Native Vegetation Clearing Permit – Supporting Report

Desktop Flora, Vegetation and Fauna Assessment – Silvergrass

October 2022

Hamersley Iron Pty Limited

152-158 St Georges Terrace

Perth WA 6000

Restrictions on use

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Document Status

				Approved for issue	
Rev	**Author**	**Reviewer/s**	**Date**	**Distributed to**	**Date**
1	N. Murdock	A. Michael	10/10/2022	N/A	-
2	N. Murdock		21/10/2022	Internal	21/10/2022

Executive Summary

Rio Tinto Iron Ore is proposing to construct pipeline and associated infrastructure to recharge underground aquifers and mitigate potential environmental impacts of dewatering operations on groundwater dependent ecosystems downstream of the Silvergrass mine. The study area covers an area of approximately 288 ha, with proposed clearing of 30 ha of native vegetation, approximately 65 km northwest of Tom Price in the Pilbara region of Western Australia.

This report is intended as a supporting document for a Native Vegetation Clearing Permit application by Rio Tinto, as required under Section 51A of the *Environmental Protection Act 1986* and has been prepared based on a desktop review of existing information for the study area from recent (< 5 years ago) surveys. The study area has been the subject of several flora and fauna surveys in recent years. Flora and vegetation, and fauna surveys were completed over the study area as part of much larger surveys by Biota (2010, 2012, 2019a, 2019b), Biologic (2020a, 2021) and Stantec (2021a, 2021b).

Four vegetation associations were identified across three major landforms within the study area. Two were described from hillslopes, one from minor flowline and one from mixed woodlands on flats.

Although known within close proximity (< 200m) of the study area, none of the vegetation associations corresponded to ecosystems listed as Threatened under the *Environmental Protection and Biodiversity Conservation Act* 1999 or correspond to any ecological communities listed as Threatened or Priority Ecological Communities by the Department of Biodiversity, Conservation and Attractions.

A total of 321 (NatureMap) and 363 (Rio Tinto) taxa from 139 and 158 genera, respectively, were recorded within 20 km of the study area. No priority flora were recorded within the study area. Two flora species (*Calotis squamigera* (P1) and *Ipomoea racemigera* (P2)) have the potential to occur within the study area. However, the proposed clearing within the proposal is unlikely to have a significant impact on these species due to the prevalence of suitable habitat outside of the study area, and their documented broad ranges across the Pilbara bioregion and beyond.

The ‘Debris slope/rocky outcrop’ fauna habitat mapped by Biologic (2021) on the western boundary of the study area may potentially contain significant microhabitats for threatened fauna species such as the northern quoll, Pilbara olive python, ghost bat and Pilbara leaf-nosed bat. This habitat, however, is a small proportion of the study area, at less than 1% and extends beyond the study area boundary. Threatened fauna have been recorded within and nearby the study area. These species may pass through the area at times, however, are unlikely to have specific dependence upon it, given that the area is heavily disturbed and adjacent to existing infrastructure corridors.

The landforms, vegetation and fauna habitats identified within the study area are well represented within the broader Hamersley sub-region of the Pilbara. Furthermore, based on this assessment, the proposal is unlikely to be at variance with any of the ten clearing principles under Schedule 5 of the *Environment Protection Act 1986*.

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1. Introduction

1.1 Project background and study area location

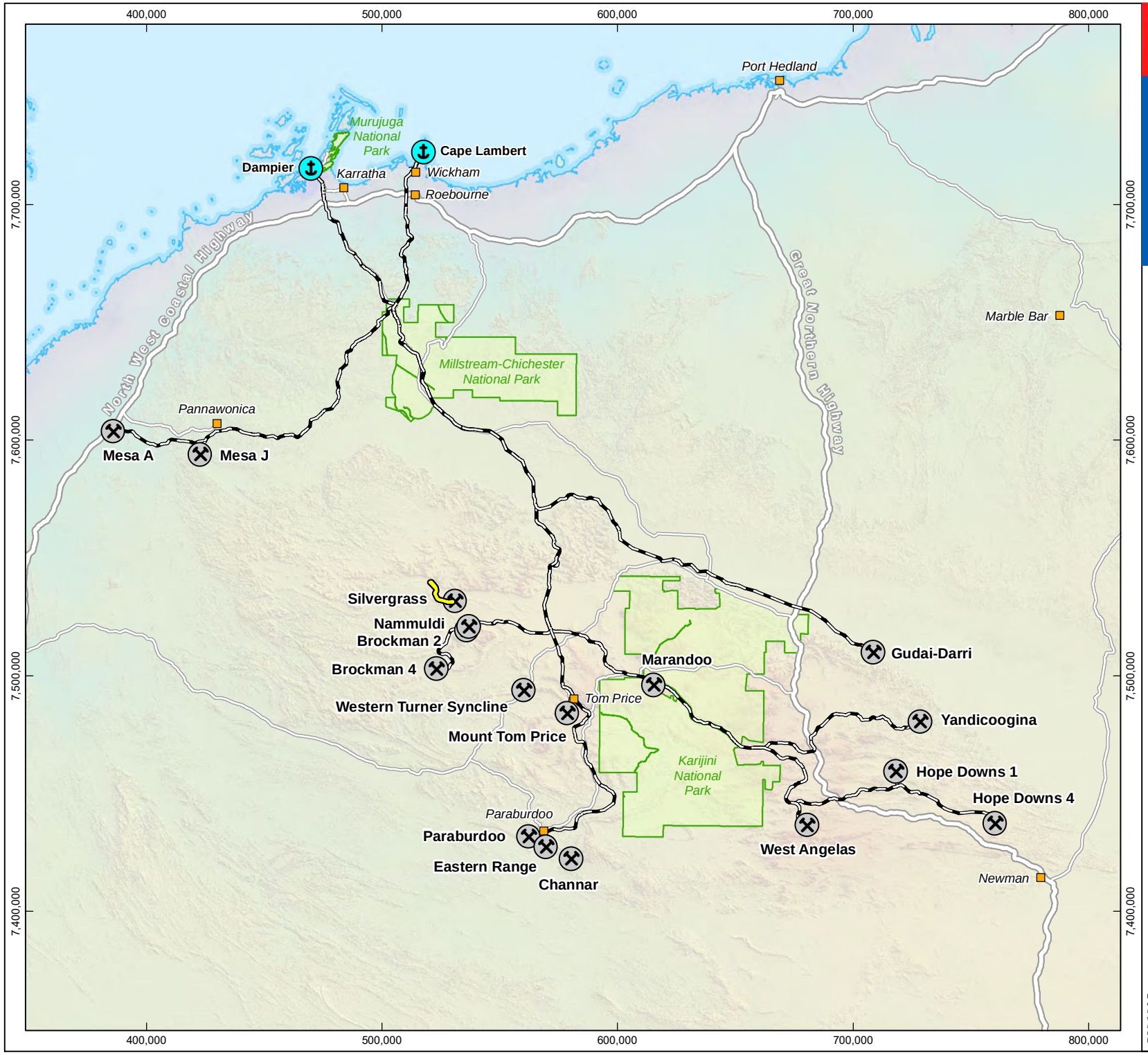
Rio Tinto Iron Ore (Rio Tinto) on behalf of Hamersley Iron Pty Ltd is proposing to construct pipeline and associated infrastructure via establishment of a managed aquifer recharge (MAR) scheme. The proposed scheme aims to recharge underground aquifers and mitigate potential environmental impacts of dewatering operations on groundwater dependent ecosystems downstream of the Silvergrass mine. The Project includes construction of pipeline and associated infrastructure within tenements ML4SA and M272SA, hereafter referred to as the 'study area'.

The study area covers an area of approximately 288 ha, with proposed clearing of 30 ha of native vegetation, approximately 65 km northwest of Tom Price in the Pilbara region of Western Australia. The study area location is shown in Figure 1-1.

1.2 Scope of survey

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 study area. This report includes a description of the:

- Local environment of the study area including flora, vegetation, geology, landforms, and hydrology;
- Methods employed during the desktop assessment;
- Locations and populations of conservation listed flora;
- Vegetation associations occurring in the study area, an assessment on their condition and conservation significance for the locality and sub-region;
- Fauna habitats present, assessment of their significance for the locality and sub-region, including mapping, and likelihood assessment of conservation listed fauna; and
- Potential impacts of the proposal on the local environment through assessment of the ten clearing principles, as outlined in Schedule 5 of the *Environment Protection Act 1986* (EP Act).



RioTinto

Figure 1-1: Location of the study area

Drawn: T.M.
Plan: RTIO-0952484v1
Date: October 2022

Proj: GDA 1994 MGA Zone 50
Scale: 1:2,225,000 @ A4
gisteam@riotinto.com

Legend

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

N

0 20 40 60 80 100

Kilometres

Map units in metres

1.3 Limitations

Limitations of the current survey of the study 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. Numerous flora and fauna surveys have been conducted in the Greater Brockman region, including seven from the study area locality, notably a detailed two-phase flora and vegetation survey in 2019 covered over 46 % of the study area. Therefore, a suitable number of survey reports are available. Sources of information was not considered a limitation for the study area.
Scope of works	The requirements of a desktop flora, vegetation and fauna report for a clearing permit application were met. No field survey was undertaken as adequate information was available from previous surveys undertaken within the locality within the previous five years. Flora, vegetation, fauna and fauna habitat information was assessed and summarised from previous survey reports.
Completeness of survey	The study area has been comprehensively surveyed to provide an adequate level of information for this desktop assessment. Numerous flora, vegetation, fauna habitat consolidation and desktop reports exist over the broader Greater Brockman area. A two-phase detailed flora and vegetation survey (Biota 2019a) covers 135 ha (over 46% of the study area). Based on this information, no additional surveys were deemed necessary for the purpose of this assessment. Fungi and non-vascular flora (algae, mosses and liverworts) were not considered.
Intensity of survey	No survey was undertaken for the current assessment. Results were derived and summarised from previous flora, vegetation and fauna surveys relevant to the study area.
Timing, weather, season, cycle	The Biota (2019a) survey was conducted in October 2018 and March 2019. Seasonal conditions prior to the March 2019 survey were considered below average due to lower-than-average rainfall in the preceding three months, however desktop information available in the area and a previous single phased detailed survey by Biota (2010) was conducted in April 2009 after above average rainfall for the season. Therefore, timing, weather etc. is not seen as a limitation for this report.
Disturbances	A moderate proportion (22 %) of the study area has been disturbed by historical clearing for tracks and mining infrastructure. There have been no recent fires (< 2 years) within the study area.
Resources	The biologists undertaking the desktop assessment and reviews were suitably qualified (> 10 years' experience conducting environmental surveys and reporting in Western Australia). There were no limitations noted in reports cited in the desktop assessment due to resourcing.
Accessibility / remoteness	No survey was undertaken for this current assessment. Accessibility was not a limitation in previous surveys as the current study area runs parallel to an existing track.

1.4 Background Information

1.4.1 Climate

The closest meteorological station providing long term data for rainfall is Cheela Plains, located approximately 78 km to the south-south-west of the study area. Rainfall data from the Bureau of Meteorology (BoM) for Cheela Plains is presented in Figure 1-2 (BoM 2022). The closest meteorological station to the study area providing temperature data is Paraburdoo Aero (7185), located approximately 106 km to the south-east of the study area. Temperature data from the BoM for Paraburdoo Aero is presented in Figure 1-2 (BoM 2022).

The regional climate is semi-arid to semi-tropical with a summer rainfall season and relatively dry winter season, which varies in frequency and volume from year to year. The summer wet months extend from November to April when temperatures can exceed 47°C. The remainder of the year is moderate to warm with a continental effect resulting in low minimum temperatures, below 10°C, in June and July. The closest data for Pan evaporation rates are in Port Hedland, which averages 3,500 mm per annum (Luke et al. 1987), exceeding annual rainfall averages.

Annual rainfall is variable with tropical lows producing large regional rainfall events (between 100 mm and 200 mm in a few days) to isolated thunderstorm events in the dry (winter) season. For Cheela Plains, the mean annual rainfall for the period 2002-2022 is 284.1 mm, with most precipitation occurring between January and March, coinciding with the cyclone season (Figure 1-2).

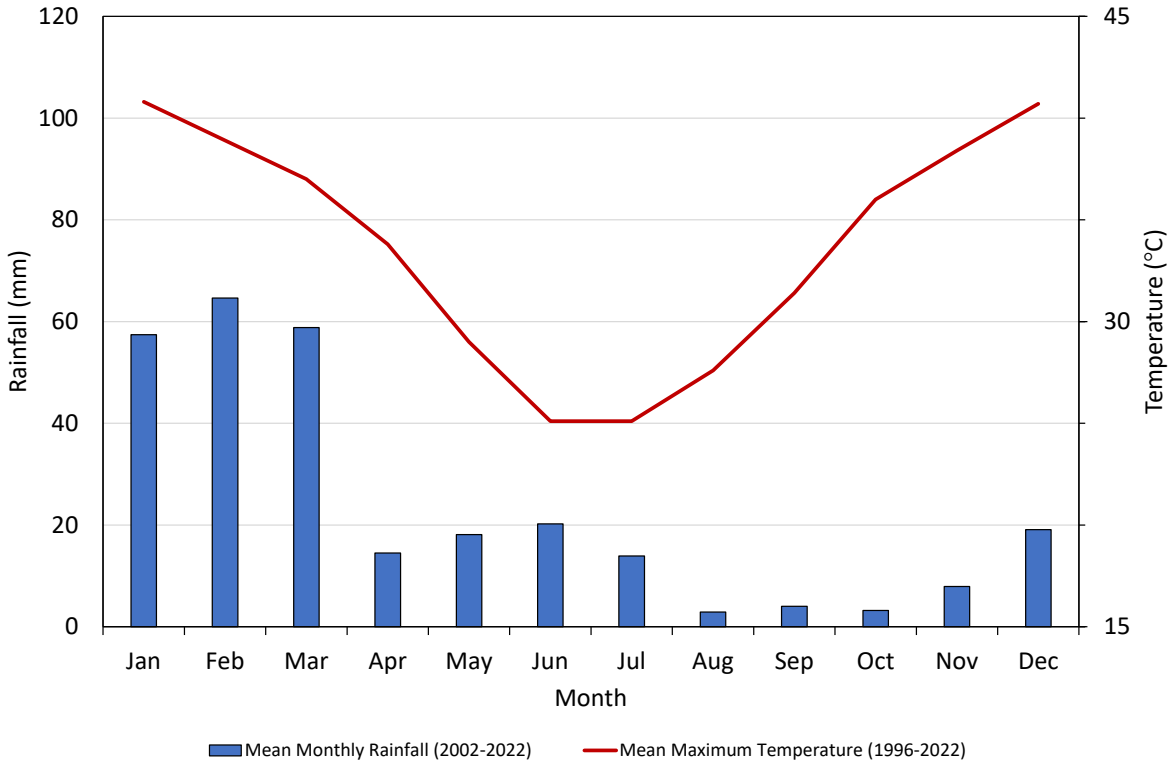


Figure 1-2: Mean rainfall (Cheela Plains 5095) and temperatures (Paraburdoo Aero 7185)

1.4.2 Geology and soils

Two major geological units based on 1:250,000 scale map sheet series (Department of Mines, Industry Regulation and Safety 2015) occur within the study area:

- **Czc** – alluvium and colluvium: red brown sandy and clayey soil; on low slope and sheetwash areas; and
- **AHm** – Marra Mamba Iron Formation – chert, banded iron-formation, and pelite.

The geological units represented within the study area are shown in Figure 1-3.

1.4.3 Land systems

Land system (rangeland) mapping is based on regional patterns in topography, soils and vegetation (Christian and Stewart 1953). The most recent land system mapping of the Pilbara bioregion, in which the study 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 study area.

The study area intersects two land systems - Newman Land System and the Boolgeeda Land System (Figure 1-4). The Land Systems and their extent within the study area are presented below (

Table 1-2) and described as follows:

- **Newman Land System** – Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands; and
- **Boolgeeda Land System** – Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.

