Rio Tinto Iron Ore

Brockman Syncline 4 – Revised Proposal

Assessment on Proponent Information

Environmental Review Document

Hamersley Iron Pty Limited
152 – 158 St Georges Terrace, Perth
GPO Box A42, Perth, WA 6837

July 2014

RTIO-HSE-0209902
Disclaimer and Limitation

This report has been prepared by Rio Tinto Iron Ore (Rio Tinto), on behalf of Hamersley Iron Pty Limited (Hamersley Iron), specifically for the Brockman Syncline 4 Iron Ore Project. Neither the report nor its contents may be referred to without the express approval of Rio Tinto, unless the report has been released for referral and assessment of proposals.

<table>
<thead>
<tr>
<th>Document Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rev</td>
</tr>
<tr>
<td>A - D</td>
</tr>
<tr>
<td>E - F</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

1 INTRODUCTION ......................................................................................................................... 1

1.1 PROPOSENT DETAILS ........................................................................................................... 1

1.2 THE BROCKMAN SYNCLINE 4 PROJECT ............................................................................. 1

2 PROPOSAL DESCRIPTION ............................................................................................................. 6

2.1 PROVISION OF A DEVELOPMENT ENVELOPE ................................................................. 6

2.2 DEWATERING AND DISCHARGE ......................................................................................... 7

2.3 ADDITIONAL CLEARING ...................................................................................................... 7

3 ENVIRONMENTAL APPROVAL PROCESS .............................................................................. 13

3.1 KEY PROPOSAL CHARACTERISTICS OF THE B4 REVISED PROPOSAL .................. 13

3.2 KEY ENVIRONMENTAL FACTORS ..................................................................................... 14

3.3 PROPOSED ENVIRONMENTAL CONDITIONS ...................................................................... 16

4 PROPOSAL TENURE .................................................................................................................... 17

4.1 STATE AGREEMENT AND MINING ACT ........................................................................... 17

4.2 NATIVE TITLE ...................................................................................................................... 17

4.3 LAND USE AND SOCIAL ENVIRONMENT IN PROXIMITY TO THE PROPOSAL ........... 18

5 STAKEHOLDER CONSULTATION .............................................................................................. 21

6 DEWATERING AND SURPLUS WATER MANAGEMENT ......................................................... 27

6.1 HYDROGEOLOGICAL MODELLING ...................................................................................... 27

6.2 OREBODY DEWATERING AND WATER BALANCE .............................................................. 31

6.3 CONSIDERATION OF OPTIONS FOR SURPLUS WATER MANAGEMENT ....................... 33

6.4 COMPARISON OF LOCAL SURFACE DISCHARGE OPTIONS ........................................... 39

6.5 DISCHARGE WATER QUALITY ............................................................................................. 43

7 ASSESSMENT OF IMPACT ON HYDROLOGICAL PROCESSES .......................................... 44

7.1 GROUNDWATER DRAWDOWN ............................................................................................ 44

7.2 SURFACE DISCHARGE TO BOOLGEEDA CREEK .................................................................. 44

8 ASSESSMENT OF IMPACT ON FLORA AND VEGETATION ............................................... 49

8.1 FLORA AND VEGETATION STUDIES ............................................................................... 49

8.2 VEGETATION OF THE PROPOSED DEVELOPMENT ENVELOPE .................................... 54
8.3 FLORA OF CONSERVATION SIGNIFICANCE ............................................................... 80

9 ASSESSMENT OF IMPACT ON TERRESTRIAL FAUNA ........................................ 89
  9.1 TERRESTRIAL FAUNA STUDIES ........................................................................ 89
  9.2 RHAGADA ........................................................................................................... 92
  9.3 FAUNA HABITAT CONSERVATION SIGNIFICANCE ASSESSMENT ................. 93
  9.4 IMPACT ASSESSMENT ON TERRESTRIAL FAUNA ........................................... 97

10 OTHER CHANGES TO SCHEDULE 1 OF MINISTERIAL STATEMENT 717 ................ 103
  10.1 WASTE DUMP OPTIMISATION ........................................................................ 103
  10.2 CHANGES TO KEY CHARACTERISTICS OF MS 717 .......................................... 104

11 OTHER ENVIRONMENTAL IMPACTS AND MANAGEMENT .................................... 107
  11.1 ENVIRONMENTAL IMPACTS AND MANAGEMENT ............................................ 107
  11.2 ENVIRONMENTAL MANAGEMENT SYSTEM OVERVIEW .................................. 107

12 CUMULATIVE IMPACTS ...................................................................................... 113

13 RESIDUAL IMPACTS ............................................................................................ 115
  13.1 DETERMINATION OF CRITICAL AND HIGH VALUE ASSETS ............................ 115
  13.2 OFFSET REQUIREMENTS FOR THE REVISED PROPOSAL ................................. 116

14 OTHER LEGISLATION AND APPROVALS ............................................................ 119

15 PRINCIPLES OF ENVIRONMENTAL PROTECTION AND EIA ............................... 120
  15.1 PRINCIPLES OF ENVIRONMENTAL PROTECTION .............................................. 120
  15.2 PRINCIPLES OF EIA FOR THE PROPOINENT .................................................. 121
  15.3 CRITERIA FOR API CATEGORY A ........................................................................ 123

16 REFERENCES ....................................................................................................... 124
FIGURES

Figure 1-1: Regional Setting of the Brockman Syncline 4 Iron Ore Project .............................................. 2
Figure 2-1: B4 Revised Proposal ................................................................................................................. 9
Figure 2-2: Disturbance Footprint .............................................................................................................. 11
Figure 2-3 Disturbance Footprint - Area 1 .................................................................................................. 12
Figure 3-1 Identified Environmental Factors and Legislative Controls for the Revised Proposal (from EAG8) ................................................................................................................................. 15
Figure 4-1: Tenure of the B4 Revised Proposal ........................................................................................... 20
Figure 6-1: B4 Conceptual Hydrogeological Model .................................................................................. 28
Figure 6-2: Comparison of Predicted End of Mine Drawdown .................................................................. 29
Figure 6-3: Conceptual Water Balance for the B4 Project .......................................................................... 32
Figure 8-1 Land Systems of the Greater Brockman region ........................................................................ 56
Figure 8-2: Area 1 Vegetation ...................................................................................................................... 59
Figure 8-3: Area 2 Vegetation ...................................................................................................................... 60
Figure 8-4 Vegetation Legend for the Brockman 4 Development Envelope ............................................. 61
Figure 8-5 Boolgeeda Creek Riparian Vegetation ....................................................................................... 65
Figure 8-6 Flora and Vegetation of Elevated Significance within the Proposed B4 Development Envelope – Area 1 .................................................................................................................................................. 76
Figure 8-7 Flora and Vegetation of Elevated Significance within the Proposed B4 Development Envelope – Area 2 .................................................................................................................................................. 77
Figure 8-8 Flora and Vegetation of Elevated Significance within the Discharge Footprint ................... 78
Figure 9-1: Significant Fauna Records and Fauna Habitats within the Development Envelope – Area 1 .................................................................................................................................................. 98
Figure 9-2: Significant Fauna Records and Fauna Habitats within the Development Envelope – Area 2 .................................................................................................................................................. 99
Figure 9-3 Significant Fauna Records and Fauna Habitats within the Discharge Footprint ............... 100

TABLES

Table 1-1: Summary of Key Characteristics of the B4 Operation (MS 717) .................................................... 3
Table 1-2: Summary of Changes to MS 717 ................................................................................................. 5
Table 3-1: Summary of the B4 Revised Proposal ......................................................................................... 13
Table 3-2: Location and Extent of Physical Elements of the – B4 Revised Proposal ............................ 14
Table 3-3: Location and Extent of Operational Elements of the – B4 Revised Proposal .................... 14
Table 5-1: Stakeholder Consultation Relevant to this Proposal ................................................................. 22
Table 6-1: Actual Abstraction and Water Use at the B4 Project ........................................... 31
Table 6-2: Alternatives considered for the management of surplus water at the B4 Revised Proposal 35
Table 6-3: Estimated Discharge Footprint in Boolgeeda Creek and Beasley River Systems ........... 40
Table 6-4: B4 Water Quality .................................................................................................. 43
Table 7-1: Hydrological Processes: Description of Factor, Impact Assessment and Management... 47
Table 8-1: Summary of Key Flora and Vegetation Studies .................................................. 51
Table 8-2: Land Systems in the B4 Development Envelope .................................................. 55
Table 8-3: Distribution of Land Systems within the B4 Development Envelope and wider Pilbara Bioregion ........................................................................................................... 57
Table 8-4 Vegetation of Elevated Significance within Development Envelope and Discharge Footprint .............................................................................................................................. 69
Table 8-5 Priority Flora Recorded or Potentially Occurring within the Development Envelope ...... 81
Table 8-6: Flora and Vegetation: Description of Factor, Impact Assessment and Management ...... 85
Table 9-1: Summary of Terrestrial Fauna Studies .................................................................. 90
Table 9-2 Summary of Conservation Significant Fauna Habitats occurring in the Development Envelope .......................................................................................................................... 95
Table 9-3: Conservation Significant Species potentially occurring within the Development Envelope 96
Table 9-4: Terrestrial Fauna: Description of Factor, Impact Assessment and Management .......... 101
Table 10-1: Proposed Changes to the Key Characteristics (MS 717) ......................................... 105
Table 11-1: Rehabilitation and Closure: Description of Factor, Impact Assessment and Management 109
Table 11-2: Factors Considered Not Relevant to this Proposal ............................................. 111
Table 12-1 Assessment of potential for cumulative impacts .................................................. 113
Table 13-1: Environmental Offsets Reporting Form .............................................................. 117
Table 14-1: Other Legislation and Approvals ......................................................................... 119
Table 15-1: Principles of Environmental Protection .............................................................. 120
Table 15-2: Principles of EIA for the Proponent .................................................................. 121
Table 15-3: Criteria for API Category A .............................................................................. 123
APPENDICES

Appendix 1  S38 Referral Form ................................................................. 127
Appendix 2  Ministerial Statement 717 .................................................... 127
Appendix 3  EPA Prepared Scoping Guideline (27 May 2014) .................... 127
Appendix 4  Proposed Environmental Conditions for Revised Proposal .......... 127
Appendix 5  Modelled Scenario for Boolgeeda Creek Discharge .................. 127
Appendix 6  Discharge Monitoring and Management Plan (3 July 2014) ........ 127
Appendix 7  Key Flora and Vegetation Studies: ........................................ 127
Appendix 8  Vegetation types and Fauna Habitats to be disturbed ................. 127
Appendix 9  Key Fauna Studies: .............................................................. 127
Appendix 10 Brockman Syncline 4 Spontaneous Combustion and ARD (SCARD) Management Plan. 128
Appendix 11 Mineral Waste Management Plan ......................................... 128
Appendix 12 Checklist on terrestrial biodiversity ....................................... 128
1 INTRODUCTION

1.1 PROPOONENT DETAILS

The Proponent for this Proposal is Hamersley Iron Pty Limited

ABN: 49 004 558 276

GPO Box A42

Perth WA 6837

The contact person for the Proposal is:

Annie Featherstone

Rio Tinto: Senior Advisor Environmental Approvals

T: +61 (08) 6211 6995

annie.featherstone@riotinto.com

1.2 THE BROCKMAN SYNCLINE 4 PROJECT

Hamersley Iron Pty Limited (Hamersley Iron) (a wholly owned subsidiary of Rio Tinto) is operating the Brockman Syncline 4 Iron Ore Project (the B4 Operation) as approved by Ministerial Statement 717 (MS 717). Refer to Figure 1-1 for the regional setting of the B4 Operation.

The B4 Operation, as implemented, consists of:

- Three main mining areas (Western, Central and Eastern lenses of mineralisation) with approximately 20% of the orebody occurring below the water table.
- A dry processing plant with a nominal capacity of 42 Mtpa.
- Associated iron ore mine infrastructure (e.g. product stockpiles, waste dumps, topsoil, low-grade stockpiles and haul roads).
- Associated infrastructure (e.g. mine access roads, offices, warehouses, accommodation, bore fields, fuel storage facilities and utilities).
- A rail spur and siding works from the B4 Project to the rail spur at Brockman 2 Iron Ore Mine.
- Infrastructure corridor for power supply.
- Groundwater abstraction of 4.38 GL/annum (equivalent to 12 ML/day annualised) plus 0.15 GL/annum (equivalent to 400 kL/day annualised) for mine camp needs.
Figure 1-1
Regional Setting of the Brockman Syncline 4 Iron Ore Project

RioTinto

Iron Ore (WA)

Drawn: J Woodroof
Date: July 2014
Plan No: PDE0122100v1
Prep: MG94 (Zone 59)

Scale: 1:2,000,000 @ A4
A summary of the Key Characteristics of the B4 Operation (from MS 717) is provided below in Table 1-1.

Table 1-1: Summary of Key Characteristics of the B4 Operation (MS 717)

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td></td>
</tr>
<tr>
<td>Project life</td>
<td>Estimated 30 years</td>
</tr>
<tr>
<td>Area of disturbance</td>
<td>Approximately 2,610(^1) ha</td>
</tr>
<tr>
<td>Potential ore reserves</td>
<td>600 Mt high grade (&gt;60%Fe), 280 Mt low grade (&gt;50% Fe)</td>
</tr>
<tr>
<td>Mining rate</td>
<td>42 Mtpa of product</td>
</tr>
<tr>
<td>Waste rock</td>
<td>420 Mt (approx. 150 Mt will be used to backfill pits)</td>
</tr>
<tr>
<td>Greenhouse Gas Emissions</td>
<td>5.59 kg CO(_2)e per tonne of production per annum</td>
</tr>
<tr>
<td><strong>Mine and mining</strong></td>
<td></td>
</tr>
<tr>
<td>Pits and ore type</td>
<td>Three mining areas with high phosphorus Brockman ore. The deposit extends approximately 14 km in length, is 1 km wide and averages 150 m deep.</td>
</tr>
<tr>
<td>Ore below water table</td>
<td>Approximately 20% of total ore (variable between each pit).</td>
</tr>
<tr>
<td>Stripping ratio</td>
<td>Ranges from 0.5:1 to 1.5:1 waste to ore depending on processing and stockpile strategies (average 1.2:1).</td>
</tr>
<tr>
<td>Waste rock disposal</td>
<td>Surface dumps until mined-out pit voids become available, then backfilled to above pre-mine water table.</td>
</tr>
<tr>
<td>Waste dumps, high grade and low grade stockpiles – location, height</td>
<td>Original site as shown in Figure 2 of Attachment 1 of MS 717 and a stockpile area adjacent to rail loop as shown in Figure 5 of Attachment 2 of MS 717. Height of waste dumps to be total height of 50m.</td>
</tr>
<tr>
<td>Dewatering</td>
<td>Dewatering is required to access ore from below the water table.</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td></td>
</tr>
<tr>
<td>Water supply</td>
<td>Supplied from the Orebody and Wittenoom Dolomite aquifers. Alternative borefield as an additional source via pipeline along infrastructure corridor. 4.38 GL/annum (dust management) plus additional 0.15 GL/annum (mine camp).</td>
</tr>
</tbody>
</table>

\(^1\) B4 Phase 2 S45C application, approved (4 November 2008) an increase in clearing from 2,470 ha to 2,610 ha. Schedule 1 of MS 717 was not correctly updated to reflect this.
<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>25 MW supplied from the Dampier-Tom Price 220 kV transmission system via a 33 kV sub-transmission system. Power lines will approach the mine within the infrastructure corridor, except at the southern end where the route diverges from the infrastructure corridor (Figure 4 of MS 717).</td>
</tr>
<tr>
<td>Processing plant</td>
<td>A dry plant with a crushing and screening circuit for a total 42Mtpa of product.</td>
</tr>
<tr>
<td>Product transport</td>
<td>By rail via a 35 km long rail spur from the project area to Brockman 2 mine, then along the existing Brockman 2 rail spur and the main railway to port including rail siding earthworks between Brockman 2 and B4.</td>
</tr>
<tr>
<td>Rail Spur</td>
<td>330 ha footprint (see Figures 1a and 1b of MS 717)</td>
</tr>
<tr>
<td>Plant, administration, workshops and stockpiles location</td>
<td>Original site as shown in Figure 2 of Attachment 1 of MS 717 and a stockpile area adjacent to rail loop as shown in Figure 5 of Attachment 2 of MS 717.</td>
</tr>
<tr>
<td>Mine access roads</td>
<td>Construction of a sealed access road from the Brockman 2 Mine that will mostly be provided by bitumen sealing of the approved B4 infrastructure corridor service road (no additional footprint); some deviations from the approved track are required and these will create additional footprint.</td>
</tr>
</tbody>
</table>

### Workforce

<table>
<thead>
<tr>
<th>Construction operation</th>
<th>Peak of 700&lt;br&gt;300 (plus approximately 40 during periodic shutdown maintenance periods)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodation</td>
<td>A permanent village and contractor’s camp, plus small rail spur camps&lt;br&gt;Total 570 rooms&lt;br&gt;Total 1350 rooms</td>
</tr>
</tbody>
</table>

### 1.2.1 Environmental Approvals History

Exploration drilling was undertaken over a period of years, prior to Part IV approval under Part IV of the Environmental Protection Act 1986 (EP Act), as part of the pre-feasibility and feasibility studies conducted to design and develop the Brockman Syncline 4 Iron Ore Mine (B4 Operation).

This ground disturbance was authorised primarily via notification under the Iron Ore (Hamersley Range) State Agreement Act 1963 or Notices of Intent under the Mining Act 1978 as appropriate. More recently vegetation disturbance for exploration outside of the Part IV footprint has been authorised via Native Vegetation Clearing Permit (NVCP) under Part V of the EP Act. NVCPs include conditions on rehabilitation.

The Minister for the Environment issued MS 717 on 24 March 2006 allowing implementation of the B4 Operation. Since then several changes have been approved under Part IV of the EP Act as summarised below in Table 1-2. A copy of MS 717 is provided in Appendix 2.
Table 1-2: Summary of Changes to MS 717

<table>
<thead>
<tr>
<th>Change</th>
<th>Date</th>
<th>Nature of Change</th>
<th>Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19/09/07</td>
<td>Minor changes including:</td>
<td>S45C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- re-design of approved mine site layout</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- re-design of approved rail spur</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- relocation of approved 220kV power line and construction of 33kV power line reticulation system</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- increase in throughput from 20Mtpa to 22Mtpa</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- increase in water use from 2.26 GL/annum (6.2ML/day) to 2.92 GL/annum (8ML/day) plus 0.11GL/a (300kL/day) (mine camp) purposes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- bitumen sealing of the White Quartz Road; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- removal of the conveyor and a new airstrip²</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>22/09/08</td>
<td>Rerouting of the power line corridor and change in power capacity.</td>
<td>S45C</td>
</tr>
<tr>
<td>3</td>
<td>17/12/08</td>
<td>Minor changes including:</td>
<td>S45C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- an increase in throughput from 22Mtpa to 42Mtpa</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- increase in waste dump height and additional locations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- changes to infrastructure and accommodation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- an increase in water use from 8ML/day to 12ML/day (4.38GL/a), plus an increase from 300kL/day to 400kL/day (0.15GL/a) for mine camp needs; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- an increase in the clearing limit</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- removal of requirement to bitumen seal White Quartz Road.</td>
<td></td>
</tr>
</tbody>
</table>

The Brockman Syncline 4 - Nammuldi Water Pipeline Corridor Proposal was granted Not Assessed – Public Advice Given in May 2011 after the Office of the Environmental Protection Authority (OEPA) determined that the scope of works was not significant as to warrant formal assessment or the setting of conditions. This proposal included a pipeline between Nammuldi and the B4 Operation to supplement water supply at the B4 Operation and reduce surplus discharge associated with the Nammuldi-Silvergrass Expansion. This proposal has not been implemented as the B4 Operation has been able to meet its own water demand.

First ore was railed from the B4 Operation in 2010.

² Note that clearing for an airstrip was subsequently approved via an NVCP
2 PROPOSAL DESCRIPTION

This Environmental Review (ER) document has been referred to the OEPA in order to enable assessment under the provisions of Part IV of EP Act and has been prepared in accordance with the information requirements for a API Category A as set out in the Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2012 (2012 Administrative Procedures). The s38 Referral Form is provided in Appendix 1.

This Proposal is a revision to the B4 Operation with the following proposed changes (the Revised Proposal is depicted in Figure 2-1):

- provision of a Development Envelope (refer to Section 2.1, Section 8 and Section 9);
- surface discharge of surplus dewatering water to Boolgeeda Creek (refer to Section 2.2, Section 6 and Section 7);
- new clearing of up to 950 ha for pits, dumps and infrastructure, within the Development Envelope, to support ongoing production at the B4 Operation (refer to Figure 2-2 and Figure 2-3, Section 2.3 and Section 8);
- other changes to Schedule 1 of MS 717, such as:
  - waste dump optimisation (refer to Section 10.1); and
  - changes to the Key Characteristics (refer to Section 10.2).

Note that the following terminology is used throughout this ER document:

**B4 Operation** - existing Brockman Syncline 4 as approved under MS 717

**Proposal** – the changes requested as described in this ER document

**Revised Proposal** – all components of the Brockman Syncline 4 Iron Ore Mine that are currently authorised under MS 717, plus the changes that are described in this Proposal. The operation that will be authorised by a new Ministerial Statement, in the event of acceptance by the Minister of the changes requested in this ER.

2.1 PROVISION OF A DEVELOPMENT ENVELOPE

The EPA’s Environmental Assessment Guideline No. 1 (EAG1) allows for the disturbance footprint of a proposal to be defined within a broader Development Envelope provided that appropriate biological surveys and an environmental impact assessment have been conducted for the area.

The authorised footprint for the B4 Operation (Appendix 2, Figure 2 - Schedule 1 of MS 717) specifies locations of all pits and infrastructure with no flexibility built-in to accommodate changes due to avoidance of impacts, geotechnical or design related reasons. The Proponent requires flexibility to maximise the development of the approved ore bodies at B4, therefore this Proposal includes the delineation of a Development Envelope for the Brockman Syncline 4 Revised Proposal (Revised Proposal).
The extent of the Development Envelope is depicted in Figure 2-1 and it includes all elements currently authorised under MS 717 as well as relevant changes sought in this Proposal.

Based on discussion with the OEPA, the Development Envelope has been divided into the following two sections:

- mine operations area (Area 1); and
- northern and southern linear infrastructure corridors (combined to form Area 2).

This separation acknowledges the relative differences in flexibility and nature of impacts of clearing to mine an orebody (that cannot be moved) compared to clearing for construction of linear infrastructure (that overall tends to be a more flexible option). Area 1 includes the bulk of the mining and ore handling operation and therefore has a larger proposed clearing limit of 2,160 ha, whilst Area 2 comprises the northern and southern corridors that contain existing linear infrastructure such as mine access roads, power and rail with associated disturbance (borrow pits, drainage works, etc.). The northern and southern corridors have a proposed combined clearing limit of 1,400 ha.

The proposed total clearing limit for the B4 Revised Proposal is 3,560 ha within a 20,046 ha Development Envelope (where Area 1 is 14,227 ha and Area 2 is 5,818 ha).

Sections 8 and 9 describe the flora, vegetation, fauna and fauna habitats of conservation significance that occur within the proposed Development Envelope.

2.2 DEWATERING AND DISCHARGE

Improvements in hydrogeological knowledge and ongoing constraints on the mine plan, resulting from sub-optimal dewatering of the orebody, have resulted in a revision of the conceptual hydrogeological model for the B4 Operation. Current modelling has identified the need to increase the dewatering rate in order to achieve production rates.

The proposed increase in dewatering will generate surplus water that will require management. An assessment of surplus water management options was conducted and the option to discharge surplus water to nearby Boolgeeda Creek was selected.

Further details and the rationale for this change to the B4 Operation are provided in Section 4.

2.3 ADDITIONAL CLEARING

Additional clearing of 950 ha is required to accommodate changes to the mine plan, primarily revision of the waste management strategy. Additional waste dumps will allow waste to be placed out of pit pending availability of mined out voids for backfilling.

A portion of the additional clearing will be allocated to minor changes to pit boundaries, roads, operational areas etc. within the Development Envelope as required to support future mining and to minimise the requirement to obtain NVCP’s for exploration and minor works.
Figure 2-2 and Figure 2-3 show the extent of existing clearing for a range of purposes authorised under a combination of the State Agreement Act; Mining Act; NVCPs; MS 717 (B4 Operation); MS 925 (Nammuldi Silvergrass Expansion); and MS 131 (Brockman 2). Also shown is planned disturbance areas authorised under these approvals. Note that clearing limits apply to each of the approvals listed and ground disturbance is kept within the limit in each instance.

The Additional clearing is overlain on the existing/authorised disturbance footprint in Figure 2-3.
Figure 2-2
Disturbance Footprint

Legend:
- Areas 1 & Area 2
- Proposed Development Envelope
- Disruption Under MS717
- Disturbance Under Other Approvals
- MS 925 Boundary
- MS 946 Boundary
- Proposed Discharge Location
- Anurangaw Creek Discharge

SCALE
1:150,000 A3
3 ENVIRONMENTAL APPROVAL PROCESS

The OEPA has determined that this Proposal is a revised proposal to the B4 Operation (MS 717). An EPA-Prepared Scoping Guideline for the B4 Revised Proposal was issued on 27 May 2014. This ER has been prepared in accordance with that guideline. It is expected that upon approval of this Proposal, a new Ministerial Statement will be issued which will supersede MS 717 and any associated s45c attachments, providing one overall contemporary Ministerial Statement for the B4 Revised Proposal.

This ER has been revised in line within the EPA’s Environmental Assessment Guidelines (EAGs): specifically Defining the Key Characteristics of a Proposal Environmental Protection Act 1986 (EAG 1) and EAG for Environmental factors and objectives (EAG 8).

3.1 KEY PROPOSAL CHARACTERISTICS OF THE B4 REVISED PROPOSAL

It is intended that this Proposal will be implemented as part of the B4 Operation and will be managed in accordance with existing legislative conditions and Rio Tinto management systems and procedures. Table 3-1 provides a summary of the B4 Revised Proposal.

Table 3-1: Summary of the B4 Revised Proposal

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposal Title</td>
</tr>
<tr>
<td>Proponent Name</td>
</tr>
<tr>
<td>Short description</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Table 3-2 and Table 3-3 provide details on the proposed location and authorised extent of physical and operational elements of the Proposal. The new or modified factors being assessed in this Proposal are highlighted to assist with identification.
### Table 3-2: Location and Extent of Physical Elements of the – B4 Revised Proposal

<table>
<thead>
<tr>
<th>Element</th>
<th>Location</th>
<th>Proposed Extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine Operations Area (refer to Section 8.1)</td>
<td>Area 1 on Figure 2-1</td>
<td>Clearing no more than 2,160 hectares within a 20,046 ha Development Envelope.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mining of deposit to a depth of 150m.</td>
</tr>
<tr>
<td>Linear Infrastructure Corridors</td>
<td>Area 2 Figure 2-1</td>
<td>Clearing no more than 1,400 hectares within a 20,046 ha Development Envelope.</td>
</tr>
<tr>
<td>Backfilling of mine pits</td>
<td>Area 1 on Figure 2-1</td>
<td>Mine pits are to be backfilled at closure so that the final surface levels are at a higher elevation than the pre-mining groundwater level to prevent the formation of pit lakes.</td>
</tr>
</tbody>
</table>

### Table 3-3: Location and Extent of Operational Elements of the – B4 Revised Proposal

<table>
<thead>
<tr>
<th>Element</th>
<th>Location</th>
<th>Proposed Extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water abstraction</td>
<td>Area 1 on Figure 2-1</td>
<td>Groundwater abstraction no more than 6.4 GL/a.</td>
</tr>
<tr>
<td>Management of surplus dewater</td>
<td>Figure 2-1</td>
<td>Dewater disposal through use on site and controlled surface discharge of surplus water to Boolgeeda Creek of no more than 6.4 GL/a.</td>
</tr>
</tbody>
</table>

### 3.2 KEY ENVIRONMENTAL FACTORS

In its Scoping Guideline (27 May 2014, Appendix 3) the EPA identified that the following preliminary Key Environmental Factors may be relevant to the Proposal and that they should be reported on in this ER document.

- **Hydrological Processes** - groundwater drawdown and altered surface water flow regimes.
- **Flora and Vegetation** - clearing, groundwater drawdown and surface discharge of surplus mine dewater.
- **Terrestrial fauna (conservation significant fauna species and their habitats)** - vegetation clearing and vehicle movements.

The Proponent also independently assessed and identified all environmental factors that may be relevant to this Proposal, based on the EPA’s EAG8. The assessment included consideration of existing legislative controls for each identified key and non-significant factors. The outcome of this assessment is shown in Figure 3-1.
Brockman 4

Figure 3-1  Identified Environmental Factors and Legislative Controls for the Revised Proposal (from EAG8)

The preliminary Key Environmental Factors that are relevant to this Proposal are described and discussed in this ER as follows:

- Hydrological Processes (Section 7)
- Flora and Vegetation (Section 8)
- Terrestrial Fauna (Section 9)

The Proponent considers that for the following factors the B4 Revised Proposal will not result in any significant change in addition to, or different from, that originally assessed and approved under MS 717. Each of these factors has been addressed in this ER as indicated:

- Rehabilitation and Closure (Section 11)
- Heritage (Section 11)
- Air Quality (Section 11)
- Visual Amenity (Section 11)
- Residual Risk and Management (Section 13).
3.3 PROPOSED ENVIRONMENTAL CONDITIONS

The Proponent has developed proposed environmental conditions (refer to Appendix 4) to address the key environmental aspects of the B4 Revised Proposal. It is proposed that these environmental conditions be applied to the B4 Revised Proposal (i.e. the B4 Operation and this Proposal) and to replace the existing MS 717.

These environmental conditions have been proposed so as to not duplicate other regulatory controls that are, or will be, applied under other existing legislation (refer to Section 14).

A condition has not been proposed if the environmental factor is considered to be adequately addressed by other environmental control instruments (i.e. the existing B4 Operation Environmental Management Plan {EMP}).
4 PROPOSAL TENURE

4.1 STATE AGREEMENT AND MINING ACT

The B4 Operation is located on Mineral Lease 4SA (ML4SA) which was granted in 1965 under the Iron Ore (Hamersley Range) Agreement Act 1963 (Figure 4-1). State Agreements are contracts between the State and major project developers that establish a framework of rights and obligations for both parties to facilitate the development of resources and/or downstream processing projects in Western Australia. The State Agreement provides rights of renewal of ML4SA for further periods of 21 years; the current expiry date of ML4S is 24 March 2028.

