a fundamental consideration.	Comprehensive biological surveys have already been undertaken and others are other are underway to identify aspects of the environment that are of conservation significance. Where significant potential environmental impacts are identified measures have been, and will continue to be, incorporated into the Proposal design and management to avoid or minimise these impacts where practical. The Proponent's HSECQ Management System has established rehabilitation procedures for restoring disturbed environments.
5. Waste minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	Application of the Proponent's management policies, systems and procedures, in combination with the Mine Closure Plan, will provide the basis for minimising the generation of waste and its discharge into the environment. Mine planning objectives to minimise stripping ratios, thereby reducing mineral waste materials volumes, will assist in meeting the aims of this principle.

8. REFERENCES

Bowman, Bishaw and Gorham (1991). Consultative Environmental Review: Proposed Iron Ore Mining at Mesa J, Deepdale. June 1991.

Department of Mines and Petroleum (DMP) and Environmental Protection Authority (EPA) (2015). *Guidelines for Preparing Mine Closure Plans.* May 2015.

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EPA Environmental Factor guideline (Water): *Environmental Factor Guideline – Hydrological Processes* (2016).

EPA Environmental Factor guideline (Water): *Environmental Factor Guideline – Inland Waters Environmental Quality* (2016).

EPA Environmental Factor guideline (Land): *Environmental Factor Guideline – Flora and Vegetation* (2016).

EPA Technical Guidance (Land): *Flora and Vegetation Surveys for Environmental Impact Assessment* (2016).

EPA Environmental Factor guideline (Land): *Environmental Factor Guideline – Terrestrial Fauna* (2016).

EPA Technical Guidance (Land): *Terrestrial Fauna Surveys* (2016).

EPA Technical Guidance (Land): *Sampling methods for terrestrial vertebrate fauna* (2016).

EPA Technical Guidance (Land): *Sampling of Short Range Endemic invertebrate fauna* (2016)

EPA Environmental Factor guideline (Land): *Environmental Factor Guideline – Subterranean Fauna* (2016).

EPA Technical Guidance (Land): *Sampling methods for subterranean fauna* (2016).

EPA Technical Guidance (Land): *Subterranean Fauna Survey* (2016).

EPA Environmental Factor guideline (People): *Environmental Factor Guideline – Social Surroundings* (2016).

EPA Environmental Factor guideline (Air): *Environmental Factor Guideline – Air Quality* (2016)

EPA Environmental Factor guideline (Land): *Environmental Factor Guideline – Landforms* (2016).