Fortescue
The New Force in Iron Ore

Report

Integrated Rail Network Closure Plan

Long Term Mine Planning

7 June 2018
R-PL-EN-0041 Rev 0

	Integrated Rail Network Closure Plan		
Document_Revision Number	R-PL-EN-0041 Rev 0		**7/06/2018**
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This document was prepared on behalf of Fortescue Metals Group Limited by: bioscope environmental

Approved by Fortescue:	Kirsty Beckett	Signature	7/06/2018

CLOSURE GUIDELINE CHECKLIST

This closure plan addresses the progressive rehabilitation and closure of rail infrastructure projects associated with the *Railway and Port (The Pilbara Infrastructure Pty Ltd) Agreement Act 2004*.

In the absence of regulatory guidelines for inland infrastructure projects, this closure plan follows the report structure described within the *Guidelines for Preparing Mine Closure Plans* May 2015 published by the Government of Western Australia Department of Mines and Petroleum (now the Department of Mines, Industry Regulation and Safety) and Environmental Protection Authority.

The closure of mining operations, including quarries, is not within the scope of this closure plan.

	Closure Plan (CP) checklist	Y/N	Page	Comments
1	Has the Checklist been endorsed by a senior representative within the tenement holder/operating company?	Y	2	Report has been endorsed using standard Fortescue processes.
Public Availability				
2	Are you aware that from 2015 all CPs will be made publicly available?	N/A	This report is not subject to mine closure conditions under the Mining Act.	
3	Is there any information in the CP that should not be publicly available?	N		
4	If "Yes" to Q3, has confidential information been submitted in a separate document/section?	N/A		
Cover Page, Table of Contents				
5	Does the CP cover page include: • Project Title • Company Name • Contact Details (including telephone numbers and email addresses) • Document ID and version number • Date of submission (needs to match the date of this checklist)	Y	1	This report is provided for information only.
Scope and Purpose				
6	State why the CP is submitted	Y	11	This plan has been provided to support the Eliwana Rail Project Public Environmental Review.
Project Overview				
7	Does the project summary include: • Land ownership details • Location of the project; • Comprehensive site plan(s); • Background information on the history and status of the project.	Y	15	

	Closure Plan (CP) checklist	Y/N	Page	Comments
Legal Obligations and Commitments				
8	Does the CP include a consolidated summary or register of closure obligations and commitments?	Y	App 1.	
Stakeholder Engagement				
9	Have all stakeholders involved in closure been identified?	Y	26	
10	Does the CP include a summary or register of historic stakeholder engagement with details on who has been consulted and the outcomes?	Y	App 2	
11	Does the CP include a stakeholder consultation strategy to be implemented in the future?	Y	21	
Post-mining land use(s) and Closure Objectives				
12	Does the CP include agreed post-mining land use(s), closure objectives and conceptual landform design diagram?	Y	28	
13	Does the CP identify all potential (or pre-existing) environmental legacies, which may restrict the post closure land use (including contaminated sites)?	Y	54	
14	Has any soil or groundwater contamination that occurred, or is suspected to have occurred, during the operation of the asset, been reported to DER as required under the Contaminated Sites Act 2003?	N		
Development of Completion Criteria				
15	Does the CP include an appropriate set of specific completion criteria and closure performance indicators?	Y	30	
Collection and Analysis of Closure Data				
16	Does the CP include baseline data (including pre-mining studies and environmental data)?	Y	35	
17	Has materials characterisation been carried out consistent with applicable standards and guidelines (e.g. GARD Guide)?	Y	44	
18	Does the CP identify applicable closure learnings from benchmarking against other comparable assets?	N		Benchmarking is not possible as rail assets are not regularly closed or decommissioned in Australia.
19	Does the CP identify all key issues impacting closure objectives and outcomes (including potential contamination impacts)?	Y	60	
20	Does the CP include information relevant to closure for each domain or feature?	Y	64	
Identification and Management of Closure Issues				
21	Does the CP include a gap analysis/risk assessment to determine if further information is required in relation to closure of each domain or feature?	Y	57	
22	Does the CP include the process, methodology, and has the rationale been provided to justify identification and management of the issues?	Y	57	

	Closure Plan (CP) checklist	Y/N	Page	Comments
Closure Implementation				
23	Does the CP include a summary of closure implementation strategies and activities for the proposed operations or for the whole site?	Y	62 66 72	
24	Does the CP include a closure work program for each domain or feature?	Y	65	
25	Does the CP contain site layout plans to clearly show each type of disturbance as defined in Schedule 1 of the MRF Regulations?	N/A		The rail is not subject to the Mine Rehabilitation Fund (MRF)
26	Does the CP contain a schedule of research and trial activities?	Y	69	Improvement activities have been identified
27	Does the CP contain a schedule of progressive rehabilitation activities?	Y	72	
28	Does the CP include details of how unexpected closure and care and maintenance will be handled?	Y	69	
29	Does the CP contain a schedule of decommissioning activities?	N		Decommissioning schedules will be developed if and when closure of the asset is announced.
30	Does the CP contain a schedule of closure performance monitoring and maintenance activities?	Y	70	
Closure Monitoring and Maintenance				
31	Does the CP contain a framework, including methodology, quality control and remedial strategy for closure performance monitoring including post-closure monitoring and maintenance?	Y	70	
Financial Provisioning for Closure				
32	Does the CP include costing methodology, assumptions and financial provision to resource closure implementation and monitoring?	Y	78	
33	Does the CP include a process for regular review of the financial provision?	Y	78	
Management of Information and Data				
34	Does the CP contain a description of management strategies including systems and processes for the retention of mine records?	Y	79	

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1. PURPOSE AND SCOPE

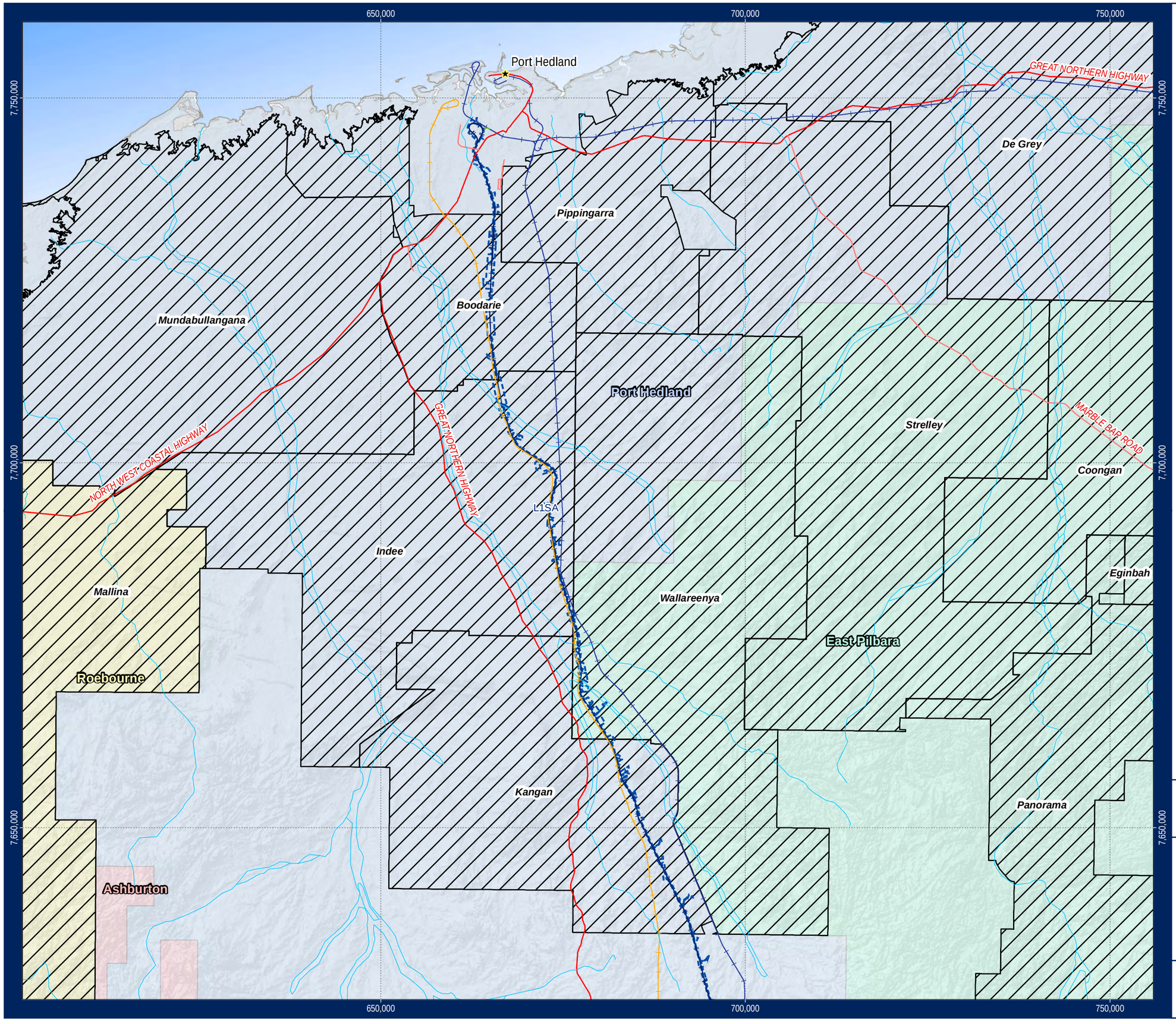
The Integrated Rail Network (IRN) is owned by The Pilbara Infrastructure Pty Ltd (TPI), a wholly-owned subsidiary of Fortescue Metals Group Ltd (Fortescue). The IRN currently services Fortescue's iron ore mining operations in the Pilbara region of Western Australia, transporting ore from mining operations to port facilities at Anderson Point in Port Hedland.

The purpose of this *Integrated Rail Network Closure Plan* (IRNCP) is to support closure planning for the Integrated Rail Network (IRN) within the Special Rail Licence L1SA. This includes:

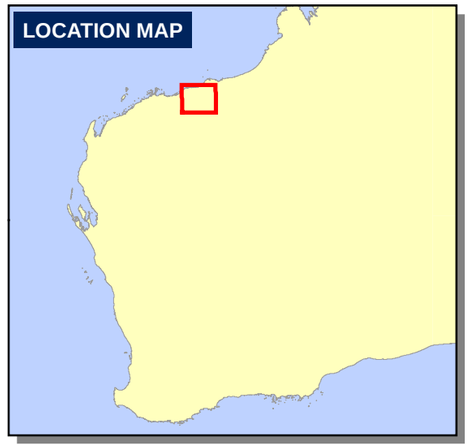
- Rehabilitation of land disturbance during infrastructure construction phases and not required for ongoing operation of the asset;
- Rehabilitation of minor land disturbances associated with maintenance of the linear infrastructure; and
- End of asset life decommissioning, dismantle / demolition, disposal and associated land rehabilitation, where required.

Closure planning for the IRN has previously been undertaken via Fortescue's *Conceptual Closure Plan*. This IRNCP serves the following purposes:

- Replaces Fortescue's *Conceptual Closure Plan* where relevant to the IRN, following acceptance of the IRNCP from the requisite regulatory authorities.
- Consolidates and replaces multiple rehabilitation management plans previously applied to the IRN, following acceptance of the IRNCP from the requisite regulatory authorities:
    - *Rail Corridor Rehabilitation Management* (R-PL-EN-0008); and
    - *Rehabilitation and Revegetation Management Plan* (45-PL-EN-0023).
- Complements and supersedes borrow pit rehabilitation management actions within the *Borrow Pit Management Plan* as it pertains to the IRN.
- Informs external stakeholders of Fortescue's long-term closure strategy for the IRN.
- Assists internal stakeholders to plan for the cessation of IRN services when mining in the Pilbara stops.



LOCATION MAP



LEGEND

- Towns
- Principal Road
- Secondary Road
- Fortescue Rail Alignments
- BHPB Rail
- Rio Tinto Rail
- Roy Hill Rail
- Major Drainage
- Special Lease Area boundary L1SA
- FMG Pastoral Leases Generalised

Local Government Authority

- Ashburton
- East Pilbara (S)
- Port Hedland (T)
- Roebourne

Data Sources:
National Park, DPaW.
LGA, Towns, Landgate.
Roads, Drainage, SRTM, GA.
Pastoral leases, FMG based on Landgate.
All other data, FMG, 2018.

N

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Kilometres

Integrated Rail Network
Map 3 of 3

Requested By: S. Robinson
Drawn By: S. Costello
Revised By: scostello
Approved By: S. Costello
Scale: 1:500,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 750EW_MP_OP_0007.003_r0

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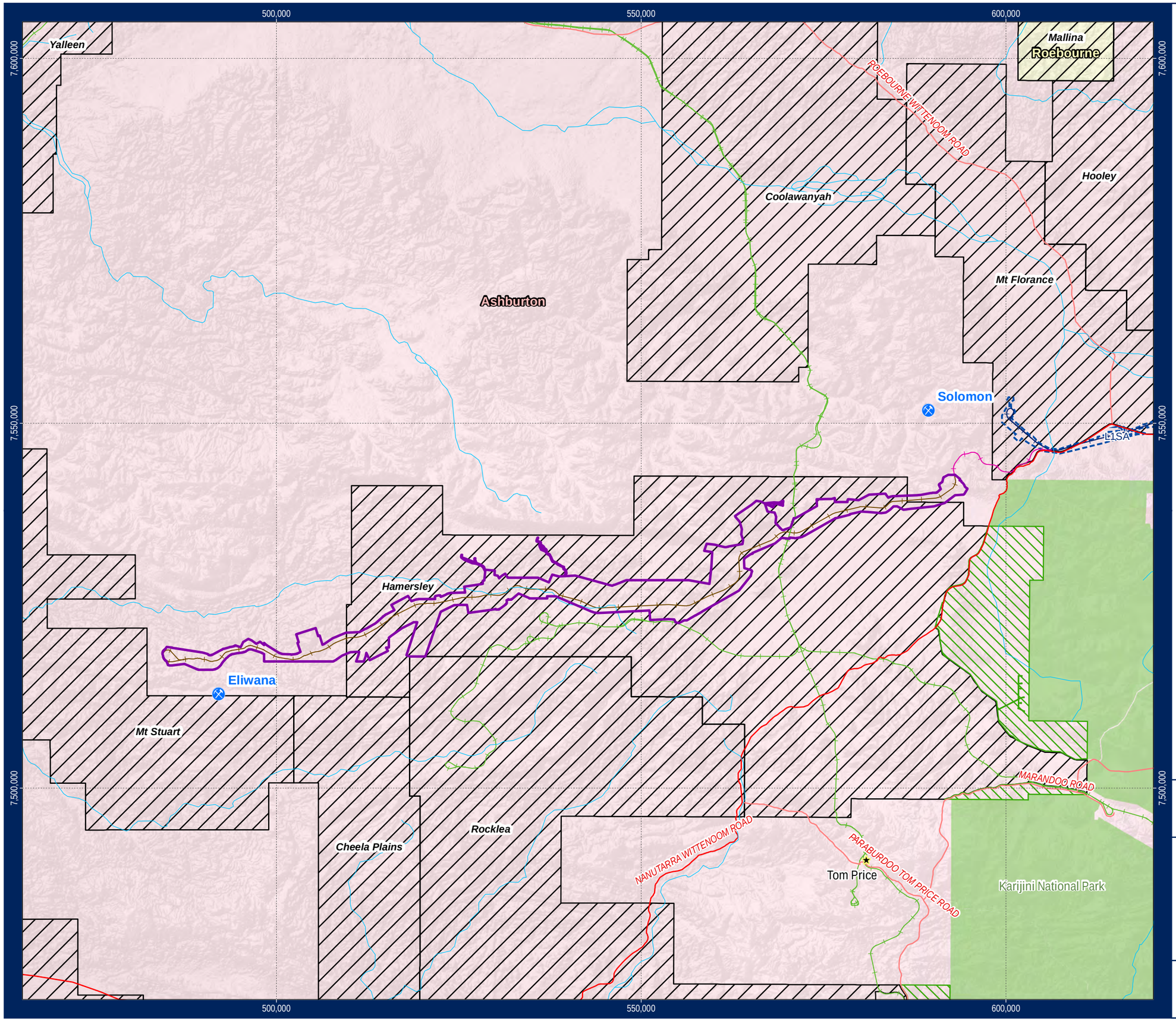

LEGEND

- Fortescue Projects
- Towns
- Principal Road
- Secondary Road
- Fortescue Rail Alignments
- Eliwana Stage One Rail Spur
- Eliwana Stage Two Rail Spur
- Rio Tinto Rail
- Major Drainage
- Rail Development Envelope
- Proposed for Conservation
- Special Lease Area boundary L1SA
- FMG Pastoral Leases Generalised
- National Park

Local Government Authority

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Map 1 of 3

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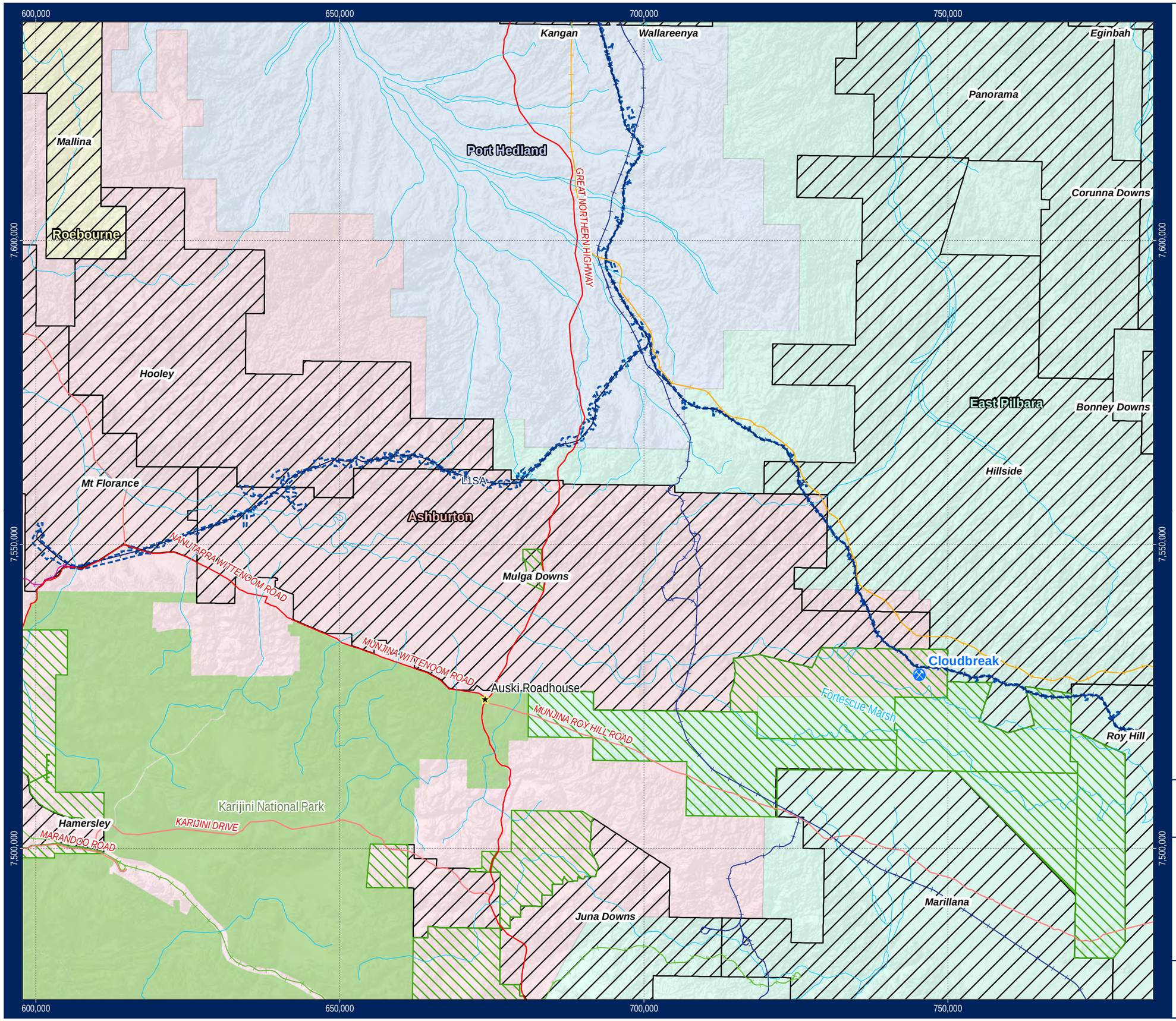

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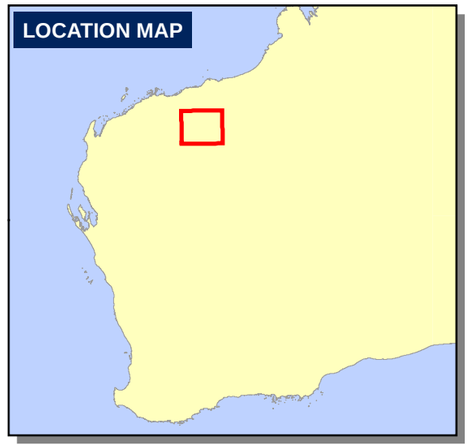

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Kilometres

Integrated Rail Network
Map 2 of 3

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2. PROJECT SUMMARY

2.1 Ownership

The IRN is 100% owned by The Pilbara Infrastructure Pty Ltd (ACN 103096340), a wholly owned subsidiary of Fortescue.

The contact details for Fortescue are:

Fortescue Metals Group Ltd

Level 2

87 Adelaide Terrace

East Perth WA 6004

2.2 Description of operation

The IRN consists of 620 km heavy haulage railway line and associated infrastructure that connects the loading and port facilities at Anderson Point (Port Hedland) to Fortescue's Solomon and Chichester (Cloudbreak and Christmas Creek) iron ore mines. The combined disturbance footprint of the existing IRN is around 5,300 ha of which around 2,200 ha has been rehabilitated.

The network is organised into sections, including a main line with two lines that connect to the mine operations. The rail sections are described below and shown in Figure 1:

- Main Line rail: 182 km rail from the Port Hedland rail loop to Chainage 182. This section was opened in 2008, with portions of the rail duplicated in 2012.
- East-West rail: 119 km rail from Main Line Chainage 182 to the Christmas Creek rail loop, including a rail siding with train loadout facilities at the Cloudbreak iron ore deposit. The East-West rail section was opened in 2008. The Christmas Creek (Kennedy Spur) rail spur and loop was completed in 2011.
- Hamersley rail: 130 km rail from Main Line Chainage 172 to the Firetail rail loop at the Solomon mine hub. This rail extension and loop was completed in 2013. The Hamersley rail also includes approval for the 23 km Frederick rail spur that has yet to be constructed. The Frederick rail spur extends from the Firetail rail loop to Solomon's Frederick iron ore deposit.
- (Proposed) Eliwana Rail Spur: 120 km rail, if approved, will extend from the yet to be constructed Frederick rail spur to the proposed Eliwana Iron Ore Project.

The IRN traverses a number of municipalities and pastoral stations. These are outlined in Figure 1 and are listed in Table 1.

Table 1. Municipalities and Pastoral Leases Traversed by the Integrated Rail Network

Segment of Network	Pastoral Leases	Municipalities
Main Line	Boondarie Indee Wallareenya Kangan	Town of Port Hedland Shire of East Pilbara
Hamersley Line:	Mulga Downs Hooley Mt Florence	Town of Port Hedland Shire of East Pilbara Shire of Ashburton
East-West Line	Hillside Mulga Downs Roy Hill	Town of Port Hedland Shire of East Pilbara Shire of Ashburton
Eliwana Line	Mt Stuart Rocklea Hamersley Cheela Plains	Shire of Ashburton

Each section of rail consists of a number of different elements described below. Elements specific to select lines are listed in Table 2.

Table 2. Elements of the Integrated Rail Network

Elements	Main Line	East-West Line	Hamersley Line	Eliwana Line
Rail loop and train loadout facility	Anderson Point Loop	Cloudbreak (spur only) Christmas Creek Loop	Firetail Loop	Eliwana Loop
Railway and associated embankments	X	X	X	X
Crossing/passing loops/banker refuge/sidings/bad order spur	Road Crossing Kanga Station Road	Maddina Siding Kennedy Siding Road Crossing at Ruby's Bore	Roebourne-Wittenoom Road Crossing Rail passing tracks (Avon, Bow, Capel)	Hamersley Road at Chainage 29 Near Rio Tinto Irrigation Agricultural Area at Chainage 74
Marshalling yards	Thomas Marshalling Yard. Kanyirri Yard	-	-	-
Railway overpass/bridges	East Turner River Bridge Gilliam Creek Turner River Bridge BHP Bridge (road)	-	Coonarie Creek Bridge 2 Fortescue South Bridge 1 Fortescue South Bridge 2	unspecified

Elements	Main Line	East-West Line	Hamersley Line	Eliwana Line
	Coorong Creek Bridge Coonarie Creek Bridge			
Borrow areas[1]	X	X	X	X
Rail maintenance track	X	X	X	X
Access roads	X	X	X	X
Culverts and surface water management infrastructure	X	X	X	X
Signalling infrastructure	X	X	X	X
Gas and water pipelines	X	X	X	X
Power transmission lines	X	X	X	X
Construction and potable water supply borefields, infrastructure and water storage	X	X	X	X
Communications infrastructure (including towers, tracks and fibre optic cables)	X	X	X	X
Laydown areas	X	X	X	X
Fuel storage facilities	X	X	X	X
Other facilities	Accommodation Camp Chainage 145	-	-	-

Railways and Sidings

The railway consists of 1,435 mm gauge width heavy haulage railway track. The main components are an embankment fill under a sub ballast capping, ballast, sleepers and rail. Elements of the constructed railway are demonstrated in Figure 2. The railway generally consists of nominal 25 m sections of new head hardened rail rated as 68kg/m, fastened on concrete sleepers spaced between 600-675 mm apart, on ballast of at least 250 mm depth and 4 m wide, and sub ballast capping of the same depth with a mechanical strength of 40% CBR (California Bearing Ratio) with a width of 6 m. Embankments typically can be 5 m above ground level and are constructed from fill with embankment angles of between 1v:1.5h - 1v:3h. Embankments greater than 12 m are benched and capped at 10 m.

Where unsuitable soils were found during railway construction (such as gilgai soils along the Hamersley line), these were removed and replaced with a stable fill.

[1] Ballast quarries outside the Special Rail Licence L1SA require additional mining approvals under the Mining Act 1978 supported by site specific mine closure plans and are not within the scope of this closure plan.

Cuttings

Cuttings into hills have been made along the railway alignment where required to provide a suitable rail slope for the railway. The extent of the cutting varies depending on the nature of the materials, as summarised in Table 3. An example of railway cuttings can be seen in Figure 2. Berms were generally installed at 10 m height (maximum) with a berm width of 6 m. Catch drains were nominally designed to be 1 m wide for cuts less than 5 m and doubled in width where the cuts were greater. Cut-off drains above the cuttings with a 20 year average recurrence interval (ARI) design flow capacity were also installed.

Table 3. Cutting Requirements

Material	Depth Range	Batter slope and berm requirements
Weathered granite	0-7.5 m	1:1
Silty sand/meta sediments and/or alluvial granitic soil	0-14 m	1:1.5 to 3 m deep, 6 m berm width, 3:1 below berm
Stony gilgai	0 – 20 m	1:3 to 3 m deep, 6 m berm width, 3:1 below berm
Sandstone & volcanoclastic sediments	2m – 20m	2:1
Madding basalt	1.5 – 20m	3:1

Rail Loops and Train Load Out Facilities

At the Anderson Point, Christmas Creek and Solomon termini the rail forms a rail loop and train load-out facilities are present. These consist of either one (Christmas Creek and Solomon) or two (Cloudbreak) clamshells through which ore is transferred into ore cars as the train drives underneath using its own power. Train load-out bins are used to buffer variations in infeed and outfeed.

Surface Water Management Structures

Where required to prevent critical flood impacts to the rail, culverts and other surface water infrastructure generally sized to convey 20 year ARI events have been used to manage surface water flow through the railway. These culverts have been designed to have a life of 30 years. Culverts are designed to provide 0.3 m freeboard for the rail formation shoulder with at least 600 mm in cover. Where installed, the culverts are corrugated steel or concrete and are bedded on then backfilled with compacted fill. The inlet and outlet head walls have rocks aprons, and where required, cement stabilised backfill to minimise piping.

Culverts are also used where it has been recognised that the surface water flows are required to support environmental values. Environmental culverts have been used to maintain surface water flow to the potentially sheetflow dependent Mulga communities. The environmental culverts are

300 – 600 mm in diameter. In some locations low guide banks have also been installed in order to prevent the linear flow of water along the railway.

Bridges were considered and used where the 50 year ARI design flow was modelled to exceed 500m^3/s. The bridges are ballasted deck bridges with approach embankments. The design life of the structural elements used in these bridges is 100 years, with the overall structure having a designed life of 50 years. Bridges have been designed with a freeboard of 0.5m for 1 in 50 year ARI events (to the underside of the soffit). The formation width of approaches is 6,000 mm.

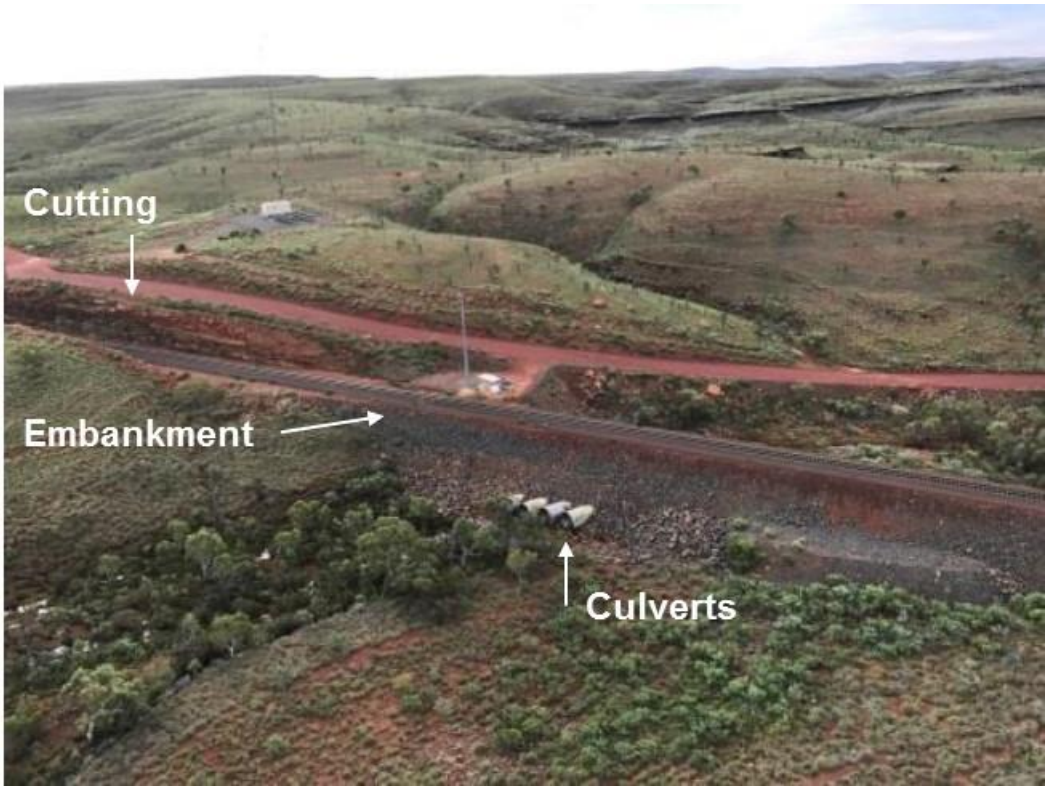


Figure 2. An example of railway construction (embankment, cutting and culverts)

Railway Maintenance Track

A railway maintenance track is located adjacent to the IRN. This road is designed in alignment with the *Ausroads Rural Road Design Guidelines* and is used by authorised vehicles to travel along the railway corridor.

Marshalling Yards and Refuelling Areas

Marshalling yards are located near Port Hedland. These are used to sort and move ore cars and consist of compacted areas with rails. Refuelling facilities are available at Anderson Point, Christmas Creek and Solomon.

Road Crossings

Three types of crossing have been used along the railway. These comprise an underpass of the Great Northern Highway near Port Hedland, bridges over the BHP railway line and level crossings where the railway crosses local roads.

Support Infrastructure

Linear infrastructure that supports the railway operations includes solar-powered signalling infrastructure, gas and water pipelines, power transmission lines, construction and potable water supply borefields, infrastructure and water storage facilities, and communications infrastructure (including towers, tracks and fibre optic cables) and masts.

Accommodation Camps

Accommodation camps were used during construction and after construction, and one is currently used by staff. Other accommodation camps have been decommissioned and rehabilitated, or decommissioned. The current accommodation camp is at Chainage 145 and comprises 150 rooms. The camp has waste water treatment facilities and water treatment facilities with domestic rubbish trucked out. Potable water is drawn from bores. The camp is powered by diesel generators.