The infrastructure associated with the B4 Operation is located on a number of Miscellaneous Licences and General Purpose Leases that were granted under the Mining Act 1978 (Figure 4-1). These include Miscellaneous Licences 47/141; 47/152; 47/153; 47/184; and 47/185 and General Purpose Leases 47/1225; 47/1227; and 47/1232. This tenure supports the B2 – B4 railway and road, the B4 powerline, the B4 airstrip, the Boolgeeda exploration camp and the B4 accommodation village.

In regards to tenure that has been granted under the Land Administration Act 1997, the majority of the B4 Operation is situated on Rocklea Station which is held by the Proponent. A portion of the proposed Development Envelope lies on Hamersley Station which is also held by the Proponent. The western part of the proposed Development Envelope extends onto Cheela Plains Station, and the maximum modelled extent of the proposed discharge footprint extends across parts of Rocklea, Cheela Plains and Mt Stuart stations. Cheela Plains and Mt Stuart stations are held by separate third parties.

All pastoral leases in Western Australia issued under the now repealed Land Act 1993 expire on 30 June 2015. When these pastoral leases are reissued to lessees some portions of some stations across the region will be retained by the State and added to the conservation estate and other areas will be set aside for conservation management under conservation agreements with the Department of Parks and Wildlife (DPaW). The parts of Rocklea Station, Hamersley Station, Cheela Plains Station or Mt Stuart Station that are relevant to this proposal will not be subject to these changes.

4.2 NATIVE TITLE

The proposed Development Envelope lies within Native Title claim areas belonging to two Traditional Owner groups.

The native title claim over the western area was lodged in 2001 by the Puutu Kunti Kurrama and Pinikura (PKKP) people; in March 2011 a claim wide participation agreement was signed with the Proponent which provides consent of the PKKP people to the Proponent’s operations including to this Proposal.

The Eastern Guruma group has determined native title over land covered by the eastern part of the proposed Development Envelope. This part of the proposed Development Envelope is subject to an Indigenous Land Use Agreement between the Eastern Guruma group and the Proponent, and provides consent of the Eastern Guruma people to Rio Tinto’s operations including to this Proposal.
4.3 LAND USE AND SOCIAL ENVIRONMENT IN PROXIMITY TO THE PROPOSAL

The Proposal is located in the Shire of Ashburton (Pilbara Region) and is approximately 60 km and 80 km from the towns of Tom Price and Paraburdoo respectively (refer to Figure 1-1).

4.3.1 Pastoral Activities

Pastoralism has been active in the area for over 100 years, with grazing by sheep until 1970 and by cattle thereafter. The Proponent holds and directly manages five stations in the Pilbara region: Karratha, Hamersley, Rocklea; Yarraloola and Juna Downs. The Proponent also holds a sixth station in the Pilbara (Yalleen) which is sub-leased to a third party.

The Revised Proposal is mostly located within Rocklea Station which borders Hamersley Station (Figure 4-1). The Hamersley Station homestead is the closest residential premise (other than the Proponent’s accommodation: the Brockman 2 camp, the B4 village and the Jeeriwah Village at Nammuldi) and is located approximately 23 km from the Proposal. Cheela Plains Station homestead is approximately 30 km south-west of the Development Envelope. Cheela Plains Station is a family owned and managed cattle station which was formerly part of Wyloo Station until 2001. The Mt Stuart Station is a family owned and managed cattle station located west of Cheela Plains Station. The now abandoned Duck Creek Homestead is located on Mt Stuart Station.

4.3.2 Relationship with existing operations

The Brockman 2 Detrital Iron Ore Mine (Brockman 2) and Nammuldi Silvergrass Iron Ore Mines (Nammuldi-Silvergrass) are located approximately 22km and 32km north east of the Develop Envelope, respectively.

The Brockman rail spur extends from the Proponent’s existing Paraburdoo – Dampier rail line and services the Brockman 2, Nammuldi, Silvergrass and Brockman 4 operations. Similarly power for each of these operations is supplied from the main 220 kV powerline that extends from Dampier to Brockman 2.

The Nammuldi-Silvergrass Expansion Project Area overlaps the Brockman 2 operation and includes provision for vehicle access from B4 to Nammuldi, thence to Silvergrass. Linear infrastructure authorised for B4 under MS 717 (rail, power, roads, water pipeline) extends from north-east of the Nammuldi mine, through both Nammuldi and Brockman 2 to the B4 operation. The Nammuldi-Silvergrass Expansion Project Area, Brockman 2 operation and the proposed B4 Development Envelope therefore overlap (Figure 4-1).

The Western Turner Syncline Stage 2 operation is located 40 km east/south east from the Proposed Development Envelope (refer to Figure 4-1). The southern linear infrastructure corridor of the proposed Development Envelope (Area 2) intersects with the WTS Stage 2 Development Envelope along its north-western edge.
4.3.3 Tourism

National Parks are the major tourism focus in the central Pilbara region. The Revised Proposal is located approximately 90 km from the nearest boundary of the Karijini National Park and 100 km from the nearest boundary of the Millstream Chichester National Park.

The Development Envelope contains no significant features that warrant attention from the tourism sector. There are few public roads in the vicinity to facilitate access for tourists; therefore tourism is very limited in, or adjacent to, the Development Envelope.
Figure 4-1
Tenure of the Brockman Syncline 4 - Revised Proposal
5 STAKEHOLDER CONSULTATION

Identified key stakeholders for this Proposal include:

- **Government agencies:**
  
  - Office of the Environmental Protection Authority (OEPA);
  
  - Department of Parks and Wildlife (DPaW) – Pilbara region, Perth Environmental Management Branch (EMB);
  
  - Department of Environment and Regulation (DER);
  
  - Department of State Development (DSD);
  
  - Department of Mines and Petroleum (DMP);
  
  - Department of Water (DoW) – Pilbara regional office, Perth office; and
  
  - Department of Aboriginal Affairs (DAA).

- **Traditional Owners:**
  
  - Puutu Kunti Kurrama and Pinikura People (PKKP); and
  
  - Eastern Guruma Group.

- **Cheela Plains Pastoral Station.**

- **Mt Stuart Pastoral Station**

Stakeholder consultation undertaken to date, and the Proponent’s response to issues raised, is detailed in Table 5-1. The Proponent will continue to consult with relevant stakeholders during the environmental approval process and during implementation of the Proposal.
## Table 5-1: Stakeholder Consultation Relevant to this Proposal

<table>
<thead>
<tr>
<th>Date</th>
<th>Topics/Issues Raised</th>
<th>Proponent Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/07/2013</td>
<td>The Proponent provided a detailed overview of the Proposal and discussed the preferred approvals pathway. OEPA advised that surface discharge, as a new factor in addition to MS 717, should be assessed via an API A.</td>
<td>The Proponent accepted the OEPA’s position that the Proposal warranted formal assessment via an API A.</td>
</tr>
<tr>
<td>26/09/2013</td>
<td>The Proponent discussed additions to the scope of the Proposal which included additional clearing at B4 and some administrative changes to Schedule 1 of MS 717. The OEPA requested detailed information regarding the significance of the proposed clearing. OEPA advised that the administrative changes to Schedule 1 of MS 717 could proceed via a s45c application.</td>
<td>The Proponent provided detailed information regarding the additional clearing required.</td>
</tr>
<tr>
<td>12/11/2013</td>
<td>Based on the information provided by the Proponent regarding the significance of the proposed clearing, the OEPA requested that the clearing be included in the API for assessment with the proposed surface water discharge.</td>
<td>The Proponent revised the draft API and s45C documents accordingly.</td>
</tr>
<tr>
<td>25/11/2013</td>
<td>The OEPA advised the Proponent that all proposed works should be included in the API as a Revised Proposal to MS 717.</td>
<td>The Proponent revised the draft API document accordingly.</td>
</tr>
<tr>
<td>2/4/2014</td>
<td>The OEPA advised the Proponent that additional information was required in the API document prior to assessment including further details on alternatives considered for surplus water management, vegetation mapping, terrestrial fauna and revision to the proposed Development Envelope. The requirement for and timing of a discharge monitoring and management plan was also discussed and agreed.</td>
<td>The Proponent revised the draft API document accordingly and prepared the draft Discharge and Riparian Vegetation Monitoring and Management Plan for submission with the revised API document.</td>
</tr>
<tr>
<td>28/05/2014</td>
<td>Discussion was held regarding the format and extent of the proposed Development Envelope allocation of clearing between aspects of the B4 Project.</td>
<td>The Proponent revised the proposed Development Envelope and allocation of clearing.</td>
</tr>
<tr>
<td>Date</td>
<td>Topics/Issues Raised</td>
<td>Proponent Response</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Department of Parks and Wildlife (DPaW)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29/07/2013</td>
<td>Rio Tinto - DPAW Quarterly Meeting: the Proponent presented on the proposed surface discharge to Boolgeeda Creek at the Rio Tinto – DPaW Quarterly meeting. No issues or concerns were raised by DPaW.</td>
<td>The Proponent will continue to consult with DPaW throughout the environmental approvals process.</td>
</tr>
<tr>
<td><strong>Department of Environment Regulation (DER)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ongoing</td>
<td>The Proponent will apply for approval to discharge surplus dewatering water to the environment under Part V of the <em>Environmental Protection Act 1986</em>. This includes providing a detailed overview of the Proposal, relevant environmental studies, potential environmental impacts and proposed management.</td>
<td></td>
</tr>
<tr>
<td><strong>Department of Mines and Petroleum (DMP) – Operations and Environment Division</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30/06/2014</td>
<td>The Proponent gave an overview of the proposal, the level and progress of the assessment under Part IV of the EP Act. DMP indicated that should it have questions or require clarification on any aspect of the proposal it would request a meeting with the Proponent.</td>
<td></td>
</tr>
<tr>
<td><strong>Department of Water (DoW) – Perth Office</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ongoing</td>
<td>The Proponent is liaising with the DoW to amend the existing <em>Rights in Water and Irrigation Act 1914</em> Groundwater Licence (GWL164398), to increase the abstraction limit from 4.53 GL/a to 6.4 GL/a. The Groundwater Operating Strategy under GWL164398 will also be updated. This involves providing an overview of the Proposal, relevant hydrogeological studies and proposed management measures, with a focus on groundwater management issues.</td>
<td></td>
</tr>
<tr>
<td><strong>Department of State Development</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ongoing</td>
<td>The Proponent provides ongoing updates on relevant projects at monthly meetings with the DSD. No specific concerns have been raised to date with the Proposal.</td>
<td>The Proponent will continue consultation with DSD.</td>
</tr>
<tr>
<td>Date</td>
<td>Topics/Issues Raised</td>
<td>Proponent Response</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ongoing</td>
<td>The Proponent provides ongoing updates on relevant Proposals and heritage matters at regular liaison meetings.</td>
<td>The Proponent will continue liaising with the DAA and will discuss Proposal specific matters as required. The Proponent will consult with DAA regarding any planned submissions for approval under s18 of the Aboriginal Heritage Act 1972 to disturb any heritage sites that cannot be avoided.</td>
</tr>
</tbody>
</table>

**Department of Aboriginal Affairs**

<p>| Cheela Plains Station Owners | Meeting with Evan and Robin Pensini of Cheela Plains Station in town of Paraburdoo. The Proponent provided the background approvals history for the B4 Project and outlined details of the Proposal. Key issues of concern raised and discussed included: • The Station owners preferred choice of surplus water management for the B4 Project is re-injection to another aquifer. • Discharge of open waters into Boolgeeda Creek that will extend into Cheela Plains station is likely to attract feral animals (mainly donkeys and cattle). • The public availability of the SCARD Management Plan. • Agreement to meet again toward the end of January 2014 once the API document is drafted. | The Proponent advised that the API document would provide information regarding the consideration of alternative surplus water management options and that it would address the issue for feral animals. The Proponent, if requested, will provide information from the Proponent’s SCARD Management Plan. A follow-up meeting was scheduled to coincide with Cheela Plains Station owners being in Perth between 26 January and 11 February 2014. |
| 28/11/2013 | Meeting with Evan and Robin Pensini of Cheela Plains Station in the Proponent’s Perth office – a follow up to the previous meeting in November 2013. The Proponent provided a copy of draft API document (version dated February 2014 Revision 1) as issued to the OEPA on 3 February 2014 and went through the broad structure and content of the document. Confirmation was given that the SCARD plan was included in the draft API document. Evan and Robin Pensini sought confirmation that the earlier consultation and the matters raised at that meeting had been incorporated in the draft API. | The Proponent advised that it would keep Evan and Robin Pensini advised on key developments in the approvals process and that comments received back from them on the draft API would be considered in future revisions of the document. The Proponent provided a copy of the API document to Mr and Mrs Pensini’s Legal Counsel in response to a request in a follow up email. |
| 7/2/2014   |                                                                                       |                                                                                     |</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>Topics/Issues Raised</th>
<th>Proponent Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>21/03/2014</td>
<td>Meeting between Robyn Sermon (Rio Tinto) and Evan and Robin Pensini of Cheela Plains Station in the Proponent’s Perth office.</td>
<td>The Proponent agreed to:</td>
</tr>
<tr>
<td></td>
<td>Issues raised and discussed included:</td>
<td>• Visit Cheela Plains.</td>
</tr>
<tr>
<td></td>
<td>• Environmental and economic concerns about the impact of the proposed discharge of surplus waters from Brockman 4 Project into Boolgeeda Creek.</td>
<td>• Organise a briefing on future plans.</td>
</tr>
<tr>
<td></td>
<td>• Questions about discharge of waters into Beasley River from Western Turner Syncline.</td>
<td>• Provide update on the surplus water discharge Proposal for Boolgeeda Creek and send a copy of Appendices disk (disk with Appendices sent on 26 March 2014).</td>
</tr>
<tr>
<td></td>
<td>• Concerns about ongoing development by the Proponent on Cheela Plains Station in the future.</td>
<td></td>
</tr>
<tr>
<td>13/06/2014</td>
<td>Mr and Mrs Pensini were provided with a copy of the draft Discharge MMP</td>
<td></td>
</tr>
<tr>
<td>17/06/2014</td>
<td>Meeting between Robyn Sermon, Peter Royce and Jenny Carter (Rio Tinto) and Evan Pensini of Cheela Plains Station at Cheela Plains Station.</td>
<td>The Proponent agreed to:</td>
</tr>
<tr>
<td></td>
<td>The draft Water Discharge and Riparian Vegetation Monitoring and Management Plan was discussed and Boolgeeda Creek in the vicinity of the B4 project was visited.</td>
<td>• Revise the draft MMP to include management actions for impacts from feral animals and weeds on Cheela Plains Station that may result from discharge to Boolgeeda Creek.</td>
</tr>
<tr>
<td></td>
<td>Issues raised and discussed included:</td>
<td>• Provide copies of the revised API document and the revised draft Discharge MMP to Mr and Mrs Pensini following submission to OEPA.</td>
</tr>
<tr>
<td></td>
<td>• Environmental and economic concerns about impact of dewatering from the Brockman 4 Project and discharge into of surplus waters into Boolgeeda Creek. In particular:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Attraction of feral animals and control.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Spread of weeds and control.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Effect of permanent water on biodiversity and ecosystem structure along the creek.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Responsibility for management of impacts resulting from discharge</td>
<td></td>
</tr>
</tbody>
</table>

In addition to the meetings detailed above, communication is ongoing with Mr and Mrs Pensini of Cheela Plains Station.
<table>
<thead>
<tr>
<th>Date</th>
<th>Topics/Issues Raised</th>
<th>Proponent Response</th>
</tr>
</thead>
</table>
| 13/01/2014 | Conversation with Martin (at Mt Stuart Station) and Deborah (at Badgingarra farm) Avery. The Proponent provided the background approvals history for the B4 Operation and outlined details of the Proposal. Key issues of concern raised and discussed included:  
  - Will the quality of the discharge water into Boolgeeda Creek be suitable for feral herbivores/cattle?  
  - It was considered that water would not pool along Boolgeeda Creek for more than a day or so (based on cyclonic rainfall events).  
  - Provision of Proposal details. | The Proponent noted these comments and addressed water quality in the API document.  
  A copy of the API, as submitted to the OEPA, will be provided to both the Mt Stuart Station and Badgingarra properties. |

### Puutu Kunti Kurrrama and Pinikura (PKKP) – Traditional Owner

**Ongoing**

Issues relevant to the B4 Project are discussed with PKKP at six monthly Local Implementation Committee (LIC) meetings, as agreed to in the claim-wide Participation Agreement. This proposal was raised at the LIC meeting in Dampier on the 26 November 2013.

The Proponent will continue with regular consultation with PKKP through the LIC meetings.

### Eastern Guruma – Traditional Owner

**Ongoing**

Any issues relevant to the Eastern Guruma People are raised at quarterly Monitoring and Liaison Meetings. It is a condition of the Agreements that notification of any activities is provided to Eastern Guruma prior to works taking place and effort is made to address any areas of concern raised by the group.

The Proponent will continue with regular consultation with Eastern Guruma through the Monitoring and Liaison meetings.
6 DEWATERING AND SURPLUS WATER MANAGEMENT

This section describes the changes to the orebody dewatering, site water balance and surplus water management strategy that forms part of this Proposal. Assessments of impacts that may result from these changes are discussed in Section 6 and Section 7.

6.1 HYDROGEOLOGICAL MODELLING

Hydrogeological modelling undertaken in 2008 predicted that relatively low rates of dewatering would be required over several years in order to mine the below water table orebodies of the B4 Project (Aquaterra 2005; 2008a and 2008b). Key improvements in the hydrogeological conceptual model for the B4 Operation have been made since that time (Figure 6-1) (Rio Tinto 2013b and Rio Tinto 2013c). These include:

- The permeability of the dolerite sill within the Brockman Iron Formation is now thought to be lower than originally modelled. The result is that this appears to hydraulically disconnect the Boolgeeda Valley and the Hamersley Group that lie above the sill (Zone 1) from the mineralised Brockman Iron Formation (Zone 2). This disconnect is confirmed by a measured difference in groundwater levels of up to 10m between the two zones.

- The lower un-mineralised Marra Mamba Iron Formation and the Fortescue Group (Zone 4) are now thought to be disconnected from the mineralised Marra Mamba Iron Formation and Wittenoom Formation (Zone 3) due to their very low permeability. These have now been designated as an inactive zone in the groundwater model.

- The mineralised Brockman Iron Formation (Zone 2) and the Wittenoom Formation (Zone 3) are juxtaposed by faulting between the Centre and Western Pits which allows for hydraulic connection.

Hydrogeological modelling using this improved understanding has indicated that the groundwater drawdown at the end of mining due to dewatering is likely to be less extensive than that predicted in 2008 (Figure 6-2). The change in drawdown is due to inclusion in the revised model of lower permeability rates of the sill and the lower un-mineralised Marra Mamba and Fortescue Group.

Conversely, the peak dewatering rate is predicted to be higher at 16.7 ML/d (6.12 GL/a). This increase is due in part to the increased hydraulic connection between the Brockman Iron Formation and the Wittenoom Formation in the revised model, but is compounded by the sub-optimum dewatering undertaken, between 2008 and 2013. In order to optimise dewatering for mining and to make up for the constraints on dewatering that have been in place to date, the abstraction rate will need to be increased. This optimised dewatering rate combined with the lower permeability rates described above will result in deeper drawdown with a reduced lateral footprint over the mine life.

As the groundwater drawdown of the proposal is expected to be smaller overall than that approved under the Original Proposal (Figure 6-2), the impacts of dewatering on groundwater levels and subterranean fauna have not been considered in this document.
Figure 6-1  B4 conceptual hydrogeological model
Figure 6-2
Comparison of predicted end of mining drawdown
6.2 OREBODY DEWATERING AND WATER BALANCE

The initial groundwater modelling for the B4 Operation predicted that water generated from dewatering could be entirely used to meet onsite demand (Aquaterra 2005; 2008a and 2008b). It was also determined that later in the mine life an additional external source of water would be required to meet demand following reduction in predicted dewatering volumes. Consequently, in the Original Proposal, management of surplus water was not considered necessary.

When approval was obtained in December 2008 for an increase in throughput at the B4 Operation (from 22 to 42 Mtpa) the ongoing water demand for the site was estimated at approximately 4.53 GL/a (4.38 GL/annum plus 0.15 GL/annum to supply the mine camp), overall this was equivalent to 12.4 ML/d. To date, this volume of water use has not been required (Table 6-1), meaning that under the existing approval (with no surplus water management option) the dewatering required to safely mine below the water table safely has not been possible. The result is that the mine plan has been constrained by availability of dry ore for a number of years.

Table 6-1: Actual Abstraction and Water Use at the B4 Project

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Abstraction/Water Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GL/annum</td>
</tr>
<tr>
<td>2008</td>
<td>0.67</td>
</tr>
<tr>
<td>2009</td>
<td>0.74</td>
</tr>
<tr>
<td>2010</td>
<td>1.15</td>
</tr>
<tr>
<td>2011</td>
<td>2.39</td>
</tr>
<tr>
<td>2012</td>
<td>2.66</td>
</tr>
<tr>
<td>2013</td>
<td>2.68</td>
</tr>
</tbody>
</table>

With an improved understanding of the hydrogeology of the area from monitoring data and further hydrogeological drilling and testing programs, the mine plan has been revised and an update to the future dewatering requirements has been undertaken. A demand-based dewatering strategy can no longer be used to meet the mine plan and therefore a surplus water management strategy is required. Figure 6-3 depicts the expected water demand and surplus water volume based on the current predicted dewatering requirements.

Figure 6-3 illustrates the predicted water demand for the B4 Project, the predicted dewatering volumes and the likely surplus water volumes on an annual basis. This simplified conceptual water balance includes the assumption that although the actual dewatering requirement will vary, the water demand will remain relatively constant at around 8 ML/day for the life of mine. Under this circumstance the surplus water volume is predicted to be in the order of 4-5ML/day for much of the life of the operation, with the occasional peak in abstraction volume in the order of 16-17 ML/day; with a corresponding increase in discharge.

Peaks in abstraction rates are generally encountered when new below water table pits are developed (i.e. dewatering commences in a new area of the aquifer), when vertical mining rates increase or when a part of the aquifer with increased permeability is encountered. Consequently the timing and

---

3 Predicted abstraction, demand and surplus volumes based on mine plan as at May 2014

4 For a production rate of ~45Mtpa product
scale of the peaks in abstraction are largely influenced by the mining schedule and the nature of the aquifer being dewatered and will vary according to operational circumstances.

![Graph](image)

**Figure 6-3: Conceptual Water Balance for the B4 Project**

The volumes indicated here are based on hydrogeological and water use modelling. The figures provided differ from those presented for the B4 Operation and represent a progression in the hydrogeological conceptualisation of the area based on actual dewatering to-date combined with further investigation of the orebody. In addition changes have been made to the mine plan since the B4 Operation was developed. Such changes are common and are often implemented in response to factors such as conditions encountered during mining, grade requirements, ore quality, market conditions, performance of the dewatering system and water usage on site. These factors will continue to influence the dewatering volumes during the remainder of the life of the B4 Operation, making it difficult to predict exactly how much water will be abstracted, used or discharged at any point in time.

The environmental approvals process under Part IV of the EP Act is such that a reasonable prediction of abstraction and discharge volumes is required to be presented by the Proponent based on technically-sound information that is available at the time. This is so that the scale of any resultant environmental impacts can be realistically assessed and addressed and a limit can be applied to the authorised abstraction and/or discharge volumes in Schedule 1 of the associated Ministerial Statement. The Proponent considers that a conservative upper limit on abstraction and discharge is appropriate given that the prediction of these volumes:

1) is the result of modelling;
2) is required to apply to an operation in the long term (e.g. 20-30 years); and
3) can be influenced by a number of factors during the execution of the project (as described above).

Adoption of a conservative limit allows flexibility in managing the dewatering program to maximise efficiency without an artificial constraint on abstraction volumes. In the long term, an efficiently run targeted dewatering program produces less water overall than an inefficient system, run at a suboptimal abstraction rate. Where water is abstracted at an insufficient rate, an orebody aquifer may be allowed to continually refill and will therefore require dewatering over a longer period of time in order to mine the same pits, resulting in a greater volume of water abstracted over the life of the mine.

Therefore this Proposal includes an abstraction limit of 17.5 ML/day: a volume above that which is predicted by the current model (16.7 ML/day). This is considered to represent a realistic limit that allows for fluctuation in the actual peak abstraction, although for the majority of years the abstraction is expected to be lower. A similar approach to setting conservative abstraction limits was adopted for the Nammuldi-Silvergrass Expansion (MS 925, 11 January 2013).

Whilst water use at the B4 Project is expected to be constant at about 8 ML/day, there will be operational factors that may apply on a day to day basis that result in more than or less than this volume being used. The processing plant and dust suppression together account for the greatest on-site consumption of water. Clearly during periods of rain the requirement for dust suppression on haul roads and other open areas is significantly reduced and consequently so is the demand for water. In the event of a plant shutdown, water use is similarly reduced. These are normal occurrences in the operation of a mine where short-term water demand may fall. Under such circumstances mine dewatering continues in order to allow continued access to below water table ore and therefore when demand falls there is a corresponding short-term increase in the surplus water volume that requires management.

Under this Proposal, the additional surplus water produced in such circumstances would be discharged into Boolgeeda Creek, as required, up to the prescribed limit. This management option is discussed in the following sections. Note that the difference in the extent of the maximum discharge footprint resulting from 17.5 ML/day compared to 16.7 ML/day (a difference equivalent to 0.8 ML/day) is not expected to be significant and nor is it expected to cause impact to any additional identified environmental values of high conservation significance.

6.3 CONSIDERATION OF OPTIONS FOR SURPLUS WATER MANAGEMENT

Management of surplus water on the Proponent’s sites follows environmental and water use standards that align with the Western Australian DoW’s preferred options for surplus water disposal (DoW 2013). The DoW recommended disposal options are:

- use on site;
- transfer to another site or industrial location;
- re introduction to aquifer(s);
- controlled discharge to natural watercourses (e.g. irrigation, storage and periodic discharge); and
The following surplus water use assessment (Table 6-2) is based on that conducted for the Nammuli-Silvergrass Expansion (Expansion) which was assessed by EPA in 2012 (Report No. 1457). Whilst the surplus water volumes predicted for the Expansion are significantly in excess of those predicted for the B4 Revised Proposal, the operations are located approximately 35 km apart, within the same region. It is therefore considered that the surplus water management assessment conducted for the Expansion can reasonably be applied to the B4 Revised Proposal. The Expansion assessment has been reviewed in consideration of the following differences for the B4 Revised Proposal:

1) Lower volume of surplus water: dewatering of up to 6.4 GL/annum for the B4 Revised Proposal (annualised volume based on 17.5 ML/day) and on average 4-5 ML/day (vs combined dewatering of up to 119 GL/annum, equivalent to 326 ML/day, for the Expansion).

