

# South Walker Creek Mulgrave Resource Access: Stage 2C (MRA2C)

EPBC 2017-7957

Appendix E: Ecological Impact Study



## Mulgrave Stage 2C Ecological Impact Study

Assessment of Matters of National Environmental Significance

Prepared for **BHP** 

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## Abbreviations

Abbreviation	Description	
BMC	BHP Billiton Mitsui Coal	
DoEE	Commonwealth Department of the Environment and Energy	
EA	Environmental Authority	
ELA	Eco Logical Australia Pty Ltd	
EPBC	Environment Protection and Biodiversity Conservation Act 1999 (Clth)	
ERE	Endangered Regional Ecosystems	

Abbreviation	Description	
ESA	Environmentally Sensitive Area	
GIS	Geographic Information System	
GPS	Geographical positioning system	
ML	Mining Lease	
MNES	Matters of National Environmental Significance	
MRA	Mulgrave Resource Access	
RE	Regional Ecosystem	
REDD	Regional Ecosystem Description Database	
SWC	South Walker Creek	
TEC	Threatened Ecological Community	
VM Act	Vegetation Management Act 1999	

## **Executive summary**

South Walker Creek (SWC) Mine is a BHP Billiton Mitsui Coal (BMC) owned and operated open cut coal mine located in the Northern Bowen Basin subregion of Central Queensland. To allow for continued development of the coal resource, the Mulgrave Pit located in the north-central portion of the mine's operational land has been identified as requiring further progression. Referred to as MRA Stage 2C (Project), the project will encompass approximately 1,279 ha of land disturbance, which includes disturbance associated with diversion of about 8km of Walker Creek, progressive mining of the Mulgrave coal resource, and associated works.

Matters of National Environmental Significance (MNES) protected under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) have been previously identified in ecological studies across the project disturbance footprint. This included:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (TEC)
- One threatened flora species Black Ironbox (*Eucalyptus raveretiana*)
- Four threatened fauna species South-eastern Long-eared Bat (*Nyctophilus corbeni*); Koala (*Phascolarctos cinereus*), Ornamental Snake (*Denisonia maculata*) and Squatter Pigeon (*Geophaps scripta scripta*)

Current database searches confirmed the potential presence of these MNES values as well as an additional three threatened species and ten migratory species. Recently de-listed MNES values previously identified were also confirmed in the current database results.

Based on additional field validation surveys, the following MNES values or associated habitat were confirmed within the project disturbance footprint of MRA Stage 2C:

- Brigalow TEC
- Black Ironbox
- Habitat for Koala, Ornamental Snake, Greater Glider (*Petauroides volans*) and Squatter Pigeon

Further analysis identified critical habitat for the Brigalow TEC, as well as critical habitat and an important population of Ornamental Snake within the MRA Stage 2C disturbance footprint. The determination of critical habitat for the Brigalow TEC is attributed to the extent of area that the study area provides for the endangered ecological community. For the Ornamental Snake, the presence of high value habitat within the disturbance footprint and nearby confirmed records determined both critical habitat and an important population of the species.

Koala and Greater Glider were both confirmed to be present within the study area during field assessments in 2018. The presence of these species and the types of habitat present (including high density tree hollows), suggests the study area supports important populations and habitat critical to the survival of both species.

The occurrence of Black Ironbox and Squatter Pigeon were not determined to be part of an important population as larger habitat areas with the ability of supporting a source population occur outside of the disturbance footprint and within the surrounding region. Habitat for these species within the project disturbance footprint was also not determined to be critical due to the availability of higher quality habitat in the surrounding area and therefore the ability of the species to still persist in the surrounding region. No species were considered to be near the limit of their range.

The level of dependency that Black Ironbox has on groundwater sources at SWC Mine is also not considered to be high. The interaction with groundwater is likely to be intermittent, seasonally and situationally dependent at best. Due to the lower level of reliance on groundwater, the severity of threat of potential groundwater drawdown is considered to be low.

Based on these determinations and/or potential disturbance limits associated with the project, significant impacts were assessed to be likely for Brigalow TEC, Ornamental Snake, Koala and Greater Glider. The implementation of mitigation measures will limit the severity and magnitude of significant impacts; however residual impacts will remain significant. Significant residual impacts associated with MRA Stage 2C are:

- Clearing of Brigalow TEC 32.7 ha
- Ornamental Snake habitat clearing- 33.7 ha
- Koala habitat clearing 212.2 ha
- Greater Glider habitat clearing 149.3 ha

In accordance with the EPBC Act, the residual significant impacts for these MNES values will be offset as per the EPBC Act Environmental Offset Policy.

## 1 Introduction

## 1.1 Project Background

South Walker Creek (SWC) Mine is a BMC operated open cut coal mine located in the Northern Bowen Basin subregion of Central Queensland, approximately 125 km south-west of Mackay within the Isaac Regional Council Local Government Area (herein referred to as the Project Area) (**Figure 1**).

The mining activities at SWC operate under Environmental Authority (EA) MIN100552107, and are conducted on Mining Lease (ML) 4750 across five active pits. The Mulgrave Pit is located in the north-central portion of the mine's operational land and has been identified in the mid-long term mine planning process as requiring further progression to allow for continued development of the coal resource.

An earlier progression project extending 778 ha from the western boundary of the Mulgrave Pit (MRA Stage 2A) has previously been referred to the Department of the Environment and Energy (DoEE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) referral process (EPBC 2014/7272). The proposed action was decided to be a "controlled action" in 2014, with relevant controlling provisions relating to listed threatened species and communities (sections 18 & 18A). The proposed action was assessed and approved with conditions under the EPBC Act on 16 January 2015.

The current progression project, referred to as MRA Stage 2C, will encompass 1,279 ha of land disturbance within the total study area of 1,775.8 ha. The MRA2C Project Area overlaps the approved MRA2A (2014/7272) Project Area by approximately 98 ha.

Much of the MRA2C area has been previously disturbed by grazing activities; however the proposed activity will require clearing of some previously undisturbed vegetation and the diversion of Walker Creek, which currently traverses through the Project Area.

This ecological impact assessment has been prepared to identify and quantify likely impacts to ecologically related MNES within the MRA Stage 2C 'study area' (**Figure 1**).

