

Native Vegetation Clearing Permit – Supporting Report

Flora, Vegetation and Fauna Habitat Assessment –
Gorge Bore

January 2023



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				Distributed to	Date
0	B. Duncan	J. Hantzis	13/01/2023	Internal	13/01/2023
1	B. Duncan	-	23/01/2023	Internal & External	23/01/2023
2	B. Duncan	J. Quartermaine	26/01/2023	Internal & External	31/01/2023

Executive Summary

Hamersley Iron on behalf of Rio Tinto is proposing to undertake an exploration drilling program within tenement E47/01490 'Gorge Bore', hereafter referred to as 'the survey area'. The survey area covers an area of approximately 628.1 ha, and is located within the Shire of Ashburton on Munjina Road approximately 79.9 km northeast of Tom Price, and 10.5 km southeast of Wittenoom in the Pilbara region of Western Australia.

The proposed drill program will comprise 325 drill holes with a maximum depth of 200 m, and 19.6 km of new track using blade down technique when grading and will require the clearing of 27.8 ha of native vegetation.

This report is intended as a supporting document for a Native Vegetation Clearing Permit (NVCP) application by Rio Tinto, as required under Section 51A of the *Environmental Protection Act 1986* (EP Act) and has been prepared on the basis of a review of existing information for the survey area, combined with a reconnaissance survey, including a targeted flora, vegetation and fauna habitat assessment.

The survey area was surveyed by Rio Tinto Biological Assessments Superintendent Alicia Michael, Specialist Botanist Julijanna Hantzis, and Botanists Bridget Duncan and Daenia Dundon on the 10th – 13th October 2022.

Six vegetation types were identified across two major landforms within the survey area. Two vegetation types were described from drainage lines, and four vegetation types from plains.

None of the six vegetation types occurring within the survey area correspond to any ecosystems listed as Threatened under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) or correspond to any ecological communities listed as Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) by the Department of Biodiversity, Conservation and Attractions (DBCA). None of the vegetation types are considered of conservation significance or restricted in the landscape.

A total of 172 vascular flora taxa from 92 genera representing 36 families were recorded during the field survey. The number of taxa recorded by the current survey appears consistent than what was expected when compared with previous surveys completed nearby. No Threatened or Priority flora taxa were recorded during the survey. Seven weed species were recorded from the survey area.

Three broad fauna habitat types were recorded within the survey area: Minor Drainage, Mulga Woodland, and Stony Plain. These fauna habitats are not considered to be restricted at a local or regional level.

No conservation significant fauna species were observed during the survey. Five conservation significant species have the 'potential' to occur within the survey area. Grey Falcon (VU), Peregrine Falcon (OS), Night Parrot (CR), Ghost Bat (VU), and Pilbara Leaf-nosed Bat (VU) may visit the survey area for foraging and hunting opportunities, however none are considered to be dependent on the habitats of the survey area.

The Proposal was assessed against the 10 Clearing Principles as defined in Schedule 5 (Principles for Clearing Native Vegetation) of the *Environmental Protection Act 1986* and determined that:

- Principles (a), (g), (h), (i) & (j) are not likely to be at variance;
- Principles (b), (c), (d) & (e) are not at variance; and
- Principle (f) may be at variance.

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1. Introduction

1.1 Background

Hamersley Iron on behalf of Rio Tinto is proposing to undertake an exploration drilling program within tenement E47/01490 'Gorge Bore' hereafter referred to as 'the survey area'. The survey area covers an area of approximately 628.1 ha, and is located within the Shire of Ashburton on Munjina Road approximately 79.9 km northeast of Tom Price, and 10.5 km southeast of Wittenoom in the Pilbara region of Western Australia.

The survey area is located within an Environmentally Sensitive Area (ESA), which is associated with the former Hamersley Range National Park, and is adjacent to the northern boundary of Karijini National Park.

The proposed drill program will comprise 325 drill holes with a maximum depth of 200 m, and 19.6 km of new track using blade down technique when grading and will require the clearing of 27.8 ha of native vegetation. The survey area location is shown in Figure 1-1.

1.2 Scope

This report describes the methods employed for the flora, vegetation and conservation significant fauna habitat assessment, documents the results of the survey undertaken in October 2022, and identifies vegetation, flora and fauna habitats of conservation significance relevant to the survey area.

This report is intended as a supporting document for a Native Vegetation Clearing Permit (NVCP) application by Rio Tinto, as required under Section 51A of the *Environmental Protection Act 1986* (EP Act) and has been prepared based on a review of existing information for the survey area, combined with a field survey. This report includes a description of the:

- Local environment of the survey area including flora, vegetation, threatened fauna habitats, geology, landforms, and hydrology.
- Methods employed during the field survey.
- Vegetation types occurring in the survey area, an assessment on their condition and conservation significance for the locality and sub-region, including mapping.
- Fauna habitats present, assessment of their significance for the locality and sub-region, including mapping.
- Potential impacts of the Proposal on the local environment through application of the 10 Clearing Principles, as outlined in Schedule 5 of the EP Act.

Figure 1-1 Location of the survey area

Drawn: J. Wesson
Plan: RTIO0973569v1
Date: January 2023

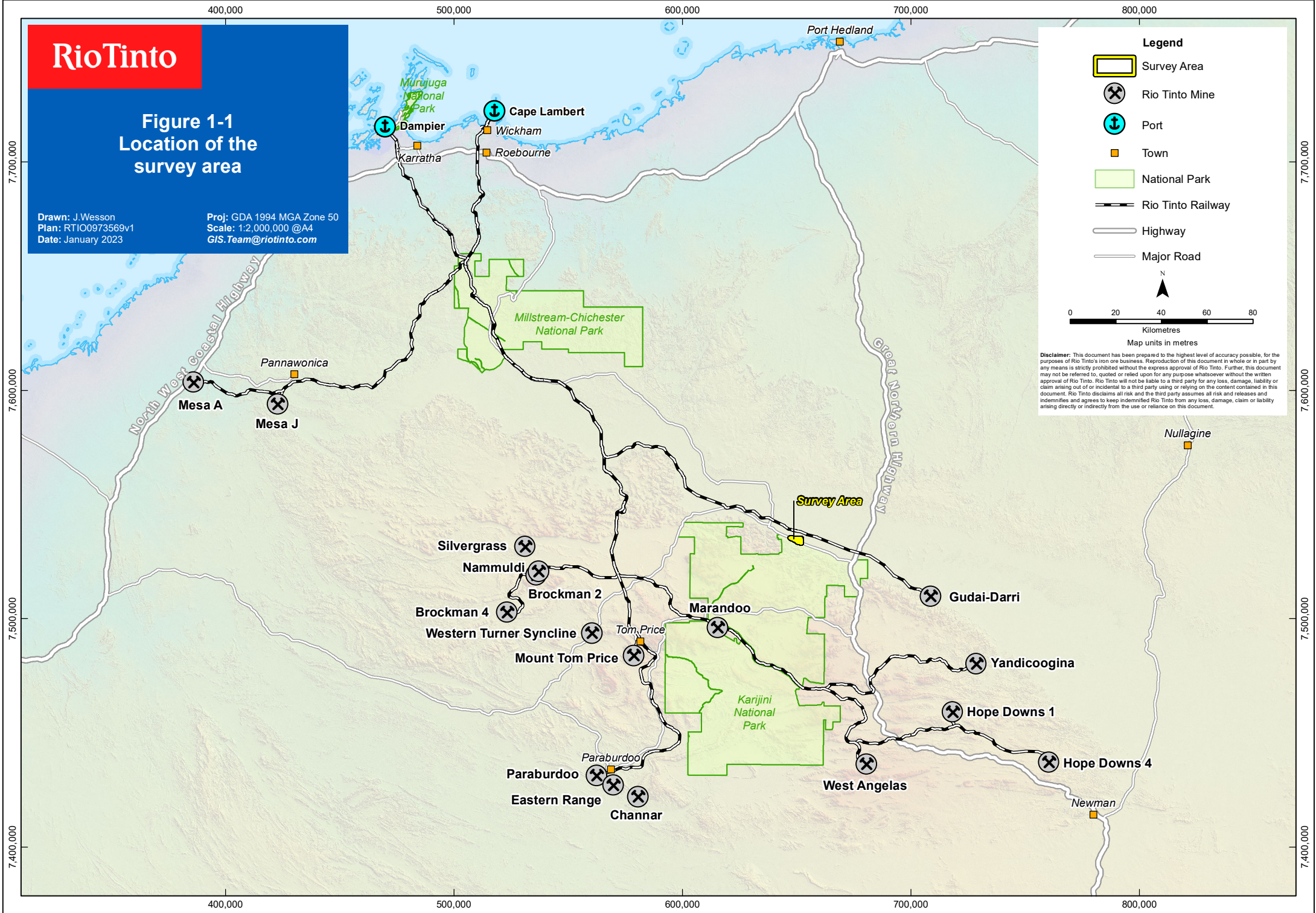
Proj: GDA 1994 MGA Zone 50
Scale: 1:2,000,000 @A4
GIS.Team@riotinto.com

Legend

- Survey Area
- Rio Tinto Mine
- Port
- Town
- National Park
- Rio Tinto Railway
- Highway
- Major Road

0 20 40 60 80
Kilometres
Map units in metres

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1.3 Limitations

Limitations of the current survey of the survey area are summarised in Table 1-1.

Table 1-1: Constraints and limitations of the current study

Constraint	Limitation
Sources of information	The Pilbara bioregion has been relatively well surveyed, with increasing biological survey work occurring due to the resource expansion in the region. A total of nine biological surveys have previously been completed over the survey area, comprising three detailed flora surveys, one targeted flora survey, two detailed fauna surveys, two targeted fauna surveys and one targeted Short-Range Endemic invertebrate survey; therefore, a suitable number of survey reports are available. Source of information was not considered a limitation for the survey area.
Scope of works	The survey requirements of a reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for a NVCP application were met. No quadrat sampling or fauna trapping was undertaken, however, relevés were undertaken to confirm vegetation associations in addition to foot traverses of the survey area, and targeted flora and fauna searches.
Completeness of survey	The survey area was fully surveyed to the satisfaction of a reconnaissance survey. No additional surveys were deemed necessary for the purpose of this assessment. Fungi and non-vascular flora (algae, mosses and liverworts) were not sampled.
Intensity of survey	The survey area was surveyed by targeted traverses on foot. Habitats with potential to support conservation significant species were searched.
Timing, weather, season, cycle	The survey was conducted during October 2022, which is outside the primary survey period recommended by the EPA. Seasonal conditions were considered adequate due to average rainfall in the three months preceding the survey.
Disturbances	A small proportion of the survey area has been disturbed by historical clearing for tracks (2.2%), and rehabilitation (0.4%). A portion of the survey area was recently burnt (less than one year old), however the vegetation type was able to be identified.
Resources	<p>The biologists who undertook the surveys and reporting were suitably qualified and experienced. Alicia Michael has over 10 years' experience conducting environmental surveys throughout Australia. Julijanna Hantzis has five years' experience as a botanist in Western Australia and conducting surveys of similar scope in the Pilbara region. Bridget Duncan has three years' experience and Daenia Dundon has two years' experience as botanists in the Pilbara region.</p> <p>Fauna habitat mapping was reviewed by Zoologist Madi Roberts, who has six years' experience working as a zoologist in the Pilbara region.</p> <p>Steven Dillon, from the Western Australian Herbarium, completed the plant specimen identifications.</p>
Accessibility / remoteness	The survey area was accessed by vehicle and on foot. The survey area was adequately traversed on foot. No parts of the survey area were inaccessible. Accessibility/remoteness was not considered a limitation to this survey.

2. Methodology

2.1 Desktop Assessment

A desktop assessment was undertaken prior to the commencement of the field survey to identify environmental values relevant to the survey area. This desktop assessment included a review of:

- A review of rainfall data from the closest reliable weather station (BoM, 2022).
- A review of major geological units based on 1:250,000 scale map sheet series (Martin, Hocking, & Tyler, 2014).
- Surface hydrology and groundwater.
- Land systems mapping adapted by van Vreeswyk et al. (2004).
- Bioregional assessments (including IBRA bioregions, Beard's vegetation mapping, and pre-European vegetation mapping).
- Conservation areas and environmentally sensitive areas.

2.1.1 Literature Review

A literature review of the survey area was conducted prior to the survey and included 10 biological reports that have been conducted in the greater area (Table 2-1, Figure 2-1). Five flora and vegetation survey reports have been reviewed as part of the flora and vegetation desktop assessment (Biota Environmental Sciences, 2013; Biota Environmental Sciences, 2012; Biota Environmental Sciences, 2013; Biota Environmental Sciences, 2012; Pilbara Flora, 2011). Additionally, five fauna survey reports have been reviewed as part of the fauna desktop assessment (Biota Environmental Sciences, 2013; Biota Environmental Sciences, 2012; Biota Environmental Sciences, 2012; Biota Environmental Sciences, 2012; Biota Environmental Sciences, 2013).

The findings of these surveys, together with the database searches results, form the desktop assessment to determine conservation significant taxa that are known to, or may occur within the survey area, as well as flora, vegetation types, ecological communities and fauna habitats. A summary of the findings is presented in Table 2-1.

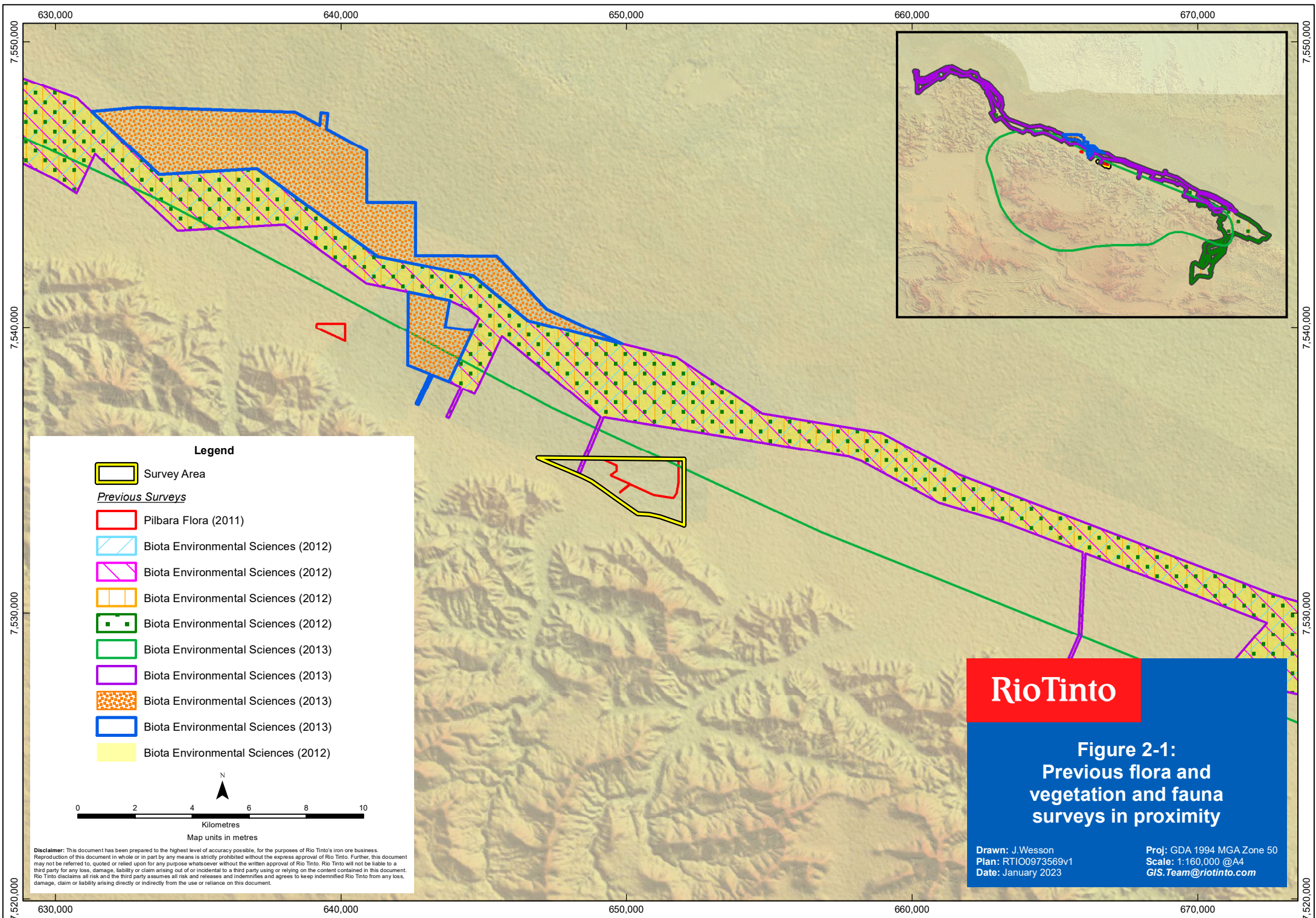
Table 2-1: Summary of previous flora and vegetation and fauna reports utilised for the desktop assessment

Report and level of survey	Size (ha)	Number of taxa	Conservation listed flora / fauna	Weeds	Vegetation / Fauna Habitat of significance
Biota Environmental Sciences (2013) Addendum to Koodaideri Western Rail Corridor Terrestrial Fauna Survey: 3,434 KWRC 3 km Variation Targeted fauna survey		56 vertebrate fauna taxa from 29 families: <ul style="list-style-type: none"> • 45 avifauna. • 9 herpetofauna. • 2 mammals. 7 taxa recorded from potential SRE invertebrate groups.	3 mygalomorphs spiders – potential SREs	NA	None
Biota Environmental Sciences (2013) Addendum to Koodaideri Western Rail Corridor Vegetation and Flora Survey 3,434 KWRC 3 km Variation Targeted flora survey		179 native flora taxa from 83 genera and 33 families	None	9 taxa	One vegetation type represents the 'grove / inter-grove Mulga communities 'ecosystem at risk.
Biota Environmental Sciences (2012) Koodaideri Iron Ore Project Short-Range Endemic Invertebrate Fauna Integration Report Desktop review, systematic (dry pit-line transects) and non-systematic sampling (targeted searches)	67,857	Fauna recorded from potential SRE invertebrate groups: <ul style="list-style-type: none"> • 7 land snails. • 3 scorpions. • 11 pseudoscorpions. • 1 selenopid spider. • 5 millipides. • 4 centipedes. • 47 mygalomorph spiders. 	1 scorpion species, Urodacus 'hamersley black' – potential SRE. 3 pseudoscorpions – unknown SRE status. 1 centipede – unknown SRE status. 10 mygalomorph spiders – unknown SRE status. 27 mygalomorph spiders – SRE fauna.	NA	Three landforms were identified as having intrinsic value for SRE fauna: <ul style="list-style-type: none"> • Gorges and gullies. • Mulga woodlands and drainage features. • Calcrete plains.