2) Unreliability of water supply: in-pit bores have relatively low utilisation rates due to constraints on bore operating hours imposed by blasting, mining and power supply. The B4 Revised Proposal will only need to employ a small number of bores which will be located primarily in-pit; in contrast to the Expansion there is therefore unlikely to be a reliable base load supply of surplus water to support a business case for management through development of beneficial use, or transfer via a purpose-built pipeline. The majority of the dewatering volume will be used to supply the operational water demands, and while dewatering volumes at the B4 Revised Proposal may peak at over 16 ML/day, surplus volumes during normal operation are expected to average about 4-5 ML/day over the operational life.
### Table 6-2: Alternatives considered for the management of surplus water at the B4 Revised Proposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Options</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Transfer to another site or industrial use</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| a | Transferring surplus water to third party users | • Beneficial use of water. | • Any nearby third party user identified in the future would likely source water from a mine with larger, more reliable volumes such as Nammuldi-Silvergrass or Marandoo.  
• Contractual difficulties associated with inability to guarantee supply to a third party (e.g. if less water or unreliable supply of water is available from dewatering).  
• Difficulties attracting a third party user as the water supply will not be available in the long-term.  
• No third party user of such volumes of water in proximity, therefore transfer to a third party would require that water be moved a significant distance resulting in high piping and pumping costs for a relatively small volume of water.  |
| b | Transfer off-site for secondary use by the Proponent’s other operations | • Beneficial use of water.  
• As water is transferred to the Proponent’s own operations there are no contractual difficulties.  
• Avoids the need for other operations to source water locally. | • Currently the Proponent has no local operation that cannot meet its own water demand.  
• Capex and Opex associated with piping and pumping further afield would be significant for a relatively small volume of water.  |
| c | Transfer for incorporation into the West Pilbara Water Supply Scheme (WPWSS) | • Water can be used for public water supply. | • The Proponent’s Bungaroo borefield is closer, can supply significantly more water, has a longer supply life and is already approved under Part IV.  
• Significant additional clearing footprint for pipeline, across tenure that the Proponent currently does not have access to.  
• High Capex and Opex associated with piping and pumping for a relatively small volume of water.  |
| d | Transfer off-site for secondary use by the Proponent agricultural operations | • Beneficial use of water.  
• As water is transferred to different the Proponent’s operations there are no contractual difficulties. | • Nearest agriculture project is at Nammuldi. Supply from B4 Revised Proposal to the agriculture project would offset surplus water from the Nammuldi-Silvergrass Expansion and result in additional discharge to Duck Creek.  
• Volume of water available from B4 Revised Proposal is insufficient to warrant cost and complexity of approvals for a new agriculture project (e.g. on the Proponent’s Rocklea Station).  
• Additional clearing of Pastoral Station required.  
• High Capex and Opex associated with piping and pumping for a relatively small volume of water.  |
| e | Supply Tom Price town | • Water can be used as public water supply. | • A portion of the surplus water volume from dewatering of the Proponent’s Marandoo operation is currently used to meet Tom Price mine and town demand using existing infrastructure and an existing Part IV approval. Therefore, there is no demand for water from B4 Operation at Tom Price.  
• Significant additional clearing for a pipeline between B4 Operation and Tom Price.  
• High Capex and Opex associated with piping and pumping for a relatively small volume of water for a short period of time.  |
| 2. Reintroduction to aquifer(s) | | | |
| a | Passive recharge via a disused pit | • Water can be returned to local groundwater system. | • No pits at the B4 Operation have yet been mined-out and therefore no pit will be available to accept surplus water at the commencement of dewatering.  
• Use of a mined out pit for passive recharge would prevent potential backfilling and increase external waste dumps.  
• All pits within the deposit are hydrogeologically connected which would result in recycling of water and an overall increase in dewatering volumes.  
• Discharge within extent of drawdown would result in recycling of water and greater pumping required to lower water table.  
• Mining is currently occurring in the mineralised Joffre and Dales Gorge Members of the Brockman Iron Formation. Although there are several significant faults and dolerite dykes dissecting the deposits, some of which are thought to have an impact on groundwater flow, these do not isolate any areas where water could be passively re-injected without adversely affecting current mining operations within the Brockman Iron Formation, or potential future mining within the Marra Mamba Formation.  |
| b | Aquifer reinjection | • Water can be returned to local groundwater system. | • Investigations into the permeability and storage potential of the formations present identify only the Paraburdoon Member of the Wittenoom Formation as being a realistic target for re-injection (Rio Tinto 2011b) and would require a large number of boreholes to be successful.  
• Not considered to be possible to locate required number of boreholes on the Proponent’s tenure.  
• Significant additional clearing for drilling and location of pipeline infrastructure.  
• Uncertainty over finding sufficient appropriate formations within reasonable distance and timeframe.  
• Capacity of Paraburdoon Member to accommodate the full amount of surplus water is unknown.  
• Paraburdoon Member in proximity to the B4 Operation is in hydraulic connection with future Brockman Syncline 4 Marra Mamba deposits and in poor connection with the Brockman Iron deposits currently being mined, compromising current and future mining.  
• High Capex associated with drilling enough investigative and reinjection boreholes.  |
| c | Re-injection into creek alluvium | • NA | • Boolega Formation creek alluviums are generally shallow and underlain by low permeability basement units, resulting in low water storing capacity. Rejected water may surface in Boolega Creek.  
• Capex of reinjection into alluvium is relatively high for the small volume of water involved.  |
<table>
<thead>
<tr>
<th>No.</th>
<th>Options</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Controlled discharge to single natural watercourse:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| a   | Duck Creek (regional option) | - Not constrained by demand.  
- Comparatively wetter than other creeks in the area (e.g. contains more pools); therefore, natural system is more adapted to presence of water.  
- No locations with exceptional environmental value, such as areas included in the EPA Red Book listings.  
- Culturally significant sites comparatively further away from discharge locations.  
- No effect on development of iron ore deposits in future. | - Surface expression of water will be further downstream than ‘drier’ neighbouring creeks.  
- Periodic discharge to Duck Creek would be changed to continuous discharge by addition of B4 surplus water.  
- Potential for cumulative impacts from additional, continuous discharge to Duck Creek.  
- Of options considered, existing Duck Creek discharge location is furthest from B4 Project (>20 km) resulting in comparatively higher piping costs.  
- High Capex and Opex associated with piping and pumping for a relatively small volume of water for a short period of time. |
| b   | Boolgeeda Creek (local option) | - Not constrained by demand.  
- Comparatively drier than other creeks, the surface expression of peak discharge volume will not extend as far downstream as it would in the Beasley River.  
- No locations with exceptional environmental value, such as areas included in the EPA Red Book listings.  
- Closest creek to B4 Project results in lower piping and pumping costs.  
- Closest creek to B4 Project simplifies logistics for construction, operation, monitoring and management of impacts.  
- Smallest clearing footprint of discharge options for 1.36km pipeline and discharge infrastructure.  
- No effect on development of iron ore deposits in future.  
- Discharge contained within country of one Traditional Owner group.  
- Impacts from discharge contained within the same valley/catchment as the B4 Project.  
- Discharge would be partway down the creek system, allowing greater flushing of system (e.g. with surface runoff and micro and macroinvertebrates) from the upper reaches natural during flow events and post-discharge. | - Potential for relatively greater change to ecosystem within discharge footprint.  
- Potential for surface water to affect existing access tracks that intersect Boolgeeda Creek.  
- Discharge at moderate volumes potentially extends onto pastoral leases of two third parties. |
| c   | Beasley River tributary (local option) | - Not constrained by demand.  
- No locations with exceptional environmental value, such as areas included in the EPA Red Book listings.  
- For lower discharge volumes (< peak volume) the surface expression of water will not travel as far downstream as it would in Boolgeeda Creek.  
- Discharge potentially extends onto pastoral lease of a third party only at higher volumes. | - Potential for relatively greater change to ecosystem within discharge footprint.  
- Larger clearing footprint of local discharge options for 3.8km pipeline and discharge infrastructure.  
- Discharge likely to affect country of two Traditional Owner groups.  
- Upper reaches of Beasley River already subject to surplus water discharges (from Western Turner Syncline Stage 2). Addition of water from B4 to a second tributary has potential to compound the impacts from existing discharge.  
- Discharge would be into the top of the tributary, removing the opportunity for replenishment of affected fauna species from flushing (e.g. micro and macroinvertebrates).  
- Shorter discharge footprint at low volumes potentially concentrates impacts from feral animals (e.g. trampling, grazing, nutrient input).  
- Furthest local creek to B4 Operation complicates logistics for construction, operation, monitoring and management of impacts.  
- Potential to have a negative impact on future mining operations of B4 Marra Mambas and Beasley River Limonite Channel Iron Deposit.  
- Discharge location further from B4 Operation of local options considered resulting in higher piping costs. |
<table>
<thead>
<tr>
<th>No.</th>
<th>Options</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| 4   | Discharge to multiple creeks | - Greater flexibility in terms of controlling and temporally spacing discharges, potentially minimising the scale of impacts within each receiving environment.  
- Potential to have greater capacity to dispose of surplus water. | - Potential for more creeklines to be affected and increased land disturbance.  
- Use of multiple creeklines complicates logistics for construction, operation, monitoring and management of impacts.  
- Increased resources required to monitor and manage multiple creeklines.  
- High costs associated with piping as pipelines and pumps for all discharge locations would need to be built to full capacity to allow flexibility. |
| 5   | Storage and pulsed discharge to creeks | - Greater flexibility in terms of controlling and temporally spacing discharges, potentially minimising the scale of impacts to receiving environment. | - Unlikely to identify a suitable location in proximity to Development Envelope.  
- Dam would be prohibitively large to provide effective spacing of discharges as well as accommodating flood/storm volumes, resulting in high costs and significant additional clearing and earthworks. |
| 6   | Other | - On-site disposal of water.  
- Controlled by the Proponent. | - Real-world experience shows that up to 50% of the jetted water does not evaporate but falls to the ground beneath the jet plume, creating runoff and irrigation of uncontrolled areas with potential for weed growth.  
- High cost, energy and greenhouse gas requirements.  
- Does not manage a material volume of water relative to the dewatering volumes.  
- Large scale water bottling operations goes against the Proponent’s sustainable development principles due to substantial increase in plastic footprint.  
- the Proponent’s research has shown that Pilbara groundwater quality typically does not meet the profile of minerals necessary to qualify as a marketable bottled water product.  
- Logistically difficult and expensive due to remote Pilbara location and large volume of water involved.  
- Risk associated with stability and seepage, WFSF is required to be relatively dry to avoid these problems.  
- the Proponent’s Mineral Waste Standards prohibit the storage of excess water in tailings dams and WFSF’s. WFSF’s are not designed for the purpose of water storage and rely on a constant cycle of solids beaching, evaporation of supernatant water and desiccation of waste fines to ensure geotechnical integrity of the WFSF contents.  
- Potential for concentration of salts in the WFSF and affecting potential for saline plume problems at closure.  
- Significant clearing required for pipeline to Nammuldi.  
- Closest WFSF is at Nammuldi necessitating high cost of piping and pumping for relatively small volume of water. |
| a   | Discharge to multiple creeks with discharge rotated between the creeks, allowing creeks to “dry out” between discharges: using combinations of the above creeks | | |
| b   | Containment in purpose built storage dam for pulsed discharge to creeks | - On-site disposal of water.  
- Local business opportunity, including indigenous business engagement. | |
| c   | Containment and evaporation from Waste Fires Storage Facility (WFSF) | - On-site disposal of water.  
- Rio Tinto controlled. | |
Development of the surplus water management strategy involved the consideration of a number of different alternatives in accordance with the DoW list of water use options published in the WA Water in Mining Guidelines (DoW 2013). A number of alternatives considered were excluded due to the prohibitively high costs, potential environmental impacts, or because they represent a substantial technical risk to the Proposal. In general the alternatives that were not preferred involved:

1) Secondary use by the Proponent or a third party was rejected due to the relatively small volumes of water and high costs involved, combined with the unreliability of supply and potential for constraints on demand.

2) Reinjection was rejected due to the technical uncertainty, absence of known suitable geological formations in proximity to the dewatering and the relatively small volumes of water and high costs involved.

3) Containment and/or discharge to regional creeklines was rejected due to the complexity of logistics and high costs involved for relatively small volumes of water in addition to the potential for cumulative impacts resulting from discharge to existing receiving water bodies (e.g. Duck Creek).

In view of the relatively small volumes of water, the unreliability of supply, the logistics and costs associated with transfer and/or use by another site or third party and the flexibility afforded by the absence of user-defined constraints it was concluded that surface discharge to a local natural watercourse (Boolgeeda Creek or a local un-named tributary of the Beasley River to the south of the B4 Operation) was the most appropriate option for further consideration. Comparison of these two options is discussed in further detail in the following section.

6.4 COMPARISON OF LOCAL SURFACE DISCHARGE OPTIONS

This section discusses the rationale for selection of a receiving water body for surplus water from the B4 Revised Proposal. In determining which option to choose, consideration was given to the following:

- hydrological response;
- vegetation and flora;
- aquatic fauna;
- logistics and costs; and
- future iron ore resources.

6.4.1 Hydrological response

The Proponent has developed a surplus water discharge model that it routinely uses to estimate the maximum surface water expression and wetting front that would be expected to result from discharge of water to a specified creek. The model is modified to apply to the particular creek under
consideration and has been used to estimate the likely discharge footprint that would result from discharge of surplus water into a number of Pilbara creeks.

This model was used to estimate the discharge footprints that may develop under steady state conditions in each of Boolgeeda Creek and the un-named tributary of the Beasley River for a hypothetical range of surplus water volumes (Rio Tinto 2013a). The maximum wetting front has been estimated for a range of discharge volumes from 2.5–20 ML/day in 2.5 ML/day increments in order to gauge the relative change in the footprint for increasing discharge volumes (Table 6-3). Wetting fronts were determined on the assumption that steady state conditions were established.

Table 6-3: Estimated Discharge Footprint in Boolgeeda Creek and Beasley River Systems

<table>
<thead>
<tr>
<th>Discharge Volume (ML/d)</th>
<th>Maximum wetting front (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boolgeeda Creek</td>
</tr>
<tr>
<td>2.5</td>
<td>12.0</td>
</tr>
<tr>
<td>5</td>
<td>22.0</td>
</tr>
<tr>
<td>7.5</td>
<td>31.0</td>
</tr>
<tr>
<td>10</td>
<td>33.0</td>
</tr>
<tr>
<td>12.5</td>
<td>34.0</td>
</tr>
<tr>
<td>15</td>
<td>35.0</td>
</tr>
<tr>
<td><strong>17.5</strong></td>
<td><strong>37.0</strong></td>
</tr>
<tr>
<td>20</td>
<td>38.0</td>
</tr>
</tbody>
</table>

Beasley River and tributary

The underlying basement of the Beasley River tributary and the Beasley River itself is the Fortescue Group. Aquifers associated with this group are generally of low permeability. Overlying the Fortescue Group is a laterally discontinuous cover of alluvium, colluvium and pisolite of Cainozoic age. Transient pools within the tributary and river are likely to depend on rainfall, surface water and shallow alluvial interflow rather than regional groundwater.

Boolgeeda Creek

Boolgeeda Creek catchment covers an area of approximately 1,650 km² and is a tributary of Duck Creek within the regional Ashburton River catchment. The creek extends approximately 106 km and is characterised by a braided, meandering creek dominated by multiple active and inactive flow channels that are likely to be reworked during flow events, within a broad valley. The creek becomes more defined when it enters a gorge system downstream of the B4 Operation, before discharging into Duck Creek at Lawloit Range (Rio Tinto 2013b).

The underlying basement of the Boolgeeda Creek valley comprises Tertiary valley fill and Quaternary alluvial gravels overlying the Hamersley Group (Boolgeeda Iron Formation and Woongarra Volcanics) and Turee Creek Group basement. Aquifers associated with the basement units (Hamersley Group and Turee Creek Group) are generally of low permeability. The valley fill material underlying the alluvium is typically less than 20 m thick with no significant inflow or outflows of groundwater (Aquaterra 2005). Transient pools within the creek bed are likely to depend on rainfall, surface water and shallow alluvial interflow rather than regional groundwater.

The geology of the two systems means that they are considered to be comparable in their capacity to accept surplus water discharge: neither has continuous inflow or outflow of groundwater – and
Therefore significantly greater or lesser capacity to “lose” surplus water from its channel. Both systems are known to have ephemeral pools within the modelled discharge footprint and are likely to respond to additional water from discharge by increased surface expression - in particular further pooling and continuous surface flows within the discharge footprint.

At peak discharge rates of 17.5 ML/day the maximum wetting front in Boolgeeda Creek is predicted to extend approximately 37 km from the discharge point. In the Beasley River tributary the footprint distance is predicted to be 7 km further at 44 km. However at lower discharge volumes the discharge footprint is expected to be less for Beasley than for the Boolgeeda system. In each system the velocities of the modelled discharge in the different reaches are not expected to vary significantly, surplus water is likely to be contained within the channel and water will remain relatively shallow throughout the discharge footprint. Each system is naturally dynamic and localised deeper areas would be expected to occur in either system due to changing morphology of the creek bed combined with surplus water discharge.

Therefore Boolgeeda Creek and the Beasley River tributary are expected to have comparable hydrological responses to discharge of surplus water.

6.4.2 Vegetation and Flora

Biota undertook vegetation and flora surveys in the Beasley River tributary valley in 2009 (Biota 2009a) and of Boolgeeda Creek in 2013 (Biota 2013a). Riparian vegetation monitoring transects were set up along Boolgeeda Creek by Biota in 2014 as part of the vegetation monitoring program to support the proposed discharge.

The riparian flora and vegetation of Boolgeeda Creek are described in further detail in Section 8 and Appendix 7. The following summarises the key features of vegetation associated with both creeks.

- Neither system contains any Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs).

- The riparian vegetation types of both systems are considered to be of Moderate Conservation Significance, consistent with fringing vegetation of major ephemeral watercourses in the Pilbara. Vegetation types dominated by Eucalypts (in particular Eucalyptus victrix and E. camaldulensis) are present within each system.

- The riparian vegetation in both systems is considered to be under threat from grazing and invasion by weeds, as is typical of major ephemeral watercourses in the region, with several species of introduced flora present and infestations of weeds (in particular Buffel Grass) considered to be affecting the vegetation condition of each system.

- No Declared Rare Flora (DRF) has been found in either system. However Priority Flora occur in the riparian vegetation in both systems

The identified vegetation and flora values within the Boolgeeda Creek and Beasley River tributary are considered to be comparable.
6.4.3 Aquatic Fauna

Aquatic fauna sampling and water quality monitoring has been undertaken in both systems as part of the ongoing monitoring program conducted by Wetland Research and Management (WRM) for surplus water discharge from the Nammulti-Silvergrass Expansion and the West Turner Syncline Stage 2 operations. Limited sites sampled on Beasley River and Boolgeeda Creek have shown that the composition of micro- and macroinvertebrates and fish taxa and overall species richness are similar in these systems to those found in Duck and Caves Creeks and comparable to other creek systems within the region and wider Pilbara.

Based on site inspections, both systems are known to have ephemeral pools and these may act as short-term refugia for fauna.

The identified aquatic fauna values within the Boolgeeda Creek and Beasley River tributary are considered to be comparable.

6.4.4 Logistics and costs

The discharge pipeline to Boolgeeda Creek will be approximately 2.5 km shorter than that which is required to reach the Beasley River tributary. In addition the Boolgeeda Creek pipeline route follows an existing track for much of its length. Therefore less clearing of native vegetation will be required overall for construction of the pipeline and discharge outlet.

6.4.5 Future iron ore resources

The Brockman Syncline 4 Marra Mamba deposit lies along the Marra Mamba ridge to the south of and parallel to, the existing B4 Brockman pits. Drilling has indicated that there is potential for future development of this deposit. A long term pipeline to Beasley River tributary would need to extend across the deposit and has the potential to sterilise part of the resource and/or complicate its mining and/or its associated infrastructure.

The Beasley River Limonite Channel Iron Deposits (CID) lies to the south of the B4 Operation, in proximity to the tributary of the Beasley River. The deposits occur on the Proponent’s tenure as a series of flat topped mesas occupying a 30 km palaeochannel: the present drainage has dissected the original continuous deposit to leave a series of mesas.

A preliminary drilling program in 2011/2012 indicated that the majority of the resource is above water table, with a groundwater level of 440-445 mRL within the deposit. Further drilling will be required to determine the extent of the deposit and to prove up the resource.

Current understanding of both the B4 Marra Mambas and Beasley River Limonites deposits is insufficiently advanced at this stage to provide confidence in the placement of a discharge pipeline such that it does not compromise and is not compromised by, future mining in this area.

The Proponent is not aware of any potential resource in close association with Boolgeeda Creek and therefore as a measure to protect the ability to investigate and develop both the B4 Marra Mamba deposit and Beasley River Limonites CID in future, discharge to Boolgeeda Creek is preferred over discharge to the Beasley River tributary.
6.5 DISCHARGE WATER QUALITY

At present the Eastern Borefield is used for potable water supply to the B4 camp and office facilities as well as mineral processing and dust suppression. The Western and Southern Strike Valley Borefields supply water for mineral processing and dust suppression, with some used for potable purposes. The Eastern Borefield is the preferred source for potable water because of its superior water quality compared with that of the Western and Southern Strike Valley Borefield.

Overall, the current groundwater quality at B4 is fresh to brackish with a neutral to slightly basic pH (Table 6-4). The surface water quality measured is not dissimilar to that observed in the existing B4 groundwater bores (Rio Tinto 2013d).

Table 6-4: B4 Water Quality

<table>
<thead>
<tr>
<th>Groundwater</th>
<th>pH</th>
<th>EC (µS/cm)</th>
<th>TDS (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Borefield</td>
<td>6.57-8.03</td>
<td>521-849</td>
<td>344-444</td>
</tr>
<tr>
<td>Western Borefield</td>
<td>6.71-7.71</td>
<td>946-1452</td>
<td>620-776</td>
</tr>
<tr>
<td>Southern Strike Valley Borefield</td>
<td>6.3-8.36</td>
<td>623-2310</td>
<td>576-1580</td>
</tr>
<tr>
<td>All</td>
<td>6.57-8.36</td>
<td>521-2310</td>
<td>344-1580</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surface Water**</th>
<th>pH</th>
<th>EC (µS/cm)</th>
<th>TDS (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boolgeeda Creek (BC1)***</td>
<td>8.72</td>
<td>1676</td>
<td>1000</td>
</tr>
<tr>
<td>Beasley River (BR1 &amp; BR2, BRWC1, BRWC2, BRWC3 &amp; BRWC4)</td>
<td>8.16-9.03</td>
<td>674-3820</td>
<td>650-3820</td>
</tr>
</tbody>
</table>

*Rio Tinto 2013d
**Wetland Research and Management 2011a; 2011b; and 2012
***Only one sample is available, therefore no range is provided

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000) provides a framework for setting of site-specific trigger values, establishing sampling regimes and undertaking decision-making in the event that actions are triggered. This will be adopted as at the Proponent’s other sites and site specific trigger values will be established and reviewed in accordance with the ANZECC/ARMCANZ framework. Monitoring and management of water quality is considered to be a surrogate for protection of aquatic faunal communities.

Part V of the EP Act provides an appropriate mechanism to regulate and control the quality of discharge water to a receiving environment.
7 ASSESSMENT OF IMPACT ON HYDROLOGICAL PROCESSES

This Section describes the hydrological systems that exist within the Greater Brockman region, provides details regarding the potential impacts to ground and surface water regimes that may result from the orebody dewatering and the discharge of surplus water that forms part of this Proposal and identifies mitigation and management that will be implemented.

The EPA applies the following objective, in its EAG8 (EPA, 2013) in its assessment of proposals that may affect hydrological processes:

To maintain the hydrological regimes of groundwater and surface water so that the existing and potential uses, including ecosystem maintenance, are protected.

7.1 GROUNDWATER DRAWDOWN

Dewatering of the orebody is now predicted to result in a smaller overall cone of depression than that authorised under the original proposal (MS 717). Therefore it is considered that there is no potential for additional impacts as a result of this Proposal.

7.2 SURFACE DISCHARGE TO BOOLGEEDA CREEK

The Boolgeeda Creek catchment covers an area of approximately 1,650 km² and is a tributary of Duck Creek within the regional Ashburton River catchment. The headwaters of the Boolgeeda Creek catchment rise from the mountain ranges of Mount Brockman and the Hamersley Range. The creek is approximately 106 km in length and is characterised by a braided, meandering creek dominated by multiple active and inactive flow channels within a broad valley. The creek becomes more defined when it enters a gorge system downstream of the B4 Operation, before discharging into Duck Creek at Lowlait Range. The general absence of permanent and semi-permanent water features suggests it is a relatively dry system, typical of ephemeral creeks in the Pilbara.

The Boolgeeda Creek is characterised by active creek beds of coarse sand and gravel that are likely to be reworked during flow events. There is also evidence of the development of a new secondary flow channel following these flood events which indicates that the system is dynamic and naturally capable of changing course and flow conditions (refer to Appendix 5).

There are no permanent stream gauging stations in the Boolgeeda Creek catchment. The Index Flood method has been used to estimate the ARI design peak flows following rainfall within the area of discharge. The proposed discharge outlet (MGA50 coordinates 521783E; 7504099N) is located at the upper reach of the main stream, requiring approximately 1.4 km extension from the existing pipe network at the B4 Operation. The peak flow of rainfall runoff estimated at this outlet is 148 m³/s for a 2 year ARI event and 3,310 m³/s for a 100 year ARI flood. Compared to the peak flows of rainfall runoff, the predicted maximum discharge volume (17.5 ML/day, equivalent to 0.2 m³/s) would be negligible during a flood event.

Results for the modelled scenario for Boolgeeda Creek discharge are summarised in Appendix 5 and Figure 2-1 depicts the estimated discharge footprint along Boolgeeda Creek. In summary the baseline hydrology modelling (Rio Tinto 2013d) indicated the following:
• The wetting footprint in Boolgeeda Creek would extend approximately 37 km down gradient from the proposed discharge outlet for a modelled volume of 17.5 ML/day.

• The estimated surface water expression footprint was less than the estimated steady state distance which indicates that the water released into the creek is likely to move in and out of the creek bed, creating transient pools into topographical depressions and associated saturated bank conditions within the reach.

• The peak flow volume of water discharging into Boolgeeda Creek is significantly smaller than the peak flow volume generated by the catchment during any flood event. The discharge is likely to result in the development of constant, shallow (on average <7cm) stream flow between flood events and with transient pools in local depressions within the discharge footprint.

• At the peak discharge rate of 17.5 ML/day water released into Boolgeeda Creek is likely to be contained within the channel, hence overtopping of the bank is not expected5. While the creek bed will remain saturated, the creek banks are likely to remain unsaturated. However, the increased availability of water in the creek and within the unsaturated zone has the potential to affect the health and vigour of fringing groundwater dependent vegetation.

• The bedrock units underlying the Boolgeeda Creek valley are of low permeability as a result discharge water will be retained within the surface alluvials.

Table 7-1 describes the factor, summarises how the proposal meets the EPA’s objective and presents an impact and assessment of significance. Management and mitigation measures are also presented.

5 Notwithstanding the fact that the natural system is dynamic and evidence shows that the channel can be reworked during flood events.
Table 7-1: Hydrological Processes: Description of Factor, Impact Assessment and Management

<table>
<thead>
<tr>
<th>EPA Objective</th>
<th>Existing Environment</th>
<th>Potential Impact (without Mitigation)</th>
<th>Management and Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Groundwater drawdown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.</td>
<td>The rate of groundwater abstraction to dewater the mine pits will increase as a result of this Proposal. Water for processing, dust suppression, BWT mining and potable water purposes is sourced from groundwater production bores and mine dewatering bores, with dewatering production prioritised over external bore fields.</td>
<td>Dewatering of the orebody at an increased rate is predicted to result in a smaller overall cone of depression than that authorised under the original proposal (MS 717). Therefore no impacts from drawdown (different from, or additional to, the approved B4 Operation) will occur as a result of implementation of this Proposal.</td>
<td>Impacts to groundwater will continue to be managed in accordance with existing B4 Operation EMP. The following key management measures for surface water will be implemented and, where applicable, have been implemented during Proposal design and operation of the B4 Operation to date:</td>
</tr>
<tr>
<td></td>
<td>Dewatering discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Surplus water will be discharged into Boolgeeda Creek from a pipeline north of the B4 deposit (refer to Figure 2-1).</td>
<td>• Groundwater levels through the B4 Project area are naturally deep and do not support phreatophytic vegetation (with the exception of Cl – Coolibah Eucalyptus victrix woodlands mainly along Boolgeeda Creek, and possibly P1 – the Mulga woodlands in the broad drainage area within the valley south of the B4 Range), and there is no indication of shallow water table aquifers within the B4 Operation area.</td>
<td>• Surface water management is included within the existing B4 Operation EMP which will continue to be implemented with the objective of minimising the adverse impacts to water courses, water quality and the downstream environment.</td>
</tr>
<tr>
<td></td>
<td>• A maximum predicted discharge of 6.4 GL/a (17.5 ML/day) will be required. The predicted water demand will remain steady at approximately 8 ML/day and the proposed surface discharge will average at 4 ML/day however peaks of up to 17.5 ML/day are expected.</td>
<td>• The peak flow volume of water discharging into Boolgeeda Creek is significantly smaller than the peak flow volume generated by the catchment during any flood event, however creek flows will change significantly smaller than the peak flow volume generated by the catchment during any flood event, however creek flows will change from episodic to continuous within the discharge footprint.</td>
<td>• Proposal design has incorporated consideration of surface water management, including minimising disruption to watercourses. The discharge outfall will be designed and constructed so as to reduce the velocity of the water at discharge and thereby minimise erosion of the channel.</td>
</tr>
<tr>
<td>Boolgeeda Creek</td>
<td>• B4 lies on the divide between the Boolgeeda Creek and Basely River catchments. Boolgeeda Creek lies approximately 2.5 km north (at is closest point) from the B4 Central Pit.</td>
<td>• Water released into the creek is likely to move in and out of the creek bed, creating transient pools in topographical depressions and associated saturated bank conditions within the reach.</td>
<td>• A discharge water quality management and monitoring strategy (including site specific water quality trigger values) will be developed in accordance with the ANZECC/ARMCANZ (2000) water quality management framework to manage the potential impacts of discharge water on the downstream environment. This will be managed under Part V of the EP Act.</td>
</tr>
<tr>
<td></td>
<td>• Boolgeeda Creek catchment covers an area of approximately 1,650 km² and is a tributary of Duck Creek within the regional Ashburton River catchment. The creek becomes more defined when it enters a gorge system downstream of B4 operation, before discharging into Duck Creek at Lawloit Range.</td>
<td>• The peak flow volume of water discharging into Boolgeeda Creek is significantly smaller than the peak flow volume generated by the catchment during any flood event, however creek flows will change from episodic to continuous within the discharge footprint.</td>
<td>• The Discharge Monitoring and Management Plan will be implemented to ensure that the associated environmental and conservation values are maintained (Appendix 6).</td>
</tr>
<tr>
<td></td>
<td>• A total of six pools were observed in 2013. Reconnaissance of Boolgeeda creek in November 2009 and April 2010 revealed no surface water present in the area currently modelled for this Proposal (WRM 2011a). One control site was sampled in Boolgeeda Creek 70 km downstream from the proposed B4 discharge point. Pools in Boolgeeda Creek are likely to be transient and ephemeral and water quality will vary with the season. They are likely to be dependent on rainfall, surface water and shallow alluvial interflow rather than regional groundwater.</td>
<td>• The bedrock units underlying the Boolgeeda Creek valley are of low permeability as a result discharge water will not be “lost” to groundwater. Therefore the discharge is likely to result in the development of constant, shallow (&lt;7 cm) stream flow between flood events and with transient pools in local depressions within the discharge footprint.</td>
<td>• Management of weeds will be carried out in accordance with commitments made in the Discharge Monitoring and Management Plan.</td>
</tr>
<tr>
<td></td>
<td>• The pools noted by Biota during the August 2013 survey have not been identified in previous studies. However, they are likely to be a result of the unseasonably high rainfall recorded at B4 in May and June 2013 (32.8 mm and 52.8 mm respectively, compared with 8.8 mm and 16.4 mm in 2011 and 0 mm and 12.4 mm in 2012).</td>
<td>• At the peak discharge rate of 17.5 ML/day water released into Boolgeeda Creek is likely to be contained within the channel, hence overtopping of the bank is not expected. While the creek bed will remain saturated, the creek banks are likely to remain unsaturated. However, the increased availability of water in the creek and within the unsaturated zone has the potential to affect the health and vigour of fringing groundwater dependent vegetation.</td>
<td>• The Discharge Monitoring and Management Plan will be implemented with the objective of minimising the disruption to watercourses.</td>
</tr>
<tr>
<td></td>
<td>• An updated hydrological model was completed in June 2013 (Rio Tinto, 2013a) to predict the hydrological reaction of Boolgeeda Creek to the release of surplus dewater from the B4 Project. An extra 1.36 km discharge pipe is required to be extended from the existing B4 discharge pipe network to the proposed outlet. The response of the creek systems through the continual discharge for a range of discharge options varying from 2.5 ML/day to 20 ML/day was investigated (the estimated peak</td>
<td>At the peak discharge rate of 17.5 ML/day water released into Boolgeeda Creek is likely to be contained within the channel, hence overtopping of the bank is not expected. While the creek bed will remain saturated, the creek banks are likely to remain unsaturated. However, the increased availability of water in the creek and within the unsaturated zone has the potential to affect the health and vigour of fringing groundwater dependent vegetation.</td>
<td>• Appropriate monitoring and management of discharge water quality will be undertaken in accordance with the</td>
</tr>
</tbody>
</table>

6 Notwithstanding the fact that the natural system is dynamic and evidence shows that the channel can be reworked during flood events.
<table>
<thead>
<tr>
<th>EPA Objective</th>
<th>Existing Environment</th>
<th>Potential Impact (without Mitigation)</th>
<th>Management and Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>watering demand is 17.5 ML/d.</td>
<td></td>
<td>ANZECC/ARMCANZ (2000) water quality management framework.</td>
</tr>
<tr>
<td>Pipeline Corridor</td>
<td>Modelling of surface hydrology in the vicinity of the discharge pipeline corridor indicates the following outcomes:</td>
<td></td>
<td>• The spatial and temporal extent of dewatering discharge is relatively limited, and substantial areas of similar watercourses occur outside the discharge extent within the Boolgeeda Creek sub-catchment.</td>
</tr>
<tr>
<td></td>
<td>• All potential water movement is likely to be confined within the channel, hence overtopping of the creek banks is not anticipated. While the creek bed will remain saturated, the creek banks are likely to remain unsaturated such that bank vegetation should be largely unaffected by the flow. However, the continuous flow will increase the water availability close to the creek. Thus the content of water in unsaturated zones moving away from the saturated creek bed may increase vegetation vigour and/or encourage sapling growth. The peak flow volume of water discharged into Boolgeeda Creek is significantly smaller than the peak flow volume generated by the catchment during any flood events; a 2 year ARI flood event would deliver 148 m³/s at the proposed discharge outlet, compared with peak modelled discharge rates of 17.5 ML/day which is equivalent to 0.2 m³/s (Rio Tinto 2013a, 2013d).</td>
<td></td>
<td>• The discharge pipeline corridor is unlikely to impact overland flow.</td>
</tr>
<tr>
<td></td>
<td>Surface water flows</td>
<td>Modelling of surface hydrology indicates the following outcomes (Rio Tinto 2013e):</td>
<td>Appropriate management measure to avoid and minimise potential impacts of the Revised Proposal on surface water will be implemented (and where applicable have been implemented during Proposal design).</td>
</tr>
<tr>
<td></td>
<td>• No ‘overland flow’ is likely to occur as discharge will be confined to the creek bed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Creek banks will remain unsaturated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The bedrock units of Boolgeeda Creek valley are low permeability so discharge water will be retained within the surface alluvials.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8 ASSESSMENT OF IMPACT ON FLORA AND VEGETATION

This Section describes the flora and vegetation within the proposed Development Envelope and within the discharge footprint of Boolgeeda Creek. It provides details regarding the potential impacts to flora and vegetation from the 950 ha of additional clearing of native vegetation and the potential impacts on riparian vegetation of Boolgeeda Creek from the discharge of surplus water that forms part of this Proposal.