Table 1-2: Land Systems occurring within the study area and their representation in the Pilbara bioregion

Land System	Total area (ha) in Pilbara bioregion	Area (ha) in study area	Proportion (%) of study area	Study area proportion (%) of land system extent
Boolgeeda Land System	774,800	206.48	71.76	<0.01
Newman Land System	1,458,000	81.25	28.24	<0.01

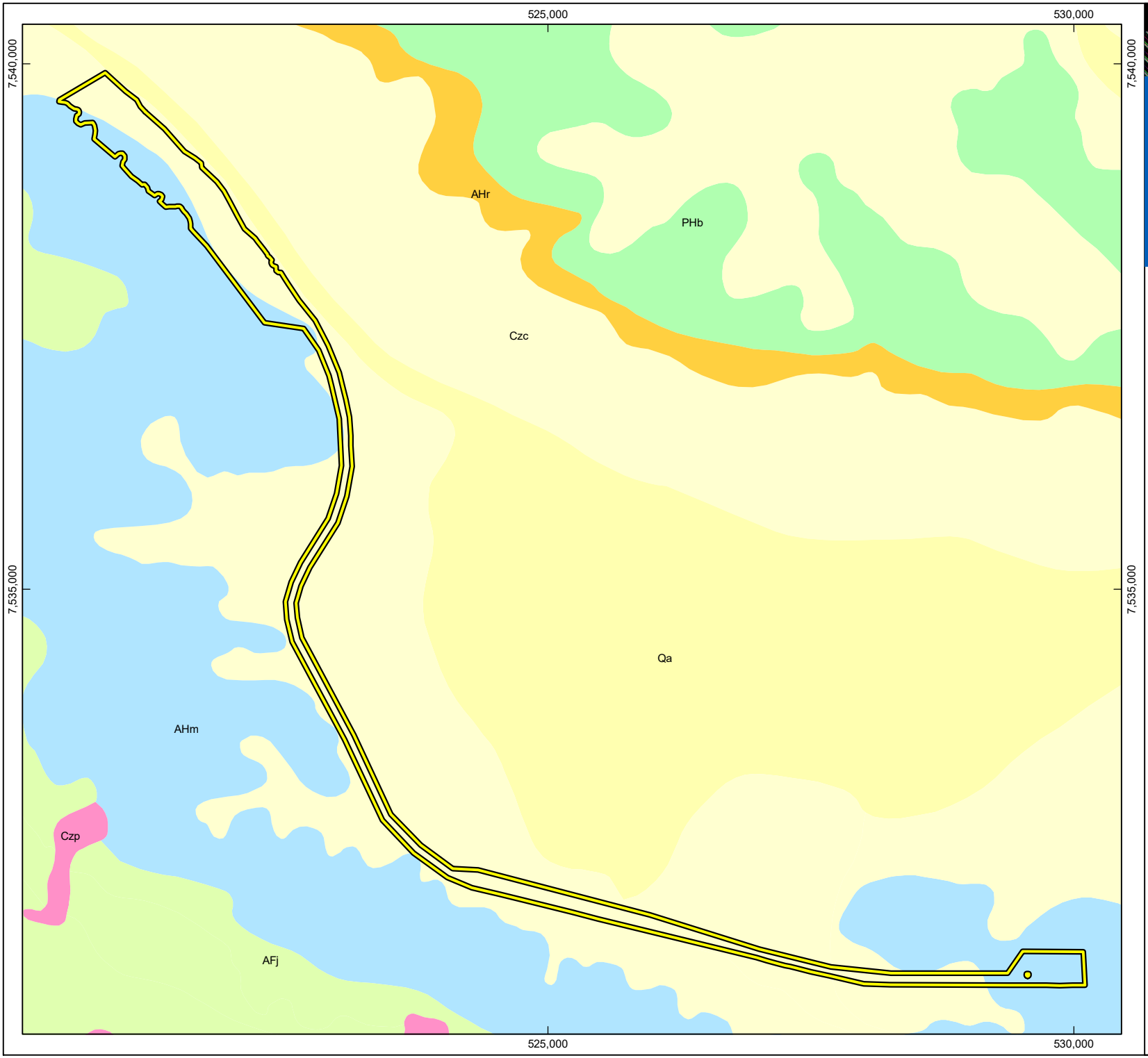


Figure 1-3: Geology within the study area

Drawn: T.M.
Plan: RTIO-0952484v1
Date: October 2022

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

Legend

- Study Area

250k Geology

- AFj
- AHm
- AHr
- Czc
- Czp
- PHb
- Qa

N

0 0.5 1 1.5 2
km

Map units in metres

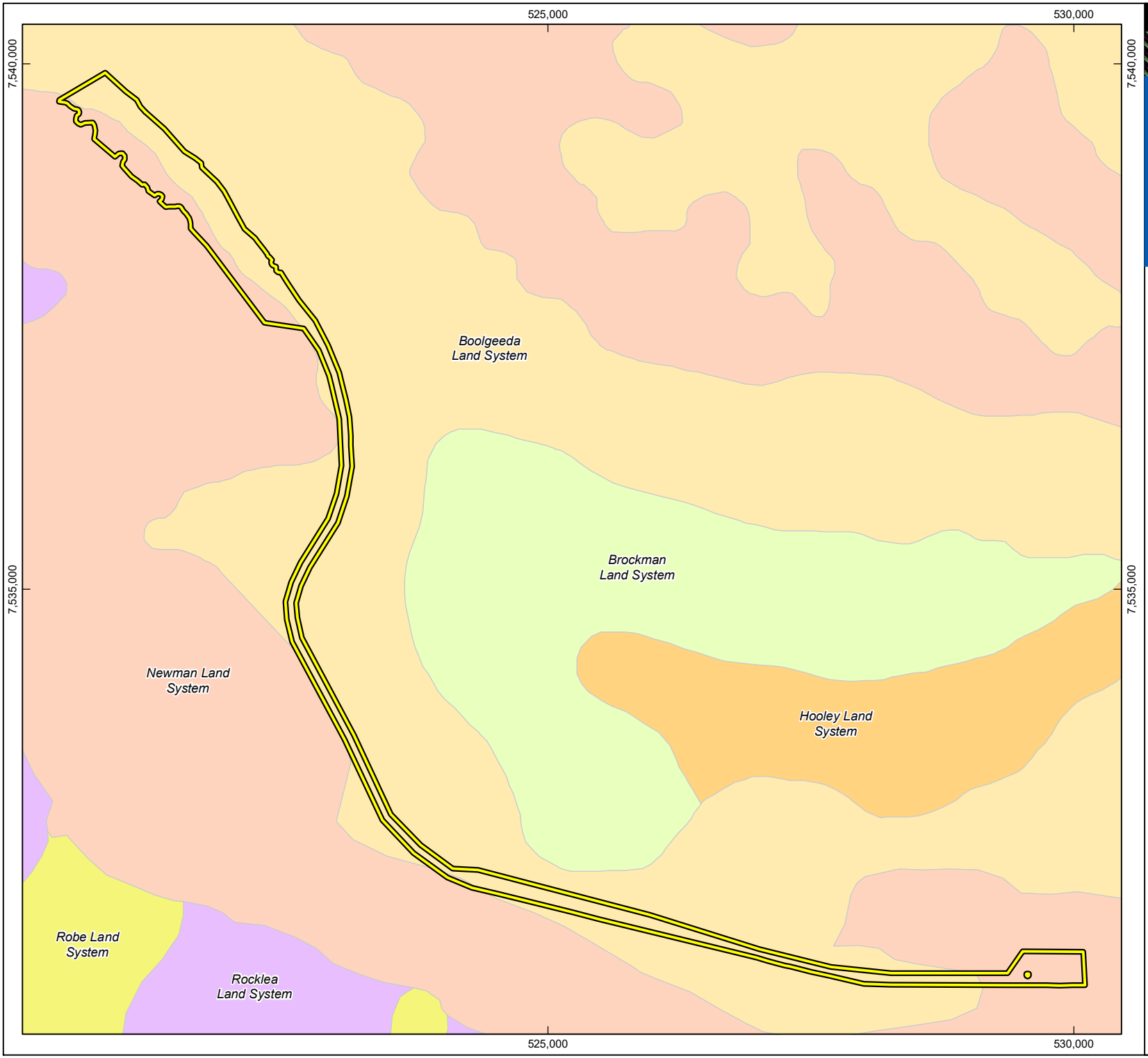


Figure 1-4: Land systems within the study area

Drawn: T.M.
Plan: RTIO-0952484v1
Date: October 2022

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

Legend

Landsystems

- Study Area
- Boolgeeda Land System
- Brockman Land System
- Hooley Land System
- Newman Land System
- Robe Land System
- Rocklea Land System

N

0 0.5 1 1.5 2
km

Map units in metres

1.4.4 Surface hydrology and groundwater

The study area lies within the Ashburton groundwater subarea of the Pilbara (Department of Water and Environmental Regulation 2022). Caves Creek, a major creekline runs parallel with the northern study area boundary, however, does not intersect the study area. Numerous minor, ephemeral drainage lines intersect the study area. The study area does not occur in any Public Drinking Water Reserves.

1.4.5 Regional biogeography

The Interim Biogeographic Regionalisation of Australia (IBRA7) recognises 89 bioregions (DAWE 2022a). The study 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 study area falls within the PIL3 Hamerlsey sub-region and is described by Kendrick (2001) as:

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

1.4.6 Beard's regional vegetation mapping

Beard (1975) mapped the vegetation of the Pilbara at a scale of 1:1,000,000. The study area lies within the Fortescue Botanical District of the Eremaean Botanical Province (Beard, 1990). The vegetation of this province is typically open, and frequently dominated by *Triodia* spp. (spinifex), *Acacia* spp. (wattles) and occasional eucalypts. Of the four major physiographic units within the Fortescue District identified by Beard, the study area belongs to the Hamersley Plateau sub-region (generally equivalent to the Hamersley (PIL3) IBRA subregion) which is described by van Vreeswyk, *et al*. (2004) as:

- *rounded hills and ranges, mainly of jaspilite and dolomite with some shale, siltstone and volcanics. and dominated by tree steppe with Eucalyptus leucophloia (snappy gum), Acacia aneura (Mulga) low woodland in valleys, …and sparse shrub steppe with Acacia xiphophylla (snakewood) on drainage lines.*

Beard further delineated these broad units into vegetation associations. The study area intersects three vegetation associations:

- **Hamersley 565** (e16Lr t3Hi) - Hummock grasslands, low tree steppe; bloodwood over soft spinifex;
- **Hamersley 18** (a1Li) - Low woodland; mulga (*Acacia aneura*); and
- **Hamersley 82** (e16Lr t3Hi) - Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*.

1.4.7 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 1-3 and Figure 1-5 present the pre-European and current extent of the three vegetation associations across their range and within the study area.

Table 1-3: Beard's mapping unit occurring within the study area, its current and pre-European extent within the Pilbara bioregion and its extent across the study area

Beard's mapping unit (Shepherd vegetation association)	Pre-European extent (ha)^	Current extent (ha)^	Percentage remaining (%)	Extent (ha) within study area / (Percentage of current extent)
Hammersley 565	108,957	108,945	99.99	52.26 (0.05)
Hammersley 18	580,512	575,808	99.19	203.44 (0.04)
Hammersley 82	2,158,862	2,146,708	99.44	32.03 (<0.01)

^Government of Western Australia (2019)

As part of the Biodiversity Audit of WA (McKenzie & May 2003) these vegetation associations were assessed according to their reservation status in IUCN Class I-IV Reserves, non-IUCN Reserves, and (the then) CALM managed pastoral leases, and their priority for acquisition and reservation ranked as low (L), medium (M) or high (H). Hamersley 565 and 18 are ranked as Medium, Hamersley 82 is ranked as Low priority (Kendrick 2001).

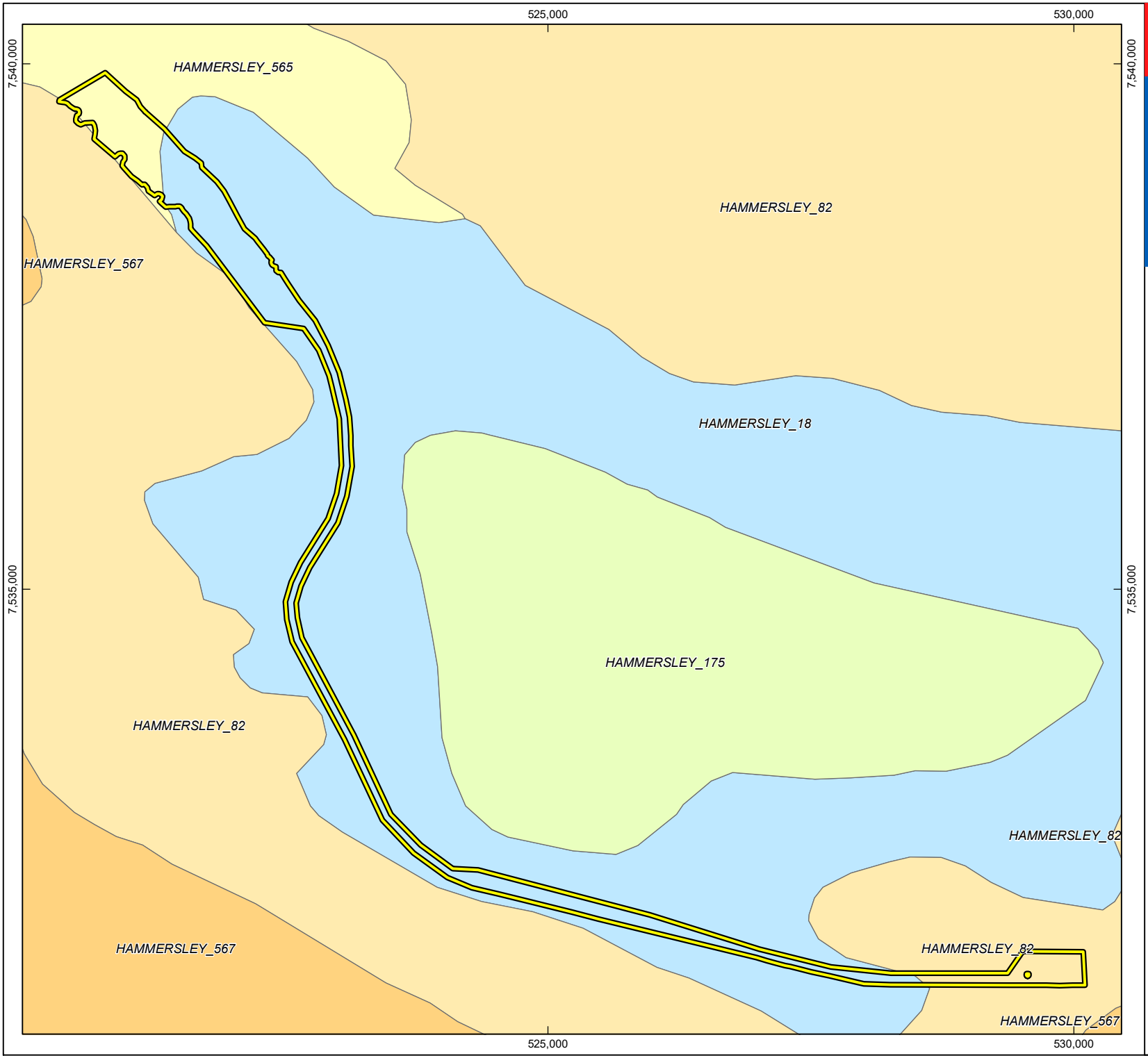


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Figure 1-5: Pre-European vegetation association mapping within the study area