Report and level of survey	Size (ha)	Number of taxa	Conservation listed flora / fauna	Weeds	Vegetation / Fauna Habitat of significance
Biota Environmental Sciences (2012) Koodaideri Iron Ore Project Vegetation and Flora Integration Report Detailed flora and vegetation survey	67,857	758 native flora taxa from 203 genera and 60 families	<i>Acacia subtiliformis</i> (P3) <i>Dolichocarpa</i> sp. Hamersley Station (A.A. Mitchell PRP 1479) (P3) <i>Eremophila magnifica</i> subsp. <i>magnifica</i> (P4) <i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727) (P3) <i>Gymnanthera cunninghamii</i> (P3) <i>Isotropis parviflora</i> (P2) <i>Lepidium catapycnon</i> (P4) <i>Nicotiana umbratica</i> (P3) <i>Ptilotus mollis</i> (P4) <i>Rostellularia adscendens</i> var. <i>latifolia</i> (P3) <i>Rhynchosia bungarensis</i> (P4) <i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) (P4) <i>Synostemon hamersleyensis</i> (P1) <i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431) (P3) <i>Vittadinia pustulata</i> (P3)	18 taxa	One habitat of moderate to high conservation significance: the Koodaideri Spring and associated <i>Ficus virens</i> communities. Eight vegetation types represent the 'major ephemeral water courses' ecosystem at risk. Three vegetation types of note: <ul style="list-style-type: none"> • Riparian vegetation. • Dense Mulga vegetation. • Calcrete plains vegetation.
Biota Environmental Sciences (2012) Koodaideri Iron Ore Project Vertebrate Fauna Integration Report Detailed vertebrate fauna survey	67,857	223 vertebrate fauna taxa, comprising: <ul style="list-style-type: none"> • 3 amphibians. • 89 reptiles. • 95 avifauna. • 18 native ground mammals. • 14 bats. • 4 introduced mammals. 	Australian Bustard (P4) Blind snake (<i>Aniliios ganei</i>) (P1) Fork-tailed Swift (S3) Ghost Bat (VU, S1) Grey Falcon (P4) Northern Quoll (EN, S1) Orange Leaf-nosed Bat (EN, S1) Peregrine Falcon (S4) Pilbara Olive Python (VU, S1) Western Pebble-mound Mouse (P4)	NA	Two habitats considered of high conservation significance as it represents core habitat for three Threatened fauna species (Northern Quoll, Pilbara Olive Python and Orange Leaf-nosed Bat): <ul style="list-style-type: none"> • Koodaideri spring stream channel. • Free faces and gorges within the Koodaideri Mining Lease area.

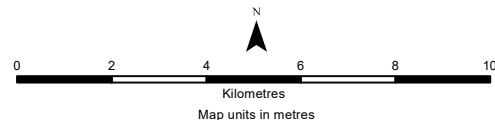
Report and level of survey	Size (ha)	Number of taxa	Conservation listed flora / fauna	Weeds	Vegetation / Fauna Habitat of significance
Biota Environmental Sciences (2012) Koodaideri Western Rail Corridor Fauna Survey Detailed vertebrate fauna survey	35,209	166 vertebrate fauna taxa, comprising: <ul style="list-style-type: none"> • 2 amphibians. • 66 reptiles. • 83 avifauna. • 14 native mammals. • 1 introduced mammal. 	Australian Bustard (P4) Fork-tailed Swift (S3) Grey Falcon (P4) Northern Quoll (EN, S1) Peregrine Falcon (S4) Western Pebble-mound Mouse (P4)	NA	None
Biota Environmental Sciences (2013) Koodaideri Western Rail Corridor Seasonal Vegetation and Flora Survey Detailed flora and vegetation survey	38,628	501 native flora taxa from 152 genera and 49 families	<i>Ptilotus mollis</i> (P4) <i>Rostellularia adscendens</i> var. <i>latifolia</i> (P3)	15 taxa	Eight vegetation types represent ecosystems at risk: <ul style="list-style-type: none"> • Groved and/or valley floor Mulga vegetation. • Vegetation of major ephemeral water courses.
Biota Environmental Sciences (2012) Koodaideri Western Rail Corridor Vegetation and Flora Survey Detailed flora and vegetation survey	38,628	469 native flora taxa from 149 genera and 49 families	<i>Rostellularia adscendens</i> var. <i>latifolia</i> (P3)	13 taxa	Eight vegetation types represent ecosystems at risk: <ul style="list-style-type: none"> • Groved and/or valley floor Mulga vegetation. • Vegetation of major ephemeral water courses.
Biota Environmental Sciences (2013) Orange Leaf-nosed Bat Targeted Survey: Munjina Gorge and Karijini National Park Targeted fauna survey	NA	NA	Orange Leaf-nosed Bat (EN, S1) recorded at 11 sites out of 50 sampling locations. Two separate roosts (one in the Gudai-Darri Mining Lease area, and one in Karijini National Park/Wittenoom area) were identified. Activity levels were low to medium.	NA	Three prospective artificial roost sites were identified

Report and level of survey	Size (ha)	Number of taxa	Conservation listed flora / fauna	Weeds	Vegetation / Fauna Habitat of significance
(Pilbara Flora, 2011) Targeted Flora Search for: Hydrogeological exploration drilling at Koodaideri (AR-10-06687), RC drilling at Gidgyea Bore (AR-10-06269), RC drilling at Gorge Bore (AR-10-06268)	16,623 (total) 2,864 (Gorge Bore)	Total: 274 taxa from 120 genera and 45 families Gorge Bore: 156 taxa	Four recorded, none at Gorge Bore	8 taxa	Two PECs identified, none at Gorge Bore



Legend

- Survey Area
- Previous Surveys*
- Pilbara Flora (2011)
- Biota Environmental Sciences (2012)
- Biota Environmental Sciences (2012)
- Biota Environmental Sciences (2012)
- Biota Environmental Sciences (2012)
- Biota Environmental Sciences (2013)
- Biota Environmental Sciences (2013)
- Biota Environmental Sciences (2013)
- Biota Environmental Sciences (2013)
- Biota Environmental Sciences (2012)



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**Figure 2-1:
Previous flora and
vegetation and fauna
surveys in proximity**

Drawn: J.Wesson
Plan: RT\O0973569v1
Date: January 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:160,000 @A4
GIS.Team@riotinto.com

2.1.2 Database Searches

The following databases were searched to determine the flora and fauna composition of the survey area and to identify any conservation significant taxa with the potential to occur within the survey area:

- The Department of Biodiversity, Conservation and Attractions (DBCAs) NatureMap database for flora and fauna species previously recorded within a 20 km radius of the survey area (Appendix 1).
- The Department of Climate Change, Energy, the Environment and Water Protected Matters Search Tool (PMST) to identify species and communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) potentially occurring within a 20 km of the survey area (Department of Climate Change, Energy, the Environment and Water, 2022) (Appendix 2).
- The Atlas of Living Australia database for flora and fauna species previously recorded within a 20 km radius of the survey area (Atlas of Living Australia, 2022) (Appendix 3).
- Rio Tinto's database for flora and fauna species previously recorded within a 20 km radius of the survey area.

2.1.3 Likelihood of Occurrence Assessment

2.1.3.1 Flora

The results of the database searches were used to compile a list of conservation significant flora taxa previously recorded within, or with the potential to occur within, the survey area.

The likelihood of conservation significant flora taxa occurring within the survey area was determined prior to the field survey based on proximity of known records and presence of potentially suitable habitat (Section **Error! Reference source not found.**). The likelihood rating of conservation listed flora was updated following the field survey based on presence / absence of the species and suitable habitat within the survey area, including a consideration of factors such as whether that species was likely to have been readily detected during the survey (based on size, life form, flowering status etc.), or if the species was unlikely to be present due to unsuitable survey timing and conditions.

Likelihood of occurrence rankings and their definitions are presented in Appendix 4.

2.1.3.2 Terrestrial Vertebrate Fauna

A likelihood of occurrence assessment was undertaken to identify habitats within the survey area for which Threatened and Priority fauna taxa listed under the current EPBC Act and BC Act may have specific dependence.

The likelihood of Threatened and Priority fauna taxa occurring within the survey area was determined prior to the field survey based on the location of database records, availability of potentially suitable habitat and knowledge of the taxon ecology (Section **Error! Reference source not found.**). Each taxon's likelihood of occurrence was updated following the field survey based on species sightings and observation of suitable habitat within the survey area.

Marine fauna taxa were excluded from the likelihood assessment as the survey area does not contain marine habitat.

Likelihood of occurrence rankings and their definitions are presented in Appendix 4.

2.2 Field Survey

The survey area was surveyed by Rio Tinto Superintendent Alicia Michael, Specialist Botanist Julijanna Hantzis, and Botanists Bridget Duncan and Daenia Dundon on the 10th – 13th October 2022.

2.2.1 Establishment of Flora Sites

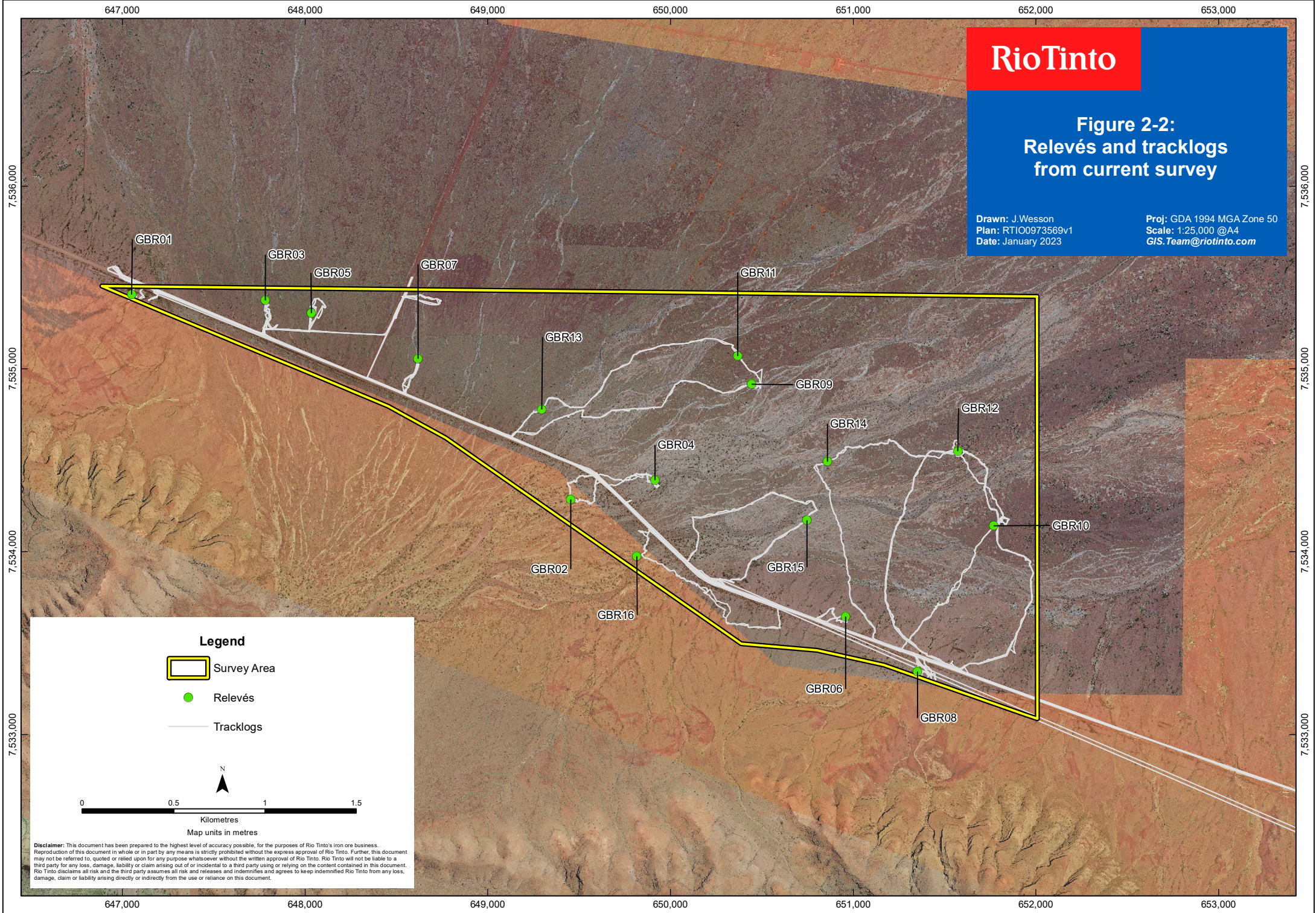
The survey area was assessed in accordance with the *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority, 2016) and *Environmental Factor Guideline – Flora and Vegetation* (Environmental Protection Authority, 2016) for a reconnaissance flora and vegetation survey.

Relevé (unpegged) survey sites, typically 50 x 50 m in size (to represent an approximate 2,500 m²), were established in representative areas of vegetation associations within the survey area. A botanical relevé is described as a vegetation sample that describes the structure and floristics and associated physical attributes, flora and opportunistic fauna sightings. A total of 16 relevés were surveyed in representative vegetation types. At each relevé, a location was recorded with a handheld GPS (GDA94, Z50) and photographs were taken. Data was collected on the flora taxa present including: percentage cover; maximum height of each vegetation stratum; aspect; topography; soil texture and colour; and landform type and habitat features. Relevé locations are presented in Figure 2-2 and Appendix 5.

**Figure 2-2:
Relevés and tracklogs
from current survey**

Drawn: J.Wesson
Plan: RTIO0973569v1
Date: January 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:25,000 @A4
GIS.Team@riotinto.com



Legend

- Survey Area
- Relevés
- Tracklogs



0 0.5 1 1.5
Kilometres
Map units in metres

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2.2.2 Opportunistic Flora and Targeted Searching

Additional flora taxa observed opportunistically around flora sites or while traversing on foot were recorded. Habitats with potential to support species of conservation significance identified by the database searches and desktop assessment were the focus of targeted searches.

Prior to the field survey, a list of conservation significant flora with the likelihood or potential to occur within the survey area was compiled. Field personnel familiarised themselves with reference material prior to the survey, such as photographs, samples and descriptions of these taxa.

Locations of unknown flora, and introduced flora were recorded using a hand-held GPS (GDA94, Z50). Where populations of introduced flora were encountered; estimates of density or numbers of individuals were recorded.

2.2.3 Vegetation Descriptions and Mapping

Vegetation community mapping was conducted using a combination of aerial photo-interpretation, regional and local vegetation mapping, on-ground confirmation and vegetation structure data. Vegetation types were described to Association (Level 5) in accordance with the National Vegetation Information System (NVIS) (NVIS Technical Working Group, 2017) (Appendix 6).

Vegetation condition mapping was conducted using the recommended EPA (Environmental Protection Authority, 2016) scale adapted from Trudgen (1988) (Appendix 6).

The mapping notes gathered in the field were used to prepare a draft map of vegetation, utilising rectified colour digital aerial photography as the background. The vegetation boundaries were digitised on-screen using ArcMap 10.7.1. The resulting polygons were attributed with the relevant information including the vegetation association, description and condition. Point locations of each relevé recorded were also uploaded into ArcMap, and together with visual photographs were used to assist with the finalising of vegetation boundaries.

2.2.4 Flora Identification

Voucher samples of unknown and potentially conservation significant flora taxa were collected, pressed and dried in the field and assigned a unique reference identification sample number.

Flora samples collected in the field were taken to the Western Australian Herbarium (WAH) to be formally identified using relevant taxonomic publications and comparisons to collections at the WAH. Sample identifications were conducted by specialist taxonomist Steven Dillon. None of the specimens collected were required to be vouchered with the WAH. Nomenclature was cross-checked using the FloraBase (Western Australian Herbarium, 2022) website and updated where required.

2.2.5 Fauna Habitat Assessment

Fauna habitats were assessed in reference to *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* (Environmental Protection Authority, 2020) and *Environmental Factor Guideline – Terrestrial Fauna* (Environmental Protection Authority, 2016).

The fauna habitat assessment aims to identify fauna habitat types (and their extent) represented within the survey area. Habitat assessments incorporate information gathered through the desktop assessment and field survey. Fauna habitats are identified based on their unique combination of landforms, and soil and vegetation, which helps to determine whether they may support specific fauna assemblages or significant fauna species.

Significant habitats include rare or isolated habitats and habitat features, such as rock piles, caves, gullies, significant trees, drainage lines or waterholes, damplands and springs as well as those that are

likely to provide special resources to fauna. Other important habitats include ecological linkages and migration pathways, refugia, islands, areas that support large or seasonal aggregations of fauna and areas that are important to significant fauna, for breeding, roosting or foraging.

Habitats were assessed for their potential to support species of conservation significance, taking into account relevant State and Commonwealth Guidelines to support identification of 'potential' habitat. Supporting evidence such as sightings, the presence of microhabitats including caves, water holes, tree hollows and burrows were recorded throughout the survey area. Representative traverses were also completed throughout all habitats present within the survey area.

Fauna habitat mapping was based on vegetation mapping and reviewed by Zoologist Madi Roberts.

3. Desktop Assessment

3.1 Existing Environment

3.1.1 Climate

The closest meteorological station providing climate data is the Paraburdoo Aero weather station (station ID: 007185) located approximately 115 km southwest of the survey area. For rainfall data, the closest meteorological station is the Karijini North weather station (station ID: 005098). The mean annual rainfall for the period 2018 – 2022 is 436.2 mm, with most precipitation occurring between January and March, coinciding with the cyclone season (Figure 3-1).

Karijini received 68.0 mm of rainfall in the three months (July – September 2022) preceding the survey (BoM, 2022). This is 41.7 mm above the long-term average for this period, therefore seasonal conditions prior to the survey were considered above average.