3. CLOSURE OBLIGATIONS AND COMMITMENTS

Closure obligations and commitments pertaining to the rehabilitation and closure of the IRN have been established via various agreements and approvals submissions. Appendix 1 provides an overview of those key legal instruments and the associated conditions, clauses and commitments arising from those compacts. A comprehensive legal review will be required as closure approaches to ensure that all relevant obligations are identified and actioned.

The key legal instruments that influence progressive rehabilitation and closure of the IRN include:

- *Railway and Port (The Pilbara Infrastructure Pty Ltd) Agreement Act 2004* (TPI State Agreement) established with the State of Western Australia, and
    - associated Special Railway Licence (SRL) L1SA miscellaneous licence.
- Ministerial Statements 690, 1033, 1062 issued under Part IV of the *Environmental Protection Act 1986* (WA) (EP Act).

To assist stakeholders to understand the differing obligations and commitments that influence progressive rehabilitation and closure of the IRN, a summary of the key legal instruments is provided below. This summary is provided as 'plain English' interpretation of the legal documents and is not intended to reflect or replace a legal interpretation of the agreements. Consequently, the interpretation provided below may change over time, following legal review and / or the establishment of alternate legal precedents.

3.1 TPI State Agreement

The TPI State Agreement ratifies an agreement between the State of Western Australia and TPI to develop a multi-user railway and port facilities and authorises implementation of that agreement. The multi-user railway is the subject of this closure plan.

Within the TPI State Agreement the State agreed to assist in the development of the railway and port facilities for the purpose of promoting development of multi-user infrastructure in the Pilbara and promoting the development of the iron ore industry and employment opportunities generally in WA.

The TPI State Agreement requires that TPI use all reasonable endeavours to promote access to, and attract customers for, the railway. Through the Agreement, TPI is also required to "at all times keep and maintain in good repair and working order and condition" the railway and associated infrastructure, including private roads that cross the railway. This "obligation includes, where necessary, replacing or renewing all part which are worn out or in need of replacement or renewal due to their age or condition". [Clause 20]

Within the TPI State Agreement the 'Railway' means "the standard gauge haul heavy railway", "all railway track, associated track structures including sidings, turning loops, over or under track structures, supports…, tunnels, bridges, train control systems, signalling systems, switch and other gear, communication systems, electric traction infrastructure, buildings (excluding office buildings, housing and freight centres), workshops and associated plant, machinery and equipment and including rolling stock maintenance facilities, terminal yards, depots, culverts and weigh bridges..." 'Additional Infrastructure' includes the infrastructure necessary for the transport of iron ore products, freight goods or other products from the SRL Railway to the Port Facilities. [Clause 1]

On the basis of the above, it is reasonable to assume that the IRN will be in good working order and condition at the time that TPI decides to cease operating the railway.

Clause 32 outlines the requirements relevant to cessation or determination of the TPI State Agreement. Clause 32(2)(b)(ii) states that "…the SRL Railway and Additional Infrastructure located outside the Port shall become and remain the absolute property of the State" unless the Minister responsible for administering the TPI State Agreement gives notice to TPI under Clause 32(2)(a) to remove the Railway and Additional Infrastructure and rehabilitate the land.

Infrastructure that is not explicitly included in the Railway and Additional Infrastructure definitions, and therefore understood to be excluded from the handover of the IRN include office building and housing [Clause 1].

Fortescue considers the IRN would be an asset of value to the State as:

- There are no government owned railways in the Pilbara;
- The IRN will be in good repair and working order;
- The IRN links the central Pilbara region to a viable, commercial port and the Port Hedland regional centre; and
- There has been regular and ongoing demand for use of the existing privately-owned Pilbara rail networks to support Pilbara development opportunities.

For the purposes of this closure plan, it is assumed that the State of Western Australia would take ownership of the IRN if TPI elected to cease operation of the railway. Office buildings within the SRL Railway and accommodation camps have been interpreted to be excluded from this handover, as per the definition provided above, and would need to be removed and the land rehabilitated on determination of the TPI State Agreement.

3.2 SRL L1SA

The SRL is a miscellaneous licence administered by the Minister for Mines pursuant to clause 14(1)(a) of the TPI State Agreement to facilitate planning, design, construction, commissioning,

operation and maintenance activities within the railway corridor. SRL L1SA was issued to TPI in 2006 for a period of 50 years. The main tenement conditions imposed on L1SA relevant to closure planning for the IRN are listed in Table 4.

Table 4. Special Rail Licence Conditions

No	Description
Condition 8	Topsoil being removed from areas of temporary disturbance and stockpiled for later respreading or immediately respread as rehabilitation progresses.
Condition 9	All rubbish and scrap is to be progressively disposed of in a suitable manner.
Condition 10	At the completion of operations, or progressively where possible, all access roads and other disturbed areas being covered with topsoil, deep ripped and revegetated with local native grasses, shrubs and trees.

3.3 Ministerial Statements issued under Part IV of the EP Act

Each stage of the IRN development has been assessed under Part IV of the EP Act. The current Ministerial Statement conditions relevant to rehabilitation and / or closure of facilities associated with the IRN are outlined in Table 5.

In due course, this IRNCP is intended to replace the *Rail Corridor Rehabilitation Plan* stipulated under Ministerial Statement 690 Condition 9 and fulfil the requirement for condition specific Condition Environmental Management Plans associated with Ministerial Statement 1033 Condition 14 and Ministerial Statement 1062 Condition 18.

Table 5. State Ministerial Approval Conditions

Main Line	Ministerial Statement 690
Condition 9 -1	For the portion of the project area which lies outside the Port Hedland Port Authority Boundary, the proponent shall rehabilitate all areas not required for ongoing operations in accordance with a Rail Corridor Rehabilitation Plan prepared to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority. Note: In preparation of advice to the Minister for the Environment, the Environmental Protection Authority expects that the advice of the following agency will be obtained: • Department of Conservation and Land Management. The Rail Corridor Rehabilitation Plan shall set out measures for: 1. identification of disturbed areas not required for ongoing operations; 2. topsoil management; 3. borrow pit management; 4. weed management during operations; 5. restoration of fauna habitat areas lost or modified during construction activities, fauna habitat reconstruction, and rehabilitation of disturbed areas (including rehabilitation of mulga communities); 6. the derivation of completion criteria; 7. monitoring the success of rehabilitation against completion criteria; 8. maintenance of rehabilitation; and 9. progressive surveying of total area rehabilitated.

East-West Line	Ministerial Statement 1033
Condition 14-1	The proponent shall manage the implementation of the proposal to meet the following environmental objective: (1) ensure that the proposal is decommissioned and rehabilitated consistent with the requirements of the TPI State Agreement.
Condition 14-2	The proponent shall prepare a plan required by condition 6-1 that satisfies the requirements of condition 6-2, to meet the objective required by condition 14-1.
Condition 6-1	The proponent shall prepare and submit Condition Environmental Management Plans:… (4) within 12 months of the Minister (for State Development) giving notice under Clause 32 (2)(a) of the TPI State Agreement or as otherwise agreed in writing by the CEO, or at least 3 years prior to the planned cessation of Railway Operations by the proponent, whichever occurs first, to demonstrate that the environmental objective in condition 14-1 for the East-West Railway will be met.
Condition 6-2	The Condition Environmental Management Plans shall:… (1) specify the environmental objectives to be achieved, as specified in conditions … 14-1, …; (2) specify risk-based management actions that will be implemented to demonstrate compliance with the environmental objectives specified in … 14-1, … Failure to implement one or more of the management actions represents non-compliance with these conditions; (3) specify measurable management target(s) to determine the effectiveness of the risk-based management actions; (4) specify monitoring to measure the effectiveness of management actions against management targets, including but not limited to, parameters to be measured, baseline data, monitoring locations, and frequency and timing of monitoring; (5) specify a process for revision of management actions and changes to proposal activities, in the event that the management targets are not achieved. The process shall include an investigation to determine the cause of the management target(s) being exceeded; (6) provide the format and timing to demonstrate that … 14-1…have been met for the reporting period in the Compliance Assessment Report required by condition 3-6 including, but not limited to: (a) verification of the implementation of management actions; and (b) reporting on the effectiveness of management actions against management target(s).
Hamersley Line	**Ministerial Statement 1062**
Condition 18-1	The proponent shall manage the implementation of the proposal to meet the following environmental objective: (1) ensure that the rail line within the rail development envelope is decommissioned and rehabilitated consistent with the requirements of the *Railway and Port (The Pilbara Infrastructure Pty Ltd) Agreement Act 2004*.
Condition 18-2	The proponent shall prepare a plan required by condition 7-1 that satisfies the requirements of condition 7-2, to meet the objective required by condition 18-1.
Condition 7-1	The proponent shall prepare and submit Condition Environmental Management Plans:… (2) within 24 months of the issue of this Statement or as otherwise agreed in writing by the CEO, to demonstrate that the environmental objectives in conditions … 18-1 will be met.
Condition 7-2	The Condition Environmental Management Plans shall: (1) specify the environmental objectives to be achieved, as specified in conditions … 18-1; (2) specify risk-based management actions that will be implemented to demonstrate compliance with the environmental objectives specified in conditions …18-1. Failure to implement one or more of the management actions represents non-compliance with these conditions; (3) specify measurable management target(s) to determine the effectiveness of the risk-based management actions; (4) specify monitoring and analysis to measure the effectiveness of management actions against management targets, including but not limited to, parameters to be measured, baseline data, monitoring locations, and frequency and timing of monitoring;

	(5) specify a process for revision of management actions and changes to proposed activities that could be undertaken, in the event that the management targets are not achieved; (6) provide the format and timing to demonstrate that conditions … 18-1 have been met for the reporting period in the Compliance Assessment Report required by condition 3-1 including, but not limited to: (a) verification of the implementation of management actions; and (b) reporting on the effectiveness of management actions against management target(s).

3.4 EPBC Act

Controlled actions issued under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) include 2010/5513 and 2012/6530 associated with the Main Line and 2010/5567 and 2014/7275 for the Hamersley Line. No rehabilitation or closure specific conditions were applied in these controlled actions.

3.5 Traditional owner land access agreements

Fortescue has agreements in place with multiple native title groups along the IRN. With regard to closure, these agreements general express an expectation for the pre-existing environment to be re-established, to a maximum reasonable extent, or for the land to be returned to a condition equivalent to the environmental conditions existing in adjacent areas.

4. STAKEHOLDER ENGAGEMENT

4.1 Key stakeholders

Fortescue's stakeholder engagement strategy aims to establish open dialogue between key stakeholders, using face-to-face modes of engagement wherever practicable. For engagement on closure planning and-closure related aspects, this strategy includes:

- Transparency in disclosure of project characteristics and closure processes;
- Awareness of, and responsiveness to, stakeholder views and concerns;
- Seeking agreement on closure objectives and closure criteria; and
- Understanding stakeholder visions on post-closure land use.

Given the extent of the IRN, a number of stakeholder groups have been identified (Table 6).

Table 6. Key stakeholders

Segment of Network	Traditional Owner Group	Pastoral Leases	Local Governments	Government Departments and Agencies
Main Line	Kariyarra People Palyku People	Boondarie Indee Wallareenya Kangan	Town of Port Hedland Shire of East Pilbara	Department of Jobs, Tourism, Science and Innovation (JTSI) Environmental Protection Authority (EPA) Department of Mines, Industry Regulation and Safety (DMIRS) Department of Water and Environmental Regulation (DWER) Department of Biodiversity, Conservation and Attractions (DBCA) (Formerly Department of Conservation) Department of Planning, Lands and Heritage (DPLH) Main Roads Western Australia (MRWA) Department of the Environment and Energy (DEE)
Hamersley Line	Martu Idja Banyjima People Yindjibarndi People Eastern Guruma	Mulga Downs Hooley Mt Florence	Shire of East Pilbara Shire of Ashburton	
East-West Line	Palyku People Nyiyaparli People	Hillside Mulga Downs Roy Hill	Shire of East Pilbara Shire of Ashburton	
Eliwana Line	Eastern Guruma People Puutu Kunti Kurrama and Pinikura (PKKP) People	Mt Stuart Rocklea Hamersley Cheela Plains	Shire of Ashburton	

4.2 Ongoing consultation

The views of Fortescue's stakeholders have been tested through discussions used to facilitate project planning. Specific advice on the development and content of the approved, predecessor *Rail Corridor Rehabilitation Plan* has been obtained from the Department of Environment and

Conservation (now DBCA and DWER). Advice was also sought on management of surface water drainage and alleviation of potential impacts on Mulga from a specialist consultant.

Table 7. Engagement Style with Key Stakeholders

Stakeholder group	Engagement forum and style
Department of Jobs, Tourism, Science and Innovation	• Regular meetings.
Town of Port Hedland Shire of East Pilbara Shire of Ashburton	• Ad hoc meetings on an “as needs” basis.
Environmental Protection Authority	• Ad hoc meetings with representatives during the assessment process for Rail Projects
Department of Mines, Industry Regulation and Safety	• Ad hoc meetings with technical staff, to provide updates on technical aspects relating to closure outcomes • Statutory reporting
Department of Water and Environmental Regulation	• Statutory reporting • Ad hoc meetings with nominated assessors
Department of Biodiversity, Conservation and Attractions	• Statutory reporting • Ad hoc meetings with nominated assessors, to review status of closure plan development.
Department of Planning, Lands and Heritage	• Ad hoc meetings with the nominated parties. • When the mine life is determined, discussions regarding infrastructure transfer will commence.
Department of the Environment and Energy	• Ad hoc meetings with nominated assessors.
Traditional Owner Groups	• Regular meetings that discuss rail developments and closure planning on an ad hoc basis.
Pastoral Stations	• Ad hoc meetings to inform of rail developments. • When the mine life is determined, discussions regarding infrastructure transfer will commence.
Other land users (e.g. mining companies)	• Ad hoc meetings on an “as needs” basis.

Issues associated with rehabilitation and closure that have been raised and / or resolved during Fortescue’s ongoing stakeholder engagement are summarised in Appendix 2. Fortescue will continue to engage with closure stakeholders on an as-needs basis using the engagement forum and style listed in Table 7.

5. POST-CLOSURE LAND USE AND CLOSURE OBJECTIVES

5.1 Post-closure land use

It is expected that the IRN will be transferred to the State of Western Australia once TPI ceases to operate the railway. It is anticipated that the State will either operate or sell the railway, such that the assets will continue to operate as a railway following the cessation of the TPI State Agreement.

Land adjacent to the railway may be temporarily disturbed during the construction and maintenance of the railway. This land will be returned to a condition similar to the pre-disturbance and / or adjacent land condition, compatible with the underlying pastoral land use (where applicable).

5.2 Closure objectives

Fortescue's aims for rehabilitation are to:

1. Stabilise the land surface such that it is safe, stable, erosion resistant over the long term and, where practicable, visually similar to the surrounding landscape.

2. Re-establish self-sustaining vegetation that is compatible with planned end land uses and comparable to surrounding or pre-existing vegetation or to meet completion criteria specific to the next land user's requirements.

3. Minimise adverse affects on the environmental values of surrounding areas, e.g. through changes in surface water drainage, weed infestation, and impacts on fauna.

The proposed closure objectives listed in Table 8 are a refinement of these aims, expanded to include closure objectives associated with permanent infrastructure.

Table 8. Rail Closure Objectives

Objective		Rationale	Applicable Closure Domain
1.	Infrastructure is removed or retained in line with agreements reached with future land users and managing authorities.	The Government will receive the rail in accordance with the conditions stipulated in the TPI State Agreement. Some infrastructure not included in the TPI State Agreement may be retained at the request of the next land-users. Transfer of the liability and accountability for managing retained infrastructure requires a legal agreement between parties.	Permanent
2.	Reconstruct safe, stable and erosion-resistant landforms.	Excessive erosion can prevent plants from establishing and lead to soil degradation.	Temporary Light Disturbance Temporary Heavy Disturbance

Objective		Rationale	Applicable Closure Domain
		Effective erosion controls will require suitable management of surface water drainage.	
3.	Rehabilitated land supports native vegetation and encourages fauna recolonisation, where practicable.	To be compatible with the underlying and post-closure land uses, rehabilitated land will need to support native, self-sustaining vegetation. Connection to the surrounding vegetation will be required to allow ready access for recolonising fauna. Ground disturbance can encourage weed development, which in turn can limit native vegetation development and spread to / impact areas outside of the initial disturbance.	Temporary Light Disturbance Temporary Heavy Disturbance

Closure domains are areas of land that have similar rehabilitation and closure requirements. For the purposes of closure planning and establishing closure objectives, the IRN has been divided into Permanent closure domains, where infrastructure is handed back to the State, and Temporary Light Disturbance and Temporary Heavy Disturbance closure domains (Table 9).

Table 9. Closure Domains

Domain	Area	Elements
Permanent	~1200 Ha	Railway (including sidings) Level crossings Overpasses, underpasses and bridges Marshalling yards Train refuelling points Train load-out areas Signalling infrastructure Gas and water pipelines Power transmission lines Construction and potable water supply borefields, infrastructure and water storage facilities Communications infrastructure (including towers, tracks and fibre optic cables)
Temporary Light Disturbance	~1800 Ha	Access roads Laydown areas Free-draining borrow pits
Temporary Heavy Disturbance	~90 Ha	Internally draining borrow pits Camps, administration buildings

6. COMPLETION CRITERIA

Conceptual closure objectives and completion criteria for the IRN have been stipulated in previous closure documents. The closure objectives and completion criteria have been reviewed and revised to reflect changed expectations in closure planning in Western Australia.

6.1 Completion criteria rationale

Completion criteria are the measures that will be used to determine whether the Fortescue has achieved the closure objectives. The completion criteria are provided in Section 6.2 and have been developed with consideration of the measurable outcomes that result from implementation of the closure plan. The completion criteria were designed to be:

- Measurable, scientifically quantifiable;
- Achievable or realistic in the opinion of the subject matter expert;
- Relevant to the objective; and
- Time-bound so that the criteria can be monitored over an appropriate time frame (when required) to ensure that results are robust to facilitate relinquishment.

When developing the completion criteria, emphasis was placed on ensuring that the criteria were definitive and clear, of a pass or fail type, as the achievement of the criteria indicates that appropriate management practices have been employed and that the closure objective has been achieved. Although it is recognised that at this stage the completion criteria, which are dominantly qualitative, will require further refinement prior to the cessation of the IRN to establish quantitative measures.

This approach was employed by Fortescue to provide flexibility with regards to which management practices are employed by Fortescue and to allow monitoring of performance indicators to be changed to target different aspects of issues as they arise without compromising compliance requirements.

To provide guidance and to foster discussion on how the completion criteria could be measured at implementation, Table 10 includes a list of indicative measurement approaches that may be used. These approaches will be subject to testing and refinement, with further consideration of measurement suitability and emerging monitoring and measurement technologies.

As each completion criterion is achieved, monitoring and/or maintenance associated with the criterion will cease. When all of the completion criteria have been met, closure is considered to have been successfully implemented and the land tenure can be relinquished to the State. Land tenure considered to be in this position may be relinquished in one block when all areas have met completion criteria, or smaller blocks of land tenure may be progressively relinquished as each

block achieves the completion criteria. Determination of how this would occur with respect to the TPI State Agreement will be determined closer to closure.

6.2 Performance indicator and control measures

Performance indicators are the measures used to assess and/or track the progress towards achieving the closure objective. Unlike completion criteria, which are focussed on the end outcome, performance indicators can provide stage gates, milestones and other qualitative measures that can be used by a technical specialist, independent of the completion criteria, to advise on whether progress to long-term outcomes is being made.

Performance indicators can change over time, in response to emerging issues and a developing knowledge base. Accordingly, performance indicators include activities undertaken during the operation to support closure objectives, key milestone activities and, later (as the IRNCP) is updated, quantitative indicators associated with trends over time developed from predicative models or field-based studies, particularly in relation to revegetation of temporary domains.

Controls are required to ensure the closure activities are performed in a manner that is consistent with the IRNCP in order to meet the completion criteria. Controls have been developed through the application of knowledge gained at other Fortescue sites, risk assessments and known local rehabilitation response. Further controls will be developed after the knowledge base is expanded and further risk assessments are undertaken on future closure design. The types of controls that will be considered when closure is closer to implementation include but not limited to management plans and procedures, designs, specifications and standards, and audits.

Performance indicators and control measures have been developed for the IRN as part of this IRNCP. These are presented in Table 10 along with the associated closure objectives, completion criteria and their applicable domains.

Table 10. Detailed rail closure objectives and completion criteria with measurement approach and suggested performance indicators.

Objective	Applicable domains	Criteria	Indicative measurement approach	Performance indicator	Controls
1. Infrastructure is removed or retained in line with agreements reached with future land users and managing authorities.	Permanent	a) Fortescue's obligations in any transfer agreements have been satisfied within agreed-to timeframes.	Visual inspection to confirm infrastructure has been removed / retained in accordance with agreements. Provision of documented evidence that agreements have been satisfied during the post closure period.	No significant environmental impacts associated with the retention of the infrastructure. No significant erosion impacting on the function of structures.	Working relationships with other land users and land managers maintained. Decommissioning and demolition plan to be developed once it is agreed with future land users and managing authorities what infrastructure will remain and to what standard it is to be handed over. Corrective earthworks or other stabilisation works completed where significant erosion, slumping or pending is discovered prior to handover to the leaseholder.
2. Reconstruct safe, stable and erosion-resistant landforms.	Temporary	a) Erosion rates are below or comparable to the neighbouring undisturbed land.	Signs of erosion are mapped using aerial photography, measured using high resolution LiDAR (or equivalent) and / or recorded during field surveys. Where signs of erosion are indicated, the rate of erosion is calculated by comparing topographical elevation changes from surveys, taken at least 12 months apart, to establish average annual erosion rates. Visual inspection shows no evidence of detrimental gully erosion.	Monitoring results show limited and decreasing numbers of rill development over time. No significant erosion impacting on the function of structures or on establishment of vegetation. No surface or batter slumping or collapse that impacts on local hydrology. No significant impact on conservation significant vegetation as a result of changes to surface water flow.	Implement environmental management plans Risks to people and fauna assessed and additional risk management employed where required Site supervision during final landform construction to confirm adherence to construction controls. Implement rehabilitation monitoring Implement remedial earthworks where monitoring indicates ongoing issues with unacceptable erosion rates
		b) Landforms pose minimal risk to people and fauna.	Visual inspection with photo log shows management has been successfully implemented.	No trenches remain that prevent fauna egress. Abandonment bunds are utilised to prevent inadvertent access to stable, open edges Ponding in borrow pits dissipates within days following rainfall events.	

Objective	Applicable domains	Criteria	Indicative measurement approach	Performance indicator	Controls
3. Rehabilitated land supports native vegetation and encourages fauna recolonisation, where practicable.	Temporary	a) The number of key plant species is within the range historically observed at the reference site.	'Key plant species' are identified as those species that have 80th percentile dominance by total coverage or individual plant count in vegetation units as defined by the relevant flora survey. 'Reference range' established with respect to individual key plant species as plants per hectare by monitoring reference sites quadrats or comparative photopoints over time.	Topsoil and vegetation is removed prior to disturbance. Topsoil and vegetation is stockpiled for rehabilitation use. All topsoil is respread as part of rehabilitation activities following construction / maintenance activities. Construction corridor disturbance is rehabilitated 12 months following the cessation of railway construction. Improving trends in species diversity, structural complexity and percentage cover are observed in monitoring data. Ponding in borrow pits dissipates within days following rainfall events.	Topsoil and vegetation reapplication works completed following construction / maintenance activities progressively. Implement rehabilitation monitoring Implement weed management Undertake supplementary seeding where plant species are unlikely to return without assistance
		b) The percentage of bare ground is less than the maximum historically observed at the reference site.	'Bare ground' is established using spatial assessment of aerial photography or satellite remote sensing. 'Bare ground' is defined as the percentage of visible absence of vegetation and is measured as a per hectare rate per vegetation unit. 'Bare ground' is measured at the end of the dry season when cover is lowest. 'Maximum' is established by assessing historical aerial photography and / or satellite remote sensing imagery in a representative area of the vegetation units as defined by the relevant flora survey.		
		c) Measures to encourage fauna recolonization are evident.	Visual inspection with photo log shows management has been successfully implemented, where practicable.	Large vegetation (>2m) is stockpiled separately and returned on rehabilitation to provide fauna habitat. Rehabilitated borrow pits are connected to surrounding vegetation via vegetated slopes to allow ready access for recolonising fauna	Implement environmental management plans, including feral animal management Monitor the return of native fauna to disturbed area. Review and employ new management actions if monitoring finds fauna are not returning.

Objective	Applicable domains	Criteria	Indicative measurement approach	Performance indicator	Controls
	Temporary	d) The percentage of weed cover is no more than the weed cover percentage observed in the adjacent, undisturbed area.	Measurement approach in accordance with *Weed Management Plan*, including: - 'Weed cover' established using three 10m x 10m quadrats or two 100m transects with three or more 2m x 2m quadrats.	Weed monitoring demonstrates low to no weed presence. No new weed species are established in the surrounding areas as a result of earthworks or rehabilitation activities.	Implement Weed Management Plan and Weed Hygiene procedures, such that weed treatments are undertaken in accordance the latest regulatory advice Identify and treat weed infected topsoil stockpiles prior to use in rehabilitation. Where weeds are identified, implement weed controls in accordance with Weed Management Plan

7. CLOSURE DATA – BASELINE

The following section summarises the local environmental conditions at and surrounding the IRN. Information presented in this section is derived from technical studies and corporate management plans listed in Section 13 *References*. Over the life of the asset this section will be updated to reflect the most recent information and understanding of the local environment and management.

7.1 Climate

The IRN passes through both Köppen Desert - hot, persistently dry, and Köppen Grassland – hot, persistently dry, climate classes. The climate information from three areas are included here to describe the three end points of the IRN (Figure 3). All data show that the climate is characterised by hot wet summers (October to April) and mild winters (May to September). The evaporation rate is in excess of 3,000 mm per year, which significantly exceeds annual rainfall and the average evapotranspiration rate of around 300 mm per year. These conditions are typical of the Köppen Desert and Grassland climate classes.

Precipitation is predominantly from tropical cyclones and monsoonal thunderstorms that occur during the summer months (December to February).

The most representative open weather station is located at Paraburdoo (Paraburdoo/Paraburdoo Aero) approximately 117 km to south west of Eliwana and is operated by the Bureau of Meteorology (BoM) (Figure 3). Rainfall data have been collected at Paraburdoo since 1974, and temperature data since 1996. In 2017, BoM reported the monthly mean maximum temperature at Paraburdoo ranges from 24.8°C in July to 40.6°C during January and the minimum temperature ranges from 9.8°C in July to 25.9°C in January.

Figure 3 also includes the mean rainfall data from the Hamersley rainfall gauge (BoM station 5005). The Hamersley rainfall gauge, located near the headwaters of Duck Creek, commenced operation in 1912, although data collection has been sporadic over the past decade. The higher rainfall levels recorded at the Hamersley gauge over the longer term and over the same timeframe as the Paraburdoo gauge (since 1974) suggests that rainfall is likely to be higher at Eliwana than at Paraburdoo.

The climate at Christmas Creek is typical of the Pilbara region and is characterised by temperatures ranging from a maximum average monthly temperature of 39°C in December to an average monthly minimum of 7°C in July. Between mid-December and April, the region is susceptible to tropical cyclones which are capable of producing damaging winds, heavy rainfall and flooding in inland areas. The closest long term rainfall gauge is located in Bonney Downs and is operated by the Bonney Downs Pastoral Station. This gauge is approximately 30 km away and has operated since 1907. Bonney Downs has a median annual rainfall of 283 mm, ranging from

as low as 46 mm in 1944 to 824 mm in 2000. The rainfall is generally heavy and concentrated over a few days (less than 30 rain days occur per year on average).

Mean monthly rainfall reported by BoM for Paraburdoo ranged from <4 mm in September to 76 mm in February, with a mean annual rainfall of 325 mm. Rainfall in the region often falls in short period intense events. Over a 72 hour period, for example, for a 100 year event the rainfall intensity is estimated to be around 3.75 mm/hr, over which time 270 mm of rain could fall.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) 2017 publication *Climate Change in Australia* indicates that average temperatures in the large "Rangelands North" subcluster, which includes the Pilbara and central Australia, will continue to rise. However, future rainfall trends have yet to be confirmed, and in the near future natural variation is predicted to be greater than those changes that can be attributed to climate change.

The impacts from, and implications of, climate change on Pilbara ecosystems remains uncertain. As carbon dioxide levels in the atmosphere increase (a major contributing factor to climate change), for example, some Pilbara plant species may be able to use water more efficiently. On a local scale, this could mean less water is used by plants so that more plants or larger plants could prosper, with the surplus contributing to increased groundwater recharge. Consequently, while climate change is considered to be a factor in this closure plan, management of the ecosystem and landforms for the recorded climate variability is expected to be sufficient to address climate change issues.

The Average Recurrence Interval (ARI) for selected areas along the IRN also reflect the nature of the intense rainfall events. The amount of rainfall received during a 72 hour event ranges from 257 mm to 433 mm (Table 11). For rarer events, this increases to approximately 700 mm at Port Hedland to 400 mm at Christmas Creek.

Table 11. Average Recurrence Interval data for selected locations of the IRN

Location	Total Rainfall	Rate (mm/hr)
Port Hedland	433	6.01
Christmas Creek	257	3.57
Eliwana	270	3.75

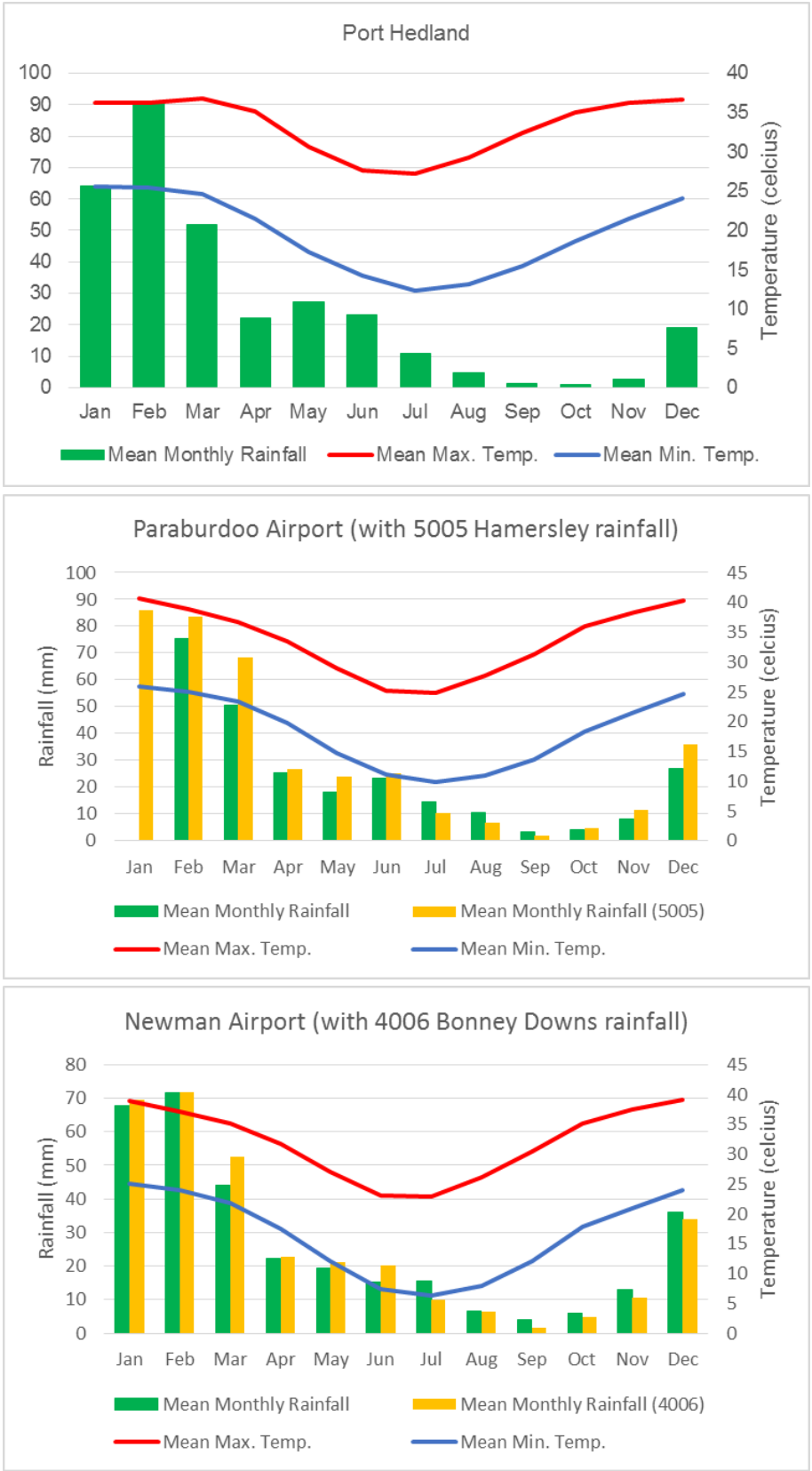


Figure 3. Selected Climatographs

7.2 Land

7.2.1 Land systems

The IRN traverses a number of physiographic regions including ranges, river valleys and peneplains. The Main Line begins in the alluvial and peneplains which are associated with the coast and the De Grey, Oakover, Shaw and Coogan Rivers and rises to approximately 50 m AHD. This then grades into the Hamersley Plateau, Chichester Range and Fortescue Valley as the line progresses to the Christmas Creek operations, and grades into the Hamersley Plateau and Hamersley Range as it moves towards the Solomon operations. The proposed Eliwana Rail traverses the Hamersley Range plateau and surrounding flat areas.