## 1.1.1 EPBC Act process to date

The project was referred to the Department of the Environment and Energy (DoEE) in June 2017 and was determined to be a controlled action (EPBC2017/7957). The controlling provisions were listed as threatened species (section 18 and 18A) and protection of water resources (i.e. 'the water trigger' section 24D and 24E).

Further assessment via Preliminary Documentation (PD) is required and DoEE has provided a list of additional information requirements that should be addressed in the PD. Relevant to this report, are a number of threatened species, as well as potential groundwater dependent ecosystems (GDEs).

## 1.2 Objectives and Scope of Works

The objective of this assessment is to identify and quantify potential impacts associated with the project on ecological values, specifically MNES protected under the EPBC Act. The assessment includes both desktop and existing information previously reported for the area as well as additional field verified data.

Scope of works specific to this objective include:

• Reviewing and confirming the suitability of previous ecological studies in determining the presence of MNES values within the study area

- Confirming the type and extent of vegetation communities and habitats within the study area
- Validating the habitat values, particularly in relation to supporting previously identified threatened species as well as species recently listed under the EPBC Act
- Assessing the condition and extent of Threatened Ecological Communities (TECs) that have been reported as occurring within the study area
- Collecting population data on previously identified threatened flora species
- Undertaking targeted threatened species assessments for a number of species highlighted by DoEE as being potentially impacted by the project
- Evaluating potential presence of Groundwater Dependent Ecosystems (GDEs) and associated ecological values
- Determining the likelihood of significant impacts to MNES
- Providing avoidance, mitigation and management strategies to reduce the severity and magnitude of potential impacts
- Evaluating significant residual impacts and developing an environmental offsets strategy that will sufficiently compensate for the impacts

## 1.3 Study Area

The study area includes both the project and surrounding adjacent areas and is located within the southern portion of ML 4750 (granted in 1978) and a small area in the northern portion of ML70131 (granted in 1996) (**Figure 1**). The study area encompasses approximately 1,775.8 ha of land and is divided into three areas – a northern, central and southern area. The central area is the largest component of the study area and is bounded by the existing Mulgrave pit and haul road to the north and east, Central Pit to the south-east, Carborough Creek to the north-west and the mine lease boundary to the west. The northern area is surrounded by a current grazing lease and the southern area is bounded by the north by Walker Creek, to the east by rail and to the south and west by operational mining land. The study area falls within Surface Areas 1,2,4 and 5 formally described as Lot 7 on SP155252, Lot 2 on SP162563 and Lot 2 on WHS16.

The study area is predominantly vegetated and consists of remnant and regrowth vegetation as well as cleared areas. Walker Creek and associated drainage lines traverse through the central portion the study area. Existing mine site infrastructure within the study area includes powerline easements, easement and exploration access tracks, fugitive emission drainage facility and dragline road.

## 1.3.1 Project Disturbance Footprint

The Project will require the disturbance of approximately 1,279 ha of land for mine pit extension, diversion of approximately 8 km of Walker Creek, levee, northern and southern water storage dam development, and associated works (**Figure 1**).

Previously studies have been conducted on the watercourse diversion for Walker Creek, which has resulted in the preferred option of utilising an existing tributary of Walker Creek to divert water flows. The diversion is about 8 km long and has been designed to be a functioning and sustainable diversion that meets regulatory requirements. The creek diversion will connect to Carborough Creek, directly adjacent to the approved and developed MRA Stage 2A diversion and make the new confluence with Walker Creek about 6.4 km downstream from its current confluence. An overland flow bund will be constructed along the south-western length of the diversion channel with associated batter drains to receive overland flow runoff. Levees will be required at sections along the north-eastern length of the diversion channel to retain functionality of the diversion.

The expansion of the Mulgrave pit will involve clearing of vegetation and the continuation of mining activities in the Mulgrave Pit via south-west migration of the existing highwall. Associated mine related infrastructure will disturb vegetation, including for an approximate 2GL water storage dam in the south of the Project Area, and an approximately 0.5GL water storage in the northern.

## Figure 1: Study area and location







EPBC approved area (MRA Stage 2A) Walker Creek

1,100 Metres Datum/Projection: GDA 1994 MGA Zone 55 Ν



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Prepared by: RW Date: 03/05/2018 mentation\mxd\Prelim Doc\Fig1\_MRA2C Study Area.m N:\17BRI\GIS\8852 MRA2C Preliminary Doc

## 2 Method

This report has been developed over several iterations between 2016 and 2018 to accommodate the requirement of the EPBC Act assessment and approvals process. It has included a desktop assessment to evaluate available literature and data (e.g. database searches) as well as the review of a number of previous field assessments undertaken within and around the study area. Three field surveys have also been undertaken in 2016, 2017 and 2018 to specifically investigate particular aspects of the ecology of the study area. The methods for both the desktop and field assessments are detailed below.

## 2.1 Desktop Assessment

A desktop assessment and review of previous ecological studies, as well as associated literature, was undertaken to evaluate existing data and identify the presence of information gaps relating to MNES within the study area.

## 2.1.1 Databases

The following databases were reviewed to determine potential MNES values occurring within the study area:

- Protected Matters Search Tool (PMST) Report from a central coordinate of -21.77785, 148.47047 (10 km buffer)<sup>1</sup>
- Wildlife Online Search from a central coordinate of -21.77785, 148.47047 (10 km buffer)
- Protected Plants Flora Survey Trigger Map
- Regional Ecosystem (RE) mapping version 9.0
- Queensland geological digital data, Clermont mapping tile (DNRM, 2012)
- Isaac-Comet land-systems mapping (CSIRO, 1967)
- Essential Habitat mapping
- Referrable Wetland mapping
- Environmentally Sensitive Area (ESA) Map
- Vegetation Management Act 1999 (VM Act) watercourse data
- Matters of State Environmental Significance mapping
- VM Act wetland data
- GDE Atlas
- Queensland GDE mapping
- Atlas of Living Australia species search

## 2.1.2 **Previous Studies**

Five previous ecological studies have been conducted within or within close proximity to the study area. These previous ecological studies, including associated mapping and data, were reviewed in order to confirm their suitability in determining the presence of MNES values within the study area. This also included cross-checking results with database results (**Section 2.1.1**). Each previous study and survey effort has been summarised in **Table 2-1**.