Drawn: T.M.
Plan: RTIO-0952484v1
Date: October 2022

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

Legend

- Study Area

Pre-European vegetation association mapping

- HAMMERSLEY_175
- HAMMERSLEY_18
- HAMMERSLEY_565
- HAMMERSLEY_567
- HAMMERSLEY_82

N

0 0.5 1 1.5 2 2.5
km

Map units in metres

1.4.8 Conservation areas and environmentally sensitive areas

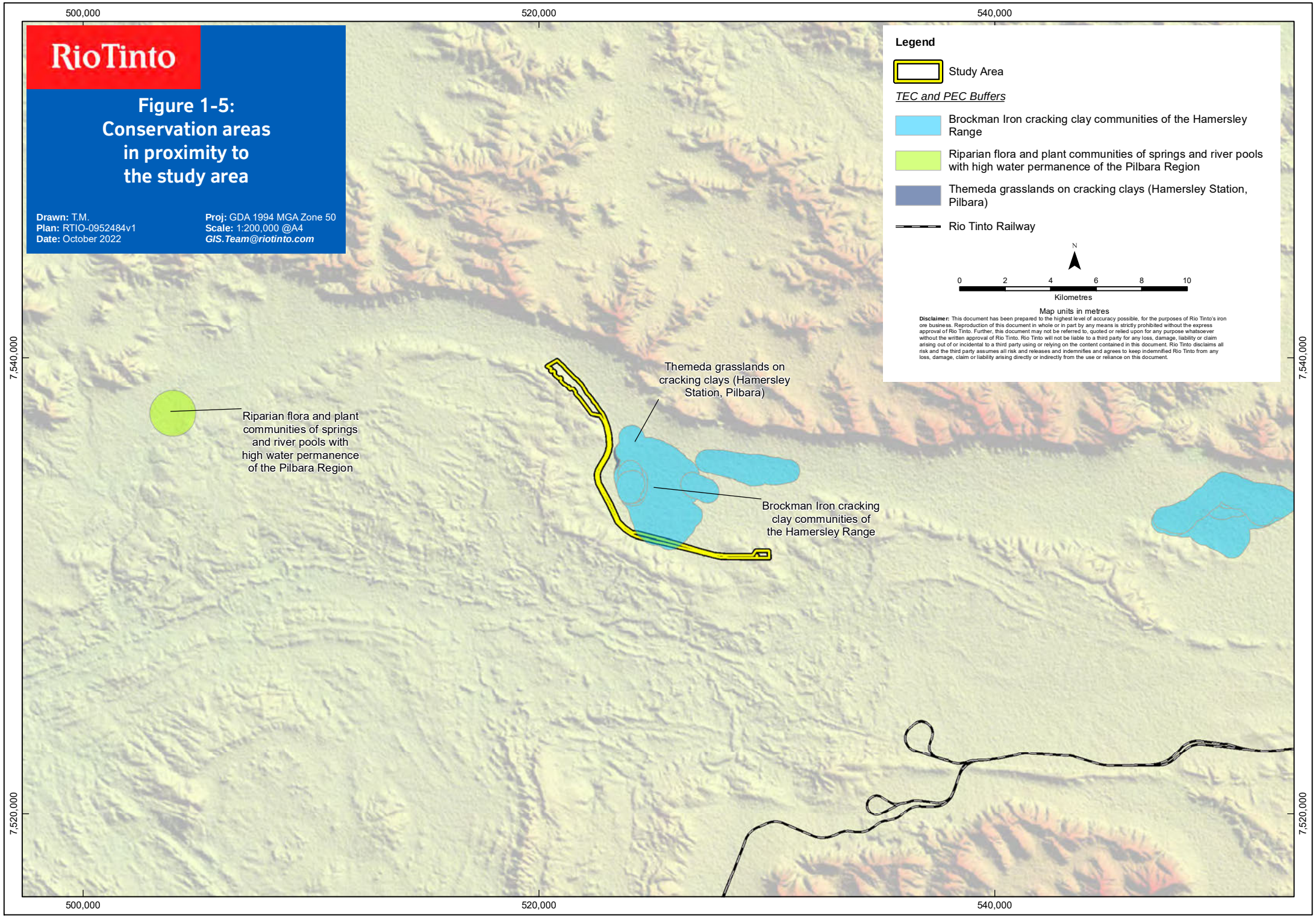
Environmentally Sensitive Areas (ESAs) are defined in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005* under section 51B of the EP Act. ESAs include areas declared as: World Heritage; included on the Register of the National Estate; defined wetlands; vegetation containing rare (Threatened) flora; Threatened Ecological Communities (TECs); and Bush Forever sites. No ESAs occur within the study area.

No mapped conservation areas intersect the study area. The nearest conservation area, Karijini National Park lies approximately 68 km east of the study area. Due to the separation, the proposed clearing is not expected to impact the environmental values of Karijini National Park (Figure 1-6).

Although no mapped Threatened Ecological Communities (TECs) intersect the study area, the 'Themeda grasslands on cracking clays (Hamersley Station)' TEC and associated ESA is located within 200 m to the east of the study area (Figure 1-6). Numerous survey reports have identified the presence of the TEC in the local area, however not within the study area. Due to the narrow width of the corridor and existing level of disturbance, it is unlikely the proposed activities are going to impact this community.

1.4.9 Priority ecological communities

The buffer of the Priority Ecological Community, 'Brockman Iron cracking clay communities of the Hamersley Range' (Priority 1) extends within the study area to the south. This section of the study area is an existing road corridor with minimal intact native vegetation. Numerous survey reports have identified the presence of the PEC in the local area, however not within the study area. Due to the narrow width of the corridor and existing level of disturbance, it is unlikely the proposed activities are going to impact this community.


RioTinto
Figure 1-5:
Conservation areas
in proximity to
the study area
Drawn: T.M.
Plan: RTIO-0952484v1
Date: October 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:200,000 @A4
GIS.Team@riotinto.com
Legend
Study Area
TEC and PEC Buffers
Brockman Iron cracking clay communities of the Hamersley Range
Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara Region
Themeda grasslands on cracking clays (Hamersley Station, Pilbara)
Rio Tinto Railway
N
0 2 4 6 8 10
Kilometres
Map units in metres
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500,000
520,000
540,000
7,540,000
7,520,000
Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara Region
Themeda grasslands on cracking clays (Hamersley Station, Pilbara)
Brockman Iron cracking clay communities of the Hamersley Range

2. Methodology

2.1 Desktop assessment

A desktop assessment was undertaken to identify environmental information relevant to the study area. This desktop assessment included a review of:

- Overall site characteristics including:
  - 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 (Department of Mines, Industry Regulation and Safety 2022);
  - Surface hydrology and groundwater;
  - Land systems mapping adapted by van Vreeswyk *et al.* (2004);
  - Bioregional assessments (including IBRA bioregion, Beard's regional vegetation mapping, pre-European vegetation mapping); and
  - Conservation areas and environmentally sensitive areas.
- Relevant reports previously prepared for Rio Tinto as outlined as Section 2.1.1
- Databases maintained by state and federal government and Rio Tinto as described at Section 2.1.2

2.1.1 Literature review

Four previous flora and vegetation reports have been reviewed as part of the flora and vegetation desktop assessment: Biota (2010) – single phase detailed flora and vegetation survey, Biota (2012) - desktop vegetation mapping, Biota (2019a) - detailed flora and vegetation survey and Stantec (2021a) - desktop vegetation mapping.

Four previous fauna reports have been reviewed as part of the fauna desktop assessment: Biota (2019b) – detailed fauna survey, Biologic (2020a) – targeted vertebrate fauna survey, Stantec (2021b) desktop fauna habitat mapping and Biologic (2021) desktop fauna habitat mapping.

These reports have been consulted as part of the literature review to determine conservation significant species that may occur within the study area, as well as flora, vegetation units, ecological communities and fauna habitats. A summary of the findings of each report utilised in the desktop review is presented in Table 2-1. The previous surveys in relation to the current survey area are shown in Figure 2-1 and Figure 2-2.

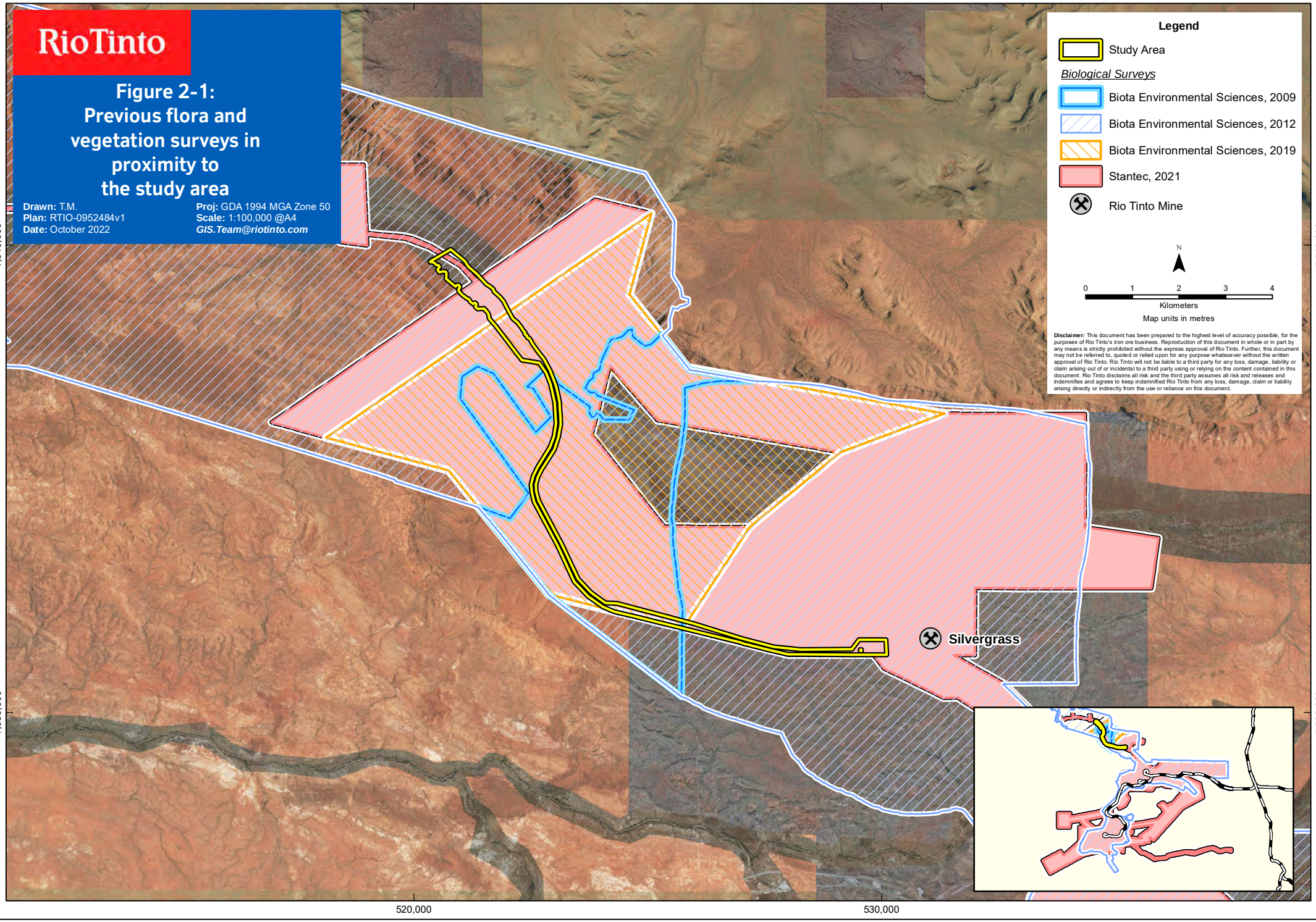
Table 2-1: Summary of previous flora, vegetation and fauna reports utilised for the desktop assessment

Report and level of survey	Size (ha)	Number of taxa	Conservation listed flora / fauna	Weeds	Vegetation / Fauna Habitat of significance
FLORA					
Stantec (2021a) *Greater Brockman Syncline: Consolidated Vegetation Type and Condition mapping* [RTIO-HSE-0343944]	76,198.57	N/A	N/A	N/A	Threatened Ecological Community – three units Priority Ecological Community – eight units Groundwater Dependent Vegetation – four units Other – vegetation dominated by P1 species

Report and level of survey	Size (ha)	Number of taxa	Conservation listed flora / fauna	Weeds	Vegetation / Fauna Habitat of significance
Biota Environmental Sciences (2019a) *Silvergrass West Detailed flora and vegetation survey Phase 1 and 2* [RTIO-HSE-0337235]	4,539	388 native flora taxa from 149 genera and 52 families.	**Priority 1:** *Euphorbia inappendiculata* var. *queenslandica, Triodia* sp. Silvergrass (P.-L. de Kock BES 00808) and *Vittadinia* sp. Coondewanna Flats (S. van Leeuwen 4684); **Priority 2:** *Euphorbia australis* var. *glabra, E. inappendiculata* var. *inappendiculata, Hibiscus* aff. sp. Gurinbiddy Range (M.E. Trudgen MET 15708) and *Teucrium pilbaranum*; **Priority 3:** *Astrebla lappacea, Eremophila magnifica* subsp. *velutina, Fimbristylis sieberiana, Glycine falcata, Grevillea saxicola, Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301), *Iotasperma sessilifolium, Oldenlandia* sp. Hamersley Station (A. A. Mitchell PRP 1479), *Rostellularia adscendens* var. *latifolia, Sida* sp. Hamersley Range (K. Newbey 10692), *Swainsona thompsoniana, Themeda* sp. Hamersley Station (M.E. Trudgen 11431) and *Triodia basitricha*; and **Priority 4:** *Acacia bromilowiana, Eremophila magnifica* subsp. *magnifica, Ptilotus mollis* and *Rhynchosia bungarensis*.	12 taxa	Threatened Ecological Community – three units. Priority Ecological Community – four units. Other – vegetation dominated by P1 species
Biota Environmental Sciences (2012) *Nammuldi-Silvergrass vegetation mapping integration* [RTIO-HSE-0204864]	60,495	N/A	N/A	N/A	N/A

Report and level of survey	Size (ha)	Number of taxa	Conservation listed flora / fauna	Weeds	Vegetation / Fauna Habitat of significance
Biota (2010) *A Vegetation and Flora Survey of Silvergrass West* [RTIO-HSE-0091922]	4,539	Dominant families: Fabaceae – 66 Poaceae – 47 Malvaceae – 45 Amaranthaceae - 17	**Priority 3:** *Astrebla lappacea*, *Eremophila magnifica* subsp. *velutina*, *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301), *Polymeria* sp. Hamersley (M.E. Trudgen 11353), *Rostellularia adscendens* var. *latifolia*, *Swainsona* sp. Hamersley Station (A.A. Mitchell 196), *Themeda* sp. Hamersley Station (M. E. Trudgen 11431)	Five species	High significance – Eight units were representative of the TEC and PEC.
FAUNA					
Stantec (2021b) *Greater Brockman and Nammuldi-Silvergrass Hub: Consolidated Fauna Habitat Mapping* [RTIO-HSE-0341527]	76,198.57	N/A	N/A	N/A	Gorge/Gully and Free Face, Debris Slope and Rocky Outcrop, Major and Minor Creeklines.
Biologic Environmental Survey (2020a) *Brockman Syncline targeted vertebrate fauna survey* [RTIO-HSE-0343367]	75,088	Four MNES fauna	**Targeted:** Northern Quoll, Greater Bilby, Pilbara leaf-nosed bat, Ghost Bat, Night Parrot, Pilbara Olive Python. **Recorded:** Northern Quoll, Pilbara leaf-nosed bat, Ghost Bat, Pilbara Olive Python.	N/A	Gorge/Gully and Free Face, Debris Slope and Rocky Outcrop, Major Creekline, Minor Creekline.
Biota Environmental Sciences (2019b) *Silvergrass West Detailed fauna survey Phase 1 and 2* [RTIO-HSE-0337239]	4,539	93 vertebrates including 38 herpetofauna species, 37 avifauna, eight ground-dwelling mammals and 10 bat species	**Recorded**: Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Peregrine Falcon, *Anilios ganei*, Lined Soil-crevice skink.	N/A	Gorges and gullies, breakaways and free faces, permanent or semi-permanent water.