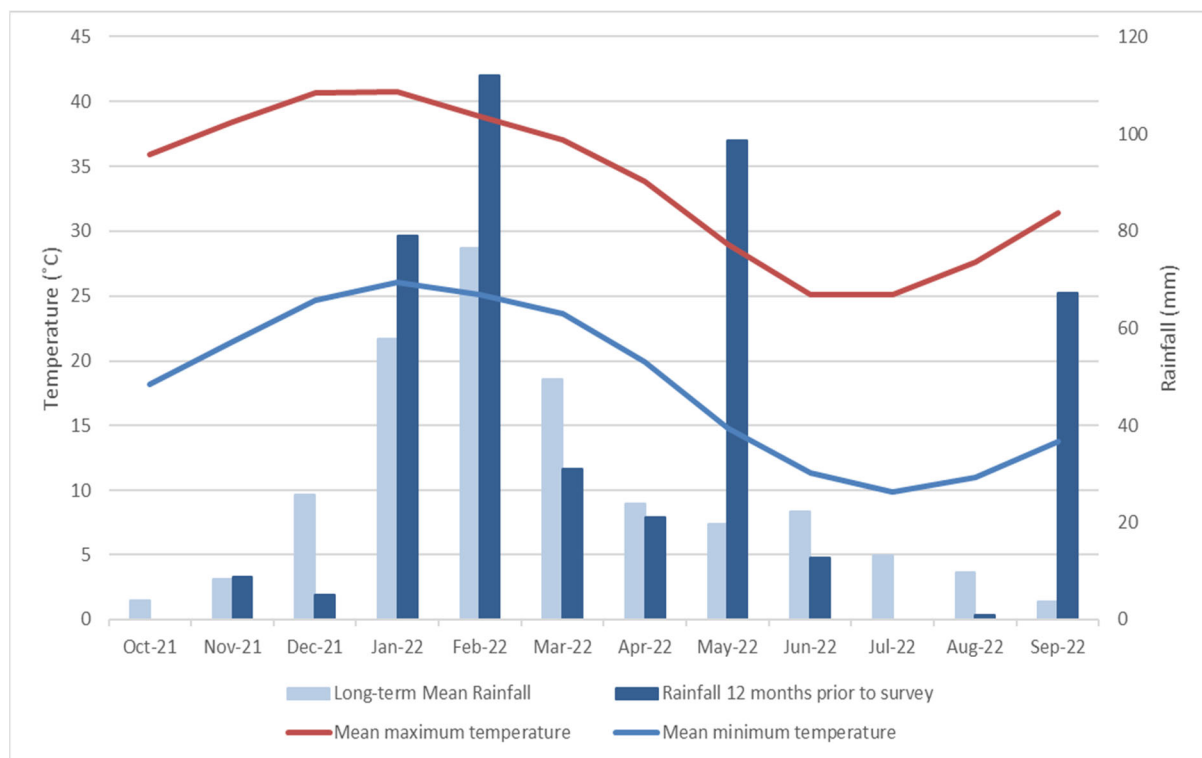


Figure 3-1: Climate and rainfall statistics for Paraburdoo Aero (Station ID: 007185) 12 months prior to survey.

3.1.2 Geology and Soils

Soil-landscape zones of Western Australia have been mapped at a scale of 1:1,000,000 by Tille (2006). These zones describe broad soil and landscape characteristics. The survey area lies within the Fortescue Valley Zone, which is characterised by alluvial plains, hardpan wash plains and sandplains on alluvial deposits over Hamersley Basin sedimentary rocks with red deep sands, red loamy earths and red/brown non-cracking clays.

Two major geological units based on 1:500,000 scale map sheet series (Martin, Hocking, & Tyler, 2014) occur within the survey area:

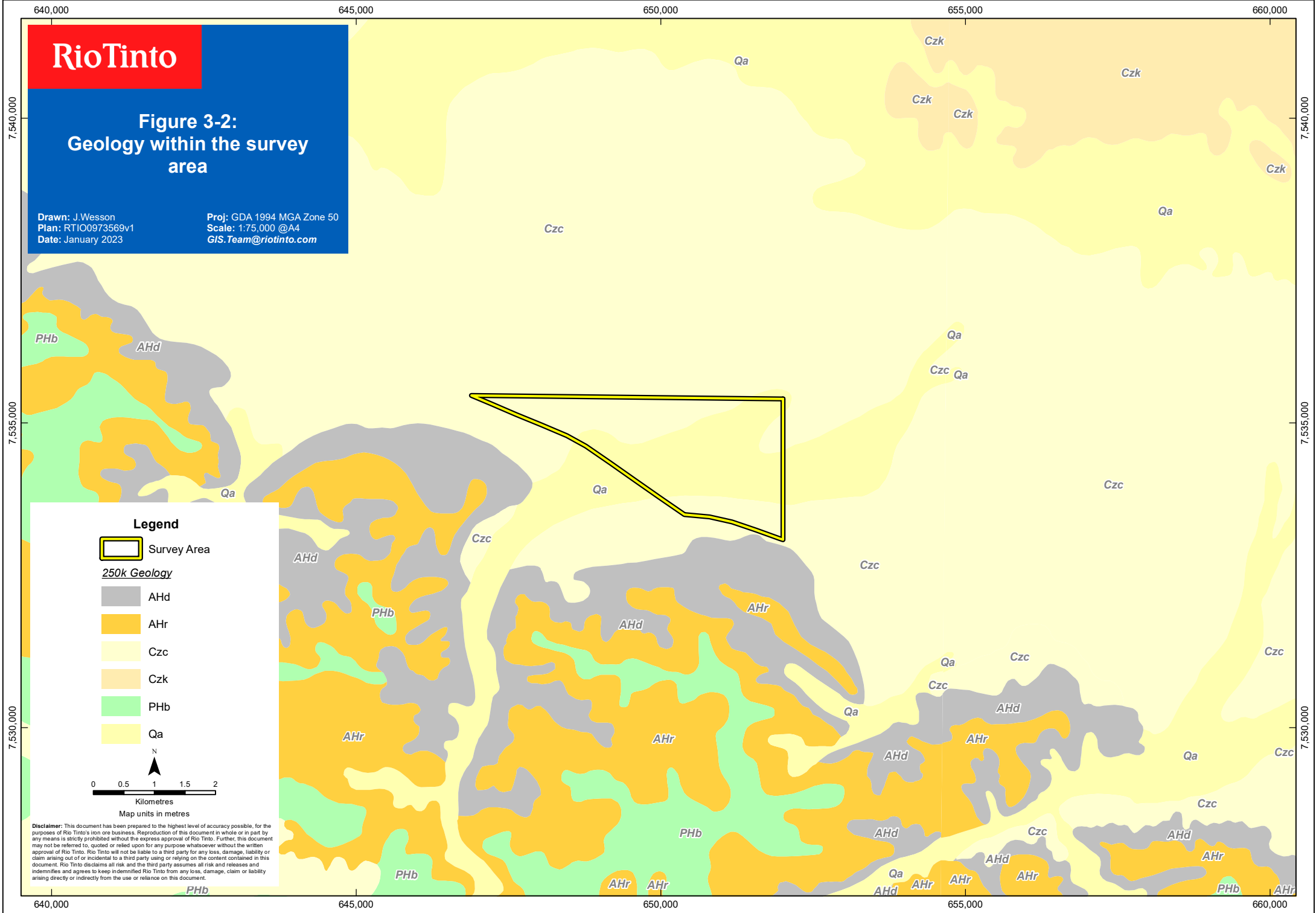
- Czc: Alluvium and colluvium - red-brown sandy and clayey soil; on low slope and sheetwash areas
- Qa: Alluvium - unconsolidated silt, sand, and gravel; in drainage channels and adjacent floodplains.

The geological units represented within the survey area are shown in Figure 3-2.

Figure 3-2:
Geology within the survey area

Drawn: J Wesson
Plan: RTIO0973569v1
Date: January 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:75,000 @A4
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3.1.3 Land Systems

Land system (rangeland) mapping is based on regional patterns in topography, soils and vegetation (Christian & Stewart, 1953). The most recent land system mapping of the Pilbara bioregion, in which the survey area lies, was completed by Van Vreeswyk *et al.* (2004). The mapping classifies the Pilbara region into 102 land systems. An assessment of land systems provides an indication of the occurrence and distribution of flora and vegetation types as well as fauna habitats present in the survey area.

The survey area intersects two land systems – the Boolgeeda Land System and the Urandy Land System (Figure 3-3). The Land Systems and their extent within the survey area are presented below (Table 3-1) and described as follows:

- The Boolgeeda Land System (284Bg) is characterised by stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands
- The Urandy Land System (284Ur) is characterised by stony plains, alluvial plains and drainage lines supporting shrubby soft spinifex grasslands.

Table 3-1: Land systems occurring within the survey area and their representation in the Pilbara bioregion

Land System (Map code)	Total area (ha) in the Pilbara	Area (ha) in survey area	Proportion (%) of survey area	Survey area proportion (%) of land system extent
Boolgeeda Land System	774,800	149.3	23.8	0.081
Urandy Land System	131,100	478.8	76.2	0.479

646,000 648,000 650,000 652,000 654,000

RioTinto

**Figure 3-3:
Land systems within the
survey area**

*Boolgeeda
Land System*

*Urandy Land
System*

*Newman Land
System*

*Boolgeeda
Land System*

*Newman Land
System*

7,536,000

7,534,000

7,532,000

7,536,000

7,534,000

7,532,000

Drawn: J.Wesson
Plan: RTIO0973569v1
Date: January 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:30,000 @A4
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Legend

 Survey Area

Rangelands Land systems

 Boolgeeda Land System

 Newman Land System

 Urandy Land System

N

0 0.25 0.5 0.75 1

Kilometres
Map units in metres

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646,000 648,000 650,000 652,000 654,000

3.1.4 Surface Hydrology and Groundwater

The survey area lies across the Fortescue River catchment basin (Department of Water and Environmental Regulation, 2022).

No significant streams or tributaries as mapped by State GIS datasets (Department of Water and Environmental Regulation, 2018) occur in the survey area. Nine non-perennial minor creeks occur within the survey area. The survey area is classed as having Low potential for groundwater interaction according to BoM Groundwater Dependent Ecosystems Atlas (BoM, 2022).

3.1.5 Regional Biogeography

The Interim Biogeographic Regionalisation of Australia (IBRA7) recognises 89 bioregions (Department of Agriculture, Water and the Environment, 2022). The survey area is located in the Pilbara (PIL) bioregion as defined by IBRA. The Pilbara bioregion has been further subdivided into four subregions: Chichester (PIL1); Fortescue Plains (PIL2); Hamersley (PIL3); and Roebourne (PIL4).

The survey area falls within the PIL2 Fortescue Plains sub-region and is described by Kendrick (2001) as:

- *'Alluvial plains and river frontage. Extensive salt marsh, mulga-bunch grass, and short grass communities on alluvial plains in the east. Deeply incised gorge systems in the western (lower) part of the drainage. River gum woodlands fringe the drainage lines. Northern limit of Mulga (Acacia aneura). An extensive calcrete aquifer (originating within a palaeo-drainage valley) feeds numerous permanent springs in the central Fortescue, supporting large permanent wetlands with extensive stands of river gum and cadjeput Melaleuca woodlands.'*

3.1.6 Beard's Regional Vegetation Mapping

Beard (1975) mapped the vegetation of the Pilbara at a scale of 1:1,000,000, and further delineated these broad units into vegetation associations. The survey area intersects two vegetation associations:

- Fortescue Valley 29: Sparse low woodland; mulga, discontinuous in scattered groups.
- Fortescue Valley 111: Hummock grasslands, shrub steppe; *Eucalyptus gamophylla* over hard spinifex.

Given the broad nature of Beard's mapping; these vegetation associations are only broadly applicable to the vegetation types occurring in the study area.

3.1.7 Pre-European Vegetation Extent

The pre-European and current extent of native vegetation associations in Western Australia has been interpreted by Shepherd *et al.* (2002) using data from Beard's (1975) regional vegetation mapping and other vegetation mapping, as well as satellite imagery and orthophoto interpretation.

Shepherd *et al.* (2002) identified the Pilbara bioregion as having largely intact native vegetation owing to the lack of intensive agricultural land use practices. Although the native vegetation remains widespread and largely intact, the floristic composition and structural characteristics have almost certainly changed since European settlement by grazing and altered fire regimes (Shepherd *et al.* 2002).

Table 3-2 presents the pre-European and current extent of the Fortescue 29 and 111 vegetation associations across its range and within the survey area and is mapped in Figure 3-4.

Table 3-2: Beard's mapping units occurring within the survey area, their current and pre-European extent within the Pilbara bioregion and their extent across the survey area

Beard's mapping unit (Shepherd vegetation association)	Pre-European extent (ha)^	Current extent (ha)^	Percentage remaining (%)^	Extent (ha) within survey area / (Proportion of current extent %)
Fortescue Valley 29	1,133,220	1,131,712	99.87	387.1 (0.07%)
Fortescue Valley 111	550,287	550,232	99.99	241.0 (0.02%)

^Government of Western Australia (2019)

**Figure 3-4:
Pre-European vegetation
associations within the
survey area**

Drawn: J.Wesson
Plan: RTIO0973569v1
Date: January 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:50,000 @A4
GIS.Team@riotinto.com

FORTESCUE
VALLEY_111

FORTESCUE
VALLEY_29

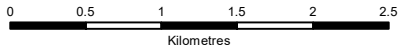
FORTESCUE
VALLEY_111

HAMMERSLEY_82

Legend

- Survey Area
- Pre-European Vegetation (associations)

N



Map units in metres

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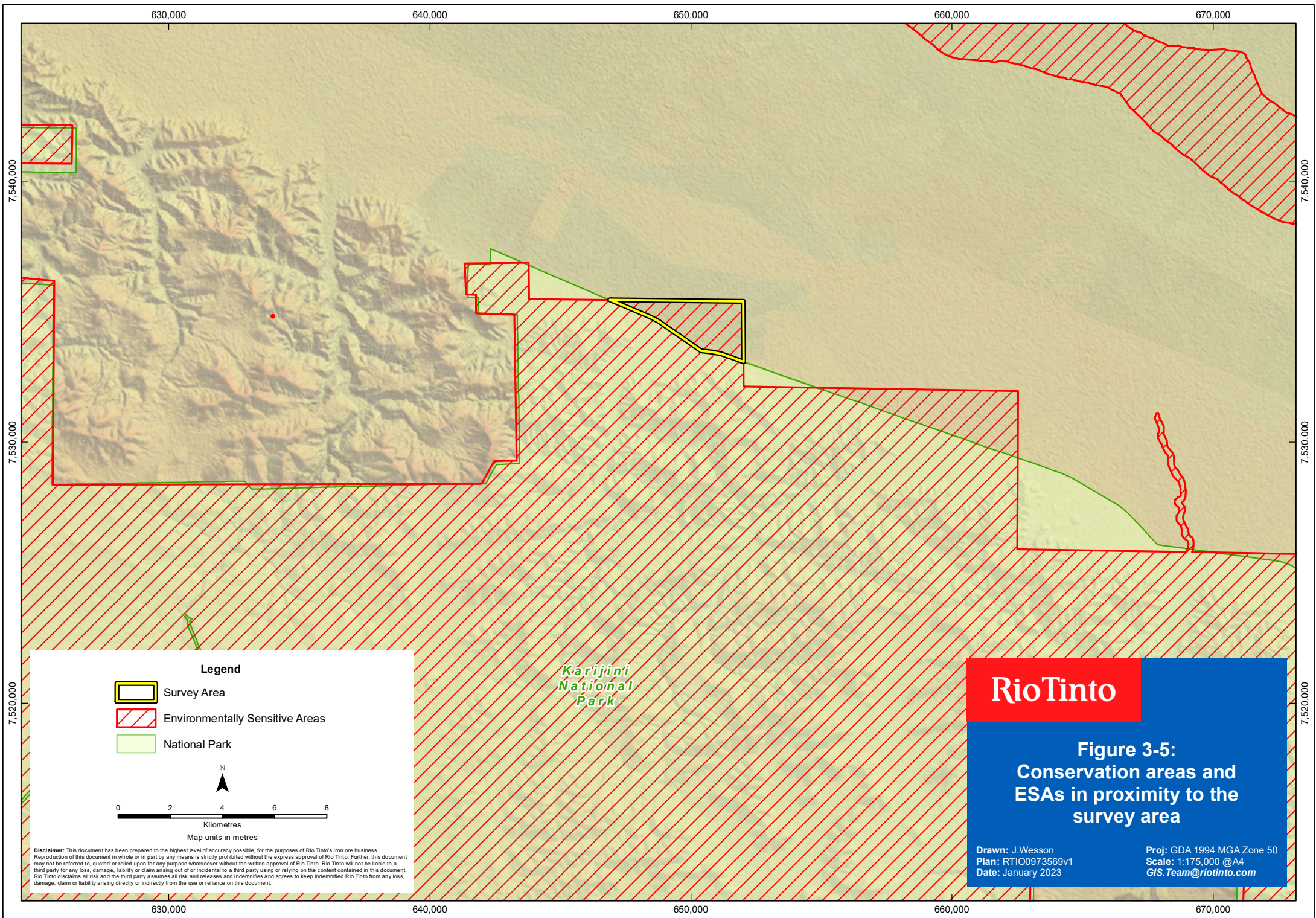
3.1.8 Conservation Areas and Environmentally Sensitive areas

Environmentally Sensitive Areas (ESAs) are defined in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005* under section 51B of the WA State EP Act. ESAs include areas declared as: World Heritage; included on the Register of the National Estate; defined wetlands; vegetation containing rare (Threatened) flora; Threatened Ecological Communities (TEC); and Bush Forever sites.

The former Hamersley Range National Park (1977 boundary) is mapped over the survey area, which represents an ESA and was listed in the Register of National Estate in 1978 (Government of Western Australia, 2022). The Register of National Estate was archived in 2007 and is no longer a statutory list (Department of Climate Change, Energy, the Environment and Water, 2021). The Hamersley Range National Park has since been superseded by Karijini National Park.

The nearest conservation area, Karijini National Park is adjacent to the southern boundary of the survey area. Due to the proposed clearing being north of Munjina Rd, the proposal is not expected to impact the environmental values of Karijini National Park (**Error! Reference source not found.**).

No mapped TECs occur within the survey area. The nearest buffer boundary to the 'Themeda grasslands on cracking clays (Hamersley Station)' TEC is located approximately 59 km west of the survey area (**Error! Reference source not found.**). Due to the separation of this TEC, the proposed clearing is not expected to impact the environmental values of this TEC.



7,540,000

7,530,000

7,520,000

7,540,000

7,530,000

7,520,000

630,000

640,000

650,000

660,000

670,000

630,000




640,000

650,000

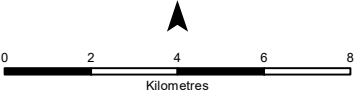
660,000

670,000

Legend

-  Survey Area
-  Environmentally Sensitive Areas
-  National Park

N



Map units in metres

*Karijini
National
Park*

RioTinto

**Figure 3-5:
Conservation areas and
ESAs in proximity to the
survey area**

Drawn: J.Wesson
Plan: RTI00973569v1
Date: January 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:175,000 @A4
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3.2 Database Searches

3.2.1 Flora Diversity

The DBCA NatureMap, Atlas of Living Australia (ALA) and Rio Tinto database search results cover all flora taxa detected previously within 20 km of the survey area. The database searches returned a total of 17 conservation significant (Priority) flora taxa. The PMST database search did not return any conservation significant flora species.