<sup>&</sup>lt;sup>1</sup> A number of PMST searches have been undertaken over the course of the project. The latest was undertaken on 8 May 2018 and provides the most up to date list of threatened and migratory species relevant to the project

Previous Study Aim		Method & Survey Effort	
Threatened Terrestrial Fauna Species Assessment Report for Mulgrave Pit Expansion Project (Footprints Environmental Consultants, 2013)	The survey focused on determining the presence of EPBC Act or NC Act listed species identified as potential occurrences.	<ul> <li>Targeted threatened fauna species surveys were undertaken within the study area during 5<sup>th</sup> – 14<sup>th</sup> April and 22<sup>nd</sup> – 26<sup>th</sup> April 2013. The survey methods and effort were reported to be in accordance with the Commonwealth threatened species survey guidelines. Survey techniques utilised in the survey included: <ul> <li>Brigalow Scaly-foot – pits &amp; areas searches five pits / three nights</li> <li>Yakka Skink – area searches, Elliott trapping, three days / three nights</li> <li>Ornamental Snake – nocturnal area searches (throughout survey period)</li> <li>Red Goshawk – 80 hrs over 10 days</li> <li>Squatter Pigeon – 15 hrs of area searches, 10 hours of flushing</li> <li>Cotton Pygmy-goose – waterbody survey (throughout survey period)</li> <li>Little Pied Bat – active and passive searches, harp trapping (20 traps), Anabat (six nights, nine locations)</li> <li>Greater Long-eared Bat – harp trapping (20 traps), Anabat (six nights, nine locations)</li> </ul> </li> </ul>	
Walker Creek Diversion Biodiversity Assessment Report – Stage 1 (Cardno, 2012a)	Assess biodiversity values within the study area and associated environmental constraints (Commonwealth and State).	The study area incorporated a 100 m wide buffer area either side of the high bank of Walker and Carborough Creeks (totalling 17 km). The assessment included both desktop and a field survey conducted from 14 <sup>th</sup> – 16 <sup>th</sup> March 2012.	
Walker Creek Diversion Biodiversity Assessment Report – Stage 3 (Cardno, 2012b)	Assess ecological values of terrestrial habitats within mining lease of South Walker Creek Mine (ML 4750)	The assessment included desktop searches and a field survey conducted from 23rd – 28th April 2012, to review terrestrial vegetation communities and the distribution of significant species within the study area. Vegetation communities were recorded in accordance with Neldner <i>et al</i> 2012, whilst significant flora recognised as being of conservation significance at the Commonwealth and / or State level were recorded.	
South Walker Mine Biodiversity Assessment – Bee Creek Section (Cardno, 2012c)	Quantify the presence of Black Ironbox ( <i>Eucalyptus</i> <i>raveretiana</i> ) along a 4.3 km section of Bee Creek	A two day survey ( $5^{th} - 6^{th}$ June 2012) along Bee Creek. The survey area extended 100 m either side of the centre line of the creek. The survey was undertaken in order to gain an understanding of potential biodiversity offset	

## Table 2-1: Summary of Previous Studies

Previous Study	Aim	Method & Survey Effort
		options should disturbance to Black Ironbox be proposed along Walker Creek (upstream of Bee Creek).
Koala Kemmis II (Vital Signs Environmental Services, 2014)	Assess Koala presence and utilisation across the Kemmis II project area (approximately 7.5km north-west of MRA2C) and in surrounding area, including east of Walker Creek within MRA2C study area.	A four day (July 2014), two person field survey adopting the 'Koala Rapid Assessment Methodology' where direct sightings, and indirect evidence e.g. faecal evidence, scratches, were recorded across 30 x 2,000m <sup>2</sup> quadrats that represented all vegetation community types within the project area.

## 2.1.3 Literature Review

Database searches and previous studies informed an assessment of the MNES values likely to occur within the study area. From this list, further information was obtained on each MNES. The literature reviewed included:

- Relevant previous ecological studies listed in Table 2-1
- Species Profile and Threats Database (SPRAT), to determine the distribution, habitat requirements, population statistics and ecology of each species identified
- Survey guidelines for Australian's threatened reptiles (for the Ornamental Snake)
- National Koala Conservation Management Strategy 2009-2014
- EPBC Act Referral Guidelines for Vulnerable Koala (2014)
- Commonwealth Conservation Advice and / or Commonwealth Listing Advice, for each threatlisted species identified in the desktop assessment
- Priority Threat Management for Imperilled Species of the Queensland Brigalow Belt (Ornamental Snake, Koala and Squatter Pigeon)
- Species Management Program Koala. (Transport and Main Roads, Queensland Government, 2015)
- Australian Koala Foundation (AKF) National Koala Tree Planting List (2015)
- Draft Assessing Groundwater-Dependent Ecosystems: IESC Information Guideline Explanatory Note (2018)
- Commonwealth Significant Impact Guidelines (Version 1.1).

#### 2.2 Field Survey

Three field surveys were undertaken to develop this report. Each survey was undertaken by two qualified ecologists and included a number of survey techniques. The details of each survey are provided in **Table 2-2**, with details of specific survey elements provided in the sections below. Survey sites are illustrated in **Figure 2 and Figure 3**.

Field survey & dates	Purpose	Survey techniques
2016 – 4 to 8 May	Address information gaps identified in the desktop analysis (incl. updates to threatened species listings)	Flora, TEC and targeted habitat assessments

#### Table 2-2: Field survey program

2017 – 20 to 21 April	Assess additional impact areas	Flora, TEC and targeted habitat assessments
2018 – 9 to 13 February	Undertaken targeted threatened fauna surveys, particularly for species of interest to DoEE	Targeted threatened fauna species surveys

## 2.2.1 Flora Assessment

Information gaps identified in the previous studies included no population data on previously recorded threatened flora species and the lack of detailed vegetation mapping with associated condition rating, including TEC status. These gaps were addressed in the flora assessment during the field surveys.

#### Targeted Flora Survey

A targeted flora survey to record individuals of Black Ironbox was undertaken along a 7 km section of Walker Creek in order to determine the extent and density of the species. The search was restricted to the riparian zone of Walker Creek as well as instream bars.