Report and level of survey	Size (ha)	Number of taxa	Conservation listed flora / fauna	Weeds	Vegetation / Fauna Habitat of significance
Biologic Environmental Survey (2021) *Brockman Syncline Fauna Habitat extrapolation mapping memo* [RTIO-HSE-0350388]	332,569	MNES fauna	N/A	N/A	Gorge/Gully and Free Face, Major Creeklines.


RioTinto
Figure 2-1:
Previous flora and vegetation surveys in proximity to the study area
Drawn: T.M.
Plan: RTIO-0952484v1
Date: October 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:100,000 @A4
GIS.Team@riotinto.com
520,000
530,000
7,540,000
7,530,000
Legend
Study Area
Biological Surveys
Biota Environmental Sciences, 2009
Biota Environmental Sciences, 2012
Biota Environmental Sciences, 2019
Stantec, 2021
Rio Tinto Mine
N
0 1 2 3 4
Kilometers
Map units in metres
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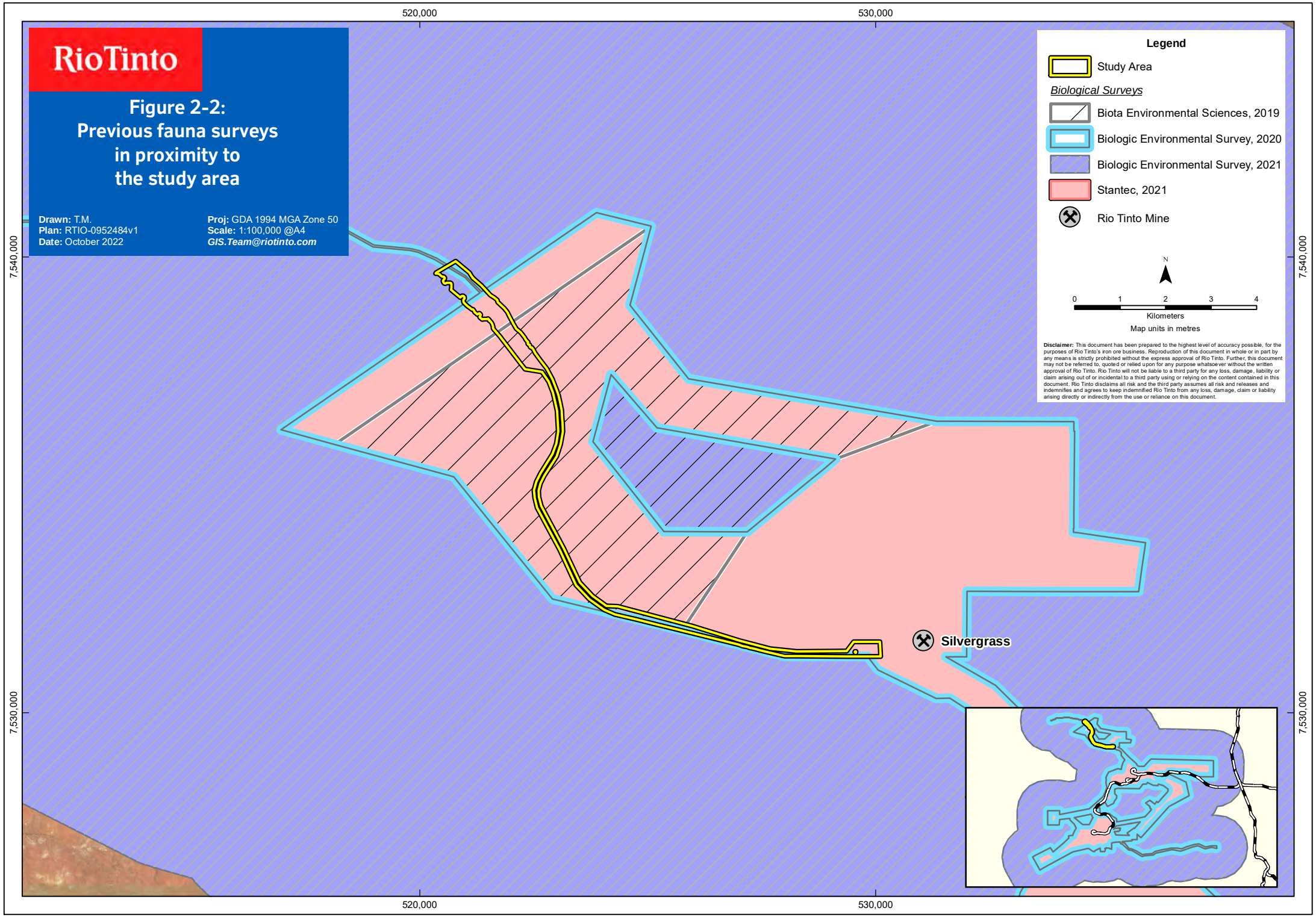
Silvergrass


RioTinto
Figure 2-2:
Previous fauna surveys
in proximity to
the study area
Drawn: T.M.
Plan: RTIO-0952484v1
Date: October 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:100,000 @A4
GIS.Team@riotinto.com
520,000
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Legend
Study Area
Biological Surveys
Biota Environmental Sciences, 2019
Biologic Environmental Survey, 2020
Biologic Environmental Survey, 2021
Stantec, 2021
Rio Tinto Mine
N
0 1 2 3 4
Kilometers
Map units in metres
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Silvergrass

2.1.2 Database searches

The Department of Biodiversity, Conservation and Attractions (DBCA) and WA Museum's (WAM) NatureMap database was reviewed for Threatened and Priority Flora and Threatened and Priority Fauna (EPBC Act and BC Act) that have the potential to utilise the habitats present within the study area. The Commonwealth Department of Agriculture, Water and the Environment (DAWE) administered EPBC Act Protected Matters Search Tool (PMST) was also reviewed for Matters of National Environmental Significance (MNES) listed under the EPBC Act including Threatened flora and fauna and TECs (DAWE 2022b).

Spatial data for conservation significant flora held and maintained by Rio Tinto was also reviewed as part of the desktop study (Rio Tinto Flora Database). Any ESA, Reserves and/or conservation areas within or surrounding the study area were identified using relevant GIS layers held by Rio Tinto. The search coordinates used (521750 mE, 7533760 mN, GDA94 Z50) were at a central point within the study area. A buffer of 20 km was used for the NatureMap, Rio Tinto and Protected Matters search tool (PMST) database searches. Result outputs of NatureMap and PMST searches undertaken are presented in Appendix 2 and summarised in section 3.

2.2 Likelihood of occurrence assessment

The results of the database searches were used to create a list of flora and fauna of conservation significance recorded, or with the potential to occur, within the study area. The likelihood of a flora or fauna species occurring within the study area was assessed through consideration of available habitats in the study area and each species' ecology. The fauna list will invariably include some species that do not occur in the study area, as some fauna have a limited or patchy distribution, high level of habitat specificity for habitat types not located in the study area, are locally extinct or were erroneously identified in previous surveys. These fauna were excluded from the list where relevant.

The likelihood of a flora species occurring within the study area was determined based on the location of database records, availability of potentially suitable habitat and knowledge of the species ecology.

2.3 Vegetation descriptions and condition

Vegetation descriptions were based on the consolidated units defined by Stantec (2021a), based on multiple field surveys and desktop reports in the Greater Brockman area. Where necessary, approximately 40 ha of vegetation mapping was extrapolated to align with the Stantec (2021a) descriptions to provide complete and consistent coverage of the study area. The extrapolated vegetation was based on previous mapping by Biota (2012).

Vegetation condition was based on previous mapping by Stantec (2021a). Where necessary, vegetation condition from adjacent vegetation mapping polygons was extrapolated to provide complete coverage for the study area. Current disturbance layers held on Rio Tinto's database were used to clip known cleared areas from the Stantec (2021a) vegetation polygons to provide most up to date assessment of cleared areas within the study area.

2.4 Other vegetation of significance

Vegetation not formally classified and protected under state or Commonwealth legislation may still be considered conservation significant. Vegetation that may fall under this category includes (but is not limited to) vegetation supporting elevated floristic diversity, habitats supporting numerous conservation-listed species, ecosystems at risk (Kendrick 2001), novel floristic associations, groundwater dependant ecosystems, uncommon vegetation and associations on novel landforms.

Vegetation associations or biological features assigned a significance classification are, for the purpose of this document, considered to be of elevated significance when compared to all other identified associations or features that are common or widespread and therefore well represented.

2.5 Environmentally significant areas

Rio Tinto manages all work, including clearing, through the Approvals Request Coordination System which ensures biological and heritage surveys are completed and all government regulatory approvals are in place prior to the commencement of works.

Environmentally significant features are uploaded into Rio Tinto's Geographic Information System (GIS) database which includes a description highlighting the significance of these areas. Individuals or small populations of conservation listed flora are protected as buffered point locations, while larger populations and significant habitat are protected as 'significant areas'. The GIS database is used as part of the Approvals Request Coordination System when reviewing the Proposal, thereby ensuring appropriate management conditions are in place to protect identified listed flora, communities and habitat where works are approved to take place.

3. Desktop assessment results

3.1 Flora

3.1.1 Flora diversity

The DBCA NatureMap and Rio Tinto database search results cover all species detected previously within 20 km of the study area. The DBCA NatureMap search returned a total of 321 taxa from 139 genera. The Rio Tinto database returned a total of 363 flora taxa from 158 genera and 56 families from within a 20 km radius of the study area (Table 3-1). The combined DBCA NatureMap and Rio Tinto databases returned a total of 44 conservation significant (Priority) flora species (Table 3-2). The PMST database search did not return any listed flora species.

Table 3-1: 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 study area	
	NatureMap database	Rio Tinto database
Families	-	56
Genera	139	158
Species	321	363
Conservation listed	21	42
Weeds	3	13

3.1.2 Conservation significant flora

The desktop study, utilising previous survey results, a NatureMap database search, an EPBC Protected Matters search, and searches of the Rio Tinto database, identified 43 conservation listed flora species as occurring within a 20 km buffer of the study area. None of these species have been recorded within the study area, however.

An assessment of all 43 species and their likelihood of occurrence within the study area, based on the results of the field survey, is detailed in Table 3-2. Based on proximity of known records and habitat presence within the study area, two flora conservation species were considered to have potential to occur within the study area, with the remaining 41 considered unlikely to occur (Table 3-2).

The two 'Potential' species were *Calotis squamigera* (P1) and *Ipomoea racemigera* (P2). *I. racemigera* was recorded along banks of Caves Creek adjacent to study area. Minimal similar habitat occurs within the actual study area. *C. squamigera* (P1) was recorded from a 2008 survey, approximately 10 km from the study area and was associated with an open mulga woodland. This specific habitat was not recorded within the study area and therefore it is less likely that the species *C.squamigera* would be found within the study area. Biota (2010) noted above average rainfall prior to the field survey, and Biota (2019a) surveys noted below average rainfall prior to the field surveys. Both species were also described and known at the time of the surveys.

Table 3-2: Conservation listed flora species returned by database searches, including likelihood of occurrence assessment

Species	Status	NM	RT	Distance to nearest record (km)	Habit, habitat and discussion	Likelihood of occurrence
Calotis squamigera	P1		x	10 km	Prostrate annual herb to 0.2m tall with yellow flowers. Occurs on pebbly loam (WAH 2022). This species is also known from multiple locations across Queensland and in the Northern Territory. One record is held by the South Australian Herbarium, collected from Karijini National Park in the Pilbara (Atlas of Living Australia 2022).	**Potential** Habitat may occur within study area.
Hibiscus sp. Mt Brockman (E. Thoma ET 1354)	P1	x	x	5 km	Perennial shrub to 2.5m tall with mauve flowers. Grows in rocky drainage lines below cliff lines or rocky ridges (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Triodia sp. Karijini (S. van Leeuwen 4111)	P1	x		96 km	Perennial grass (spinifex) forming lax hummocks. Occurs on upper slopes and summits of hills around Karijini National Park (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Triodia sp. Silvergrass (P.-L. de Kock BES 00808)	P1		x	3.6 km	Perennial grass (spinifex) forming hummocks. Occurs on shale (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)	P1		x	1.1 km	Somewhat woody, annual herb or subshrub to 1m tall with white flowers. Occurs on clay-loams, cracking clays and gilgai, usually associated with low open woodland and mulga (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Euphorbia inappendiculata var. *inappendiculata*	P2	x		11 km	Prostrate herb to 0.3m long. Occurs on loamy depressions, floodplains (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Euphorbia inappendiculata var. queenslandica	P2	x	x	1 km	Prostrate herb to 0.3m long. Occurs on loamy depressions, floodplains (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.

Species	Status	NM	RT	Distance to nearest record (km)	Habit, habitat and discussion	Likelihood of occurrence
Teucrium pilbaranum	P2	x	x	1.3 km	Upright shrub to 0.2m tall with white flowers. Occurs on clay, crab hole plains, floodplains or margin of calcrete table (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Aristida lazaridis	P2		x	5.5 km	Tufted perennial grass to 1.5m tall. Occurs on sand or loam mostly east of Karijini National Park (WAH 2022). This species is also known from multiple locations across Queensland and in the Northern Territory. One record held by the WAH, is collected from Karijini National Park in the Pilbara (Atlas of Living Australia 2022).	**Unlikely** No core/potential habitat within study area.
Ipomoea racemigera	P2		x	1.6 km	Creeping annual, herb or climber with white flowers. Occurs on sandy soils along watercourses (WAH 2022; Rio Tinto and Parks and Wildlife 2015).	**Potential** Potential habitat occurs directly adjacent to study area.
Oxalis sp. Pilbara (M.E. Trudgen 12725)	P2		x	5.2 km	Small, trailing or tufted herb with yellow flowers. Occurs in shaded areas around rocky outcrops and gullies (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Pentalepis trichodesmoides subsp. *hispida*	P2		x	21.3 km	Much-branched shrub to 1m tall. Leaves are conspicuously hispid. Occurs on summits and slopes of low hills, basaltic soils (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Astrebla lappacea	P3	x	x	< 500 m	Tufted perennial grass to 0.8m tall. Occurs on clay, loam (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Dolichocarpa sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3		x	900 m	Small, spreading annual herb to 0.2m with blue to white flowers. Occurs on seasonally inundated clays on gibber plains (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Eremophila magnifica subsp. *velutina*	P3	x	x	< 300 m	Shrub to 1.5m tall with blue-purple flowers. Occurs on skeletal soils over ironstone on hills and summits (WAH 2022).	**Unlikely** No core/potential habitat within study area.