The relief along the IRN ranges from plains, to gently undulating ranges and dissected ranges. The top of the Hamersley Range plateau is a series of rounded hills and narrower ridges, reaching an elevation of 1,245 m above sea level at its highest point. It forms the watershed between the Fortescue River to the north and the Ashburton River to the south. Numerous rivers and streams have dissected the plateau, forming gorges and broader scree and rubble-filled valleys (Copp, 2005).

The broad land systems that underlie the IRN are described in Table 12. Features that may impact closure of the temporary domains are the self-mulching clays of the Wona and White Springs land systems due to the erosion potential of the landscapes which occur along the Hamersley Line.

Table 12. Land systems in the IRN area

Land System	Description	Main	East-West	Hamersley	Eliwana
Bonney	Low rounded hills and undulating stony plains supporting soft spinifex grasslands.			x	
Boolaloo	Granite hills, domes, tor fields and sandy plains supporting spinifex grasslands with scattered shrubs.	x			
Boolgeeda	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.			x	x
Brockman	Gilgai alluvial plains with cracking clay soils supporting tussock grasslands.			x	x
Calcrete	Low calcrete platforms and plains supporting shrubby hard spinifex grasslands.				x
Coolibah	Flood plains with weakly gilgaied clay soils supporting coolibah woodlands with tussock grass understorey			x	
Granitic	Rugged granitic hills supporting shrubby hard and soft spinifex grasslands		x	x	
Hooley	Alluvial clay plains supporting a mosaic of snakewood shrublands and tussock grasslands.				x
Jamindie	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey		x		
Jurrawarrina	Hardpan plains and alluvial tracts supporting mulga shrublands and tussock and spinifex grasses.			x	x
Macroy	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex shrubby grasslands.	x	x	x	
Mallina	Sandy surfaced alluvial plains supporting soft spinifex grasslands and minor hard spinifex and tussock grasslands.	x			
McKay	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.		x	x	
Newman	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.		x		x
Oakover	Breakaways, mesas, plateaux and stony plains of calcrete supporting hard spinifex shrubby grasslands.	x			
Platform	Dissected slopes and raised plains supporting hard spinifex grasslands.				x
River	Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.	x		x	

Land System	Description	Main	East-West	Hamersley	Eliwana
Robe	Low plateaux, mesas and buttes of limonite supporting soft spinifex and occasionally hard spinifex grasslands.	x	x		x
Rocklea	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.		x	x	x
Table	Low calcrete plateaus, mesas and lower plains supporting mulga and cassia shrublands and minor spinifex grasslands.				x
Talga	Hills and ridges of greenstone and chert, and stony plains supporting hard and soft spinifex grasslands	x	x		
Turee	Stony Alluvial plains and gilgaied and non-gilgaied surfaces supporting tussock grasslands and grassy shrublands of mulga and snakewood.		x		
Uaroo	Broad sandy plains, pebbly plains and drainage tracts supporting hard and soft spinifex hummock grasslands with scattered acacia shrubs.	x			
Urandy	Stony plains, alluvial plains and drainage lines supporting shrubby soft spinifex grasslands.			x	
White springs	Stony gilgai plains supporting Roebourne Plains grass grasslands and hard spinifex grasslands			x	
Wona	Basalt upland gilgai plains supporting Roebourne Plains grass and Mitchell grass tussock grasslands, minor hard spinifex grasslands or annual grasslands/herbfields			x	
Bonney	Low rounded hills and undulating stony plains supporting soft spinifex grasslands.			x	
Boolaloo	Granite hills, domes, tor fields and sandy plains supporting spinifex grasslands with scattered shrubs.	x			

Source: Mitchell *et al.* (1988)

7.2.2 Soil

The soils characteristics of the IRN corridor generally reflect the underlying geology and geomorphic processes occurring in the region. The soils along the alignment range from deep red sands to self-mulching clays (Table 13). Specific characterisation of the soils has not been undertaken due to the broad, but shallow, extent of the disturbance. Where characterisation has been undertaken, it has been for the purposes of geotechnical considerations.

The general characteristics of soils are outlined in Table 13. When complemented with other studies, the following general comments can be made about the soils found in the railway corridor:

- Other studies undertaken for Fortescue operations have shown that nutrient levels are dependent on Organic Carbon content of the soil. It is suspected to be the same for the soils of the IRN.
- Gilgai soils were required to be removed from areas of both the Main Line near the Chichester Range and Hamersley Lines due to the soils' instability.
- Most soils could be considered to be apedal or massive.
- Most soils (except for gilgai soils and some granite based soils and river sands) were considered to be suitable for different fill types for the rail embankment, which suggests that although the soil can be used for geotechnically stable landforms.
- Most soils can be considered to be at risk of hardsetting and dispersive, common in the Pilbara, which suggests most topsoils could be erodible depending the landscape setting they are used in.

Ground disturbance and topsoil management is governed by Fortescue's *Ground Disturbance and Topsoil Management* plan. In accordance with these guidelines, Fortescue aims to strip and stockpile an average of 10 cm from the cleared surface. During construction the stripped topsoil is generally stored immediately adjacent to the disturbance in stockpiles no more than 2 m high. The topsoil stockpiles are managed to maintain seed banks without introducing weed and other undesirable species.

Areas of temporary disturbance are rehabilitated using the stockpiled topsoil. For the purposes of the rehabilitation of the temporary disturbance domains, the recovery of 10 cm of soil has generally been found to be sufficient. Topsoil recovered from ground cleared for permanent infrastructure is utilised in rehabilitation of the temporary domains.

Table 13. Soil description

WA Soil Group Classification	Stony Soils (203)	Red Loamy Earths (544)	Red Shallow Loam (522)	Shallow Gravel Soils (on granite) (304)	Red deep sandy duplex soils (405)	Red shallow sandy duplex soils (406)	Red shallow sands on granite (423)	Red sandy earths (463)	Red deep loamy duplex soils (506)	Calcareous shallow loams (521)	Calcareous red loamy earths (542)	Self-mulching cracking clay (602)	Red/brown non-cracking clays (622)
Position in the landscape	Breakaway, footslope, hill, hillcrest, low rise, plateau, ridge, scree face and stony plain	Alluvial plain, drainage zone, flood plain, footslope, grove, hill slope, laterite plain, low rise, ridge, saline plain, stony plain and some sand sheets	Hillcrest, hill slope, laterite plain, low rise, lower footslope, narrow drainage zone, saline plain, stony plain, scree slope and ridge	Lateritic plain, low rise, plateau, stony hardpan plain, stony plain and occasional sand sheet	Lateritic plains, loamy plains, alluvial plains, drainage zones	Low rises, footslopes and stony plains	Hills, ridges, tor fields, footslopes, gritty surfaced plains and stony plains	Lateritic plains, loamy plains, sand sheets, sand banks, alluvial plains, and drainage zones.	Alluvial plains, floodplains, gilgaied groves, drainage zones and saline plains	Calcrete platforms and stony plains	Saline plains and loamy plains	Drainage foci, swamps, gilgai plains and saline plains	Stony plains, alluvial plains, claypans, swamps, floodplains, gilgai plains, groves and saline plains
Soil Texture	Fine sandy loam to loam, or occasionally clay loam in areas dominated by basalt, ironstone and shale. Loamy course sand to sandy loams in areas dominated by granite or sandstone	Sandy loam to clay loam topsoils over clay loam to light clay subsoils	Sandy loam to clay loam throughout or overlying sandy clay loam to clay loam	Weakly grading or uniform profiles of course sandy loam, fine sandy loam, loam or occasionally sandy clay loam with common to abundant (10 - >50%) ironstone gravels throughout the soil, increasing in abundance and size in depth	Loamy sand to sandy loam topsoils over loamy clay or light to medium clay subsoils	Loamy sand to sandy loam topsoils over sandy clay loam to light clay subsoils	Sand to clayey coarse sand or sandy loam	Loamy coarse sand to sandy loam overlying sandy loam, sandy clay loam or occasionally clay	Topsoils of loam (fine sandy) to loam (rarely light clay loam) overlying subsoils of light to medium clay	Fine sandy loam to sandy loam or clay loam	Sandy loams to loams and silty loams overlying clay loams or light to medium clay	Silty clay loam to light or medium clay topsoils overlying light to heavy clay subsoils	Clay loam to light or medium clay topsoils over light to heavy clay subsoils
Soil Depth	Mostly very shallow (<25 cm) to shallow (25-50 cm)	Deep (>100cm)	Very shallow (<25 cm) to shallow (25-50 cm)	Mostly shallow (25-50 cm), occasionally very shallow (<25 cm) or moderately deep (<60 cm)	Mostly deep (>100 cm), occasionally moderately deep (>80 cm)	Shallow (25-50 cm)	Mostly very shallow (<25 cm) to shallow (25-50 cm)	Mostly shallow to moderately deep (25 80 cm) to deep (>100 cm)	Deep (>100 cm).	Shallow (25-50 cm)	Deep (>100 cm)	Deep (>100 cm)	Deep (>100 cm), shallow (<50 cm) within hill areas
Soil surface condition	Mostly rock outcrop (10 - >50%) or abundant stony mantle (>50%) Infrequent (<10%) cryptogam crusting in absence of stony mantle	Common to abundant (10- >50%) stony mantles, otherwise common to abundant (10- >50%) cryptogam crusting	Common to abundant (10- >50%) stony mantle or common to abundant (10- >50%) cryptogam crusting where stony mantle is absent	Common to abundant (20- >50%) medium to course (2-20 mm) ironstone gravel mantle. (Sand sheet stone free with a loose surface)	Common to abundant (10- >50%) stony mantles or common to abundant (10- >50%) cryptogam crusting where stony mantle is absent	Common (10-50%) stony mantle with firm to hardsetting surfaces. Cryptogam crusting common (10-50%) where stony mantle is absent	Common (10-50%) cryptogam crusting or coarse loose sand developed from adjacent bare rock. Infrequent to common (1-50%) stony mantle or rock outcropping	Soft to firm. Minor areas of infrequent (<10%) cryptogam crusting or infrequent to common (1-50%) stony mantle	Infrequent to common (1-50%) stony mantles, otherwise stone free with abundant (>50%) cryptogam crusting	Mostly common (10-50%) stony mantles of calcrete or weathered basalt with infrequent to common (1-50%) cryptogam crusting	Mostly stone free with common to abundant cryptogam (10- >50%) crusting for grey soils. Common (10-50%) stony mantles of calcrete or basalt for red soils	Cracking or self-mulching (crumbly) topsoils with infrequent to common (1-50%) stony mantles of quartz, calcrete, ironstone or basalt. Common to abundant (10- >50%) cryptogam crusting where stony mantle is absent	Mostly common to abundant (10- >50%) stony mantle or common (10-50%) cryptogam crusting where stony mantle is absent
Substrate	Basalt, banded ironstone, dolerite, granite, ironstone, sandstone, sedimentary rock, shale, silcrete, unconsolidated or metamorphic rock	Occasionally ironstone gravel, red-brown hardpan, banded ironstone or granite	Basalt, schist, shale, banded ironstone, ironstone gravel or occasionally granite	Ironstone gravel of ferruginous duricrust with minor red-brown hardpan or unconsolidated rock	Infrequently granite or hardsetting subsoil pan	Dominantly decomposing granite, occasionally sandstone, red-brown hardpan, calcrete, basalt or ironstone	Dominantly granite, occasionally sandstone or red-brown hardpan	Occasionally decomposing granite, ironstone or quartz		Calcrete, weathered basalt or dolerite	Calcrete or occasionally weathering basalt on red soils	Infrequently calcrete or basalt	Basalt, calcrete, shale, ironstone or gravel underlying shallow soils
Topsoil slaking					Partial to complete	Partial to complete	Partial to complete	Complete to partial	Complete to partial	Partial to complete	Nil to complete	Partial to complete	Partial to complete
Subsoil slaking					Partial to complete	Partial to complete	Partial to complete	Complete	Complete	Partial to complete	Partial to complete	Partial to complete	Mostly complete

WA Soil Group Classification	Stony Soils (203)	Red Loamy Earths (544)	Red Shallow Loam (522)	Shallow Gravel Soils (on granite) (304)	Red deep sandy duplex soils (405)	Red shallow sandy duplex soils (406)	Red shallow sands on granite (423)	Red sandy earths (463)	Red deep loamy duplex soils (506)	Calcareous shallow loams (521)	Calcareous red loamy earths (542)	Self-mulching cracking clay (602)	Red/brown non-cracking clays (622)
Topsoil dispersion					Nil to partial	Nil to partial	Nil to partial	Nil to partial	Nil to partial	Nil to partial	Nil to partial	Variable (nil to complete)	Nil to partial
Subsoil dispersion					Partial to complete	Nil to partial	Nil to partial	Partial	Nil to partial	Nil to partial	Nil to partial	Variable (nil to complete)	Nil to complete
Topsoil pH range	Mostly neutral (6.0-7.5) with ranges from 5.1 to 9.0 dependant on parent rock	Mostly neutral (6.0-7.0) with ranges from 5.8 to 8.8	Weakly acidic to neutral (5.8-7.5) with some alkaline shale and basalt soils (7.8-8.6)	Mostly acid to neutral (5.1-7.3)	Neutral to alkaline (6.2-6.8)	Mostly neutral (6.0-7.0) ranging to alkaline (8.0) on basalt areas	Mostly neutral (6.0-7.0) with ranges from 5.1 to 7.8.	Mostly neutral (6.0-6.5) with ranges from 5.5 to 8.5	Neutral to alkaline (6.5-7.5) for Chromosols, Kandosols and Dermosols. Alkaline (8.5-9.0) for Sodosols	Alkaline (occasionally neutral) with ranges from 7.6 to 9.5	Alkaline (8.7-9.6)	Alkaline (7.5-9.5)	Mostly neutral to alkaline (7.0-9.5)
Subsoil pH range		Mostly neutral to slightly alkaline (6.7-8.2) with ranges from 6.5 to 9.0	Mostly neutral to alkaline (6.5-9.0)	Mostly acid to neutral (5.1-7.7)	Weakly to strongly alkaline (7.8-9.7)	Mostly neutral to weakly alkaline (7.0-8.0)	Mostly neutral (6.5-8.0) with ranges from 5.1 to 8.8	Mostly neutral (6.0-7.0) with ranges to 8.5	Neutral to alkaline (7.0-8.5) for Kandosols and Dermosols. Alkaline (8.5-9.0) for Sodosols and some Chromosols	Alkaline with ranges from 8.7 to 9.5	Alkaline (8.8-9.8)	Alkaline (8.0-9.9)	Mostly alkaline (7.5-9.5)
Topsoil EC range	Non-saline (1-25 mS/m)	Mostly non-saline (1-20 mS/m). Moderately saline on some stony, saline or alluvial plains (20 - 70 mS/m)	High for some shale dominant (150- >400 mS/m), otherwise low (1-25 mS/m)	Non-saline (1-7 mS/m)	Non-saline (1-20 mS/m), moderately saline within saline plains (up to 50 mS/m)	Non-saline (1-25 mS/m)	Non-saline (1-15 mS/m)	Non- saline (1-6 mS/m)	Low (1-15 mS/m) for Chromosols, Kandosols and Dermosols. Moderate to high (50-100 mS/m) for Sodosols	Low (1-20 mS/m)	Non-saline to moderately saline (10-90 mS/m) for grey soils. Non-saline (1-21 mS/m) for red soils	Non-saline (1-31 mS/m), infrequently low to moderately saline (50-80 mS/m)	Moderately to highly saline (40-280 mS/m) on some alluvial, stony or drainage plains, otherwise non-saline (1-15 mS/m)
Subsoil EC range	Non-saline (1-20 mS/m)	Mostly non-saline (1-50 mS/m). Highly saline on some stony, saline or alluvial plain (50- 70 mS/m)	High for some shale dominant (130 - 220 mS/m), otherwise low (1-38 mS/m)	Non-saline (1-11 mS/m)	Non-saline (20-230 mS/m), highly saline within saline plains (up to 450 mS/m)	Non-saline (1-10 mS/m), highly saline within saline plain land units (to 660 mS/m)	Non-saline (1-20 mS/m)	Non-saline (1-12 mS/m)	Low for Chromosols, Kandosols and Dermosols (1-120 mS/m). High (120->400mS/m) for Sodosols	Low (1-120 mS/m, mostly under 50 mS/m)	Non-saline to highly saline (35-520 mS/m) for grey soils). Non saline (1-35 mS/m) for red soils and highly saline (>350 mS/m) for clay plain soils	Non-saline (1-64 mS/m), infrequently highly saline (80-400 mS/m). Highly saline for saline plains (>850 mS/m)	Non-saline to highly saline (40-280 mS/m) on some alluvial, stony or drainage plains, otherwise non-saline (1-40 mS/m)
Wind erosion hazard	Low (due to stony mantle and rock outcrop)	Low	Low (due to stony mantle or cryptogam crusting)	Low (due to stony mantle), sand sheet low to moderate	Low to moderate dependent on stony mantle.	Low (due to stony mantle)	Low (due to stony mantle and rock outcrop)	Low	Low (due to stony mantle or cryptogam hazard crusting)	Low (due to stony mantle)	Low to moderate for cryptogam crusted grey soils, and low (due to stony mantle) for red soils	Low	Low (high for soils with saline soft puffy surfaces)
Water erosion hazard		Low (due to stony mantle) to moderate (dependant on slope)	Low (due to stony mantle) to moderate (dependant on slope)	Low (due to stony mantle)	Moderate to high dependent on stony mantle and slope.	Low (due to stony mantle) to moderate or high (in absence of a stony mantle and dependent on slope)	Low (due to stony mantle and rock outcrop) to moderate (dependent on slope)	Low or low to moderate (dependant on slope)	Low to moderate for units with a stony mantle, otherwise high (especially in drainage zones)	Low (due to stony mantle) to moderate (dependant on slope)	Low (due to stony mantle or cryptogam crusting) or low to moderate (dependant on slope)	Moderate to high for drainage zones otherwise, low	Moderate to high on alluvial plains, gently sloping gilgai plains, sloping stony plains and some footslopes, otherwise low to moderate dependent on slope

Source: van Vreeswyk *et al.* (2004)

7.2.3 Geology

The IRN is hosted within a number of different geologies but is primarily contained within the Pilbara Craton super province. This province is described as an Archean granite-greenstone terrace. The craton hosts precious and base metal mineral deposits and is overlain by the iron-ore-bearing sedimentary rocks of the Fortescue and Hamersley Basins, near the Port Hedland coast, Cainozoic sedimentary formations and near the Solomon operations, the calcrete formations of the Fortescue Marsh region.

Fibrous materials may be present within some Pilbara geological units including the Brockman Iron Formation. Geotechnical testwork is undertaken before material is excavated for rail construction and maintenance, during which fibrous materials may be encountered. Fortescue manages Fibrous materials in accordance with its *Fibrous Materials Management Plan*. Test pits with fibrous materials are covered and rehabilitated. Fibrous materials are not used in construction or maintenance activities and no fibrous materials have been identified in rock cuttings or borrow pits to date.

Geochemical characterisation of the fill and cuttings for rail works is undertaken when the potential to encounter potential acid producing rocks or soils. To date all of the cut / fill and borrow materials have identified as non-acid forming (NAF).

Spoil material, that is material that is not suitable for construction, may be generated during the construction of the railway cuttings. Spoil materials can have dispersive characteristics, consequently, where possible spoil material will be disposed a borrow pit. Where small volumes of spoil are generated the spoil may be stockpiled then blended into the disturbed landscape and covered with more component rocks or soils during rehabilitation.

Main Line Geology

The geological units for the Main Line from north to south can be broadly described as:

- Clay, mud, silt and sand on tidal areas and coastal dunes;
- Alluvium - unconsolidated silt, sand and gravel in major river channels (e.g. the Turner, Yule and Fortescue Rivers);
- Undivided quaternary deposits fringing major river systems, mainly on the northern Abydos Plain but also occurring broadly in the Fortescue Valley;
- Granitoid rocks of various ages on the central and southern Abydos Plain;
- Tumbiana basalts, Maddina basalts, Jeerinah basalts that occur broadly over the Chichester Range;
- Metamorphosed chert, Banded Iron Formation (BIF), mudstone and siltstone of the Marra Mamba Formation along the southern edge of the Chichester Range;

- Undivided Cainozoic deposits, of partly consolidated colluvium and alluvium, and silcrete and laterite in the central Fortescue Valley area and on the colluvial fans on the Hamersley Range; and
- Boolgeeda Iron Formation and Weeli Wolli Formation on the Hamersley Range.

East-West Line Geology

The geological units that occur along the East-West Line include those that form the southern units of the Main Line. The units that are found along this alignment (broadly from west to east) include:

- Archaean Granites and Proto-Archaean Granites – including granites, metamorphosed felsic intrusives, and basalts.
- Fortescue Group of volcanic and sedimentary rocks, including the:
  - Maddina Formation – Massive to amygdaloidal basalt and andesite with minor sedimentary units.
  - Jeerinah Formation – Quartz sandstone, carbonaceous pelite, chert and thin bedded-sandstone.
- Hamersley Group:
  - Marra Mamba Formation – Banded Iron Formation, chert and pelite.
- Various alluvial and colluvial units throughout the alignment (e.g. Robe Pisolites, alluvial sediments associated with rivers).

Hamersley Line Geology

The geology along the Hamersley Line alignment are mid-Archaean Granites, the late-Archaean (~2700 Ma) Fortescue Group and the Proterozoic (~2500 Ma) Hamersley Group. The granites are part of the Archaean Yule and Shaw Granitoid Complex. The formation comprises metamorphosed biotite monzogranite and minor granodiorite locally intruded by a network of metamorphosed muscovite pegmatite veins. The Fortescue and Hamersley groups can be subdivided into the formations along the alignment (listed as youngest to oldest) and are listed below.

The Hamersley Group consists of the following units along the alignment:

- Mt McRae Shale – Interlayered Shale, dolomitic shale and BIF, up to 70m thick;
- Wittenoom Dolomite – Dolomite with chert and argillite, between 275 and 700m thick; and
- Marra Mamba Formation – Banded Iron Formation, chert and pelite, up to 200m thick.

The Fortescue Group is approximately 1.8km thick and consists of volcanic and sedimentary rocks from the following formations:

- Jeerinah Formation – Quartz sandstone, carbonaceous pelite, chert and thin bedded-sandstone, conformably overlies the Maddina Formation and conformably overlain by the Marra Mamba Formation. It is up to 150m thick.
- Maddina Formation – Massive to amygdaloidal basalt and andesite with minor sedimentary units. This formation is up to 350m thick and comprises thin or thick basaltic lava flows interbedded with sedimentary units.
- Tumbiana Formation – Volcanoclastic sandstone and siltstone, with dolomite and stromatolitic limestone and minor basalt and chert. This formation is up to 150m thick and overlies the Kylena Formation with a conformity. It was deposited in a low-energy coastal setting in a period of intermittent volcanic activity.
- Kylena Formation – Massive and vesicular basalt, and minor volcanoclastic rock.

Eliwana Line Geology

The geology along the Eliwana Line consists mainly of representative from the Hamersley Group, Fortescue Group and colluvial and alluvial deposits. These are defined further below.

The Hamersley Group consists of the following units along the alignment:

- Mt Mount Sylvia Formation– Mudstone, siltstone, chert, iron-formation, and dolomite.
- Brockman Iron Formation – Banded iron-formation, chert, mudstone and siltstone.
- Marra Mamba Iron Formation - Chert, ferruginous chert, jaspilite, banded iron-formation, minor shale, siltstone, mudstone.

The Fortescue Group is approximately 1.8km thick and consists of volcanic and sedimentary rocks from the two following formations:

- Jeerinah Formation – Quartz sandstone, carbonaceous pelite, chert and thin bedded-sandstone.
- Bunjinah Formation – massive basaltic flows, breccia, volcanic sandstone; minor chert; amygdaloidal basalt flows occur in upper parts of formation; metamorphosed to 900 m thick.

Colluvial and alluvial deposits such as thick deposits of weakly iron-cemented colluvial gravels, and fine-grained surficial deposits of alluvial wash, floodplain and gilgai deposits.

7.3 Water

7.3.1 Surface water

Stream flows in the Pilbara are mostly a direct response to rainfall and are highly seasonal and variable. Most runoff occurs from January to March as a result of episodic cyclonic activities. Other rainfall comes from local thunderstorms. Soils typically have high initial infiltration rates for dry catchment conditions, i.e. when the antecedent moisture content of the soils is low. Significant streamflow usually occurs when antecedent moisture content of the soils is high, which is caused by significant rainfall in the days or weeks preceding a storm event.

Tropical lows or cyclones that can impact the region during November to March can bring heavy rainfall and associated flooding. The flood potential of a system is not directly related to cyclone intensity but is associated with its track and speed, the geographic area it affects and the degree to which catchments are saturated from prior rainfall events. Rainfall totals of more than 100 mm are common with tropical lows that move over land. Flooding is enhanced when multiple tropical lows occur within a few weeks of each other. These events can be large enough individually and cumulatively to significantly reshaped drainage channels. Isolated thunderstorms have the potential to create fast and localised flooding, referred to as flash flooding. These events generally have a lower potential for widespread damage as the extent and magnitude of flooding is much smaller than cyclonic events.

The IRN traverses a number of catchments, including:

- Main Line: Turner River, South West Creek and Coastal catchments.
- Hamersley Line: Lower Fortescue Catchment and Yule River catchments.
- East-West Line: Yule River, Shaw River and Upper Fortescue catchments.
- Eliwana Line: Ashburton River and Lower Fortescue River catchments.

These catchments drain into the Yule, Turner and Fortescue Rivers.

The streamflow in the ephemeral creeks in the sub-catchments (and wider Pilbara) are typically fresh but is generally highly turbid due to the rapid rise of creek levels in response to rainfall when flooding occurs. Typical values for the Ashburton River basin and the broader Pilbara region from the Western Australian Department of Water's (now DWER) *Water Information Reporting* database are presented in Table 14.

Water quality in naturally occurring pools can be highly variable, in part due to the individual characteristics of each pool, its water supply (rainfall, creek flow, alluvial groundwater or groundwater structure), the preceding climate (drought/flood history, recent groundwater recharge etc.), and interaction with livestock. The high turbidity levels indicate that the ephemeral

creeks have high bed loads in their natural state with many instances of significant erosion on existing stream banks and notable areas of instability in the natural environment, highlighting that erosion is a naturally occurring process.

Table 14. Surface Water Quality Data

Parameters	Pilbara		Ashburton Catchment		Lower Fortescue River	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
pH (pH units)	5.2	9.4	6.7	8.8	6	9.2
EC (µS/cm)	3	6,090	83	6,090	3	4,600
Turbidity (NTU)	0.1	3,200	0.5	3,200	0.1	1,460
Alkalinity (mg/L)	3.6	420	35	274	6.5	358
TDS (mg/L)	22	3,932	70	2,618	22	3,350
Nitrate as N (mg/L)	0.05	32	1	3	1	4
Hardness (mg/L)	3.6	1,538	48.9	1,539	6.8	1,050
Dissolved Silica (mg/L)	1	68	7.7	22	1	51

As described in Section 2.2 Description of Operation, an extensive network of bridges, culvert and diversion drains has been used to maintain surface water flow. Sheetflow dependent vegetation communities, such as the sheet-flow dependent Mulga communities near the Christmas Creek mine, can be sensitive to changes in surface water flow conditions. In order to minimise the impacts to these communities, environmental culverts and other drainage structures are used to convey, divert and return flows where practicable to these sensitive surface water dependent ecosystems. These structures are regularly inspected and maintained, to ensure environmental commitments to manage downstream impacts are met.

7.3.2 Groundwater

Groundwater in the Pilbara occurs in various hydrogeological environments ranging from surficial and sedimentary aquifers with inter-granular porosity, to weathered and fractured aquifers (van Vreeswyk *et al*., 2004). Measured depth to groundwater along the railway alignment ranges from 5-9 m below ground level to 50 m below ground level. Groundwater quality in along the rail alignment is dominantly fresh but can range to hypersaline along the East-West Line (near the Chichester operations).

7.4 Biodiversity

7.4.1 Plants

The IRN occurs in a broad range of vegetation as it traverses multiple subregions of the Interim Biogeographic Regionalisation of Australia with over 400 different associations mapped through previous studies.

The vegetation can be broadly described by these subregions, as listed below:

- Roebourne – flat areas contain mixed bunch and hummock grass savanah, and dwarf shrub steppe of *Acacia stellaticeps* or *A. pyrifolia* and *A. inaequilatera* with uplands dominated by *Triodia* hummock grasslands. Ephemeral drainage lines support *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands, with samphire (*Tecticornia* spp.) supported on river deltas.
- Chichester - Plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia* species hummock grasslands, with *Eucalyptus leucophloia* tree steppes occur on ranges.
- Fortescue Plains - Extensive salt marsh, mulga-bunch grass, and short grass communities on alluvial plains, *Eucalyptus camaldulensis* woodlands fringing drainage lines and *Eucalyptus camaldulensis* and *Melaleuca argentea* woodlands supported by permanent springs and calcrete aquifers.
- Hamersley - Mulga low woodland over bunch grasses on valley floors with *Eucalyptus leucophloia* over *Triodia* species on skeletal soils of ranges.

The condition of the vegetation recorded during these studies ranged from Excellent to Poor. The areas of poorer conditions were generally confined to flowlines and associated floodplains. The cause of degradation in these areas is mostly due to higher abundances of weed species (e.g. *Cenchrus* species) and moderate to heavy grazing.

No threatened flora has been recorded in the current IRN or the proposed Eliwana railway. The Priority Flora species that have been identified within the IRN SRL are listed in Table 15.

Table 15. Priority Flora recorded in the IRN

Family	Species	Main	Hamersley	East-West	Eliwana
Priority 1					
Malvaceae	*Abutilon* sp. Pritzelianum (S. van Leeuwen 5095)	x			
Euphorbiaceae	*Euphorbia inappendiculata* var. *queenslandica*				x
Asteraceae	*Helichrysum oligochaetum*				x

Family	Species	Main	Hamersley	East-West	Eliwana
Poaceae	*Triodia* aff. sp. Karijini (S. van Leeuwen 4111)				x
Asteraceae	*Vittadinia* sp. Coondewanna Flats				x
Priority 2					
Euphorbiaceae	*Euphorbia australis* var. *glabra*				x
Euphorbiaceae	*Euphorbia clementii*	x			
Convolvulaceae	*Ipomoea racemigera*				x
Asteraceae	*Pentalepis trichodesmoides* subsp. *hispida*				x
Priority 3					
Poaceae	*Aristida jerichoensis* var. *subspinulifera*				x
Poaceae	*Astrebla lappacea*				x
Poaceae	*Eragrostis crateriformis*	x			
Poaceae	*Eragrostis surreyana*				x
Fabaceae	*Glycine falcata*				x
Amaranthaceae	*Gomphrena leptophylla*	x			
Goodeniaceae	*Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727)				x
Proteaceae	*Grevillea saxicola*				x
Apocynaceae	*Gymnanthera cunninghamii*	x			
Boraginaceae	*Heliotropium muticum*	x			
Fabaceae	*Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301)				x
Asteraceae	*Iotasperma sessilifolium*				x
Rubiaceae	*Oldenlandia* sp. Hamersley Station (A.A. Mitchell PRP 1479)				x
Amaranthaceae	*Ptilotus subspinescens*				x
Chenopodiaceae	*Rhagodia* sp. Hamersley (M. Trudgen 17794)				x
Acanthaceae	*Rostellularia adscendens* var. *latifolia*				x
Fabaceae	*Rothia indica* subsp. *australis*	x			
Stylidiaceae	*Stylidium weeliwolli*	x		x	
Fabaceae	*Swainsona thompsoniana*				x
Poaceae	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431)				x
Poaceae	*Triodia basitricha*				x
Priority 4					
Cyperaceae	*Bulbostylis burbidgeae*	x			
Goodeniaceae	*Goodenia nuda*	x		x	x
Amaranthaceae	*Ptilotus mollis*	x			x

A number of associations have been demarcated as being of conservation significance (Appendix 3). Mitigation of the impacts associated with conservation significance are managed in accordance with Fortescue's *Significant Flora and Vegetation Management Plan*[2]. The mitigation of the impact to these associations are not dependent on closure activities, although rehabilitation of temporary domains will support these associations. The key vegetation associations with conservation significance are the Threatened and Priority Ecological Communities described below.