The EPA applies the following objective, in EAG8 (EPA, 2013), in its assessment of proposals that may affect flora and vegetation:

To maintain representation, diversity, viability and ecological function at the species, population and community level.

8.1 FLORA AND VEGETATION STUDIES

Multiple flora and vegetation surveys have been conducted on behalf of the Proponent since the 1980s in the Greater Brockman/Greater Nammuldi region (covering in excess of 58,600 hectares). Table 8-1 summarises the key surveys within the Development Envelope.

In addition, the Proponent has conducted a number of targeted searches for DRF and Priority Flora in the area that provides a considerable reference for the distribution of these species.

The combined coverage of these surveys has enabled a detailed understanding of the existing vegetation and flora in the Greater Brockman/Greater Nammuldi region. However the evolution of vegetation mapping codes used since the 1980’s has increased the complexity of the vegetation mapping and therefore interpretation and presentation of the dataset.

In 2012 Biota (2012a) reviewed the previous studies in the Greater Nammuldi/Greater Brockman region and developed an integrated vegetation mapping system covering the majority of the area from the Proponent’s Homestead deposit at Caves Creek, through Silvergrass West and East, Nammuldi, Nammuldi Irrigated Agriculture Area, Brockman 2 to and including Brockman 4. This work was undertaken to support the environmental impact assessment for the Nammuldi-Silvergrass Expansion PER (Strategen 2012).

Coverage of this integrated vegetation mapping includes most of the proposed Development Envelope, specifically Areas 1 and 2 North, therefore this system has been presented here in respect of these areas. The remainder of the Development Envelope is covered by other surveys, in terms of coverage these are primarily A Vegetation and Flora Survey of the White Quartz Road Corridor near Tom Price (Biota 2007b) and Brockman Syncline 4 Marra Mamba Vegetation and Flora Survey (2013b) (Table 8-1 and Appendix 7).

The integrated mapping units that are relevant to the Development Envelope are presented in Appendix 7. Biota 2012a lists the corresponding vegetation codes from the previous included mapping.
Land Systems are shown in Figure 8-1 and vegetation mapping is shown in Figure 8-2, Figure 8-3 and Figure 8-5. Where multiple surveys and therefore mapping overlap within the Development Envelope, a decision has been made to present one set of mapping. Given the extent of its coverage Biota 2012a has been selected as a preference with spatial information from other surveys used to cover the remainder of the Development Envelope.
<table>
<thead>
<tr>
<th>Report Title and Author</th>
<th>Summary of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A Vegetation and Flora Survey of the Brockman Syncline 4 Project Area, near Tom Price</strong>&lt;br&gt;Biya Environmental Sciences (2005a) RTIO HSE 0014404</td>
<td>Desktop review, rare flora searches and a single phase field survey:&lt;br&gt;• Rare flora searches – February to June 2003&lt;br&gt;• Flora and Vegetation Survey – October 2004&lt;br&gt;EPA Position Statement No.3 “Terrestrial Biological Surveys as an Element of Biodiversity Protection” (EPA 2002) and Guidance Statement No. 51 - Terrestrial Flora and Vegetation Surveys for EIA in Western Australia (EPA 2004a) level 1 survey.</td>
</tr>
<tr>
<td><strong>Rare Flora Searches of B4 Rail Loop Extension, Airport Extension and Plant Sites</strong>&lt;br&gt;Biya Environmental Sciences (2007a) RTIO HSE 0030036</td>
<td>Rare flora searches – January 2007.&lt;br&gt;EPA Position Statement No.3 “Terrestrial Biological Surveys as an Element of Biodiversity Protection” (EPA 2002) and Guidance Statement No. 51 - Terrestrial Flora and Vegetation Surveys for EIA in Western Australia (EPA 2004a) level 1 survey.</td>
</tr>
<tr>
<td><strong>A Vegetation and Flora Survey of the White Quartz Road Corridor near Tom Price</strong>&lt;br&gt;Biya Environmental Sciences (2007b) RTIO HSE 0043584</td>
<td>Botanical survey within a corridor surrounding the White Quartz Road.&lt;br&gt;• description and mapping of vegetation types;&lt;br&gt;• establishment of 20 floristic survey quadrats;&lt;br&gt;• recording of populations of flora of conservation significance and weeds; and&lt;br&gt;• collation of a list of all vascular flora observed in the study area.&lt;br&gt;30th of May 2005 and the 23rd of June 2006.</td>
</tr>
<tr>
<td><strong>A Flora Survey of the Brockman Syncline 4 Rail and infrastructure Corridor.</strong>&lt;br&gt;Biya Environmental Sciences (2007c) RTIO HSE 0036363</td>
<td>Wet season flora survey to supplement 2005a and comply with MS717 Condition 7.1. Incorporates findings of Biota 2006a above.&lt;br&gt; Late May – late June 2006&lt;br&gt;January 2007&lt;br&gt;EPA Position Statement No.3 “Terrestrial Biological Surveys as an Element of Biodiversity Protection” (EPA 2002) and Guidance Statement No. 51 - Terrestrial Flora and Vegetation Surveys for EIA in Western Australia (EPA 2004a) level 1 survey.</td>
</tr>
<tr>
<td>Report Title and Author</td>
<td>Summary of Study</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td><strong>Vegetation and Rare Flora of the BS4 33kV Powerline Corridor through the Boolgeeda Valley</strong>&lt;br&gt;Biota Environmental Sciences (2008a)&lt;br&gt;RTIO HSE 0046368</td>
<td>Desktop review of recent botanical studies conducted in the area were reviewed to identify vegetation types and flora species of conservation significance which had previously been recorded from the area of the new power line corridor and that may occur based on habitats apparent on aerial photography. March 2008</td>
</tr>
<tr>
<td><strong>A Vegetation and Flora Survey of Beasley River</strong>&lt;br&gt;Biota Environmental Sciences (2009a)&lt;br&gt;RTIO HSE 0086518</td>
<td>Single phase vegetation and flora survey: May and September 2009 Western Australian Environmental Protection Authority (EPA) Guidance Statement 51 (EPA 2004a) and EPA Position Statement No 3 (EPA 2002).</td>
</tr>
<tr>
<td><strong>Brockman Syncline 4 Water Pipeline Corridor Biological Review</strong>&lt;br&gt;Biota Environmental Sciences (2010)&lt;br&gt;RTIO-HSE-0095889</td>
<td>Desktop review and a NVCP level biological assessment including rare flora searches and a compilation of existing survey data Rare flora searches – June 2010. EPA Position Statement No.3 “Terrestrial Biological Surveys as an Element of Biodiversity Protection” (EPA 2002) and Guidance Statement No. 51 - Terrestrial Flora and Vegetation Surveys for EIA in Western Australia (EPA 2004a) level 1 survey.</td>
</tr>
<tr>
<td><strong>Nammuldi-Silvergrass Vegetation Mapping Integration</strong>&lt;br&gt;Biota Environmental Sciences (2012a)&lt;br&gt;RTIO-HSE-0204864</td>
<td>Desktop review and integration of vegetation mapping conducted for Rio Tinto in the Greater Nammuldi/Greater Brockman Region to produce a single vegetation map. April 2012</td>
</tr>
<tr>
<td><strong>Brockman 4 Camps Vegetation and Flora Survey</strong>&lt;br&gt;Biota Environmental Sciences (2012b)&lt;br&gt;RTIO HSE 0156020</td>
<td>Desktop review and NVCP level vegetation assessment including conservation significant flora searches 5-7 July 2012 Guidance Statement No. 51 - Terrestrial Flora and Vegetation Surveys for EIA in Western Australia (EPA 2004a) level 1 survey.</td>
</tr>
<tr>
<td><strong>Brockman 4 Riparian Vegetation Mapping</strong>&lt;br&gt;Biota Environmental Sciences (2013a)&lt;br&gt;RTIO HSE 0205968</td>
<td>Desktop Review, Level 2 vegetation and flora survey: 21-28 August 2013. Western Australian Environmental Protection Authority (EPA) Guidance Statement 51 (EPA 2004a) and EPA Position Statement No 3 (EPA 2002).</td>
</tr>
<tr>
<td><strong>Brockman Syncline 4 Marra Mamba Vegetation and Flora Survey</strong>&lt;br&gt;Biota Environmental Sciences (2013b)&lt;br&gt;RTIO HSE 0180207</td>
<td>Single phase, Level 2 vegetation and flora survey: 30 August – 4 September 2012. Western Australian Environmental Protection Authority (EPA) Guidance Statement 51 (EPA 2004a) and EPA Position Statement No 3 (EPA 2002).</td>
</tr>
<tr>
<td>Report Title and Author</td>
<td>Summary of Study</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| *Marra Mamba West (AR-13-11158) Native Vegetation Clearing Permit Report*  
Biota Environmental Sciences (2013d)  
RTIO HSE 0201775 | Desktop review and Level 1 flora and fauna survey  
Guidance Statement No. 51 - Terrestrial Flora and Vegetation Surveys for EIA in Western Australia (EPA 2004a) and EPA Position Statement No 3 (EPA 2002) and the Technical guidance - Terrestrial Fauna Surveys for Environmental impact Assessment (EPA and DEC 2010) |
| *Brockman Syncline 4 East Biological Assessment*  
Eco Logical (2013a)  
RTIO HSE 0197495 | Desktop review and NVCP level vegetation assessment including conservation significant flora searches  
July 2013  
Guidance Statement No. 51 - Terrestrial Flora and Vegetation Surveys for EIA in Western Australia (EPA 2004a) level 1 survey |
| *Brockman Syncline 1 East Biological Assessment*  
Eco Logical (2013b)  
RTIO HSE 0197496 | Desktop review and NVCP level vegetation assessment including conservation significant flora searches  
July 2013  
Guidance Statement No. 51 - Terrestrial Flora and Vegetation Surveys for EIA in Western Australia (EPA 2004a) level 1 survey |
8.2 VEGETATION OF THE PROPOSED DEVELOPMENT ENVELOPE

8.2.1 IBRA Bioregions and Subregions

The proposed Development Envelope is located within the Pilbara (PIL) bioregion as defined in the Interim Bio Regionalisation of Australia (IBRA) Report. The Pilbara bioregion has been divided into 4 subregions: Chichester (PIL1); Fortescue Plains (PIL2); Hamersley (PIL3); and Roebourne (PIL4). The Development Envelope falls within the Hamersley (PIL3) sub-region and is described as:

‘Mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). Mulga low woodland over bunch grasses on fine textured soils in valley floors, and Eucalyptus leucaphloia over Triodia brizoides on skeletal soils of the ranges. The climate is Semi-desert tropical, average 300 mm rainfall, usually in summer cyclonic or thunderstorm events. Winter rain is not uncommon. Drainage into either the Fortescue (to the north), the Ashburton to the south or the Robe to the west.’

8.2.2 Beards Vegetation Mapping

The Development Envelope lies entirely within the Fortescue Botanical District of the Eremean Botanical province as defined by Beard (1975). The vegetation of this province is typical of arid landscapes including bunch grasslands, spinifex, wattles and occasional Eucalypts.

According to Beard the predominant vegetation associations in the Development Envelope are:

- Snappy Gum *Eucalyptus leucaphloia* scattered trees over *Triodia wiseana* hummock grassland on the hills of the Brockman ridge at B4 in Area 1 and the stony undulating plains of Area 2 North; and hills and stony plains in Area 2 South.

- An area of Mulga *Acacia aneura* continuous low woodland on the broad stony plain to the north of the Brockman ridge at B4 in Area 1.

- Small areas of Mulga *Acacia aneura* continuous low woodland on clay plains in Area 2 South.

- *Acacia aneura*, *A. inaequilatera* scattered shrubs over *T. epatica*, *T. basedowii* hummock grassland over the majority of Area 2 South.

Beard mapped these units at 1:1,000,000 therefore these mapping units correlate only broadly with the vegetation mapping that has been conducted specifically for the B4 Operation and surrounds.

8.2.3 Land systems

Land Systems (Rangelands) mapping covering the Development Envelope has been prepared by the Western Australian Department of Agriculture (Payne et al. 1988, Department of Agriculture 2002) (Table 8-2). Land systems comprise a series of ‘land units’ that occur on characteristic physiographic types within the land system. Of the one hundred and seven Land Systems that have been identified in the Pilbara, eight occur within the Development Envelope.
With the exception of the Table Land System all of those units occurring within the Development Envelope are extensive within the Pilbara bioregion. The Development Envelope comprises 0.29% of the total extent of Land Systems in the Pilbara, with 18,506 ha of the 20,046 ha Development Envelope being Boolgeeda, Newman, Rocklea and Robe (Table 8-3). However a small portion of the Land System mapped by Payne et al (1988) in the north-western part of Area 1 is considered by Biota to represent the less common Table Land System.

Figure 8-1 shows the distribution and extent of Land Systems within the proposed Development Envelope (from Biota 2005a (using Payne et al.1988) and 2007 (using van Vreeswyk et al. 2004)).

Table 8-2: Land Systems in the B4 Development Envelope

<table>
<thead>
<tr>
<th>Land System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boolgeeda</td>
<td>Stony lower slopes and plains found below hill systems supporting hard and soft spinifex grasslands and mulga shrublands: occupies the north-eastern section of Area 1 as well as the majority of the northern infrastructure corridor (Area 2 North)</td>
</tr>
<tr>
<td>Newman</td>
<td>Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands: coincides with the authorised Brockman orebodies (Area 1) and a small section of the northern infrastructure corridor (Area 2 North) and the western end of the southern infrastructure corridor Area 2 South</td>
</tr>
<tr>
<td>Platform</td>
<td>Dissected slopes and raised plains supporting hard spinifex grasslands: occurs as a small area within the centre and eastern edge of Area 1, within the northern infrastructure corridor (Area 2 North) and at the western end and centre of the southern infrastructure corridor (Area 2 South)</td>
</tr>
<tr>
<td>River</td>
<td>Active floodplains and major rivers supporting grassy Eucalypt woodlands, tussock grasslands and soft spinifex grasslands: common throughout the Pilbara in major river systems such as the Yule, de Grey and Fortescue river systems and Weeli Wolli Creek: only one occurrence has been mapped in the northern section of Area 1 within Boolgeeda Creek</td>
</tr>
<tr>
<td>Robe</td>
<td>Low limonite mesas and buttes supporting soft spinifex (and occasionally hard spinifex) grasslands: occurs as narrow areas in the southern section of Area 1 and at both ends of the southern infrastructure corridor (Area 2 South)</td>
</tr>
<tr>
<td>Rocklea</td>
<td>Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (occasionally soft spinifex) grasslands; small occurrences in the southern section of Area 1 and dominating the majority of Area 2 South</td>
</tr>
<tr>
<td>Table</td>
<td>Low calcrite plateaux, mesas and lower plains supporting mulga and cassia shrublands and minor spinifex grasslands: occurs as two small areas in the north-western section of Area 1 and at the eastern end of Area 2 South</td>
</tr>
<tr>
<td>Wona</td>
<td>Level to gently undulating upland basaltic plains with gilgai microrelief and clay soils, relief up to 30m. Self-mulching clay plains on top of basalt hills; cassia short grass forb pastures in poor to excellent condition; no erosion: occurs in a small area in the south of Area 1 near the Beasley River tributary</td>
</tr>
</tbody>
</table>
Figure 8-1
Land Systems of the Greater Brockman Region

Namnuldi-Silvergrass Project Area

Brockman 2

Proposed Development Envelope

Brockman 4

Western-Turner Syncline

WTS Stage 2 Project Area

LEGEND

Calcite Land System
Hockey Land System
Rookla Land System
Booigeda Land System
Wuna Land System
Pindering Land System
Marandoo Land System
Table Land System
Newman Land System
Noccingo Land System
Nobile Land System
McKay Land System
Paraburdoo Land System
Roe Land System
Brockman Land System
Platform Land System
Spearhole Land System
Jurramarrina Land System
River Land System
Wannamurra Land System

SCALE

0 2 4 6 8 10km
1:320,000 @ A4

Geospatial Information and Mapping
<table>
<thead>
<tr>
<th>Land System</th>
<th>Total Area in the Pilbara Bioregion (Rank)</th>
<th>Number of Mapping Polygons in the Pilbara Bioregion</th>
<th>General Distribution through the Pilbara Bioregion</th>
<th>Amount of Land System within the proposed Development Envelope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boolgeeda</td>
<td>961,634 ha (103rd)</td>
<td>588</td>
<td>Widespread with a large number of occurrences, particularly through the Hamersley range subregion</td>
<td>8,312 0.9</td>
</tr>
<tr>
<td>Newman</td>
<td>1,993,741 ha (106th)</td>
<td>321</td>
<td>Relatively widespread through the Hamersley Range subregion, also occurring as a band along the Chichester range to the north of the Fortescue Marsh: numerous occurrences</td>
<td>5,229 0.3</td>
</tr>
<tr>
<td>Platform</td>
<td>236,335 ha (92nd)</td>
<td>169</td>
<td>Occurs predominantly in the Hamersley Range with small occurrences also in the Chichester Range</td>
<td>809 0.3</td>
</tr>
<tr>
<td>River</td>
<td>482,175 ha (101st)</td>
<td>126</td>
<td>Widespread in major river systems</td>
<td>698 0.1</td>
</tr>
<tr>
<td>Robe*</td>
<td>128,859 ha (76th)</td>
<td>251</td>
<td>Occurs within the central and western regions of the Hamersley Range subregion, with a few occurrences within the Chichester subregions</td>
<td>1,389 1.1</td>
</tr>
<tr>
<td>Rocklea</td>
<td>2,881,199 ha (107th)</td>
<td>385</td>
<td>Widespread through both the Hamersley and Chichester Range</td>
<td>3,576 0.1</td>
</tr>
<tr>
<td>Table*</td>
<td>20,645 ha (31st)</td>
<td>47</td>
<td>Few scattered occurrences in the south and east of the Hamersley Range subregion</td>
<td>7 0.03</td>
</tr>
<tr>
<td>Wona</td>
<td>19,482 ha (88th)</td>
<td>203</td>
<td>Occurring as a band along the Chichester Range, north of the Fortescue River, with few scattered occurrences in the Hamersley Range</td>
<td>25 0.01</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17,800,478 ha</strong></td>
<td><strong>5636</strong></td>
<td></td>
<td><strong>20,046 ha 0.29</strong></td>
</tr>
</tbody>
</table>

*According to Biota 2005a ground-truthing showed that two polygons assigned to the Robe Land System by Payne et al (1988) actually represent the Table Land System.
Vegetation types

Multiple flora and vegetation surveys have been conducted within the proposed Development Envelope. The spatial mapping data has been rationalised and is presented in Figure 8-2, Figure 8-3, Figure 8-4, Figure 8-5 and. A description of each vegetation type is included at Appendix 8.

Vegetation types mapped within the Development Envelope can be classified broadly into the following types:

- Hummock grasslands of *Triodia* species (mainly *T. wiseana*) within a variable shrub overstorey on low stony.
- Tall shrublands of mixed species, usually dominated by *Acacia* often with an overstorey of *Eucalyptus* or *Corymbia* in creeklines.
- Hummock grasslands of *Triodia longiceps* and/or *T. angusta* on calcaereous plains.
- Open woodlands of Coolibah *Eucalyptus victrix* over herblands in the gravelly bed of Boolgeeda Creek.
- Mulga *Acacia aneura* and Snakewood *A. xiphophylla* tall shrublands over spinifex on plains and stony hills.
C1: ChcHlAgGDr
Coriaria hancockii open woodland over Acacia cavenoides low open woodland over Acacia tumida, Gossypium rotundifolium scattered tall shrubs
C1: EVGOMPI
Eucalyptus banksii scattered low trees to open woodland over Gossypium rotundifolium, Pipturus dentata very open heath
C2: ExAcChalbyTHFdE
Eucalyptus eucalyptoides scattered low trees over Arctotis lamprosperma, Stylidium greggii scattered tall shrubs over Themeda triandra, Cynodon dactylon, *C. strictus clumps very open tussock grass
C3: ExAcChalbyTEdiUs
Eucalyptus xerothermica, Eucalyptus leucophloia subsp. leucophloia and Corymbia hamersleyana low open woodland over Acacia cavenoides hummock grassland and Paraneurachne muelleri
C4: ExAcChalbyHEU
Eucalyptus xerothermica, Eucalyptus leucophloia subsp. leucophloia and Corymbia hamersleyana low open woodland over Acacia cavenoides hummock grassland and Paraneurachne muelleri
C5: CD
Eucalyptus xerothermica, Eucalyptus leucophloia subsp. leucophloia and Corymbia hamersleyana low open woodland over Acacia cavenoides hummock grassland and Paraneurachne muelleri
C6: CD0
Eucalyptus xerothermica low open forest to tall open shrubland over mixed open tussock grassland and Triodia epactia very open hummock grassland
C7: CD11
Eucalyptus xerothermica, Eucalyptus hamiltonii low open woodland over Acacia cavenoides, Gossypium sturtianum var. sturtianum, Pennsylvion latifoliosus tall shrubland over Triodia epactia hummock grassland
C8: CD12
Eucalyptus xerothermica, Corymbia hamersleyana scattered low trees over Acacia cavenoides, A. cavenoides, A. micholitzii, A. exilis tall shrubland over Triodia epactia hummock grassland and Eulaalia australis very open heath
C9: CD15
Corymbia hamersleyana, Eucalyptus hamiltonii scattered trees over Acacia cavenoides open heath over Triodia angusta open shrubland and Themeda triandra very open heath
C10: CD16
Corymbia hamersleyana, Eucalyptus hamiltonii low woodland over Acacia cavenoides, A. cavenoides, A. exilis, A. maitlandii shrubland to closed heath over Triodia epactia hummock grassland
C11: CD17
Eucalyptus hamiltonii scattered low trees over Gastrolobium grandiflorum open heath over Chrysopogon flexus, Eulaalia australis tussock grassland
C12: CD19
Eucalyptus hamiltonii low woodland over Acacia cavenoides, Acacia pruinocarpa tall shrubland over Triodia epactia hummock grassland
C13: CD20
Eucalyptus hamiltonii low woodland over Gossypium rotundifolium, Acacia humilis, A. cavenoides, A. maitlandii tall shrubland over Triodia epactia open heath, T. epactia very open hummock grassland
C14: CD22
Eucalyptus hamiltonii, Corymbia decolorata scattered low trees over Acacia cavenoides, A. cavenoides tall open shrub over Triodia epactia, T. epactia open hummock grassland
C15: CD24
Coriaria hamersleyana, Eucalyptus xerothermica, Grevillea wilsonii scattered tall shrubs over Gossypium rotundifolium, Acacia humilis, A. cavenoides, A. maitlandii tall shrubland over Triodia epactia, T. epactia open hummock grassland
C16: CD25
Coriaria hamersleyana low woodland over Acacia epactia hummock grassland and Eucalyptus tenuifolia, D. humilis, Themeda triandra open tussock grassland
C17: CD27
Coriaria hamersleyana, Eucalyptus grandis scattered low woodland over Acacia monticola, A. axicarpa, A. bivenosa, Eulaalia latifolia tall closed scrub over Triodia epactia hummock grassland
C18: CD28
Coriaria hamersleyana scattered low trees over Acacia bivenosa, Pentalophus latifolius shrubland over Triodia epactia hummock grassland
C19: CD11
Eucalyptus leucophloia scattered low trees over Acacia micholitzii, A. cavenoides, A. maitlandii open shrubland over Gossypium sturtianum var. sturtianum, Pennsylvion latifoliosus tall shrubland over Themeda triandra, Cynodon dactylon, *C. strictus clumps very open tussock grass
C20: CD22
Eucalyptus hamiltonii, Corymbia decolorata scattered low trees over Acacia cavenoides, A. cavenoides tall open shrub over Triodia epactia, T. epactia open hummock grassland
C21: CD24
Coriaria hamersleyana, Eucalyptus xerothermica, Grevillea wilsonii scattered tall shrubs over Gossypium rotundifolium, Acacia humilis, A. cavenoides, A. maitlandii tall shrubland over Triodia epactia, T. epactia open hummock grassland
C22: CD25
Coriaria hamersleyana low woodland over Acacia epactia hummock grassland and Eucalyptus tenuifolia, D. humilis, Themeda triandra open tussock grassland
C23: CD27
Coriaria hamersleyana, Eucalyptus grandis scattered low woodland over Acacia monticola, A. axicarpa, A. bivenosa, Eulaalia latifolia tall closed scrub over Triodia epactia hummock grassland
C24: CD28
Coriaria hamersleyana scattered low trees over Acacia bivenosa, Pentalophus latifolius shrubland over Triodia epactia hummock grassland
C25: H2
Acacia vitiensis low woodland over Triodia epactia hummock grassland
C26: H1
Eucalyptus vitiensis scattered low trees over Acacia vitiensis, A. prunocarpa open shrubland over Triodia epactia open hummock grassland
C27: H3
Acacia vitiensis, Corymbia haemacarpa low woodland over Triodia epactia hummock grassland and Cymbopogon magnum, Themeda triandra open tussock grassland
C28: H4
Acacia vitiensis scattered low trees over Acacia vitiensis, A. vitiensis open shrubland over Triodia epactia open hummock grassland
C29: H5
Acacia vitiensis low woodland over Triodia triandra, T. epactia very open hummock grassland
C30: H6
Acacia vitiensis scattered low trees over Acacia vitiensis, A. vitiensis open shrubland over Triodia epactia open hummock grassland
C31: H7
Acacia vitiensis low woodland over Triodia triandra, T. epactia very open hummock grassland
C32: H8
Acacia vitiensis, Corymbia haemacarpa low woodland over Triodia epactia hummock grassland and Cymbopogon magnum, Themeda triandra open tussock grassland
C33: H9
Acacia vitiensis scattered low trees over Acacia vitiensis, A. vitiensis, A. vitiensis open shrubland over Triodia epactia open hummock grassland
This page is intentionally blank
8.2.4 Vegetation condition

The B4 area has been extensively grazed for over 100 years, by sheep and more recently by cattle. Grazing, periodic wildfires and exploration activities in the area have had a negative impact on the flora and vegetation health over time in some areas. At the time that the vegetation surveys were carried out, the majority of the vegetation in the Development Envelope was in Good or better condition, with the main signs of disturbance comprising exploration tracks, grazing by cattle and the presence of weeds.

The stony plains (particularly in the northern third of the rail corridor) and hills habitats typically show less weed invasion than the remainder of the Development Envelope. These areas are not preferred grazing habitat for stock, and the stony, relatively dry substrates also tend to discourage germination and growth of weed species. The main disturbance noted in such areas has been clearing of access tracks for mining exploration, and condition was generally considered to be Very Good to Excellent.

In contrast, introduced species have been recorded frequently within the larger flowlines and on floodplains. These environments have loose and mesic substrates that are favourable for germination and growth of weed species, which may also be spread by stock movement and/or encouraged by grazing. Dense weed infestations (largely Buffel Grass) are generally restricted to drainage areas that have been subject to heavy grazing and such areas are considered to be in Very Poor to Poor condition. Where only scattered weeds were recorded, the vegetation associated with creeklines is considered to be in Good to Excellent condition overall.

Appendix 8 lists all of the vegetation types that will be cleared under this Proposal. In all instances the vegetation is considered to be in Good to Excellent Condition.

8.2.5 Vegetation of Elevated Significance in the Development Envelope

No Threatened Ecological Communities (TECs) occur within the Development Envelope. The nearest mapped TEC is the ‘Themeda grasslands on cracking clays (Hamersley Station, Pilbara)’ located adjacent to Caves Creek at Silvergrass, approximately 25 km north of the Development Envelope. The Development Envelope does not encompass suitable habitat for this TEC to occur.

No Priority Ecological Communities (PECs) are known to occur within the Development Envelope. The nearest mapped PEC, is the ‘Brockman Iron cracking clay communities of the Hamersley Range’ and is co-located with the TEC to the north of the Development Envelope. This PEC is also unlikely to occur within the Development Envelope due to the absence of suitable habitat.