Direct counts of identified Black Ironbox individuals were taken using hand-held GPS units. Fertile material (fruit) was present to confirm the species identification. Accuracy of the GPS units at the time of the survey was noted to be  $\pm 5$  m.

### Site Condition Assessments

In accordance with the BioCondition Assessment Manual 'A Condition Assessment Framework for Terrestrial Biodiversity in Queensland' (Eyre, T.J. et al 2015), 25 site condition assessments were conducted across 16 assessment units identified on site. Assessment units were based on ground-truthed vegetation communities within the study area that had associated MNES values.

Site condition assessments involved the collection of the following eight site based attributes within a 100 m x 50 m nested sampling plot:

- Large trees
- Tree canopy height
- Recruitment of dominant canopy species
- Native species richness
- Tree canopy cover
- Native shrub cover
- Course woody debris
- Ground cover (native shrub, grass, forbs, non-native cover and organic litter cover)

#### Quaternary surveys

Quaternary surveys were conducted to validate the extent, classification and condition of ground-truthed vegetation communities and habitat types within the study area, as well as increase spatial coverage of the survey. Quaternary surveys were undertaken in accordance with the '*Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*' (Nelder *et. al.* 2012). At each survey point, the following information was recorded:

- RE classification
- Vegetation status (remnant, high-value regrowth or non-remnant).

A total of 191 quaternary surveys were conducted across the study area.

## TEC Assessments

Specific condition assessments were conducted for Brigalow patches to determine whether patches met the thresholds for classification as the TEC, which had not been previously recorded. Assessments were conducted in accordance with condition thresholds outlined within the *Approved Conservation Advice for the Brigalow (dominant or co-dominant) Ecological Community* (DoE, 2013). Thresholds included, species composition of patches (dominance or co-dominance of *Acacia harpophylla*) and species condition including patch size and percentage exotic perennial grass cover.

A total of nine TEC assessments were conducted across the study area.

## 2.2.2 Targeted Habitat Assessments

To further confirm and validate threatened fauna species values within the study area, targeted habitat assessments were conducted for the Squatter Pigeon (*Geophaps scripta scripta*), Koala (*Phascolarctos cinereus*) and Ornamental Snake (*Denisonia maculata*) to quantify the extent of habitat within the study area. Targeted habitat assessments were not conducted for the Greater Glider during the May 2016 survey, as the survey occurred prior to the species listing under the EPBC Act. Targeted Greater Glider habitat assessments were conducted during the April 2017 survey. Habitat assessments were species specific and included identifying the presence of key values such as:

- Habitat condition (i.e. remnant or regrowth)
- Presence of foraging resources (e.g. Koala food trees)
- Presence and proximity to water
- Soil type
- Occurrence of species specific habitat features (deep cracking clays, gilgai, percentage of bare ground and native vegetation cover)
- Species specific threats

For Greater Glider habitat assessments, tree hollow density quadrats (50 x 100 m) were conducted in areas of suitable habitat. Within the quadrat, total number of small (<8 cm), medium (8 to 15 cm) and large (>15 cm) hollows were counted and recorded. Density data was used to map areas of suitable denning habitat.

A total of 24 Squatter Pigeon, 27 Koala, six Ornamental Snake and 32 Greater Glider targeted habitat assessments were conducted. **Appendix A** describes the targeted habitat assessment criteria considered for each species. Species specific habitat attributes targeted during the field survey was from relevant literature for each species (**Section 2.1.3**).

## 2.2.3 Targeted fauna survey

Further field surveys were undertaken in February 2018 to provide additional information for key threatened species that were highlighted by DoEE as having the potential to be impacted by the project. Review of the list of species provided by DoEE in the information request (provided by DoEE to BHP on 25 October 2017) was undertaken and it was deemed necessary to undertake targeted threatened species surveys for Greater Glider and Star Finch (*Neochmia ruficauda*).

## Greater Glider

Survey Guidelines for Threatened Mammals recommend the following for Greater Glider:

- Spotlighting
  - At least two 200 m transects per 5 ha site within suitable habitat (at least 100 m apart)

- Repeated over two separate nights
- Stag watch
  - Observe a potential shelter site (hollow) 30 minutes before dusk and 60 minutes after sunset.

For this survey, spotlighting was conducted over four consecutive nights, for a minimum of two hours by two qualified ecologists, equating to a total survey effort of 16 spotlighting hours. Spotlighting transects included a combination of driving and walking. Where suitable habitat was present alongside driving tracks, these areas were driven at slow speed and eye-shine searched for by two ecologists. Walking transects were also conducted within and alongside of Walker Creek. Any eye-shine that was detected was investigated to confirm species. Stag watches were conducted at the beginning of each spotlighting evening (30 minutes before sunset).

### Star Finch

EPBC Act Survey Guidelines for Threatened Birds (DEWHA 2010) recommends the following survey effort for Star Finch:

- Area searches or transect-point surveys (15 hours over five days)
- Broadcast surveys (15 hours over three days)
- Targeted waterhole surveys (10 hours over four days)

A combination of all survey types was conducted over six days by two qualified ecologists. The site was initially searched for dam sites or any areas of Walker Creek that may be holding water where targeted surveys were conducted either early morning or late evening. Transect surveys were conducted throughout the day within riparian and open woodland habitats. Broadcast surveys were conducted using calls available on the eGuide to The Birds of Australia (Morecombe & Stewart 2014) phone application. Total survey effort for each survey technique equated to the following:

- Transect bird survey 30.5 hours over six days
- Broadcast surveys 15.5 hours over five days
- Targeted surveys 16.5 hours over five days

## 2.3 Data Analysis

#### 2.3.1 GIS Analysis

Spatial data collected during the field survey was imported into ArcMap GIS (Version 10.2) and analysed. Where necessary, vegetation community and habitat boundaries were refined using the collected spatial data to produce a final ground-truthed map.

This mapping was then used to undertake a landscape-scale attribute assessment to provide a quantitative assessment of the landscape values of the study area as well as an overall condition score for each assessment unit as per Eyre *et.al.* (2015).