Themeda Grasslands Threatened Ecological Community

Themeda Grasslands Threatened Ecological Community (TEC) is listed at State level as Vulnerable and known to occur within the eastern end of the Eliwana Rail Development Envelope. It covers less than 1% of the proposed rail footprint. It is broadly described as "grassland plains dominated by the perennial *Themeda* (kangaroo grass)". The following characteristics have been noted by the DBCA:

- Falls within a topographical range of 549 – 607 metres above sea level;
- Characterised by a uniformly flat landform, with minimal topographical variation within any given area (van Vreeswyk, 2004).
- Minimal surface water runoff with rainfall absorbed within the soil profile and ponding within gilgais.
- Occurs on cracking clays soils, containing clay content of over 50 %. The soil type commonly forms a surface 'mulch' layer of 1 – 2 mm aggregates that expand and contract during cycles of wetting and drying, a soil characteristic known as 'self mulching' (van Vreeswyk, 2004).

The TEC is considered to be under threat from grazing of stock, weed invasion, changed fire regimes and changed hydrology.

Brockman Priority Ecological Community

The 'Brockman Iron cracking clay communities of the Hamersley Range' (Brockman) PEC is listed as Priority 1 and is described as 'Rare tussock grassland dominated by *Astrebla lappacea* in the Hamersley Range, on the Newman land system. Tussock grassland on cracking clays - derived in valley floors, depositional floors. This is a rare community and landform known from near West Angeles, Newman, Tom Price and boundary of Hamersley and Brockman Stations' (DBCA, 2016).

The following characteristics have been noted by the DBCA:

[2] This management plan is currently under review and will, in due course, be replaced by the *Vegetation Health Monitoring and Management Plan*.

- Falls within a topographical range of 548 – 675 metres above sea level.
- Characterised by a uniformly flat landform.
- Recognised as containing additional dominant structural species including *Astrebla elymoides, A. pectinata and Aristida latifolia*.

The main threat to the Brockman Iron PEC is identified as grazing by native or introduced species (Kendrick, 2002).

Wona Priority Ecological Community

The Wona Priority 3 ecological community was recorded along the Hamersley Line and consists of four different associations, all on the Wona Land System gilgai plains according to the DBCA. These associations are:

- A grassless plain of stony gibber community of which occur on the tablelands (cracking clays of the Chichester and Mungaroona Range) with very little vegetative cover during the dry season. However, during the wet season, a suite of ephemerals/annuals and short-lived perennials emerge, many of which are poorly known and range-end taxa.
- Annual Sorghum grasslands on self mulching clays. This community appears very rare and restricted to the Pannawonica-Robe valley end of Chichester Range.
- Mitchell grass plains (*Astrebela* spp.) on gilgai.
- Mitchell grass and Roebourne Plain grass (*Eragrostis xerophila*) plain on gilgai (typical type. This community is heavily grazed.

These associations are considered to be susceptible to grazing.

Mulga

The term Mulga refers to a highly variable species complex consisting of *Acacia aneura* F. Muell. Ex Benth and its close relatives (e.g. *A. ayersiana*, *A. minyura* and *A. paraneura*). The members of this complex are small trees that dominate the vegetation of arid regions, in all occupying around 20% of Australia; although Mulga vegetation communities are extensive in the Pilbara region.

Mulga vegetation exhibits a high degree of structural, morphological and genetic variability. This variation occurs both between and within populations and often results in a very complex mosaic of mixed Mulga populations. Banded and unbanded Mulga populations are found occupying different positions in the landscape – alluvial wash plains to rocky lower southern slopes and drainage channels.

Whilst Mulga vegetation types are not considered to be TECs, they are considered to be significant vegetation as they:

- Appear to play an important role in wat and nutrient capture and are important to ecosystem function;
- Exhibit a high degree of morphological variability between populations;
- Are susceptible to disturbance from fire, grazing, weeds and development; and
- May support or provide refuge to restricted flora and fauna species.

In some Mulga communities run-on is an important water source (additional to incipient rainfall) for sustaining Mulga vegetation. The construction of linear infrastructure and other infrastructure can disrupt patterns of surface flow, potentially exposing Mulga vegetation to either reduced or increased water availability.

Where sheetflow dependent Mulga communities have been identified and significant impacts from changes to sheetflow regimes are likely, surface water management controls have been implemented during construction[3] and maintained during operations to mitigate impacts.

7.4.2 Seed

Pilbara flora has evolved to thrive under the extreme climatic variability experienced in the Pilbara. Fortescue opportunistically collects and stores local provenance seed for use in progressive rehabilitation activities, in accordance with its *Seed Collection and Management Guidelines*. This guideline addresses issues related to timing of seed collection, quality and viability of seed, seed dormancy release and seed storage including:

- options to burn or dry capsules, pods and cones to release seeds and, when required, treating seed with insecticide and fungicide prior to storage;
- storing clean seed in dry, insect and vermin proof containers, labelled with details of the species, date collected and collection location; and
- applying pre-sowing treatment, including scarification, heat and/or smoke.

Seed germination rates are expected to decline with extended storage. Therefore, continuous seed collection and storage over the life of the mine is not considered to be an effective management strategy. Local provenance seed, however, is not commercially available in sufficient quantities to support large scale rehabilitation activities. Consequently, adequate seed supply is a consideration for the closure planning.

The seed bank in the IRN temporary domains is expected to persist in the topsoil stockpile if rehabilitation activities are undertaken within a short period of time. Where stockpiles and cleared areas are left for an extended period of time, these areas will undergo supplementary seeding if

[3] Unless impacts to the sheetflow communities have been approved via the environmental approvals process.

required. Seed selection will be based on those dominant species of the surrounding communities.

7.4.3 Weeds

Weeds pose a threat to natural ecosystems and the native species they support predominantly through the loss of biodiversity as a consequence of species competition. Since 2005, pre-disturbance flora surveys and weed management surveys have recorded ~30 weed taxa, at various times and in various locations, within the IRN SRL.

Fortescue's *Weed Management Plan* is used to identify weed management and monitoring measures to minimise the introduction and spread of weeds established within and adjacent to Fortescue controlled sites, in accordance with the *Biosecurity and Agriculture Management Act 2007* (**BAM Act**).

The *Weed Management Plan* targets priority weed species, such as:

- Weeds of National Significance listed by DEE;
- Declared Pests that require management listed by Department of Primary Industries and Regional Development; and
- Environmental weeds listed by DBCA as requiring eradication or control.

The list of priority weed species is reviewed and revised regularly, in line with external guidance. This review process will be continued over the life of the mine and through closure as part of closure weed monitoring/maintenance activities.

During ground disturbance activities, the spread of weeds is minimised through the application of the *Weed Hygiene* procedures. These procedures are developed specific to the activity, location and ground conditions expected to be encountered during the disturbance activity.

7.4.4 Fauna

At least 40 vertebrate fauna surveys have been conducted along the IRN. Conservation species recorded, and their conservation status, are outlined in Table 16.

Table 16. Significant fauna species recorded in the local area

Name	Conservation Status		Main	Hamersley	East-West	Eliwana
	Federal	State				
Northern Quoll (*Dasyurus hallucatus*)	Endangered	Schedule 2 – Endangered	x	x	x	

Name	Conservation Status		Main	Hamersley	East-West	Eliwana
	Federal	State				
Bilby (*Macrotis lagotis*)	Vulnerable	Schedule 3 – Vulnerable	x	x	x	
Olive Python (*Liasis olivaceus barroni*)	Vulnerable	Schedule 3 – Vulnerable		x		x
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantius*)	Vulnerable	Schedule 3 – Vulnerable	x			x
Ghost Bat (*Macroderma gigas*)	Vulnerable	Schedule 3 – Vulnerable	x			x
Grey falcon (*Falco hypoleucos*)	Vulnerable	Schedule 3 – Vulnerable	x			x
Fork-tailed Swift (*Apus pacificus*)	Migrant	Schedule 3 – Migrant				x
Peregrine Falcon (*Falco peregrinus*)	-	Schedule 7 – Other Specially protected fauna		x		x

It is not expected that closure of temporary domains will impact these species, except to support the habitat types in which the species occur. The key habitats that have been identified include:

- Plain (stony/gibber).
- Lower slopes/hill slopes.
- Hills/Ranges/Plateaux.
- Plain-cracking clay.
- Gorges/Gullies.
- Drainage Line/River/Creek (minor).
- Drainage Line/River/Creek (major).

No values of conservation significance for subterranean, short range endemic, and aquatic fauna have been recorded along the IRN, although impacts on stygofauna habitats have been considered possible from the drawdown from water bores. It is expected that closure will not have an adverse impact on recorded values.

It is anticipated that the restoration of fauna habitat will primarily be addressed through the revegetation of disturbed areas using existing soil seed banks or, if unsuccessful, seeding with locally collected seed. However, a review was conducted of other possible measures that could be adopted to assist with fauna recolonisation. Various measures were identified in a review by Brennan et at (2005) and the suitability of each of these measures for use in rail corridor rehabilitation is outlined in Table 17.

Table 17. Review of Techniques to Encourage Fauna Return (from Brennan et al 2005; M. Bamford, pers. comm.) and Their Applicability to Rehabilitation Along Fortescue's Railway Corridor.

Technique	Applicability for IRN
Control of introduced predators such as feral cats and dogs.	Feral cat control is conducted at the rail camps and minesites when they are active. Dogs are trapped and euthanised during designated trapping programs.
Addition of habitat logs and rocks.	Cleared vegetation will be used on the batters of borrow pits. Cleared vegetation will be left in small stockpiles along the rail and road alignment. Where possible, large rocks will be left in situ in borrow pits.
Installation of nesting boxes.	Unlikely to be a useful measure in the Pilbara as nesting hollows are not a typical ecological feature.
Transplantation of long-lived, slow-growing plants.	No suitable candidates. Transplantation of live plants unlikely to be successful in the arid zone.
Leave remnants of natural vegetation within disturbed areas.	Would necessitate an increase in the size of borrow pits to allow for access to the same volume of material. Not a preferred option although individual habitat trees will be considered for retention.
Addition of piles of mulch.	Will occur on the batters of borrow pits and along the rail and access road alignment.
Promotion of hollow formation in re-established trees.	Not relevant to vegetation types occurring in the Pilbara.
Transplantation of 'stags' (dead trees).	Likely to be of limited benefit in the Pilbara environment although cleared vegetation will be used (see Addition of habitat logs and rocks).
Where they exist, re-instate fine and sandy loams on surface.	Will occur in accordance with Topsoil and Subsoil Management
Avoid isolating borrow pits with a track going around the circumference.	Will be included in borrow pit rehabilitation design.

7.4.5 Pests

Like weeds, pest animals pose a threat to natural ecosystems and the native species they support. Of the six introduced terrestrial fauna species, *Mus musculus* (house mouse), *Felis catus* (feral cat), *Bos taurus* (European cattle), *Equus asinus* (donkey), *Equus caballus* (horse) and *Canis lupus* (dog), cattle are likely to most influence closure. This concern is due to flora diversity being impacted by overgrazing which could compromise vegetation and rehabilitation outcomes, as well as trampling by cattle and other ungulate (hoofed) mammals traversing areas for grazing purposes, which is known to increase landform instability and erosion rates.

Pest animals also have the capacity to carry and transmit diseases to native flora (plant pathogens). Management of feral herbivores is a consideration for monitoring and maintenance activities.

7.5 Contamination

For the purpose of this closure plan, contamination relates to any substance that is present in or on that land or water at above background concentrations and presents, or has the potential to

present, a risk of harm to human health or any environmental value. For a contamination risk to exist there must be a contaminant source, a receptor (human health or environmental value) and a pathway.

The key areas where contamination could occur are workshops, refuelling areas and the waste water treatment spray fields associated with accommodation camps. It is recognised that there is potential for contaminants to remain unidentified during the life of the operation. Consequently, contaminated sites assessment and associated clean-up are a consideration for decommissioning and transfer activities.

7.6 Progressive rehabilitation performance

Ground disturbance activities are approved via Fortescue's Land Use Certificate (LUC) process and reconciled quarterly using geographic information systems (GIS). This tracking system includes the identification of land that has been rehabilitated using aerial photography.

The latest review of revegetation condition within the 2,200 Ha of completed rail rehabilitation areas was undertaken by Spectrum Ecology in 2018. This review included a desktop analysis of aerial photography, collected from 2008 to the present, rehabilitation monitoring data and field verification.

Rehabilitation condition was divided into four classes:

1. **Satisfactory** – appropriate substrate and landform with vegetation progressing towards or achieving a similar state as the surrounding vegetation. 65% of rehabilitated land was classified as Satisfactory.
2. **Monitor** – requires further monitoring to confirm the site will achieve completion criteria over time without specific intervention. The sites may be experiencing some performance issues such as some weeds, relatively small areas of ponding, low vegetation cover or minor erosion. (The use of the word "Monitor" here does not equate to inclusion in the annual rehabilitation monitoring program). 28% of rehabilitated land requires further monitoring.
3. **Remediate** – sites are experiencing performance issues that will require intervention to achieve the completion criteria. Performance issues may be related to rehabilitation e.g. ponding, low vegetation cover and / or erosion or due to land use activities e.g. ongoing disturbance from vehicles, cattle grazing etc. Only 5% of rehabilitated land was identified as requiring re-work to correct performance issues.
4. **Not Rehabilitated** – no evidence of rehabilitation. Areas likely to have been incorrectly identified as rehabilitated and require rehabilitation. Includes locations where GIS digitising has erred. Around 2% of rehabilitated land was incorrectly or inaccurately identified and will be removed from the rehabilitated land reporting.

Table 18 lists the rehabilitation issues described across the sites and categories. Spectrum Ecology found that, across the majority of the sites, sustained ponding in borrow pits (Temporary Heavy Disturbance closure domains) was the likely cause of the majority of poor rehabilitation outcomes. They concluded that the ponding was the cause of bare ground or poor vegetation growth. This issue is likely to have arisen due to the relatively flat landscape adjacent to the rail where the borrow pits were established. As the landscape has limited slope, it was not possible to create free-draining areas within the disturbance footprints of the borrow landforms, and as a result the borrow pits are internally draining. Site specific remediation options, to improve landform design and /or vegetation development, are currently being investigated.

Table 18. Preliminary Results for Rehabilitation Review

Rehabilitation Condition Category	Main Rehabilitation Issue	Area (ha)	% of area
1. Satisfactory (1955 polygons, 1,449ha, 64.9%)	None noted	1,293	58.2
	Minor weeds/Grazing	62.5	2.9
2. Monitor (678 polygons, 630.0ha, 28.1%)	Low Vegetation Cover	503.9	22.6
	Bunding	48.5	2.2
	Erosion	36.9	1.7
	Minor Ponding	23.9	1.0
	Weeds	6.6	0.3
	Other	133.7	6.0
3. Remediate (108 polygons, 111.8ha, 5.0%)	Ponding	89.9	4.0
	Vehicle track/traffic	3.0	0.1
	Stockpiles	7.4	0.3
	Erosion	10.0	0.4
	Other	1.4	0.1
4. Not rehabilitation (175 polygons, 1.9%)	Infrastructure	41.7	1.9

Borrow Pit A (Figure 4) is an example of successful rehabilitation of shallow borrow pits in a Temporary Light Disturbance closure domain associated with the IRN. This borrow pit was rehabilitated in 2015 by reshaping the landscape to minimise ponding within the rehabilitated area. Topsoil was replaced, and the land was subsequently contour ripped.

In 2016, it was recorded that the site had vegetation cover of 13%. A number of juvenile *Triodia* individuals and a few *Acacia* individuals were recorded. The site has been assessed as continuing to develop successfully, with over 40% of perennial plant species coverage recorded in 2017. Approximately 25% of this cover comprises *Triodia* species (primarily *Triodia wiseana*). The development of perennial shrubs and grasses can be seen in Figure 5. Some minor soil movement has occurred and flattening of the troughs was observed, but overall the borrow pit is stable.

2016 2017

Figure 4. Case example of self-draining borrow pit rehabilitation at a Fortescue-managed operation

2016

2017

Figure 5. Re-establishment of perennial vegetation at Borrow Pit A

8. CLOSURE ISSUES IDENTIFICATION AND MANAGEMENT

Closure-related risks are identified and managed in accordance with Fortescue's *Risk Management Framework* (2016). The aims of the closure risk assessment process are to:

- Identify potential hazards that could influence successful rehabilitation and closure of the IRN;
- Evaluate the risks to people, property and the environment given the management controls and strategies described in the IRNCP; and
- Identify actions to reduce the risk to as low as reasonably practicable (ALARP), preferably to a Low or Very Low risk.

Risks within the closure risk register are reviewed and updated as conditions change. The closure risk register is also systematically reviewed and updated at least every three years with a panel of multi-disciplinary subject matter experts.

8.1 Identification and evaluation of closure hazards

Review of the baseline data suggests that the absence of a topsoil inventory for the longer lived assets, such as the camps, could influence closure outcomes at these locations. Review of rehabilitation performance identified the following opportunities to improve rehabilitation outcomes:

- Review procedures to improve performance within internally draining borrow areas.
- Develop guidance to assist with supplementary seeding rates and techniques.

Table 19 summarises the key environmental hazards that were identified for the IRN during a closure risk workshops conducted by Fortescue on 6 March 2018. A total of 12 hazards including 6 environmental related hazards were assessed.

Table 19. Potential Environmental Hazards

Aspect	Potential hazard	Closure risks
Stakeholders	Environmental non-compliance and reputational damage	New owners of assets fail to manage the asset appropriately, resulting in localised environmental issues/non-compliance. Creates reputational damage to Fortescue.
Infrastructure	Contamination	Soil or land contamination is discovered after asset transfer or during decommissioning
Water	Surface water flow maintenance	Reshaping of land creates water shadows downstream of the disturbance.
Landform	Stability and sediment movement	Water logging in internal draining areas (e.g. heavy disturbance borrow pits) prevents vegetation from re-establishing and/or creates hazardous conditions for cattle/animals.

Aspect	Potential hazard	Closure risks
		Poor rehabilitation practice results in increasing erosion and degradation of ground conditions, i.e. sediment smothering vegetation, vegetation undercut/removed.
Vegetation	Ecosystem	Re-vegetation communities do not reflect adjacent ecosystems due to absence of key species or weed competition.

Fortescue employs a 7x7 risk matrix to evaluate risk (Figure 6). The criteria used for this evaluation are provided in Appendix 4. Hazards were assessed in consideration of the baseline data and are not intended to represent generic closure risks.

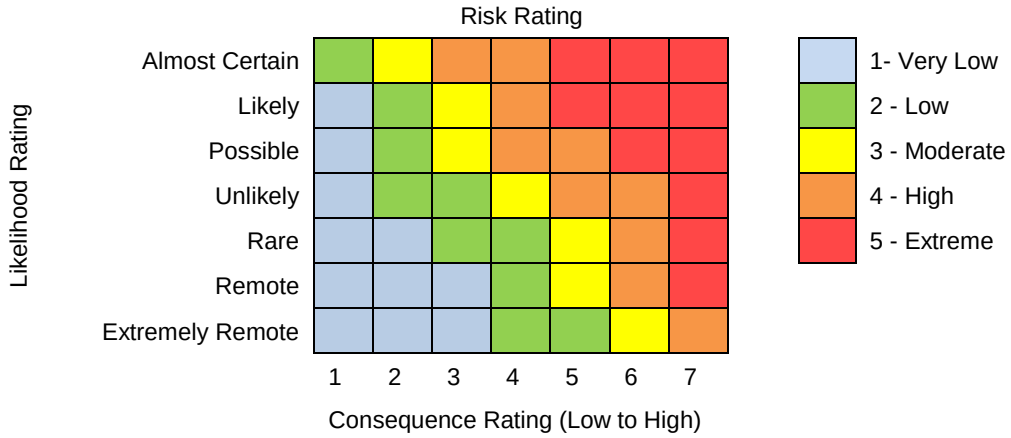


Figure 6. Fortescue risk rating matrix

To determine the risk rating, the likelihood of the consequence occurring was considered with respect to the current knowledge, performance and, in the case of the treated / residual risks, confidence that success could be achieved if the designs and plan were implemented today. In undertaking the risk assessment in this context, closure strategy progress to date as well as vulnerabilities are highlighted.

Results from the risk analysis are presented in full in Appendix 4.

8.2 Closure issues analysis and risk reduction actions

Following evaluation of the hazards listed in Table 19, no high raw environmental risks and three moderate raw environmental risks were identified (Figure 7). These moderate raw environmental risks were associated with the transfer of infrastructure to other stakeholders, erosion and water logging at the base of borrow pits.

Figure 7. IRN closure environmental risk profile showing inherent risk (left) and residual risk (right) after applying closure plan controls

Environmental non-compliance following transfer of the closed temporary disturbances to the new owner or land holder and consequential reputational damage for Fortescue has a raw environmental risk ranking of moderate. However, the treated risk ranking becomes low when the controls outlined in this IRNCP are applied. The controls to be applied include engaging with the new owner or land holder prior to transfer of these areas to ensure that these parties understand their environmental obligations and requirements.

The risk of poor rehabilitation practices resulting in erosion and degradation of ground conditions had a raw environmental risk ranking of moderate. Controls included in previous rehabilitation plans included progressive rehabilitation of temporary disturbances in accordance with the strategies, monitoring of rehabilitation performance and maintenance of areas not achieving satisfactory environmental outcomes. As part of the regular review of rehabilitation performance it was observed that erosion was the second most common cause of rehabilitation failure; and subsequently the IRNCP borrow slopes strategies were reviewed as part of this update. Following these reviews slope angles recommended for borrow pits have been reduced from 20 degrees to 1V:5H (~11 degrees), to provide a slope that is suitable for animal traffic, that is less likely to erode, and is therefore compatible with rangeland pastoral activities. Following application of all these controls the treated environmental risk was reduced to low.

There is a risk that water logging in areas that drain internally (such as borrow pits) could prevent vegetation re-establishment and/or create hazardous conditions for cattle and other animals. The potential for water logging has a raw risk ranking of moderate and has been recorded as the leading cause of railway rehabilitation failure (Spectrum, 2018). In addition to management actions included in previous rehabilitation management plans, such as progressive rehabilitation of temporary disturbances, monitoring of rehabilitation performance and maintenance of areas not achieving satisfactory environmental outcomes, new rehabilitation techniques have been proposed in this IRNCP to improve the rehabilitation performance of internally draining borrow pits. These additions include increased ripping depths in borrow pit floors and modification of the

borrow pit floor design to create ‘dry zones’ that are less susceptible to waterlogging. With the application of these controls the treated environmental risk ranking was reduced to low.

9. CLOSURE IMPLEMENTATION

9.1 Implementation framework

Table 20 lists the phases and associated closure planning and implementation stages applied in this closure plan.

Table 20. Implementation framework nomenclature

Phases	Closure phases	Closure planning focus	Closure implementation stages
Approval and Study	Approval	Baseline	Construction rehabilitation
		Strategies	
		Risk identification	
Operational	Pre-closure planning	Stakeholders	Maintenance related rehabilitation and Progressive rehabilitation of temporary infrastructure disturbance
		Feature / domain designs	
		Risk management	
		Rehabilitation performance improvement initiatives	
Closure	Closure	Stakeholders	Decommissioning
			Rehabilitation
	Post-closure		Observational

Pre-closure planning

The IRN will be maintained in a good condition, in accordance with the TPI State Agreement, until the assets are transferred to the State. Table 21 lists the standards and guidance that will be used to inform the IRN management.

Table 21. Guiding documents for the maintenance of railways and associated infrastructure

Name of Document
Rail Safety National Law (WA) Act 2015
Rail Safety National Law (WA) Regulations 2015
Occupational Safety & Health Act 1984
Occupational Safety & Health Regulations 1996
HSES Management Standards 100-ST-SA-0079
Major Hazards Control Standards 100-ST-SA-1000
Rail Safety Management Plan R-PL-SA-0001
Bridges and Structures Inspection and Assessment R-PR-RT-0091

In recognition of the long life of the IRN asset, Fortescue will engage with JTSI and other parties to determine the final recipients of the land covered by the IRN's Special Rail Licence. It has been assumed that for the purposes of this closure plan that the rail and associated features that form the Permanent Domain will be transferred to the State.

Land not required to support the ongoing operation of the IRN is progressively rehabilitated in accordance with the Temporary Heavy and Light Disturbance closure strategies. Monitoring programs serve to identify potential issues with existing rehabilitation strategies, providing an opportunity to improve technique over time.

Closure phase

During the closure phase, options to transfer facilities not required by the State to other parties will be investigated and the appropriate legal transfer of assets will be implemented. Examples where infrastructure might be relinquished to other users include:

- Access roads that may provide access to support ongoing pastoral and cultural activities; and
- Camps to the State or other land users.

Facilities not required by the State or other parties will be dismantled and demolished. Decommissioning and demolition activities may include:

- Re-deployment and sale of mobile fleet and equipment and other transportable assets, i.e. salvageable equipment, demountable buildings, scrap metal etc.
- Decommissioning, dismantling and demolition management and schedule, including:
    - delineation of preparatory activities to be undertaken (e.g. isolation and clean-up) prior to closure;
    - activities requiring expert contractors, i.e. demolition; and
    - workforce management and transition.
- Specific work methods and waste management, including:
    - landfill and associated waste management facility requirements; and
    - on-site or off-site decontamination, bioremediation and other disposal options.
- Quality controls, environmental management, workplace health & safety, including:
    - licenses, permits and approvals; and
    - monitoring activities and key performance indicators.
- Stakeholder/regulatory interface.

A decommissioning plan may be developed for complex facilities. Monitoring programs will be implemented to ensure that the activities are undertaken, and waste materials are disposed of in

accordance with Australian health, safety and environmental standards and regulations, and in line with permits and approvals. The majority of these activity-based monitoring programs will be developed immediately prior to decommissioning, in accordance with operational licences and statutory obligations.

The remaining disturbed land will be rehabilitated in accordance with the Temporary Heavy and Light Disturbance closure strategies.

Post-closure phase

The post-closure phase is triggered by the completion of on-ground activities and transfer of assets to the new owners.

During this post-closure phase, monitoring, inspection and maintenance are managed through an adaptive framework. Starting initially with a range of environmental performance indicators and activities required to address various approval, permit and other legal obligations, the frequency and type of monitoring undertaken is reduced once conformance to the plan is demonstrated and approvals/permits are retired. Eventually only the long-term monitoring associated with completion criteria and enduring environmental and tenure conditions remain. Completion criteria monitoring will continue until it has been agreed that the closure objectives have been met.

9.2 Temporary Light Disturbance domain rehabilitation strategies

Temporary Light Disturbance areas are defined as locations where soil and vegetation have usually been cleared, grubbed and stockpiled adjacent to the area prior to disturbance.

Areas classified as Temporary Light Disturbance include, for example, drill holes, drill pads tracks, water bores and pads, access roads, shallow free draining borrow areas, some communication infrastructure, some laydown areas and linear infrastructure disturbance for gas and water pipelines. It is assumed that any minor infrastructure located in the Temporary Light Disturbance closure domain has been removed and appropriately disposed of prior to rehabilitation.

Rehabilitation actions required for Temporary Light Disturbance areas include:

- Pull windrows across disturbed land and reshape the landform so that surface water shadows are not present. Where unconsolidated land is reshaped, slopes should not exceed grades of 1V:5H (~11 degrees), unless site specific surface water management strategies have been developed.
- Respread stockpiled topsoil, targeting an average depth of 10 cm, adjusted based on the availability of topsoil. (Ensure weed infested stockpiles are treated prior to use.)
- Rip the ground perpendicular to slope direction, to a depth appropriate to the ground conditions, to minimise erosion potential and encourage infiltration.

- Consider seeding with species from adjacent areas when topsoil has been stockpiled for more than 18 months.
- Place any stockpiled large vegetation or large rocks in small piles on rehabilitated land to improve fauna habitat recolonisation.

9.3 Temporary Heavy Disturbance domain rehabilitation strategies

Temporary Heavy Disturbance areas are characterised by heavily altered / compacted soils and relatively minor (<5 m vertical change) topographical changes, such as with internally-draining borrow pits. Some areas classified as Temporary Heavy Disturbance, such as camps, will be subject to a decommissioning before rehabilitation activities can occur.

Rehabilitation of Temporary Heavy Disturbance areas can require site specific surface water and erosion management strategies to be developed.

Rehabilitation actions required for Temporary Heavy Disturbance areas include:

- Pull windrows and stockpiled spoil materials across disturbed land and reshape the landform so that surface is free-draining.
    - Where a free draining landform cannot be achieved consider the use of diversion banks or other raised earthen landforms that can be rehabilitated (without introducing additional erosion or other environmental hazards), to minimise the volume of surface water reporting to the landform. [4]

      Diversion banks should be employed where the downstream environment will be significantly impacted if the surface water flow is reduce following rehabilitation. For example, where Mulga communities have been identified as dependent on the sheetflow from the Temporary Heavy Disturbance area.

      Diversion banks are to be constructed on the upslope side of a borrow pit, to divert natural runoff around the pit, minimise ponding within the pit and encourage water shedding. These banks must be designed to blend in with the local landscape as much as possible.
    - Where unconsolidated land is reshaped, slopes should not exceed grades of 1V:5H (~11 degrees[5]), unless site specific surface water management strategies have been developed.
    - Natural stream and drainage flows are to be re-established, where practicable, to approximate original drainage patterns.

[4] This action has been introduced in 2018 to reduce water logging conditions at the base of internally draining borrow pits.
[5] This slope angle has been reduced from 20 degrees, recommended in some previous rehabilitation management plans, in response to the erosion observed to occur at steeper slope angles.

- Where the area is more than 1,000 m^2 with a slope of more than five degrees, construct / push up shallow windrows (<20cm high) on the contour approximately every 50 m to reduce sheetflow erosion while vegetation is establishing. The shallow windrows are expected to trap leaf litter, nutrients and seeds to encourage vegetation growth adjacent to the shallow windrows.
- Deep rip (>40 cm) borrow pit floors prior to the application of topsoil, to encourage infiltration. [6]
    - If the base of the borrow pit is very rocky, the borrow pit floor may need to be partially excavated and the rock left in situ, in order to create a substrate to facilitate plant growth.
- Respread all stockpiled topsoil, to a depth of at least 5 cm.
    - Ensure weed infested stockpiles are treated prior to use.
    - The soil depth should be adjusted based on the availability of topsoil.
    - Consider constructing small topsoil 'islands' with excess topsoil across the base of internally draining borrow pits, to create areas that are less susceptible to water logging.[6] The islands can be created by randomly depositing small piles of soil or pushing up soil to create an undulating surface. To provide effective 'dry ground' it is recommended that the island height is sized to be equal to the flood level[7] expected following a ~2 year storm event (0.5 annual exceedance probability, 6 hour), approximately 50 mm rainfall for most locations across the Pilbara.
- Rip the ground perpendicular to slope direction, to a depth appropriate to the ground conditions, to minimise erosion potential and encourage infiltration.
- Consider seeding with species from adjacent areas when topsoil has been stockpiled for more than 18 months.
- Place any stockpiled large vegetation or large rocks in small piles on rehabilitated land to improve fauna habitat recolonisation.

[6] This action has been introduced in 2018 to reduce water logging conditions at the base of internally draining borrow pits.
[7] Flood level = Borrow pit catchment area x rainfall ÷ pit floor area. In a 'normal' borrow pit with no external catchment, the flood level would be <20 cm.

9.4 Implementation schedule

Fortescue will rehabilitate most of the disturbances in the Temporary Disturbance Domain on a progressive basis. The timeframe over which other closure tasks will be completed is summarised in Table 22. Note that activities that are part of normally operating procedures and practices are undertaken on a regular basis and have not been captured in this table.

Table 22. Closure implementation schedule

Details	Start	Timeframe
Review of progressive rehabilitation, and examination of improvements to processes (as required): • Review rehabilitation performance of internally draining borrow pits based on updated procedures. • Develop guidance to assist with supplementary seeding rates and techniques.	Next five years	5 years
Implementation and review of stakeholder engagement strategy	Underway	25 years
Legal review of transfer obligations	>10 years	5 years
Review of approvals required for closure activities	>10 years	5 years

9.5 Premature closure and other factors

It is anticipated that the IRN will only enter closure if the Fortescue's operations cease or if the Minister responsible for administering the TPI State Agreement gives notice to Fortescue that the rail network is to be closed and rehabilitated. If the railway was to enter temporary suspension (recognising that the TPI State Agreement requires that the IRN be kept in good repair), a plan that includes appropriate closure activities will be developed, including those activities that have been recognised as required in the pre-closure planning phase, but have not been undertaken as yet.

10. MONITORING AND MAINTENANCE

Monitoring programs are initiated following rehabilitation:

- To confirm the closure strategies proposed in this IRNCP have been successfully implemented;
- To track and alert Fortescue to any ongoing issues that may prevent the closure objectives from being met; and
- To demonstrate the agreed completion criteria have been achieved.