Several vegetation types have been identified as being of elevated significance in the original survey reports. Of these, only two are considered to be of High Significance whilst 39 have been classed as having Moderate Significance (Table 8-4, Figure 8-6 and Figure 8-7). The majority of the vegetation of Moderate significance within the Development Envelope is located north of the B4 Operation and is associated with and/or lying north of Boolgeeda Creek and in the headwaters of the Beasley River tributary to the south of the B4 Operation. Of the proposed 950 ha of additional clearing within the 20,046 ha Development Envelope, 61.29 ha of vegetation with elevated conservation significance is expected to be disturbed.
<table>
<thead>
<tr>
<th>Original Vegetation Unit Code</th>
<th>Source</th>
<th>Habitat</th>
<th>Original vegetation description</th>
<th>Location</th>
<th>Integrated Code (Biota, 2012a)</th>
<th>Extent to be cleared (ha’s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Significance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P11</td>
<td>Biota 2005a</td>
<td>Calcareous Plains</td>
<td><em>Acacia</em> <em>synchronic</em>ia scattered shrubs over <em>Triodia</em> <em>angusta</em> mid-dense hummock grassland Not restricted, but main vegetation type for <em>Ptilotus</em> sp. Brockman. Occurs extensively outside immediate mining area and along White Quartz Road.</td>
<td>Area 1, Area 2 South</td>
<td>PL6</td>
<td>11.33</td>
</tr>
<tr>
<td>EcAcI MgCv</td>
<td>Biota 2007b</td>
<td>Creeklines</td>
<td><em>Eucalyptus camaldulensis</em> var. <em>obtusa</em> open forest over <em>Acacia</em> <em>citrinoviridis</em>, <em>Melaleuca glomerata</em> tall open scrub over <em>Cyperus vaginatus</em> very open sedgeland</td>
<td>Area 2 South</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td><strong>Moderate Significance – within Development Envelope</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1: Ev GOOiPld</td>
<td>Biota 2005a, 2013d</td>
<td>Moderate creeklines</td>
<td><em>Eucalyptus</em> <em>victrix</em> scattered low trees to open woodland over <em>Goodenia lamprosperma</em>, <em>Pluchea dentex</em> very open herbland</td>
<td>Boolgeeda Creek</td>
<td>CD4</td>
<td>0</td>
</tr>
<tr>
<td>C1: Ch AcI Atu GoR</td>
<td>Biota 2013a</td>
<td>Creeklines</td>
<td><em>Corymbia hammersleyana</em> open woodland over <em>Acacia</em> <em>citrinoviridis</em> low open woodland over <em>Acacia</em> <em>tumida</em>, <em>Gossypium robinsonii</em> scattered tall shrubs</td>
<td>Boolgeeda Creek</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>C2</td>
<td>Biota 2005a</td>
<td>Minor flowlines</td>
<td><em>Acacia</em> <em>pyrifolia</em>, <em>A. ancistrocarpa</em>, <em>Petalostylis labicheoides</em> shrubland over <em>Bonamia rosea</em>, <em>Tephrosia rasea</em> var. <em>glabrior</em> low open shrubland over <em>Triodia epactia</em> hummock grassland and <em>Thedea triandra</em> very open tussock grassland</td>
<td>Drainage features, Boolgeeda Creek</td>
<td>CD30</td>
<td>0</td>
</tr>
<tr>
<td>C2: Ev AcI Atu Apy ThT Te</td>
<td>Biota 2013a</td>
<td>Creeklines</td>
<td><em>Eucalyptus</em> <em>victrix</em> open woodland over <em>Acacia</em> <em>citrinoviridis</em> scattered low trees over <em>Acacia tumida</em>, <em>A. bivenosa</em>, <em>A. pyrifolia</em> tall open shrubland over <em>Thedea triandra</em> very open tussock grassland over <em>Triodia epactia</em> very open hummock grassland</td>
<td>Boolgeeda Creek</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Original Vegetation Unit Code</td>
<td>Source</td>
<td>Habitat</td>
<td>Original vegetation description</td>
<td>Location</td>
<td>Integrated Code (Biota, 2012a)</td>
<td>Extent to be cleared (ha’s)</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------</td>
<td>---------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------</td>
<td>--------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>C3</td>
<td>Biota 2005a</td>
<td>Minor creeklines</td>
<td><em>Eucalyptus xerothermica</em> scattered low trees over <em>Acacia citrinoviridis</em>, <em>Stylobasium spathulatum</em> tall shrubland over <em>Ptilotus obovatus var. obovatus</em> scattered shrubs over <em>Themeda triandra, Chrysopogon fallax</em> very open tussock grassland. Occurs in habitats that are of value as surface drainage features. Floristic group is not apparently widespread within the region.</td>
<td>Drainage features, Boolgeeda Creek</td>
<td>CD6</td>
<td>2.35</td>
</tr>
<tr>
<td>C3: EvEcAciApyTErEUa</td>
<td>Biota 2013a</td>
<td>Creeklines</td>
<td><em>Eucalyptus victrix, E. camaldulensis</em> open woodland over <em>Acacia citrinoviridis</em> low open woodland over <em>A. pyrifolia</em> tall open shrubland over <em>Tephrosia rosea</em> low open shrubland over very open mixed herbland over <em>Eulalia aurea</em> open tussock grassland.</td>
<td>Boolgeeda Creek</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>C4: EvEcAciEUa</td>
<td>Biota 2013a</td>
<td>Creeklines</td>
<td><em>Eucalyptus victrix, E. camaldulensis</em> woodland over <em>Acacia citrinoviridis</em> low open woodland over <em>Eulalia aurea</em> very open tussock grassland over very open mixed herbland.</td>
<td>Boolgeeda Creek</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>C18</td>
<td>Biota 2005a</td>
<td>Moderate creeklines</td>
<td><em>Eucalyptus victrix, E. xerothermica</em> low open woodland over <em>Acacia citrinoviridis</em> tall open shrubland over <em>Themeda triandra Chrysopogon fallax</em> tussock grassland.</td>
<td>Boolgeeda Creek</td>
<td>CD5</td>
<td>0</td>
</tr>
<tr>
<td>C6</td>
<td>Biota 2005a</td>
<td>Minor flowlines</td>
<td><em>Eucalyptus xerothermica</em> scattered low trees over <em>Gastrolobium grandiflorum</em> open heath over <em>Chrysopogon fallax, Eulalia aurea</em> tussock grassland.</td>
<td>Boolgeeda Creek</td>
<td>CD17</td>
<td>0</td>
</tr>
<tr>
<td>C17</td>
<td>Biota 2005a</td>
<td>Minor Creeklines</td>
<td><em>Acacia aneura</em> low woodland to low open forest over <em>Chrysopogon fallax</em>, <em>Triodia epactia</em> open tussock / hummock grassland.</td>
<td>Drainage features, Boolgeeda Creek</td>
<td>CD10</td>
<td>0</td>
</tr>
<tr>
<td>C20</td>
<td>Biota 2005a</td>
<td>Minor Creeklines</td>
<td><em>Acacia off. aneura</em> (narrow fine veined; site 1259) low open forest over <em>Acacia citrinoviridis</em> tall open shrubland over <em>Triodia epactia</em> open hummock grassland. Unit is likely to be restricted in terms of areal extent in the Hamersley subregion and would also be susceptible to degradation by fire.</td>
<td>Drainage features, Boolgeeda Creek</td>
<td>CD9</td>
<td>1.52</td>
</tr>
<tr>
<td>AanTe</td>
<td>Biota 2007b</td>
<td>Creeklines</td>
<td><em>Acacia aneura</em> low open forest over <em>Triodia epactia</em> very open hummock grassland and mixed bunch grassland</td>
<td>Area 2 South</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Original Vegetation Unit Code</td>
<td>Source</td>
<td>Habitat</td>
<td>Original vegetation description</td>
<td>Location</td>
<td>Integrated Code (Biota, 2012a)</td>
<td>Extent to be cleared (ha’s)</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------</td>
<td>-----------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------</td>
<td>--------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>AanReTwTbr</td>
<td>Biota</td>
<td>Stony Hills</td>
<td><em>Acacia aneura</em> tall open shrubland over <em>Rhogodia eremaeoa</em> open shrubland over <em>Triodia wiseana, T. brizoides</em> open hummock grassland</td>
<td>Area 2 South</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AxSCdTa</td>
<td>Biota</td>
<td>Stony Plains</td>
<td><em>Acacia xiphophylla</em> low woodland over <em>Sclerostegia disarticulata</em> low open shrubland over <em>Triodia angusta</em> very open hummock grassland</td>
<td>Area 2 South</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ElAbTloTa</td>
<td>Biota</td>
<td>Stony Plains</td>
<td><em>Eucalyptus leucophloia subsp. leucophloia</em> scattered low trees over <em>Acacia bivenosa</em> scattered shrubs over <em>Triodia longiceps, T. angusta</em> hummock grassland</td>
<td>Area 2 South</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ElMeAeTloTa</td>
<td>Biota</td>
<td>Stony Plains</td>
<td><em>Eucalyptus leucophloia subsp. leucophloia</em> scattered low trees over <em>Melaleuca eleuterostachya, Acacia exilis</em> scattered shrubs over <em>Triodia longiceps, T. angusta</em> hummock grassland</td>
<td>Area 2 South</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EsMeAeTlo</td>
<td>Biota</td>
<td>Stony Plains</td>
<td><em>Eucalyptus socialis</em> scattered low mallees over <em>Melaleuca eleuterostachya, Acacia exilis</em> scattered shrubs over <em>Triodia longiceps</em> hummock grassland</td>
<td>Area 2 South</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P1</td>
<td>Biota</td>
<td>Stony Plains</td>
<td><em>Acacia aff. aneura</em> (narrow fine veined; site 1259), <em>A. ayersiana, A. tetragonophylla</em> tall shrubland over <em>Eremophila forrestii, Acacia bivenosa</em> shrubland over <em>Triodia epactia</em> mid-dense hummock grassland</td>
<td>Area 1</td>
<td>PS1</td>
<td>8.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Restricted within Area 1 to a single broad drainage area within a valley and may be poorly represented in the locality: whilst is does not belong to a restricted floristic group, floristically similar Mulga woodlands in drainage habitats appear to be uncommon in the region.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td>Biota</td>
<td>Stony Plains</td>
<td><em>Acacia ayersiana</em> low open forest/woodland over <em>Eremophila forrestii</em> open shrubland over <em>Triodia epactia, T. wiseana</em> hummock grassland</td>
<td>Area 1</td>
<td>PS1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Belongs to a floristic group that is apparently not widespread within the region.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>Biota</td>
<td>Stony Plains</td>
<td><em>Eucalyptus leucophloia</em> scattered low trees over <em>Acacia aneura</em> (various forms), <em>A. ayersiana</em> tall open shrubland over <em>Triodia epactia, T. wiseana</em> mid-dense hummock grassland</td>
<td>Area 1</td>
<td>PS1</td>
<td></td>
</tr>
<tr>
<td>Original Vegetation Unit Code</td>
<td>Source</td>
<td>Habitat</td>
<td>Original vegetation description</td>
<td>Location</td>
<td>Integrated Code (Biota, 2012a)</td>
<td>Extent to be cleared (ha's)</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------</td>
<td>-------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------</td>
<td>------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>P8</td>
<td>Biota 2005a</td>
<td>Stony plains</td>
<td>Belongs to a floristic group that is apparently not widespread within the region.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P9</td>
<td>Biota 2005a</td>
<td>Calcareous Plains</td>
<td><em>Eucalyptus xerothermica</em> low open woodland over <em>Eremophila fraseri</em> scattered shrubs over <em>Triodia wiseana</em> mid-dense hummock grassland</td>
<td>Area 1</td>
<td>PS9</td>
<td>0</td>
</tr>
<tr>
<td>P10</td>
<td>Biota 2005a</td>
<td>Calcareous Plains</td>
<td><em>Eucalyptus socialis</em> low open woodland over, <em>T. wiseana</em> open hummock grassland Belongs to a floristic group that is apparently not widespread within the region: calcrete areas in particular are not well represented in the Hamersley subregion and this vegetation type may have restricted distribution.</td>
<td>Area 1</td>
<td>PL2</td>
<td>4.16</td>
</tr>
<tr>
<td>H10</td>
<td>Biota 2005a</td>
<td>Gorges</td>
<td><em>E. leucophloia, E. xerothermica</em> scattered low trees over over <em>Acacia bivenosa, A. exilis</em> open shrubland to tall opens shrubland over <em>Triodia wiseana, T. angusta</em> mid-dense hummock grassland Belongs to a floristic group that is apparently not widespread within the region: calcrete areas in particular are not well represented in the Hamersley subregion and this vegetation type may have restricted distribution.</td>
<td>Area 1</td>
<td>HG3</td>
<td>27.59</td>
</tr>
<tr>
<td>H11</td>
<td>Biota 2005a</td>
<td>Rocky Gorges</td>
<td><em>Eucalyptus leucophloia</em> low open woodland over <em>Acacia bivenosa</em> open shrubland over <em>Triodia brizoides, T. epactia</em> hummock grassland and <em>Themeda sp.</em> Mt. Barricade, <em>Cymbopogon ambigua</em> open tussock grassland Vegetation of narrow gorges belonging to a floristic group apparently restricted within the region and supporting species restricted to rocky habitats. Whilst widespread within the Hamersley subregion the “HG” vegetation units are small in areal extent.</td>
<td>Area 1</td>
<td>HG1</td>
<td>1.39</td>
</tr>
<tr>
<td>Original Vegetation Unit Code</td>
<td>Source</td>
<td>Habitat</td>
<td>Original vegetation description</td>
<td>Location</td>
<td>Integrated Code (Biota, 2012a)</td>
<td>Extent to be cleared (ha’s)</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------</td>
<td>-----------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------</td>
<td>-------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>H13</td>
<td>Biota 2005a</td>
<td>Rocky Gorges</td>
<td>Hamersley subregion the “HG” vegetation units are small in areal extent.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
|                               |              |                 | *Corymbia ferriticolae, Eucalyptus leucophloia* scattered low trees over *Acacia hamersleyensis* scattered tall shrubs over *Dodonaea pachyneura* open shrubland over *Eriachne mucronata, E. tenuiculmis, Cymbopogon ambiguous* open tussock grassland and *Triodia epatica* open hummock grassland
Vegetation of narrow gorges belonging to a floristic group apparently restricted within the region and supporting species restricted to rocky habitats. Whilst widespread within the Hamersley subregion the “HG” vegetation units are small in areal extent. |          |                               |                              |
| H12                           | Biota 2005a  | Gorges          | *Eucalyptus leucophloia* low open woodland over *Acacia hamersleyensis* open shrubland over *Triodia brizoides, T. epactia* hummock grassland and *Themeda triandra, Eriachne mucronata* open tussock grassland
Vegetation of narrow gorges belonging to a floristic group apparently restricted within the region and supporting species restricted to rocky habitats. Whilst widespread within the Hamersley subregion the “HG” vegetation units are small in areal extent. |          |                               | 0.84                        |
| H16                           | Biota 2005a  | Breakaways      | *Eucalyptus leucophloia* scattered low trees to low open woodland over *Astrotricha hamptonii, Ficus brachypoda* scattered tall shrubs over *Themeda sp. Mt Barricade, Eriachne mucronata* open tussock grassland and *Triodia brizoides, T. epatica* open hummock grassland
Vegetation of breakways belonging to a floristic group apparently restricted within the region and supporting species restricted to rocky habitats. Whilst widespread within the Hamersley subregion the “HG” vegetation units are small in areal extent. |          |                               | 2.63                        |
<table>
<thead>
<tr>
<th>Original Vegetation Unit Code</th>
<th>Source</th>
<th>Habitat</th>
<th>Original vegetation description</th>
<th>Location</th>
<th>Integrated Code (Biota, 2012a)</th>
<th>Extent to be cleared (ha's)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AanElTe</td>
<td>Biota 2009a</td>
<td>Hills</td>
<td><em>Acacia aneura, Eucalyptus leucophloia subsp. leucophloia</em> low open forest over <em>Triodia epatica</em> hummock grassland</td>
<td>Upper Beasley River tributary</td>
<td>H2</td>
<td>0</td>
</tr>
<tr>
<td>AciThtCEc</td>
<td>Biota 2009a</td>
<td>Minor Creeklines</td>
<td><em>Acacia citrinoviridis</em> tall shrubland over *Themeda triandra, <em>Cenchrus ciliaris</em> tussock grassland  Occurs in the upper reaches of the main creekline. Condition rating of Poor to Very Poor due to heavy Buffel Grass infestation</td>
<td>Upper Beasley River tributary</td>
<td>CD7</td>
<td>1.36</td>
</tr>
<tr>
<td>ExApYGoSpITeCEc</td>
<td>Biota 2009a</td>
<td>Minor Creeklines</td>
<td><em>Eucalyptus xerothermica</em> low open woodland over <em>Acacia pyriformia, Gossypium sturtianum var. sturtianum, Petalostylis labicheoides</em> tall shrubland over <em>Triodia epactia</em> hummock grassland and <em>Cenchrus ciliaris</em> closed tussock grassland</td>
<td>Upper Beasley River tributary</td>
<td>CD11</td>
<td>0</td>
</tr>
<tr>
<td>EvExAcICEc</td>
<td>Biota 2009a</td>
<td>Minor Creeklines</td>
<td><em>Eucalyptus victrix, E. xerothermica</em> open woodland over <em>Acacia citrinoviridis</em> tall closed scrub over <em>Cenchrus ciliaris</em> closed tussock grassland</td>
<td>Upper Beasley River tributary</td>
<td>CD5</td>
<td>0</td>
</tr>
<tr>
<td>C1: ChAcIAtuGoR7</td>
<td>Biota 2013a</td>
<td>Creekline</td>
<td><em>Corymbia hamersleyana</em> open woodland over <em>Acacia citrinoviridis</em> low open woodland over <em>Acacia tumida, Gossypium robinsonii</em> scattered tall shrubs</td>
<td>Boolgeeda Creek</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>C2: EvAcIAtuApYHtTe7</td>
<td>Biota 2013a</td>
<td>Creekline</td>
<td><em>Eucalyptus victrix</em> open woodland over <em>Acacia citrinoviridis</em> scattered low trees over <em>Acacia tumida, A. bivenosa, A. pyriformia</em> tall open shrubland over <em>Themeda triandra</em> very open tussock grassland over <em>Triodia epactia</em> very open hummock grassland</td>
<td>Boolgeeda Creek</td>
<td>-</td>
<td>0</td>
</tr>
</tbody>
</table>

7 Also present within Development Envelope (above)
<table>
<thead>
<tr>
<th>Original Vegetation Unit Code</th>
<th>Source</th>
<th>Habitat</th>
<th>Original vegetation description</th>
<th>Location</th>
<th>Integrated Code (Biota, 2012a)</th>
<th>Extent to be cleared (ha's)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C3: EvEcAciApyTerEUa⁷</td>
<td>Biota 2013a</td>
<td>Creekline</td>
<td><em>Eucalyptus victrix</em>, <em>E. camaldulensis</em> open woodland over <em>Acacia citrinoviridis</em> low open woodland over <em>A. pyrifolia</em> tall open shrubland over <em>Tephrosia rosea</em> low open shrubland over very open mixed herbland over <em>Eulalia aurea</em> open tussock grassland</td>
<td>Boolgeeda Creek</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>C4: EvEcAciEUa⁷</td>
<td>Biota 2013a</td>
<td>Creekline</td>
<td><em>Eucalyptus victrix</em>, <em>E. camaldulensis</em> woodland over <em>Acacia citrinoviridis</em> low open woodland over <em>Eulalia aurea</em> very open tussock grassland over very open mixed herbland</td>
<td>Boolgeeda Creek</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>C5:EvEcAciCEc</td>
<td>Biota 2013a</td>
<td>Creekline</td>
<td><em>Eucalyptus victrix</em>, <em>E. camaldulensis</em> woodland over <em>Acacia citrinoviridis</em> low open woodland over <em>Cenchrus ciliaris</em> scattered tussock grasses</td>
<td>Boolgeeda Creek</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>C6:EvEcAciMGaam</td>
<td>Biota 2013a</td>
<td>Creekline</td>
<td><em>Eucalyptus victrix</em>, <em>E. camaldulensis</em> woodland over <em>Acacia citrinoviridis</em> low open woodland over <em>Melaleuca glomerata</em>, <em>Acacia ampliceps</em> tall shrubland</td>
<td>Boolgeeda Creek</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>C7: EvEcAciMgCEcTe</td>
<td>Biota 2013a</td>
<td>Creekline</td>
<td><em>Eucalyptus victrix</em>, <em>E. camaldulensis</em> woodland over <em>Acacia citrinoviridis</em> low open woodland over <em>Melaleuca glomerata</em> tall shrubland over <em>Cenchrus ciliaris</em> scattered tussock grasses over <em>Triodia epactica</em> scattered hummock grasses</td>
<td>Boolgeeda Creek</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>61.29</td>
</tr>
</tbody>
</table>
Iron Ore (WA)

Figure 8-8
Flora and Vegetation of Elevated Significance within the Discharge Footprint

Legends:
- Proposed Development Envelope
- Booroogolla Creek Discharge
- Authorised Disturbance
- Moderate Conservation Significance Area
- High Conservation Significance Area

Drawn: J. Woodroofe
Date: July 2014
Plan No: OEO122102v1
Proj: MAG94 (Zone 50)

Scale: 1:120,000 @ A4

Discharge 12.5ML/d
Footprint 34 km

Discharge 10ML/d
Footprint 33 km

Discharge 17.5ML/d
Footprint 37 km
8.3 FLORA OF CONSERVATION SIGNIFICANCE

Three Threatened Flora species (Thryptomene wittweri, Lepidium catapycnon and Aluta quadrata) are known from the Pilbara bioregion. Thryptomene wittweri and Hamersley Lepidium catapycnon are listed as Threatened flora under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) as well as the WA Wildlife Conservation Act 1950. Aluta quadrata is listed as a Threatened species in WA and is recognised as such under the Wildlife Conservation Act 1950. None of these species has been recorded within the Development Envelope.

T. witteri is less common than L. catapycnon and within the Pilbara bioregion it occurs only on hilltops at high altitude further east in the Hamersley subregion. It has also been recorded from the Gascoyne and Great Victoria Desert bioregions. There is no suitable habitat for this species within the Development Envelope and therefore it would not be expected to occur.

L. catapycnon occurs in hummock grasslands on low stony hills and occasionally stony plains in the Hamersley subregion. It is thought to be short-lived and is generally found on recently disturbed ground. Whilst this species has been recorded approximately 10 km to the east of the B4 Operation, extensive searches by qualified botanists over several years has not located any populations within the Development Envelope.

A. quadrata occurs mainly in rocky gullies and sometimes also along the creeklines downstream or on adjacent ridge slopes and crests. Recorded only on the southern side of hills at Paraburdoo, this species has not been recorded in the Development Envelope.

Eleven Priority Flora species have been recorded as occurring within the Development Envelope (Table 8-5). Of these, two Priority Flora are expected to be disturbed by the proposed clearing: Ptilotus subspinescens (P3) and Eremophila magnifica subsp. Magnifica (P4).

Table 8-6 describes how the proposal meets the EPA’s objectives with respect to flora and vegetation and summarises the potential impacts and assessment of significance. Management and mitigation measures are also presented.
### Table 8-5 Priority Flora Recorded or Potentially Occurring within the Development Envelope

<table>
<thead>
<tr>
<th>Species</th>
<th>Priority</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Peplidium sp. Fortescue March</em> (S.van Leeuwen 4865)</td>
<td>1</td>
<td>One specimen was recorded from a location in the open creek bed of Boolgeeda Creek (C3: EvEcAcIApyTErEUa vegetation type) immediately upstream of the proposed discharge point, within the Development Envelope.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>One other record of this species exists – from a saline flat on the northern apron of Fortescue Marsh (approximately 270 km east of Boolgeeda Creek.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The proposed clearing does not intersect with the known location of this species. Therefore the Revised Proposal is not expected to adversely affect the representation or viability of the species.</td>
</tr>
<tr>
<td><em>Hibiscus</em> sp. Mt Brockman (E. Thoma E.T.1354)</td>
<td>1</td>
<td>This species has been recorded from a single location within the westernmost portion of the DE. Several records exist outside of the Development Envelope at Nammuldi/Brockman 2 and near Mt Brockman. Its current known distribution extends over a radius of approximately 35 km centred on B4.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This species is commonly found in rocky habitat including gorges and gullies.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The proposed clearing does not intersect with the known location of this species. Therefore the Revised Proposal is not expected to adversely affect the representation or viability of the species.</td>
</tr>
<tr>
<td><em>Grevillea</em> sp. Turee (J. Bull &amp; G. Hopkinson ONS JJ 01.01)</td>
<td>1</td>
<td>This species has been recorded in four locations on the tops of small rocky hills in H4 <em>Acacia aneura</em> vegetation type in the south western portion of the Development Envelope.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The proposed clearing does not intersect with the known locations of this species. Therefore the B4 Revised Proposal is not expected to adversely affect the representation or viability of this species.</td>
</tr>
<tr>
<td><em>Sida</em> sp. Hamersley Range (K. Newbey 10692)</td>
<td>1</td>
<td>This species has not been recorded within the Development Envelope, although it has been recorded at Vivash to the south west of the Development Envelope. Recorded from a broad range of 326 km from Hope Downs to Metawandy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It is typically found on rocky hill slopes and in gorges and suitable habitat may occur within the Development Envelope.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Due to the absence of records in the Development Envelope, the Revised Proposal is not expected to adversely affect the representation or viability of this species.</td>
</tr>
<tr>
<td>Species</td>
<td>Priority</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>----------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| *Pentalepis trichodesmoides* subsp. *hispida* | 2        | Collected from a floodplain associated with Boolgeeda Creek (F5: AciAPyCecTe vegetation type)  
This species has been found over a broad range of over 200 km from Roeburne to Tom Price and also at Western Turner. Records exist for Millstream-Chichester National park, and Karijini National Park.  
The proposed clearing does not intersect with the known location of this species. Therefore the Revised Proposal is not expected to adversely affect the representation or viability of the species.                                                                                           |
| *Ipomoea racemigera*                         | 2        | Recorded within Area 2 South occurring along Beasley River as two of eighteen records in that locality.  
The proposed clearing does not intersect with the known locations of this species. Therefore the Revised Proposal is not expected to adversely affect the representation or viability of this species.                                                                                                                                                                                                                               |
| *Indigofera* sp. Bungaroo Creek* (S. van Leeuwen 4301) | 3        | Multiple records exist within the Development Envelope and along Boolgeeda Creek both upstream and downstream of the discharge point. Recorded outside of the Development Envelope in several locations from Bungaroo Creek to West Turner (approximately 208 km, range). Populations are known from the Greater Brockman/Greater Nammuldi region (including Brockman 2, Silvergrass, Pinarra, Mt Farquhar, Beasley River and Vivash).  
Occurs in drainage lines, floodplains and rocky gullies.  
The Revised Proposal is not expected to adversely affect the representation or viability of this species.                                                                                                                                                                                                                     |
| *Gymnanthera cunninghamii*                   | 3        | This species has not been recorded in the Development Envelope; however it has been recorded at Nammuldi and also at West Turner. Recorded also in the Great Sandy Desert and Carnarvon regions.  
Usually found growing along drainage lines.  
Due to the absence of records in the Development Envelope, the Revised Proposal is not expected to adversely affect the representation or viability of this species.                                                                                                                                                                                                                                                          |
| *Rostullaria* adscendens var. *latifolia*    | 3        | Broadly distributed across the Pilbara bioregion (approximately 400 km), with several records within the Greater Brockman area and five known populations in Karijini National Park.  
Occurs in a variety of habitats.  
The Revised Proposal is not expected to adversely affect the representation or viability of this species.                                                                                                                                                                                                                                                                                                                                                             |
<table>
<thead>
<tr>
<th>Species</th>
<th>Priority</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Phyllanthus aridus</em></td>
<td>3</td>
<td>Recorded from the broad gravelly bed of Boolgeeda Creek from one location upstream of the discharge point. Infrequently recorded in the Pilbara, typically from creeklines but also from rocky outcrops. There is potential for it to be poorly collected due its inconspicuous habit. The Revised Proposal is not expected to adversely affect the representation or viability of this species.</td>
</tr>
<tr>
<td><em>Eremophila magnifica subsp velutina</em></td>
<td>3</td>
<td>This species has not been recorded within the Development Envelope, although it has been recorded at Vivash to the south west of the Development Envelope. Populations are also known from as close as Silvergrass West, West Turner, from Karijini National Park and as far away a Newman. Due to the absence of records in the Development Envelope, the Revised Proposal is not expected to adversely affect the representation or viability of this species.</td>
</tr>
<tr>
<td><em>Sida sp. Barlee Range (S. van Leeuwen 1642)</em></td>
<td>3</td>
<td>This species has not been recorded within the Development Envelope, although it there are numerous records along the Brockman ridge at Brockman 2 and at West Turner. It has a known broad distribution from Barlee Range Nature Reserve to near Newman (approximately 370 km). Commonly occurs on pockets of deep red soil on steep rocky slopes and along the base of rock faces. This species may occur in rocky gorges within the Development Envelope. However due to the absence of records in the Development Envelope (despite several targeted flora searches) the Revised Proposal is not expected to adversely affect the representation or viability of this species.</td>
</tr>
<tr>
<td><em>Themeda sp. Hamersley Station (M. E. Trudgen 11431)</em></td>
<td>3</td>
<td>Recorded from one location in the Development Envelope within the footprint of the Nammuldi Irrigated Agriculture Area. The Revised Proposal does not involve any ground disturbance at that location and therefore will not adversely affect the representation or viability of this species.</td>
</tr>
<tr>
<td>Species</td>
<td>Priority</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><em>Ptilotus mollis</em></td>
<td></td>
<td>This species has not been recorded within the Development Envelope although it has been recorded at Nammuldi as well as north north-west and east south-east of the B4 Operation. It has a broad distribution throughout the Pilbara with a known range measuring approximately 300 km by 640 km including one known population within Karijini National Park. Suitable hill habitat exists however due to the absence of records in the Development Envelope (despite several targeted flora searches) the Revised Proposal is not expected to adversely affect the representation or viability of this species.</td>
</tr>
<tr>
<td><em>Ptilotus subspinescens</em></td>
<td>3</td>
<td>Large populations of this species occur in the southern half of the Development Envelope: to the south of the Brockman pits, along White Quartz Road (Area 2 South) and in the headwaters of the Beasley River tributary. This species has been recorded from the Robe, Newman and Rocklea Land Systems which are well represented in the Pilbara bioregion, although at a finer scale this species is commonly found in areas with fine silt/clay substrate and <em>Triodia angusta</em> and/or <em>T. longiceps</em> hummock grasslands. A portion of the population immediately south of the existing B4 pits that is located within the vegetation community: P11 (PL16 Biota 2012a) will be partially disturbed by the proposed clearing (11.33 ha of P11). However several large populations exist nearby and therefore the Revised Proposal is not expected to adversely affect the representation or viability of this species.</td>
</tr>
<tr>
<td><em>Eremophila magnifica</em> subsp. <em>magnifica</em></td>
<td>4</td>
<td>This species occurs in several locations within the Development Envelope and a small proportion of the population at B4 will be affected by the proposed clearing. However it has been recorded in a number of locations within and surrounding the Development Envelope that will not be affected by the proposed clearing. Nine populations are known to occur in Karijini National Park exist, with additional populations recorded at Vivash East, West Turner and Silvergrass West. It typically occurs in rocky areas such as steep rocky hill slopes, gorges and gullies. The Revised Proposal is not expected to adversely affect the representation or viability of this species.</td>
</tr>
<tr>
<td><em>Goodenia nuda</em></td>
<td>4</td>
<td>This species occurs along Boolgeeda Creek downstream of the discharge point and in the western portion of the Development Envelope; however it has not been recorded frequently in the Greater Brockman area. The species has broad distribution and has been recorded over a range of approximately 450 km within the Pilbara bioregion, including populations in Karijini and Millstream-Chichester National Parks. It has also been recorded from the Gascoyne bioregion. Appears to be widespread but uncommon. Typically restricted to creeklines and wet areas. The Revised Proposal is not expected to adversely affect the representation or viability of this species.</td>
</tr>
</tbody>
</table>
Table 8-6: Flora and Vegetation: Description of Factor, Impact Assessment and Management

<table>
<thead>
<tr>
<th>EPA Objective</th>
<th>Existing Environment</th>
<th>Potential Impact (without mitigation)</th>
<th>Management and Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>To maintain representation, diversity, viability and ecological function at the species population and community level.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Additional Clearing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B4 requires up to 950 ha of additional clearing to support ongoing operations, including pit expansion and waste dump optimisation. Figure 2-1 depicts the proposed clearing within the Development Envelope.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vegetation – additional clearing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation mapping for the Development Envelope has been completed (Figure 8-2) and does not indicate the presence of any vegetation types that qualify for specific legislative protection (i.e. TECs). Similarly, no PECs have been identified within the Development Envelope.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The additional clearing areas intersect with the following vegetation types previously identified by Biota as being of Elevated Significance (refer to Figure 8-6 and Table 8-4):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- P11 - Acacia synchronia scattered shrubs over Triodia angusta hummock grassland. This vegetation type does not belong to a restricted floristic group, but is the main associated vegetation type for a significant sized population of the Priority 3 species Ptilotus subspinescens. Although this vegetation type is considered unlikely to be well represented in the Hamersley subregion, it does occur extensively outside the Development Envelope and on similar substrates along White Quartz Road.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- H10, H11, H12, H13 and H16 - Mixed shrublands over hummock grasslands dominated by suites of species preferring rocky habitats. These vegetation types of narrow gorges, gullies and breakaways belong to a floristic group apparently restricted in the region, and support cryptic species restricted to such rocky habitats. These habitats, while widespread within the Hamersley subregion, comprise a small proportion of the total area.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- P1, P2, P3, P9 and P10 - Triodia wiseana / T. angusta hummock grasslands with variable overstoreys occurring on stony plains. These vegetation types belong to floristic groups that are apparently not widespread in the region; calcareous areas in particular are not well represented in the Hamersley subregion and these vegetation types may have a somewhat restricted distribution. These communities are however, relatively abundant in the habitats present within the vast valley stretching between the B4 and Western Turner Syncline ranges. The P3 represents potential habitat for the Khagada sp. “Mt Brockman” snail.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- C20 – Creekline vegetation dominated by Mulga. This vegetation type is likely to be restricted in terms of area of extent in the Hamersley subregion.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- C3 and AcIThCc – vegetation of minor creeklines dominated by Ac. citriniviridis over Themeda triandra, <em>Cenchrus ciliaris</em> tussock grasslands</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Vegetation and Flora – Clearing**

This Proposal will result in the clearing up to 950 ha of native vegetation (in addition to the 2,610 ha approved under MS 717).