Table 3-3 presents a summary of flora taxa returned by the DBCA NatureMap, ALA, and Rio Tinto database searches. Figure 3-6 shows conservation significant flora taxa records from the Rio Tinto database in the vicinity of the survey area.

Table 3-3: Summary of flora species returned from the NatureMap and Rio Tinto database searches

Flora group	Number of potential species within a 20 km radius of the survey area		
	NatureMap database	ALA database	Rio Tinto database
Families	55	33	30
Genera	175	86	68
Species	388	151	104
Conservation listed	16	3	4
Weeds	10	3	13
Total	618	270	202

620,000

640,000

660,000

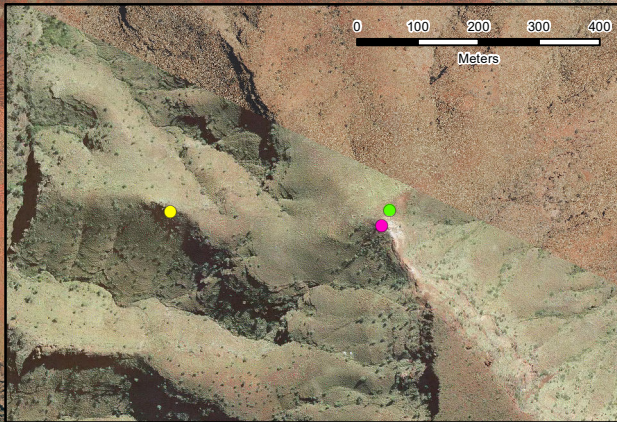
680,000

RioTinto

Figure 3-6: Rio Tinto records for conservation listed flora previously recorded within 20 km of survey area

Drawn: J.Wesson
Plan: RTIO0973569v1
Date: January 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:250,000 @A4
GIS.Team@riotinto.com



7,540,000

7,540,000

7,520,000

7,520,000

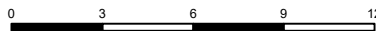
Legend

Survey Area

Priority Flora

- Dicladanthera glabra* (P2)
- Hibiscus* sp. Mt Brockman (E. Thoma ET 1354) (P1)
- Lepidium catapycnon* (P4)
- Ptilotus mollis* (P4)

N



Map units in metres

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620,000

640,000

660,000

680,000

3.2.2 Pre-field Flora Likelihood of Occurrence Assessment

Seventeen (17) conservation significant flora taxa were returned from the database searches, comprising two Priority 1 taxa, six Priority 2 flora taxa, five Priority 3 flora taxa, and four Priority 4 flora taxa. None of these Priority species have been previously recorded within the survey area, however three were considered 'likely', and three have the 'potential' to occur within the survey area (Table 3-4). The remaining ten flora taxa were considered unlikely to occur within the survey area.

Table 3-4: Conservation listed flora taxa returned by database searches, including pre-field likelihood of occurrence assessment

Species	Status	NM	ALA	RTIO	Distance to nearest record (km)	Flowering period	Preferred habitat	Likelihood of occurrence (pre-field)
<i>Adiantum capillus-veneris</i>	P2	X			13.5	N/A	Moist, sheltered sites in gorges and on cliff walls.	Unlikely Suitable habitat is not likely to occur within the survey area.
<i>Cladium procerum</i>	P2	X			12.7	Nov	Perennial pools.	Unlikely Suitable habitat is not likely to occur within the survey area.
<i>Dicladantha glabra</i>	P2	X	X	X	3.0	Apr or Aug – Oct	Alluvium. Along watercourses, near rock pools.	Likely Habitat suitable to support this species, watercourses and alluvium, are potentially present within the survey area based on aerial imagery. Additionally, this taxon was recorded in proximity to the survey area.
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	X			13.6	Aug – Nov	Skeletal soils over ironstone. Rocky screes.	Unlikely Suitable habitat is not likely to occur within the survey area.
<i>Fimbristylis sieberiana</i>	P3	X			11.4	May – Jun	Mud, skeletal soil pockets. Pool edges, sandstone cliffs.	Unlikely Suitable habitat is not likely to occur within the survey area.
<i>Gompholobium karjini</i>	P2	X			13.6	Aug – Sep	Flat to gently undulating plateau, hillslopes, drainage lines, mesa tops, recently burnt areas. Red clay or gravelly loam over ironstone.	Potential Habitat suitable to support this species, flat plateau and drainage lines, are potentially present within the survey area based on aerial imagery, however this taxon was not recorded in proximity to the survey area.

Species	Status	NM	ALA	RTIO	Distance to nearest record (km)	Flowering period	Preferred habitat	Likelihood of occurrence (pre-field)
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	P3	X			9.5	Jan – Oct	Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains.	Potential Habitat suitable to support this species, flat plateau and drainage lines, are potentially present within the survey area based on aerial imagery, however this taxon was not recorded in proximity to the survey area.
<i>Hibiscus</i> sp. Mt Brockman (E. Thoma ET 1354)	P1	X	X	X	2.8	May or Jul – Aug or Nov	Breakaways, rocky crevices, scree slopes, gullies, steep slopes. Red-brown skeletal soil, sand. Ironstone gravel, outcropping or boulders.	Unlikely Suitable habitat is not likely to occur within the survey area.
<i>Isotropis parviflora</i>	P2	X			13.6	Mar	Valley slope of ironstone plateau.	Unlikely Suitable habitat is not likely to occur within the survey area.
<i>Lepidium catapycnon</i>	P4	X	X	X	2.9	Oct	Stony hill slopes, open woodland in hilly areas, more frequently on south facing slopes, hill hummock grasslands, and road verges.	Likely Habitat suitable to support this species, road verges, are present within the survey area. Additionally, this taxon was recorded in proximity to the survey area.
<i>Olearia mucronata</i>	P3	X			16.4	Aug – Dec or Jan	Schistose hills, along drainage channels.	Unlikely Despite habitat suitable to support this species, drainage channels, being present within the survey area, this taxon was not recorded in proximity to the survey area.
<i>Ptilotus mollis</i>	P4			X	2.9	May or Sep	Stony hills and screes.	Unlikely Suitable habitat is not likely to occur within the survey area.
<i>Rhynchosia bungarensis</i>	P4	X			13.5	May – Dec	Pebbly, shingly coarse sand amongst boulders. Banks of flow line in the mouth of a gully in a valley wall.	Potential Habitat suitable to support this species, banks of flow lines, are potentially present within the survey area based on aerial imagery, however this taxon was not recorded in proximity to the survey area.

Species	Status	NM	ALA	RTIO	Distance to nearest record (km)	Flowering period	Preferred habitat	Likelihood of occurrence (pre-field)
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	P3	X			3.7	Apr – May	Ironstone soils. Near creeks, rocky hills.	Likely Habitat suitable to support this species, creeks, are potentially present within the survey area based on aerial imagery. Additionally, this taxon was recorded in proximity to the survey area.
<i>Teucrium pilbaranum</i>	P2	X			9.6	May or Sep	Clay. Crab hole plain in a river floodplain, margin of calcrete table.	Unlikely Suitable habitat is not likely to occur within the survey area.
<i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)	P3	X			9.4	Aug	Red clay. Clay pan, grass plain.	Unlikely Suitable habitat is not likely to occur within the survey area.
<i>Triodia</i> sp. Karijini (S. van Leeuwen 4111)	P1	X			13.7	Aug – Sep	Hillcrests and steep slopes. Sandy loam, grey or brown silty loam. Ironstone outcropping, boulders, cobbles and pebbles.	Unlikely Suitable habitat is not likely to occur within the survey area.

NM – NatureMap; **ALA** – Atlas of Living Australia Database; **RTIO** –Rio Tinto Priority Flora Database.

3.2.3 Threatened and Priority Ecological Communities

The database search did not identify any Threatened Ecological Communities (TEC) within 20 km of the survey area. The closest occurrence of a TEC is the buffer of the Vulnerable '*Themeda* grasslands on cracking clays (Hamersley Station, Pilbara)', located approximately 60 km west of the survey area. There is no suitable habitat to support this TEC within the survey area, therefore it would not be expected to occur.

No mapped Priority Ecological Communities (PECs) occur within the survey area. The closest occurrence of a PEC is the buffer of the Priority 1 ecological community, Freshwater claypans downstream of the Fortescue Marsh - Goodaidarrie Hills on Mulga Downs Station, located approximately 12 km north of the survey area. The proposed activities are unlikely to impact on this community

3.2.4 Fauna Diversity

The DBCA NatureMap, PMST and Rio Tinto database search results cover all fauna taxa detected previously within 20 km of the survey area. The database searches returned a total of 18 conservation significant fauna taxa.

Table 3-5 presents a summary of fauna taxa returned by the DBCA NatureMap, PMST, and Rio Tinto database searches. Figure 3-7 shows conservation significant fauna taxa records from the Rio Tinto database in the vicinity of the survey area.

Table 3-5: Summary of terrestrial vertebrate fauna species returned from the NatureMap search

Fauna group	Number of potential species within a 20 km radius of the survey area		
	NatureMap database	PMST database	RTIO database
Amphibians	3	0	0
Reptiles	61	1	3
Avifauna	160	4	14
Mammals	21	4	1
Conservation listed	12	9	1
Total	245	9	17

620,000

640,000

660,000

680,000

RioTinto

Figure 3-7: Rio Tinto records for conservation listed fauna previously recorded within 20 km of survey area

Drawn: J.Wesson
Plan: RTIO0973569v1
Date: January 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:250,000 @A4
GIS.Team@riotinto.com

7,540,000

7,540,000

7,520,000

7,520,000

Legend

 Survey Area

Tier 1 and 2 Fauna

 *Rhinionciteris aurantia* (VU)

N

0 3 6 9 12

Kilometres
Map units in metres

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620,000

640,000

660,000

680,000

3.2.5 Pre-field Fauna Likelihood of Occurrence Assessment

Eighteen (18) conservation significant fauna species were returned by the database searches (Table 3-6). Under the BC Act, two of these are listed as Critically Endangered (CR), two as Endangered (EN), five as Vulnerable (VU), one as Other Special (OS), four as Migratory (MI), two as Priority 2 (P2) and two as Priority 4 (P4) fauna. None of these species are considered likely to be dependent on the habitat within the survey area.

The Ghost Bat (VU), Pilbara Leaf-nosed Bat (VU), Grey Falcon (VU) and Peregrine Falcon (OS) may opportunistically utilise the survey area while traversing or foraging. As the survey area does not appear to contain core habitat features for these species (i.e. large trees, breakaways, caves, permanent pools of water), these species are not considered dependent on the habitat of the survey area. The habitat is considered to be potential foraging habitat for these species.

The Bilby (VU) is considered to potentially occur within the survey area due to the possible presence of mulga woodland and sandplain habitat. Additionally, the survey area lies marginally within its reported known range.

As little is still known about the Night Parrot (CR), this species is also considered to potentially occur within the habitat, where it may utilise large spinifex (if present) for nesting. However, the survey area currently lies outside the known range of this species.

The likelihood of occurrence assessment for all conservation significant fauna returned by the database search is presented in Table 3-6.

Table 3-6: Conservation listed fauna species returned by database searches, including pre-field likelihood of occurrence assessment

Species	Common name	BC Act	EPBC Act	NM	PMST	RTIO	Preferred habitat	Distance to nearest record	Likelihood of occurrence (pre-field)
Birds									
<i>Amytornis striatus striatus</i>	Striated Grasswren (sandplain)	P4	-	X	-	-	The Striated Grasswren prefers spinifex, with or without low shrubs (especially <i>Aluta maisonneuvei</i>) and herbs, on sandy or loamy plains; also bushy acacias (especially <i>Acacia ligulata</i> or <i>A. aneura</i>) on sandridges and interdunes and usually with spinifex (Johnstone & Storr, 2004).	No previous records of this sub-species occur within 20 km of the survey area.	Unlikely The survey area contains suitable habitat for this taxon, however the survey area is outside the current distribution of this taxon (within range of unlisted <i>A. striatus whitei</i> , but not within range of P4 <i>A. striatus striatus</i>).
<i>Calidris ferruginea</i>	Curlew Sandpiper	CR	CR, MI & MA	-	X	-	The Curlew Sandpiper prefers habitats such as tidal mudflats, saltmarsh, salt fields, fresh, brackish or saline wetlands and sewerage ponds (Pizzey & Knight, 2012). It is also found at lagoons and mangroves, as well as beaches, rocky shores and around lakes, dams and floodwaters. The Curlew Sandpiper does not breed in Australia (Birdlife Australia, 2022).	No previous records of this species occur within 20 km of the survey area.	Unlikely The survey area does not contain suitable habitat to support this species.
<i>Falco hypoleucos</i>	Grey Falcon	VU	VU	-	X	-	The Grey Falcon is a wide roaming species and prefers habitats such as lightly treed inland plains, gibber deserts, sand ridges, pastoral lands, timbered watercourses. They are seldom in the driest deserts (Pizzey & Knight, 2012).	No previous records of this species occur within 20 km of the survey area.	Potential The Grey Falcon may opportunistically forage over the survey area however the survey area does not contain habitat of specific dependence for this species.
<i>Falco peregrinus</i>	Peregrine Falcon	OS	-	X	-	-	The Peregrine Falcon occupies most environments with suitable nest sites: cliff faces are preferred, including man-made ones, and it commonly uses stick nests built by other species (Menkhorst, Rogers, Clarke, Davies, & Marsack, 2017).	No previous records of this species occur within 20 km of the survey area.	Potential The Peregrine Falcon may opportunistically forage over the survey area however the survey area does not contain habitat of specific dependence for this species.
<i>Gelochelidon nilotica</i>	Gull-billed Tern	MI	-	X	-	-	The Gull-billed Tern is strictly coastal, at high tide it often roosts with other terns or shorebirds (Menkhorst, Rogers, Clarke, Davies, & Marsack, 2017).	No previous records of this species occur within 20 km of the survey area.	Unlikely The survey area does not contain suitable habitat to support this species.
<i>Hydroprogne caspia</i>	Caspian Tern	MI	MI & MA	X	-	-	The Caspian Tern occurs in sheltered coastal waters, also uses inland water bodies, including large rivers, fresh to saline lakes, reservoirs and temporary wetlands (Menkhorst, Rogers, Clarke, Davies, & Marsack, 2017).	No previous records of this species occur within 20 km of the survey area.	Unlikely The survey area does not contain suitable habitat to support this species.
<i>Pezoporus occidentalis</i>	Night Parrot	CR	EN	-	X	-	The Night Parrot is a highly cryptic bird which was presumed extinct until its rediscovery in 2013. As such, habitat requirements are still being researched. At the time of this report Night Parrots are thought to roost and nest in clumps of dense vegetation, primarily old and large spinifex (<i>Triodia</i>) clumps, but sometimes other vegetation types are used (Department of Biodiversity, Conservation and Attractions, 2017). Little is known about foraging sites, but favoured sites are considered likely to vary across the range of the species. <i>Triodia</i> is also likely to provide a good food resource for night parrots, in times of mass flowering and seeding, but they also rely heavily on a range of other food species (Department of Biodiversity, Conservation and Attractions, 2017). <i>Sclerolaena</i> has been shown to be a source of food and moisture (Department of Biodiversity, Conservation and Attractions, 2017).	No previous records of this species occur within 20 km of the survey area.	Potential There is limited information available on the complete habitat preferences for this species. The survey area is not within the current known range of this species however it may contain suitable habitat to support this species.
<i>Plegadis falcinellus</i>	Glossy Ibis	MI	-	X	-	-	The Glossy Ibis inhabits shallow, fresh water, occasionally estuarine waters or dry grasslands (Menkhorst, Rogers, Clarke, Davies, & Marsack, 2017).	No previous records of this species occur within 20 km of the survey area.	Unlikely The survey area does not contain suitable habitat to support this species.
<i>Rostratula australis</i>	Australian Painted Snipe	EN	EN & MA	-	X	-	The Australian Painted Snipe is usually found in shallow inland wetlands, either freshwater or brackish, that are either permanently or temporarily filled. Suitable wetlands usually support a mosaic of low, patchy vegetation, as well as lignum and canegrass (Birdlife Australia, 2022).	No previous records of this species occur within 20 km of the survey area.	Unlikely The survey area does not contain suitable habitat to support this species.

Species	Common name	BC Act	EPBC Act	NM	PMST	RTIO	Preferred habitat	Distance to nearest record	Likelihood of occurrence (pre-field)
<i>Sternula albifrons</i>	White-shafted Little Tern (Little Tern)	MI	MI & MA	X	-	-	The Little Tern forages over sheltered waters and roosts on exposed sandbars, spits or beaches. Nests in colonies in open sandy setting, sloe to tideline (Menkhorst, Rogers, Clarke, Davies, & Marsack, 2017).	9 km north of the survey area	Unlikely The survey area does not contain suitable habitat to support this species.
Mammals									
<i>Dasyurus hallucatus</i>	Northern Quoll	EN	EN	X	X	-	Northern Quoll occupy a diverse range of habitats including rocky areas, eucalypt forest, woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (Threatened Species Scientific Committee, 2005). Habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal. Dens are made in rock crevices, tree holes or occasionally termite mounds (Threatened Species Scientific Committee, 2005). In the Pilbara region, the species appears to prefer the Rocklea, Macroy and Robe land systems (Biota Environmental Services, 2008). The Northern Quoll has also been recorded in other land systems which comprise sandstone and dolomite hills and ridges, shrublands, sandy plains, clay plans and tussock grasslands and coastal fringes including dunes islands and beaches (Biota Environmental Services, 2008).	18 km northwest of the survey area	Unlikely The survey area does not contain suitable habitat to support this species.
<i>Macroderma gigas</i>	Ghost Bat	VU	VU	-	X	-	The Ghost Bat is patchily distributed across the northern half of Australia. This species requires undisturbed roost sites which are often complex and contain multiple entrances; it has been known to utilise old abandoned mine shafts (Menkhorst & Knight, 2021).	No previous records of this species occur within 20 km of the survey area.	Potential This species may opportunistically use the survey area for foraging, however no roosting habitat is present within the survey area. This species has not been recorded within 20 km of the survey area.
<i>Macrotis lagotis</i>	Bilby, Dalgyte	VU	VU	-	X	-	The Bilby inhabits a variety of habitats including acacia shrublands and hummock grassland, stony downs country of cracking clays, desert sandplains and dune fields sometimes containing laterite (Menkhorst & Knight, 2021; Van Dyck & Strahan, 2008).	No previous records of this species occur within 20 km of the survey area.	Potential The survey area contains potentially suitable habitat to support this species and lies within its known range. However, this species has not previously been recorded within 20 km of the survey area.
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	P4	-	X	-	-	This species is found on stony hillsides with hummock grassland (Menkhorst & Knight, 2021). This species favors scree and stony plains habitat where it constructs conspicuous, extensive mounds of small stones. The pebble-mounds are found on gently sloping hills where the ground is stony with continuous small pebbles.	15 km west of the survey area	Unlikely The survey area does not appear to contain suitable habitat to support this species.
<i>Rhinonictis aurantia</i> (Pilbara form)	Pilbara Leaf-nosed Bat	VU	VU	X	X	X	The Pilbara Leaf-nosed Bat (PLNB) inhabits abandoned mine shafts, granite rock pile terrain of the east Pilbara and caves formed in gorges that dissect sedimentary geology in the west Pilbara (Van Dyck & Strahan, 2008). During the dry season, the PLNB roosts in deep, warm, humid caves or mines and forages nearby, while during the wet season, it is more widespread and may not require caves for roosting (Menkhorst & Knight, 2021). The PLNB forages low in open habitats, including grasslands and along roads.	4 km south of the survey area	Potential This species may opportunistically utilise the survey area to forage, however the study area does not contain roosting habitat or permanent pools to support this species.
Reptiles									
<i>Ctenotus uber johnstonei</i>	Spotted Ctenotus (northeast)	P2	-	X	-	-	The Spotted Ctenotus is known from an area of chenopod shrubland at the base of a sandstone hill near Balgo, northeast interior of Western Australia, and possibly extends further west (Wilson & Swan, 2010).	No previous records of this species occur within 20 km of the survey area.	Unlikely The survey area is outside the current distribution of this taxon.
<i>Liasis olivaceus</i> subsp. <i>barroni</i>	Pilbara Olive Python	VU	VU	X	X	-	The Pilbara Olive Python is found in arid to subhumid areas of northern Australia, it is often encountered along watercourses, especially those associated with rocky areas (Wilson & Swan, 2010). The preferred habitat of this taxon includes escarpments, gorges and water holes in the ranges of the Pilbara region (Wilson & Swan, 2010). Individuals are usually recorded in close proximity to water and rock outcrops that attract suitably sized prey species.	No previous records of this species occur within 20 km of the survey area.	Unlikely The survey area does not contain suitable habitat to support this species.