10.1 Vegetation and erosion monitoring

Vegetation performance in rehabilitated areas will be undertaken in accordance with the *Rehabilitation and Revegetation Monitoring Procedure*. This procedure uses a combination of photographic monitoring points and monitoring transects compared against reference site performance. Monitoring transects track the following performance indicators:

- Species diversity, richness and composition, and general vegetation condition;
- Total perennial percentage cover, and overstorey (upper) species density and percentage cover;
- Land Function Analysis (LFA) measures of stability, nutrient cycling and infiltration;
- Erosion as measured by the mean number of rills/gullies per 50 m and average rill/gully width and depth;
- Evidence of feral animals (e.g. grazing, tracks, scats, burrows and/or direct sightings).

Where transects are utilised, data is currently collected on an annual basis for the first three years, to evaluate the success of the initial establishment, then on a biennial basis or other interval depending on the vegetation performance and condition.

Maintenance trigger and management actions will be triggered when monitoring results show:

- Rates of erosion occurring beyond natural geomorphic processes and subsequent investigation shows the erosion could have a detrimental impact on rehabilitated success;
- Key plant species establishment is below desired levels;
- Bare ground percentage is observed to increase over time; or

- A general diversity of species fails to establish, which could have a detrimental influence on vegetation condition over the long term.

Management actions will be developed in consideration of the site specific issues. Management actions will include repair of the erosion and / or, as appropriate, application of ancillary native, local seed of local provenance.

10.2 Weed monitoring

Weed monitoring will be undertaken throughout the year while the site is operational and annually once rehabilitated, in accordance with the *Weed Management Plan*.

Mapping will be undertaken using a targeted approach based on observed / reported weed occurrence and historical occurrence. Mapping approaches will vary depending on the nature and extent of the rehabilitated land. For example, weed cover may be established using three 10m x 10m quadrats or two 100m transects with three or more 2m x 2m quadrats. Mapping will include the identification of weed species, stem count, and foliar cover class.

Weed treatments will be undertaken in accordance the latest regulatory advice. Selected nuisance weeds may also be treated during some campaigns.

10.3 Reporting

Performance results will continue to be reported to relevant regulatory authorities using the established processes. Where appropriate, the reports will include progress against completion criteria and other indicators of environmental performance associated with approval and permit conditions.

11. FINANCIAL PROVISIONING FOR CLOSURE

Financial provisions for closure are a measure of the best estimate of the expenditure required to close the IRN in accordance with the current legal requirements, based on the current disturbance footprint, at the point in time when decommissioning is scheduled to commence.

Financial provisioning for closure is undertaken in accordance with Fortescue's external accounting requirements. The provision includes costs to implement and manage activities during the asset life-cycle, such as:

- decommissioning, dismantling and removal of infrastructure, and associated disposal costs;
- remediation of contamination;
- earthmoving and landscaping;
- reconstruction and management of surface water drainage;
- treatments to establish vegetation;
- maintenance and monitoring programs; and
- project management and contingency cost.

Direct costs (costs relating to on-ground activities) are estimated on a per hectare disturbance basis for each closure domain, factoring for salaries, fuel costs, fuel burn rate and machine maintenance costs. Additional cost elements for specific activities, (e.g. grouting groundwater bores), are estimated using current market rates. Indirect costs, cost for project management etc., and contingency is estimated as a proportion of the direct cost.

Closure-related activities undertaken during the operational phase are managed as operational costs. These costs are budgeted and reviewed on an annual basis and include:

- decommissioning, dismantling and removal of infrastructure, and associated disposal activities;
- remediation of spills and contamination activities;
- progressive rehabilitation, including closure studies, research and trials;
- operational phase monitoring and maintenance programs;
- stakeholder engagement and consultation; and
- project development and management costs.

12. MANAGEMENT OF INFORMATION AND DATA

12.1 Closure plan information management system

Closure related reports, guidelines, management plans and procedures are coordinated and managed through Fortescue's *Planning For Closure* SharePoint site. Support pages have been established for various aspects of the closure including Landform Design, Water Management, Revegetation, Stakeholders and Financial Provision. The site is owned and managed by Fortescue's Operations Planning team but includes contact details for the various internal subject matter experts and study owners located in various departments within Fortescue.

All of the documents presented on the *Planning For Closure* SharePoint site are managed via the document controlled database PIMS, which is supported by internal document control procedures. The database and document control procedures facilitate documents version control and review processes.

12.2 Data management

Monitoring data are predominantly stored in *EnviroSys* ™. *EnviroSys* is a database system with a web based interface that manages environmental and water parameters collected in the field and/or analysed under laboratory conditions. Data are exported from *Envirosys* for analysis and interpretation, and the reports resulting from that interpretation are accessed via PIMS.

Spatial data is managed via Fortescue's Geographic Information Systems department and delivered via multiple spatial data platforms including ArcGIS and Fortescue Maps. Data currently captured and tracked within the spatial systems include, but are not limited to: flora, fauna and vegetation pre-disturbance conditions, ground disturbance area, disturbance type and associated permits, monitoring locations, heritage sites and areas to be avoided/not-disturbed.

12.3 Corporate legal and other obligations management

Corporate legal and other obligations are managed through Fortescue's BMS and Land Management System (LMS) systems. These systems track and manage tenement, TPI State Agreement, environmental and other systems, heritage and pastoral obligations.

13. REFERENCES

13.1 Internal guidelines, procedures and plans

The following tables list the closure-related internal guidelines, procedure and plans. These documents are available for internal staff via PIMS.

Table 23. Fortescue internal guidance documents.

Reference	Title	Author	Date
100-GU-EN-0018	Characterisation of Mineral Waste Rock and Soils	Fortescue	23 November 2011
100-GU-EN-0042	Waste Rock Landform (WRL) Design Guidelines	Fortescue	23 June 2016
100-PL-EN-0011	Chemical and Hydrocarbon Management Plan	Fortescue	18 July 2014
100-PL-EN-0022	Conservation Significant Fauna Management Plan	Fortescue	February 2018
100-PL-EN-1009	Groundwater Management Plan	Fortescue	February 2018
100-PL-EN-1014	Life of Mine Geochemistry Programme AMD Sampling Plan	Tetra Tech Australia	29 July 2014
100-PL-EN-1015	Surface Water Management Plan	Fortescue	February 2018
100-PL-EN-1016	Acid and Metalliferous Drainage Management Plan	Fortescue	3 November 2015
100-PL-EN-1017	Weed Management Plan	Fortescue	19 August 2016
100-PL-EN-1020	Vegetation Health Monitoring and Management Plan	Fortescue	February 2018
100-PR-EN-1017	Waste Rock Landform (WRL) Design Procedure	Fortescue	15 August 2012
100-PR-EN-0024	Vegetation Clearing and Topsoil Management Procedure	Fortescue	February 2018
100-SP-CI-0004	Standard Engineering Specification for Drainage and Flood Protection	Fortescue	9 May 2012
45-GU-EN-0007	Seed Collection and Management Guidelines	Fortescue	1 July 2014
45-GU-EN-0010	Defining Closure Objectives and Completion Criteria	Fortescue	19 July 2016
45-PL-EN-0010	Subterranean Fauna Survey Plan	Fortescue	February 2018
45-PL-EN-0014	Waste Management Plan	Fortescue	8 September 2011
45-PL-EN-0017	Significant Flora and Vegetation Management Plan	Fortescue	20 September 2011
45-PL-EN-0018	Borrow Pit Management Plan	Fortescue	20 October 2009
45-PR-EN-0006	Weed Control Procedure	Fortescue	22 October 2007
45-PR-EN-0027	Rehabilitation and Revegetation Monitoring Procedure	Fortescue	15 April 2016
45-PR-SA-0024	Asbestos Management	Fortescue	19 January 2012
45-SY-EN-0001	Life of Mine Geochemistry Programme Site Specific Trigger Values	Fortescue	12 June 2015
SO-01001-WI-WI-OP-0001	Collecting and Dispatching AMD Samples	Fortescue	6 July 2016
SO-PR-EN-0006	Weed Monitoring and Control Procedure	Fortescue	1 April 2015
SO-PR-EN-0007	Weed Hygiene Management Procedure	Fortescue	11 June 2015

13.2 Internal and commissioned technical reports

Table 24 lists internal reports used within this closure plan to establish the baseline conditions and inform the issues analysis. These documents are subject to commercial confidentiality and are not available for external release or review.

Table 24. Fortescue Internal Technical Documents

Reference	Title	Author	Date
100-RP-EN-6406	Vegetation and Flora Survey of the Proposed FMG Stage A Rail Corridor	Biota Environmental Sciences	1 August 2004
100-RP-EN-6407	Fauna Habitats & Fauna Assemblage of the Proposed FMG Stage A Rail Corridor	Biota Environmental Services	1 August 2004
100-RP-EN-6701	Fauna Habitats & Fauna Assemblage of the Proposed FMG Stage B Rail Corridor & Mindy, Mindy, Christmas Creek.	Biota Environmental Services	1 January 2005
100-RP-EN-7511	Fauna Assessment of the Proposed South Point Rail Camp	ATA Environment	1 August 2006
100-RP-EN-7600	Supplementary Vegetation and Flora Surveys of the Port Hedland to Cloudbreak Rail Corridor and Associated Borrow Pits and Infrastructure	Coffey Environments	22 August 2007
100-RP-EN-7618	Flora and Vegetation Near Fortescue Marshes	Mattiske Consulting Pty Ltd	1 June 2005
100-RP-EN-9626	Conservation Significant Fauna Monitoring, 2015-2016	Ecoscape	31 January 2016
100-RP-EN-9670	Conservation Significant Fauna Monitoring, 2017/2018	Ecoscape	31 January 2018
45-PR-EN-0027	Rehabilitation and Revegetation Monitoring Procedure	Fortescue	15 April 2014
510RC0024-00000-RP-EN-0001	Targeted Surveys – Northern Quolls, Mulgara and Pilbara Olive Python	Coffey Environments	7 October 2011
550NY-00000-AS-EN-0002	Nyidinghu Rail Spur Flora and Vegetation Assessment	Cardno	10 August 2012
662MIC0023-5530-AS-EN-0001	North Star Slurry and Infrastructure Corridors Conservation Significant Flora and Vegetation Assessment	Ecologia Environment	17 August 2015
750WHC0002-5500-RP-EN-0004	Eliwana Consolidated Detailed Flora and Vegetation Phase 2	Biota Environmental Sciences	20 November 2017
CB-AS-EN-0024	Cloudbreak Flora and Vegetation Assessment	ENV.Australia	24 February 2011
CB-RP-EN-0022	Flora and Vegetation on the Cloud Break and White Knight Leases	Mattiske Consulting Pty Ltd	1 June 2007
CB-RP-EN-0024	Supplementary Flora Survey	ATA Environmental	N/A
CB-RP-EN-0026	Fortescue Metals Group Fauna Assessment - Extension to the Cloud Break Mining Pit	ATA Environment	1 August 2006
CC-AS-EN-0002	Christmas Creek Flora and Vegetation Asessment	ENV.Australia	27 February 2013

Reference	Title	Author	Date
CC-AS-EN-0007	Christmas Creek Life of Mine Flora and Vegetation Assessment	ENV.Australia	4 September 2012
CC-AS-EN-0014	Christmas Creek Terrestrial Vertebrate Fauna and Fauna Habitat Assessment	ENV.Australia	12 July 2012
CC-RP-EN-0008	Fortescue Metals Group Stage B Rail Corridor, Christmas Creek, Mt Lewin, Mt Nicholas and Mindy Mindy Mine Areas	Biota Environmental Sciences	1 December 2004
EW-RP-EN-0004_A	Eliwana Railway Project Environmental Review Document	Fortescue	9 January 2018
EW-SY-EN-0001	Western Hub - Stage 1 Eliwana and Flying Fish Subsurface Materials Characterisation and Risk Assessment	Fortescue	28 September 2017
EX-AS-EN-0044	Investigator Project - Terrestrial Vertebrate Fauna Assessment	Ecologia Environment	15 December 2014
EX-AS-EN-0048	Investigator Flora and Vegetation Assessment	Ecologia Environment	5 January 2015
EX-RP-EN-0019	North Star Alternate Access Road: Flora and Vegetation Assessment	Coffey Environments	26 August 2014
LR-100-E-0130	080528 Risk Assessment for Conservation Significant Fauna of GDP 2125	Coffey Environments	28 May 2008
LR-100-E-0792	090430 ENVSUR-0003, Christmas Creek Rail Loop Fauna Ground Truthing Assessment	ENV.Australia	29 April 2009
LR-100-E-1508	060807 Northern Quoll, Bilby & Mulgara Issues Associated with the Proposed South Point Camp Site an*	ATA Environment	7 August 2006
LR-100-E-1512	060831 Fauna Assessment - Marshalling Yards	ATA Environment	31 August 2006
LR-100-E-1523	061212 Pre-Clearing Fauna Survey of the Rail Corridor	ATA Environment	12 November 2006
LR-100-E-1529	070103 Preclearing Fauna Survey of the Rail Corridor	ATA Environment	3 January 2007
LR-100-E-1534	070301 Preclearing Fauna Survey of the Loop	Coffey Environments	1 March 2007
LR-100-E-1535	070307 Preclearing Fauna Surveys March	ATA Environment	7 March 2007
LR-100-E-1540	070514 Preclearing Fauna Surveys Water, Intersection, Road Upgrades	ATA Environment	14 May 2007
LR-100-E-1546	070608 Preclearing fauna surveys of various sites along the railway corridor	Coffey Environments	8 June 2007
LR-100-E-1550	070625 Preclearing fauna surveys and Mulgara relocation from the rail loop, Port Hedland.	Coffey Environments	25 June 2007
LR-100-E-1989	071123 Pre-Clearing Fauna Assessment of GDP 1255	Coffey Environments	23 November 2007
LR-100-E-211	080805 Risk Assessment for Conservation Significant Fauna of GDP 2227	Coffey Environments	4 August 2008
LR-100-E-212	080805 Risk Assessment for Conservation Significant Fauna of GDP 2225	Coffey Environments	4 August 2008
LR-100-E-212	Coffey Advice CC Railway Extension - Level 1 Fauna Risk Assessment for the CB to CC Railway Corridor	Coffey Environments	4 August 2008

Reference	Title	Author	Date
LR-100-E-260	ENV-00020, GDP2273, Risk Assessment for Conservation Significant Fauna	Coffey Environments	3 September 2008
LR-100-E-282	080923 GDP2152 Gnarloo, Risk Assessment for Conservation Significant Fauna	Coffey Environments	22 September 2008
LR-100-E-290	ENV-00036, GDP2290, Risk Assessment For Conservation Significant Fauna	Coffey Environments	8 September 2008
NS-AS-EN-0001	North Star Vegetation and Flora Assessment	Ecologia Environment	16 March 2012
P-AS-EN-0002	Port Water Supply Flora and Vegetation Assessment	Ecoscape	1 January 2011
P-AS-EN-0005	Port Hedland Outer Harbour Rail Flora and Fauna Report	GHD	1 September 2012
PH-RP-EN-0001	120213 Port Hedland Water Supply Fauna Assessment	Ecoscape	1 December 2010
R-16018-RA-HY-0001	Hamersley Rail Culverts Hydraulic Risk Assessment	Adivisan	7 September 2017
R-AS-EN-0008	Additional rail infrastructure Mainline project, conservation significant Fauna monitoring program	Ecologia Environment	4 July 2014
R-PL-EN-0008	Railway Corridor Rehabilitation Management Plan	Fortescue	9 March 2009
R-PL-SA-0001	Rail Safety Management Plan	Fortescue	20 May 2016
R-RA-EN-0001	Coffey Advice CC Railway Extension - Level 1 Fauna Risk Assessment for the CB to CC Railway Corridor	Coffey Environments	3 June 2008
R-RP-EN-1006	FMG Targeted Fauna Assessment of the Rail Duplication	Bamford Consulting Ecologists	15 December 2010
R-RP-EN-1012	FMG Rail Corridor: Targeted Threatened Fauna Search	Western Wildlife	26 April 2006
R-RP-EN-1053	Additional Rail Infrastructure Project; Conservation Significant Fauna Monitoring 2013/2014 (Draft)	Ecologia Environment	25 July 2014
R-RP-EN-1064	Hamersley line. Conservation Significant Fauna Monitoring Report 2014	Ecologia Environment	3 November 2014
R-RP-EN-1082	Additional Rail Infrastructure Project. Conservation significant fauna annual monitoring 2014/2015.	Ecologia Environment	7 August 2015
R-SP-RT-0109	Basis of Design Rail	TPI	29 February 2012
SO-AS-EN-0002	Flora and Vegetation Assessment, Solomon Rail Project	Coffey Environments	20 November 2009
SO-AS-EN-0028	Solomon Project Rail Re-Alignment Flora and Vegetation Assessment	Ecoscape	20 August 2010
SO-AS-EN-0035	Level 1 Vertebrate Fauna Assessment - Solomon Rail Project	Coffey Environments	31 August 2010
SO-AS-EN-0041	Fortescue Metals Group Ltd Proposed Gas Pipeline Targeted Threatened Fauna Survey (August 2013)	Outback Ecology	5 August 2013
SO-AS-EN-0056	Solomon Hub Vertebrate Fauna Report	Ecologia Environment	1 September 2014
SO-AS-EN-0057	Solomon Hub Flora and Vegetation Assessment	Ecologia Environment	10 October 2014
SO-AS-EN-0059	Coffey (2010), Flora and Vegetation Assessment. Solomon Rail. Vegetation Mapping Recording.	Ecologia Environment	31 October 2014

Reference	Title	Author	Date
SO-EN-0222	Solomon Regional Veg Mapping Infill	Engenium	8 May 2015
SO-PL-EN-0001	Potential Sheetflow Dependent Mulga Area	Fortescue Metals Group	3 July 1905
SS-AS-EN-0001	Solomon Rail Annual Monitoring, Conservation Significant Fauna Monitoring Report 2012	Ecologia Environment	25 October 2013
WH-AS-EN-0010	Western Hub Baseline Subterranean Fauna Assessment	Bennelongia	28 February 2015
WH-AS-EN-0012	Western Hub Project – Eliwana and Flying Fish Terrestrial Vertebrate Fauna Assessment	ecologia Environment	19 January 2015
TBA	Eliwana Project – Soil Characterisation Study	Soilwater	December 2017
TBA	Fortescue Rail Rehabilitation Condition Assessment Post-Field Memorandum	Spectrum Ecology	5 March 2018

13.3 External references

The following externally published documents were referenced in the production of this report.

Brennan K.E.C., Nichols O.G. and Mayer, J.D. (2005) Innovative Techniques for Promoting Fauna Return to Rehabilitated Sites Following Mining. Australian Centre for Minerals Extension and Research (ACMER), Brisbane and Minerals and Energy Research Institute of Western Australia (MERIWA Report 248), Perth.

Bureau of Meteorology. (2016). *Data for Eliwana.* Retrieved from 2016 Rainfall IFD Data System: http://www.bom.gov.au/water/designRainfalls/revised-ifd/?coordinate_type=dd&latitude=-22.442809&longitude=116.916594&sdmin=true&sdhr=true&sdday=true&user_label=Eliwana&year=2016

Bureau of Meteorology. (2017a, a). *Monthly Climate Statistics - Paraburdoo Aero (007185).* Retrieved from Climate Statistics for Australian Locations: http://www.bom.gov.au/climate/averages/tables/cw_007185.shtml

Bureau of Meteorology. (2017b, b). *Annual Average Evaporation.* Retrieved from Average annual, monthly and seasonal evaporation: http://www.bom.gov.au/jsp/ncc/climate_averages/evaporation/index.jsp

CSIRO/BoM. (2017). *Rangelands North.* Retrieved from Climate Change in Australia: https://www.climatechangeinaustralia.gov.au/en/climate-projections/future-climate/regional-climate-change-explorer/sub-clusters/?current=RLNC&tooltip=true&popup=true

Johnson, S. L., & Wright, A. H. (2001). *Central Pilbara groundwater study.* Water and Rivers Commission, Western Australia: Hydrogeological record series: HG 8. Pp 57.

Kendrick, P. (2001). Pilbara 3 (PIL3 - Hamersley Subregion). In D. o. Management, *A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions in 2002* (p. 724). Kensington, Western Australia: Dept. of Conservation & Land Management.

MWH. (2011). *Central Pilbara 2 – Eliwana Scoping Surface Water Assessment.* MWH Global.

Payne A.L., M. A. (1988). An inventory and condition survey of rangelands in the Ashburton River catchment, Western Australia. In W. A. Agriculture, *Technical Bulletin No. 62.* Perth.

van Vreeswyk A.M.E, Payne A.L., Leighton K.A. and Hennig P. (2004) *An inventory and condition survey of the Pilbara region, Western Australia*. Technical Bulletin No. 92. Department of Agriculture, South Perth.

Appendix 1: Closure Obligations and Commitments

Report

Closure-related legal obligations register

Integrated Rail Network Closure Plan

7 June 2018
Appendix to the Integrated Rail Network Closure Plan

Fortescue
The New Force in Iron Ore

	Closure-related legal obligations		**Appendix 1** **R-PL-EN-0041**
Revision Number	**0**		**7/06/2018**
Status	**IFR - ISSUED FOR REVIEW**		
Author	S. Finucane	Signature	13/04/2018
Confidentiality	**FORTESCUE STAFF & CONTRACTORS**	**Publish on Extranet**	☐ Yes ☒ No
Review Date	**30/04/2019**		

TABLE OF CONTENTS

1. PURPOSE

This register has been developed to support the Integrated Rail Network Closure Plan (IRNCP).

The register outlines the closure-related obligations and commitments identified through “plain English reading” of agreements and approval submissions identified during the IRNCP literature review. The work conducted in preparing this register does not constitute a legal review. A comprehensive legal review will be required as closure approaches to ensure that all relevant obligations are identified and actioned.

The register also identifies legislation, standards and guidelines that may not apply to the IRN specifically, but that may be generally relevant to closure of supporting infrastructure associated with mine sites.

2. OBLIGATION EXTRACTS

2.1 *Railway and Port (The Pilbara Infrastructure Pty Ltd) Agreement Act 2004*

The TPI State Agreement ratifies an agreement between the State of Western Australia and TPI to develop a multi-user railway and port facilities and authorises implementation of that agreement. The multi-user railway is the subject of this closure plan.

Within the TPI State Agreement the State agreed to assist in the development of the railway and port facilities for the purpose of promoting development of multi-user infrastructure in the Pilbara and promoting the development of the iron ore industry and employment opportunities generally in WA.

The TPI State Agreement requires that TPI use all reasonable endeavours to promote access to, and attract customers for, the railway. Through the Agreement, TPI is also required to “at all times keep and maintain in good repair and working order and condition” the railway and associated infrastructure, including private roads that cross the railway. This “obligation includes, where necessary, replacing or renewing all part which are worn out or in need of replacement or renewal due to their age or condition”. [Clause 20]

Within the TPI State Agreement the ‘Railway’ means “the standard gauge haul heavy railway”, “all railway track, associated track structures including sidings, turning loops, over or under track structures, supports…, tunnels, bridges, train control systems, signalling systems, switch and other gear, communication systems, electric traction infrastructure, buildings (excluding office buildings, housing and freight centres), workshops and associated plant, machinery and equipment and including rolling stock maintenance facilities, terminal yards, depots, culverts and weigh bridges...” ‘Additional Infrastructure’ includes the infrastructure necessary for the transport of iron ore products, freight goods or other products from the SRL Railway to the Port Facilities]. [Clause 1]

On the basis of the above, it is reasonable to assume that the IRN will be in good working order and condition at the time that TPI decides to cease operating the railway.

Clause 32 outlines the requirements relevant to cessation or determination of the TPI State Agreement. Clause 32(2)(b)(ii) states that "…the SRL Railway and Additional Infrastructure located outside the Port shall become and remain the absolute property of the State" unless the Minister responsible for administering the TPI State Agreement gives notice to TPI under Clause 32(2)(a) to remove the Railway and Additional Infrastructure and rehabilitate the land.

Infrastructure that is excluded from the handover of the IRN include office building and housing [Clause 1].

Fortescue considers the IRN would be an asset of value to the State as:

- There are no government owned railways in the Pilbara;
- The IRN will be in good repair and working order;
- The IRN links the central Pilbara region to a viable, commercial port and the Port Hedland regional centre; and
- There has been regular and ongoing demand for use of the existing privately-owned Pilbara rail networks to support Pilbara development opportunities.

For the purposes of this closure plan, it is assumed that the State of Western Australia would take ownership of the IRN if TPI elected to cease operation of the railway. Office buildings within the SRL Railway and accommodation camps have been interpreted to be excluded from this handover, as per the definition provided above, and would need to be removed and the land rehabilitated on determination of the TPI State Agreement.

2.2 *Environmental Protection Act 1986*

The TPI State Agreement states that nothing shall be construed to exempt TPI from compliance with any requirement in connections with the protection of the environment arising out of or incidental to its activities under this Agreement that may be made by or under the EP Act. This section outlines the key closure requirements relevant to the IRN arising from environmental approvals issued under Parts IV and V of the EP Act.

Part IV Ministerial Statements

The key documents listed in Table 1, generated during the environmental assessment and approval of the IRN under Part IV of the *Environmental Protection Act 1986* (EP Act), describe the regulatory reasoning and conclusions in relation to closure of the IRN.

Table 1. Environmental Assessments under Part IV of the *Environmental Protection Act 1986*

Segment of IRN	Environmental Review Document	EPA Bulletin No	Ministerial Statement No
Main Line	Pilbara Iron Ore and Infrastructure Project: Stage A Port and North-South Railway Public Environmental Review prepared by Environ (September 2004)	1173	690
Hamersley Line	"Solomon Project" Public Environmental Review prepared by Fortescue (November 2010) Note: also assessed as a controlled action under the EPBC Act (see Section 2.3)	1386	862 (superseded by MS 1092)
	"Solomon Iron Ore Project – Sustaining Production" Public Environmental Review prepared by Fortescue (December 2015)	1588	1062
East-West Line	"Pilbara Iron Ore and Infrastructure Project: Stage B East-West Railway and Mine Sites" Public Environmental Review prepared by Environ (January 2005)	1202	707 (superseded by MS 1033)
	"Christmas Creek Iron Ore Expansion" Public Environmental Review prepared by Fortescue (March 2015)	1567	1033
Eliwana Line	*Still under assessment*	-	-

The Main Line Railway was assessed as part of the Public Environmental Review (PER) prepared for the Pilbara Iron Ore and Infrastructure Project: Stage A Port and North-South Railway. This PER, which was issued for review in 2004, states that the railway should be considered an asset to the State and could have an indefinite operating life. Consequently, decommissioning of the Main Line would occur only if the facilities were no longer required by Fortescue or another party. If this occurred, decommissioning procedures and closure plans would be established in accordance with applicable legislation and standards at that time.

However, this PER also comments that where the removal of non-visible infrastructure or features that have become incorporated into the natural landscape may cause more environmental damage than if left in situ, then their retention would be discussed with the relevant authorities. In its report and recommendations in relation to this proposal, the Environmental Protection Authority (EPA) recommended that a Rail Corridor Rehabilitation Plan be prepared for all areas not required for ongoing operations (EPA Bulletin 1173). This was included in Ministerial Statement 690 as Condition 9.

The East-West Railway was assessed as part of the PER prepared for the Pilbara Iron Ore and Infrastructure Project: Stage B East-West Railway and Mine Sites, and issued for review in early 2005. The comments on decommissioning of this railway line in this PER are the same as those in the 2004 PER for the Stage A proposal (as discussed above). In its report and recommendations in relation to Stage B proposal, the EPA recommended preparation of a Rail Route Environmental Management Plan that included consideration of final closure strategies for the railway at the end of mining (EPA Bulletin 1202). This was included in Ministerial Statement 707 as part of Condition 12.

A revised proposal for the Pilbara Iron Ore and Infrastructure Project (Christmas Creek Mine, East-West Railway and Mindy Mindy Mine) was assessed as a PER and approved by the Minister for the Environment under Ministerial Statement 1033. Ministerial Statement 1033 supersedes Ministerial Statement 707. Condition 14 of Ministerial Statement 1033 requires that Fortescue ensure that the East-West Railway is decommissioned and rehabilitated consistent with the requirements of the TPI State Agreement (see Section 2.1).

The PER prepared for the Solomon Project in late 2010 included a railway line between the Main Line Railway and the Firetail mine area. This was called the Solomon Rail in this PER, but is now known as the Hamersley Railway. The PER also included a rail spur to the Kings mining area (which is now known as the Fredericks Spur). The Solomon PER included a commitment to develop a Rehabilitation and Revegetation Management Plan for the Railway.

In its report and recommendations in relation to Fortescue's proposal for the Solomon Project (EPA Bulletin 1386), the EPA noted that Fortescue had committed to progressive rehabilitation of the mine site and infrastructure, and recommended that a condition be included in the Ministerial approval to ensure that rehabilitation is carried out according to current best practice. There was no specific reference in this recommendation to the inclusion or exclusion of the railway. The Solomon Project was approved under Ministerial Statement 862. This approval included conditions relating to progressive rehabilitation (Condition 9), preparation of a Mine Plan and Preliminary Closure Strategy (Condition 14) and Final Closure and Decommissioning Plan (Condition 15). Although none of these conditions refer specifically to the railway, neither do they exclude the railway.

The North Star Magnetite and Cloudbreak projects were also assessed as PERs (and approved) but did not include rail components so have not been considered further in this document.

In 2015, a PER that assessed a proposal to sustain production at the Solomon Mine was issued for public review. The PER states that transport of ore from the Solomon Mine would be via the existing Hamersley Line, but included an increase of disturbance within the Mine Development Envelope to accommodate additional borrow pits and additional footprint required for construction of the rail spur approved in April 2011 under Ministerial Statement 862.

The proposal to sustain production at the Solomon Mine (including the modifications to the rail corridor noted above) was approved by the Minister for the Environment in October 2017 (Ministerial Statement 1062), superseding Ministerial Statement 862. Condition 18 of Ministerial Statement 1062 requires that the rail line within the rail development envelope be decommissioned and rehabilitated in a manner that is consistent with the requirements of the *Railway and Port (The Pilbara Infrastructure Pty Ltd) Agreement Act 2004*, and that Fortescue prepare a management-based environmental management plan under Condition 7 to meet the objective of Commitment 18.

The proposed Eliwana Railway is currently under assessment at the PER level of assessment.

The conditions set by the Minister for the Environment resulting from the currently active Ministerial Statements that are relevant to closure are outlined in Table 2. Some of these conditions relate directly to closure planning, while others inform planning and/or implementation of closure of office buildings, housing and freight centres, and any current water or energy infrastructure supporting these facilities (if the Company is directed to do so by the Minister responsible for administration of the TPI State Agreement).

Table 2. State Ministerial Approval Conditions

Railway Segment	EPA Assessment	Ministerial Statement
Main Line	1505	Ministerial Statement No 690 Prepare and implement a Rail Corridor Rehabilitation Plan (Condition 9). This includes measures for topsoil, borrow pit and weed management, fauna habitat restoration, completion criteria derivation and monitoring, surveying of rehabilitation total area and rehabilitation maintenance. Under this condition (as amended – see Attachment 8 of MS 690), Fortescue is required to rehabilitation not less than 2,385 ha of land disturbed for the Main Line unless written authorisation is obtained from the Minister for the Environment. This includes 2,050 ha for Part 1 of the proposal (from the port to a point northwest of Cloudbreak). Prepare and implement management plans for railway corridor disturbance (Condition 6), fauna (Condition 7), surface water (Condition 8), weeds (Condition 10), subterranean fauna (Condition 11), noise (Condition 18), fire (Schedule 2 -Commitment 3), Aboriginal heritage (Schedule 2 – Commitment 8) and water usage (Schedule 2 – Commitment 9) Compliance reporting in relation to the above (Condition 5). Note that minor changes to the approved proposal have been made under this Ministerial Statement under s45C of the EP Act (rail loop changes and De Grey Rail realignment). See Attachment 3 of MS 690 for details.
East-West Line	1520	Superseded Ministerial Statement No 707 This statement has been superseded by MS 1033. .
	1989	Ministerial Statement No 1033 MS 1033 supersedes MS 707 (and MS 871) Prepare management-based Condition Environmental Management Plans to meet the requirements of Condition 6. The following plans are required: - Within 24 months of issue of MS 1033, prepare a management-based condition environmental management plan to demonstrate that the environmental objectives in Conditions 12-1 and 13-1 for the East-West Railway will be met (see below). - Within 12 months of the Minister for State Development giving notice under Clause 32(2)(a) of the TPI State Agreement or as otherwise agreed in writing by the CEO, at least three years prior to the planned cessation of railway operations by the proponent, whichever comes first, prepare a management-based condition environmental management plan to demonstrate that the environmental objectives in Conditions 14-1 for the East-West Railway will be met (see below). Prepare a plan for surface water management for the East-West Railway to minimise direct and indirect impacts of flora, vegetation and fauna from activities associated with the management of surface water including, but not limited to, modifications to surface water drainage (Condition 12). This plan must meet the requirements of Condition 6.