Some of the Priority 3 species, Ptilotus subspinescens, will potentially be impacted by this Proposal. The effect of the proposed change to Flora and vegetation values is not considered significantly different or additional to that of the approved B4 Operation as the potential impacts to flora and vegetation values are considered to remain unchanged from that assessed in the PER. This is because the proposed changes will:

- Not affect any new vegetation communities that have not been previously assessed.
- Not affect any known TEC’s or PEC’s in the area.
- Not affect any known occurrences of DRF and will minimise impacts to known locations of the Priority 3, Ptilotus subspinescens where practicable.

**Vegetation – Surplus Water Discharge**

No TECs or PECs occur in proximity to the Boolgeeda Creek watercourse; however seven vegetation units of elevated conservation significance occur in proximity.

Hydrological modelling was performed along a 52km section downstream of the proposed discharge point. The creek was divided into three different reaches with unique morphology, soil conditions and vegetation types. For each of these reaches, the modelling suggests that the water discharged into the creek is likely to be contained in the existing channel; hence no overtopping of the creek banks is anticipated (Appendix 5). Therefore the potential impact due to waterlogging is expected to be confined to vegetation growing within or immediately adjacent to the low flow channel, and the root systems of trees growing on the banks of these watercourses are likely to be partially, rather than completely waterlogged.

The key species within vegetation units are considered tolerant (E. camaldulensis subsp. refulgens) or relatively tolerant (E. victoriae) to waterlogging based on a review of previous studies and observations in the Pilbara. Detrimental impacts due to waterlogging may range from reduced growth and health to tree death, with the degree of impact dependent on the species tolerance, complete or partial waterlogging of the root system, and the duration of waterlogging.

Based on these considerations, for the scattered populations of *E. victoriae* on the banks of the discharge watercourse, reduced growth and health, and some tree death, is considered possible. For *E. camaldulensis* subsp. refulgens some reduced growth and health is possible but widespread tree death is unlikely. The vegetation communities would be expected to recover after cessation of discharge (as only the areas/individuals immediately adjacent to the low flow channel may be detrimentally affected), with timeframe to recovery dependent on the degree of detrimental impact.

Potential detrimental impact to these vegetation units due to dewatering

The following key management measures for vegetation and flora will be implemented (and where applicable have been implemented during Proposal design and operation of the B4 Operation to date):

- Proposal design has minimised planned vegetation clearing to areas necessary for safe construction and operation.
- Proposal design has, and will continue to, avoid and minimise clearing of elevated conservation significance vegetation and flora, including the Priority 3 Ptilotus subspinescens.
- Ground truthing will be conducted prior to clearing to identify DRF.
- The Rio Tinto Iron Ore (WA) internal ground disturbance authorisation procedure will be implemented, including internal assessment and authorisation prior to any clearing of vegetation.
- Management of weeds will be carried out in accordance with the Rio Tinto Iron Ore (WA) Weed Management Strategy, Equipment Hygiene Expectations Procedure, and the Soil Resource Management Procedure, including the following actions:
  - Weed monitoring will be undertaken at the discharge point and management implemented as appropriate.
  - The existing B4 Project weed action plan will be updated to include activities within this Proposal.
  - All earth engaging equipment brought onto site will be inspected to ensure they are clean and free of built up mud, rock, soil, vegetation.
  - Areas to be cleared will be assessed for weeds; topsoil cleared from weed infested areas will be separated from other stockpiles and/or managed to prevent the spread of weeds.
  - Proposal design has incorporated consideration of surface water management, including minimising disruption to watercourses where possible.
  - A discharge water management and monitoring strategy (including site specific water quality trigger values) will be developed in accordance with ANZECC/ARMCANZ (2000) water quality management framework, to manage the potential impacts of discharge water on the downstream environment. This will be implemented and managed under Part V of the EP Act.
- Prior to discharging water to Boolgeeda Creek the Discharge Monitoring and Management Plan (MMP)(Appendix 6) will be finalised and implemented to
Occur in habitats that are of value as surface drainage features. Floristic groups are not apparently widespread within the region.

**Flora – additional clearing**

Figure 8-6 and Figure 8-7 depict recorded Priority Flora within the Proposal area. Numerous biological surveys have been completed over the broader B4 Operation area, vegetation mapping has been extrapolated over a small area at the western edge of the Development Envelope based on existing vegetation information in adjacent areas and aerial imagery.

- *Phylitis subsinensis* **Priority 3**

*P. subsinensis* has been recorded from multiple locations on rocky plains within the wider B4 area. The additional clearing areas intersect five records of this species. However, as the area has not been systematically traversed for Priority Flora, more individuals may be present within the vicinity of these records and also within the wider B4 area. The small population located within the additional clearing area is not considered to be of significance due to the number, and wide distribution, of records in the vicinity. Populations of this species have also been recorded nearby at Brockman 2, Silvergrass, Western Turner Syncline and Beasley River.

- *Eremophila magnifica* **subsp. magnifica** **Priority 4**

*Eremophila magnifica* subsp. *magnifica* has been recorded 25 times from the broader B4 Project area. All records were from the stony hill slopes associated with Mt West which represents typical habitat for this species. The additional clearing areas intersect five records of this species on Mt West. Given that the habitat present in this area is now heavily fragmented due to disturbance associated with the approved B4 Project, these records are considered to be of low value. *Eremophila magnifica* subsp. *magnifica* is distributed through the central-eastern Hamersley Ranges, and nearby records exist from the Tom Price and Silvergrass localities.

**Surplus Water Discharge**

In order to make up for lost dewatering and to continue to meet production requirements, the rate of pit dewatering will need to increase over the remainder of the life of the mine. Under the Revised Proposal water that is surplus to requirements will be discharged to Boolgeeda Creek at a rate of up to 6.4 GL/annum.

**Vegetation – Pipeline Corridor**

Six previously mapped vegetation units are located within the study area. Three units are considered to be of moderate conservation significance (Biota 2005a):

- **C1:** *EvgGOOPlPl* – comprising *Eucalyptus victoriae* scattered low trees to open woodland over *Goodenia lamproserpa*, *Pluchea dentex* very open herbland is considered. This unit occurs in habitats that are of value as surface drainage features and support species restricted to such habitat (Biota 2005a).
- **C2** – comprising *Acacia pyriformis*, *Acacia anistocarpa*, *Petalostylis labicheoides* shrubland over *Banania rosea*, *Tephractis rosea* var. *glabrior* discharge is not considered significant, based on the following:
  - These vegetation units are widespread regionally (Biota 2013a).
  - On a local scale, the area of these creekline vegetation units in the vicinity of the maximum discharge extent comprises the following extent (ha) and as a % of the riparian study area (Figure 8-4):
    - C1: *ChAciAtuGOr* – 10.52 ha (0.81%)
    - C2: *EvAciTuAPyNTeH* – 6.48 ha (0.5%)
    - C3: *EvEciApPyTEuA* – 30.28 ha (2.33%)
    - C4: *EvEciAiEAu* – 26.29 ha (2.02%)
    - C5: *EvEciAciCEc* – 179.90 ha (13.83%)
    - C6: *EvEciAciMGaAm* – 46.85 ha (3.6%)
    - C7: *EvEciAciMiCeTe* – 152.74 ha (11.74%).

Based on helicopter and ground reconnaissance, and examination of aerial photography, extensive areas of Eucalypt woodland occur locally on the Beasley and Hardey Rivers outside the extent of current vegetation surveys, and therefore the area of eucalypt woodland potentially impacted is relatively minor on a local scale.

- The total length of Boolgeeda Creek is approximately 106km and the modelled maximum discharge extent is approximately 37km for the highest discharge volume scenario – this equates to approximately 30% of the creek being within the maximum extent of discharge.

**Management and Outcome**

ensure that the associated environmental and conservation values are maintained.

- The Discharge MMP includes provision for monitoring of weeds within the riparian vegetation associated with Boolgeeda Creek that may be attributed to discharge of surplus water. The Discharge MMP includes triggers associated with increases in the representation (extent or species) of weeds and management actions that will follow.

- The Discharge MMP includes provision for monitoring of increases in impacts due to grazing and/or trampling of riparian vegetation by feral herbivores that may be attributed to the discharge of surplus water. Triggers relate to increases in evidence of damage caused by feral herbivores and identify actions to be taken in the event that management is required.

**Outcome**

The Proponent considers that this Proposal can be managed to meet the EPA Objective for this factor, in summary:

- No new or potentially significant environmental features have been recorded within the Development Envelope.

- Flora and vegetation potentially affected by the Proposal is well represented outside the Development Envelope, on a local and regional scale.

- Clearing will be restricted to within the Development Envelope.

- Appropriate management measures to avoid, minimise and mitigate potential impacts of the Proposal on flora and vegetation will be implemented (and where applicable have been implemented during Proposal design and operation of the B4 Project).

- The predicted spatial extent of groundwater drawdown of the B4 deposit is less than that assessed and approved for the original B4 Project (MS 717).

- The spatial and temporal extent of discharge is limited.

- A Discharge MMP has been developed and will be implemented in order to monitor, manage the potential impacts of discharge to Boolgeeda Creek including: waterlogging of riparian vegetation, spread of weeds and potential impacts from feral herbivores.
low open shrubland over Triodia epactia hummock grassland and Themeda triandra very open tussock grassland. This unit occurs in habitats that are of value as surface drainage features and support species restricted to such habitat. This unit also appeared to be in a floristic group that did not appear to be widespread in the region (Biota 2005a).

- P3 – comprising Eucalyptus leucophloia scattered low trees over Acacia aneura (various forms), Acacia ayersiana tall open shrubland over Triodia epactia, Triodia wislizeni mid-dense hummock grassland. Biota (2005a) reported that this unit appeared not to be widespread across the region.

In addition, C1: EvGOOIPLd contains Eucalyptus victoriae and Eucalyptus camaldulensis, which may behave as a phreatophyte and thus be influenced by groundwater drawdown (Biota 2005a). Impacts to groundwater dependent vegetation were assessed for the approved B4 Project and are not considered a key environmental factor for this Proposal as the predicted extent of groundwater drawdown is predicted to reduce in lateral extent.

Vegetation – Riparian Impact Zone

- The riparian study area is located on the Hamersley Plateau, which is within the Fortescue Botanical District of the Eremaean Botanical Province as defined by Beard (1975). The riparian study area intersects two of Beard’s vegetation units (Biota 2013a).

- Fifteen (15) vegetation units were identified within the riparian study area which were grouped into 5 broad categories:
  - o Creekline dominated by Corymbia hamersleyana (C1:ChAciAtuGOr);
  - o Creekline dominated by Eucalyptus victoriae and/or E. camaldulensis (C2:EvAciAtuApThTe, C3:EvEcAciApThTeEua, C4:EvEcAciEuA, C5:EvEcAciC,Ec, C6:EvEcAciMGAam and C7:EvEcAciMgCeTe);
  - o Floodplains with Corymbia hamersleyana (F1, F4 and F7);
  - o Floodplains dominated by Acacia cristinoviridis and A. pyrifolia (F2, F3, F5 and F8);
  - o Floodplains supporting Acacia sclerosperma subsp. sclerosperma (F6 and F7).

- No vegetation comprising TECs or PECs were recorded within the riparian study area.

- Seven vegetation units (C1:ChAciAtuGOr, C2:EvAciAtuApThTeEua, C3:EvEcAciApThTeEua, C4:EvEcAciEuA, C5:EvEcAciC,Ec, C6:EvEcAciMGAam and C7:EvEcAciMgCeTe) recorded in the riparian study area were considered to be of elevated significance as they are equally at risk from a number of threats (including grazing and invasion by weeds) known to impact on the vegetation of major ephemeral watercourses.

The vegetation condition of the creek bed was ranked as being Very Good overall despite the presence of *Cenchrus ciliaris*, which was found to be growing both as scattered grasses and very open tussock grasslands. The vegetation conditions of surrounding floodplains was categorised as Good due to the higher degree of invasion of *Cenchrus ciliaris*.

Flora - Riparian Impact Zone

- No threatened flora species protected under the Wildlife Conservation Act 1950 (WC Act) were recorded, or expected to occur within the riparian

<table>
<thead>
<tr>
<th>EPA Objective</th>
<th>Existing Environment</th>
<th>Potential Impact (without mitigation)</th>
<th>Management and Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low open shrubland over Triodia epactia hummock grassland and Themeda triandra very open tussock grassland. This unit occurs in habitats that are of value as surface drainage features and support species restricted to such habitat. This unit also appeared to be in a floristic group that did not appear to be widespread in the region (Biota 2005a).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPA Objective</td>
<td>Existing Environment</td>
<td>Potential Impact (without mitigation)</td>
<td>Management and Outcome</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------</td>
<td>---------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Impact zone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>One Priority 1 (P1) Species – Pseudidium sp. Fortescue Marsh (S. Van Leeuwen 4865) was recorded in the riparian survey area.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>One Priority 2 (P2) Species – Pentaeperis trichodesmoides subsp. hispida was recorded in the riparian survey area.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>One Priority 3 (P3) Species – Indigofera sp. Bungaroo Creek (S. Van Leeuwen) was recorded in the riparian survey area.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>One Priority 4 (P4) Species – Goodenia nuda was recorded in the riparian survey area.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The vegetation condition of the creek bed was ranked as being Very Good despite the presence of <em>Cenchrus ciliaris</em>, which is growing both as scattered grasses and very open tussock grasslands. The creek line supports a healthy and diverse range of flora species.</td>
<td></td>
</tr>
</tbody>
</table>
9 ASSESSMENT OF IMPACT ON TERRESTRIAL FAUNA

This Section describes the terrestrial fauna and fauna habitats that occur within the proposed Development Envelope and provides details regarding the potential impacts to terrestrial fauna and conservation significant fauna habitats from 950 ha of additional clearing of native vegetation that forms part of this Proposal.

The EPA applies the following objective, in its EAG8 (EPA, 2013) in its assessment of proposals that may affect terrestrial fauna:

To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.

9.1 TERRESTRIAL FAUNA STUDIES

A number of terrestrial fauna studies have been conducted in the B4 Operation area. Summaries of the keys findings of the findings of the main terrestrial fauna surveys (in the Development Envelope and adjacent nearby areas) is provided in Table 9-1.

Database searches conducted as part of these fauna surveys have indicated a total of 18 species of conservation significance for the locality (two avifauna species, six migratory avifauna species, two reptile species and eight mammal species). Of these only seven species have been recorded in previous surveys in the vicinity or are considered likely to occur.

Table 9-3 lists the conservation significant vertebrate species that have the potential to occur in the Development Envelope.
### Table 9-1: Summary of Terrestrial Fauna Studies

<table>
<thead>
<tr>
<th>Report Title and Author</th>
<th>Summary of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fauna Habitats and Fauna Assemblage of the B4 Project, near Tom Price.</strong>&lt;br&gt;Biota Environmental Sciences (2005b)&lt;br&gt;RTIO HSE 0014405</td>
<td>Baseline fauna survey between 18/10/2004 and 30/10/2004 and between 12/04/2005 and 21/04/2005 (including White Quartz Road).&lt;br&gt;The survey was planned and implemented in accordance with the following:&lt;br&gt;• Environmental Protection Authority (EPA) Position Statement No. 3 “Terrestrial Biological Surveys as an Element of Biodiversity Protection” (EPA 2002); and&lt;br&gt;• Guidance Statement No. 56 “Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia” (EPA 2004b).&lt;br&gt;Size of study area = 11,796 ha.&lt;br&gt;Two Priority 4 fauna species were recorded within the study area. Further details are provided in Table 9-3.</td>
</tr>
<tr>
<td><strong>Beasley River Limonites - Baseline Fauna Survey.</strong>&lt;br&gt;Biota Environmental Sciences (2009b)&lt;br&gt;RTIO HSE 0086993</td>
<td>Single phase baseline survey between 21/05/2009 and 31/05/2009.&lt;br&gt;The survey was planned and implemented in accordance with the following:&lt;br&gt;• Environmental Protection Authority’s (EPA) Guidance Statement 20, “Sampling Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia” (EPA 2009);&lt;br&gt;• Position Statement No. 3 “Terrestrial Biological Surveys as an Element of Biodiversity Protection” (EPA 2002); and&lt;br&gt;• Guidance Statement No. 56 “Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia” (EPA 2004b).&lt;br&gt;Size of study area = 4,162 ha.&lt;br&gt;The following four vertebrate fauna species of conservation significant were recorded in the study area: two Schedule 1; one Schedule 3; and one Priority 4 species. Further details are provided in Table 9-3.</td>
</tr>
</tbody>
</table>
### Summary of Study

**Brockman Syncline 4 Marra Mamba - Targeted Fauna Survey.**

Biota Environmental Sciences (2013c)
RTIO HSE 0179976

Desktop review, targeted fauna survey between 28 August and 4 September 2012. The survey was planned and implemented in accordance with the following:

- Environmental Protection Authority’s (EPA) Guidance Statement 20, “Sampling Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia” (EPA 2009);
- Position Statement No. 3 “Terrestrial Biological Surveys as an Element of Biodiversity Protection” (EPA 2002); and

Size of study area = 1,921 ha.

The study area comprised four fauna habitats: stony plains; creeklines and floodplains; stony hillslopes; and rocky gorges. Targeted surveys using systematic sampling in specific habitats was conducted for vertebrate fauna: Northern Quoll (*Dasyurus hallucatus*), Orange Leaf-nosed Bat (*Rinoniceris aurantis*) and Ghost Bat (*Macroderma gigas*) and for invertebrate groups known to support short-range endemic (SRE) taxa: Mygalomorphae (trapdoor spiders), Diplopoda (millipedes), Pulmonata (land snails) and Pseudoscorpiones.

Although no Schedule or Priority Fauna were recorded within the study area, Biota (2013c) considered that ten conservation significant species were considered likely to occur or having the potential to occur in the study area. These included three Schedule 1 species; two Schedule 3 (Migratory) species; and five Priority 4 listed species. On the basis of the field assessment and results of the targeted survey Biota concluded that the study area is unlikely to have elevated conservation significance for any of the species listed in Table 9-3.

**Marra Mamba West (AR-13-11158) - Native Vegetation Clearing Permit Report.**

Biota (2013d)
RTIO-HSE-0201775

Desktop review and Level 1 flora and fauna survey between 14 and 18 September 2013.

Size of study area = 324 ha.

This survey was planned and implemented in accordance with the following:

- Guidance Statement No. 51 - Terrestrial Flora and Vegetation Surveys for EIA in Western Australia (EPA 2004a); and

Five mammal species, two reptiles’ species and one invertebrate species were recorded from the study area. One Priority 4 species was recorded in the study area. Further details are provided in Table 9-3.
9.2 RHAGADA

MS 717 included a condition relating to land snails at site BROMD, which identified the requirement for the preparation of a Snail Management Plan. A Snail Management Plan was completed and approved by the DPaW in August 2007.

The Snail Management Plan suggested that that the apparent uniqueness of the snails from BROMD was an artefact of limited samples across few locations. This statement was based on findings from subsequent molecular studies carried out by Biota from a number of localities across the Pilbara bioregion.

Furthermore, the Snail Management Plan considered that if additional and similar populations of *Rhagada* sp “Mt Brockman” to those occurring at BROMD were located elsewhere, then the requirement to commence or continue monitoring the BROMD location would be extinguished.

The Snail Management Plan further highlighted that the valley supporting the P1 vegetation unit from which the BROMD haplotype was recorded is broadly connected with other valleys and is therefore unlikely to support a genetically isolated population of *Rhagada*.

Based on this, additional sampling was undertaken along the contiguous drainages features (including Beasley River West) to the south of the BROMD site. The BROMD haplotypes was found at eight additional sites, of which six are outside of the Development Envelope.

Biota (2008) considered that the data from this work strongly supported the notion that the taxon collected at BROMD occurs more widely and at least as far as 24 km to the south. The data also suggested that the specimen from the BROMD site are part of a population that has a broader distribution that follows the West Beasley River (near the Paraburdo – Nanutarra Rd) north along a minor tributary to the BROMD location, a total distance of more than 25 km.

Throughout this distribution, evidence suggested that snails occur in Triodia dominated habitat along drainage features irrespective of the over storey component. In other words it is not restricted to the P1 vegetation type identified at BROMD.

On this basis, the Proponent proposed to the OEPA and DPaW that the monitoring of the BROMD population and its habitat (the P1 vegetation unit) at the BROMD site cease. However, in recognition of the complex evolutionary histories of Rhagada in the Brockman area and the Pilbara region in general, the Proponent committed to funding a three year research project titled “Genetic structure, phylogenetic relationships and systematics of endemic snails of the Pilbara, Western Australia”. The project was funded with the University of Western Australia (UWA) and covered several taxonomic studies and PhD’s. The project completed its funding in 2012 and several Journal articles have been produced.

This proposal was accepted by DPaW and the OEPA in March 2009 with confirmation that the Snail Management Plan required to address Condition 8 of MS 717 was considered redundant and that the proponent had met the obligations under Condition 8 and proponent Commitment 14 of MS 717. The Proponent therefore considers that the Revised Proposal does not require a specific condition to manage potential impacts to the Rhagada as a result of the Proposal.
9.3 **FAUNA HABITAT CONSERVATION SIGNIFICANCE ASSESSMENT**

The following assessment utilises the Land Systems framework and the vegetation types to extrapolate the distribution of the fauna habitats within the broader region.

In addition, comment is made as to whether the habitats linked with particular land systems are known, or likely, to support fauna of conservation significance.

### 9.3.1 Assessment Based on Land Systems

#### Boolgeeda Land System

The Boolgeeda Land System occurs widely through the Hamersley Range subregion, with scattered occurrences through the Chichester Range subregion. The Development Envelope is located centrally in relation to the primary extent of the coverage of the Boolgeeda Land System and includes only 0.9% (8,312 ha) of the Land System representation in the region.

No fauna species of conservation significance have been recorded from this Land System within the Development Envelope.

#### Newman Land System

The Newman Land System is widespread throughout the Hamersley Range, with relatively few occurrences in the Chichester Range. The Development Envelope lies almost centrally within the core area of occurrence of this Land System type and includes less than 0.3% (5,229 ha) of its overall representation in the Pilbara.

With the exception of the undescribed *Rhagada* (Section 9.2), no fauna species of conservation significance have been recorded from this Land System within the Development Envelope.

#### Platform Land System

The Platform Land System occurs predominantly in the Hamersley Range, though there are also isolated occurrences in the Chichester Range. Approximately 0.3% (809 ha) of the Platform Land System within the Pilbara occurs within the Development Envelope.

No fauna species of conservation significance have been recorded from this Land System within the Development Envelope.

#### River Land System

The River Land System is widespread throughout the Pilbara bioregion in major river systems. Some 698 ha of this Land System is mapped within the Development Envelope, which is approximately 0.1% of the total area mapped as this Land System in the Pilbara bioregion.

The Priority 4 species *Notoscincus butleri* and Australian Bustard *Ardeotis australis* have been recorded from vegetation types within this Land System for this Proposal.
Robe Land System

The Robe Land System occurs within the central and western sections of the Hamersley subregion, with a few occurrences in the Chichester subregion. The occurrences within the Development Envelope are part of an extensive area in the central Hamersley Range.

Approximately 1,389 ha of Robe Land System occurs within the Development Envelope, which represents 1.1% of the total area of this Land System within the Pilbara bioregion.

No fauna species of conservation significance have been recorded from this Land System within the Development Envelope.

Rocklea Land System

The Rocklea Land System is the most extensive Land System in the Pilbara bioregion. It is widespread throughout the Chichester Range subregion, and also relatively frequent in the Hamersley Range subregion.

The occurrences within the Development Envelope are part of a large area in the central Hamersley Range.

Approximately 3,576 ha of Rocklea Land System occurs within the Development Envelope, which is 0.1% of the total representation of this Land System within the Pilbara bioregion.

No fauna species of conservation significance have been recorded from this Land System within the Development Envelope.

Table Land System

This Land System occurs as isolated dispersed occurrences in the south of the Pilbara bioregion and also within the Gascoyne bioregion. The 47 ha occurring within the Development Envelope comprises only 0.03% of that mapped for the Pilbara bioregion. Calcrete outcroppings have been identified as important for stygial, troglobitic and land snail communities. All these groups can and do support taxa with narrow distributions.

While the Table Land System thus has a high conservation significance rating within the Development Envelope, current mine planning does not impact this Land System.

Wona Land System

The Wona Land System occurs primarily in the Chichester Range subregion and as scattered occurrences in the Hamersley subregion.

Only 25 ha of this Land System occurs within the Development Envelope, at the northern end of the Beasely River tributary valley. This represents only 0.01% of the Pilbara occurrence of this Land System.

No fauna species of conservation significance have been recorded from this Land System within the Development Envelope.
9.3.2 Assessment Based on Vegetation Types

Most of the vegetation types identified within the Development Envelope have been previously recorded outside the Development Envelope in widespread landforms and with common dominant species.

However three vegetation types were considered unlikely to be widespread in the region and it follows that aspects of these fauna habitats may therefore also have a limited distribution:

- gorge vegetation types H10, H11, H12, H13 and H16 (mixed shrublands over hummock grasslands dominated by suites of species preferring rocky habitats);

- vegetation types of stony plains (equivalent to the Acacia over Triodia fauna habitat): P1 (Acacia aff. aneura (narrow fine veined; site 1259), A. ayersiana, Acacia tetragonophylla tall shrubland over Eremophila forrestii, Acacia bivenosa shrubland over Triodia epactia mid-dense hummock grassland); P9 and P10 (Triodia wiseana / T. angusta hummock grasslands with variable overstoreys occurring on stony calcrete plains); and P11 (Acacia synchronicia scattered shrubs over Triodia angusta hummock grassland); and

- creekline vegetation types C2, C6, C13, C17 and C20 (variously dominated by Mulga, Eucalyptus xerothermica, Acacia pyrifolia, A. citrinoviridis or Gastrolobium grandiflorum) (Biota 2005a).

Table 9-2 Summary of Conservation Significant Fauna Habitats occurring in the Development Envelope

<table>
<thead>
<tr>
<th>Fauna Habitat</th>
<th>Habitat features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hummock Grasslands and Acacia Shrublands</td>
<td>Grasses e.g. Triodia forming mound-like tussocks on relatively flat plains. Spinifex with emergent Acacia species on relatively flat plains.</td>
</tr>
<tr>
<td>Mulga Woodlands and Shrublands</td>
<td>A. aneura (Mulga) dominated overstorey (including woodlands) with mixed shrubland and grassland understorey, on relatively flat plains. Mulga Groves – stands of Acacia species forming a closed canopy on relatively flat plains.</td>
</tr>
<tr>
<td>Gorges and Gullies</td>
<td>Deeply incised gorges or gullies including breakaways.</td>
</tr>
<tr>
<td>Rock Piles</td>
<td>Distinct, massive piles of rocks, often found on plains or other landforms.</td>
</tr>
<tr>
<td>Major Drainage</td>
<td>Vegetation in or along major rivers, including permanent pools. Creeklines (with or without flowing water) with Coolibahs present.</td>
</tr>
<tr>
<td>Minor Drainage</td>
<td>Creeklines (with or without flowing water) that are dominated by Acacia species, usually Acacia citrinoviridis. Small drainage lines that flow in wet periods and have vegetation that is distinct from the surrounding areas.</td>
</tr>
</tbody>
</table>
9.3.3 Fauna Species of Conservation Significance

Conservation significant vertebrate fauna species indicated in desktop searches as potentially occurring within the Development Envelope are summarised in Table 9-3. An assessment was conducted of the likely occurrence of those species within the Development Envelope. The assessment also considered potential impacts to Matters of National Environmental Significance (MNES) as listed under the EPBC Act which concluded that the Proposal did not require referral under this EPBC Act.