Species	Common name	BC Act	EPBC Act	NM	PMST	RTIO	Preferred habitat	Distance to nearest record	Likelihood of occurrence (pre-field)
<i>Underwoodisaurus seorsus</i>	Pilbara Barking Gecko	P2	-	X	-	-	The Pilbara Barking Gecko is known from an isolated population in West Angelas and Paddlesack Range in the central Hamersley Range (Wilson & Swan, 2010).	No previous records of this species occur within 20 km of the survey area.	Unlikely The survey area is outside the current distribution of this taxon.

NM – NatureMap; **PMST** – EPBC Act Protected Matters Search Tool; **RTIO** –Rio Tinto Priority Fauna Database.

4. Field Results

4.1 Vegetation Types

Six vegetation types were identified across two major landforms within the survey area. Two vegetation types were described from drainage lines, and four from plains. Additionally, rehabilitation and cleared areas were mapped.

The majority of the survey area consisted of vegetation type D1, (ChEv)AprAhClCcCs, which represented 40.7% of the survey area (255.6 ha). The least widespread vegetation type was P4, EgAsTw, which represented less than 1% of the survey area (2.2 ha).

All vegetation types within the survey area were representative of existing broad scale vegetation (Beard, 1975), and soil and land system mapping (Christian & Stewart, 1953; Van Vreeswyk, Payne, Leighton, & Hennig, 2004; Tille, 2006) for the area.

The vegetation types are summarised in Table 4-1 and are described in detail on the following pages, accompanied by vegetation mapping (Figure 4-1).

Table 4-1: Summary of vegetation types

Vegetation Code	Species Code	Vegetation Description	Extent within the survey area (ha)	Proportion of survey area (%)
Vegetation of Drainage Lines				
D1	(ChEv)AprAhClCcCs	(Scattered trees of <i>Corymbia hamersleyana</i> and <i>Eucalyptus victrix</i> over) low open woodland of <i>Acacia pruinocarpa</i> and <i>Atalaya hemiglauca</i> over open shrubland of <i>Corchorus laniflorus</i> over open tussock grassland of * <i>Cenchrus ciliaris</i> and * <i>Cenchrus setiger</i> .	255.6	40.7
D2	GwApyCcCsTp	Tall shrubland of <i>Grevillea wickhamii</i> and <i>Acacia pyrifolia</i> over tussock grassland of * <i>Cenchrus ciliaris</i> and * <i>Cenchrus setiger</i> over scattered hummock grasses of <i>Triodia pungens</i> .	26.5	4.2
Vegetation of Plains				
P1	AapAanTp	Low open woodland of <i>Acacia aptaneura</i> over tall open shrubland of <i>Acacia ancistrocarpa</i> over open hummock grassland of <i>Triodia pungens</i> .	34.5	5.5
P2	AprAbTw	Scattered low trees of <i>Acacia pruinocarpa</i> over open shrubland of <i>Acacia bivenosa</i> over open hummock grassland of <i>Triodia wiseana</i> .	71.2	11.3
P3	AiTp	Scattered tall shrubs of <i>Acacia inaequilatera</i> over hummock grassland of <i>Triodia pungens</i> .	221.5	35.3
P4	EgAsTw	Scattered low trees of <i>Eucalyptus gamophylla</i> over scattered shrubs of <i>Grevillea wickhamii</i> over low open shrubland of <i>Acacia spondylophylla</i> over open hummock grassland of <i>Triodia wiseana</i> .	2.2	0.3
Rehabilitation	R	Scattered hummock grasses of <i>Triodia pungens</i> over scattered herbs of <i>Ptilotus exaltatus</i> , <i>Sida echinocarpa</i> and <i>Dysphania rhadinostachya</i> .	2.6	0.4
Cleared	HD		13.9	2.2
Total			628.1	100.00

Vegetation of Drainage Lines

D1: (Scattered trees of *Corymbia hamersleyana* and *Eucalyptus victrix* over) low open woodland of *Acacia pruinocarpa* and *Atalaya hemiglauca* over open shrubland of *Corchorus laniflorus* over open tussock grassland of **Cenchrus ciliaris* and **Cenchrus setiger*.

Landform and soils	This vegetation type occurs in larger drainage lines with sandy clay loam soils, and basalt and ironstone rocks.
Distribution	This vegetation type occurs in the eastern portion of the survey area and accounts for 40.7% of the survey area.
Associated species	<p><u>Trees:</u> <i>Acacia pruinocarpa</i>, <i>Atalaya hemiglauca</i>, <i>Corymbia hamersleyana</i>, <i>Eucalyptus victrix</i></p> <p><u>Tall shrubs:</u> <i>Acacia pyrifolia</i>, <i>Gossypium robinsonii</i>, <i>Grevillea wickhamii</i></p> <p><u>Shrubs:</u> <i>Corchorus laniflorus</i></p> <p><u>Low shrubs:</u> <i>Afrohybanthus aurantiacus</i>, <i>Indigofera monophylla</i>, <i>Ptilotus obovatus</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>Tephrosia rosea</i> var. <i>Fortescue</i> creeks (M.I.H. Brooker 2186)</p> <p><u>Grasses:</u> <i>Cymbopogon ambiguus</i>, <i>Triodia pungens</i></p> <p><u>Herbs:</u> <i>Polycarpaea longiflora</i>, <i>Salsola australis</i></p>
Conservation listed flora	None recorded
Weeds	<i>*Aerva javanica</i> , <i>*Argemone ochroleuca</i> , <i>*Cenchrus ciliaris</i> , <i>*Cenchrus setiger.</i> , <i>*Rumex vesicarius</i>
Condition	Good
Sampling sites	Relevés: GBR02, GBR04, GBR09, GBR13, GBR14, GBR15, GBR16 Three mapping notes
Fire and disturbance	Fire age between two and 12 years old. Cattle present.
Photo	Plate 1



Plate 1: Representative photo of vegetation type (ChEv)AprAhCICcCs at GBR16

Vegetation of Drainage Lines

D2: Tall shrubland of *Grevillea wickhamii* and *Acacia pyrifolia* over tussock grassland of **Cenchrus ciliaris* and **Cenchrus setiger* over scattered hummock grasses of *Triodia pungens*.

GwApyCcCsTp

Landform and soils	This vegetation type occurs in shallow drainage lines with red brown loamy clay soils.
Distribution	This vegetation type occurs in the western portion of the survey area and accounts for 4.2% of the survey area.
Associated species	<p><u>Trees:</u> -</p> <p><u>Tall shrubs:</u> <i>Acacia pyrifolia</i>, <i>Atalaya hemiglauca</i>, <i>Grevillea wickhamii</i>, <i>Hakea loreus</i> subsp. <i>loreus</i></p> <p><u>Shrubs:</u> <i>Gossypium australe</i>, <i>Jasminum didymum</i> subsp. <i>lineare</i></p> <p><u>Low shrubs:</u> <i>Corchorus sidoides</i> subsp. <i>Sidoides</i>, <i>Indigofera monophylla</i></p> <p><u>Grasses:</u> <i>Triodia pungens</i></p> <p><u>Herbs:</u> <i>Rhynchosia minima</i></p>
Conservation listed flora	None recorded
Weeds	<i>*Cenchrus ciliaris</i> , <i>*Cenchrus setiger</i>
Condition	Poor
Sampling sites	Relevés: GBR03, GBR07
Fire and disturbance	Fire age between two and 10 years old.
Photo	Plate 2



Plate 2: Representative photo of vegetation type GwApyCcCsTp at GBR07

Vegetation of Plains

P1: Low open woodland of *Acacia aptaneura* over tall open shrubland of *Acacia ancistrocarpa* over open hummock grassland of *Triodia pungens*

AapAanTp

Landform and soils	This vegetation type occurs on plains with sandy clay loam soils.
Distribution	This vegetation type occurs on the eastern boundary of the survey area and accounts for 5.5% of the survey area.
Associated species	<u>Trees:</u> <i>Acacia aptaneura</i> <u>Tall shrubs:</u> <i>Acacia ancistrocarpa</i> , <i>Acacia pruinocarpa</i> <u>Shrubs:</u> <i>Acacia bivenosa</i> , <i>Anthobolus leptomerioides</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> <u>Low shrubs:</u> <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>Hibiscus burtonii</i> , <i>Maireana planifolia</i> , <i>Ptilotus obovatus</i> , <i>Senna glutinosa</i> subsp. <i>glutinosa</i> , <i>Sida echinocarpa</i> <u>Grasses:</u> <i>Enneapogon polyphyllus</i> , <i>Eulalia aurea</i> , <i>Triodia pungens</i> <u>Herbs:</u> <i>Duperreya commixta</i> , <i>Dysphania kalpari</i> , <i>Euphorbia vaccaria</i> var. <i>vaccaria</i> , <i>Portulaca oleracea</i> , <i>Ptilotus exaltatus</i> , <i>Salsola australis</i> , <i>Sclerolaena deserticola</i> , <i>Sida fibulifera</i>
Conservation listed flora	None recorded
Weeds	* <i>Cenchrus ciliaris</i> , * <i>Cenchrus setiger</i>
Condition	Good
Sampling sites	Relevés: GBR10, GBR12 One mapping note
Fire and disturbance	Fire age between four and 12 years old.
Photo	Plate 3



Plate 3: Representative photo of vegetation type AapAanTp at GBR12

Vegetation of Plains

P2: AprAbTw	Scattered low trees of <i>Acacia pruinocarpa</i> over open shrubland of <i>Acacia bivenosa</i> over open hummock grassland of <i>Triodia wiseana</i>
Landform and soils	This vegetation type occurs on plains with loamy clay sand soils.
Distribution	This vegetation type is in the south-eastern portion of the survey area and accounts for 11.3% of the survey area.
Associated species	<p><u>Trees:</u> <i>Acacia pruinocarpa</i></p> <p><u>Tall shrubs:</u> <i>Acacia monticola</i>, <i>Acacia tumida</i> subsp. <i>pilbarensis</i>, <i>Clerodendrum floribundum</i> var. <i>angustifolium</i>, <i>Gossypium robinsonii</i>, <i>Grevillea pyramidalis</i></p> <p><u>Shrubs:</u> <i>Acacia acradenia</i>, <i>Acacia bivenosa</i>, <i>Anthobolus leptomerioides</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>Senna glutinosa</i> subsp. <i>xluerssenii</i>, <i>Senna glutinosa</i> subsp. <i>pruinosa</i></p> <p><u>Low shrubs:</u> <i>Bonamia erecta</i>, <i>Corchorus laniflorus</i>, <i>Indigofera monophylla</i>, <i>Ptilotus astrolasius</i>, <i>Ptilotus obovatus</i>, <i>Sida echinocarpa</i>, <i>Tribulus suberosus</i></p> <p><u>Grasses:</u> <i>Amphipogon sericeus</i>, <i>Aristida holathera</i>, <i>Eriachne mucronate</i>, <i>Triodia wiseana</i></p> <p><u>Herbs:</u> <i>Euphorbia vaccaria</i> var. <i>vaccaria</i>, <i>Polymeria mollis</i>, <i>Ptilotus exaltatus</i>, <i>Ptilotus helipteroides</i>, <i>Salsola australis</i>, <i>Trigastrotheca molluginea</i></p>
Conservation listed flora	None recorded
Weeds	* <i>Cenchrus ciliaris</i> , * <i>Cenchrus setiger</i> , * <i>Rumex vesicarius</i>
Condition	Very Good
Sampling sites	Relevés: GBR06, GBR08 Two mapping notes
Fire and disturbance	Fire age between two and four years old.
Photo	Plate 4



Plate 4: Representative photo of vegetation type AprAbTw at GBR06

Vegetation of Plains

P3: Scattered tall shrubs of *Acacia inaequilatera* over hummock grassland of *Triodia pungens*

AiTp

Landform and soils	This vegetation type occurs on plains with loamy clay soils, and ironstone and quartz rocks.
Distribution	This vegetation type is widespread and accounts for 35.3% of the survey area.
Associated species	<p><u>Trees:</u> -</p> <p><u>Tall shrubs:</u> <i>Acacia inaequilatera</i></p> <p><u>Shrubs:</u> <i>Acacia pruinocarpa</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i></p> <p><u>Low shrubs:</u> <i>Gossypium australe</i>, <i>Sida echinocarpa</i></p> <p><u>Grasses:</u> <i>Triodia pungens</i></p> <p><u>Herbs:</u> <i>Swainsona stenodonta</i></p>
Conservation listed flora	None recorded
Weeds	* <i>Cenchrus ciliaris</i>
Condition	Very Good
Sampling sites	Relevés: GBR05, GBR11 Two mapping notes
Fire and disturbance	One patch was recently burnt (less than one year old), the remaining of the survey area was burnt between five and 10 years ago.
Photo	Plate 5



Plate 5: Representative photo of vegetation type AiTp at GBR05

Vegetation of Plains

P4: Scattered low trees of *Eucalyptus gamophylla* over scattered shrubs of *Grevillea wickhamii*
EgAsTw over low open shrubland of *Acacia spondylophylla* over open hummock grassland of *Triodia wiseana*

Landform and soils	This vegetation type occurs on the plains with loamy clay soils, and ironstone and quartz rocks.
Distribution	This vegetation type is restricted to the western portion of the survey area, and accounts for approximately 0.3% of the survey area.
Associated species	<u>Trees:</u> <i>Eucalyptus gamophylla</i> <u>Tall shrubs:</u> - <u>Shrubs:</u> <i>Grevillea wickhamii</i> <u>Low shrubs:</u> <i>Acacia spondylophylla</i> <u>Grasses:</u> <i>Triodia pungens</i> , <i>Triodia wiseana</i> <u>Herbs:</u> <i>Ptilotus calostachyus</i> , <i>Ptilotus exaltatus</i>
Conservation listed flora	None recorded
Weeds	* <i>Cenchrus ciliaris</i>
Condition	Very Good
Sampling sites	Relevés: GBR01
Fire and disturbance	Fire age between five and 10 years old.
Photo	Plate 6



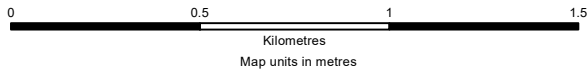
Plate 6: Representative photo of vegetation type EgAsTw at GBR01

Figure 4-1:
Vegetation types within
the survey area

Drawn: J.Wesson
Plan: RTIO0973569v1
Date: January 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:20,000 @A4
GIS.Team@riotinto.com

- Legend**
- Survey Area
 - Vegetation Types**
 - D1
 - D2
 - HD
 - P1
 - P2
 - P3
 - P4
 - R



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4.2 Vegetation Condition

The vegetation within the survey area was predominantly rated as being in Very Good (294.9 ha, 46.9%) and Good condition (290.1 ha, 46.2%). Completely degraded areas such as cleared access tracks and rehabilitation areas constituted the minority of the survey area (16.6 ha, 2.6%).

The western half of the survey area was in poorer condition, with drill pads and access tracks being numerous in this area; vehicle movements and poor weed hygiene have resulted in the weeds spreading north of Munjina Road.

Disturbance factors included weeds, including aggressive infestations of **Cenchrus ciliaris* and **Cenchrus setiger*, cattle grazing, tracks and scats, and previously cleared areas. One portion of vegetation type AiTp was characterised by frequent fires, with none of the original vegetation structure present and the area dominated by emerging herbs, such as *Ptilotus exaltatus* and *Ptilotus auriculifolius*.

Vegetation condition mapping is presented in Figure 4-2, and Table 4-2 presents the extent of vegetation condition mapped within the survey area.

Table 4-2: Vegetation condition of the survey area

Condition	Condition rank	Area (ha)	Proportion (%) of survey area
Very Good	0.8	294.9	46.9
Good	0.6	290.1	46.2
Poor	0.4	26.5	4.2
Completely Degraded	0.1	16.6	2.6
Total		628.1	100

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Figure 4-2: Vegetation condition within the survey area

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Legend


 Survey Area

Vegetation Condition

 0.1 - Completely Degraded

 0.4 - Poor

 0.6 - Good

 0.8 - Very Good

N



0 0.5 1 1.5

Kilometres

Map units in metres

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4.3 Vegetation of Conservation Significance

None of the vegetation associations occurring within the survey area correspond to any ecosystems listed as Threatened under the EPBC Act or listed as TECs or PECs by DBCA (Department of Biodiversity, Conservation and Attractions, 2022; Department of Biodiversity, Conservation and Attractions, 2018; Department of Climate Change, Energy, the Environment and Water, 2022).