Railway Segment	EPA Assessment	Ministerial Statement
		Prepare a plan for vegetation health management for the East-West Railway to minimise impacts to Mulga communities (Condition 13). This plan must meet the requirements of Condition 6. Prepare a plan for rehabilitation and decommissioning of the East-West Railway to ensure that the proposal is decommissioned and rehabilitated consistent with the requirements of the TPI State Agreement (Condition 14). This plan must meet the requirements of Condition 6. Compliance reporting in relation to the above (Condition 3). Note that minor changes to the approved proposal have been made under this Ministerial Statement under s45C of the EP Act (rail loop changes and De Grey Rail realignment). See Attachment 1 of MS 1033 for details.
Hamersley Line	1841	Superseded Ministerial Statement No 862 This statement has been superseded by MS 1062.
	2019	Ministerial Statement No 1062 MS 1062 supersedes MS 862. Within 24 months of issue of MS 1062, prepare management-based condition environmental management plans to demonstrate that the environmental objectives in Conditions 17-1 and 18-1 for the Hamersley Railway will be met (see below) (Condition 7). In accordance with Condition 17, prepare a plan for flora and vegetation (including Mulga) within and downstream of the Rail Development Envelope to: Maintain the health of populations of regionally and locally significant flora species and ecological communities not authorised to be cleared in Schedule 1 including, but not limited to, Gompholobium karijini within the rail development envelope. Maintain the health of Mulga and other significant vegetation downstream of the rail line consistent with pre-development surveys. This plan must meet the requirements of Condition 7. Prepare a plan for rehabilitation and decommissioning of the Hamersley Railway to ensure that the rail line ithin the rail development envelope is decommissioned and rehabilitated consistent with the requirements of the TPI State Agreement (Condition 18). This plan must meet the requirements of Condition 7. Compliance reporting in relation to the above (Condition 3).
Eliwana Line	2129	*Still under assessment*

Part V Licence

No existing licences issued under Part V of the EP Act that are relevant to closure of the IRN have been identified. It is noted that a works approval and/or licence may be required during closure if there is potential to pollute associated with the closure of office buildings, housing and freight centres, and any current water or energy infrastructure supporting these facilities.

2.3 *Environment Protection and Biodiversity Conservation Act 1999*

Company development proposals assessed as controlled actions under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) are listed in Table 3, along with conditions relevant to closure. Some of these conditions relate directly to closure planning, while others inform planning and/or implementation of closure of office buildings, housing and freight centres, and any current water or energy infrastructure supporting these facilities (if the Company is directed to do so by the Minister responsible for administration of the TPI State Agreement).

Table 3. Approval Conditions under the *Environment Protection & Biodiversity Conservation Act 1999*

EPBC Act Reference No	Project	Rail Component	Approval Conditions
2010/5513	Additional Rail Infrastructure between Herb Elliott Port Facility and Cloudbreak Mine	Main Line	Approval issued on 17-5-11 Variations to approval issued on 22-4-12, 27-11-12, 24-7-14, 17-4-15 and 11-8-16 Condition 2 requires implementation of a Conservation Significant Fauna Management Plan. Condition 4 refers to making a contribution to research on the Greater Bilby. Condition 13 requires implementation of an Offsets Plan in relation to EPBC Act listed threatened fauna that includes management of feral animals and weeds. Condition 14 requires implementation of a Land Management Action Plan. Condition 15 refers to compliance reporting.
2010/5567	Solomon Iron Ore and Infrastructure Project	Hamersley Line	Approval issued on 28-4-11 Variations to approval issued on 22-4-12, 27-11-12, 20-12-13, 24-7-14 and 17-4-15 Condition 4 requires implementation of a Conservation Significant Fauna Management Plan. Condition 5 refers to making a contribution to research on the Northern Quoll. Condition 13 requires implementation of an Offsets Plan in relation to EPBC Act listed threatened fauna that includes management of feral animals and weeds. Condition 14 requires implementation of a Land Management Action Plan. Condition 15 refers to compliance reporting.
2012/6530	North Star Hematite Project	Main Line (new rail crossing only)	Approval issued on 14-6-13 Variation to approval issued on 10-2-15 Condition 2 requires implementation of an EPBC Listed Threatened Fauna Management Plan.
2014/7275	Solomon Iron Ore Project Expansion	Hamersley Line	*Assessment complete. Awaiting issue of approval conditions*
2017/8025	Eliwana Railway Project	Eliwana Line	*Still under assessment*

2.4 *Special Railway Licence L1SA*

The Special Railway Licence (SRL) is a miscellaneous licence administered by the Minister for Mines pursuant to clause 14(1)(a) of the TPI State Agreement to facilitate planning, design, construction, commissioning, operation and maintenance activities within the railway corridor. SRL L1SA was issued to TPI in 2006 for a period of 50 years. The main tenement conditions imposed on L1SA relevant to closure planning for the IRN are listed in Table 4.

Table 4. Special Rail Licence Conditions and Endorsements

No	Description
Condition 8	Topsoil being removed from areas of temporary disturbance and stockpiled for later respreading or immediately respread as rehabilitation progresses.
Condition 9	All rubbish and scrap is to be progressively disposed of in a suitable manner.
Condition 10	At the completion of operations, or progressively where possible, all access roads and other disturbed areas being covered with topsoil, deep ripped and revegetated with local native grasses, shrubs and trees.

2.5 Traditional Owner Land Access Agreements

Fortescue has negotiated and established Land Access Agreements with most of the Traditional Owners of the Pilbara country on which the IRN operates. General obligations pertaining to closure that may be found within these agreements is summarised in Table 5.

Table 5. Traditional Owner Land Access Agreement Generalised Closure Requirements - Summary

Closure Condition
Within the Agreement Area, Fortescue must: (1) maintain consistently high standards of environmental planning and management in connection with the IRN operation; (2) regularly monitor the environmental performance of the IRN operation and ensure that proper management procedures are in place to meet its environmental responsibilities in connection with the IRN operation; (3) design the IRN operation with the objective of minimising to the greatest extent practicable the release of contaminants during and after the life of the IRN; and (4) carry out the IRN operation in a manner that practically minimises any negative impact on the environment.
When conducting the IRN operation, Fortescue must: (1) not unreasonably damage or adversely alter any natural hydrological systems; (3) take all practicable steps to prevent erosion; … (5) take all reasonable steps to: … (d) keep or make safe the IRN by not creating, or by removing, any unusual or hidden dangers created, as a result of the IRN operation. (e) accord with best practicable technology (subject to operational restraints and availability); and (f) anticipate changing community values and be alert to technical advances which may improve environmental standards.
Following the completion of any part of the IRN operation within the Agreement Area, Fortescue must rehabilitate those parts of the IRN disturbed with a view to meeting the following objectives: (1) re-establishing an environment to the maximum reasonable extent, the pre-existing environment or the environment existing in adjacent areas; (2) progressively revegetating areas with local native plant species similar in density and abundance to that existing prior to the commencement of Project Operations, in order to form an ecosystem the long term viability of

which will not require a maintenance regime significantly different from that appropriate to those adjacent areas; and

(3) limiting erosion in rehabilitation areas, as far as can reasonably be achieved, to that characteristic of similar land forms in surrounding undisturbed areas.

2.6 Other licences and permits

No other licences or permits were identified that would influence closure planning.

3. OTHER COMMITMENTS

The following paraphrased commitments are subject to change, may be superseded or extinguished during the life of the mine, as a consequence of established regulatory review and update processes and other similar negotiations.

This section outlines the Fortescue management plans and similar documents that relate directly to closure planning or inform planning and/or implementation of closure. It is noted that the IRN Closure Plan to which this document is appended replaces the following Fortescue plans, but these remain in this section as they have not yet been replaced:

- Borrow Pit Management Plan (45-PL-EN-0018).
- Rail Corridor Rehabilitation Plan (R-PL-EN-0008).

Borrow Pit Management Plan, 45-PL-EN-0018

Closure commitment	
To implement the plan	
Reference	**Management actions**
4.2.4	Future Development of Closure Criteria – undertake baseline and annual LFA monitoring.
4.2.5	Development of Borrow Pits to Facilitate Future Rehabilitation and Closure – assess, design and develop.
4.2.7	Establishing a Safe and Stable Post-mining Land Surface – design & construction; drainage; slopes; landforms to resemble surrounding topography as much as possible.
4.2.8	Re-establishing a Self-generating Ecosystem – rehabilitation, recontouring, revegetation, drainage flows.

Chemical and Hydrocarbon Management Plan, 100-PL-EN-1011

Closure commitment	
To implement the plan	
Reference	**Management action**
1.5	Ensure relevant personnel and contractors involved in chemical and hydrocarbon handling and storage activities are provided with the appropriate training and equipment as outlined in the *Chemical and Hydrocarbon Spills Procedures* (45-PR-EN-0014) and the *Hazardous Materials Management Procedure* (45-PR-SA-0051).
1.9	Chemicals and hydrocarbons should be stored in accordance with AS 1940, AS 3833 or AS 3780 to minimise the potential for environmental harm. Storage should only be in designated areas and within the limits specified in applicable Licence conditions under the *EP Act* (see Table 2).
1.10	Store chemicals and hydrocarbons in accordance with Licence conditions under the *EP Act*. Where a storage facility is not required to be licenced, store chemicals and hydrocarbons, other than goods classified as minor storage, in bunded compounds with a capacity of 110% of the volume of the largest vessel and at least 25% of the total volume in accordance with AS 1940, AS 3833 and AS 3780.

Closure commitment	
1.11	Ensure appropriate types and quantities of spill response equipment are maintained and are proportionate to the volume of chemicals and hydrocarbons stored and the risks identified in Action 1.2 to improve spill response time and effort and minimise the potential for environmental harm in accordance with the *Chemical and Hydrocarbon Spills Procedure* (45-PL-EN-0014).
1.12	Where a chemical or hydrocarbon spill has occurred, manage the spill including any contaminated material, in accordance with the *Chemical and Hydrocarbon Spills Procedure* (45-PL-EN-0014) and investigate and report the incident in accordance with the *Incident Event Management Procedure* (100-PR-SA-0011).
1.14	Where required, monitor groundwater quality in potential high risk areas identified in Action 1.2, to meet requirements of a Licence or Works Approval issued under the *EP Act* and in accordance with the *Groundwater Management Plan* (100-PL-EN-1009).
1.15	Where required, monitor surface water quality in potential high risk areas identified in Action 1.2, to meet requirements of a Licence or Works Approval issued under the *EP Act* and in accordance with the *Surface Water Monitoring Guidelines* (45-GU-EN-0002).
2.1	Ensure chemicals and hydrocarbons transported on roads open to or used by the public are in accordance with the Australian Dangerous Goods Code (ADGC) and the *Hazardous Materials Management Procedure* (45-PR-SA-0051). Ensure chemicals and hydrocarbons are appropriately stowed and restrained to prevent any movement which may result in a leak or spill.
2.2	When transporting chemicals or hydrocarbons by road in a container with a capacity greater than 500 L or with more than 500kg of a dangerous good in a container, ensure a licensed contractor is engaged in accordance with the Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Amendment Regulations 2010.
3.2	Dispose of any waste materials contaminated with chemicals or hydrocarbons, including water contaminated with hydrocarbons, in accordance with the *Chemical and Hydrocarbon Spills Procedure (45-PR-EN-0014),* Licence requirements under the *EP Act* and where required the *Environmental Protection (Controlled Waste) Regulations 2004.*
3.3	Manage bioremediation facilities to ensure compliance with applicable Licence conditions and in accordance with the DER's *Contaminated Sites Management Series - Bioremediation of Hydrocarbon Contaminated Soils in Western Australia* (2004).
3.4	Remediate any area declared contaminated as defined under the *Contaminated Sites Act 2003* in accordance with the DER's *Contaminated Sites Management Series – Assessment Levels for Soil, Sediment and Water* (2011) and the *Rehabilitation and Revegetation Management Plan* (45-PL-EN-0023).
4.1	Develop and implement a greenhouse gas reporting system to ensure emissions data associated with chemical and hydrocarbon use is accurate, complete, transparent and auditable in accordance with the *Greenhouse Gas Emissions and Energy Reporting Management Plan* (100-PR-GH-0001) and to meet reporting requirements under the *National Greenhouse and Energy Reporting Act 2007*.

Conservation Significant Fauna Management Plan, 100-PL-EN-0022

Closure commitment	
To implement the plan	
Reference	**Management actions**
2.14	Develop and implement a Feral Animal Program to effectively manage and control feral animals within Fortescue controlled sites to minimise impacts on conservation significant fauna.
2.15	Manage waste materials and on-site landfill facilities in accordance with the *Waste Management Plan* (45-PL-EN-0014) to minimise potential impacts on fauna and the likelihood of increases in feral animal numbers.
2.20	Conduct progressive rehabilitation of disturbed areas, particularly those areas with known conservation significant fauna and associated habitat
3.1	Where populations of conservation significant fauna listed under the *Wildlife Conservation Act 1986* or the *Environment Protection and Biodiversity Conservation Act 1999* have been recorded in Fortescue controlled sites, develop and implement a Conservation Significant Fauna Monitoring

Closure commitment	
	Program in accordance with the *Conservation Significant Fauna Monitoring Guidelines* (100-GU-EN-0034).
4.1	Where a fauna injury or death has occurred as a result of Fortescue Operations, investigate and report the incident in accordance with the *Incident Event Reporting Procedure* (100-PR-SA-0011) and employ corrective actions in accordance with Section 9 of this Plan.
4.2	When an incident has occurred, review mitigation measures and monitoring programs and update where require to inform an adaptive management approach for the life of the project.

Groundwater Management Plan, 100-PL-EN-1009

Closure commitment	
To implement the plan	
Reference	**Management action**
2.3	When required as a condition of a licence issued under the *Rights in Water and Irrigation Act 1914*, develop and implement a Groundwater Operating Strategy in accordance with the Operational policy 5.08: Use of operating strategies in the water licensing process (DoW).
2.10	Ensure chemicals and hydrocarbons are managed in accordance with the *Chemical and Hydrocarbon Management Plan* (100-PL-EN-0011) to reduce the risk of soil or groundwater contamination.
2.11	When an uncontrolled release of water has occurred as a result of Fortescue activities and the release has caused or is likely to cause pollution or environmental harm as defined in the *Environmental Consequence Descriptors Matrix* (100-MX-EN-0001), investigate and report the incident in accordance with the *Incident Event Management Procedure* (100-PR-SA-0011).
2.12	To ensure erosion, water quality and groundwater flow regimes are minimally impacted conduct progressive rehabilitation in accordance with the *Rehabilitation and Revegetation Management Plan* (45-PL-EN- 0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans.
5.1	Develop and implement a groundwater monitoring program in accordance with an approval, license or works approval issued under the *Environmental Protection Act 1986*, an approval under the *Environment Protection and Biodiversity Conservation Act 1999, a* licence issued under the *Rights in Water and Irrigation Act 1914* and where applicable a Groundwater Operating Strategy developed in accordance with the Operational policy 5.08: Use of operating strategies in the water licensing process (DoW).

Mine and Rail Dust Management Plan, 45-PL-EN-0030

Closure commitment	
To implement the plan	
Reference	**Management actions**
2.4	Develop and implement a monitoring program as outlined in the *Dust Monitoring Guidelines* (45-GU-EN-0004)
3.2	To ensure vegetation conservation values are maintained, conduct progressive rehabilitation in accordance with the Rehabilitation and Revegetation Management Plan (45-PL-EN-0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans.

Rail Corridor Rehabilitation Plan, R-PL-EN-0008

Closure commitment	
Commitment	**Management actions**

Closure commitment	
Establish agreed completion criteria for rehabilitation work	Develop completion criteria for rail rehabilitation works. Develop completion criteria and monitoring methods for assessment of rehabilitation success in conjunction with DEC (Parks and Conservation), land owners and end users. Consider the Pilbara region's seasonal and unreliable rainfall in setting completion criteria. Monitor the success of rehabilitation performance against agreed criteria. Review and amend completion criteria and monitoring methods where required. Corrective action: Initiate / continue consultation. Amend criteria and monitoring methods where required.
Clearly identify disturbed areas, areas available for rehabilitation and areas completed	Use information recorded within the Ground Disturbance Permit (GOP) system (Form: E-EN-FM-0001) and Fortescue GIS database to identify areas disturbed and requiring rehabilitation. Survey all areas disturbed as a result of rail construction works and store data in a central Fortescue GIS database and the GOP system. Clear areas for rail construction only in accordance with the Vegetation Clearing and Re-use Procedure (E-EN-PP-1140). Develop rehabilitation work plans for areas as they become available. Following rehabilitation works, survey areas completed, document all treatments applied to rehabilitation areas, and update GIS database and the GOP system. Corrective actions: In the event that mapping information is found to be out of date or insufficient; surveys, data collation, or other actions as appropriate, are to be instigated to ensure disturbed area information is complete and current.
Reconstruct safe, stable and erosion-resistant landforms (Other than Camp 90)	Design and construct final landforms such that the surface is stable and not prone to erosion, and the risk to people or animals entering the area is minimised. Remove, store and replace subsoil and topsoil in accordance with the Topsoil and Subsoil Management Procedure (E-EN-PP-0001). Ensure pending is minimised in borrow pits and other artificially created depressions through self drainage or by ensuring surface water flows or drainage lines are directed around the pit or depressions. Borrow pit slopes are pushed to 1:5 or gentler on end of borrow pit use. Establish landforms that resemble landforms and topography of the surrounding environment Corrective action: Corrective earthworks or other stabilisation works where significant erosion, slumping or pending is discovered.
Retention of infrastructure required by leaseholder and reconstruction of remaining landforms to be safe, stable and suitable for intended use as stockyards and outcamp	Retain for use of the leaseholder, the following infrastructure With the exception of the retained infrastructure listed above, establish landforms that resemble landforms and topography of the surrounding environment. Design and construct final landforms such that the surface is stable and not prone to erosion and the risk to people or animals entering the area is minimised. Remove, store and replace subsoil and topsoil in accordance with the Topsoil and Subsoil Management Procedure (E-EN-PP-0001). Corrective actions: Corrective earthworks or other stabilisation works where significant erosion, slumping or pending is discovered prior to handover to the leaseholder
Re-establish vegetation compatible with completion criteria	Clear and stockpile native vegetation such that it can be re-used efficiently for rehabilitation in compliance with Vegetation Clearing and Re-use Procedure (E-EN-PP-1140). Strip, store and reapply topsoil and subsoil in accordance with Topsoil and Subsoil Management Procedure (E-EN-PP-0001). Monitor rehabilitated areas to ensure success of vegetation re-establishment.

Closure commitment	
	All revegetation will be managed in accordance with the Mulga and Other Flora Communities Management Plan. Develop completion criteria for rail rehabilitation works Develop completion criteria and monitoring methods for assessment of rehabilitation success in conjunction with DEC (Parks and Conservation), land owners and end users. Consider the Pilbara region's seasonal and unreliable rainfall in setting completion criteria. Monitor the success of rehabilitation performance against agreed criteria. Review and amend completion criteria and monitoring methods where required. Corrective action:
Undertake measures to encourage recolonisation of fauna to disturbed areas.	Undertake feral cat control at rail construction camps. Spread cleared vegetation over batters at edge of borrow pits and in small stockpiles along the rail and access road alignment. Where possible, leave large rocks in situ within borrows pits as a habitat feature. Identify any outstanding individual habitat trees and modify pit design to allow their retention. Ensure rehabilitated borrow pits are connected to surrounding vegetation to allow ready access for recolonising fauna. Monitor the return of native fauna to disturbed area. Review and employ new management actions if monitoring finds fauna are not returning. Corrective actions: Supplementary feral cat trapping if sightings occur after trapping program. Remedial works if a non-compliance with the vegetation re-use procedure is recorded
Control weed establishment in rehabilitated areas and ensure they do not adversely impact the environmental values of surrounding areas by the introduction or spread of weeds.	Identify weed areas during disturbance activities and dispose affected topsoil as directed in the Topsoil and Subsoil Management Procedure (E-EN-PP-0001). In rehabilitated areas, control weeds as per the Weed Hygiene and Management Plan (E-SA-RP-0106-1145). Drainage and surface water impacts are to be addressed as per the Surface Water Management Plan (204-60-EN-RP-0003/ 204-03-EN- RP-0003). Ensure vehicle hygiene measures are followed as per the· Weed Hygiene Management Plan. Corrective actions: Where weeds are identified in rehabilitated areas, initiate appropriate control measures in accordance with Weed Hygiene and Management Plan.
Monitor rehabilitation to determine progress towards meeting completion criteria and determine if further works are required.	Quantitative assessment of factors including, but not limited to, species diversity and density, and vegetation cover in rehabilitation areas using monitoring methodology developed in consultation with DEC (Parks and Conservation). Visual assessment of erosion, surface water run-off and weeds in rehabilitation areas. Development and implementation of a fixed-point photo monitoring program for vegetation in selected rehabilitation areas. Development of a fauna re-colonisation monitoring program for disturbed areas other than for Camp 90. Corrective actions: Remedial seeding and earthworks if erosion or vegetation monitoring indicates rehabilitation will not meet completion criteria. Remedial site works if disturbance occurs e.g. due to unauthorised vehicle access.

Significant Flora and Vegetation Management Plan, 45-PL-EN-0017

Closure commitment	
To implement the plan	
Reference	**Management actions**

Closure commitment	
2.6	Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into the Fortescue Operations Area in accordance with the *Weed Management Plan* (100-PL-EN-1017 formerly 45-PL-EN-0013).
2.9	To minimise the potential for dust deposition on vegetation, implement dust suppression measures in accordance with the *Mine and Rail Dust Management Plan* (45-PL-EN-0030).
3.1	When significant flora and vegetation are known or likely to occur in the Fortescue Operations Area, develop and implement a monitoring program as outlined in the *Significant Flora and Vegetation Monitoring Guidelines* (45-GU-EN-0001)
4.1	When unauthorised disturbance of significant flora or vegetation occurs, report and investigate the incident in accordance with the *Incident Event Reporting Procedure* (100-PR-SA-0011).
4.2	To ensure vegetation conservation values are maintained, conduct rehabilitation in accordance with the … applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans.
4.3	Develop and implement targeted research projects to investigate key areas related to significant flora and vegetation.

Surface Water Management Plan, 100-PL-EN-1015

Closure commitment	
To implement the plan	
Aspect	**Management action**
Roads	Develop and implement a surface water monitoring program, which includes the inspection of all drainage infrastructure, in accordance with the *Surface Water Monitoring Guidelines (*100-GU-EN-0037). To ensure erosion, water quality and surface water flow regimes are minimally impacted conduct rehabilitation in accordance with the Rehabilitation and Revegetation Management Plan (45-PL-EN-0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans. Where appropriate, re-establish natural stream and drainage flows where practicable to resemble original drainage patterns, including rehabilitation of major drainage channels.
Railway Infrastructure	Manage chemicals and hydrocarbons in accordance with the *Chemical and Hydrocarbon Management Plan* (100-PL-EN-0011). Develop and implement a surface water quality monitoring program, which includes the inspections of all drainage infrastructure, in accordance with the *Surface Water Monitoring Guidelines (*100-GU-EN-0037). To ensure erosion, water quality and surface water flow regimes are minimally impacted conduct rehabilitation in accordance with the Rehabilitation and Revegetation Management Plan (45-PL-EN-0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans Where appropriate, re-establish natural stream and drainage flows to resemble original drainage patterns, including rehabilitation of major drainage channels
Mines	Manage chemicals and hydrocarbons in accordance with the *Chemical and Hydrocarbon Management Plan* (45-PL-EN-0011). Develop and implement a surface water quality monitoring program, which includes the inspection of all drainage infrastructure, in accordance with the *Surface Water Monitoring Guidelines (*45-GU-EN-0002). To ensure erosion, water quality and surface water flow regimes are minimally impacted conduct rehabilitation in accordance with the Rehabilitation and Revegetation Management Plan (45-PL-EN-0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans Where appropriate, re-establish natural stream and drainage flows to resemble original drainage patterns, including rehabilitation of major drainage channels

Closure commitment	
Operational Works	Manage chemicals and hydrocarbons in accordance with the *Chemical and Hydrocarbon Management Plan* (45-PL-EN-0011). Develop and implement a surface water quality monitoring program, which includes the inspection of all drainage infrastructure, in accordance with the *Surface Water Monitoring Guidelines (*45-GU-EN-0002). To ensure erosion, water quality and surface water flow regimes are minimally impacted conduct rehabilitation in accordance with the Rehabilitation and Revegetation Management Plan (45-PL-EN-0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans Where appropriate, re-establish natural stream and drainage flows to resemble original drainage patterns, including rehabilitation of major drainage channels.

Weed Management Plan, 100-PL-EN-1017

Closure commitment	
To implement the plan	
Reference	**Management actions**
1.5	Undertake weed mapping every two years to ensure spatial data for presence and distribution of weeds in Fortescue controlled sites is up to date to enable effective weed management practices to be implemented.
1.6	Undertake periodic inspections of weed risk areas to ensure new populations of priority weed species are identified and included in the site specific weed control program.
2.4	Develop and implement a weed control program for priority weed species in identified weed risk areas.
3.1	Develop and implement a weed monitoring program to determine the effectiveness of the weed management strategies and weed control program.
3.3	Where monitoring results indicate: a potential impact on conservation values of conservation significant flora, vegetation and/or fauna habitat Implement corrective actions defined in Table 7 and any reporting requirements defined in Section 7. Update the following to reflect the monitoring outcomes: • the weed mapping dataset and the weed control program • the Plan where required, to inform an adaptive management approach to weed management across the business.

4. RELEVANT LEGISLATION

A list of potentially relevant legislation is provided below, but is not necessarily exhaustive. A comprehensive legal review will be required as closure approaches to ensure that all relevant legislative requirements are identified.

Act / Regulation
Commonwealth Legislation
Aboriginal and Torres Strait Islander Heritage Protection Act 1984
Environment Protection and Biodiversity Conservation Act 1999
Native Title Act 1993
Workplace Relations Act 1996
Western Australian Legislation
Aboriginal Affairs Planning Authority Act 1972
Aboriginal Heritage Act 1972
Biosecurity Act 2015
Contaminated Sites Act 2003
Contaminated Sites Regulations 2006
Conservation and Land Management Act 1984
Criminal Code Compilation Act 1913
Environmental Protection Act 1986
Environmental Protection Regulations 1987
Environmental Protection (Controlled Waste) Regulations 2004
Environmental Protection (Unauthorised Discharges) Regulations 2004
Mining Act 1978
Mining Regulations 1981
Mining Rehabilitation Fund Regulations 2013
Mines Safety and Inspection Act 1994
Mines Safety and Inspection Regulations 1995
Occupiers Liability Act 1985
Parks and Reserves Act 1895
Rights in Water and Irrigation Act 1914
Railway and Port (The Pilbara Infrastructure Pty Ltd) Agreement Act 2004
Wildlife Conservation Act 1950

5. RELEVANT GUIDELINES AND STANDARDS

Closure planning has been prepared so as to be considered with relevant content of these guidelines and standards.

Guideline or Standard	Author
Guidelines for the Preparing Mine Closure Plans (2015)	Western Australian Department of Mines and Petroleum and Environmental Protection Authority
Leading Practice Sustainable Development Program for the Mining Industry - Mine Closure and Completion (2006)	Commonwealth Department of Industry Trade and Resources
Leading Practice Sustainable Development Program for the Mining Industry - Mine Rehabilitation (2006)	Commonwealth Department of Industry Trade and Resources
Mine Rehabilitation in the Australian Minerals Industry (2016)	Minerals Council of Australia
Statement of Environmental Principles, Factors and Objectives (2016)	Western Australian Environmental Protection Authority
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)	Agriculture and Resource Management Council of Australia and New Zealand and the Australian and New Zealand Environment and Conservation Council
Mine Void Water Resource Issues in Western Australia (2003)	Western Australian Water and Rivers Commission
Assessment and Management of Contaminated Sites - Contaminated Sites Guidelines	Western Australian Department of Environmental Regulation
Environmental Notes on Mining: Acid Mine Drainage (2009)	Western Australian Department of Mines and Petroleum
Environmental Notes on Mining: Waste Rock Dumps (2009)	Western Australian Department of Mines and Petroleum
Safety Bund Walls Around Abandoned Open Pit Mines (1997)	Western Australian Department of Industry and Resources
Draft Guidance Materials Characterisation Baseline Data Requirements for Mining Proposals (2016)	Western Australian Department of Mines and Petroleum
Guidelines for Mining Proposals in Western Australia (2016)	Western Australian Department of Mines and Petroleum
Guide to departmental requirements for the management and closure of tailings storage facilities (2015)	Western Australian Department of Mines and Petroleum
Guidance Note – Environmental Risk Assessment for Mining Proposals and Mine Closure Plans (2018)	Western Australian Department of Mines, Industry Regulation and Safety
Global Acid Rock Drainage Guide (2014)	International Network for Acid Prevention
Australian Standard 2601: The Demolition of Structures (2001)	Standards Australia
Australian Standard 4976: The Removal of Underground Petroleum Storage Tanks (2008)	Standards Australia
Demolition Work Code of Practice (2015)	Safe Work Australia
National Strategy for Ecologically Sustainable Development (1992)	Department of Environment
Schedule B1 Guideline Investigation Levels for Soil and Groundwater (2013)	National Environment Protection Council

Guideline or Standard	Author
Minimum Construction Requirements for Water Bores in Australia (Section 18: Decommissioning) (2012)	National Uniform Drillers Licensing Committee

Appendix 2: Stakeholder Engagement Register

Appendix 2. Stakeholder Concerns and Considerations in Closure Planning and Implementation

Date	Consultation Type	Type of Stakeholder	Stakeholder Name	Contact Names/Attendees	Project Phase	Details of Engagement	Outcome
22 June 2004	Verbal discussion	Government Agency	N/A	N/A	Public Environmental review	During stakeholder engagement conducted for the Pilbara Iron Ore and Infrastructure Project: Stage A Port and North-South Railway Public Environmental Review, a Government department asked about Fortescue's rehabilitation process/procedures.	Fortescue provided a response in an appendix to this PER that outlines the way in which the Company would progressively rehabilitate pastoral leases in consultation with pastoral lease holders and within Pastoral Lands Board guidelines and lease restrictions.
3 July 2004	Meeting	Non-Government Organisation	N/A	N/A	Public Environmental review	During stakeholder engagement conducted for the Pilbara Iron Ore and Infrastructure Project: Stage A Port and North-South Railway Public Environmental Review, a Non-Government Organisation raised concern over money being put aside for rehabilitation should something go wrong and research on plant species etc.	Fortescue provided a response in an appendix to this PER that confirms that the Company would put aside money for rehabilitation purposes, would implement a closure plan and would consider the option of providing funding for research as part of this closure plan.
26 October 2006	Letter to Fortescue	Government Agency	Department of Environment and Conservation (Mining and Industrial Assessments Branch)	Ray Cladius	Construction	Acceptance of Railway Corridor: Rehabilitation Management Plan (E-EN-RP-0106-001) prepared under Condition 9 of Ministerial Statement 690.	Plan accepted. No further action required unless changes are made to the plan that affect or modify the targets/objectives. If these occur, the plan is to be submitted for review/acceptance of new version.
23 December 2008	Letter from Fortescue	Government Agency	Department of Environment and Conservation (Environmental Impact Assessment Division)	Ray Cladius	Construction	Approval sought for amendments to the Railway Corridor: Rehabilitation Management Plan prepared under Ministerial Statement 690 (see also correspondence from Fortescue to the DEC dated 6 May 2008).	Plan accepted (see entry for letter to Fortescue dated 9 March 2009).