#### Landscape-scale Attributes Assessment

In accordance with the BioCondition Assessment Manual, landscape-scale attributes were assessed within a 'Fragmented Landscape'. Attributes calculated included:

- Patch Size
- Connectedness
- Context

The spatial layers used to assess the site context attributes were:

- Ground-truthed vegetation mapping of the study area (ELA, 2016 and ELA, 2017)
- Regulated Vegetation Mapping (Version 9.0)

## 2.3.2 BioCondition Scoring

BioCondition scoring was conducted in accordance with Eyre *et. al.* 2015. This involved accumulating the site condition and landscape attributes score and dividing the total against the maximum score for the ecosystem type (i.e. woodland = maximum score of 100) to provide a total BioCondition score.

Benchmark data to complete the comparison value assessment for the site condition assessment was sourced from Queensland Herbarium prepared benchmarks for each assessment unit's ground-truthed RE (or closest RE benchmark within the same Broad Vegetation Group). Where multiple field survey sites were assessed for one assessment unit, site condition scores were averaged.

## Figure 2: Flora survey sites



## Legend

Mining Lease

Study area



- Quarternary sites
- BioCondition sites
- TEC assessment sites
- Threatened flora sites

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## Legend

## Fauna survey sites

- Mining Lease Study area
- Koala habitat assessment sites
- Ornamental Snake habitat assessment sites
- Squatter Pigeon habitat assessment sites
- Greater Glider habitat assessment sites
- Bird survey targeted waterhole watch ☆
- Bird survey area searches
- Hollow bearing tree density quadrats
- Spotlighting survey transects

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## 3 Desktop Assessment Results

## 3.1 Previous Ecological Assessments

Previous ecological studies across the study area identified a number of MNES values either as occurring or likely to occur. These included:

- Brigalow (Acacia harpophylla dominant and co-dominant) TEC
- One threatened flora species Black Ironbox
- Four threatened fauna species South-eastern Long-eared Bat (*Nyctophilus corbeni*); Koala, Ornamental Snake and Squatter Pigeon

MNES values considered unlikely to occur were so determined due to a lack of detection during field surveys or the absence of ground-truthed suitable habitat.

## 3.2 Database Results

Results from the desktop assessment confirmed the potential occurrence of MNES values identified in previous ecological assessments with the exception of two threatened species and five migratory species that have since been reclassified and are no longer listed under the EPBC Act. This includes the following species:

- Brigalow Scaly-foot (*Paradelma orientalis*)
- Finger Panic Grass (*Digitaria porrecta*)
- Australian Cotton Pygmy-goose (Nettapus coromandelianus albipennis)
- Cattle Egret (Ardea ibis)
- Great Egret (Ardea modesta)
- Rainbow Bee-eater (*Merops ornatus*)
- White-bellied Sea-eagle (Haliaeetus leucogaster)

In addition to this, four new threatened fauna species have been recently listed under the EPBC Act and identified as potentially occurring within the study area. These species are the Curlew Sandpiper (*Calidris ferruginea*; also listed as migratory), Greater Glider (*Petauroides volans*), Ghost Bat (*Macroderma gigas*) and the Southern Snapping Turtle (*Elseya albagula*). Furthermore, potential habitat for seven migratory species has recently extended to include the range of the study area. These species are the Common Sandpiper (*Actitis hypoleucos*), Sharp-tailed Sandpiper (*Calidris acuminata*), Pectoral Sandpiper (*Calidris melanotos*), Oriental Cuckoo (*Cuculus optatus*), Osprey (*Pandion haliaetus*) and Yellow Wagtail (*Motacilla flava*).

The full extent of desktop government database results are provided in **Appendix B.** The likelihood of occurrence for all threatened and migratory species identified on the current databases has been assessed, with the results provided in **Section 4.3** and **Section 4.5**.

# 4 Field Results

## 4.1 Vegetation Communities

The majority of the study area was found to comprise remnant vegetation (approximately 1,392.2 ha), in which 15 vegetation communities were ground-truthed (**Figure 4**). All ecosystem types present are wooded ecosystems, dominated by either *Eucalyptus, Corymbia* or *Acacia* species. This includes a Brigalow dominated community described as the listed Brigalow TEC RE 11.4.9. Vegetation communities ground-truthed within the study area are described in **Table 4-1** as per the Regional Ecosystem Description Database (REDD).

Vegetation communities were found to range in functional biodiversity condition, with some areas scoring within the highest BioCondition Class through to areas scoring within the medium Class of 3. However, the majority of vegetation communities (60%) within the study area were found to be in functional condition and a BioCondition Class of 2.

The higher BioCondition scoring for vegetation communities is predominantly attributed to the landscape context of the study area. Over 85% of the vegetation communities are part of a larger tract of vegetation (>200 ha of remnant vegetation) which continues outside of the study area. Connectivity and context of vegetation communities to other adjacent vegetation also ranged from medium to very high connectivity. However, at a site level the condition of the vegetation communities is reflective of the historical and on-going long-term grazing disturbances that are present within the study area. Extensive weed incursion occurs within the understorey of riparian communities along Walker Creek and portions of the Eucalypt woodland communities are in a state of regrowth and regeneration from previous thinning and clearing activities.

BioCondition Score and BioCondition Class for each vegetation community is provided in **Table 4.1**. Detailed BioCondition data is provided in **Appendix C**.

RE	Short Description	TEC RE*	BioCondition Score / Class**	
11.3.2	Eucalyptus populnea woodland on alluvial plains	82.75	-	0.81 / 1
11.3.25a	Riverine wetland or fringing riverine wetland. <i>Eucalyptus raveretiana, Melaleuca fluviatilis</i> woodland	66.66	-	0.69 / 2
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	_	0.53 / 3	
11.3.27	Freshwater wetlands	-	0.77 / 2	
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus spp</i> . woodland on alluvial plains	15.73		0.54/2
11.3.4a	Floodplain (other than floodplain wetlands). Corymbia tessellaris woodland.	244.49	_	0.5473
Analogous to 11.3.4a	Corymbia tessellaris open woodland.	8.32		-