Figure 9-1 and Figure 9-2 depict the known records of conservation significant fauna within the Development Envelope.

Table 9-3: Conservation Significant Species potentially occurring within the Development Envelope

<table>
<thead>
<tr>
<th>Species</th>
<th>Conservation status WA</th>
<th>EPBC Act status</th>
<th>Likelihood of occurrence within Development Envelope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Quoll <em>Dasyurus hallucatus</em></td>
<td>Schedule 1</td>
<td>Endangered</td>
<td>Whilst the Northern Quoll has not been recorded within the Development Envelope there is suitable core habitat for this species in the broader area (Biota 2013d). The closest record of Northern Quoll to the Revised Proposal is from Marandoo which is 100 km to the east. It is considered that this species may potentially occur within the Development Envelope (rather than likely to occur) and that it would more likely use the area for foraging than denning. Given the absence of core habitat within the area of additional clearing and the lack of records from the locality, no significant impact is expected to the Northern Quoll from clearing within the Development Envelope.</td>
</tr>
<tr>
<td>Pilbara Olive Python <em>Liasis olivaceus barroni</em></td>
<td>Schedule 1</td>
<td>Vulnerable</td>
<td>A skin slough believed to belong to this species was recorded at a site within the Development Envelope but approximately 2.5 km south of the additional clearing. Given the absence of core habitat within the area of additional clearing no significant impact is expected to the Pilbara Olive Python from clearing within the Development Envelope.</td>
</tr>
<tr>
<td>Orange Leaf-nosed Bat <em>Rhinonicteris aurantius</em></td>
<td>Schedule 1</td>
<td>Vulnerable</td>
<td>Records of this species were made approximately 22 km south of the proposed new clearing and outside of the Development Envelope. Due to lack of suitable habitat within the Development Envelope it is considered that no significant impact is expected to the Orange Leaf-nosed Bat from clearing within the Development Envelope.</td>
</tr>
<tr>
<td>Species</td>
<td>Conservation status WA</td>
<td>EPBC Act status</td>
<td>Likelihood of occurrence within Development Envelope</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>------------------------</td>
<td>----------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Peregrine Falcon</td>
<td>Schedule 4</td>
<td>-</td>
<td>Whilst this species has not been recorded within the Development Envelope it is considered likely to occur as suitable prey species, such as parrots, are common in the area. The Revised Proposal is unlikely to affect the conservation status of this species.</td>
</tr>
<tr>
<td><strong>Falco peregrinus</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ghost Bat</td>
<td>Priority 4</td>
<td>-</td>
<td>The Ghost Bat has been recorded from Brockman 2 which is approximately 18 km northeast of the B4 Operation. As for the Orange Leaf-nosed Bat, the Ghost Bat is reliant on deep caves to roost and no suitable roosting sites are present within the additional clearing area. Individuals may potentially forage within the broader Development Envelope, but given their mobile nature and nocturnal habits, clearing of vegetation within the Development Envelope will not have an impact on the conservation status of this species.</td>
</tr>
<tr>
<td><strong>Macrodernis gigas</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Pebble-mound Mouse</td>
<td>Priority 4</td>
<td>-</td>
<td>No active mounds have been recorded within the Development Envelope. Therefore the conservation status of this species will not be affected as a result of the Revised Proposal.</td>
</tr>
<tr>
<td><strong>Pseudomys chapmani</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian Bustard</td>
<td>Priority 4</td>
<td>-</td>
<td>Several sightings and recordings of this species have been made within the Development Envelope. However, given their mobile nature clearing of vegetation within the Development Envelope will not have an impact on the conservation status of this species.</td>
</tr>
<tr>
<td><strong>Ardeotis australis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bush Stonecurlew</td>
<td>Priority 4</td>
<td>-</td>
<td>This species has been recorded sheltering beneath mulga within the Development Envelope. However, given the species mobility the Revised Proposal will not affect the conservation status of this species.</td>
</tr>
<tr>
<td><strong>Burhinus grallarius</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A skink</td>
<td>Priority 4</td>
<td>-</td>
<td>This species has previously been recorded within Boolgeeda Creek. Clearing within the Development Envelope is unlikely to impact the conservation status of this species, should it occur, given the broad occurrences of this species in the locality and broader bioregion.</td>
</tr>
<tr>
<td><strong>Notoscincus butleri</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 9.4 IMPACT ASSESSMENT ON TERRESTRIAL FAUNA

Table 9-4 describes how the proposal meets the EPA’s objectives in respect of terrestrial fauna and presents an impact assessment of significance. Management and mitigation measures are also presented.
Figure 9-1
Significant Fauna
Records and Fauna
Habitats within the
Development Envelope
- Area 1

Drawn: J Woodroof
Date: July 2014
Plan No: P260122102v1
Prod: MGA94 (Zone 58)
Figure 9-2
Significant Fauna Records and Fauna Habitats within the Development Envelope - Area 2

Drawn: J. Woodroof
Plan No: P0E0122102v1
Date: July 2014
Proj: MG484 (Zone 50)

LEGEND

- Proposed Development Envelope
- Boolgeeda Creek Discharge
- Leggadina falcataenssis - P4
- Ardeotis australis - P4
- Pseudomys chapmani - P4
- Burhinus grallator - P4
- Authorized Disturbance
- Hummock Grasslands and Acacia Shrublands
- Mixed Woodlands and Shrublands
- Mulga Woodlands and Shrublands
- Hills
- Major Drainage
- Minor Drainage
- Gorges and Gulleys

SCALE
0 1 2 3 4 5km
1:170,000 @ A4
Figure 9-3
Significant Fauna Records and Fauna Habitats within the Discharge Footprint

Drawn: J. Woodroof  
Date: July 2014  
Plan No: PCBR123202r1  
Proc. M39A4 (Zone 50)
**Table 9-4: Terrestrial Fauna: Description of Factor, Impact Assessment and Management**

<table>
<thead>
<tr>
<th>EPA Objective</th>
<th>Existing Environment</th>
<th>Potential Impact (without mitigation)</th>
<th>Management and Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>To maintain representation, diversity, viability and ecological function at the species, population and assembly level.</td>
<td>Vertebrate terrestrial fauna and fauna habitat</td>
<td>Fauna surveys have been undertaken over approximately most of the Development Envelope. Summaries of the findings of the three main surveys (in the Development Envelope and adjacent, nearby areas) that are relevant to the additional clearing areas are provided below.</td>
<td>The key potential impacts of the Proposal on terrestrial fauna (e.g. loss of habitat due to clearing) will be minimised via management measures to reduce potential impacts on flora and vegetation, as detailed in Table 8-6.</td>
</tr>
</tbody>
</table>

- **Fauna Habitats and Fauna Assemblage of the B4 Project Area**
  - Biota (2005b) recorded 159 taxa of terrestrial vertebrate fauna belonging to 54 families comprising two frogs, 54 reptiles, 83 birds, seven bats and 13 non-vascular mammals. Six primary habitats were identified within the Development Envelope, largely based on vegetation structure and landscape. | Four priority vertebrate fauna species were recorded (Biota 2005b): | The prediction of groundwater drawdown will be reduced from that assessed for the approved B4 Operation. |
  - Western Pebble-mound Mouse (Pseudomys chapmani) | Not affect regional population levels of any fauna species. | Ensure sightings of conservation significant fauna species (primarily species listed under the EPBC Act) encountered by the B4 Operation workforce are reported to site Environmental Advisors. |
  - Australia Bustard (Ardeotis australis) | Not contribute to new/additional fragmentation of habitat. | Proposal design has, and will continue to, avoid and minimise clearance of higher value fauna habitat. |
  - Bush Stone-curlew (Burhinus grallarius) | Not affect any new fauna species or habitat types that have not been previously assessed. | Food wastes appropriately disposed of in bins/waste facilities to discourage scavenging by both feral and native animals, and bin lids securely closed. |
  - A skink (Notoscincus butleri) | Not contribute a new or additional threat to conservation significant fauna species. | Internal reporting of incidents involving native fauna. |
  - Brockman Syncline 4 Marra Mamba Targeted Fauna Survey | The detection of both the Pilbara Orange Leaf-nosed Bat and Pilbara Olive Python at the Beasley River study area represent the most significant faunal findings to the overall environmental value of the Development Envelope. However, the Pilbara Olive Python record was the result of finding a skin slough believed to belong to this species, and was recorded at a site approximately 2.5 km south of the proposed clearing. In addition, the Pilbara Orange Leaf-nosed Bat records were made at a site approximately 22 km south of the Development Envelope. | Implementing and enforcing appropriate vehicular speed limits on site access roads. |
  - The Marra Mamba deposit is located immediately south of the current mining area and comprises an area of approximately 3,921 ha. No vertebrate fauna of conservation significance were recorded during systematic trapping, or encountered opportunistically during traverses of the Marra Mamba survey area (Biota 2013c). | The presence of the Pilbara Olive Python in the south of the Development Envelope suggests that populations of this species may exist in the area. However, the lack of suitable habitat combined with the lack of additional records from the other two surveys near the B4 project area suggests that their presence is unlikely within the Proposal area. | Monitoring of feral herbivores and predators will be undertaken along the Boolgeeda Creek wetting front and management measures will be put in place to reduce the risk of significant increases in feral herbivores being attracted by the supply of discharge water. It is not proposed to fence the 37 km creekline along Boolgeeda Creek. |
  - A variety of fauna habitats were sampled including rocky breakaways, gorges, stoney hills, Triodia plains, and broad drainage lines. These habitats are all well represented throughout the Hamersley subregion, and are not restricted to the Marra Mamba survey area. There was very limited core (preferred) habitat for Northern Quolls or Pilbara Olive Pythons observed within the Development Envelope. | The failure to detect the Pilbara Orange Leaf-nosed Bat during other fauna surveys conducted throughout the wider Development Envelope, combined with the 22 km separation between the Beasley River records and the Development Envelope, suggests this species is unlikely to be roosting in the vicinity. Whilst it is possible that this species may use parts of the Development Envelope for foraging, it is highly unlikely that development of these areas would have any impact on the conservation status of this species. | The Discharge MMP will be implemented to ensure that the associated environmental and conservation values are maintained during discharge of surplus water to Boolgeeda Creek. |
  - **Beasley River Limonites Fauna Survey** | The Beasley River is located approximately 10 km south-east of the Development Envelope. Biota (2005b) recorded the following three species that are considered to be of conservation significance: | Outcome |
  - The Pilbara Orange Leaf-nosed Bat (Rhinonicteris aurantius), listed as a Schedule 1 species under the State WC Act and ‘Vulnerable’ under the EPBC Act. | - Fauna habitats potentially impacted by the Proposal (including habitat of higher value for conservation significant fauna species) are well represented outside of the Proposal boundary, on a local and regional scale. |
  - The Short-tailed Mouse (Leggadina jakei jakei), listed as Priority 4 species under the WC Act. | - Of the four conservation significant vertebrate fauna species recorded in the B4 area only the priority species Notoscincus butleri (skink) was recorded within the Proposal’s riparian impact zone. |
  - The Pilbara Olive Python (Liopsis olivaceus barroni), listed as a Schedule 1 species under the WC Act and the EPBC Act. | - The predicted extent of groundwater drawdown will be reduced from that assessed for the approved B4 Project. Therefore no new or additional impacts to subterranean fauna are expected to result from implementation of this | The Revised Proposal can be managed to meet the EPA environmental objective for this factor, as detailed in the adjacent columns: | | | |

**July 2014**

101
is unlikely. Consequently, it is considered highly unlikely that the development of the Proposal would have an impact on the conservation status of such species.

**Terrestrial fauna – riparian impact zone**

S3 vegetation types were identified within the B4 Project area, most of which have been previously recorded outside the B4 Project area or are likely to occur in the vicinity, as the landforms are widespread and the dominant species are relatively common. Fourteen vegetation types were considered unlikely to be widespread in the region (Biota 2005a), and it follows that aspects of these fauna habitats may therefore also have limited distribution:

- Creekline vegetation types C2, C6, C13, C17 and C20 (variously dominated by Mulga, Eucalyptus xerothermica, Acacia pyrifolia, A. citroniviridis or Gastrolobium grandflorum) (Biota 2005a)

Of the four conservation significant vertebrate fauna recorded, the priority species Notoscincus butleri was recorded in the Biota 2005 survey in creekline habitat at Boolgeeda Creek. However the conservation status of this species was deemed unlikely to be impacted by the proposed mining activities at the bioregion and subregion level.

There are no apparent areas of sheet flow dependent habitat in the B4 Project area; however Boolgeeda Creek exists as a broad drainage channel where appropriate culverts will be required to eliminate erosion and avoid weed introduction and spread.

A potential impact of surplus water discharge to Boolgeeda Creek, which was highlighted during consultation with the Cheela Plains pastoral station, is the attraction of feral herbivores to surface water. Whilst this has not been a significant issue at the Proponent’s other mine operations, it may be for the Revised Proposal given the reported presence of donkeys and feral cattle in the area.

Reconnaissance of Boolgeeda Creek in November 2009 and April 2010 revealed no surface water present in the area currently modelled for this Proposal (WRM 2011a). Pools in Boolgeeda Creek are likely to be transient and ephemeral and water quality will vary with the season. They are likely to be dependent on rainfall, surface water and shallow alluvial interflow rather than regional groundwater. The pools noted by Biota during the August 2013 survey have not been identified in previous studies. However, they are likely to be a result of the unseasonably high rainfall recorded at B4 in May and June 2013 (32.8 mm and 52.8 mm respectively, compared with 8.8mm and 16.4 mm in 2011 and 0 mm and 12.4 mm in 2012).

Therefore no new or additional impacts to subterranean fauna are expected to result from implementation of this Proposal.

- None of the recorded taxa that may represent SRE species are considered likely to be restricted to the B4 area, and the majority of records of each of these taxa were collected from outside of the Project Boundary.

Appropriate management measures to avoid, minimise and mitigate potential impacts of the Proposal on fauna will be implemented (and where applicable, have been implemented during Proposal design and operation of the B4 Operation to date).
10  OTHER CHANGES TO SCHEDULE 1 OF MINISTERIAL STATEMENT 717

This Section provides details of requested changes to Schedule 1 of MS 717 for inclusion in the proposed new Statement that are not considered to warrant impact assessment.

10.1  WASTE DUMP OPTIMISATION

In line with B4 Operation and Closure commitments, the Life of Mine Schedule has incorporated in-pit dumping to ensure that below water table pits are backfilled to at least 2 m above the pre-mining water table at closure. However, timely access to pit voids to allow the commencement of backfilling activities will not be possible before 2018. In addition, areas with potential future low grade cutbacks cannot be backfilled as it would result in a loss of this low grade ore resource to backfill material and compromise the potential value from future processing.

It is against this background that the Proponent seeks the following waste dump optimisation:

• removal of the waste dump height and waste rock limits to allow flexibility in handling of waste rock and low grade ore whilst maintaining the backfill schedule; and

• an increase in waste dump capacity and clearing of native vegetation.

10.1.1  Waste Dump Height Limit

The height of a waste dump is constrained by a combination of its approved footprint limit, maximum waste rock capacity and the batter slopes required for long term stability. The latter is determined by the material properties of the waste rock. The final height is determined by the final landform design requirements, although changes in operational height may be required during the life of the mine in order to maximise flexibility in handling of waste rock and low grade material.

Any increases in waste dump height will be managed in accordance with the Proponent’s Landform Design Guidelines (RTIO-HSE-0015708) and the Proponent’s D3 Standard—Management of pit slopes, stockpiles, spoil and waste dumps. Additional lift heights will be 20 m, with operational angles of approximately 37 degrees (angle of repose). Final rehabilitation angles of 18 degrees will be required, based on the material types and quantities expected in the dumps. The Brockman 4 Closure Plan is currently being updated (scheduled to be submitted to Government in Quarter 1 2015 in accordance with MS 717 Condition 10.2) and will provide further detail on each of the waste dumps (including material type and volume) and their associated rehabilitation criteria.

10.1.2  Waste Dump Capacity

The Proponent considers that the above mentioned flexibility regarding the height of waste dumps will provide a temporal buffer to the availability of relevant pit voids for backfilling and reduce the post-closure footprint that would otherwise be required for the B4 Operation. However, additional waste dumps are required to cater for waste rock handling from the eastern pits (Pit 18, 11, 12 and 17).

New waste dumps will be built with the same configuration as the existing waste dumps and will require capacity to manage an expected increase in waste rock generated from 420 Mt to approximately 620 Mt. The Proponent considers that the volume of waste rock generated is not
environmentally significant beyond the clearing footprint and ability to backfill voids to avoid pit lakes. As constraints are proposed for both of these aspects, the Proponent proposes that the waste volume be removed from Schedule 1.

10.1.3 Mineral Waste Characteristics

The majority of waste material at B4 is competent rocky material (over 80 percent of waste comprises Joffre, Dales Gorge and Hydrated Zone material).

Pits 1, 2, 3 and 5 have been identified as containing potentially acid forming material (PAF); however it is a relatively small amount of material (2.1 Mt) which, based on the current B4 mine plan, is scheduled to be intercepted by mining in 2015. This material will be placed in an out of pit dump on Rocklea Station as no pit void will be available for use at the predicted time of interception.

The PAF material will be managed (encapsulated) during operations in accordance with the Mineral Waste Management Plan (WMP) and the Spontaneous Combustion and Acid Rock Drainage (SCARD) Management Plan for the B4 Operation (SCARD and WMP are provided in Appendix 10 and Appendix 11). PAF material will remain encapsulated at closure.

10.2 CHANGES TO KEY CHARACTERISTICS OF MS 717

The Proponent requires the following changes to the Key Proposal Characteristics as currently specified in MS 717:

- **Removal of GHG emissions limit** - the Proponent considers that Greenhouse Gas Emissions (GHG) is not environmentally significant for the B4 Project. In Bulletin 1214 the EPA considered that GHG was not considered a relevant environmental factor that required evaluation. In addition, this factor is adequately managed under Commonwealth legislation. Therefore, this Proposal seeks the removal of this limit from the Key Proposal Characteristics.

- **Removal of stripping ratio** - the Proponent requires the flexibility to mine its resources within an approved area and to meet changes in technology and economic situations. As such, the specification of a stripping ratio should be removed from the Key Proposal Characteristics as this aspect can be managed under more relevant environmental restrictions (i.e. the overall clearing limit).

- **Removal of waste dump height restriction** – the Proponent considers that the operational height of a waste dump is constrained by a combination of the available clearing limit, the maximum waste rock capacity, and batter slopes required for long term stability of the waste dump. Similarly, the Proponent considers that the final height of a waste dump will be determined by the final landform design as part of the mine closure planning. The absence of no sensitive receptors in the surrounding area removes the need to consider visual amenity as a factor. The Proponent therefore proposes the removal of the specific height limits to waste dumps at B4.

- **Removal of water supply limit** - the Proponent considers that the water supply limits stated in the Key Proposal Characteristics can be removed as this aspect can be managed under the Rights in Water and Irrigation Act 1914 (RIWI Act).

- **Removal of specific locations of plant, administration, workshops and stockpiles location** – the Proponent considers that the flexibility in defining the layout of a project afforded by EAG1,
through the provision of a Development Envelope and a limit on disturbance of vegetation, removes the need to specify infrastructure locations in Schedule 1 beyond the standard project layout figure.

- **Removal of restriction to accommodation and workforce numbers** - the Proponent requires the flexibility to staff the mine site to meet requirements associated with changes in technology, safety, environment and other activities associated with mining and as such, requests that the specification of workforce numbers and accommodation be removed from the Key Proposal Characteristics as there is no environment impact associated with this aspect.

This Proposal includes removal of the production rate from Schedule 1 of MS 717 on the basis that production rate in itself does not result in environmental impacts and is instead limited by clearing, water abstraction and water discharge for which limits are expected to be prescribed in Schedule 1.

These proposed changes to the Key Proposal Characteristics of MS 717 are summarised in Table 10-1. The proposed Schedule 1 has been prepared in accordance with the requirements of EAG1 and is presented in Section 3.1.

<table>
<thead>
<tr>
<th>Table 10-1: Proposed Changes to the Key Characteristics (MS 717)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Element</strong></td>
</tr>
<tr>
<td>Area of disturbance</td>
</tr>
<tr>
<td>Waste rock</td>
</tr>
<tr>
<td>Greenhouse Gas Emissions</td>
</tr>
<tr>
<td>Stripping ratio</td>
</tr>
<tr>
<td>Waste dumps, high and low grade stockpiles – location and height</td>
</tr>
<tr>
<td>Element</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>Dewatering</td>
</tr>
<tr>
<td>Plant, administration, workshops and stockpiles location</td>
</tr>
<tr>
<td>Construction operation workforce</td>
</tr>
<tr>
<td>Accommodation</td>
</tr>
</tbody>
</table>
11 OTHER ENVIRONMENTAL IMPACTS AND MANAGEMENT

11.1 ENVIRONMENTAL IMPACTS AND MANAGEMENT

In accordance with the EPA Prepared Scoping Guideline for this proposal (Appendix 3), the preliminary key environmental factors relating to this Proposal are:

- Hydrological Processes;
- Flora and Vegetation; and
- Terrestrial Fauna.

Environmental impacts and management of these environmental factors are addressed in a series of Tables (Table 7-1 and Table 9-4).

The Proponent considers that the following factors will not result in any significant change in addition to or different from that originally assessed and approved under MS 717:

- rehabilitation and closure;
- heritage;
- air quality;
- visual amenity; and
- cumulative impacts.

The assessment of impacts and management of these factors is presented below within this Section.

Residual risk and management is addressed in Section 11.

11.2 ENVIRONMENTAL MANAGEMENT SYSTEM OVERVIEW

The Proponent has developed and refined environmental management objectives, systems and procedures over decades of operational mining experience in the Pilbara region that are successfully applied at multiple iron ore mine sites.

The key components to be implemented for this Proposal include:

1. The Rio Tinto Iron Ore Group Health, Safety, Environment, Communities and Quality Policy (HSECOQ Policy). The HSECOQ Policy is the guiding document for environmental management and provides context and direction for continuous improvement.

2. Rio Tinto Iron Ore (WA) operates under an Environmental Management System (EMS), contained within the HSEQ Management System. The HSEQ Management System is a continuous improvement model covering:

- systematic assessment of environmental risk and legal requirements; systems for training, operational control, communication, emergency response and corrective actions;
- the development of objectives and targets for improvements; and
• audits and review.

3. Monitoring and management plans applicable to the Revised Proposal that will interface with the HSEQ Management System.

4. The Rio Tinto Closure Standard will continue to guide closure planning for the Revised Proposal including this Proposal. This standard governs:
   • commencement of planning for closure prior to project commencement;
   • the development and content of closure plans;
   • stakeholder consultation regarding closure;
   • financial provisioning for closure;
   • the review of closure plans; and
   • the development of Decommissioning Plans five years prior to scheduled closure.

As discussed previously the key environmental factors of the Revised Proposal are Hydrological Processes: Surface Water (refer to Section 7); Flora and Vegetation (Section 8) and Terrestrial Fauna (Section 9); Rehabilitation and Closure; and Residual Risk and Management. The assessment of potential impacts associated with Rehabilitation and Closure Management are provided in Table 11-1.

Table 11-2 outlines environmental factors that were not considered in this Proposal as they will not result in any significant change in addition to or different from that originally assessed and approved under MS 717.
Table 11-1: Rehabilitation and Closure: Description of Factor, Impact Assessment and Management

<table>
<thead>
<tr>
<th>EPA Objective</th>
<th>Existing Environment</th>
<th>Potential Impact (without mitigation)</th>
<th>Management and Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>To ensure that premises can be closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.</td>
<td><strong>Mineral waste physical characteristics</strong>&lt;br&gt;The majority of waste material at B4 is competent rocky material (over 80 percent of waste in Dumps DP2 and DP4 comprises Joffre, Dales Gorge and Hydrated Zone material). Appropriate rehabilitation design criteria of 20 m lifts, 18 degree slopes and 10 m berms will be implemented for waste dumps on site. This will be further detailed in the update to the Brockman 4 Closure Plan.</td>
<td><strong>Waste dumps</strong>&lt;br&gt;The additional waste dumps and changes to existing waste dumps is considered unlikely to have significant additional environment impact to that assessed in the original B4 Project PER. This is based on the following consideration:&lt;br&gt;- Waste dump designs will consider the physical and chemical properties of waste material.&lt;br&gt;- A substantial volume of competent waste is available, enabling design/construction of waste dumps that are stable and not susceptible to excessive erosion.&lt;br&gt;- A substantial volume of inert waste material is available, enabling design/construction of waste dumps that encapsulate the lower volumes of waste rock that poses a potential Acid Mine Drainage (AMD) risk.</td>
<td>• The Rio Tinto Iron Ore (WA) Landform Design Guidelines will continue to be implemented to ensure waste dumps at B4 are safe and stable during operations and at closure.&lt;br&gt;• The Rio Tinto Iron Ore (WA) Mineral Waste Management Plan and the SCARD Management Plan will continue to be implemented, to ensure waste material is adequately geochemically characterised (via static testing, and kinetic testing where warranted) during B4 Operation, and PAF material that poses an AMD risk is appropriately managed.&lt;br&gt;• The Rio Tinto Iron Ore (WA) Soil Resource Management Work Practice will continue to be implemented to manage recovery and storage of topsoil and subsoil resources.&lt;br&gt;• Planning for closure will continue to be undertaken throughout the operation of B4. The first Closure Plan for B4 was developed in 2007 (RTIO-HSE-0063820). The site is subject to MS 717 Condition 10.2 which requires submission of a revised Closure Plan within 5 years of mine commissioning. As mining commenced in 2010, the Brockman 4 Closure Plan is due for submission in 2015.</td>
</tr>
<tr>
<td><strong>Mineral waste geochemical characteristics</strong>&lt;br&gt;Several pits at B4 (Pit 1, 2, 3 and 5) have been identified as containing PAF; however it is predicted to be a relatively small amount of material (2.1 Mt). This material is scheduled to be intercepted by mining in 2015 based on the current mine plan. Dump DP2 has been designated as the storage location of this material as no pit void is available for use at the time the material is intercepted. PAF material will be managed (encapsulated) during operations in accordance with the Mineral Waste Plan.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

---

6 Condition 10.2 of MS717 requires submission of a revised closure plan in 2015. The revised Brockman 4 Closure Plan (ref. RTIO-HSE-0205402) is scheduled for submission to OEPA during 2014.
<table>
<thead>
<tr>
<th>EPA Objective</th>
<th>Existing Environment</th>
<th>Potential Impact (without mitigation)</th>
<th>Management and Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Management Plan (WMP) and the Spontaneous Combustion and Acid Rock Drainage (SCARD) Management Plan for the B4 Operation. PAF will remain encapsulated at closure. The SCARD and WMP are provided in Appendix 10 and Appendix 11 respectively.</td>
<td></td>
<td>Work commenced in 2013 on review and update of this plan and the plan is scheduled for submission to OEPA in 2014. In terms of this Proposal, this revised Closure Plan will address waste dump rehabilitation design, progressive rehabilitation and the management of PAF material.</td>
</tr>
</tbody>
</table>

**Outcome**

The Revised Proposal can be managed to meet the EPA objectives for this factor, in summary:

- Mineral waste dumps are unlikely to have significant environmental impacts, based on analysis of mineral waste volumes, and physical and chemical properties, which indicates the majority of mineral waste is relatively benign and only a very small amount of PAF material (2.1Mt) is expected.
- A Closure Plan for the B4 Operation was prepared in 2007 and submitted with the original proposal. This Plan provides appropriate management measures regarding closure and rehabilitation and is currently being reviewed in accordance with MS 717 Condition 10.2.
<table>
<thead>
<tr>
<th>Factor</th>
<th>EPA Objective</th>
<th>Description of Factor</th>
<th>Impacts – no management</th>
<th>Existing Management and Mitigation Measures</th>
</tr>
</thead>
</table>
| Heritage                      | To ensure that historical and cultural associations are not adversely affected | B4 is located within the traditional lands of the Eastern Guruma people and the PKKP people. Discharge into Boolgeeda Creek is not expected to impact heritage sites or the heritage values of the place, as water will be restricted within the current creek banks, which have already been disturbed by natural flows. The additional clearing for waste dump optimisation will only be undertaken following heritage surveys and any s18’s if required. | Surveys undertaken to date indicate the Proposal is unlikely to have significant impact on Aboriginal heritage, in addition to or different from the B4 Operation:  
  - No ethnographic sites have been identified to date within the Development Envelope.  
  - Some archaeological sites identified to date may be impacted by the Revised Proposal; however, these sites are of low to moderate significance.  
  - Additional clearing required for waste dump optimisation is likely to result in the loss of several heritage sites. If sites cannot otherwise be avoided, the impacts will be managed in accordance with the *Aboriginal Heritage Act 1972* (AHA) Section 18, and in consultation with Traditional Owners. | Heritage values will be addressed during planning and implementation of the Proposal, in accordance with existing B4 Operation management plans, by:  
  - Avoiding disturbance to heritage sites where practical.  
  - Obtaining approval for any required disturbance to identified sites in accordance with s18 of the AHA and in consultation with the Eastern Guruma or PKKP people as applicable.  
  - Protecting all identified sites located near construction or operational areas that are not approved to be disturbed under s18 of the AHA (e.g. through the installation of physical barriers and buffer zones).  
  - Documenting the location of all protected sites in the Proponent’s Geographic Information System (GIS) database and on site plans, and designating buffer zones around these sites. |
<p>| Air Quality (Dust, Noise and Vibration and Greenhouse Gas Emissions) | To maintain air quality for the protection of the environment and human health and amenity. | The Revised Proposal will generate dust, noise, vibration and GHG emissions. | The potential impacts to air quality are not considered to be different from, or in addition to, the approved activities and impacts for the B4 Operation. | The generation of noise, dust, GHG and vibration from the Revised Proposal will continue to be managed in accordance with existing B4 Operation EMP. |</p>
<table>
<thead>
<tr>
<th>Factor</th>
<th>EPA Objective</th>
<th>Description of Factor</th>
<th>Impacts – no management</th>
<th>Existing Management and Mitigation Measures</th>
</tr>
</thead>
</table>
| Amenity (Visual) | To ensure that impacts to amenity are reduced as low as reasonably practicable. | The visual landscape of the Pilbara is generally characterised by rugged ridges and ranges supporting spinifex grasslands, with land uses generally comprising pastoralism and mining infrastructure. The visual character of the landscape in the broader area around the Revised Proposal is predominantly natural in appearance, with localised areas of highly modified landscapes due to multiple mining developments (e.g. Brockman 4, Brockman 2 and Nammuldi-Silvergrass). | In general, visual impact of the Proposal from public roads and publicly accessible viewpoints is not expected to be different or additional to that of the existing B4 Project, in consideration of the following:  
- The Revised Proposal is a small extension to the existing B4 operation.  
- The Revised Proposal is not overlooked by or adjacent to populated or sensitive areas such as scenic outlooks, settlements or National Parks.  
- Access to the Revised Proposal area is via a sealed road and can only be approached from the south via the White Quartz Road.  
- There are no known plans for future tourism ventures in the immediate vicinity. | Visual amenity will continue to be managed in accordance with existing B4 Operation management plans by:  
- Undertaking waste dump design in accordance with the Rio Tinto Iron Ore (WA) Landform Design Guidelines and with consideration of closure objectives for the Proposal, to achieve final landforms that are considered aesthetically compatible with the surrounding landscape.  
- Rehabilitating waste dumps with native vegetation.  
- Rehabilitating any long-term low grade stockpiles that remain in-situ at mine closure with native vegetation (as per waste dumps).  
- Removing infrastructure (other than pits and dumps not used for backfilling) at closure and rehabilitate remaining disturbed areas with native vegetation. |
12 CUMULATIVE IMPACTS

Cumulative impacts can arise where operation level impacts act synergistically, cause indirect impacts or combine to exacerbate impacts spatially and/or through time. In the case of Pilbara mining projects, a principal concern is the potential for multiple mining projects to incrementally diminish and degrade environmental values that would otherwise not be significantly affected by each project in isolation.