Date	Consultation Type	Type of Stakeholder	Stakeholder Name	Contact Names/Attendees	Project Phase	Details of Engagement	Outcome
24 December 2008	Letter from Fortescue	Government Agency	Department of Planning and Infrastructure	Brian Lloyd	Construction	Provision of information on pastoralist request to leave infrastructure in place and not rehabilitate an area that was being proposed for use by the pastoralist as a cattle mustering facility/outcamp.	
9 March 2009	Letter to Fortescue	Government Agency	Department of Environment and Conservation (Environmental Impact Assessment Division)	Colin Murray	Construction	Approval of amendments to the Railway Corridor: Rehabilitation Management Plan prepared under Ministerial Statement 690 (see correspondence from Fortescue to the DEC dated 6 May 2008 and 23 December 2008).	Approval of amendments to the Railway Corridor: Rehabilitation Management Plan.
26-28 July 2010	Site Visit	Government Agency	Department of Environment and Conservation (Perth and Karratha)		Operations	Site visit to Cloudbreak and Christmas Creek to see areas that will be affected by the Proposal. Borrow pit design, placement and rehabilitation, especially along the first 120 km of the rail and the need to now remediate the legacy left after construction. (The construction footprint post Rail Camp 2 to the Cloudbreak mine was very good in comparison to areas further north). The Cloudbreak access road and issues principally associated with road design, borrow pit design and placement, and topsoil/vegetation management and the need to strategically address and mitigate these impacts while being cognisant of the footprint of future mine/pit developments.	
18 October 2010	Meeting/briefing	Non-Government Organisation	The Wildflower Society	N/A	Public Environmental review	During stakeholder engagement conducted for the Solomon Project, a Non-Government Organisation asked that Fortescue consider	Rehabilitation and revegetation strategies were discussed in the Solomon Project Public

Date	Consultation Type	Type of Stakeholder	Stakeholder Name	Contact Names/Attendees	Project Phase	Details of Engagement	Outcome
						rehabilitation and revegetation strategies in the early stages of the project development.	Environmental Review.
4 November 2014	Meeting	Government Agency	Department of Minerals and Petroleum	N/A	Public Environmental review	During stakeholder engagement conducted for the Solomon Project – Sustaining Production, Fortescue was asked to provide examples of successful rehabilitation by the Company	Examples of successful rehabilitation were provided in the Public Environmental Review.
23 July 2015	Letter to Fortescue	Government Agency	Office of the Environmental Protection Authority	Kim Taylor	Operations	Fortescue sought approval for a Rehabilitation and Revegetation Management Plan (100-PL-EN-0023) intended to satisfy the requirements of Conditions 9-1 and 13-1 of Ministerial Statement 690 and Condition 8-2 of Ministerial Statement 771, and to replace the previously approved Railway Corridor Rehabilitation Management Plan (R-PL-EN-0008) and Port Area Rehabilitation Management Plan (P-PL-EN-0002). The plan was also intended to satisfy the requirements of Condition 13-2 of Ministerial Statement 707 and replace the Christmas Creek Conceptual Mine Closure Plan (100-RP-EN9058).	The OEPA requested that the plan be revised and resubmitted for approval.

Appendix 3: Vegetation Types with Conservation Significance

Appendix 3: Conservation Significant Vegetation

Conservation Status	Code	Description	Main	Hamersley	East-West	Eliwana
Brockman Iron PEC	AanVfTHt	*Acacia* 'aneura' tall sparse shrubland over **Vachellia farnesiana* mid sparse shrubland over *Chrysopogon fallax*, *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) tall tussock grassland.				x
Brockman Iron PEC	VfAS	**Vachellia farnesiana* isolated mid shrubs over *Astrebla lappacea, Themeda* sp. Hamersley Station (M.E. Trudgen 11431) mid tussock grassland.				x
Themeda grassland TEC	PANdTHs	*Panicum decompositum, Themeda* sp. Hamersley Station (M.E. Trudgen 11431) mid-tall tussock grassland.				x
Themeda grassland TEC	THsERIb	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431), *Eriachne benthamii* tall closed tussock grassland over *Cullen cinereum* low isolated shrubs.				x
Wona Land System PEC (Mulga)	DSA2	Tall Open Shrubland of *Acacia xiphophylla* and *Acacia* aff. aneura (narrow fine veined; site 1259) to 6m over Scattered Tall Trees of *Acacia tetragonophylla* over Scattered Hummock Grasses of *Triodia longiceps* to 1.1m over Scattered Tussock Grasses of *Cymbopogon ambiguus* to 1.3m.		x		
Wona Land System PEC	FGT1 (FGT1/FGT2)	Tussock Grassland to Open Tussock Grassland of *Eriachne obtusa, Astrebla pectinata* and *Aristida latifolia* to 0.5m		x		
Wona Land System PEC	FSA1	Scattered Shrubs of *Acacia bivenosa, Grevillea wickhamii* subsp. *aprica* and *Acacia maitlandii* to 2m over Hummock Grassland of *Triodia* aff. *epactia* and *Triodia* aff. *basedowii* to 1m over Low Open Shrubland of *Acacia stellaticeps* to 0.4m.		x		
Wona Land System PEC	FSA7	Tall Open Scrub to Tall Shrubland of *Acacia xiphophylla*, *Acacia synchronicia* and *Acacia victoriae* to 4m over Tussock Grassland to Scattered Tussock Grassland of *Astrebla pectinata, Aristida latifolia, Aristida contorta, Eragrostis xerophila, Eragrost is benthamii, Eragrostis leptocarpa* and *Cymbopogon ambiguous*.		x		
Wona Land System PEC	FSA8	Tall Open Scrub of *Acacia xiphophylla* to 3.2m over Scattered Shrubs of *Senna artemisioides* subsp.*helmsii* to 15m over Open Tussock Grassland of *Astrebla pectinata, Chrysopogon fallax* and *Eriachne mucronata* (typical form) to 1.1m over Open Hummock Grassland of *Triodia epactia* and *Triodia wiseana* to 0.7m.		x		
Wona Land System PEC	HSA1	Tall Open Shrubland to Scattered Tall Shrubs of *Acacia inaequilatera, Hakea lorea* subsp. *lorea, Acacia ancistrocarpa, Acacia bivenosa, Acacia orthocarpa* and *Grevillea pyramidalis* subsp. *leucadendron* to 4m over mid-dense Hummock to Hummock of *Triodia epactia, Triodia wiseana* and Triodia aff. Shovelanna Hill to 1.3m.		x		
Wona Land System PEC	HSA2	Scattered Tall Shrubs of *Hakea lorea* subsp. *lorea, Acacia xiphophylla* and *Acacia victoriae* to 4m over Scattered Hummock Grassland of *Triodia epactia* to 1.1m over Open Tussock Grassland to Scattered Tussock Grasses of *Aristida holathera* var. *latifolia*, *Chrysopogon fallax*, *Eriachne obtusa* and *Brachyachne convergens* to 1.1m.		x		
Wona Land System PEC	HSA5/HWE5/DW E7	Open Heath of *Acacia bivenosa, Senna artemisioides* subsp. *oligophylla*, *Senna glutinosa* subsp.*glutinosa x luerssenii* and *Acacia inaequilatera* to 1.8m over Closed		x		

Conservation Status	Code	Description	Main	Hamersley	East-West	Eliwana
		Hummock Grassland of *Triodia wiseana* to 0.7m over Low Shrubland of *Heliotropium chrysocarpum*				
Wona Land System PEC	HWE1	Low Open Woodland to Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* to 7m over Scattered Tall Shrubs of *Grevillea wickhamii, Acacia atkinsiana, Grevillea pyramidalis* subsp. *leucadendron, Acacia elachantha* (golden hairy variant) *Hakea lorea* subsp. *lorea* and *Acacia ancistrocarpa* to 3m over Open Shrubland of *Senna glutinosa* and *Acacia tenuissima* to 1.5m over Closed to Mid-dense Hummock Grassland of *Triodia wiseana* and *Triodia* aff.*epactia.*		x		
Wona Land System PEC	HWE11	Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* to 4m over Scattered Shrubs of *Acacia maitlandii, Acacia bivenosa*, *Senna glutinosa* subsp. *glutinosa*, *Senna glutinosa* subsp. *pruinosa* and *Acacia monticola* to 1.4m over Mid-dense Hummock Grassland of *Triodia* aff. *epactia* to 1m		x		
Wona Land System PEC	MDWE4	Open Forest of *Melaleuca argentea*, *Eucalyptus victrix* and *Eucalyptus camaldulensis* var. *obtusa* to 22m over Tall Open Scrub of *Melaleuca glomerata, Melaleuca linophylla, Melaleuca argentea, Acacia coriacea* subsp. *pendens* and *Atalaya hemiglauca* to 12m over Very Open Sedgeland of *Cyperus vaginatus* and *Typha domingensis* to 1.2m		x		
Wona Land System PEC (Riparian)	MDWE5	Open Forest of *Eucalyptus camaldulensis* var. *obtusa* to 15m over Tall Open Shrubland of *Acacia ampliceps* and *Melaleuca linophylla* to 3m over Open Sedgeland of *Cyperus vaginatus* to 1.3m.		x		
PEC - Mulga	MDSA4	Tall Open Shrubland of *Acacia aneura* var. *?aneura, Acacia synchronicia, Acacia tetragonophylla* and *Acacia coriacea* subsp. *pendens* to 6m over occasional *Corymbia hamersleyana* to 5m over Open Hummock Grassland of *Triodia* aff. *epactia* to 1.1m.		x		
PEC - Mulga Sheet Flow	FSM3	Tall Closed Scrub to Tall Open Scrub of *Acacia* aff. *aneura* (narrow fine veined: site 1, 259), *Acacia aneura* var. *conifera, Acacia aptaneura*, *Hakea lorea* subsp*. lorea, Psydrax latifolia* and *Acacia pruinocarpa* to 8m over Open Tussock Grassland of *Aristida latifolia, Aristida contorta, Eragrostis xerophila, Chrysopogon fallax, Enneapogon polyphyllus* and *Paspalidium rarum* to 0.2m		x		
PEC - Riparian	MDWE3/DWE4	Scattered Trees of *Eucalyptus victrix* to 15m over Tall Open Shrubland of *Acacia monticola, Acacia pyrifolia* var. *pyrifolia, Acacia maitlandii, Acacia citrinoviridis* and *Grevillea wickhamii* over Hummock to Open Hummock Grassland of *Triodia epactia* to 1.4m over Very Open to Scattered Tussock Grassland of *Cenchrus setiger* and *Themeda triandra* to 1m.		x		
Mulga	3	Low Woodland to Low Open Forest of *Acacia aneura* var. *aneura*, *Acacia pruinocarpa, Acacia tetragonophylla, Acacia tenuissima, Grevillea wickhamii* subsp. *aprica, Psydrax latifolia* over *Dodonaea petiolaris* and species of *Triodia* and *Aristida.*			x	

Conservation Status	Code	Description	Main	Hamersley	East-West	Eliwana
Mulga	4	Low Open Woodland of *Acacia aneura* var. *aneura, Acacia pruinocarpa, Acacia xiphophylla, Acacia victoriae* over *Acacia tetragonophylla, Psydrax latifolia* and *Psydrax suaveolens* over *Ptilotus obovatus* var. *obovatus* and mixed Chenopod species.			x	
Mulga	10	Low Open Woodland of *Acacia xiphophylla, Acacia victoriae, Acacia aneura* var. *aneura* over *Acacia tetragonophylla, Ptilotus obovatus* var. *obovatus, Senna* species and mixed Chenopod species of *Maireana* and *Sclerolaena.*			x	
Mulga	Aa1	*Acacia aptaneura* tall open shrubland *Acacia aptaneura* and *A. pruinocarpa* tall open shrubland over *Enneapogon polyphyllus, Paspalidium clementii* and *Chrysopogon fallax* sparse tussock grassland.		x		
Mulga	Aa2	*Acacia aptaneura* tall open shrubland *Acacia aptaneura* tall open shrubland over *Sida* sp. verrucose glands (F.H. Mollemans 2423) and *Abutilon otocarpum* isolated shrubs and *Enneapogon polyphyllus, Paspalidium clementii* and *Aristida contorta* sparse tussock grassland.		x		
Mulga	Aa3	*Acacia aptaneura* tall open shrubland *Acacia aptaneura* tall open shrubland over *Abutilon otocarpum, Senna artemisioides* subsp. *helmsii* and *Sida fibulifera* sparse shrubland over *Enneapogon polyphyllus, Sporobolus australasicus* and *Eragrostis xerophila* open tussock grassland.		x		
Mulga	AaAbTe	*Acacia aneura* and *Acacia pruinocarpa* tall sparse shrubland over *Acacia bivenosa* and *Acacia atkinsiana* mid sparse shrubland over *Triodia epactia* hummock grassland.		x		
Mulga	AaApAl	*Corymbia hamersleyana, Acacia* aff. *aneura* (narrow fine veined) and *Acacia pruinocarpa* low open forest, over *Acacia pteraneura* and *Dodonaea petiolaris* mid sparse shrubland and *Maireana villosa* low sparse shrubland, over *Aristida latifolia*.		x		
Mulga	AaAtAc	*Acacia aptaneura, Acacia pteraneura* and *Acacia pruinocarpa* low woodland, over *Acacia tetragonophylla, Senna artemisioides* subsp. *oligophylla* and *Vachellia farnesiana* mid sparse shrubland, over *Aristida contorta* and *Enneapogon polyphyllus* open tussock grassland.		x		
Mulga	AaAtAl	*Acacia* aff. *aneura* (narrow fine veined), *Acacia pteraneura* and *Acacia aptaneura* tall open shrubland, over *Acacia tetragonophylla* and *Acacia victoriae* sparse shrubland, over *Aristida latifolia, Cenchrus ciliaris* and *Cenchrus setiger.*		x		
Mulga	AaAvCc	*Acacia aneura, Acacia pruinocarpa* and *Hakea lorea* subsp. *lorea* tall sparse shrubland over *Acacia victoriae* and *Senna artemisioides* subsp. *oligophylla* mid sparse shrubland over *Cenchrus ciliaris* tussock grassland.		x		
Mulga	AaElfTe	*Acacia aneura* and *Acacia pruinocarpa* tall open shrubland over *Eremophila latrobei* subsp. *filiformis* and *Dodonaea petiolaris* mid sparse shrubland over *Triodia epactia* hummock grassland.		x		
Mulga	AaImTe	*Acacia aneura* and *Acacia pruinocarpa* tall shrubland, over *Acacia ancistrocarpa* and *Eremophila longifolia* mid sparse shrubland, over *Indigofera monophylla* and *Sida* sp.		x		

Conservation Status	Code	Description	Main	Hamersley	East-West	Eliwana
		verrucose glands (F.H. Mollemans 2423) low sparse shrubland, over *Cenchrus ciliaris.*				
Mulga	AaLWApAvTOS	*Acacia aneura* Low Woodland over A. *pruinocarpa, A. victoriae* Tall Open Shrubland.		x		
Mulga	AaLWTeHG	*Acacia aneura* Low Woodland over *Triodia epactia* Hummock Grassland		x		
Mulga	AaneS2	*Acacia aneura* var. *conifera* Tall Open Scrub with scattered *Acacia ayersiana, Acacia maitlandii, Acacia pruinocarpa* and *Grevillea wickhamii* over *Acacia pyrifolia, Eremophila forrestii* subsp. *forrestii,* and *Senna glutinosa* subsp. *luerssenii*.			x	
Mulga	AaneS4	*Acacia aneura* var*. intermedia* Tall Shrubland over *Ptilotus exaltatus* var. *exaltatus, Senna glutinosa* subsp*. luerssenii* and *Senna stricta* Shrubland over an Open Tussock Grassland of *Triodia* sp. Shovelanna Hill and *Enneapogon polyphyllus*.			x	
Mulga	AaPsCf	*Acacia aptaneura* open shrubland, over low *Abutilon otocarpum* sparse shrubland, over *Pterocaulon sphacelatum* and *Ptilotus obovatus* open forbeland, over open *Chrysopogon fallax* tussock grassland.		x		
Mulga	AaSfAl	*Acacia aptaneura* open shrubland, over low *Sida fibulifera* sparse shrubland, over *Aristida latifolia* and *Chrysopogon fallax* tussock grassland.		x		
Mulga	AaTb	Minor creeklines and floodplains			x	
Mulga	AaTe	*Acacia aptaneura* tall open shrubland *Acacia aptaneura, A. pruinocarpa and A. tenuissima* tall open shrubland over *Triodia epactia* open hummock grassland.		x		
Mulga	AaTt	*Themeda triandra* open tussock grassland *Acacia aptaneura, A. tetragonophylla* and/or *A. pyrifolia* over *Themeda triandra*, *Chrysopogon fallax* and/or *Cenchrus ciliaris* open tussock grassland.		x		
Mulga	AaVfTH2	*Acacia aneura* shrubland, over mid *Vachellia farnesiana* sparse shrubland, over *Chrysopogon fallax* and *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) tussock grassland.		x		
Mulga	AayS1	*Acacia ayersiana, Acacia pruinocarpa* and *Acacia aneura* Tall Open Scrub over a Mid Dense Hummock Grassland of *Triodia epactia* and *Aristida contorta.*			x	
Mulga	ApAaAiTOS	*Acacia pruinocarpa, A. aneura* and *A. inaequilatera* Tall Open Shrubland.		x		
Mulga	ApDpTe	*Acacia* aff. *aneura* (narrow fine veined; site 1259) and *Acacia pteraneura* and *Acacia pruinocarpa* low woodland, over *Dodonaea petiolaris, Grevillea berryana* and *Eremophila forrestii* subsp*. forrestii* mid sparse shrubland, over *Enneapogon polyphyllus*.		x		
Mulga	Ch17 (Ch17/Ch20)	*Acacia aneura*, *A. adsurgens, G. wickhamii, Senna glutinosa* subsp. *glutinosa, S. glutinosa* subsp. x *luerssenii* scattered shrubs over *Triodia* aff. *basedowii* mid-dense hummock grassland.			x	
Mulga	ChAcTe	*Corymbia hamersleyana* low isolated trees, over *Acacia aneura, Acacia coriacea* subsp. *pendens* and *Acacia synchronicia* tall sparse shrubland, over *Triodia epactia* sparse hummock grassland.		x		

Conservation Status	Code	Description	Main	Hamersley	East-West	Eliwana
Mulga	ChAoCf	*Corymbia hamersleyana* low woodland over Tall *Acacia aptaneura* open shrubland, over low *Abutilon otocarpum* sparse shrubland, over *Pterocaulon sphacelatum* and *Ptilotus obovatus* open forbeland, over open *Chrysopogon fallax* tussock grassland.		x		
Mulga	Fa11/Fa1a	*Acacia aneura* low closed forest over *Eremophila lanceolata* low open shrubland over *Aristida contorta, Enneapogon polyphyllus* open annual grassland and *Goodenia prostrata* very open herbland/*Acacia aneura* scattered tall shrubs to low open woodland.			x	
Mulga	Fa12/Fa1a	Fa12/*Acacia aneura* scattered tall shrubs to low open woodland over *Aristida contorta*, *Enneapogon polyphyllus, Eragrostis pergracilis, Eriachne pulchella* and/or *Fimbristylis dichotoma* closed annual grassland / sedgeland.			x	
Mulga	Fa14	*Acacia aneura* low open forest to low woodland over **Cenchrus ciliaris* tussock grassland.			x	
Mulga	Fa1a	*Acacia aneura* scattered tall shrubs to low open woodland over *Aristida contorta*, *Enneapogon polyphyllus, Eragrostis pergracilis, Eriachne pulchella* and/or *Fimbristylis dichotoma* closed annual grassland / sedgeland.			x	
Mulga	Fc12	*Acacia pruinocarpa, A. tetragonophylla, A. aneura, Atalaya hemiglauca* tall shrubland over *Triodia longiceps* hummock grassland.			x	
Mulga	FSA5 (FSA5/FWE3/FWE1)	Tall Open Shrubland of *Acacia pruinocarpa, Acacia pyrifolia* var. *pyrifolia, Hakea lorea* subsp. *lorea, Acacia ancistrocarpa, Acacia synchronicia, Acacia aneura* var. *pilbarana, Acacia sclerosperma* subsp.*sclerosperma, Acacia aneura* and *Acacia xiphophylla* to 7m over Shrubland to Open Shrubland of *Eremophila longifolia, Dodonaea petiolaris, Grevillea berryana, Eremophila forrestii* subsp. *forrestii* and *Acacia bivenosa* to 1.8m Hummock Grassland of *Triodia epactia*.		x		
Mulga	FSA5/FWE3/FWE1	Tall Open Shrubland of *Acacia pruinocarpa, Acacia pyrifolia* var. *pyrifolia, Hakea lorea* subsp. *lorea, Acacia ancistrocarpa, Acacia synchronicia, Acacia aneura* var. *pilbarana, Acacia sclerosperma* subsp.*sclerosperma, Acacia aneura* and *Acacia xiphophylla* to 7m over Shrubland to Open Shrubland of *Eremophila longifolia, Dodonaea petiolaris, Grevillea berryana, Eremophila forrestii* subsp. *forrestii* and *Acacia bivenosa* to 1.8m Hummock Grassland of *Triodia epactia.*		x		
Mulga	FWE18	Low Open Woodland to Scattered Trees of *Corymbia candida* and *Eucalyptus xerothermica* to 10m over Tall Shrubland of *Acacia* aff. *aneura* (flat curved), *Acacia* aff. *aneura* (narrow fine veined) and *Acacia pruinocarpa* to 6m over Tussock to Open Tussock Grassland of *Themeda triandra*, *Chrysopogon fallax* and *Eulalia aurea* to 0.8m over Scattered Hummock Grassland of *Triodia* aff. *epactia*.		x		
Mulga	IAa1	Woodland of *Acacia aneura* var. *pilbarana* to 11m over Tall Open Shrubland of *Acacia aneura* var. *conifera* and *Acacia pruinocarpa* to 7m over Open Hummock Grassland of *Triodia epactia* to 1.1m over Open Tussock Grassland of *Aristida contorta* and *Enneapogon polyphyllus* to 0.2m.		x		
Mulga	IAa3	Tall Shrubland of *Acacia aneura* var. *pilbarana* and *Acacia* tetragonophylla to 10m over Shrubland of *Acacia synchronicia* to 2m over Closed Tussock Grassland of		x		

Conservation Status	Code	Description	Main	Hamersley	East-West	Eliwana
		Poaceae sp., *Chrysopogon fallax*, *Eragrostis xerophila*, *Eriachne benthamii* and *Eulalia aurea* to 1m				
Mulga	IAa4	Tall Open Scrub of *Acacia* aff. *aneura* (narrow fine leaved: site 1, 259) to 6m over Very Open Tussock Grassland of *Aristida latifolia*, *Aristida contorta*, *Enneapogon polyphyllus*, *Eragrostis xerophila* and *Chrysopogon fallax* to 1m over Open Herbland of *Bidens bipinnata* and *Malvastrum americanum* to 0.4m.		x		
Mulga	IAa5	Low Open Woodland of *Acacia aneura* var. *pilbarana* and *Acacia* aff. *aneura* (narrow fine veined) to 8m over Shrubland of *Dodonaea petiolaris*, *Grevillea berryana*, *Anthobolus leptomerioides* and *Eremophila forrestii* subsp. *forrestii* to 2m over Hummock Grassland of *Triodia epactia* to 1m over Very Open Tussock Grassland of *Enneapogon polyphyllus* & *Aristida contorta* to 0.8mm over Low Open Shrubland of *Maireana villosa* & *Gomphrena affinis* subsp. *pilbarensis* to 0.3m over Very Open Herbland to 0.1m		x		
Mulga	IAa7	Tall Shrubland of *Acacia aneura* var. *pilbarana* to 7m over Tall Open Shrubland to Scattered Tall Shrubs of *Acacia synchronicia* and *Acacia tetragonophylla* to 5m over Very Open Tussock of *Aristida contorta*, *Aristida latifolia*, *Chrysopogon fallax* and *Cenchrus ciliaris* to 1.3m over Open Hummock Grassland of *Triodia epactia* (Form 4) to 1m over Low Open Shrubland of *Sclerolaena* sp., *Solanum lasiophyllum* and *Sida* sp. verrucose glands (F.H. Mollemans 2423) to 0.5m.		x		
Mulga	IAa8	Tall Shrubland of *Acacia tetragonophylla*, *Acacia aneura* var. *pilbarana* and *Acacia xiphophylla* to 8m over Tussock Grassland of *Eragrostis xerophila*, *Cenchrus ciliaris*, *Chrysopogon fallax*, *Eulalia aurea*, *Aristida latifolia* and *Aristida contorta* to 1m .		x		
Mulga	IAa9	Tall Open Scrub of *Acacia aneura* var. *conifera* to 7m over Scattered Tussock Grasses of *Cenchrus ciliaris* to 0.65m .		x		
Mulga	IE10	Low Open Woodland of *Corymbia candida* to 6m over Tall Shrubland of *Acacia* aff. *aneura* (flat curved)and *Acacia pruinocarpa* to 6m over Scattered Shrubs of *Codonocarpus cotinifolius* to 2.1m over Tussock Grassland of *Themeda triandra Chrysopogon fallax* and *Eulalia aurea* to 0.8m over Low Open Shrubland of *Acacia bivenosa* & *Ptilotus obovatus* to 0.4m over Herbland of *Evolvulus alsinoides* var. *villosicalyx*, *Bidens bipinnata*, *Ptilotus exaltatus* var. *exaltatus*, *Pterocaulon sphaeranthoides.*		x		
Mulga	IE12	Scattered Low Trees of *Corymbia deserticola* subsp. *deserticola* to 4m over Tall Open Scrub of *Acacia* aff. *aneura* (narrow fine veined) to 7m over Open Shrubland of *Eremophila latrobei* subsp. aff. *filiformis* and *Grevillea berryana* to 2m over Mid-dense Hummock Grassland of *Triodia epactia* to 1.1m.		x		
Mulga	IE14	Low Open Forest of *Corymbia hamersleyana*, *Acacia* aff. *aneura* (narrow fine veined) and *Acacia pruinocarpa* to 8m over Tussock Grassland of *Aristida latifolia* and *Paspalidium clementii* to 1.3m over Low Open Shrubland of *Maireana villosa* and *Ptilotus obovatus* to 0.5m.		x		

Conservation Status	Code	Description	Main	Hamersley	East-West	Eliwana
Mulga	IE9	Scattered Trees of *Corymbia candida* to 12m over Low Open Trees of *Eucalyptus xerothermica* and *Acacia* aff. *aneura* (narrow fine veined) to 5m over Very Open Tussock Grassland of *Themeda triandra* to 1m over Low Open Shrubland of *Ptilotus obovatus* and *Salsola tragus* subsp. tragus to 0.8m over Scattered Hummock Grassland of *Triodia* aff. *epactia* to 0.8m.		x		
Mulga	ssFa13	*Acacia aneura* low open forest over *Chrysopogon fallax*, *Digitaria brownii* open tussock grassland.			x	
Mulga - CB-RP-EN-0024	Fa1	*Acacia a*neura open scrub to low open forest over *Dodonaea petiolaris*, *Eremophila forrestii* subsp. *forrestii*, *Cassia helmsii*, *Sida* sp. unisexual open heath with very open annual grassland.			x	
Mulga - CB-RP-EN-0024	Fa1/Fa1a	*Acacia aneura* open scrub to low open forest over *Dodonaea petiolaris*, *Eremophila forrestii* subsp. *forrestii*, *Cassia helmsii*, *Sida* sp. unisexual open heath with very open annual grassland.			x	
Mulga - Community Sensitive to Groundwater Changes	1	Open Woodland of *Eucalyptus victrix*, *Eucalyptus camaldulensis* var. *obtusa* with pockets of *Acacia coriacea* subsp. *pendens* over *Grevillea wickhamii* subsp. *aprica*, *Petalostylis labicheoides*, *Acacia tumida* over *Triodia longiceps*, and *Chrysopogon fallax*.			x	
Mulga - Community Sensitive to Groundwater Changes	2	Low Woodland to Low Open Forest of *Acacia aneura* var. *aneura*, *Acacia citrinovirirdis*, *Acacia pruinocarpa* over *Acacia tetragonophylla* and *Psydrax latifolia* over *Chrysopogon fallax*, *Stemodia viscosa*, *Blumea tenella*, *Themeda triandra* and species of *Triodia.*			x	
Mulga - Sheet Flow Dependent (Inferred from Composition)	AaSvCc	*Acacia aneura* tall open shrubland over *Sida* sp. verrucose glands (F.H. Mollemans 2423) and *Sclerolaena cornishiana* mid sparse shrubland over *Abutilon otocarpum*, *Malvastrum americanum* and *Boerhavia coccinea* sparse herbland and *Cenchrus ciliaris* tussock grassland.		x		
Mulga - Sheet Flow Dependent (Inferred from Composition)	VT10.1	Low Open Woodland of *Acacia xiphophylla*, *Acacia victoriae*, *Acacia aneura* var. *aneura* over *Acacia tetragonophylla*, *Ptilotus obovatus* and mixed *Senna*, *Maireana* and *Sclerolaena* species.			x	
Mulga - Sheet Flow Dependent (Inferred from Composition)	VT2	Low Woodland to Low Open Forest of *Acacia aneura* var. *aneura*, *A. citrinoviridis*, *A. pruinocarpa* over *A. tetragonophylla* and *Psydrax latifolia* over *Chrysopogon fallax*, *Stemodia viscosa*, *Blumea tenella*, *Themeda triandra,* and *Triodia* and *Aristida* species.			x	
Mulga - Sheet Flow Dependent (Inferred from Composition)	VT3	Low Woodland to Low Open Forest of *Acacia aneura* var. *aneura*, *A. pruinocarpa, A. tetragonophylla, A. tenuissima, Grevillea wickhamii* subsp. *aprica*, *Psydrax latifolia* over *Dodonaea petiolaris* and *Triodia* and *Aristida* species.			x	

Conservation Status	Code	Description	Main	Hamersley	East-West	Eliwana
Mulga - Sheet Flow Dependent (Inferred from Composition)	VT4	Low Open Woodland of *Acacia aneura* var. *aneura*, *Acacia pruinocarpa*, *Acacia xiphophylla*, *Acacia victoriae* over *A. tetragonophylla, Psydrax latifolia* and *Psydrax suaveolens* over *Ptilotus obovatus* and mixed *Maireana* and *Sclerolaena* species.			x	
Likely to support sheet flow	AanAalmCc	*Acacia 'aneura'*, *A. pruinocarpa* tall shrubland over *A. ancistrocarpa*, *Eremophila longifolia* mid sparse shrubland over *Indigofera monophylla*, *Sida* sp. verrucose glands (F.H. Mollemans 2423) low sparse shrubland over **Cenchrus ciliaris* tussock grassland.				x
Likely to support sheet flow	AanChf	*Acacia 'aneura'* low open woodland over *Chrysopogon fallax* mid sparse tussock grassland.				x
Mulga sheet flow	FSM4	Tall open shrubland to tall shrubland of *Acacia* aff. *aneura* (narrow fine veined) with occasional *Eucalyptus victrix* and *Corymbia deserticola* subsp. *deserticola* to 6m over scattered tall shrubs of *Acacia arida* to 3m over tussock grassland of *Cenchrus ciliaris* to 0.6m.		x		
Mulga sheet flow	FSM5	Tall open scrub to tall shrubland of *Acacia aneura* var. *longicarpa* to 8m over open shrubland of *Acacia victoriae* to 1.8m over open tussock grassland of *Eriachne benthamii*, *Paraneurachne muelleri*, *Chloris pectinata*, *Aristida latifolia* and *Eragrostis xerophila* to 1m.		x		
Mulga sheet flow	FSM6	Tall shrubland of *Acacia aneura* var. *intermedia*, *Grevillea berryana* and *Acacia rhodophloia* to 4.8m over scattered shrubs of *Acacia atkinsiana* to 1.8m over mid-dense Hummock grassland of *Triodia epactia* to 1m.		x		
Mulga sheet flow	FSM7	Tall Shrubland of *Acacia aneura* var. *pilbarana*, *Acacia* aff. *aneura* (narrow fine veined), *Acacia aneura* (grey bushy form) and *Acacia pruinocarpa* to 5m over Open Shrubland of *Acacia bivenosa*, *Senna artemisioides* subsp. *helmsii*, *Acacia ancistrocarpa* and *Senna glutinosa* subsp. *glutinosa* to 1.8m over Mid-dense Hummock Grassland of *Triodia epactia* to 1.2m .		x		
Mulga sheet flow	FWM1	Open forest to woodland of *Acacia aneura* var. *pilbarana* to 11m over tall open shrubland of *Acacia aneura* var. *conifera* and *Acacia pruinocarpa* to 7m over open hummock grassland of *Triodia epactia* to 1.1m over open tussock grassland of *Aristida contorta*, *Enneapogon polyphyllus*, *Urochloa occidentalis* var. *ciliata*, *Chrysopogon fallax* and *Eulalia aurea* to 0.2m.		x		
Mulga -Sheet Flow Dependent (Inferred from Composition)	AaElCf	*Acacia aneura* tall shrubland over *Eremophila lanceolata*, *Sida* sp. verrucose glands (F.H. Mollemans 2423) and *Solanum lasiophyllum* mid sparse shrubland over *Chrysopogon fallax* and *Aristida contorta* Sparse Tussock grassland.		x		
Mulga/Riparian	EvAaW	*Eucalyptus victrix*, *Acacia aneura* Woodland.		x		
Mulga/Riparian	Fc4	*Eucalyptus victrix* open woodland over *Acacia coriacea* subsp. *pendens*, *A. aneura, Atalaya hemiglauca* low woodland over **Cenchrus ciliaris* Tussock Grassland.			x	