Table 4-1: Ground-truthed vegetation communities within the study area

RE	Short Description	Area (ha)	TEC RE*	BioCondition Score / Class**
11.3.9	<i>Eucalyptus platyphylla, Corymbia spp</i> . woodland on alluvial plains	33.65	-	0.73 / 2
11.4.9	Acacia harpophylla shrubby woodland with Terminalia oblongata on Cainozoic clay plains	37.17	Brigalow	0.74 / 2
11.4.13	<i>Eucalyptus orgadophila</i> open woodland on Cainozoic clay plains	5.5	-	-
11.5.2a	Allocasuarina luehmannii low tree layer with or without emergent woodland.	11.33	-	0.87 / 1
11.5.3	Eucalyptus populnea +/- E. melanophloia +/- Corymbia clarksoniana woodland on Cainozoic sand plains and/or remnant surfaces	358.94	-	0.82 / 1
Analogous to 11.5.3	Eucalyptus populnea regrowth.	2.97	-	-
Analogous to 11.5.3 and 11.5.8b	Mix polygon (50/50%) comprising of <i>Eucalyptus populnea</i> and <i>E. platyphylla</i> regrowth.	blygon (50/50%) comprising of <i>Eucalyptus</i> thea and <i>E. platyphylla</i> regrowth.		0.62 / 2
11.5.8b	Corymbia clarksoniana, Eucalyptus exserta, E. crebra, E. tereticornis, E. platyphylla woodland with low tree layer dominated by Melaleuca viridiflora, M. nervosa, Allocasuarina littoralis, Grevillea banksii, Acacia flavescens +/- Acacia leiocalyx.	78.17	-	0.82 / 1
11.5.8c	<i>Eucalyptus platyphylla</i> woodland on white-yellow weathered sands, with grassy ground layer. Occurs on Quaternary sediments.	<i>ptus platyphylla</i> woodland on white-yellow ered sands, with grassy ground layer. 336.23 s on Quaternary sediments.		0.71 / 2
11.5.9	<i>Eucalyptus crebra</i> and other <i>Eucalyptus spp</i> . and <i>Corymbia spp</i> . woodland on Cainozoic sand plains and/or remnant surfaces	85.55	_	0.80 / 2
11.9.2	<i>Eucalyptus orgadophila</i> woodland on fine- grained sedimentary rocks	0.68	-	-
-	Eucalypt spp. Regrowth	1.96	-	-
Total		1,525.19	_	

\* TEC listed REs as per EPBC Act Conservation Advice

\*\*Rating of 1 (for 'functional' biodiversity condition) to 4 (for 'dysfunctional' biodiversity condition)

## 4.2 Threatened Ecological Communities

Two TECs were identified in the desktop assessment as potentially occurring within the study area, including:

- Brigalow (Acacia harpophylla dominant and co-dominant) endangered community
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

Field surveys only identified the listed Brigalow TEC RE11.4.9 within the study area. This RE was ground-truthed to be in remnant condition and comprising patches >0.5 ha in size.

Further assessment of the other key diagnostic and condition thresholds during the survey determined four patches of RE11.4.9 to be dominated by *A. harpophylla* and with an exotic perennial groundcover of <50%. These patches were validated to meet TEC status (**Figure 4**). Additional patches of RE11.4.9 were found to be dominated by *Casuarina cristata* (Belah) and therefore did not meet the key diagnostic criteria for the Brigalow TEC.

The findings of the Brigalow TEC assessments across the study area are provided in Appendix D.

## 4.3 Threatened Flora Species Presence

The current database results identified five threatened flora species as potentially occurring within the study area. Of these five species, one was identified as occurring within the study area, whilst the remaining four were considered unlikely due to the lack of associated vegetation communities and soil substrates (**Table 4.2**).

The identified threatened species, Black Ironbox, was located along portions of Walker Creek's riparian zone. Targeted surveys along Walker Creek identified 525 individuals (both mature and immature) within a 6.8 km section within the study area. The species was recorded throughout the majority of the length of Walker Creek downstream of the confluence with Carborough Creek, however, the species was found to be absent along a 2 km reach of the creek. A particularly dense patch within the far westerly section of the creek was identified that contained over 100 individuals over ~370 m. The location of the species is illustrated in **Figure 4**.

The riparian vegetation in which the species was recorded was ground-truthed as RE 11.3.25a, described in short as *Eucalyptus raveretiana, Melaleuca fluviatilis* woodland. In some locations, the species was codominant with *Melaleuca* species, Queensland Blue Gum (*E. tereticornis*) and River Red Gum (*E. camaldulensis*). The ecosystem was noted to be heavily invaded by an introduced grass, Guinea Grass (*Megathyrsus maximum*). This exotic species has the potential to impact on germination and growth success for Black Ironbox seeds and saplings along Walker Creek through shading and outcompeting of resources.

It should be noted that field validation of vegetation communities and habitat values did not detect any significant inconsistencies with previous likelihood assessments conducted as part of the preceding studies (**Table 4.2**).

## Table 4-2: Likelihood of occurrence results for threatened flora species

	FPBC		Likelihood of Occurrence Assessment <sup>2</sup>		
Species	Act Status <sup>1</sup>	Habitat*	Previous assessment	Current assessment	Justification

#### Flora

Black Ironbox Eucalyptus raveretiana	V	Black Ironbox occurs on the banks of rivers, creeks and other watercourses, on clayey or loamy soil (TSSC 2008).	Known	Known	Species recorded along Walker Creek within the study area.
Bluegrass Dichanthium setosum	V	<i>Dichanthium setosum</i> is associated with heavy basaltic black soils and stony red-brown hardsetting loam with clay subsoil and is found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture. The extent to which this species tolerates disturbance is unknown (TSSC 2008).	Unlikely	Unlikely	The study area does not contain soils derived from either basalt or fine-grained sedimentary rock.
Cycas ophiolitica	E	<i>Cycas ophiolitica</i> grows on hills and slopes in sparse, grassy open forest at altitude ranges from 80–400 m above sea level. Although this species reaches its best development on red clay soils near Marlborough, it is more frequently found on shallow, stony, infertile soils, which are developed on sandstone and serpentinite (DoE 2015).	Unlikely	Unlikely	The study area does not contain soils derived from sandstone and serpentinite.
King Blue-grass Dichanthium queenslandicum	E	King Blue-grass is poorly studied but is known to occur as a component of Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (Natural Grasslands TEC) and is associated with other species of blue grasses (Dichanthium spp. and Bothriochloa spp.). The grassland community occurs on fine textured soils, typically cracking clays on derived from either basalt or fine-grained sedimentary rocks, on flat of gently undulating rise. These grasslands occur in areas with relatively high summer rainfall and where a tree canopy is usually absent (TSSC 2013).	Unlikely	Unlikely	The study area does not contain natural grassland habitat or soils derived from either basalt or fine- grained sedimentary rock

Species	EPBC Act Status <sup>1</sup>			ood of rrence sment <sup>2</sup>	
		Habitat*	Previous assessment	Current assessment	Justification
Quassia Samadera bidwillii	V	Quassia is endemic to Queensland and is known to occur in several coastal locations between Mackay and Goomboorian, north of Gympie. The species commonly occurs in lowland rainforest or rainforest margins, but can also be found in open forest and woodland. The species is commonly found near both permanent and ephemeral watercourses.	-	Unlikely	Species generally occurs in coastal areas with nearest records in Mackay, approximately 125km to the north-east.