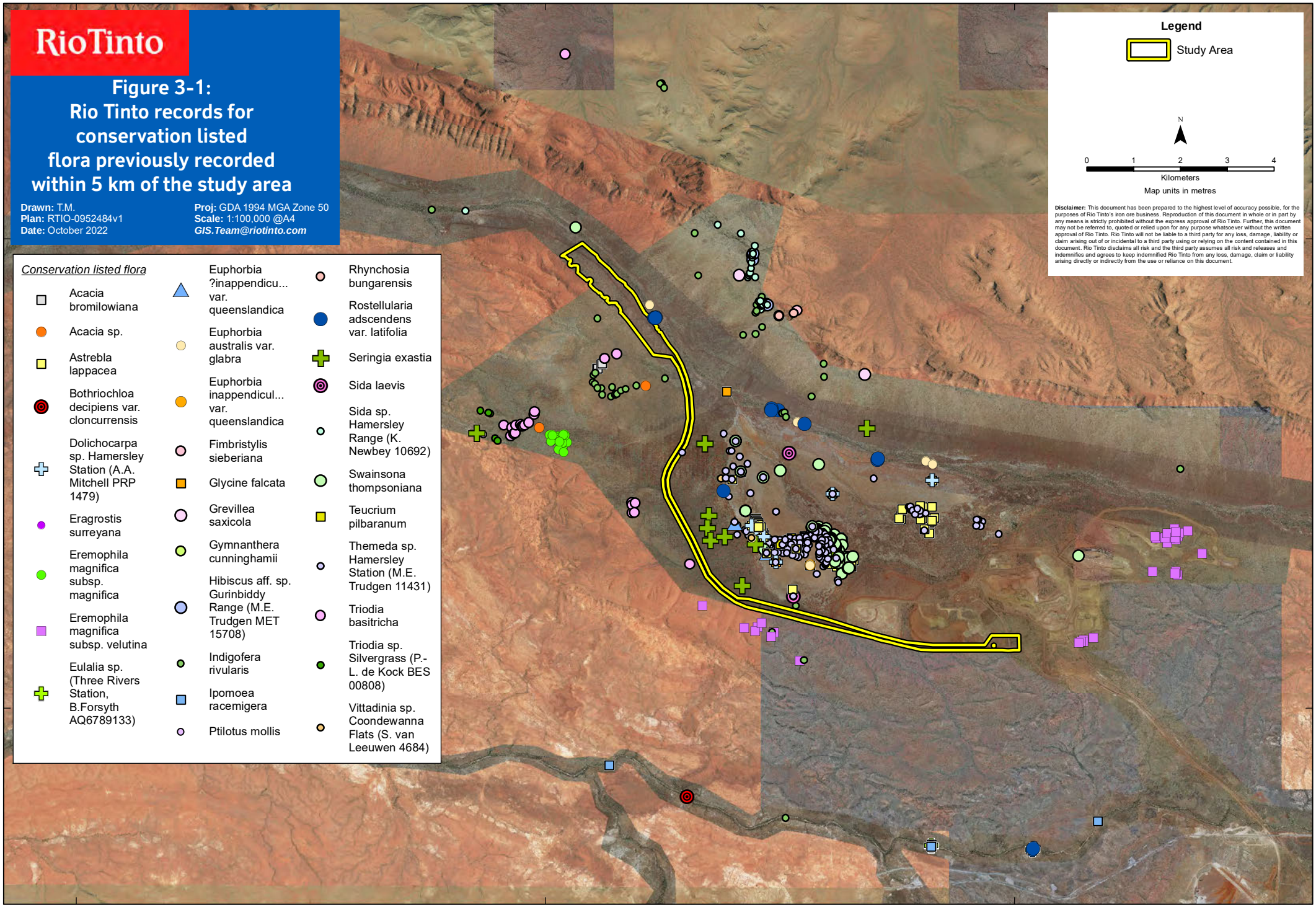
Species	Status	NM	RT	Distance to nearest record (km)	Habit, habitat and discussion	Likelihood of occurrence
Euphorbia australis var. *glabra*	P3	x	x	100 m	Prostrate, annual herb. Occurs on cracking clay loamy soils (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Fimbristylis sieberiana	P3	x	x	2.3 km	Shortly rhizomatous, tufted perennial sedge to 0.6m tall. Occurs on mud, skeletal soil pockets on pool edges and sandstone cliffs (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Glycine falcata	P3	x	x	700 m	Mat-forming perennial herb to 0.2m tall with blue-purple flowers. Occurs along drainage depressions in crabhole plains and floodplains (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Gymnanthera cunninghamii	P3	x	x	2.1 km	Erect shrub to 2m tall, with cream-yellow-green flowers. Occurs on sandy soils (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Indigofera gilesii	P3		x	15 km	Shrub to 1.5m tall with purple-pink flowers. Occurs on pebbly loam, amongst boulders and outcrops on hills (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Indigofera rivularis	P3		x	100 m	Tall shrub to 2m high with white-pink-violet flowers. Occurs on coarse alluvium in and along creeklines (Rio Tinto and Parks and Wildlife 2015). Has been recorded from vegetation association ElEgAatAeAbTeTw and ElAmaiAhiTw adjacent to the study area, however as study area is well-surveyed this perennial shrub would likely have been recorded if present within the study area.	**Unlikely** Potential habitat may occur within the study area however it has been comprehensively surveyed and was not recorded in previous surveys.
Iotasperma sessilifolium	P3	x		5.4 km	Erect herb with pink flowers. Occurs on cracking clay, black loam along edges of waterholes and on plains (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Ptilotus subspinescens	P3	x	x	6.7 km	Compact shrub to 0.8m tall. Occurs on gentle rocky slopes, screes and bases of screes (WAH 2022).	**Unlikely** No core/potential habitat within study area.

Species	Status	NM	RT	Distance to nearest record (km)	Habit, habitat and discussion	Likelihood of occurrence
Rhagodia sp. Hamersley (M. Trudgen 17794)	P3		x	18 km	Lax, scrambling shrub to 4m tall. Occurs in mulga on cracking clays (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Rostellularia adscendens var. *latifolia*	P3	x	x	< 100 m	Herb or shrub to 0.3m tall with blue-purple-violet flowers. Occurs on ironstone soils, near creeks and rocky hills (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Sida sp. Barlee Range (S. van Leeuwen 1642)	P3		x	14.5 km	Spreading shrub to 0.5m tall with yellow flowers. Occurs on skeletal red soils on steep slopes (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Sida sp. Hamersley Range (K. Newbey 10692)	P3		x	1.9 km	Open shrub to 2m tall with yellow flowers. Occurs on rocky outcrops and breakaways (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Swainsona thompsoniana	P3	x	x	350 m	Prostrate, annual herb to 0.1m tall with blue-mauve flowers. Occurs on gibber plains, crabhole plains and gilgai (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	P3	x	x	< 100 m	Robust, perennial grass to 2m tall. Occurs on drainage lines, clay flats, crabhole plains and self-mulching clays (Rio Tinto and Parks and Wildlife 2015). Has been recorded from vegetation association ElEgAatAeAbTeTw adjacent to the study area, however as study area is well-surveyed this perennial grass would likely have been recorded if present within the study area.	**Unlikely** Potential habitat may occur within the study area however it has been comprehensively surveyed and was not recorded in previous surveys.
Triodia basitricha	P3	x	x	200 m	Tussock-forming perennial grass to 0.4m tall. Occurs on slopes or crests of rocky hills (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Triodia pisoliticola	P3		x	20 km	Perennial, tufted grass (spinifex) to 0.5m tall. Occurs on skeletal soils on ironstone, associated with summits of mesas or hilly areas (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.

Species	Status	NM	RT	Distance to nearest record (km)	Habit, habitat and discussion	Likelihood of occurrence
Amaranthus centralis	P3		x	13.7 km	Annual herb to 0.6m tall. Occurs on ephemeral watercourses, sandy to clayey loam river banks and edges of permanent pools (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Aristida jerichoensis var. subspinulifera	P3		x	18.1 km	Compactly tufted, perennial grass to 0.8m tall. Occurs on hardpan plains (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Dampiera anonyma	P3		x	15.6 km	Multi-stemmed perennial herb to 0.5 (-1)m tall, with blue-purple flowers. Occurs on hill summits and upper slopes above 1,000m (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Eragrostis surreyana	P3		x	4.1 km	Small, tufted annual grass to 0.1m tall. Occurs in seasonally wet areas (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Eremophila naaykensii	P3		x	15.7 km	Rounded shrub to small tree to 2.5m tall. Occurs on tops of ironstone ranges, breakaways and on upper slopes, often in and around rocky gullies and gorges (Curtis et al. 2022).	**Unlikely** No core/potential habitat within study area.
Grevillea saxicola	P3		x	2.0 km	Upright shrub or small tree to 2.5-7m tall with cream to pale yellow flowers. Occurs on upper scree/breakaway slopes and crests often associated with banded ironstone outcropping and mulga woodlands (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Acacia bromilowiana	P4		x	1 km	Tree or shrub to 12m tall. Occurs on red skeletal soil on laterite, banded ironstone, basalt, on rocky hills, breakaways, scree slopes, gorges and creek beds (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Eremophila magnifica subsp. *magnifica*	P4		x	2.1 km	Shrub to 1.5m tall with blue flowers. Occurs on skeletal soils over ironstone, on rocky screes (WAH 2022).	**Unlikely** No core/potential habitat within study area.

Species	Status	NM	RT	Distance to nearest record (km)	Habit, habitat and discussion	Likelihood of occurrence
Goodenia nuda	P4	x	x	1.2 km	Erect to ascending herb to 0.5m tall with yellow flowers (WAH 2022). Occurs on seasonally inundated clay soils and drainage lines, often in mulga (Rio Tinto and Parks and Wildlife 2015).	**Unlikely** No core/potential habitat within study area.
Livistona alfredii Millstream Fan-palm	P4	x	x	13.3 km	Palm tree to 10m high. Occurs on the edges of permanent pools (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Ptilotus mollis	P4	x	x	4 km	Compact, perennial shrub to 0.5m tall. Occurs on stony hills and screes (WAH 2022).	**Unlikely** No core/potential habitat within study area.
Rhynchosia bungarensis	P4	x	x	2.3 km	Compact, prostrate shrub to 0.5m tall with yellow flowers. Occurs on pebbly, coarse sand amongst boulders and banks of flow lines and in gullies (WAH 2022).	**Unlikely** No core/potential habitat within study area.

NM – NatureMap; **RT** – Rio Tinto Priority Flora Database.


RioTinto
Figure 3-1:
Rio Tinto records for conservation listed flora previously recorded within 5 km of the study area
Drawn: T.M.
Plan: RTIO-0952484v1
Date: October 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:100,000 @A4
GIS.Team@riotinto.com
Conservation listed flora
Acacia bromilowiana
Acacia sp.
Astrebla lappacea
Bothriochloa decipiens var. cloncurrensis
Dolichocarpa sp. Hamersley Station (A.A. Mitchell PRP 1479)
Eragrostis surreyana
Eremophila magnifica subsp. magnifica
Eremophila magnifica subsp. velutina
Eulalia sp. (Three Rivers Station, B.Forsyth AQ6789133)
Euphorbia ?inappendicu... var. queenslandica
Euphorbia australis var. glabra
Euphorbia inappendicul... var. queenslandica
Fimbristylis sieberiana
Glycine falcata
Grevillea saxicola
Gymnanthera cunninghamii
Hibiscus aff. sp. Gurinbiddy Range (M.E. Trudgen MET 15708)
Indigofera rivularis
Ipomoea racemigera
Ptilotus mollis
Rhynchosia bungarensis
Rostellularia adscendens var. latifolia
Seringia exastia
Sida laevis
Sida sp. Hamersley Range (K. Newbey 10692)
Swainsona thompsoniana
Teucrium pilbaranum
Themeda sp. Hamersley Station (M.E. Trudgen 11431)
Triodia basitricha
Triodia sp. Silvergrass (P.-L. de Kock BES 00808)
Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)
Legend
Study Area
N
0 1 2 3 4
Kilometers
Map units in metres
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3.1.3 Introduced flora

No weed species have been recorded from the study area, however, are likely to occur within given the level of disturbance. Thirteen weed species have been recorded within 20 km of the study area, including:

**Bidens bipinnata*, **Flaveria trinervia*, **Sigesbeckia orientalis*, **Sonchus oleraceus*, **Citrullus lanatus*, **Vachellia farnesiana*, **Malvastrum americanum*, **Oxalis corniculata*, **Argemone ochroleuca* subsp*. ochroleuca*, **Cenchrus ciliaris*, **Cenchrus setiger*, **Echinochloa colona* and **Setaria verticillata.*

3.2 Vegetation of the study area

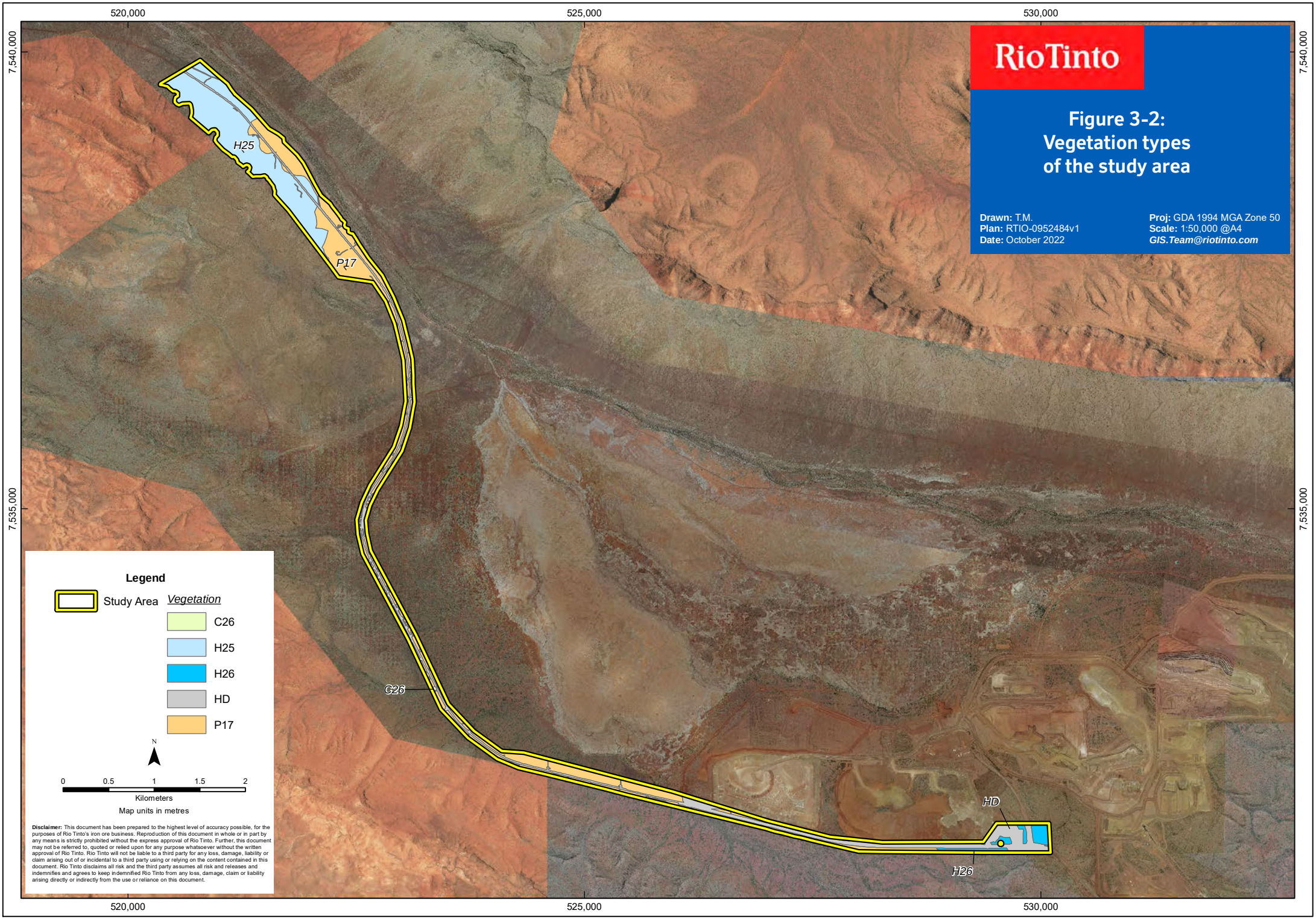
Four vegetation types were identified across three major landforms within the study area based on Stantec's (2021a) consolidated mapping. The vegetation types are summarised in Table 3-3 and are accompanied by vegetation mapping (Figure 3-2).

Two vegetation types were described from hillslopes, one from minor flowline and one from mixed woodlands on flats. The dominant vegetation units were ElEgAatAeAbTeTw (43.64 %) and ElAmaiAhiTw (30.15 %) (Table 3.2). Whilst no priority flora were recorded within the study area, vegetation associations ElEgAatAeAbTeTw and ElAmaiAhiTw support records of *Indigofera rivularis* (P3) and *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3) outside of the study area.