Conservation Status	Code	Description	Main	Hamersley	East-West	Eliwana
Mulga/Riparian	Fc4/Cc18	*Eucalyptus victrix* open woodland over *Acacia coriacea* subsp. *pendens*, *A. aneura, Atalaya hemiglauca l*ow woodland over **Cenchrus ciliaris* Tussock Grassland.			x	
Mulga/Riparian - Potential Groundwater Dependent Ecosystem	EvAcCc	*Eucalyptus victrix* low closed woodland *Acacia aneura* and *Acacia citrinoviridis* tall sparse shrubland over *Acacia victoriae* mid sparse shrubland over *Cenchrus ciliaris* t Tussock Grassland.		x		
Riparian	Ac1	*Eucalyptus victrix*, *Melaleuca argentea* low woodland to low open woodland.	x			
Riparian	Ac15	*Eucalyptus victrix* low open woodland to woodland over *Acacia colei* scattered tall shrubs to high open shrubland over *Triodia epactia* scattered hummock grasses and *Eriachne* spp. tussock grasses.	x			
Riparian	Ac2	*Eucalyptus camaldulensis* scattered low trees over *Melaleuca argentea* low open forest over *Melaleuca linophylla*, *Acacia ampliceps* high shrubland.	x			
Riparian	Ac4	*Eucalyptus victrix* scattered low trees to low open woodland over *Melaleuca glomerata* high shrubland to open scrub over *Triodia epactia*, tussock grasses and patches of sedges.	x	x	x	
Riparian	Ac8	*Eucalyptus victrix* scattered low trees over *Acacia trachycarpa* open scrub over *Triodia epactia* mid-dense hummock grassland or **Cenchrus ciliaris* open to closed Tussock Grassland.	x		x	
Riparian	AheW1	*Atalaya hemiglauca, Erythrina vespertilio* and *Eucalyptus victrix* Low Open Woodland over *Acacia trachycarpa* Tall Shrubland over a Tussock Grassland dominated by *Cenchrus ciliaris*, *Eragrostis cumingii*, *Themeda triandra* and *Chrysopogon fallax*.	x	x		
Riparian	DWE5	Low Woodland of *Eucalyptus camaldulensis* var. *obtusa* to 6m over Shrubland of *Acacia pyrifolia* var. *pyrifolia* to 2m over Hummock Grassland of *Triodia* aff. *epactia* to 1m over Very Open Sedgeland of *Cyperus vaginatus* to 1m		x		
Riparian	EcaW1	*Eucalyptus camaldulensis* var. *obtusa* and *Acacia orthocarpa* Low Woodland over *Acacia trachycarpa* Tall Open Shrubland over an Open Tussock Grassland dominated by *Eulalia aurea*, *Cenchrus ciliaris* and *Triodia longiceps*.	x			
Riparian	EcaW2	*Eucalyptus camaldulensis* and *Eucalyptus camaldulensis* var. *obtusa* Low Open Woodland over *Acacia trachycarpa* Open Shrubland over an Open Tussock Grassland of *Cenchrus ciliaris*.	x			
Riparian	EcaW4	*Eucalyptus camaldulensis* var. *obtusa* Open Woodland over a Tall Open Shrubland of *Acacia trachycarpa* over a Tussock Grassland dominated by *Cenchrus ciliaris* and *Chrysopogon fallax*.	x			
Riparian	EcOW	Open Woodland to 11m dominated by *Eucalyptus camaldulensis* var. *obtusa* with emergent *Melaleuca leucadrenda* over a Tall Shrubland to 3m dominated by *Melaleuca linophylla* and *Acacia adsurgens*.			x	
Riparian	Ev	*Eucalyptus victrix* Open Woodland Formation, *Eucalyptus victrix*, *Triodia epactia*, *Indigofera monophylla*, *Eriachne benthami* , Triodia Hummock Grassland.	x			

Conservation Status	Code	Description	Main	Hamersley	East-West	Eliwana
Riparian	EvAcpCv	*Eucalyptus victrix*, *Eucalyptus camaldulensis* subsp. *obtusa* and *Melaleuca glomerata* mid woodland, over *Acacia coriacea* subsp. *pendens* and *Acacia trachycarpa* tall sparse shrubland, over *Cyperus vaginatus* open sedgeland.		x		
Riparian	EvAppTt	*Eucalyptus victrix* mid woodland, over *Acacia pyrifolia* var. *pyrifolia*, *Acacia maitlandii* and *Acacia tumida* var. *pilbarensis* mid sparse shrubland, over *Triodia epactia* sparse hummock grassland and *Themeda triandra* sparse tussock grassland.		x		
Riparian	EviW1	*Eucalyptus victrix* and *Acacia coriacea* subsp. ? *pendens* Low Open Woodland to Woodland over *Acacia trachycarpa* Open Shrubland over a Tussock Grassland dominated by *Eulalia aurea*, *Chrysopogon fallax*, *Eulalia aurea* and *Triodia longiceps*.	x			
Riparian	EviW3	*Eucalyptus victrix* Low Open Woodland over *Acacia eriopoda* dominated Tall to Tall Open Shrubland over a Hummock Grassland dominated by *Triodia epactia* and *Triodia lanigera*.	x		x	
Riparian	EviW4	*Eucalyptus victrix* Scattered Low Trees over *Acacia trachycarpa* open scrub over Mid Dense Hummock Grassland of *Triodia epactia* or Open to Closed Tussock grassland of *Cenchrus ciliaris*.	x			
Riparian	EvLW	*Eucalyptus victrix* Low Woodland.		x		
Riparian	EvLW/CcEePoaTG	*Eucalyptus victrix* Low Woodland/**Cenchrus ciliaris*, *Eragrostis eriopoda,* Poaceae spp. Tussock Grassland mosaic.		x		
Riparian	EvLWAcTOS	*Eucalyptus victrix* Low Woodland over Acacia coriacea Tall Open Shrubland		x		
Riparian	ExAaCv	*Eucalyptus xerothermica* low isolated trees, over *Acacia ampliceps*, *Acacia coriacea* subsp. *pendens* and *Melaleuca glomerata* tall sparse shrubland, over *Cyperus vaginatus* sparse sedgeland and *Triodia longiceps* sparse hummock grassland.	x	x		
Riparian	ExAcpTe	*Eucalyptus victrix* and *Eucalyptus xerothermica* low open woodland, over *Acacia coriacea* subsp. *pendens*, *Acacia ampliceps* and *Acacia trachycarpa* tall open shrubland, over *Cyperus vaginatus* sparse sedgeland and *Triodia epactia* sparse hummock grassland.	x	x		
Riparian	Fc6	*Eucalyptus victrix* low open woodland over *Grevillea wickhamii*, *Acacia pyrifolia* tall open scrub over **Cenchrus ciliaris* tussock grassland and Triodia *longiceps*, *T. epactia* scattered hummock grasses.			x	
Riparian	IE17	Low Woodland of *Eucalyptus victrix* to 8m over Tall Open Shrubland of *Acacia tetragonophylla* and *Acacia citrinoviridis* to 5m over Very Open Herbland of *Cleome viscosa* to 0.4m.		x		
Riparian	IE18	Woodland of *Eucalyptus victrix* to 11m over Tall Shrubland of *Acacia monticola*, *Acacia pyrifolia* var. *pyrifolia*, *Acacia maitlandii* and *Grevillea wickhamii* subsp. *aprica* to 1.2m over *Triodia epactia* (Form 4) Hummock Grassland to 1.2m over Scattered Low Shrubs of *Indigofera monophylla* and *Tephrosia rosea* var. *clementii* to 0.4m over Very Open Tussock Grassland of *Eriachne mucronata* (typical form) to 0.3m.		x		

Conservation Status	Code	Description	Main	Hamersley	East-West	Eliwana
Riparian	IE19	Open Forest of *Eucalyptus victrix* and Acacia *citrinoviridis* to 18m over Scattered Low Trees of *Atalaya hemiglauca* to 9m over Very Open Herbland of *Cleome viscosa* and *Malvastrum americanum* to 0.8m over over Very Open Tussock Grassland of *Cenchrus ciliaris Bothriochloa ewartiana*, *Urochloa piligera* and *Chrysopogon fallax* to 0.8m		x		
Riparian	M1	Open Woodland of *Eucalyptus victrix*, *Eucalyptus camaldulensis* var. *obtusa* with pockets of *Acacia coriacea* subsp. *pendens* over *Grevillea wickhamii* subsp. *aprica*, *Petalostylis labicheoides*, *Acacia tumida* over *Triodia longiceps* and *Chrysopogon fallax*.			x	
Riparian	MDSA2	Tall Shrubland of *Acacia ampliceps* and *Melaleuca glomerata* to 3.7m over Scattered Hummock Grasses of *Triodia longiceps* to 1.4m over Scattered Sedges of *Cyperus vaginatus* to 1.25m.	x	x		
Riparian	MDWE3	Scattered Trees of *Eucalyptus victrix* to 15m over Tall Open Shrubland of *Acacia monticola*, *Acacia pyrifolia* var. *pyrifolia*, *Acacia maitlandii*, *Acacia citrinoviridis* and *Grevillea wickhamii* over Hummock to Open Hummock Grassland of *Triodia epactia* to 1.4m over Very Open to Scattered Tussock Grassland of *Cenchrus setiger* and *Themeda triandra* to 1m.		x		
Riparian	MDWE4	Open Forest of *Melaleuca argentea*, *Eucalyptus victrix* and *Eucalyptus camaldulensis* var. *obtusa* to 22m over Tall Open Scrub of *Melaleuca glomerata*, *Melaleuca linophylla*, *Melaleuca argentea*, *Acacia coriacea* subsp. *pendens* and *Atalaya hemiglauca* to 12m over Very Open Sedgeland of *Cyperus vaginatus* and *Typha domingensis* to 1.2m.		x		
Riparian	MDWE6	Open Forest to Woodland of *Eucalyptus victrix* and *Eucalyptus xerothermica* over Tall Open Shrubland of *Acacia tumida* var. *pilbarensis*, Acacia *coriacea* subsp. *pendens*, *Grevillea pyramidalis* subsp.*leucadendron* and *Dodonaea lanceolata* var. *lanceolata* ove r Very Open *Tussock Grassland* of *Themeda triandra*, *Eriachne tenuiculmis*, *Eulalia aurea* and *Eriachne tenuiculmis* to 1.2m over Hummock to Open Hummock Grassland of *Triodia* aff. *epactia* and *Triodia longiceps.*	x	x		
Riparian	MDWE7	Woodland of *Eucalyptus camaldulensis* var. *obtusa* and *Eucalyptus victrix* to 20m over Tall Open Scrub of *Melaleuca glomerata*, *Atalaya hemiglauca*, *Petalostylis labicheoides*, *Acacia coriacea* subsp.*pendens* and *Flueggea virosa* subsp. *melanthesoides* to 9m o ver Open Shrubland of *Acacia pyrifolia* var. *pyrifolia* to 2m over Open Hummock Grassland of *Triodia* aff. *epactia* to 1m over Scattered Sedges of *Cyperus vaginatus* and *Cyperus blakeanus* to 1m.		x		
Riparian - Groundwater Dependent Ecosystem (GDE)	EcApCa	*Eucalyptus camaldulensis* and *Melaleuca argentea* low woodland over *Acacia pyrifolia* tall sparse shrubland over *Tephrosia rosea* and *Corchorus crozophorifolius* mid sparse shrubland over *Cymbopogon ambiguus* open Tussock Grassland.		x		

Conservation Status	Code	Description	Main	Hamersley	East-West	Eliwana
Riparian - Groundwater Dependent Ecosystem (GDE)	GDE1	*Eucalyptus camaldulensis* isolated low trees to spares low woodland, over *Melaleuca argentea* open low woodland (+/- *Melaleuca glomerata*), over sparse **Cenchrus ciliaris* tussock grassland and *Triodia epactia* hummock grassland.	x			
Riparian - Groundwater Dependent Ecosystem (GDE)	GDE3	*Melaleuca argentea* open low woodland, over *Acacia trachycarpa* open tall shrubland, over *Triodia epactia* hummock grassland.	x			
Riparian - Potential Groundwater Dependent Ecosystem	Ac14	*Eucalyptus victrix*, *Corymbia* spp. scattered trees to low open woodland over *Acacia colei* open scrub over *Triodia epactia* dense hummock grassland.	x			
Riparian - Potential Groundwater Dependent Ecosystem	AtEb	*Acacia tetragonophylla* sparse shrubland *Eucalyptus victrix* over *Acacia tetragonophylla* and *A. synchronicia* sparse shrubland over *Eriachne benthamii*, *Eragrostis falcata* and *Sporobolus australasicus* sparse tussock grassland.		x		
Riparian - Potential Groundwater Dependent Ecosystem	EvAcEa	*Eucalyptus victrix* mid open woodland, over *Acacia citrinoviridis* tall sparse shrubland, over *Atalaya hemiglauca* and *Acacia tetragonophylla* mid sparse shrubland, over *Eriachne benthamii* and *Eulalia aurea* open tussock grassland.		x		
Riparian - Potential Groundwater Dependent Ecosystem	VT1	Open Woodland of *Eucalyptus victrix*, *E. camaldulensis* with pockets of *Acacia coriacea* subsp. *pendens* over *Grevillea wickhamii* subsp. *aprica*, *Petalostylis labicheoides* and *A. tumida* over *Triodia longiceps*, *Chrysopogon fallax*, and *Themeda triandra* .			x	
Samphire	As	*Tecticornia* spp., *Frankenia ambita* scattered low shrubs to low open shrubland.	x			
Locally restricted	GsTak	*Grevillea saxicola* isolated-sparse tall shrubs over *Triodia* aff. sp. Karijini (S. van Leeuwen 4111) low open hummock grassland.				x
sheet flow dependent	VT17	Hummock Grassland of *Triodia basedowii* with pockets of *Triodia epactia* and *Triodia lanigera* with emergent patches of *Eucalyptus leucophloia*, *Corymbia deserticola* over Acacia *ancistrocarpa*, A. *pyrifolia*, *Hakea lorea* subsp. *lorea* over *Goodenia stobbsiana* and mixed *Senna* and *Ptilotus* species.			x	
sheet flow dependent	VT30.1	High open Shrubland of *Acacia synchronicia* with *Senna glaucifolia* (Sclerolaena spp. and other halophytes) over *Aristida* species.			x	

Appendix 4: Risk Assessment Register

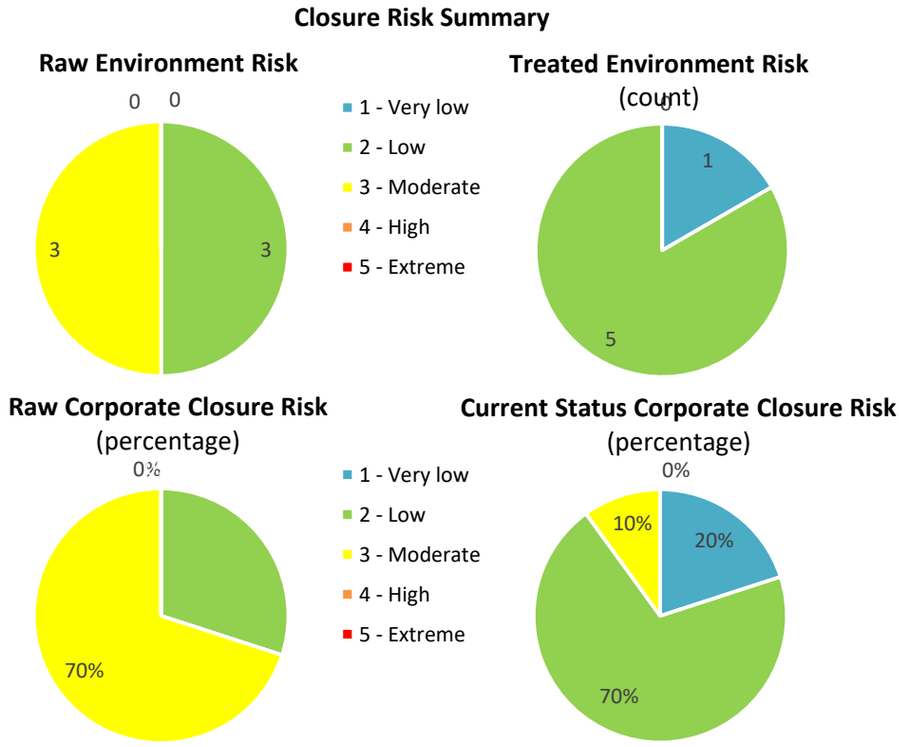
Closure Risk Assessment

Integrated Rail Network

Closure SharePoint Document

5 June 2018

Figure 1. Environmental and Corporate closure risk profiles



Corporate closure risk factors include: Financial, Health and Safety, Natural Environment, Social and Reputation, and

Mine closure risk review attendace register:
The following people attended one or more risk sessions and / or provided input into this risk assessment

Date of risk session: Tuesday, 6 March 2018

Name	Position / Department	Subject Matter Expert Area
Aaron Rowley	Heritage	Heritage
Nerolie Nikolic	Agreements	Native Title and State Agreement
Lisa Willis	Legal	Environmental Law
Marlene Lootz	Rail Environment	Environmental Management
Kirsty Beckett	Long Term Planning	Mine Closure
Stacey Gregory	External consultant - MineEarth	Rehabilitation Specialist
Sarah Robinson	External Consultant - Bioscope	Environmental Specialist
Sonia Finucane	External Consultant - Bioscope	Approvals and Closure Specialist

Mine Closure Risk Assessment			**Closure SharePoint Document**
Revision Number	**0**		
Status	**Issued for Use**		
Author	Kirsty Beckett	N/R Signature	5/06/2018 Date
Confidentiality	Fortescue Staff & Contractors	**Publish on Extranet**	**No**
Review Date	31/05/2021		

Key definitions:

Term	Definition
Action	Defined tasks and/or plans required to further mitigate the risk in addition to the existing risk mitigation strategies
Cause	Contributing internal or external factors which lead to a risk event occurring.
Consequence	The cumulative impact that is expected to arise should the risk event occur within the defined timeframe. This should consider both positive opportunities and negative impacts.
Control	An activity that reduces or prevents (preventative controls) the likelihood of risk event or eliminates or reduces the impact on the business (mitigating controls) if the risk event occurs.
Control Owner	Person responsible for ensuring that a control is operating and / or further action is implemented
Likelihood	Assessment of the probability and/or frequency of the event occurring with the expected consequence within the defined timeframe
Residual Risk Rating	Measure of the risk remaining taking into consideration planned and/or implemented controls and other risk management strategies. The calculation of residual risk should assume that identified risk mitigation strategies (including controls) are operating effectively
Risk	Negative effects from an uncertain future event or circumstance where Fortescue has limited ability to control the occurence of the risk with the consequential impact to the business being mitigated by appropriate risk management strategies.
Risk Owner	Person or function with the accountability and authority to manage a risk
Risk Response Plan	A defined set of activities or processes to manage the risk to an acceptable level. This would normally include the critical preventative and mitigating controls related to the risk.
Status	State of whether a action or control is open/planned, completed/implemented or rejected/expired respectively.

Timeframe for actions	Description
Now	Within the next 18 months. Should be part of short-term work plans.
Next 5 years	Within the next 5 years Should be part of long-term work plans.
>5years	More than 5 years away. Not part of current work plans / programs.

Risk assessment process

Closure related risks are managed in accordance with Fortescue's *Risk Management Framework (2016)* . The aims of the closure risk assessment process are to:

- Identify potential hazards that could influence successful closure of the mine;
- Evaluate the risks to people, property and the environment given the management controls / strategies described in the MCP; and
- Identify actions to reduce the risk to as low as reasonably practicable (ALARP), preferably to a Low or Very Low

Risks within the closure risk register are reviewed and updated as conditions change. The closure risk register is also systematically reviewed and updated at least every three years with a panel of multi-disciplinary subject matter experts.

Evaluation of closure hazards

This closure risk assessment employed a 7x7 risk matrix to evaluate risk.

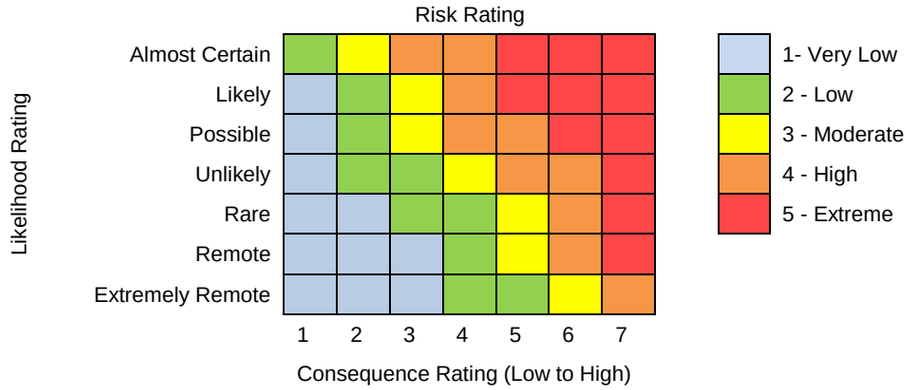


Figure 2. Fortescue risk rating matrix.

The *inherent or raw risks* represent the conditions that may result without implementing the closure plan's controls during operations or on closure. The inherent risks were defined by considering the likelihood of different outcomes occurring at the site given the nature of the local environment as established through the baseline data collation. The most significant negative outcomes (or hazards) were then rated with respect to health and safety, natural environment, social and reputation, and / or compliance factors. The inherent environment risk is established by only assessing the environmental consequence and likelihood.

The *current risk status* is a corporate risk measure used within Fortescue to highlight further work and prioritise resources for further study. The current risk status is determined by establishing the likelihood of successful closure if the existing controls (also referred to as treatments) were implemented today. When establishing the likelihood of closure success, panel members are asked to consider the performance of the same treatments / controls on the site and at other mining operations. Health and safety, natural environment, social and reputation, and / or compliance consequence ratings are not modified when assessing current risk.

The current risk status also includes an assessment of the cost to implement the planned controls as an additional consequence factor. Where the cost consequence factor is assessed to be higher than all other consequence factors, the current risk status may increase above the inherent risk status. This indicates to the business that while an acceptable closure solution is available, further study should be undertaken to identify an alternative, lower cost solution. The projected cost to implement the controls also flows through to the financial provision.

The *final or treated environmental risk* represent the anticipated outcome assuming successful implementation of the treatments / controls.

Consequence

Rating	Financial (AUD)	Health and Safety	Natural Environment	Social and Reputation	Compliance
1	< 100K	No medical treatment required.	Limited damage to minimal area of low significance.	Concern restricted to local complaints about Fortescue.	Low level legal issues.
2	100K – 1M	No medical treatment required.	Minor effects on biological or physical.	Minor, adverse complaints about Fortescue or local media attention.	Multiple minor breaches of laws or regulations and potential complaints.
3	1M – 5M	Minor first aid – no disabling.	Moderate, short-term (<5 year) effects before recovery but not affecting ecosystem function.	Attention from local media and/or heightened concern by local community complaints.	Minor breach of laws or regulations could result in civil litigation. Closure delayed
4	5M – 10M	Disabling incident requiring medical treatment with no permanent impact.	Serious medium term (<10 year) environmental effects or local ecosystem impairment.	Ongoing serious social issues. Independent arbiter required. Significant adverse national media and public attention.	Single significant breach of laws or regulations resulting in litigation and potential class actions. Relinquishment delayed
5	10M – 100M	Serious (permanent) disabling injury that was life threatening – “near miss”.	Serious, long-term (50 year) environmental impairment of habitat or ecosystem function, or loss of high value species.	Serious public or media outcry, adverse international coverage.	Multiple significant breaches of laws resulting in major civil litigation, fines and penalties.
6	100M – 500M	A fatality or very serious irreversible injury to a small number of people in localised area.	Reversible, unplanned impact on species, habitat, or ecosystem with conservation value.	International media condemnation.	Major breach of laws or regulations. Potential fines and criminal prosecutions. Temporary closure of operating sites.
7	>500M	Multiple fatalities or very serious irreversible injury to multiple persons in localised area.	Irreversible, unplanned destruction of species, habitat, or ecosystem with conservation value.	Prolonged international condemnation.	Multiple major breaches of laws resulting in imprisonment of executives/directors. Loss of licence to operate.

Likelihood

Rating		Qualitative Description	Probability
1	Extremely Remote	The event is not expected to occur in most circumstances	<1%
2	Remote	The event is not expected	1%-10%
3	Rare	The event may occur only in exceptional circumstances	10%-25%
4	Unlikely	The event could occur at some time	25%-50%
5	Possible	The event should occur at some time	50%-75%
6	Likely	The event will probably occur in most circumstances	75%-90%
7	Almost Certain	The event is expected to occur in most circumstances	>90%

Risk rating interpretation

Risk rating	Inherent (Raw) Risk Conclusion	Current Risk Status	Treated Outcome
1 - Very Low	Evidence is available to demonstrate this hazard is not present at this site.	Evidence is available to demonstrate this hazard has been eliminated as a threat.	Risk reduced to as low as reasonably practicable (ALARP)
2 - Low	Evidence suggests this hazard is not a threat to successful closure of this site.	Evidence is available to demonstrate the proposed management will successfully control the threat. Ongoing review of this threat is recommended lest site conditions change.	
3 - Moderate	Evidence suggests this hazard could pose a threat to successful closure of this site.	There is (some) evidence or widely accepted professional opinion that the proposed management will successfully control the threat. Further action and/or monitoring is required to validate success of the proposed management.	Consider if ALARP has been achieved. Discuss residual risk acceptance with stakeholders.
4 - High	Evidence suggests this hazard poses a substantive threat to successful closure of this site. OR Absence of adequate information prevents this threat from being satisfactorily assessed, and professional opinion suggests this hazard would pose a threat to successful closure of this site.	Professional opinion suggests the proposed management is likely to control the threat. Actions have been proposed to validate the threat assessment and to validate the success of the proposed management. Further refinement of the proposed management may be required based on the action outcomes.	Risk is too high. Identify other management strategies to reduce risk.
5 - Extreme	Evidence and / or professional opinion suggests this hazard has the potential for irreversible impairment to a conservation significant ecosystem or site of cultural significance.	Professional opinion suggests the proposed management is unlikely to control the threat. Irreversible impairment to a conservation significant ecosystem or site of cultural significance is still possible.	

ID	Subject	Hazard Scenario / Activity	Where	Cause / Why / Risk Pathway (Given known baseline conditions)	Impacts (max reasonable consequence) H&S	Env	S&R	C	Raw Likelihood	Raw Risk / Do nothing	Raw Env Risk / Do nothing	Treatment: What controls are implemented during operations	Treatment: What controls are planned to be implemented on closure	Current closure Risk: Control cost	Likelihood current	Current Risk	Action status	Further work / Planned improvements / Comments	Env: Likelihood with control	Env: Treated Risk
3	Stakeholders	Delay in IRN asset transfer to the State	Permanent Domains	Government requires IRN unspecified maintenance / condition / repairs to be completed prior to transfer, or other legal constraints or legislation (now or in the future) outside of the Agreement delays the process			4		Unlikely	Moderate		Continued maintenance to keep IRN in good repair in accordance with National rail standards and operating licenses Ongoing stakeholder engagement with the State government.	Legal review and establishment of legal transfer mechanisms	1	Rare	Low	Action before / on closure	Develop and agree transfer process with State regulatory agencies Develop deeds of transfer		
4	Stakeholders	Failed transfer of obligations (excluding IRN as contained in the State Agreement)	Temporary Domains	New owners of assets fail to manage the asset appropriately, resulting in localised environmental issues / non-compliance. Creates reputational damage to Fortescue.		3	3		Possible	Moderate	Moderate	Ongoing stakeholder engagement	Legal transfer of assets to new owners Likely management requirements for asset, i.e. liceses etc. to ensure legal management / obligations , are discussed with new owners prior to transfer. JTSI informed of pending transfer of assets (outside of TPI agreement)	1	Rare	Low	Action before / on closure	Develop deeds of transfer	Rare	Low
5	Stakeholders	State does not accepted all the IRN as defined under the State Agreement.	Permanent Domains	State requests Fortescue remove rail and rehabilitate land instead of transferring ownership			3		Possible	Moderate		Ongoing stakeholder engagement	Confirmation of assets transfer process before use of the IRN ceases Opportunity to discuss alternative rail disposal options, i.e. TPI asset transfer to third party, and changes to Agreement conditions.	4	Unlikely	Moderate	Actions on closure	Develop and agree transfer process with State regulatory agencies		
6	Stakeholders	Closure outcomes do not meet expectations as described in public documents	All	Public perception of rehabilitation requirements for the IRN may not reflect what the State and TPI agree too. Public outrage when government requests rail be removed, due to loss of jobs / opportunities etc.			4		Unlikely	Moderate		Ongoing stakeholder engagement. Closure plan developed describing planned outcomes. Regular review of closure plan to incorporate changes in acceptable rehabilitation standards (if / when they occur)	Stakeholder partnership with JTSI closer to the end of life to facilitate inclusion of any community concerns.	1	Remote	Low	Effective - No further actions			
7	Stakeholders	Premature closure	All	TPI ceases operations along portion or all of the rail ahead of scheduled rail closure			3	2	Unlikely	Low		Continued maintenance of IRN assets in good looking working order in accordance with Agreement. Progressive rehabilitation of temporary disturbance areas, where applicable.	If sections of rail to be decommissioned ahead of transfer notify State of change under section 14 or 15. Develop care and maintenance plan prior to / immediately after suspension of operations.	1	Extremely Remote	Very Low	Effective - No further actions			

ID	Subject	Hazard Scenario / Activity	Where	Cause / Why / Risk Pathway (Given known baseline conditions)	Impacts (max reasonable consequence) H & S	Env	S & R	C	Raw Likelihood	Raw Risk / Do nothing	Raw Env Risk / Do nothing	Treatment: What controls are implemented during operations	Treatment: What controls are planned to be implemented on closure	Current closure Risk: Control cost	Likelihood current	Current Risk	Action status	Further work / Planned improvements / Comments	Env Likelihood with control	Environmental Treated Risk
8	Infrastructure	Contamination discovered	Permanent Domains	Soil or land contamination is discovered after asset transfer or during decommissioning. (Impact small enough to have gone unnoticed prior to decom)		3		4	Unlikely	Moderate	Low	Operation in accordance with license conditions, includes monitoring for contamination.	Preliminary contaminated sites impact assessment during decommissioning (if required)	2	Rare	Low	Effective - No further actions		Rare	Low
9	Landform	Erosion	Temporary Domains	Poor rehabilitation practice results in increasing erosion and degradation of ground conditions, i.e. sediment smothering vegetation, vegetation undercut / removed		3			Possible	Moderate	Moderate	Progressive rehabilitation of temporary disturbance areas. Grade banks to appropriate slopes based on ground conditions (e.g. lower slope in sands, can be steeper on rocky areas. Monitoring of progressive rehabilitation performance. Identify and track erosion. Check if erosion is stabilising. Undertake maintenance if expansion is ongoing. Maintenance of areas not achieveing satisfactory outcomes. Consider re-grading area, addition of seed (plants to hold soil together) and reshaping including partial backfilling in extreme cases. Improvements to rehabilitation practice based on outcomes, when required.	Rehabilitation of temporary disturbance areas. Monitoring of rehabilitation performance. Maintenance of areas not achieveing satisfactory outcomes.	3	Rare	Low	Effective - No further actions		Rare	Low
10	Landform	Water logging	Temporary Domains	Water logging in internal draining areas, e.g. heavy disturbance borrow pits, prevents vegetation from re-establishing and / or creates hazardous conditions for cattle / animals		3	2		Possible	Moderate	Moderate	Rip floor of borrow pit to encourage draining. Leave ground bare (don't apply topsoil) over rocky areas, to prevent water logging conditions from developing. Review and update of procedures regularly to incorporate assessment of rehabilitation.	Rehabilitation of temporary disturbance areas. Monitoring of rehabilitation performance. Maintenance of areas not achieveing satisfactory outcomes.	1	Unlikely	Low	Effective - No further actions		Unlikely	Low

ID	Subject	Hazard Scenario / Activity	Where	Cause / Why / Risk Pathway (Given known baseline conditions)	Impacts (max reasonable consequence) H&S	Env	S&R	C	Raw Likelihood	Raw Risk / Do nothing	Raw Env Risk / Do nothing	Treatment: What controls are implemented during operations	Treatment: What controls are planned to be implemented on closure	Current closure Risk: Control cost	Likelihood current	Current Risk	Action status	Further work / Planned improvements / Comments	Env: Likelihood with control	Environmental Treated Risk
11	Water	Surface water flow maintenance	Temporary Domains	Reshaping of land creates water shadows downstream of the disturbance		3			Unlikely	Low	Low	Reshape land to minimise internal draining areas. Use bunds / raised areas to divert surface water around internal draining areas	Rehabilitation of temporary disturbance areas. Monitoring of rehabilitation performance. Maintenance of areas not achieveing satisfactory outcomes.	1	Remote	Very Low	Effective - No further actions		Remote	Very Low
12	Vegetation	Substandard vegetation communities	Temporary Domains	Vegetation communities do not reflect adjacent ecosystems due to absence of key species or weed competition		2			Possible	Low	Low	Progressive rehabilitation of temporary disturbance areas using stockpiled topsoil. Consider use of seeds if topsoil is stockpiled for more than 2 years. Monitoring of progressive rehabilitation performance. Identify which key species are absent from rehab areas. Undertake weed management in accordance with the Weed Management Plan. Consider scarification and reseeding for areas where vegetation completely fails, or supplementary seeding of key species, as appropriate.	Rehabilitation of temporary disturbance areas. Monitoring of rehabilitation performance. Maintenance of areas not achieveing satisfactory outcomes.	1	Unlikely	Low	Effective - No further actions		Unlikely	Low