<sup>1</sup> Current status under the EPBC Act: E = Endangered; V = Vulnerable

<sup>2</sup> Known: Records from the study area.

Likely: Preferred habitat observed or mapped in the study area and known to occur in the region surrounding the study area and distribution overlaps with the study area.

Potential: Marginal habitat observed or mapped in the study area and known to occur in the region surrounding the alignment corridor and distribution overlaps with the study area.

Unlikely occurring: Not known from surrounding region or distribution does not overlap with the study area but at least marginal habitat present.

Does not occur. Not known from the surrounding region and distribution does not overlap with the study area (usually associated with errors in databases searched) or no habitat present on the study area.

\* Derived from Species Profile and Threats Database (<u>http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl</u>) or A-Z of animals (<u>https://www.ehp.gld.gov.au/wildlife/animals-az/index.html</u>)

## Figure 4: Ground-truthed Regional Ecosystems & threatened flora records





## 4.4 Habitat Values

Habitat occurring within the study area can be classified into five distinct habitat types:

- Fringing riparian forest
- Floodplain Eucalypt forest
- Dry Eucalypt forest
- Brigalow woodland
- Wetland

## Fringing Riparian Forest

Fringing riparian forest habitat occurs on the stream banks of Walker Creek and Carborough Creek (**Figure 5**). This habitat was found to have well developed canopy (77% cover) and sub-canopy layers (13% cover) but a more open understorey structure with the shrub layer predominantly absent. The ground layer was also found to lack complexity with woody debris coverage (185 m per ha) and leaf litter cover (22% cover) recorded as low. The groundcover within this habitat is dominated by the exotic Guinea Grass.

Whist the more open understorey layer and low ground layer complexity limits the use of the habitat for some fauna species, the well-developed canopy layer was found to contain numerous hollow bearing trees providing sheltering, nesting and breeding habitat for hollow dependent birds, arboreal mammals and microbats.

This habitat is highly connected to adjacent vegetation, contributing to a landscape in which fauna species can readily move between areas of suitable habitat.

## Floodplain Eucalypt Forest

Floodplain Eucalypt forest habitat occurs on the Quaternary alluvial plains of the Walker Creek and Carborough Creek (**Figure 5**), adjacent to the riparian forest. This habitat was found to have a well-developed canopy (62.5% cover) and sub-canopy layers (14.5% cover) but a more open understorey structure with the shrub layer predominantly absent. The ground layer was found to be moderately complex with moderate woody debris coverage (128 m - 384 m per ha), high leaf litter cover (51% cover) and presence of native grass tussocks (26% cover).

The complex ground layer provides suitable foraging and nesting habitat for numerous mammals and reptiles. However, the more open understorey layer limits the use of the habitat for some fauna species. In addition, the well-developed canopy layer was found to lack the density of hollow bearing trees found within the adjacent riparian forest habitat.

This habitat is highly connected to adjacent vegetation, contributing to a landscape in which fauna species can readily move between areas of suitable habitat.

## Dry Eucalypt Forest

Dry Eucalypt forest encompasses the majority of the study area and is associated with the Tertiary loamy and sandy plains of the older alluvial terraces of Walker Creek and Carborough Creek (**Figure 5**). This habitat occurs both in remnant and regrowth states.

Within the remnant areas, structural complexity varied with some areas providing a diverse shrub layer whilst in other areas it was absent. A more open canopy layer was recorded compared to other habitat types within the study area and large hollow-bearing trees were limited. Across all areas the ground layer was found to be moderately complex and would provide suitable foraging and nesting habitat for

numerous mammals and reptiles. Similar habitat resources were recorded within the regrowth areas; however due to the regenerating stage of the area, a mature canopy layer was absent.

#### Brigalow / Belah Woodland

Brigalow / Belah woodland habitat occurs in discrete patches across the study area and is associated with the Cainozoic clay plains situated on the older alluvial terraces of Walker Creek (**Figure 5**). This habitat was found to have a high structural complexity consisting of a moderately dense canopy layer (61.3% cover) and a moderate shrub layer (17.6% cover). This habitat also contains a relatively complex ground layer, with extensive woody debris (1,685 m per ha) and moderate organic litter cover (66.1% cover) present, although grass cover was low / absent. A gilgai landform was present within some areas of the habitat, which during rainfall events would become an ephemeral wetland providing habitat for frog species.

This high level of structural complexity provides suitable foraging and nesting habitat for numerous woodland birds, mammals and reptiles. However, the low number of hollow bearing trees within this habitat means there is limited sheltering, nesting and breeding habitat for hollow dependent birds, arboreal mammals and microbats.

#### Wetlands

Wetland habitat within the study area is limited to a palustrine wetland located within the western outer limits (**Figure 5**), comprising of approximately 4 ha. The wetland is ephemeral, experiencing varying degrees of inundation throughout the year. The habitat predominantly consists of a disturbed Buffel Grass (*Cenchrus ciliaris*) depression with fringing large River Red Gum and *E. platyphylla* (Poplar Gum). Canopy die back was noted to be severe within this habitat.