Over 22% of the study area has been cleared and was mapped as Disturbed, which is expected as the study area runs parallel to an existing road and associated pipeline and mining infrastructure.

Table 3-3: Vegetation type summary

Unit	Vegetation Description	Extent within the study area (ha)	Proportion of study area
	Vegetation of Hillslopes		
ElAmaiAhiTw	*Eucalyptus leucophloia* subsp. *leucophloia*, (*Corymbia hamersleyana*) low open woodland over *Acacia maitlandii* open shrubland over *A. hilliana* low open shrubland over *Triodia wiseana* hummock grassland.	86.75	30.15
ElAmTw	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia maitlandii* shrubland over *Triodia wiseana* open hummock grassland.	11.00	3.82
	Vegetation of Minor Flowline		
ExChAsppGgTe	*Eucalyptus xerothermica* and/or *Corymbia hamersleyana* low open woodland over *Acacia* spp. and *Gastrolobium grandiflorum* open shrubland over *Triodia epactia* (*T. wiseana)* open hummock grassland.	0.66	0.23
	Mixed Woodlands on Flats		
ElEgAatAeAbTeTw	*Eucalyptus leucophloia* subsp. *leucophloia* (*Corymbia deserticola* subsp. *deserticola* and *C. hamersleyana*) scattered low trees and/or *E. gamophylla* scattered low mallees over *Acacia atkinsiana*, *A. exigua* and *A. bivenosa* shrubland over *Triodia epactia* and/or *T. wiseana* hummock grassland.	125.60	43.64
Disturbed		63.76	22.16
Total		**287.78**	**100.00**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RioTinto
Figure 3-2:
Vegetation types
of the study area
Drawn: T.M.
Plan: RTIO-0952484v1
Date: October 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:50,000 @A4
GIS.Team@riotinto.com
H25
P17
C26
HD
H26
Legend
Study Area
Vegetation
C26
H25
H26
HD
P17
N
0
0.5
1
1.5
2
Kilometers
Map units in metres
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3.3 Vegetation condition

Vegetation condition mapping (largely extrapolated from Stantec (2021a)) is presented in Figure 3-3, and Table 3-4 presents the extent of vegetation condition mapped within the study area. The vegetation within the study area was predominantly rated as being in Excellent condition (73.84 %), with 22.16 % mapped as Completely Degraded (Table 3-4).

Table 3-4: Vegetation condition of the study area

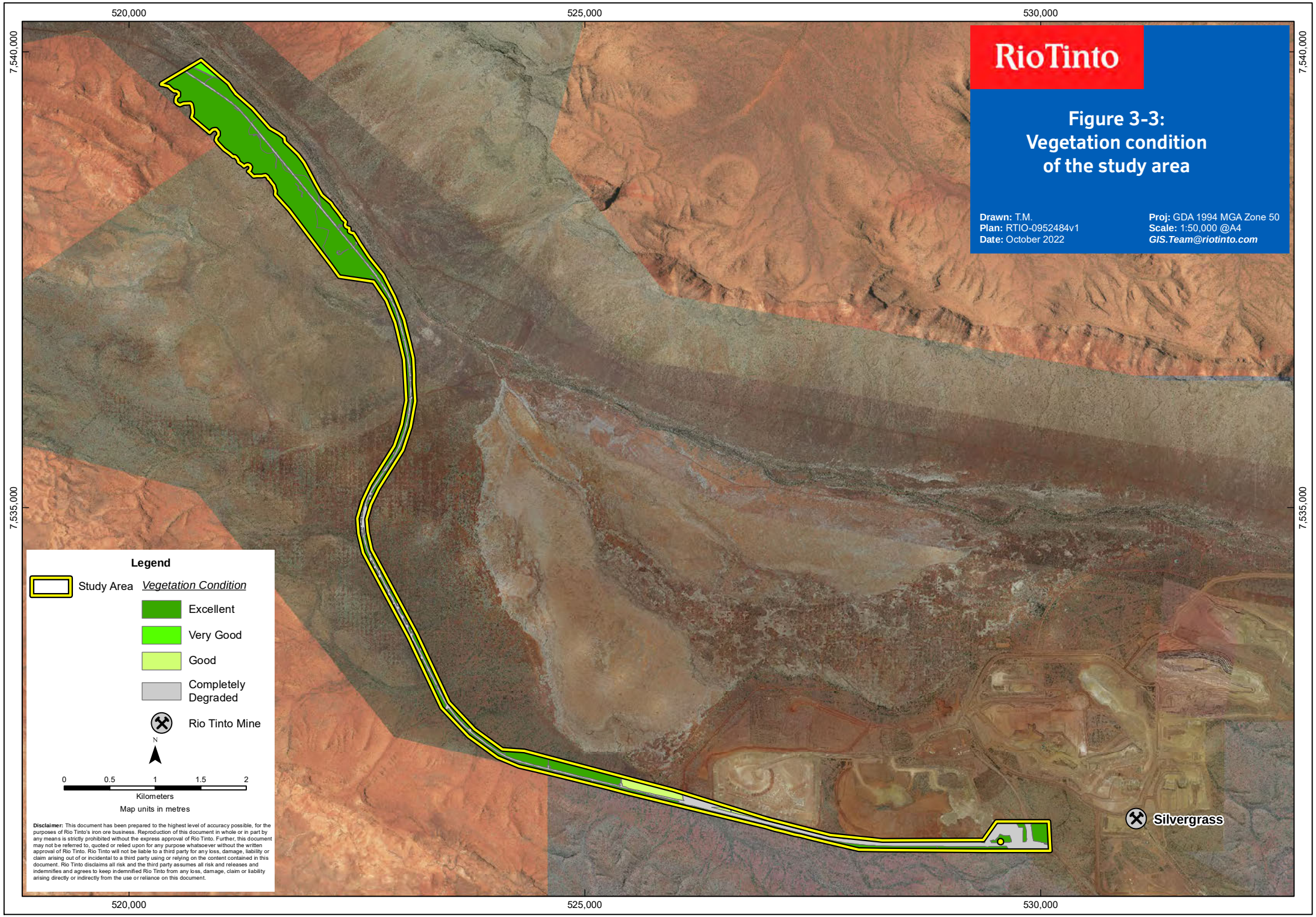
Condition	Area (ha)	Proportion (%) of study area
Excellent	212.51	73.84
Very Good	2.31	0.80
Good	9.20	3.20
Poor	0.00	0.00
Degraded	0.00	0.00
Completely Degraded	63.76	22.16
Total	**287.78**	**100.00**

3.4 Vegetation of conservation significance

TEC boundaries known by DBCA are within a kilometre of the study area, to the east. PEC boundaries known by DBCA are within 150 m of the study area. However, none of the vegetation types defined in the study area resemble the PEC or TEC (based on the mapping by Biota (2012) and Stantec (2021a)).

The Study Area is also adjacent to Caves Creek, however none of the vegetation defined by Biota (2012) and Stantec (2021a) within the study area corresponds to groundwater dependent vegetation or ecosystems.

Although within close proximity to all of these values, the proposal is aligned with an existing road corridor and does not intersect known occurrences of these significant vegetation units.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RioTinto
Figure 3-3:
Vegetation condition
of the study area
Drawn: T.M.
Plan: RTIO-0952484v1
Date: October 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:50,000 @A4
GIS.Team@riotinto.com
Legend
Study Area
Vegetation Condition
Excellent
Very Good
Good
Completely Degraded
Rio Tinto Mine
N
0 0.5 1 1.5 2
Kilometers
Map units in metres
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Silvergrass

3.5 Fauna

3.5.1 Fauna diversity

Table 3-5 presents a summary of terrestrial vertebrate fauna species returned by the NatureMap database searches.

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

Fauna group	Number of potential species
Amphibians	2
Reptiles	76
Avifauna	107
Mammals	33
Conservation listed	7
Total	**218**

3.5.2 Conservation significant fauna

Seven conservation listed fauna were returned by the NatureMap search, and eight were returned by the Rio Tinto fauna database search. In total, this included nine fauna species: three Vulnerable (VU) species and one Endangered (EN) species listed under the EPBC Act, one Other Specially Protected fauna listed under the BC Act, plus four Priority 4 fauna species listed by DBCA.

Three conservation listed fauna species were ‘previously recorded’ from the study area, five species had ‘potential’ to occur within the study area and the remaining one was ‘unlikely’ to occur (Table 3-6).

The EPBC Act listed species ‘previously recorded’ within the study area included:

- Pilbara olive python: Secondary evidence, scat (Biologic 2020a)
- Ghost bat: Primary evidence, opportunistic sighting (Biota 2009) but no echolocation calls in the area on the same survey.
- Pilbara leaf-nosed bat: Primary evidence, echolocation calls, noted small number of calls (Biota 2009), also Rio Tinto in 2017.

Other EPBC Act listed species with ‘potential’ to occur included:

- Northern quoll: recorded within 300 m of the study area, primary evidence of opportunistic sighting (Biota 2019b) and motion camera sighting, plus secondary evidence in the form of scats (Biologic 2020a).

All EPBC Act listed species may pass through the area at times as they are known from the local area. There is minimal denning, roosting, or breeding habitat within the study area. Along with the small scale of the proposal, adjacent to existing infrastructure and roads, and limited habitat that is not restricted to the study area, it is unlikely that the proposal will have a significant impact on these listed species.

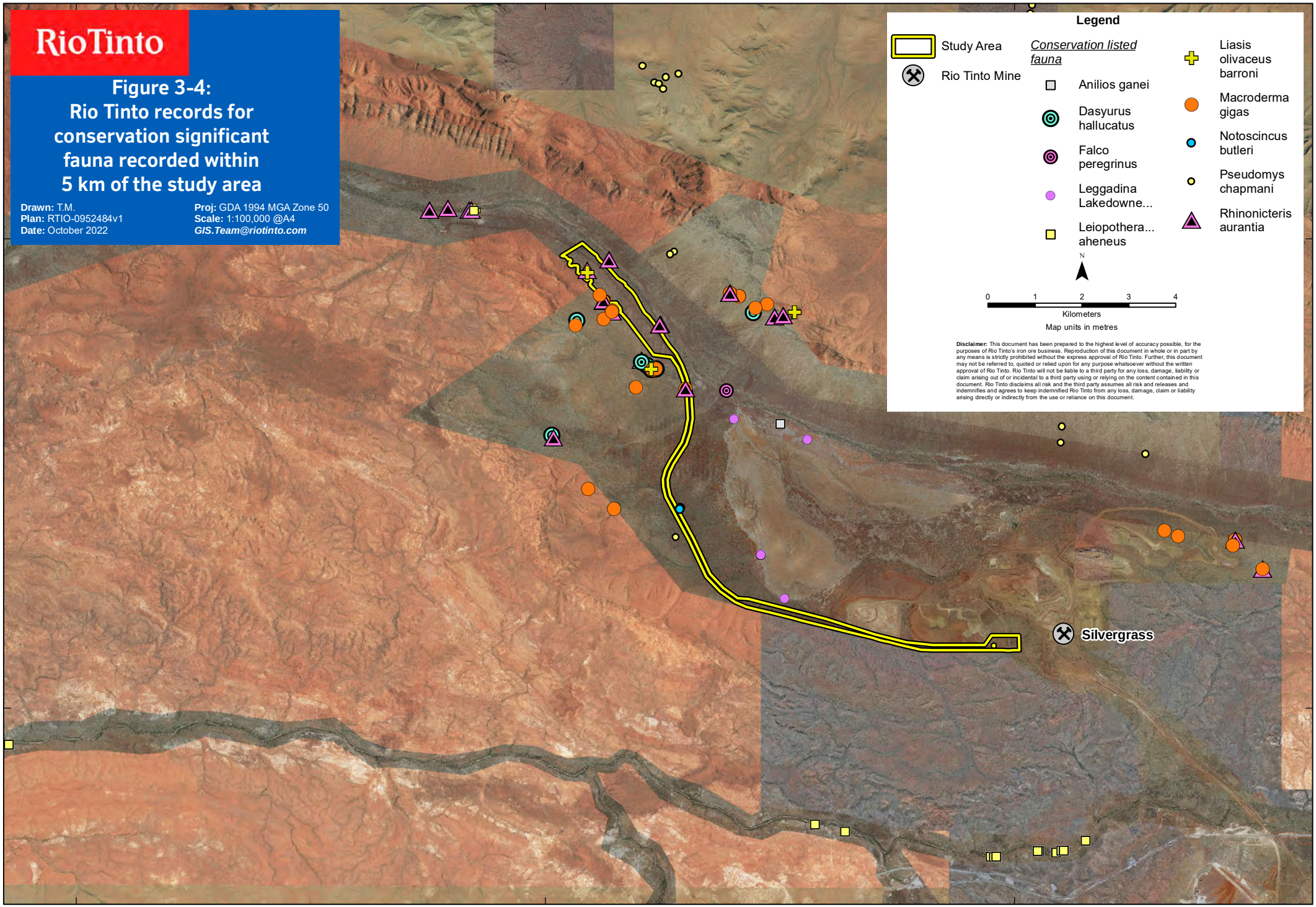
Other conservation significant Priority 4 fauna species with the ‘potential’ to occur included the Western pebble-mound mouse, Lakeland Downs mouse, lined-soil crevice skink, and the OS Peregrine Falcon (Table 3-6). Habitat within the study area is alongside existing infrastructure and

cleared areas, and would not provide high value habitat for any of these species. None of the habitats identified in the study area are restricted to the study area and occur extensively in the wider area (Biologic 2020a, Stantec 2021b, Biota 2019b). Furthermore, the peregrine falcon is a wide-ranging species and may opportunistically forage over the study area but would not be dependent upon the habitat for its survival. It is unlikely that the proposal will have a significant impact on these Priority 4 and OS fauna species.

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

Species (Common name)	Status	NM	RT	Distance to nearest record	Habitat and discussion	Likelihood of occurrence
Dasyurus hallucatus (northern quoll)	EN	x	x	300 m	Northern quoll occupy a diverse range of habitats including rocky areas, eucalypt forest, woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (Department of Climate Change, Energy, the Environment and Water 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 (Department of Climate Change, Energy, the Environment and Water 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).	**Potential** Recorded within 300 m of study area (opportunistic sighting) and also motion camera and scats. The study area does not contain core habitat for this species although it may pass through the area.
Macroderma gigas (ghost bat)	VU	x	x	Previously recorded	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 and Knight 2017).	**Previously Recorded** The study area does not contain core habitat for this species although it may pass through the area.
Rhinonicteris aurantia (Pilbara leaf-nosed bat)	VU	x	x	Previously recorded	The Pilbara leaf-nosed bat 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 and Strahan 2008). This species is more influenced by the availability of suitable roost caves than by habitat type and high humidity is particularly important to this species (Churchill 1998).	**Previously Recorded** The study area does not contain core habitat for this species although it may pass through the area.
Liasis olivaceus barroni (Pilbara olive python)	VU		x	Previously recorded	Pilbara olive python habitat includes escarpments, gorges and water holes in the ranges of the Pilbara region (Pearson 1993; Wilson & Swan 2008). Individuals are usually recorded in close proximity to water and rock outcrops that attract suitably sized prey species (Pearson 2003).	**Previously Recorded** The study area does not contain core habitat for this species although it may pass through the area.