None of the vegetation types are considered of conservation significance or restricted:

- The drainage lines within the survey area were not considered large enough to constitute major ephemeral water courses or the 'permanent wetland communities' ecosystem at risk (Kendrick, 2001).
- Vegetation type P1 (AapAanTp), mapped and described for the plains on the eastern boundary of the survey area is not considered representative of the 'grove-intergrove mulga communities' ecosystem at risk (Kendrick, 2001) due to the open woodland structure and lack of closed canopy creating a grove. This vegetation type extends to the east of the survey area, and therefore is not restricted in the landscape.
- One of the vegetation types, P4 (EgAsTw), represented 0.3% of the survey area, however it extends west of the survey area and is not restricted in the landscape.

4.4 Flora Composition

A total of 172 vascular flora taxa from 92 genera representing 36 families were recorded during the field survey (Appendix 7). The most speciose families were Fabaceae (32 taxa), Poaceae (24 taxa) and Malvaceae (22 taxa). The most speciose genera were *Acacia* (14 taxa), *Ptilotus* and *Senna* (7 taxa each).

The suite of flora taxa recorded is considered typical for the Beard's (1975) vegetation mapping over the survey area and aligns with the database search results obtained.

Six taxa were not able to be conclusively resolved due to the specimens being sterile or juvenile at the time of the survey. All of these were confidently assigned a genera, and two (*Clerodendrum ?tomentosum* and *Tephrosia ?sp.* NW Eremaean (S. van Leeuwen et al. PBS 0356)) were assigned a tentative species. None of the unconfirmed flora taxa were considered analogous to any of the conservation significant flora identified by the desktop assessment.

Seasonal condition was considered within the expected range for the bioregion. Despite the survey being undertaken outside of the recommended primary survey period, many flora taxa were still flowering or fruiting and could be confidently identified. Floristic diversity was aligned with other biological surveys completed in the vicinity of the survey area (Table 2-1). Additional annual and ephemeral species may be recorded after significant rainfall.

4.5 Flora of Conservation Significance

No Threatened or Priority flora taxa were recorded during the survey. None of the flora taxa recorded during the survey represented range extensions.

4.6 Post-survey Flora Likelihood of Occurrence Assessment

Following the survey, the likelihood of occurrence assessment was revised considering the presence of suitable habitat, survey timing and conditions (Table 4-3). Of the seventeen conservation significant flora taxa identified by the database searches, one is considered likely to occur within the survey area, *Rostellularia adscendens* var. *latifolia* (P3).

Table 4-3: Revised likelihood of occurrence of conservation listed flora species within the survey area

Species	Status	Likelihood of occurrence (post-field)
<i>Adiantum capillus-veneris</i>	P2	Unlikely No suitable habitat recorded within the survey area.
<i>Cladium procerum</i>	P2	Unlikely No suitable habitat recorded within the survey area.
<i>Dicladantha glabra</i>	P2	Unlikely Suitable habitat was present within the survey area (watercourses). The survey was undertaken during the taxon's flowering period, therefore it is unlikely that it would have been missed during the survey.
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	Unlikely No suitable habitat recorded within the survey area.
<i>Fimbristylis sieberiana</i>	P3	Unlikely No suitable habitat recorded within the survey area.
<i>Gompholobium karjini</i>	P2	Unlikely Suitable habitat was present within the survey area (flat plateau, drainage lines). Although the survey was undertaken outside the flowering period of this taxon, this is a readily identifiable shrub, and therefore it is unlikely that it would have been missed during the survey.
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	P3	Unlikely No suitable habitat recorded within the survey area.
<i>Hibiscus</i> sp. Mt Brockman (E. Thoma ET 1354)	P1	Unlikely No suitable habitat recorded within the survey area.
<i>Isotropis parviflora</i>	P2	Unlikely No suitable habitat recorded within the survey area.
<i>Lepidium catapycnon</i>	P4	Unlikely Suitable habitat was present within the survey area (road verges). The survey was undertaken during the taxon's flowering period, therefore it is unlikely that it would have been missed during the survey.

Species	Status	Likelihood of occurrence (post-field)
<i>Olearia mucronata</i>	P3	Unlikely Suitable habitat was present within the survey area (drainage channels). The survey was undertaken during the taxon's flowering period, therefore it is unlikely that it would have been missed during the survey.
<i>Ptilotus mollis</i>	P4	Unlikely No suitable habitat recorded within the survey area.
<i>Rhynchosia bungarensis</i>	P4	Unlikely No suitable habitat recorded within the survey area.
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	P3	Likely Suitable habitat was present within the survey area (ironstone soils, near creeks). This taxon was recorded within 5 km of the survey area. Due to the survey being undertaken outside the flowering period of this taxon, and <i>Rostellularia adscendens</i> var. <i>latifolia</i> being a small herb, it is possible that it could have been missed during the survey.
<i>Teucrium pilbaranum</i>	P2	Unlikely No suitable habitat recorded within the survey area.
<i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)	P3	Unlikely No suitable habitat recorded within the survey area.
<i>Triodia</i> sp. Karijini (S. van Leeuwen 4111)	P1	Unlikely No suitable habitat recorded within the survey area.

NM – NatureMap; **ALA** – Atlas of Living Australia Database; **RTIO** –Rio Tinto Priority Flora Database.

4.7 Introduced Flora

Seven introduced flora taxa were recorded during the survey:

- **Aerva javanica*, Kapok Bush
- **Argemone ochroleuca*, Mexican Poppy
- **Cenchrus ciliaris*, Buffel Grass
- **Cenchrus setiger*, Birdwood Grass
- **Malvastrum americanum*, Spiked Malvastrum
- **Rumex vesicarius*, Ruby Dock
- **Vachellia farnesiana*, Mimosa Bush.

None of the introduced flora taxa are listed as declared pests under the WA Biosecurity and Agriculture Management Act 2007, nor are listed as Weeds of National Significance (WoNS) (Department of Agriculture, Water and the Environment, 2021; Department of Primary Industries and Regional Development, 2022). The introduced flora taxa have legal status of Permitted – s11, and do not have an assigned control category (Department of Primary Industries and Regional Development, 2022).

Weed species richness was greatest on vehicle access tracks and along drainage channels, likely spread by vehicle movements, rainfall and fauna. Locations of the weed species are shown in Figure 4-3.

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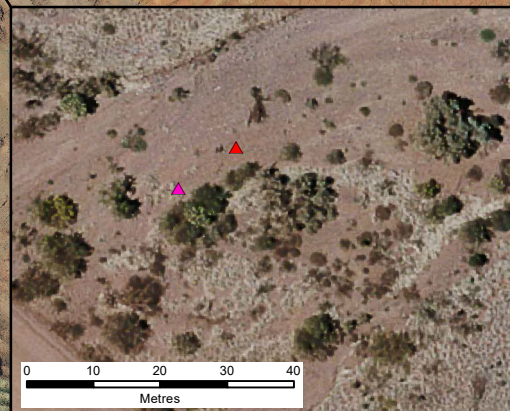
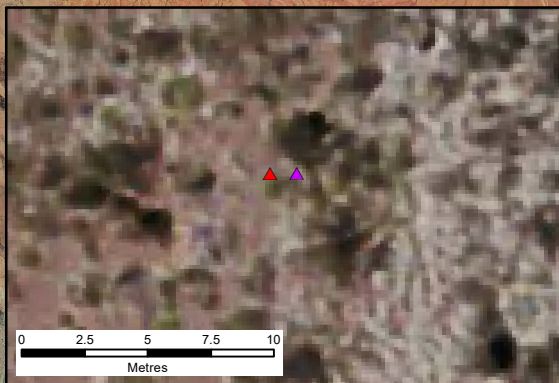
Figure 4-3:
Introduced flora recorded
during the survey

Drawn: J.Wesson
Plan: RTIO0973569v1
Date: January 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:40,000 @A4
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Legend

Survey Area

Introduced Flora Species

- **Aerva javanica*
- **Argemone ochroleuca*
- **Cenchrus ciliaris*
- **Cenchrus setiger*
- **Malvastrum americanum*
- **Rumex vesicarius*
- **Vachellia farnesiana*

N



0 0.5 1 1.5 2
Kilometres
Map units in metres

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4.8 Fauna Habitat

Three broad fauna habitat types were mapped: Minor Drainage, Mulga Woodland, and Stony Plain (Table 4-4). Additionally, rehabilitation and cleared areas were delineated. Figure 4-4 shows fauna habitat mapping within the survey area.

The fauna habitats identified provide a range of values to fauna as refuge, foraging and breeding habitat. The fauna habitats are common throughout the surrounding remnant vegetation and the overall bioregion and subregion.

Two of the fauna habitats, Minor Drainage and Mulga Woodland, were considered to hold 'moderate' fauna habitat value as they offer foraging habitat to conservation significant fauna taxa. The Minor Drainage habitat is also valuable for its role as an ecological linkage, as it provides a continuous corridor of vegetation cover that allows fauna to traverse large distances. This habitat may also occasionally flood, providing a temporary water source for fauna species.

Fauna habitat condition varied from Very Good to Disturbed condition, with the most prolific disturbances being weeds, vehicle tracks and cattle.

None of the fauna habitats occurring within the survey area correspond to any ecosystems listed as Threatened under the EPBC Act and none are consistent with ecosystems listed as TECs by DBCA (Department of Biodiversity, Conservation and Attractions, 2018; Department of Climate Change, Energy, the Environment and Water, 2022). None of the fauna habitats of the survey area are representative of listed PECs by DBCA (Department of Biodiversity, Conservation and Attractions, 2022).

Table 4-4: List of habitat types within the survey area including microhabitats and extent

Habitat	Fauna habitat description	Associated vegetation types	Extent (ha) within survey area	Proportion (%) within survey area
Minor Drainage (Plate 7)	<p>The Minor Drainage habitat occurs on red-brown loamy clay with occasional sand, and with ironstone and basalt rocks. The vegetation is described as scattered trees of <i>Corymbia hamersleyana</i> and <i>Eucalyptus victrix</i> (restricted to the larger drainage lines in the eastern portion of the survey area) with tall shrublands of <i>Acacia</i> spp. and <i>Grevillea wickhamii</i>. The ground storey of this habitat was dominated by weed tussock species such as Buffel Grass (<i>*Cenchrus ciliaris</i>) and Birdwood Grass (<i>*Cenchrus setiger</i>).</p> <p>The Minor Drainage habitat consists of small drainage channels less than 10m in width and it is less likely to support surface water for long after rains. Microhabitats in this habitat type include scattered mature <i>Eucalyptus</i> and <i>Corymbia</i> spp. trees, seasonal presence of water (seasonally inundated), and leaf litter. Drainage lines support fauna dispersal. Trees, shrubs and grasses provide shelter, refuge and nesting opportunities for birds, mammals and reptiles.</p> <p>Minor Drainage areas are considered to have a 'moderate' fauna habitat value and may provide suitable foraging habitat for conservation significant fauna species such as the Grey Falcon (VU), Peregrine Falcon (OS), Ghost Bat (VU), and Pilbara Leaf-nosed Bat (VU). This habitat may also provide nesting opportunities for the Grey Falcon (VU) and Peregrine Falcon (OS).</p>	(ChEv)AprAhCl GwApyTp	282.1	44.9
Mulga Woodland (Plate 8)	<p>The Mulga Woodland habitat consists of red-brown sandy clay loam with ironstone rocks. The vegetation is described as low open woodland of <i>Acacia aptaneura</i> with a tall open shrubland of <i>Acacia ancistrocarpa</i> and open hummock grassland of <i>Triodia pungens</i>.</p> <p>The Mulga Woodland habitat consists of stands of Mulga over clay or stony substrates. Microhabitats include woody debris. Trees and shrubs provide shelter, refuge and nesting opportunities for birds, mammals and reptiles.</p> <p>This habitat is considered to have a 'moderate' fauna habitat value, however the habitat is not considered suitable for the conservation significant Bilby (VU) due to the lack of sandy soil substrate.</p>	AapAanTp	34.5	5.5
Stony Plain (Plate 9)	<p>The Stony Plain habitat occurs on red-brown loamy clay soil, and occasionally sandy clay loam soil, with ironstone, quartz and basalt rocks. The vegetation of the Stony Plain habitat is described as scattered tall shrubs of <i>Acacia</i> spp. over open hummock grassland of <i>Triodia wiseana</i> and <i>Triodia pungens</i>.</p> <p>The Stony Plain habitat is characterised by substrates made of stones, gravel and cobbles with low lying areas with a slight to no gradient. Microhabitats include <i>Triodia</i> cover and rock cover. Shrubs and hummock grasses provide shelter, refuge and nesting opportunities for birds, mammals and reptiles.</p>	AprAbTw AiTp EgAsTw	294.9	46.9

Habitat	Fauna habitat description	Associated vegetation types	Extent (ha) within survey area	Proportion (%) within survey area
	This habitat is considered to have a 'low' fauna habitat value and may provide suitable habitat for the conservation significant Night Parrot (CR) due to the presence of large hummock grasses.			
Rehabilitation	Areas where the natural vegetation and microhabitats have been disrupted but rehabilitation activities have been undertaken.	N/A	2.6	0.4
Disturbed	Areas where natural vegetation and microhabitats have been disrupted. This includes access tracks.	N/A	13.9	2.2
Total			628.1	100.0



Plate 7: Representative photo of Minor Drainage habitat type from the survey area



Plate 8: Representative photo of Mulga Woodland habitat type from the survey area



Plate 9: Representative photo of Stony Plain habitat type from the survey area

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Figure 4-4: Fauna habitats within the survey area

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Scale: 1:20,000 @A4
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Legend

 Survey Area

Fauna Habitat

 Disturbed

 Minor Drainage

 Mulga Woodland

 Rehab

 Stony Plain

N



0 0.5 1 1.5

Kilometres

Map units in metres

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4.9 Fauna of Conservation Significance

No conservation significant fauna species were observed during the survey.

4.10 Post-survey Fauna Likelihood of Occurrence Assessment

Eighteen conservation significant fauna species were identified from the desktop study (Table 3-6) as occurring in the vicinity of the survey area.

The pre-field likelihood rating was revised post field survey.

Thirteen of the eighteen threatened fauna identified were deemed unlikely to occur within the survey area, due to the absence of suitable habitat or because outside of the current distribution of the taxa. Five species have the 'potential' to occur within the survey area, the Grey Falcon (VU), the Peregrine Falcon (OS), the Night Parrot (CR), the Ghost Bat (VU), and the Pilbara Leaf-nosed Bat (VU). No taxa were considered 'likely' to occur within the survey area (Table 4-5).

Table 4-5: Revised likelihood of occurrence for conservation significant fauna within the survey area

Species	Common name	BC Act	EPBC Act	Likelihood of occurrence (post-field)
Birds				
<i>Amytornis striatus striatus</i>	Striated Grasswren (sandplain)	P4	-	Unlikely The survey area contains suitable habitat for this taxon (Stony Plain habitat), however the survey area is outside its current distribution.
<i>Calidris ferruginea</i>	Curlew Sandpiper	CR	CR, MI & MA	Unlikely The survey area does not contain suitable habitat (tidal mudflats, saltmarsh, salt fields, fresh, brackish or saline wetlands, sewerage ponds, lagoons, mangroves, beaches, rocky shores, lakes, damn, floodwaters) to support this species.
<i>Falco hypoleucos</i>	Grey Falcon	VU	VU	Potential The Grey Falcon may opportunistically forage over the survey area and may nest in large trees (Minor Drainage habitat), however the survey area does not contain habitat of specific dependence for this species.
<i>Falco peregrinus</i>	Peregrine Falcon	OS	-	Potential The Peregrine Falcon may opportunistically forage over the survey area and may nest in large trees (Minor Drainage habitat), however the survey area does not contain habitat of specific dependence for this species.
<i>Gelochelidon nilotica</i>	Gull-billed Tern	MI	-	Unlikely The survey area does not contain suitable habitat (coastal) to support this species.
<i>Hydroprogne caspia</i>	Caspian Tern	MI	MI & MA	Unlikely The survey area does not contain suitable habitat (coastal waters, inland waterbodies, large rivers, fresh to saline lakes, reservoirs, temporary wetlands) to support this species.
<i>Pezoporus occidentalis</i>	Night Parrot	CR	EN	Potential There is limited information available on the complete habitat preferences for this species. The survey area is not within the current known range of this species however it contains suitable habitat (Stony Plains with large <i>Triodia</i> sp. hummock grasses) to support this species.

Species	Common name	BC Act	EPBC Act	Likelihood of occurrence (post-field)
<i>Plegadis falcinellus</i>	Glossy Ibis	MI	-	Unlikely The survey area does not contain suitable habitat (shallow freshwater, estuarine waters, dry grasslands) to support this species.
<i>Rostratula australis</i>	Australian Painted Snipe	EN	EN & MA	Unlikely The survey area does not contain suitable habitat (temporary or permanent shallow inland wetlands, either freshwater or brackish) to support this species.
<i>Sternula albifrons</i>	White-shafted Little Tern (Little Tern)	MI	MI & MA	Unlikely The survey area does not contain suitable habitat (sheltered waters, sandbars, beaches) to support this species.
Mammals				
<i>Dasyurus hallucatus</i>	Northern Quoll	EN	EN	Unlikely The survey area does not contain suitable habitat (rocky areas with rock crevices, tree holes and termite mounds) to support this species.
<i>Macroderma gigas</i>	Ghost Bat	VU	VU	Potential This species may opportunistically use the survey area for foraging (Minor Drainage habitat), however no roosting habitat is present within the survey area. This species has not been recorded within 20 km of the survey area.
<i>Macrotis lagotis</i>	Bilby, Dalgyte	VU	VU	Unlikely The survey area does not contain suitable habitat to support this species. Despite the survey area containing Mulga Woodland habitat, the substrate was stony and not suitable for this species. This species has not been recorded within 20 km of the survey area.
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	P4	-	Unlikely The survey area does not appear to contain suitable habitat (gentle sloping hills with continuous small pebbles) to support this species.
<i>Rhinonicteris aurantia</i>	Pilbara Leaf-nosed Bat	VU	VU	Potential This species may opportunistically utilise the survey area to forage (Minor Drainage habitat), however the study area does not contain roosting habitat or permanent pools to support this species.

Species	Common name	BC Act	EPBC Act	Likelihood of occurrence (post-field)
Reptiles				
<i>Ctenotus uber johnstonei</i>	Spotted Ctenotus (northeast)	P2	-	Unlikely The survey area is outside the current distribution of this taxon.
<i>Liasis olivaceus</i> subsp. <i>barroni</i>	Pilbara Olive Python	VU	VU	Unlikely The survey area does not contain suitable habitat (escarpments, gorges, water holes) to support this species.
<i>Underwoodisaurus seorsus</i>	Pilbara Barking Gecko	P2	-	Unlikely The survey area is outside the current distribution of this taxon.