The Proponent’s knowledge of current and potential mining projects in the region, in addition to the Revised Proposal, is limited to its own projects as follows:

- **Duck Creek/Boolgeeda Creek catchment**
  - Brockman 2 Detrital Iron Ore Mine (MS 131 and MS 867);
  - Nammuldi operation (MS 925); and
  - Brockman Syncline 4 Marra Mambas (potential).

- **Beasley River catchment**
  - Western Turner Syncline Stage 2 Project (MS 946); and
  - Beasley River Limonites CID Project (potential).

Given its distance from the nearest existing operations, absence of unique or unusual ecological features, and the relatively small scale of clearing and surplus water discharge proposed, the Proponent does not consider that the Revised Proposal will contribute to significant cumulative impacts. An assessment of the potential for cumulative impacts in relation to this proposal is summarised in Table 12-1.

<table>
<thead>
<tr>
<th>Possible cumulative impact</th>
<th>Description and assessment of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disturbance to landforms</td>
<td>The Development Envelope does not include landforms with elevated conservation significance or other special interest. Whilst existing and potential future operations may affect the same land systems, all of the land systems mapped as occurring in the Development Envelope are widely distributed across the Pilbara. No significant cumulative impacts are predicted.</td>
</tr>
<tr>
<td>Disturbance to Hydrological Processes</td>
<td>The Revised Proposal involves the discharge of surplus water to the nearby Boolgeeda Creek. Nearby WTS Stage 2 discharges water to the Beasley River, with a potential wetting front of up to 20 km in length and the Nammuldi-Silvergrass Expansion is authorised to discharge surplus water into Duck Creek periodically. The modelled wetting front for this discharge (under steady state conditions at discharge of up to 200 ML/d) is 157 km. Boolgeeda Creek has been selected as the receiving water body for surplus water from the Revised Proposal, in part to avoid the potential for cumulative impacts to occur within Duck Creek and Beasley River as a result of discharge from multiple operations. The predicted maximum wetting front for a peak discharge rate of 17.5 ML/day is 37 km representing approximately 35% of the Boolgeeda Creek.</td>
</tr>
<tr>
<td>Possible cumulative impact</td>
<td>Description and assessment of significance</td>
</tr>
<tr>
<td>----------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Disturbance to vegetation and significant flora</td>
<td>The potential for future operations locally (Beasley River Limonites CID and BS4 Marra Mambas) to include dewatering and surplus water management has not been quantified, however any additional surplus water volume generated as a result of these developments would need to be disposed of or used. Any discharge would have the capacity to contribute to cumulative impacts in the local catchment.</td>
</tr>
<tr>
<td>Disturbance to habitat for significant fauna species</td>
<td>The proposed additional clearing is centred around the existing B4 Operation, which is at least 22 km from the nearest operation at Brockman 2/Nammuldi. All vegetation units and Priority Flora species that will be disturbed by this proposal are represented elsewhere within and/or outside of the Development Envelope. The proposed clearing is not considered to contribute to cumulative impacts on flora and vegetation.</td>
</tr>
<tr>
<td>Disturbance to habitat for significant fauna species</td>
<td>The habitat types within the project area are well represented in the Pilbara bioregion. These habitats do not have regional significance for rare and endangered fauna species; The proposed additional clearing is not considered to contribute to cumulative impacts on flora and vegetation. No significant cumulative impacts to habitat for significant fauna species are predicted.</td>
</tr>
</tbody>
</table>
13 **RESIDUAL IMPACTS**

13.1 **DETERMINATION OF CRITICAL AND HIGH VALUE ASSETS**

EPA Position Statement No. 9: Environmental Offsets (EPA 2006a) and EPA Guidance Statement No. 19: Environmental Offsets (EPA 2008a) provide guidance to proponents on the approach needed to determine offset requirements for proposals. The environmental aspects of the Revised Proposal have been assessed for their potential value as critical or high value assets as per the definitions and additional criteria presented in these policy documents. Environmental aspects meeting the requirements for either category have been included in the determination of appropriate offsets Table 13-1.

The definitions of critical and high value assets in EPA Position Statement No. 9: Environmental Offsets are as follows:

**Critical Assets:** represent the State’s most important environmental assets that must be fully protected and conserved. Significant adverse impacts to these assets should be avoided at all costs. Therefore, the EPA in providing its advice will adopt a presumption against approval of project proposals where significant adverse impacts affect ‘critical assets’. However, where projects have been approved by the State Government approval should be conditional on the:

- consideration or demonstration (to the maximum extent possible) of onsite impact mitigation; and
- development and implementation of an acceptable offsets package for significant, residual adverse impacts.

**High Value Assets:** represents those environmental assets that are in good to excellent condition, and are considered valuable by the community and / or government but are not identified as ‘critical assets’. Project proposals and offset activities for these assets may be referred to and assessed by the EPA on a case-by-case basis, but are otherwise considered by relevant environmental government agencies.

In order to determine which vegetation communities or fauna habitats within the Development Envelope are ‘high value’ assets, their condition and value to community and / or government was considered.

As described in Section 8 the Development Envelope does not contain any assets considered of value to the government as it does not lie within a State or Commonwealth Government reserve or protected area. Vegetation mapping for the Development Envelope has been completed and does not indicate the presence of any vegetation types that qualify for specific legislative protection (i.e. TECs). Similarly, no PECs have been identified within the Development Envelope.

Vegetation communities mapped within the Development Envelope were generally found to be in Good to Excellent condition as per the Keighery Condition Scale despite the evidence of *Cenchrus ciliaris* invasion along creek beds and surrounding floodplains.

The majority of vegetation communities recorded in the Development Envelope is well represented across the Pilbara region. Whilst some occurrences of Priority Listed Species (flora and fauna) have been recorded within the Development Envelope, none of these were found to be restricted to the Development Envelope and therefore have not been individually classified as ‘high value assets’.
13.2 OFFSET REQUIREMENTS FOR THE REVISED PROPOSAL

The EPA’s objective for environmental offsets is to counterbalance any significant residual environmental impacts or uncertainty through the application of offsets. The requirement for offsets is considered in Table 13-1.

MS 717 covering the B4 Operation does not specify the need for an offset.
Table 13-1: Environmental Offsets Reporting Form

Section A: Administrative information

1. Proposal or scheme name: Brockman Syncline 4 – Revised Proposal

2. Summary of proposal or scheme: The Proponent, Hamersley Iron Pty Limited (a wholly owned subsidiary of Rio Tinto Iron Ore [Rio Tinto]), revise the existing Brockman Syncline 4 Operation with a resulting increase of 950 ha in clearing of native vegetation and the requirement to discharge surplus dewater to Boolgeeda Creek.

Section B: Type of environmental asset(s) – State whether Critical or High Value, describe the environmental values and attributes

No 'Critical' environmental assets are located within the Development Envelope.

Environmental assets that are present within the Development Envelope that could be considered ‘High Value’ environmental assets defined in EPA Position Statement No. 9: Environmental Offsets (EPA 2006a) include two vegetation units that are considered to be of High Conservation Significance in the region:

- **P11 - Acacia synchronica scattered shrubs over Triodia angusta hummock grassland.**
  
  This vegetation type did not belong to a restricted floristic group, but was the main associated vegetation type for a significant sized population of the Priority 3 species *Ptilotus subspinescens*. This vegetation type occurs extensively outside the immediate mining area and on similar substrates along White Quartz Road (Michi Maier, Biota Environmental Sciences, pers. obs.), however is considered unlikely to be well represented in the Hamersley subregion. (Recorded Biota 2005a)

- **EcAcIgMgCv - Eucalyptus camaldulensis var. obtusa open forest over Acacia citrinoviridis, Melaleuca glomerata tall open scrub over Cyperus vaginatus very open sedgeland**

  Recorded from two creeklines that are crossed by White Quartz Road and extend beyond the Development Envelope. This proposal does not involve clearing of this vegetation unit. (Recorded Biota 2007b)

In addition a total of 39 vegetation types that are considered to be of Moderate Significance occur within the Development Envelope (Table 8-4).

Section C: Significant impacts (describe the significant adverse environmental impacts related to the proposal or scheme before mitigation measures are applied)

Potential significant impacts on high value environmental assets from the Revised Proposal are:

- Discharging surplus water to Boolgeeda Creek Duck Creek may elevate the water table locally and provide a more constant flow regime in the short term. This may in turn change the composition of creek vegetation communities.

- Clearing of up to 950 ha of vegetation including vegetation communities of local conservation significance (High and Moderate significance).

- Clearing of vegetation may reduce a small proportion of locally available habitat for Priority Flora species and potentially disturb individual occurrences of Priority Flora species.

- Clearing of vegetation may directly disturb fauna habitat and will result in the displacement of fauna and the loss of individuals of some terrestrial fauna species.
### Section D: Mitigation measures (describe all measures to Avoid, Minimise, Rectify and Reduce)

Mitigation measures to reduce impacts on environmental assets as a result of the Revised Proposal include:

**Minimise:**
- Minimise clearing as far as practicable.
- Preferentially locate infrastructure in previously disturbed areas to minimise clearing of undisturbed native vegetation and to prevent loss of potential fauna and Priority Flora habitat.
- Design creek realignment to protect upstream and downstream channel and water quality.

**Rectify and Reduce:**
- Monitor creek ecosystems during discharge and compare against baseline data.
- Undertake progressive rehabilitation of riparian vegetation where monitoring indicates significant changes in riparian vegetation condition during project operation.
- If, at cessation of discharge, riparian vegetation differs significantly from baseline (pre-impact) riparian vegetation condition, rehabilitation actions will be undertaken to restore (as far as practicable) riparian vegetation to baseline (pre-impact) condition.
- Rehabilitate areas disturbed (excluding pit voids) following decommissioning, meeting final land use criteria specified in the Closure Plan.
- Clearing vegetation in a deliberately outward manner that allows for the progressive movement of fauna into areas beyond the disturbance footprint.
- Implement the Discharge Monitoring and Management Plan that includes monitoring and adaptive management measures as well as contingency measures to ensure that discharge does not have an adverse effect on the water quality of Boolgeeda Creek.

### Section E: Significant residual impacts (describe all the significant adverse residual impacts that remain after all mitigation attempts have been exhausted)

The Revised Proposal will not result in any significant residual impacts to any ‘Critical’ environmental assets within the Development Envelope.

Following the implementation of all mitigation measures the Revised Proposal will not result in any significant residual impacts to ‘High Value’ assets within the Development Envelope.

### Section F: Proposed offsets for each significant residual impact (identify direct and contributing offsets)

The Proponent considers that no offset is required as no significant residual impact will occur as a result of implementation of the Revised Proposal.

### Section G: Spatial data relating to offset site/s (see EPA Guidance Statement No. 19: environmental offsets- biodiversity, Appendix 4)

Not Applicable

### Section H: Relevant data sources and evidence of consultation

Not Applicable.
14 OTHER LEGISLATION AND APPROVALS

Other legislation applicable to regulation of the potential environmental impacts of the Revised Proposal, and approvals required, are outlined in Table 14-1. The Proponent will comply with all relevant legislation (including obtaining specific approvals where required) prior to, and during implementation of the Revised Proposal.

Table 14-1: Other Legislation and Approvals

<table>
<thead>
<tr>
<th>Environmental factor</th>
<th>Secondary Approval</th>
<th>Responsible Agency</th>
<th>Statute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flora and Vegetation</td>
<td>Licence to take rare flora.</td>
<td>DPaW</td>
<td>Wildlife Conservation Act 1950</td>
</tr>
<tr>
<td>Fauna</td>
<td>Licence to take protected fauna.</td>
<td>DPaW</td>
<td></td>
</tr>
<tr>
<td>Water quality and quantity</td>
<td>Licence to operate</td>
<td>DER</td>
<td>Environmental Protection Act 1986</td>
</tr>
<tr>
<td>Interference with watercourses</td>
<td>26D Permit to obstruct or interfere with bed/banks.</td>
<td>DoW</td>
<td></td>
</tr>
<tr>
<td>Groundwater abstraction</td>
<td>SC Licence to construct or alter wells. Licence to take groundwater/amendment to existing groundwater licences.</td>
<td>DoW</td>
<td>Rights in Water and Irrigation Act 1914</td>
</tr>
<tr>
<td>Rehabilitation and closure</td>
<td>Mining proposal and mine Closure Plan – for infrastructure on Mining Act tenure.</td>
<td>DMP</td>
<td>Mining Act 1978</td>
</tr>
<tr>
<td>Heritage</td>
<td>S18</td>
<td>DAA</td>
<td>Aboriginal Heritage Act 1972</td>
</tr>
</tbody>
</table>
15  PRINCIPLES OF ENVIRONMENTAL PROTECTION AND EIA

This section describes how the objectives of the EP Act and the principles of EIA have been addressed and how the Proposal meets the criteria for an API (Category A) assessment as described in the 2012 Administrative Procedures.

15.1 PRINCIPLES OF ENVIRONMENTAL PROTECTION

The objective of the EP Act is to protect the environment of the State, having regard to five principles. These principles have been considered in the EIA for the Proposal and are summarised in Table 15-1 below.

Table 15-1: Principles of Environmental Protection

<table>
<thead>
<tr>
<th>Principle</th>
<th>Consideration Given in Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Precautionary principle</td>
<td>During the Revised Proposal planning and design phase, the Proponent undertook comprehensive baseline studies, investigations and modelling of aspects of the Revised Proposal that may affect the surrounding environment. Where significant environmental impacts were identified, measures have been, and will continue to be, incorporated into Revised Proposal design and management to avoid or minimise predicted impacts.</td>
</tr>
<tr>
<td>2. Intergenerational equity</td>
<td>The Rio Tinto Iron Ore HSEQ Policy incorporates the principle of sustainable development and includes the following commitments:</td>
</tr>
<tr>
<td></td>
<td>• Prioritising research and implementation programs through technology to reduce impacts to land, enhancing our contribution to biodiversity and improving our efficiency in water and energy use.</td>
</tr>
<tr>
<td></td>
<td>• Identifying climate change improvement solutions through dedicated optimisation work programs.</td>
</tr>
<tr>
<td></td>
<td>• Contributing to the health and well-being of local communities.</td>
</tr>
</tbody>
</table>

The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

- Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment.
- An assessment of the risk-weighted consequences of various options.
<table>
<thead>
<tr>
<th>Principle</th>
<th>Consideration Given in Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3. Conservation of biological diversity and ecological integrity.</strong> Conservation of biological diversity and ecological integrity should be a fundamental consideration.</td>
<td>Biological investigations are undertaken by the Proponent during the Revised Proposal planning process to identify aspects of the environment that are of conservation significance. Where significant potential environmental impacts are identified, measures have been, and will continue to be, incorporated into Proposal design and management to avoid or minimise these impacts where practical. The Rio Tinto HSEQ Management System has well established rehabilitation procedures for restoring disturbed environments.</td>
</tr>
</tbody>
</table>
| **4. Improved valuation, pricing and incentive mechanisms**  
- Environmental factors should be included in the valuation of assets and services.  
- The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement.  
- The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes.  
- Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentives structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems. | Environmental factors have been considered during the Revised Proposal planning phase, and will continue to be considered during the operational and closure phases of the Proposal. Proposal planning, design and operational management will continue to investigate and implement opportunities to reduce impact to land, and improve efficiency in water and energy use, in accordance with the Rio Tinto Iron Ore Group HSEQ Policy. |
| **5. Waste minimisation** All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment. | All reasonable and practicable measures are taken to minimise the generation of waste and its discharge into the environment through the existing B4 Operation EMP and procedures. |

**15.2 PRINCIPLES OF EIA FOR THE PROPONENT**

Table 15-2 outlines the principles of EIA as described in clause 5 of the 2012 Administrative Procedures.

**Table 15-2: Principles of EIA for the Proponent**

<table>
<thead>
<tr>
<th>The principles of EIA for the Proponent</th>
<th>Discussed in the Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Consult with all stakeholders, including the EPA, DMAs, other relevant government agencies and the local community as early as possible in the planning of their proposal, during the environmental review and assessment of their proposal, and where necessary during the life of the project.</td>
<td>Table 5-1 details the stakeholder consultation undertaken to date. This consultation includes the OEPA, relevant DMAs, Traditional Owners and Pastoral Station managers. the Proponent will continue to consult with relevant stakeholders during the environmental approval process, and during implementation of the Revised Proposal.</td>
</tr>
<tr>
<td>The principles of EIA for the Proponent</td>
<td>Discussed in the Document</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>---------------------------</td>
</tr>
</tbody>
</table>
| 2. Ensure the public is provided with sufficient information relevant to the EIA of a proposal to be able to make informed comment, prior to the EPA completing the assessment report. | Table 7-1, Table 8-6, Table 9-4 and Table 11-1 provide an EIA of the Revised Proposal, for the preliminary key environmental factors identified by the EPA, based on:  
  - a summary of the key findings of studies and investigations (full reports provided as appendices, where relevant);  
  - assessment of potential impacts of the Proposal;  
  - key environmental management measures.  
  Table 11-2 provides a brief EIA of the Proposal for other environmental factors. |
| 3. Use best practicable measures and genuine evaluation of options or alternatives in locating, planning and designing their proposal to mitigate detrimental environmental impacts and to facilitate positive environmental outcomes and a continuous improvement approach to environmental management. | Avoiding and minimising impacts to the environment where practical is a key management commitment for the Proposal, and has been implemented during Proposal design. For example, modification of the B4 Development Envelope since referral has been undertaken, to exclude extensive areas of vegetation of elevated conservation significance, and several occurrences of a Priority 1 flora species.  
As detailed in Section 11.1, continuous improvement is a key aspect of the Rio Tinto Iron Ore (WA) HSEQ Management System. |
| 4. Identify the environmental factors likely to be impacted and the aspects likely to cause impacts in the early stages of planning for their proposal. The onus is on the proponent through the EIA process to demonstrate that the unavoidable impacts will meet the EPA objectives for environmental factors and therefore their proposal is environmentally acceptable. | Section 3.2, Section 6, Section 7, Section 8, and Section 9 identify the preliminary key environmental factors relevant to the Proposal, potential impacts, key management measures, and how the EPA objectives relevant to each environmental factor can be met by the Revised Proposal.  
Table 11-2 provides a brief EIA of the Revised Proposal for other environmental factors. |
| 5. Consider the following, during project planning and discussions with the EPA, regarding the form, content and timing of their environmental review:  
  a. The activities, investigations (and consequent authorisations) required to undertake the environmental review.  
  b. The efficacy of the investigations to produce sound scientific baseline data about the receiving environment.  
  c. The documentation and reporting of investigations.  
  d. The likely timeframes in which to complete the environmental review;  
  e. Use best endeavours to meet assessment timelines. | The form and content of the environmental review has incorporated advice provided by the OEPA in several meetings, and addressed OEPA comment on drafts of the environmental review.  
Comprehensive studies and investigations, of high standard, have been undertaken to support the environmental review, and are provided as appendices.  
Proposal planning has considered the expected timeframes for completion of supporting studies, environmental review preparation and assessment, and timings for key milestones are regularly discussed with the OEPA. |
The principles of EIA for the Proponent | Discussed in the Document
---|---
6. | Identify in their environmental review, subject to EPA guidance:  
   a. Best practicable measures to avoid, where possible, and otherwise minimise, rectify, reduce, monitor and manage impacts on the environment.  
   b. Responsible corporate environmental policies, strategies and management practices, which demonstrate how the proposal can be implemented to meet the EPA environmental objectives for environmental factors.  
   Table 8-6, Table 9-4 and Table 11-1 identify key management measures to avoid, where possible, and otherwise minimise, rectify, reduce, monitor and manage impacts on the environment.  
   These tables also provide an assessment of how the Proposal meets EPA environmental objectives for relevant environmental factors, based on implementation of key management practices, and corporate environmental policies and strategies.

15.3 CRITERIA FOR API CATEGORY A

Clause 10.1.1 in the 2012 Administrative Procedures states that the OEPA applies an API A level of assessment where the proponent has provided sufficient information about the proposal, its environmental impacts, proposed management, and it appears that the proposal is consistent with Category A criteria. Consistency of the Proposal with these criteria is addressed in Table 15-3.

Table 15-3: Criteria for API Category A

<table>
<thead>
<tr>
<th>Category A Criteria</th>
<th>Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>The proposal raises a limited number of key environmental factors that can be readily managed and for which there is an established condition-setting framework.</td>
<td>The Proposal raises preliminary key environmental factors which are assessed within this ER. These factors are typical of iron ore mining in the Pilbara and can be readily managed under the existing B4 Operation EMP and other regulatory approvals. Numerous operating iron ore mines in the region subject to Ministerial Conditions provide appropriate precedents for assessment and condition-setting.</td>
</tr>
<tr>
<td>The proposal is consistent with established environmental policies, guidelines and standards.</td>
<td>The Proposal is consistent with established environmental policies, guidelines and standards, as set out Table 8-6 and Table 9-4.</td>
</tr>
<tr>
<td>The proponent can demonstrate that it has conducted appropriate and effective stakeholder consultation, in particular with DMAs.</td>
<td>Section 5 details the stakeholder consultation that has been undertaken to date, issues raised, and Proponent response to issues raised. This consultation included the OEPA and other DMAs.</td>
</tr>
<tr>
<td>There is limited or local concern only about the likely effect of the proposal, if implemented, on the environment.</td>
<td>Stakeholder consultation has been undertaken to date; the majority of stakeholders have not raised any major concerns with the Proposal (refer to Section 4). The key issued raised, by downstream pastoral station managers, include concern over the assessment and selection of surplus water management options and the potential impacts that may result from discharge to Boolgeeda Creek. In particular the potential for feral herbivores to be attracted to discharge waters, the loss of biodiversity within the creekline and reduction in vegetation condition.</td>
</tr>
</tbody>
</table>
16 REFERENCES

Aquaterra 2005, Brockman 4 Hydrogeology pre-Feasibility Report No. GDSR 4593 RTIO-HSE-0186560

Aquaterra 2008a, Brockman Syncline 4 Dewatering and Water Supply Modelling, RTIO-PDE-0071769

Aquaterra 2008b, Brockman Syncline 4 Water Supply Modelling, RTIO-PDE-0071771


Beard, J.S. 1975, Pilbara Explanatory Notes and Map Sheet, 1:1,000,000 Series, Vegetation Survey of Western Australia, University of Western Australia Press, Nedlands


Biota Environmental Sciences (Biota) 2007a, Rare Flora Searches of B4 Rail Loop Extension, Airport Extension and Plant Sites. Unpublished report for Rio Tinto

Biota Environmental Sciences (Biota) 2007b, A Vegetation and Flora Survey of the White Quartz Road, near Tom Price. Unpublished report for Rio Tinto

Biota Environmental Sciences (Biota) 2007c, A Flora Survey of the Brockman Syncline 4 rail and Infrastructure Corridor. Unpublished report for Rio Tinto

Biota Environmental Sciences (Biota) 2008a, Vegetation and Flora of the BS4 33kV Powerline Corridor through the Boolgeeda Valley. Unpublished report for Rio Tinto

Biota Environmental Sciences (Biota) 2008b, Brockman Rhagada – A Molecular Investigation of the ‘BROMD’ Population. Unpublished report for Rio Tinto

Biota Environmental Sciences (Biota) 2009a, A Vegetation and Flora Survey of Beasley River. Unpublished report prepared for Rio Tinto

Biota Environmental Sciences (Biota) 2009b, Beasley River Limonites – Baseline Fauna Survey. Unpublished report prepared for Rio Tinto

Biota Environmental Sciences (Biota) 2010, Brockman Syncline 4 Water Pipeline Corridor Biological Review. Unpublished report for Rio Tinto

Biota Environmental Sciences (Biota) 2012a, Nammuldi-Silvergrass Vegetation Mapping Integration. Unpublished report for Rio Tinto

Biota Environmental Sciences (Biota) 2012b, Brockman 4 Camps Vegetation and Flora Survey. Unpublished report for Rio Tinto
Biota Environmental Sciences (Biota) 2013a, Brockman 4 Riparian Vegetation Mapping. Unpublished report for Rio Tinto

Biota Environmental Sciences (Biota) 2013b, Brockman Syncline 4 Marra Mamba Vegetation and Flora Survey. Unpublished report for Rio Tinto

Biota Environmental Sciences (Biota) 2013c, Brockman Syncline 4 Marra Mamba Targeted Fauna Survey. Unpublished report for Rio Tinto


Department of Mines and Petroleum and the Environmental Protection Authority (DMP/EPA) 2011, *Guidelines for Preparing Mine Closure Plans*, Department of Mines and Petroleum, Perth

Department of Water (DoW) 2013, *Western Australian water in mining guideline*, Water licensing delivery series, Report No. 12


Eco Logical Australia (Eco Logical) (2013a), Brockman 4 East Biological Assessment. Unpublished report for Rio Tinto

Eco Logical Australia (Eco Logical) (2013b), Brockman Syncline 1 East Biological Assessment. Unpublished report for Rio Tinto

Environmental Protection Authority (EPA) 2002, Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3, March 2002

Environmental Protection Authority (EPA) 2004a, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, Guidance Statement No. 51, published by the Environmental Protection Authority, Perth

Environmental Protection Authority (EPA) 2004b, Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, EPA Guidance Statement No. 56, published by the Environmental Protection Authority, Perth

Environmental Protection Authority (EPA) 2006, Environmental Offsets, Position Statement No. 9, published by the Environmental Protection Authority, Perth

Environmental Protection Authority (EPA) 2008, Environmental Offsets – Biodiversity, Guidance Statement No. 19, published by the Environmental Protection Authority, Perth.

Environmental Protection Authority (EPA) (2009), Guidance Statement 20, “Sampling Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia”, published by the Environmental Protection Authority, Perth.
Environmental Protection Authority (EPA) and Department of Environment and Conservation (DEC) (2010), Technical Guidance – Terrestrial Fauna Surveys for Environmental Impact Assessment, published by the Environmental Protection Authority, Perth.

Environmental Protection Authority (EPA) (2013), Environmental Assessment Guideline No.1 (EAG1) Defining the Key Characteristics of a Proposal, published by the Environmental Protection Authority, Perth.

Environmental Protection Authority (EPA) (2013), Environmental Assessment Guideline No.8 (EAG8) for Environmental Factors and Objectives, published by the Environmental Protection Authority, Perth.


Land Systems (Rangelands) mapping covering the Development Envelope has been prepared by the Western Australian Department of Agriculture (Payne et al. 1988, Department of Agriculture 2002)

Rio Tinto 2013a, Baseline Hydrology Assessment for BM4 Discharge at Boolgeeda Creek or Beasley River System – Option Study, Rio Tinto internal memo, 18 June 2013. Unpublished report


Rio Tinto 2013e, Baseline Hydrology Assessment for Brockman 4 Discharge at Boolgeeda Creek (RTIO-HSE-0188700). Unpublished report


APPENDICES

The following supporting documents are contained on CD_ROM inside the back cover of this API Environmental Review Document.

Appendix 1  S38 Referral Form
Appendix 2  Ministerial Statement 717
Appendix 3  EPA Prepared Scoping Guideline (27 May 2014)
Appendix 4  Proposed Environmental Conditions for Revised Proposal
Appendix 5  Modelled Scenario for Boolgeeda Creek Discharge
Appendix 6  Discharge Monitoring and Management Plan (3 July 2014)
Appendix 7  Key Flora and Vegetation Studies:
                  Biota Environmental Sciences (Biota) 2005a, A Vegetation and Flora Survey of the Brockman Syncline 4 Project Area, near Tom Price
                  Biota Environmental Sciences (Biota) 2007b, A Vegetation and Flora Survey of the White Quartz Road Corridor near Tom Price
                  Biota Environmental Sciences (Biota) 2009a, A Vegetation and Flora Survey of Beasley River
                  Biota Environmental Sciences (Biota) 2012a, Nammuldi-Silvergrass Vegetation Mapping Integration
                  Biota Environmental Sciences (Biota) 2012d, Brockman 4 Camps Vegetation and Flora Survey
                  Biota Environmental Sciences (Biota) 2013a, Brockman 4 Riparian Vegetation Mapping, Level 2 Vegetation and Flora Survey
                  Biota Environmental Sciences (Biota) 2013b, Brockman Syncline 4 Marra Mamba Vegetation and Flora Survey
                  Biota Environmental Sciences (Biota) 2013d, Marra Mamba West (AR-13-11158) Native Vegetation Clearing Permit Report
Appendix 8  Vegetation types and Fauna Habitats to be disturbed
Appendix 9  Key Fauna Studies:
                  Biota Environmental Sciences (Biota) 2005b, Fauna Habitats and Fauna Assemblage of the B4 Project, near Tom Price
Biota Environmental Sciences (Biota) 2009b, Beasley River Limonites - Baseline Fauna Survey

Biota Environmental Sciences (2013c), Brockman Syncline 4 Marra Mamba - Targeted Fauna Survey.

**Appendix 10**  Brockman Syncline 4 Spontaneous Combustion and ARD (SCARD) Management Plan

**Appendix 11**  Mineral Waste Management Plan

**Appendix 12**  Checklist on terrestrial biodiversity