Species (Common name)	Status	NM	RT	Distance to nearest record	Habitat and discussion	Likelihood of occurrence
Leggadina lakedowensis (Lakeland Downs mouse)	P4	x	x	200 m	This species occurs on a variety of habitats, most of which are seasonally inundated sandy-clay soils. In the Pilbara this species occurs in spinifex and tussock grasslands (van Dyck and Strahan 2008) and are strongly correlated with cracking clay communities or heavily clay-laden soils supporting tussock grasslands.	**Potential** The study area does not contain core habitat to support this species, although it occurs in nearby areas and may opportunistically pass through the habitat within the study area.
Notoscincus butleri (lined soil-crevice skink)	P4	x	x	50 m	Spinifex dominated areas near creeks and river margins in arid, rocky, near-coastal areas (Wilson and Swan 2010).	**Potential** Adjacent water course and vegetation may provide suitable habitat, especially as this species has been previously recorded from the study area.
Pseudomys chapmani (western pebble-mound mouse)	P4	x	x	215 m	This species is found on stony hillsides with hummock grassland (Menkhorst & Knight 2017). This species favours 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.	**Potential** Mounds recorded in close proximity and potential habitat present within the study area.
Sminthopsis longicaudata (long-tailed dunnart)	P4	x		8 km	Common in rocky screes with hummock grassland and acacia shrubs, tall open shrub and woodlands (Menkhorst & Knight 2017).	**Unlikely** The study area is not expected to contain core habitat for this species.
Falco peregrinus (Peregrine falcon)	OS		x	Not available	The peregrine falcon inhabits cliffs, gorges, timbered waterways, riverine environments, wetlands, plains and open woodlands. It also inhabits pylons, spires and buildings. Nesting habitat includes cliff edges or crevices, large tree hollows, other raptor or corvid nests and ledges of city buildings (Pizzey & Knight 2012).	**Potential** This species is wide ranging and may occur within the study area opportunistically to forage.


RioTinto
Figure 3-4:
Rio Tinto records for conservation significant fauna recorded within 5 km of the study area
Drawn: T.M.
Plan: RTIO-0952484v1
Date: October 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:100,000 @A4
GIS.Team@riotinto.com
510,000
520,000
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7,530,000
Legend
Study Area
Rio Tinto Mine
Conservation listed fauna
Anilios ganei
Dasyurus hallucatus
Falco peregrinus
Leggadina Lakedowne...
Leiopothera... aheneus
Liasis olivaceus barroni
Macroderma gigas
Notoscincus butleri
Pseudomys chapmani
Rhinonicteris aurantia
N
0 1 2 3 4
Kilometers
Map units in metres
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Silvergrass

3.6 Fauna habitat

Five broad fauna habitat types were described from the study area (Biologic 2021). The fauna habitat types recorded are described below, accompanied by mapping (Table 3-7; Figure 3-5). The habitat types broadly included hills and slope formations, drainage and creeklines and stony plains.

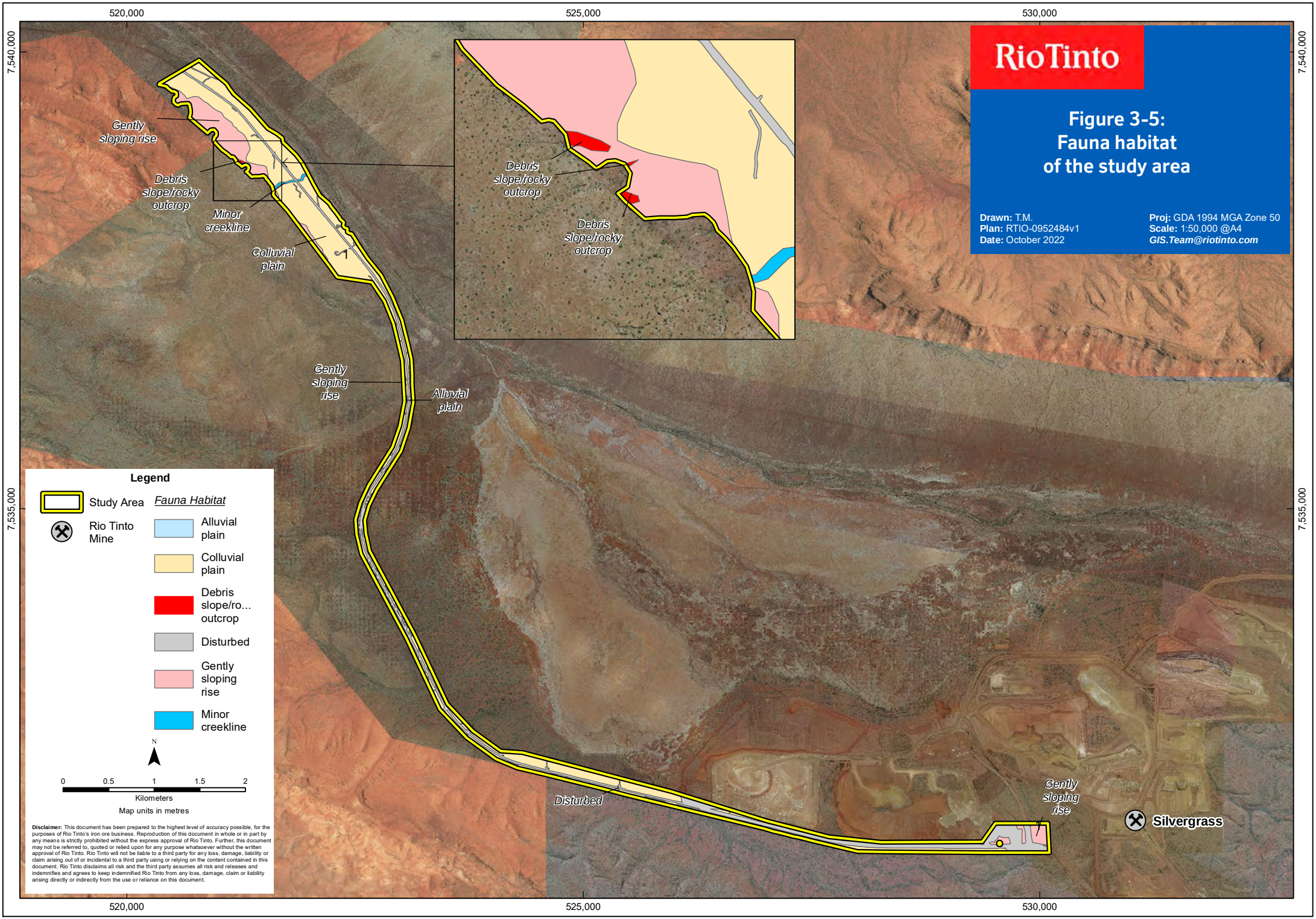
'Colluvial plains' were the most widespread fauna habitat across the study area, occupying over 64 %. More than 22 % of the study area is considered disturbed, attributed to the existing road and infrastructure.

Table 3-7: Fauna habitat type summary

Habitat	Fauna habitat description	Significant microhabitat	Extent (ha) within study area	Proportion (%) of study area
Debris slope/rocky outcrop	Debris slope - A moderately inclined to steep slope, consisting of rock accumulated by gravity. Rocky outcrop - A visible exposure of rock.	Potential caves and rocky outcrops for threatened fauna	0.36	0.13
Gently sloping rise	A gently inclined slope located towards the base of the footslope.	No	36.40	12.65
Minor creekline	A linear, generally sinuous open depression forming the floor of a minor drainage line channel (less than 10 m) that is eroded or aggraded (built up) by stream flow.	No	1.09	0.38
Alluvial plain	Flat land area adjacent to a drainage line, composed of unconsolidated sedimentary deposits (alluvium) and subject to periodic inundation by the drainage line.	No	0.24	0.08
Colluvial plain	A large very gently inclined or level element, formed by loose unconsolidated material being deposited by either rain wash, sheet wash, slow continuous downslope creep, or a variable combination of these processes.	No	186.01	64.67
Disturbed	Disturbance associated with clearing for exploration and/or mining activities.	No	63.53	22.09
Total			**287.63**	**100.00**

3.7 Fauna habitat of significance

One fauna habitat within the study area was deemed to hold elevated conservation significance, as mapped by Biologic (2021) on the western boundary. This habitat was 'Debris slope/rocky outcrop' and may potentially contain significant microhabitats for threatened fauna species. However, given the previously disturbed nature of the study area and alignment with existing road and mining infrastructure, and minimal proportion of the study area (0.36 ha or 0.13 % of the study area) containing this habitat type, it is unlikely the proposal will have a significant impact on threatened fauna species (ghost bat, Pilbara leaf-nosed bat, northern quoll and Pilbara olive python).


520,000
525,000
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7,535,000
Gently sloping rise
Debris slope/rocky outcrop
Minor creekline
Colluvial plain
Gently sloping rise
Alluvial plain
Debris slope/rocky outcrop
Debris slope/rocky outcrop
Disturbed
Gently sloping rise
Silvergrass
Legend
Study Area
Rio Tinto Mine
Fauna Habitat
Alluvial plain
Colluvial plain
Debris slope/ro... outcrop
Disturbed
Gently sloping rise
Minor creekline
N
0 0.5 1 1.5 2
Kilometers
Map units in metres
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Figure 3-5:
Fauna habitat
of the study area
Drawn: T.M.
Plan: RTIO-0952484v1
Date: October 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:50,000 @A4
GIS.Team@riotinto.com

4. Statement addressing the ten clearing principles

Rio Tinto is proposing to construct pipeline and associated infrastructure to recharge underground aquifers and mitigate potential environmental impacts of dewatering operations on groundwater dependent ecosystems downstream of the Silvergrass mine (the **Proposal**). The **Proposal** comprises approximately 288 ha, with proposed clearing of 30 ha of native vegetation.

Based on the above desktop assessment, each of the ten clearing principles under Schedule 5 of the EP Act are discussed below.

Comprises high level of biological diversity

4.1 *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 (Department of the Environment and Energy, DotEE 2020a) and is a secondary centre of endemism and species richness for *Acacia*, *Triodia*, *Corymbia* and *Sida* in Western Australia (Maslin 2001, Kendrick 2001 and Maslin and van Leeuwen 2008). The application area lies within the Hamersley (PIL3) subregion of the Pilbara, a bioregion identified by the Threatened Species Scientific Committee for the Australian Government Biodiversity Hotspots as it provides habitat for several threatened, endemic, and fire-sensitive species and communities.

The Hamersley sub-region is described as: 'Mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). Mulga low woodland over bunch grasses on fine textured soils in valley floors, and *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges' (Kendrick 2001)**.** Special features of the Hamersley include rare features such as gorges, centres of endemism including calcrete deposits, refugia and the *Themeda* grasslands Threatened Ecological Community (TEC) (Kendrick 2001).

Four vegetation associations have been mapped within the study area, described from three landforms: hillslopes, minor flowlines and mixed woodlands on flats. The dominant vegetation associations were 1) mixed eucalypt woodland over Acacia spp. over hummock grassland on flats (ElEgAatAeAbTeTw, 43.64 %); and 2) eucalypt woodland over *Acacia* spp. open shrubland over hummock grassland on slopes (ElAmaiAhiTw, 30.15 %). Furthermore, 22.16 % of the study area was considered Disturbed and none of the vegetation associations represented Threatened or Priority Ecological Communities, despite known occurrences within 1 km (TEC) and 150 m (PEC) of the study area.

No conservation significant flora have been recorded within the study area. The desktop assessment identified 43 species within a 20 km buffer of the study area. Of these, only two species were considered to have potential to occur within the study area: *Calotis squamigera* (P1), and *Ipomoea racemigera* (P2). Minimal habitat occurs within the actual study area for either of these species. *C. squamigera* (P1) was recorded from a 2008 survey, approximately 10 km from the study area and was associated with an open mulga woodland. This specific habitat was not recorded within the study area therefore *C. squamigera* (P1) is less likely to be found within the study area. The Biota (2010) noted above average rainfall prior to the field survey, and Biota (2019a) surveys noted below average rainfall prior to the field surveys. Both species were also described and known at the time of the surveys. Clearing is not expected to have a significant impact on these species due to the large representation of more suitable habitat present outside of the study area.

Five broad fauna habitat types were described within the study area, including debris slope/rocky outcrop, gently sloping rise, minor creekline, alluvial plain and colluvial plain. These fauna habitats are not considered to be restricted at a local or regional level. Although the Debris slope/rocky outcrop habitat has potential to support significant habitat for threatened fauna species, this only occupied 0.13% of the study area.

Threatened fauna species known from the local area include: Ghost bat, northern quoll, Pilbara olive python, and Pilbara leaf-nosed bat. These species may all pass through the area as they are known from the local area, but there is minimal denning, roosting or breeding habitat within the study area (0.13 %).

One priority fauna species is known form the study area: lined-soil crevice skink. Two priority fauna species have 'Potential' to occur within the study area: Western pebble-mound mouse and Lakeland Downs mouse. Potential habitat for these species is alongside existing infrastructure and cleared areas and would not provide high value habitat for the species. None of the habitats identified in the study area are restricted to the study area and occur extensively in the wider area (Biologic 2020a, Stantec 2021b, Biota 2019b). Similarly, the peregrine falcon is a wide-ranging species and may opportunistically forage over the study area but would not be dependent upon the habitat for its survival.

The **Proposal** is unlikely to be considered at variance with this Principle.

4.2 Potential impact to any significant habitat for fauna indigenous to Western Australia

Native vegetation should not be cleared if it comprises the whole, or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

Five broad fauna habitat types were described within the study area, including debris slope/rocky outcrop, gently sloping rise, minor creekline, alluvial plain and colluvial plain. These fauna habitats are not considered to be restricted at a local or regional level. Although the 'debris slope/rocky outcrop' habitat has potential to support significant habitat for threatened fauna species, this only occupied 0.13% of the study area.

Furthermore, threatened and priority fauna species are known from the local area (including ghost bat, northern quoll, Pilbara olive python, Pilbara leaf-nosed bat, plus other conservation significant species with potential to occur: Western pebble-mound mouse, Peregrine falcon and Lakeland Downs mouse). However, given the small size of the Proposal and proximity to existing disturbance and infrastructure, it is unlikely to negatively impact any of these species.

The Proposal is not considered to be at variance to this Principle.

4.3 Potential impact to any rare flora

Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora.

No threatened flora listed under the EPBC Act or BC Act were recorded within the study area, and based on the results of the desktop assessment, none are considered likely to occur.

No conservation significant flora have been recorded within the study area. Two conservation significant flora species were considered to have 'Potential' to occur within the study area, with 41 considered 'Unlikely' to occur. The two 'Potential' species were *Calotis squamigera* (P1) and *Ipomoea racemigera* (P2). *I. racemigera* was recorded along banks of Caves Creek adjacent to study area. Minimal similar habitat occurs within the actual study area. *C. squamigera* (P1) was recorded from a 2008 survey, approximately 10 km from the study area and was associated with an open mulga woodland. This specific habitat was not recorded within the study area therefore *C. squamigera* is less likely to be found within the study area. Biota (2010) noted above average rainfall prior to the field survey, and Biota (2019a) surveys noted below average rainfall prior to the field surveys. Both species were also described and known at the time of the surveys.

Whilst no priority flora were recorded within the study area, vegetation associations ElEgAatAeAbTeTw and ElAmaiAhiTw support records of *Indigofera rivularis* (P3) and *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3) outside of the study area. *Indigofera rivularis* is a perennial shrub and would have been visible during surveys in the area to be recorded. *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3) may be associated with some fringing vegetation from the nearby PEC and TEC. This species is also a perennial tussock grass so would likely have been visible and recorded if present at the time of the Biota (2010 and 2019a) field surveys.

The Proposal is not considered to be at variance to this Principle.

4.4 Presence of any threatened ecological communities

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

TEC boundaries known by DBCA (of 'Themeda grasslands on cracking clays (Hamersley Station)') are within a kilometre of the study area, to the east. PEC boundaries known by DBCA (of 'Brockman Iron cracking clay communities of the Hamersley Range' (Priority 1)) are within 150 m of the study area, also to the east. However, none of the vegetation types defined in the study area resemble these, or other, PECs or TECs (based on the mapping by Biota (2012) and Stantec (2021a)).