5. Statement Addressing the 10 Clearing Principles

Hamersley Iron on behalf of Rio Tinto is proposing to undertake an exploration drilling program within tenement E47/01490 'Gorge Bore', which will comprise 325 drill holes with a maximum depth of 200 m, and 19.6 km of new track using blade down technique when grading. The proposal will require the clearing of 27.8 ha of native vegetation (the Proposal).

Based on assessment of the application area and discussion below, it is deemed that the Proposal may be at variance with Clearing Principle (f) - Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland. The Proposal was assessed as unlikely to be at variance with the remaining nine Clearing Principles.

5.1 Principle (a) – Native vegetation should not be cleared if it comprises a high level of biological diversity

The Pilbara is one of Australia's 15 national biodiversity hotspots (Government of Western Australia, 2018) and is a secondary centre of endemism and species richness for *Acacia*, *Triodia*, *Corymbia* and *Sida* species in Western Australia (Maslin, 2001; Maslin & van Leeuwen, 2008; Kendrick, 2001).

The survey area occurs within the Fortescue Plains subregion of the Pilbara bioregion. The Fortescue Plains subregion is described as: 'Alluvial plains and river frontage. Extensive salt marsh, mulga-bunch grass, and short grass communities on alluvial plains in the east. Deeply incised gorge systems in the western (lower) part of the drainage. An extensive calcrete aquifer (originating within a palaeo-drainage valley) feeds numerous permanent springs in the central Fortescue, supporting large permanent wetlands with extensive stands of river gum and cadjeput *Melaleuca* woodlands' (Kendrick, 2001).

Rare features of the Fortescue Plains subregion are associated with the Fortescue River, such as the Millstream wetlands and aquifer, and the Fortescue Marsh (Kendrick, 2001). Centres of endemism include the Millstream aquifer for crustaceans and possibly stygofauna, as well as calcrete deposits for troglofauna. The Millstream wetlands provide seasonal refuge for vertebrate species and climatic refuge for invertebrates, while the gorges of the Fortescue River offer refuge from fire for plant species such as *Terminalia*, *Erythrina* and *Ficus* (Kendrick, 2001).

The Fortescue Plains subregion supports two wetlands of national significance (Fortescue Marshes, Millstream Pools), three wetlands of subregional significance, the 'Ethel Gorge aquifer stygobiont community' (listed as Endangered by DBCA), and four ecosystems at risk (Kendrick, 2001):

- Permanent wetland communities, Millstream.
- Fortescue Marsh saltbush community.
- Perennial grassland communities in the Fortescue Valley.
- Grove-intergrove mulga communities at Southern end of Northern apron of Hamersley Range.

The application area represents two regional vegetation associations as defined and mapped by Beard (1975) and Shepherd *et al.* (2002): the 'Fortescue Valley 29: sparse low woodland; mulga, discontinuous in scattered groups' and the 'Fortescue Valley 111: hummock grasslands, shrub steppe; *Eucalyptus gamophylla* over hard spinifex', which have 99.98% and 99.99% of its pre-European extent remaining at the IBRA subregion level, respectively. Both vegetation associations are considered to be of low reservation priority (Kendrick, 2001). The potential clearing of 27.8 ha of vegetation is unlikely to have a significant impact on these vegetation associations.

Six vegetation types were described from two major landforms within application area for the current survey: drainage lines and plains. None of the vegetation units occurring within the application area are listed as TECs under the EPBC Act or under the BC Act. None of the units represent PECs under the

State listing maintained by the DBCA. None of the vegetation types are considered of conservation significance or restricted.

Vegetation type P1 (AapAanTp), mapped and described for the plains in the eastern portion of the survey area, is not considered representative of the 'grove-intergrove mulga communities' ecosystem at risk (Kendrick, 2001) due to the open woodland structure and lack of closed canopy creating a grove. This vegetation type is mapped over 34.5 ha which represent 5.5% of the survey area, however it extends further east and therefore is not restricted in the landscape.

A total of 172 vascular flora taxa from 92 genera representing 36 families were recorded during the survey. Floristic diversity was aligned with other biological surveys completed in the vicinity of the survey area, despite the survey being undertaken outside the recommended primary survey period (Environmental Protection Authority, 2016). Seasonal condition was within the expected range for the timing of the survey area, and many flora taxa were still flowering or fruiting, therefore survey timing was not considered a limitation.

No Threatened or Priority flora taxa were recorded during the current survey. Of the seventeen conservation significant flora taxa identified by the database searches, one is considered likely to occur within the survey area, *Rostellularia adscendens* var. *latifolia* (P3). This taxon was recorded within 5 km of the survey area. Due to the survey being undertaken outside the flowering period of this taxon, and *Rostellularia adscendens* var. *latifolia* (P3) being a small herb, it is possible that it could have been missed during the survey. This taxon occurs near creeks and rocky hills on ironstone soils, which is a widespread habitat in the Pilbara. Therefore, the vegetation of the survey area is not necessary for the continued existence of *Rostellularia adscendens* var. *latifolia* (P3). Additionally, habitat in better condition is available to this taxon south of the survey area within Karijini National Park.

Seven introduced flora taxa were recorded within the survey area, including aggressive weed species **Cenchrus ciliaris*, **Cenchrus setiger* and **Argemone ochroleuca*. Weeds have the potential to alter the biodiversity of an area, competing with native vegetation for available resources and making areas susceptible to fire. Potential impacts to biodiversity as a result of the proposed clearing may be minimised by the implementation of strict weed hygiene and management.

Three broad fauna habitat types were recorded within the survey area: Minor Drainage, Mulga Woodland, and Stony Plain. These are not considered to be restricted at a local or regional level.

No conservation significant fauna taxa were recorded within the survey area.

The Proposal is not likely to be at variance with this Principle.

5.2 Principle (b) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia

Three habitat types: Minor Drainage, Mulga Woodland, and Stony Plain, are represented within the survey area. The majority of the survey area (46.9%) is Stony Plain with a condition rating of Very Good.

No conservation significant fauna taxa were recorded within the survey area.

Five conservation significant species have the 'potential' to occur within the survey area, the Grey Falcon (VU), the Peregrine Falcon (OS), the Night Parrot (CR), the Ghost Bat (VU), and the Pilbara Leaf-nosed Bat (VU), which may visit the survey area for foraging and hunting opportunities. None are considered to be dependent on the habitats of the survey area.

The Proposal is not at variance with this Principle.

5.3 Principle (c) – Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora

No Threatened flora taxa were recorded during the survey.

The Proposal is not at variance with this Principle.

5.4 Principle (d) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community

There are no State or Commonwealth listed TECs within or adjacent to the survey area. The closest occurrence of a TEC is the buffer of the Vulnerable 'Themeda grasslands on cracking clays (Hamersley Station, Pilbara)', located approximately 60 km west of the survey area. There is no suitable habitat to support this TEC within the survey area, therefore it would not be expected to occur.

The Proposal is not at variance with this Principle.

5.5 Principle (e) – Native vegetation should not be cleared if it is significant as remnant vegetation in an area that has been extensively cleared

The majority of the Pilbara region has not been extensively cleared. However, grazing, inappropriate fire regimes and weed invasion have greatly altered the vegetation in some areas.

The national target and objective for biodiversity conservation of ecological communities is to retain at least 30% of their pre-European extent (Department of the Environment and Heritage, 2001; Environmental Protection Authority, 2000; Department of Environmental Regulation, 2014).

The survey area lies within two of Beard's (1975) and Shepherd *et al.* (2002) vegetation associations – Fortescue Valley 29 and Fortescue Valley 111. The current extent of the vegetation associations within the Fortescue IBRA subregion has been estimated to be respectively 99.98% and 99.99% of the pre-European extent, which is well above the national target of 30%.

The Proposal is not at variance with this Principle.

5.6 Principle (f) – Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland

Several minor ephemeral drainage lines that flow after significant rainfall events are present within the survey area. These flow lines are not considered to be significant watercourses or wetlands, however they represent floodplain vegetation. Potential impacts to natural water flow and vegetation growing in association with non-perennial watercourses may be minimised by the implementation of a watercourse management condition.

None of the vegetation types mapped within the survey area are considered representative of groundwater-dependent ecosystems.

The Proposal may be at variance with this Principle.

5.7 Principle (g) – Native vegetation should not be cleared if the clearing of vegetation is likely to cause appreciable land degradation

The survey area intersects two land systems - Boolgeeda Land System and the Urandy Land System. The Boolgeeda Land System comprises stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands. The Urandy Land System comprises stony plains, alluvial plains and drainage lines supporting shrubby soft spinifex grasslands. The Boolgeeda Land System and most of the Urandy Land System are not susceptible to erosion or vegetation degradation (Van Vreeswyk, Payne, Leighton, & Hennig, 2004).

The proposed clearing is not expected to result in soil erosion, nutrient export, water-logging/flooding, acidification, salinization or deep subsoil compaction. Potential impacts to land degradation in the longer term as a result of the proposed clearing may be minimised by the implementation of rehabilitation.

The Proposal is not likely to be at variance with this Principle.

5.8 Principle (h) – Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area

The survey area is mapped over an ESA, the Hamersley Range National Park (1977 boundary), which was listed in the Register of National Estate in 1978 (Government of Western Australia, 2022). The Register of National Estate was archived in 2007 and is no longer a statutory list (Department of Climate Change, Energy, the Environment and Water, 2021). Register of National Estate places are protected under the EPBC Act when they are included in a Commonwealth statutory heritage list, or are owned or leased by the Commonwealth. Additionally, places may be protected under appropriate state, territory or local government heritage legislation (Department of Climate Change, Energy, the Environment and Water, 2021). The Hamersley Range National Park is only listed in the Register of National Estate and therefore the Proposal is not expected to be at variance with this Principle.

Karijini National Park is adjacent to the southern boundary of the survey area. Due to the proposed clearing being north of Munjina Road, the Proposal is not expected to impact the environmental values of Karijini National Park. However, high vehicle movement within the application area may increase the potential for spread of weeds in nearby areas and into the National Park. Potential weed spread as a result of the proposed clearing may be minimised by the implementation of strict weed hygiene and management.

The Proposal is not likely to be at variance with this Principle.

5.9 Principle (i) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water

No permanent or semi-permanent water features occur in or adjacent to the application area. None of the vegetation types mapped within the survey area are considered representative of groundwater-dependent ecosystems.

The survey area does not intersect a public drinking water source area.

Given the small scale of the proposed clearing, it is unlikely that the Proposal would affect groundwater quality in the region.

The Proposal is not likely to be at variance with this Principle.

5.10 Principle (j) – Native vegetation should not be cleared if the clearing of vegetation is likely to cause, or exacerbate, the incidence of flooding

Local flooding occurs seasonally in the Pilbara region as a result of sporadic cyclone thunderstorm activity.

The survey area is located within the Fortescue River hydrographic catchment. This catchment relies on the relationship between the underlying alluvial aquifer and seasonal flooding, which allows hydrological connectivity between the river, water pools, the floodplains and the riparian zone (Department of Water, 2010). The survey area is located approximately 11 km south of the Fortescue River.

Several minor ephemeral drainage lines but no major streams are present within the survey area. The drainage line channels are not well defined, and instances of flooding extend over the adjacent floodplains.

The small scale of clearing proposed is not expected to exacerbate the incidence or intensity of flooding in the area.

The Proposal is not likely to be at variance with this Principle.

6. Conclusion

Hamersley Iron on behalf of Rio Tinto is proposing to undertake an exploration drilling program. The proposed drill program will comprise 325 drill holes with a maximum depth of 200 m, and 19.6 km of new track using blade down technique when grading. The proposal will require the clearing of 27.8 ha of native vegetation.

The survey conducted in October 2022 was undertaken in good seasonal conditions and met the requirements for a reconnaissance level survey in order to support a Native Vegetation Clearing Permit (NVCP). No TECs or PECs were recorded within the survey area.

The survey area intersects an ESA, the Hamersley Range National Park, which is listed in the Register of National Estate. This was closed in 2007 and does not create a requirement to protect the place under Commonwealth law, rather is an archive available as an educational resource.

Six vegetation types were identified across two major landforms within the survey area. Two vegetation types were described from drainage lines, and four from plains. None of the vegetation types occurring within the survey area correspond to any ecosystems listed as Threatened under the EPBC Act or listed as TECs or PECs by the DBCA. None of the vegetation types are considered of conservation significance or restricted.

A total of 172 vascular flora taxa from 92 genera representing 36 families were recorded during the field survey. The number of taxa recorded by the current survey appears consistent than what was expected when compared with previous surveys completed nearby. No Threatened or Priority flora taxa were recorded during the survey. Seven weed species were recorded from the survey area.

Three broad fauna habitat types were recorded within the survey area: Minor Drainage, Mulga Woodland, and Stony Plain. These fauna habitats are not considered to be restricted at a local or regional level.

No conservation significant fauna species were observed during the survey.

The landforms, vegetation, and fauna habitats are well represented within the broader Fortescue Plains subregion.

An assessment against the 10 Clearing Principles determined that:

- Principles (a), (g), (h), (i) & (j) are not likely to be at variance;
- Principles (b), (c), (d) & (e) are not at variance; and
- Principle (f) may be at variance.

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8. Appendices

Appendix 1: Results of DBCA NatureMap database search

Scientific Name	Common Name	WA Conservation Status	EPBC Conservation Status
Flora			
<i>Adiantum capillus-veneris</i>	-	P2	-
<i>Cladium procerum</i>	-	P2	-
<i>Dicladantha glabra</i>	-	P2	-
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	-	P4	-
<i>Fimbristylis sieberiana</i>	-	P3	-
<i>Gompholobium karjini</i>	-	P2	-
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	-	P3	-
<i>Hibiscus</i> sp. Mt Brockman (E. Thoma ET 1354)	-	P1	-
<i>Isotropis parviflora</i>	-	P2	-
<i>Lepidium catapycnon</i>	-	P4	-
<i>Olearia mucronata</i>	-	P3	-
<i>Rhynchosia bungarensis</i>	-	P4	-
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	-	P3	-
<i>Teucrium pilbaranum</i>	-	P2	-
<i>Triodia</i> sp. Karjini (S. van Leeuwen 4111)	-	P1	-
Fauna			
<i>Amytornis striatus striatus</i>	Striated Grasswren (sandplain)	P4	-
<i>Ctenotus uber johnstonei</i>	Spotted Ctenotus (northeast)	P2	-
<i>Dasyurus hallucatus</i>	Northern Quoll	EN	EN
<i>Falco peregrinus</i>	Peregrine Falcon	OS	-
<i>Gelochelidon nilotica</i>	Gull-billed Tern	MI	-
<i>Hydroprogne caspia</i>	Caspian Tern	MI	MI & MA
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	VU	VU
<i>Plegadis falcinellus</i>	Glossy Ibis	MI	-
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	P4	-
<i>Rhinonictes aurantia</i>	Pilbara Leaf-nosed Bat	VU	VU
<i>Sternula albifrons</i>	White-shafted Little Tern (Little Tern)	MI	MI & MA

Scientific Name	Common Name	WA Conservation Status	EPBC Conservation Status
<i>Underwoodisaurus seorsus</i>	Pilbara Barking Gecko	P2	-

Appendix 2: Results of EPBC Protected Matters database search

Scientific Name	Common Name	Threatened Category	Migratory Status	Marine Status
<i>Actitis hypoleucos</i>	Common Sandpiper	-	Migratory	Listed
<i>Apus pacificus</i>	Fork-tailed Swift	-	Migratory	Listed – overfly marine
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	-	Migratory	Listed
<i>Calidris ferruginea</i>	Curlew Sandpiper	Critically Endangered	Migratory	Listed – overfly marine
<i>Calidris melanotos</i>	Pectoral Sandpiper	-	Migratory	Listed – overfly marine
<i>Charadrius veredus</i>	Oriental Plover, Oriental Dotterel	-	Migratory	Listed – overfly marine
<i>Dasyurus hallucatus</i>	Northern Quoll	Endangered	-	-
<i>Falco hypoleucos</i>	Grey Falcon	Vulnerable	-	-
<i>Hirundo rustica</i>	Barn Swallow	-	Migratory	Listed – overfly marine
<i>Liasis olivaceus barroni</i>	Olive Python (Pilbara subspecies)	Vulnerable	-	-
<i>Macroderma gigas</i>	Ghost Bat	Vulnerable	-	-
<i>Macrotis lagotis</i>	Greater Bilby	Vulnerable	-	-
<i>Motacilla cinerea</i>	Grey Wagtail	-	Migratory	Listed – overfly marine
<i>Motacilla flava</i>	Yellow Wagtail	-	Migratory	Listed – overfly marine
<i>Pezoporus occidentalis</i>	Night Parrot	Endangered	-	-
<i>Rhinonictis aurantia</i> (Pilbara form)	Pilbara Leaf-nosed Bat	Vulnerable	-	-
<i>Rostratula australis</i>	Australian Painted Snipe	Endangered	-	Listed – overfly marine

Appendix 3: Results of Atlas of Living Australia database search

Scientific Name	Common Name	WA Conservation Status	EPBC Conservation Status
Flora			
<i>Dicladanthera glabra</i>	-	P2	-
<i>Hibiscus</i> sp. Mt Brockman (E.Thoma ET 1354)	-	P1	-
<i>Lepidium catapycnon</i>	-	P4	-
Fauna			
<i>Falco peregrinus</i>	Peregrine Falcon	OS	-

Appendix 4: Likelihood of occurrence criteria for flora and fauna species

Likelihood of occurrence criteria for flora and fauna species:

- **Likelihood: Previously recorded**

- The species has previously been recorded within survey area from DEC database search results and/or from previous surveys of the survey area, and/or the species has been confirmed through a current vouchered specimen at WA Herbarium.

- **Likelihood: Likely**

- The species has not previously been recorded from within the survey area. However:
The species has been recorded in proximity (<10 km) to the survey area and occurs in similar habitat to that which occurs within the survey area.

Core habitat and suitable landforms for the species occurs within the survey area either year-round or seasonally. In relation to fauna species, this could be that a host plant is seasonally present on site, or habitat features such as caves are present that may be used during particular times during its life cycle e.g. for breeding. In relation to both flora and fauna species, it may be there are seasonal wetlands present.

There is a medium to high probability that a species uses the survey area.

- **Likelihood: Potential**

- The species has not previously been recorded from within the survey area. However:
Targeted surveys may locate the species based on records occurring in proximity to the survey area (10-20 km) and suitable habitat occurring in the survey area.

The survey area has been assessed as having potentially suitable habitat through habitat modelling.

The species is known to be cryptic and may not have been detected despite extensive surveys.

The species is highly mobile and has an extensive foraging range so may not have been detected during previous surveys.

- The species has been recorded in the survey area by a previous consultant survey or there is historic evidence of species occurrence within the survey area. However:

Doubt remains over taxonomic identification, or the majority of habitat does not appear suitable (although presence cannot be ruled out due to factors such as species ecology or distribution).

Coordinates are doubtful.

- **Likelihood: Unlikely**

- The species has been recorded locally through DBCA database searches. However, it has not been recorded within the survey area and:

It is unlikely to occur due to the site lacking critical habitat, having at best marginally suitable habitat, and/or being severely degraded.

It is unlikely to occur due to few historic record/s and no other current collections in the local area.

- The species has been recorded within the bioregion based on literature review but has not been recorded locally or within the survey area through DBCA database searches.

- The species has not been recorded in the survey area despite adequate survey efforts, such as a standardised methodology or targeted searching within potentially suitable habitat.

Appendix 5: GPS coordinates of relevés recorded within the survey area

Site	Type	Easting (mE)	Northing (mN)
GBR01	Relevé	647052	7535408
GBR02	Relevé	649454	7534287
GBR03	Relevé	647784	7535376
GBR04	Relevé	649916	7534392
GBR05	Relevé	648034	7535306
GBR06	Relevé	650959	7533645
GBR07	Relevé	648619	7535058
GBR08	Relevé	651352	7533345
GBR09	Relevé	650445	7534917
GBR10	Relevé	651768	7534143
GBR11	Relevé	650368	7535072
GBR12	Relevé	651573	7534551
GBR13	Relevé	649296	7534779
GBR14	Relevé	650859	7534495
GBR15	Relevé	650747	7534174
GBR16	Relevé	649817	7533977

Appendix 6: Vegetation structural classification and condition rating scale

Vegetation structural classification[^]

Stratum	70 - 100%	30 – 70%	10 – 30%	2 – 10%	< 2%
Trees over 30 m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland	Scattered tall trees
Trees 10-30 m	Closed forest	Open forest	Woodland	Open woodland	Scattered trees
Trees under 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
Shrubs over 2 m	Tall closed scrub	Tall open scrub	Tall shrubland	Tall open shrubland	Scattered tall shrubs
Shrubs 1-2 m	Closed heath	Open heath	Shrubland	Open shrubland	Scattered shrubs
Shrubs under 1 m	Low closed heath	Low open heath	Low shrubland	Low open shrubland	Scattered low shrubs
Hummock grasses	Closed hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland	Scattered hummock grasses
Grasses, Sedges, Herbs	Closed tussock grassland / sedgeland / herbland	Tussock grassland / sedgeland / herbland	Open tussock grassland / sedgeland / herbland	Very open tussock grassland / sedgeland / herbland	Scattered tussock grasses / sedges / herbs

[^]Based on Muir (1977) and Aplin's (1979) modification of the vegetation classification system of Specht (1970).

Vegetation condition scale rating for use on Pilbara surveys[^]

Rating	Description
Excellent	Pristine or nearly so; no obvious signs of damage caused by human activities since European settlement.
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activities since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of activities of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

[^]Based on Trudgen (1998) as presented in EPA Technical Guidance (EPA 2016a).

Appendix 7: Flora species recorded within the survey area

Taxon	GBR01	GBR02	GBR03	GBR04	GBR05	GBR06	GBR07	GBR08	GBR09	GBR10	GBR11	GBR12	GBR13	GBR14	GBR15	GBR16	Opportunistic
<i>Abutilon fraseri</i>		X										X					X
<i>Abutilon otocarpum</i>			X		X							X					
<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)		X		X												X	
<i>Abutilon</i> sp. Pilbara (W.R. Barker 2025)																	X
<i>Acacia acradenia</i>						X		X									X
<i>Acacia ancistrocarpa</i>			X							X	X	X					
<i>Acacia aptaneura</i>										X		X					X
<i>Acacia bivenosa</i>			X			X		X		X	X	X	X	X	X	X	
<i>Acacia coriacea</i> subsp. <i>pendens</i>		X		X												X	X
<i>Acacia dictyophleba</i>																	X
<i>Acacia inaequilatera</i>					X					X	X						

<i>Acacia monticola</i>					X										
<i>Acacia pruinocarpa</i>		X		X	X	X		X	X	X	X	X	X	X	X
<i>Acacia pyrifolia</i>			X	X		X	X		X		X	X	X	X	X
<i>Acacia spondylophylla</i>		X													
<i>Acacia synchronicia</i>				X											
<i>Acacia tenuissima</i>															X
<i>Acacia trachycarpa</i>															X
* <i>Aerva javanica</i>					X							X	X	X	X
<i>Afrohybanthus aurantiacus</i>		X	X		X						X	X	X	X	
<i>Amaranthus undulatus</i>															X
<i>Amphipogon sericeus</i>						X		X							
<i>Anthobolus leptomerioides</i>		X		X		X		X		X			X	X	
* <i>Argemone ochroleuca</i>		X		X										X	X
<i>Aristida contorta</i>		X		X								X	X	X	X
<i>Aristida holathera</i>						X		X							

<i>Aristida inaequiglumis</i>	X																
<i>Arivela viscosa</i>		X	X														X
<i>Atalaya hemiglauca</i>		X	X	X			X		X	X			X	X	X	X	
<i>Boerhavia coccinea</i>		X	X	X									X				X
<i>Bonamia erecta</i>			X		X	X		X									X
<i>Bonamia pilbarensis</i>																	X
<i>Calocephalus beardii</i>													X				X
<i>Calotis plumulifera</i>													X				X
<i>Capparis spinosa</i> subsp. <i>nummularia</i>																	X
* <i>Cenchrus ciliaris</i>		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
* <i>Cenchrus setiger</i>			X	X	X		X	X	X	X			X	X	X	X	
<i>Chrysopogon fallax</i>		X		X									X				X
<i>Clerodendrum ?tomentosum</i>													X				
<i>Clerodendrum floribundum</i>														X			X
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>																	X

<i>Corchorus laniflorus</i>		X		X		X		X		X	X	X	X
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>	X		X			X				X			
<i>Corymbia hamersleyana</i>								X	X				X
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>										X			X X
<i>Cucumis variabilis</i>				X								X	X X
<i>Cullen lachnostachys</i>			X		X								
<i>Cullen leucanthum</i>			X										
<i>Cymbopogon ambiguus</i>		X		X							X	X	X X
<i>Dendrophyllanthus erwinii</i>													X
<i>Digitaria brownii</i>	X									X			
<i>Diplopeltis stuartii</i>	X												
<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>		X		X							X		X
<i>Dodonaea petiolaris</i>													X
<i>Dolichocarpa crouchiana</i>													X
<i>Duperreya commixta</i>		X						X		X	X	X	X X

<i>Dysphania kalpari</i>						X	X	X					
<i>Dysphania rhadinostachya</i>			X	X		X				X	X	X	
<i>Ehretia saligna</i> var. <i>saligna</i>			X										
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	X		X			X							
<i>Enneapogon caerulescens</i>						X							
<i>Enneapogon lindleyanus</i>	X		X							X	X		
<i>Enneapogon polyphyllus</i>			X			X	X	X					
<i>Eragrostis eriopoda</i>				X	X								
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>						X		X					
<i>Eremophila latrobei</i>												X	
<i>Eremophila longifolia</i>			X			X		X					
<i>Eremophila</i> sp.					X								
<i>Eriachne aristidea</i>												X	
<i>Eriachne mucronata</i>					X	X	X	X		X			
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	X		X		X					X	X	X	X

<i>Eriachne</i> sp.	X																		
<i>Eucalyptus gamophylla</i>	X																		
<i>Eucalyptus victrix</i>									X				X	X	X	X			
<i>Eucalyptus xerothermica</i>																			X
<i>Eulalia aurea</i>																			X
<i>Euphorbia australis</i> var. <i>subtomentosa</i>																			X
<i>Euphorbia biconvexa</i>																			X
<i>Euphorbia boophthona</i>																			X
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>																			X
<i>Euphorbia vaccaria</i> var. <i>vaccaria</i>																			X
<i>Euploca pachyphylla</i>																			X
<i>Euploca tenuifolia</i>																			X
<i>Evolvulus alsinoides</i> var. <i>decumbens</i>																			X
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>																			X
<i>Gomphrena canescens</i>																			X

<i>Gomphrena cunninghamii</i>					X									X	X	X
<i>Goodenia forrestii</i>							X	X	X					X		
<i>Goodenia microptera</i>					X											X
<i>Goodenia muelleriana</i>					X	X			X			X	X			
<i>Goodenia stobbsiana</i>						X										X
<i>Goodenia triodiophila</i>														X		
<i>Gossypium australe</i>						X	X	X	X			X	X			
<i>Gossypium robinsonii</i>					X	X						X	X		X	X
<i>Grevillea pyramidalis</i>							X									
<i>Grevillea wickhamii</i>					X	X	X	X	X			X	X	X	X	X
<i>Hakea loreus</i> subsp. <i>loreus</i>					X	X	X	X				X	X			X
<i>Hibiscus burtonii</i>											X	X				
<i>Hibiscus coatesii</i>																X
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>					X											
<i>Hibiscus sturtii</i> var. <i>platyklamys</i>									X		X					

<i>Indigofera monophylla</i>	X	X	X	X	X	X	X	X		X	X	X	X
<i>Ipomoea muelleri</i>		X											
<i>Isotropis atropurpurea</i>	X												X
<i>Ixiochlamys cuneifolia</i>													X
<i>Jasminum didymum</i> subsp. <i>lineare</i>	X		X	X			X	X	X	X	X		
<i>Leichhardtia australis</i>	X												
<i>Maireana planifolia</i>									X	X	X		
<i>Maireana villosa</i>									X				
* <i>Malvastrum americanum</i>													X
<i>Nellica maderaspatensis</i>				X						X		X	X
<i>Olearia fluvialis</i>													X
<i>Paraneurachne muelleri</i>													X
<i>Paspalidium basicladum</i>													X
<i>Polycarpaea holtzei</i>													X
<i>Polycarpaea longiflora</i>		X		X						X	X	X	X

<i>Polymeria mollis</i>					X			X											X
<i>Portulaca oleracea</i>											X		X						
<i>Pterocaulon sp.</i>																			X
<i>Ptilotus astrolasius</i>		X				X		X					X						
<i>Ptilotus auriculifolius</i>																			X
<i>Ptilotus calostachyus</i>		X			X	X													
<i>Ptilotus exaltatus</i>		X		X		X		X	X	X	X	X	X		X				X
<i>Ptilotus helipteroides</i>		X				X		X			X	X							
<i>Ptilotus obovatus</i>			X	X	X		X		X	X	X	X	X	X	X	X	X	X	X
<i>Ptilotus polystachyus</i>													X	X					X
<i>Rhagodia eremaea</i>			X		X					X	X				X				X
<i>Rhynchosia minima</i>		X		X			X			X	X								
* <i>Rumex vesicarius</i>		X		X		X								X	X				X X
<i>Salsola australis</i>		X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
<i>Santalum lanceolatum</i>																			X

<i>Scaevola amblyanthera</i>																				X												
<i>Scaevola parviflora</i>																				X												
<i>Scaevola parvifolia</i>																				X												
<i>Scaevola spinescens</i>																					X											
<i>Sclerolaena deserticola</i>																					X	X	X									
<i>Senna artemisioides</i> subsp. <i>helmsii</i>																						X	X									
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>																					X	X	X	X	X	X	X	X	X	X	X	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>																						X		X								
<i>Senna glutinosa</i> subsp. <i>×luerssenii</i>																					X		X	X	X							
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>																						X		X	X	X						
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>																						X		X								
<i>Senna notabilis</i>																										X	X					
<i>Seringia exastia</i>																											X					
<i>Sida arsiniata</i>																											X					
<i>Sida echinocarpa</i>																											X	X	X	X	X	X

<i>Sida fibulifera</i>						X		X						
<i>Sida</i> sp. L (A.M. Ashby 4202)						X								X
<i>Sida</i> sp. Pilbara (A.A. Mitchell PRP 1543)			X											
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)			X		X		X		X	X				
<i>Solanum diversiflorum</i>													X	X
<i>Solanum lasiophyllum</i>						X								
<i>Solanum phlomoides</i>														X
<i>Sporobolus australasicus</i>			X											
<i>Stemodia</i> sp.				X										
<i>Swainsona stenodonta</i>			X		X			X						X
<i>Tephrosia</i> ?sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)														X
<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)		X		X		X				X	X	X	X	X
<i>Tephrosia</i> sp. Bungaroo Creek (M.E. Trudgen 11601)														X
<i>Themeda triandra</i>			X				X						X	X

<i>Trachymene oleracea</i> subsp. <i>oleracea</i>																X
<i>Trianthema pilosum</i>																X
<i>Tribulus hirsutus</i>																X
<i>Tribulus macrocarpus</i>															X	
<i>Tribulus suberosus</i>						X		X								X
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>			X	X	X								X		X	
<i>Trigastrotheca molluginea</i>				X	X	X		X	X				X			X
<i>Triodia pungens</i>	X	X	X	X	X		X		X	X	X	X	X	X		
<i>Triodia wiseana</i>	X						X		X							
<i>Triumfetta propinqua</i>		X		X									X		X	
* <i>Vachellia farnesiana</i>																X
<i>Waltheria indica</i>		X														X

Appendix 8: Relevant legislation

Legislative Framework for Conservation Significant Flora and Fauna under the *Environment Protection and Biodiversity Conservation Act 1999*

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) affords protection to species, populations and ecological communities threatened at a national level or to species listed as migratory under various international agreements (e.g. CAMBA, JAMBA RoKAMBA, Bonn Convention). Threatened flora and fauna may be listed under Section 178 of the EPBC Act in any one of the following categories:

- Extinct
- Extinct in the wild
- Critically endangered
- Endangered
- Vulnerable
- Conservation dependent

Under the EPBC Act, a proposal which is likely to have a significant impact on threatened species, populations or ecological communities or migratory species must be referred to the Commonwealth Minister for the Environment. A significant impact is determined through application of Significant Impact Criteria (Department of the Environment 2013).

State Environmental Protection Act 1986

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. The Act allows the Environmental Protection Authority (EPA), to prevent, control and abate pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing.

Part IV of the EP Act is administered by the EPA and makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals and land use planning schemes. The Department of Environment Regulation (DER) is responsible for administering the clearing provisions of the EP Act (Part V). Clearing of native vegetation in Western Australia requires a permit from the DER, unless exemptions apply. Applications for clearing permits are assessed by the Department and decisions are made to grant or refuse the application in accordance with the Act. When making a decision the assessment considers clearing against the ten clearing principles as specified in Schedule 5 of the EP Act:

- a) Native vegetation should not be cleared if it comprises a high level of biodiversity.
- b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significance habitat for fauna indigenous to Western Australia.
- c) Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora.
- d) Native vegetation should not be cleared if it comprises the whole or part of native vegetation in an area that has been extensively cleared.

e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

g) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

h) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation. GHD | 613523400 Water Corporation

i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

Exemptions for clearing include clearing that is a requirement of a written law or authorised under certain statutory processes (listed in Schedule 6 of the EP Act) and exemptions for prescribed low impact day-to-day activities (prescribed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004); these exemptions do not apply in environmentally sensitive areas (ESAs).

State Biodiversity and Conservation Act 2016 and Biodiversity Conservation Regulations 2018

On 1 January 2019, the Biodiversity Conservation Act 2016 and Biodiversity Conservation Regulations 2018 replaced both the Wildlife Conservation Act 1950 and the Sandalwood Act 1929 and their associated regulations. The BC Act is administered by the Department of Biodiversity Conservation and Attractions (DBCA).

The Biodiversity Conservation Act 2016 (BC Act) provides for the conservation and protection of biodiversity and biodiversity components, as well as the promotion of the ecologically sustainable use of biodiversity components in Western Australia. To reach the objectives of the BC Act, principles of ecological sustainable development have been established as follows:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
- If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
- The conservation of biodiversity and ecological integrity should be a fundamental consideration in decision-making
- Improved valuation, pricing and incentive mechanisms should be promoted.

State Biosecurity and Agriculture Management Act 2007

The Biosecurity and Agriculture Management Act 2007 (BAM Act) and associated regulations are administered by the Department of Agriculture and Food Western Australia (DAFWA) and replace the repealed Agriculture and Related Resources Protection Act 1976. The main purposes of the BAM Act and its regulations are to:

- Prevent new animal and plant pests (vermin and weeds) and diseases from entering WA
- Manage the impact and spread of those pests already present in the state
- Safely manage the use of agricultural and veterinary chemicals
- Increased control over the sale of agricultural products that contain violative chemical residues

The Western Australian Organism List (WAOL) is a database providing the status of organisms which have been categorised under the BAM Act 2007. A Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) of the Act is in force. Declared Pests may be assigned a control category as follows: C1 (exclusion), C2 (eradication) and C3 (management). The category may apply to part or all of Western Australia, and all landholders are obliged to comply with the specific category of control. Categories of control are defined below.

DAGWA Categories for Declared Pests under the BAM Act 2007

Control class code	Description
C1 (Exclusion)	Organisms which should be excluded from part or all of Western Australia.
C2 (Eradication)	Organisms which should be eradicated from part or all of Western Australia.
C3 (Management)	Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
Unassigned	Declared pests that are recognised as having a harmful impact under certain circumstances, where their subsequent control requirements are determined by a Plan or other legislative arrangements under the Act.

Appendix 9: Government and Rio Tinto internal operational controls for environmental management

Operational Controls for Environmental Management

The manner in which the clearing of native vegetation is regulated, undertaken and rehabilitated is under various Government and internal RTIO operational controls. These operational controls are discussed below.

Environmental Protection Authority Guidance Statements

Biological survey methodology for NVCP supporting applications require consideration of key 'land' factors of flora, vegetation and terrestrial fauna in its assessment. Relevant technical guides include:

- *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016);
- *Technical Guidance – Sampling methods for terrestrial vertebrate fauna* (EPA 2016);
- *Environmental Factor Guideline – Terrestrial fauna* (EPA 2016); and
- *Technical Guidance – Terrestrial fauna surveys* (EPA 2020).

Rio Tinto Iron Ore Operational Controls

Rio Tinto is part of the Rio Tinto group of companies and is obliged through its integrated Health Safety Environment and Quality Management System (HSEQ), to comply with five global environmental standards. RTIO has developed and implemented numerous management plans and work practices to control environmental issues relating to mining and exploration. A number of these work practices are of direct relevance in managing and controlling land clearing activities, and include:

- Approvals Permit Guidelines and Procedure;
- HSEQ Ground Disturbance, Re-entering a Rehabilitated Area and Track maintenance Standard Work Practice;
- HSEQ Iron Ore (WA) – Equipment Hygiene Inspection Work Practice;
- HSEQ Operational Control Procedure 6: Drilling; and

HSEQ Closure, Rehabilitation and Monitoring Standard Work Practice.