Due to the narrow width of the study area along existing roads and infrastructure, with over 22% of the area previously cleared, it is unlikely the proposed activities are going to impact the TEC or PEC community. **The Proposal is not considered to be at variance to this Principle.**

4.5 Significance as a remnant of native vegetation in the area that has been extensively cleared

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

The application area occurs within the Hamersley subregion of the Pilbara bioregion, the Shire of East Pilbara and within the pre-European vegetation associations 18, 29, 82 and 175 (Shepherd *et al*. 2002). Each of these vegetation associations has greater than 98% of their pre-European extent remaining at the bioregion, subregion and local government authority level (Government of Western Australia 2019).

Based on the pre-European vegetation associations, the vegetation described and mapped within the Rhodes Ridge application area is considered to be remnant and not within an extensively cleared landscape (Shepherd *et al.* 2002).

The Proposal is not considered to be at variance to this Principle.

4.6 Impact on any watercourse and / or wetlands

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

Caves Creek, a major creekline runs parallel with the northern study area boundary, however, does not intersect the study area. Numerous minor, ephemeral drainage lines intersect the study area. The study area does not occur in any Public Drinking Water Reserves.

No other vegetation associations or fauna habitats identified within the study area represent riparian habitat or have permanent water.

The Proposal is not considered to be at variance to this Principle.

4.7 Potential to cause appreciable land degradation

Native vegetation should not be cleared if the clearing of vegetation is likely to cause appreciable land degradation.

The Boolgeeda and Newman Land Systems are generally not prone to degradation and the system is not susceptible to erosion (van Vreeswyk *et al.* 2004). No weed species have been recorded from the study area, however, are likely to occur within the local area, especially along existing infrastructure corridors.

The Proposal is not considered to be at variance to this Principle.

4.8 Potential to impact on the environmental values of adjacent or nearby conservation areas

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 nearest conservation area is 68 km to the east of the study area, being Karijini National Park. Due to the separation and small scale, **the Proposal is not considered to be at variance to this Principle.**

4.9 Potential deterioration in the quality of surface or underground water

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.

The study area lies within the Ashburton groundwater subarea of the Pilbara (Department of Water and Environmental Regulation 2022). Caves Creek, a major creekline runs parallel with the northern study area boundary, however, does not intersect the study area. Numerous minor, ephemeral drainage lines intersect the study area. No permanent or semi-permanent water features occur in the study area. The study area does not occur in any Public Drinking Water Reserves Clearing of native vegetation in this area, given the pre-existing disturbances and infrastructure, is unlikely to cause deterioration in the quality of surface or underground water.

The Proposal is not considered to be at variance to this Principle.

4.10 Potential of clearing to cause, or exacerbate, the incidence or intensity of flooding

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

Following cyclonic activity, localised natural flooding events may occur in the Pilbara region. The application area is likely to naturally be affected by flood events during wet season rainfall events. The study area has areas of minor flowlines and stony plains, however the area is already heavily disturbed and fragmented. The proposed alignment of pipeline infrastructure along existing road corridors will result in minimal further changes that would cause or exacerbate the incidence of flooding.

The Proposal is not considered to be at variance to this Principle.

5. Conclusions

Rio Tinto's Proposal is to construct pipeline and associated infrastructure to recharge underground aquifers and mitigate the environmental impacts of dewatering operations on groundwater dependent ecosystems downstream of the Silvergrass mine. The study area covers an area of approximately 288 ha, with proposed clearing of 30 ha of native vegetation.

This desktop assessment has been based on numerous survey types and scales from previous studies between 2010-2021 to support an application for a native vegetation clearing permit. The flora, vegetation and fauna values identified and discussed in this report are not considered to be restricted to the study area, nor likely to be significantly impacted by the proposal.

Whilst both TEC and PEC values are located within close proximity to the study area, none of the vegetation mapped within the study area represents these communities. No priority flora were recorded within study area. However, two flora species (*Calotis squamigera* (P1) and *Ipomoea racemigera* (P2)) have potential to occur but due to the small scale of the proposal and existing disturbances, and vegetation associations not restricted to the study area, unlikely to pose a significant threat to these species' status.

The 'Debris slope/rocky outcrop' habitat mapped by Biologic (2021) on the western boundary of the study area may potentially contain significant microhabitats for threatened fauna species such as the northern quoll, Pilbara olive python, ghost bat and Pilbara leaf-nosed bat. This habitat, however, is a small proportion of the study area at less than 1 % and extends beyond the study area boundary. Threatened fauna have been recorded within and nearby the study area. These fauna species may pass through the study area at times, however, are unlikely to have specific dependence upon it, given that the area is heavily disturbed and adjacent to existing infrastructure corridors.

The landforms, vegetation and fauna habitats identified within the study area are well represented within the broader Hamersley sub-region of the Pilbara. Furthermore, based on this assessment, the proposal is unlikely to be at variance with any of the ten clearing principles under Schedule 5 of the EP Act.

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7. Appendices

Appendix 1: Results of NatureMap and EPBC Protected Matters database searches

Conservation listed fauna	Conservation status
Dasyurus hallucatus	EN
Macroderma gigas	VU
Rhinonicteris aurantia (Pilbara)	VU
Leggadina lakedownensis	P4
Leiopotherapon aheneus	P4
Notoscincus butleri	P4
Pseudomys chapmani	P4
Sminthopsis longicaudata	P4

Conservation listed flora	Conservation status
Hibiscus sp. Mt Brockman (E. Thoma ET 1354)	P1
Triodia sp. Silvergrass (P.-L. de Kock BES 00808)	P1
Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)	P1
Euphorbia inappendiculata var. *inappendiculata*	P2
Euphorbia inappendiculata var. *queenslandica*	P2
Teucrium pilbaranum	P2
Astrebla lappacea	P3
Eremophila magnifica subsp. *velutina*	P3
Euphorbia australis var. *glabra*	P3
Glycine falcata	P3
Gymnanthera cunninghamii	P3
Indigofera rivularis	P3
Iotasperma sessilifolium	P3
Ptilotus subspinescens	P3
Rostellularia adscendens var. *latifolia*	P3
Swainsona thompsoniana	P3
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	P3
Triodia basitricha	P3
Goodenia nuda	P4
Livistona alfredii	P4
Ptilotus mollis	P4
Rhynchosia bungarensis	P4

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 15-Aug-2022

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	8
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	8
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species			[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.			
Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area	In feature area
Macroderma gigas Ghost Bat [174]	Vulnerable	Breeding known to occur within area	In feature area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat likely to occur within area	In feature area
REPTILE			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Extra Information

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Blacksmith Pilbara Iron Ore Project	2011/6152	Controlled Action	Post-Approval	In buffer area only
Eliwana Iron Ore Mine Project, Pilbara region, WA	2017/8024	Controlled Action	Post-Approval	In buffer area only
Eliwana Railway Project, Pilbara region, WA	2017/8025	Controlled Action	Post-Approval	In buffer area only
Extension to Brockman Syncline Iron Ore Operations	2019/8518	Controlled Action	Assessment Approach	In feature area
Pilbara Iron Ore Project - Stage 2, Shire of Ashburton, Pilbara Region, WA	2015/7495	Controlled Action	Post-Approval	In buffer area only
Not controlled action				

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Brockman Syncline 4 Iron Ore Project	2005/2289	Not Controlled Action	Completed	In buffer area only
Eliwana Iron Ore Mine	2020/8749	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix 2: 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 study area from DEC database search results and/or from previous surveys of the study 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 study area. However:
        - The species has been recorded in proximity (<10 km) to the study area and occurs in similar habitat to that which occurs within the study area.
        - Core habitat and suitable landforms for the species occurs within the study 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 study area.
- Likelihood: Potential
    - The species has not previously been recorded from within the study area. However:
        - Targeted surveys may locate the species based on records occurring in proximity to the study area (10-20 km) and suitable habitat occurring in the study area.
        - The study 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 study area by a previous consultant survey or there is historic evidence of species occurrence within the study 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 study 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 study area through DBCA database searches.
- The species has not been recorded in the study area despite adequate survey efforts, such as a standardised methodology or targeted searching within potentially suitable habitat.

Appendix 3: 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 4: Framework for conservation significance ranking of flora and fauna species

Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

The *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 (for example, CAMBE, JAMBA, RoKAMBA, and 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 (CE)
- Endangered (EN)
- Vulnerable (VU)
- 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).

Environmental Protection Act 1986 (WA)

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. The EP 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.

Part V of the EP Act is administered by the Department of Water and Environmental Regulation (DWER). Clearing of native vegetation in Western Australia requires a permit from the DWER, 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.

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).

***Biodiversity Conservation Act 2016* (WA)**

On 1 January 2019, the *Biodiversity Conservation Act 2016* (BC Act) 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 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.

All native flora in Western Australia were protected under the state *Wildlife Conservation Act 1950*, and now under the BC Act. Under the BC Act, native flora can be specially protected, listed as Threatened (Critically Endangered, Endangered or Vulnerable) or Extinct in Western Australia. Threatened flora listings are reviewed annually and are published in the *Wildlife Conservation (Rare Flora) Notice 2018*. Flora species that may be rare or threatened in Western Australia, but have not been adequately surveyed for, are included in a supplementary Priority Flora list.

These conservation codes are attached below.

***Biosecurity and Agriculture Management Act 2007* (WA)**

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; and
- 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.

DAFWA 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.

CONSERVATION CODES

For Western Australian Fauna and Flora

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species[3] under Part 2 of the *Biodiversity Conservation Act 2016.*

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T Threatened species

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is the species of fauna that are listed as critically endangered, endangered or vulnerable threatened species.

Threatened flora is the species of flora that are listed as critically endangered, endangered or vulnerable threatened species.

The assessment of the conservation status of threatened species is in accordance with the BC Act listing criteria and the requirements of Ministerial Guideline (Number 1) and Ministerial Guideline (Number 2) that adopts the use of the International Union for Conservation of Nature (IUCN) Red List of Threatened Species Categories and Criteria[4], and is based on the national distribution of the species.

CR Critically endangered species

Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.

Examples of use:

- The western ringtail possum (*Pseudocheirus occidentalis*) is listed as a critically endangered threatened species under the *Biodiversity Conservation Act 2016.*
- Western ringtail possum is listed as critically endangered under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: CR.

EN Endangered species

Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines.

Examples of use:

- *Caladenia hopperiana* is listed as an endangered threatened species under the *Biodiversity Conservation Act 2016.*
- *Caladenia hopperiana* is listed as endangered under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: EN.

VU Vulnerable species

Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines.

Examples of use:

- The forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*) is listed as a vulnerable threatened species under the *Biodiversity Conservation Act 2016.*
- Forest red-tailed black cockatoo is listed as vulnerable under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: VU.

Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

EX Extinct species

Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Examples of use:

- *Acacia kingiana* is listed as an extinct species under the *Biodiversity Conservation Act 2016.*
- *Acacia kingiana* is listed as extinct under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: EX.

EW Extinct in the wild species

Species that *"is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no fauna or flora species listed as extinct in the wild.

SP Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered, or vulnerable) or extinct species under the BC Act cannot also be listed as specially protected species.

MI Migratory species

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Migratory species include birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA)[5], China (CAMBA)[6] or The Republic of Korea (ROKAMBA)[7], and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention)[8], an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Examples of use:

- The wedge-tailed shearwater (*Ardenna pacifica*) is listed as a specially protected migratory species under the *Biodiversity Conservation Act 2016.*
- Wedge-tailed shearwater is listed as migratory under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: MI.

CD **Species of special conservation interest (conservation dependent)**

Species of special conservation need that are dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Currently only fauna are listed as species of special conservation interest.

Examples of use:

- The wambenger, south-western brush-tailed phascogale (*Phascogale tapoatafa wambenger*) is listed as a specially protected species of special conservation interest under the *Biodiversity Conservation Act 2016.*
- Wambenger, south-western brush-tailed phascogale, is listed as conservation dependent under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: CD.

OS **Species otherwise in need of special protection (other specially protected)**

Species otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Currently only fauna are listed as species otherwise in need of special protection.

Examples of use:

- The dugong (*Dugong dugon*) is listed as a specially protected species otherwise in need of special protection under the *Biodiversity Conservation Act 2016.*
- Dugon is listed as other specially protected fauna under the *Biodiversity Conservation Act 2016.*
- Listing reference in a table: column heading: BC Act, row text: OS.

P **Priority species**

Priority is not a listing category under the BC Act.

All fauna and flora are protected in WA following the provisions in Part 10 of the BC Act. The protection applies even when a species is not listed as threatened or specially protected, and regardless of land tenure (State managed land (Crown land), private land, or Commonwealth land).

Species that may possibly be threatened species that do not meet the criteria for listing under the BC Act because of insufficient survey or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of prioritisation for survey and evaluation of conservation status so that consideration can be given to potential listing as threatened.

Species that are adequately known, meet criteria for near threatened, or are rare but not threatened, or that have been recently removed from the threatened species list or conservation dependent or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of priority status is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1 **Priority 1: Poorly-known species - known from few locations, none on conservation lands**

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, for example, agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation.

Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements for threatened listing and appear to be under immediate threat from known threatening processes. These species are in urgent need of further survey.

Examples of use:

- *Borya stenophylla* is listed as a Priority 1 species by the Department of Biodiversity, Conservation and Attractions.
- *Borya stenophylla* is listed as Priority 1 on the DBCA Priority Flora List.
- Listing reference in a table: column heading: DBCA, row text: P1.

2 Priority 2: Poorly-known species - known from few locations, some on conservation lands

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, for example, national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation.

Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements for threatened listing and appear to be under threat from known threatening processes. These species are in urgent need of further survey.

Examples of use:

- *Caladenia nivalis* is listed as a Priority 2 species by the Department of Biodiversity, Conservation and Attractions.
- *Caladenia nivalis* is listed as Priority 2 on the DBCA Priority Flora List.
- Listing reference in a table: column heading: DBCA, row text: P2.

3 Priority 3: Poorly-known species - known from several locations

Species that are known from several locations and the species does not appear to be under imminent threat or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat.

Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. These species need further survey.

Examples of use:

- *Acacia nitidula* is listed as a Priority 3 species by the Department of Biodiversity, Conservation and Attractions.
- *Acacia nitidula* is listed as Priority 3 on the DBCA Priority Flora List.
- Listing reference in a table: column heading: DBCA, row text: P3.

4 Priority 4: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as a conservation dependent specially protected species.

(c) Species that have been removed from the list of threatened species or lists of conservation dependent or other specially protected species, during the past five years for reasons other than taxonomy.

(d) Other species in need of monitoring.

Examples of use:

- *Banksia aculeata* is listed as a Priority 4 species by the Department of Biodiversity, Conservation and Attractions.
- *Banksia aculeata* is listed as Priority 4 on the DBCA Priority Flora List.
- Listing reference in a table: column heading: DBCA, row text: P4.

[1] The definition of flora includes algae, fungi, and lichens.

[2] Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

[3] Schedules are not referred to when stating the listing status of threatened, extinct or specially protected species under the BC Act. See the examples provided under each listing category.

[4] Western Australia has assigned species to threat categories using the *IUCN Red List of Threatened Species Categories and Criteria* since 1996 (referencing all criteria). At the national level, threatened species listings under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) reference only some of the IUCN criteria (http://www.environment.gov.au/biodiversity/threatened/nominations/forms-and-guidelines).

[5] JAMBA - first included in the WA migratory species list in 1980.

[6] CAMBA - first included in the WA migratory species list in 2010.

[7] ROKAMBA - first included in the WA migratory species list in 2010.

[8] Bonn Convention (Birds) - first included in the WA migratory species list in 2015.

Appendix 5: 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 Rio Tinto 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 2016a);
- Technical Guidance – Sampling methods for terrestrial vertebrate fauna (EPA 2016b);
- Environmental Factor Guideline – Terrestrial fauna (EPA 2016c);
- Environmental Factor Guideline – Flora and vegetation (EPA 2016d); and
- Technical Guidance – Terrestrial fauna surveys (EPA 2020).

Rio Tinto Iron Ore Operational Controls

Rio Tinto Iron Ore 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.