## Legend



## e Habitat types

- Brigalow Woodland
- Dry Eucalypt Forest
- Floodplain Eucalypt Forest
- Fringing Riparian Forest
- Wetland

0 550 1,100 2,200 Metres Datum/Projection: GDA 1994 MGA Zone 55



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## 4.5 Threatened Fauna Species Presence

The current database results identified 15 threatened fauna species and 10 migratory species as potentially occurring within the study area. Of the 15 threatened species, three were identified as occurring within the study area, the Greater Glider, Koala and Squatter Pigeon. Ornamental Snake was not identified within the study area; however due to the presence of suitable habitat and species records in adjacent areas, this species is considered likely to occur within the study area.

Of the 10 migratory species, none were identified as occurring with the study area. All migratory species were considered unlikely to occur due to the lack of detection of the species during field surveys and lack of suitable species habitat or key habitat features.

The complete assessment of the likelihood of occurrence is provided in **Table 4-3**. It should be noted that field validation of vegetation communities and habitat values did not detect any significant inconsistencies with previous likelihood assessments, with two exceptions. The South-eastern Long-eared Bat was previously assessed as a potential occurrence. The validated marginal habitat coupled with the study area occurring outside of the likely distribution of the species makes it an unlikely occurrence. The re-assessment of the South-eastern Long-eared Bat likelihood of occurrence is provided in **Table 4-3**. The Koala was listed in previous assessments as being a 'transient species', however it was recorded within the study area during the 2018 survey.

Surveys conducted in February 2018 were undertaken to target the presence of the Star Finch in the study area, to address the DoEE information request for the Preliminary Documentation. The eastern sub-population of the Star Finch is poorly known due to small number of records in scattered areas. However it is believed to extend north to Bowen, west to Winton and south to near Wowan. The population is likely severely fragmented with an estimate of 50 or less breeding birds and the species is believed to be locally extinct in many areas of its range (DoE 2018, DEWHA 2008). The Star Finch occurs mostly in grassy woodlands close to bodies of fresh water (DoE 2018). Seeds of native grasses are the main food source for the Star Finch (DoE 2018). Major threats to the species are degradation of habitat and reduction of native grass seeds through weed incursion and overgrazing by cattle (DEWHA 2008).

The species was not confirmed within the study area during the 2018 survey and is considered unlikely to occur. There are no recent records within the surrounding area (ALA 2018) and the species' distribution is now highly fragmented and potentially locally extinct. Ground-truthed potential habitat within the study area was considered to be of poor quality, with a high abundance of non-native grasses (Buffel and Guinea Grass) and a lack of permanent watering holes. Bird surveys also found a distinct lack of other common finch species, such as Double-barred Finch (*Taeniopygia bichenovii*) or Zebra Finch (*Taeniopygia guttata*), suggesting the study area does not contain suitable habitat for finches more generally. Abundance of bird species observed during the survey is shown in **Appendix E**.

As the Star Finch is considered unlikely to occur within the study area, impact of the project on the species is not assessed further.

A description of the habitat extent based on targeted field assessments for each known or likely occurring species is provided below. Detailed results of the targeted habitat assessments are provided in **Appendix A**.

## Greater Glider

Greater Glider has been observed in various habitat types along Walker Creek within the study area on several occasions (**Figure 6**). Greater Glider has been previously recorded within the study area during detailed fauna surveys (Footprints, 2013) and pre-clearance surveys across the mine have also recorded five individuals north of the study area along Walker Creek. During the February 2018 survey 22 Greater Gliders were recorded within the study area.

Records of Greater Glider during the 2018 survey indicate a preference for habitat along a small section of the riparian corridor of Walker Creek (**Figure 6**). Adjacent Eucalypt floodplain areas were found not to be utilised by Greater Glider, despite containing a high abundance of hollows. Other arboreal species such as Sugar Gliders, Squirrel Gliders and Brush-tail Possums, which utilise similar habitats (i.e. hollow bearing Eucalypts), were found not to overlap with Greater Glider records, and tended to occur in the floodplain or lower reaches of Walker Creek, indicating potential competition for areas containing hollows suitable for Greater Glider.

Hollow bearing tree transects found a high abundance of tree hollows suitable for Greater Glider (i.e. medium 8 to 15 cm or large >15 cm diameter). These were found to occur both within riparian corridors (average of 24 medium and nine large per hectare), as well as adjacent floodplain eucalypt woodlands (average of 23 medium and 11 large per hectare). Whilst these numbers are greater than the hollow densities that are considered suitable for Greater Glider use (2 to 4 for every two hectares of suitable habitat (TSSC 2016)), assessing the number of suitable hollows during on-ground surveys may be overestimated, as the extent to which the hollow has established and its suitability for the species is difficult to determine.

Overall, the fringing riparian habitat within the study area provides both the foraging and breeding habitat required to support the Greater Glider (**Figure 6**).

## Squatter Pigeon

Squatter Pigeon was recorded within the Dry Eucalypt Forest habitat in study area during the field survey in 2016 (**Figure 6**). Targeted Squatter Pigeon habitat assessments identified suitable water points for the species along Walker Creek, Carborough Creek and an artificial farm dam located in the central portion of the study area. Carborough Creek and Walker Creek are both ephemeral in nature but are major watercourses for the area with a stream order of four and five, respectively. Small pools of water were observed at various points along the dry sandy creek bed of Walker Creek, and the artificial dam was found to be at a moderate level of water capacity. These field observations occurred at the commencement of the dry season and whilst the water sources cannot be identified as permanent (i.e. spring-fed source), they may provide a reliable source of water for much of the year.

Habitats on the appropriate sandy substrates for foraging and breeding (DoE 2016d) that were groundtruthed within a 1 km range of these water sources, included the fringing riparian forest, floodplain Eucalypt forest and the dry Eucalypt forest. For the floodplain Eucalypt forest and dry Eucalypt forest habitat, only the southern portions of the primary impact area and a small portion of the southern dam footprint were found to comprise the bare ground conditions that are preferential for the species (i.e. in the order of 30%) (**Figure 6**). During the field survey, two Squatter Pigeon individuals were observed within the central area of the dry Eucalypt forest habitat (**Figure 6**). The extensive weed incursion within the fringing riparian forest has significantly degraded the habitat resources for the Squatter Pigeon, with the dense groundcover inhibiting foraging opportunities and providing poor conditions for breeding.

Overall, portions of the floodplain Eucalypt forest and dry Eucalypt forest habitat within 1 km of identified water sources are considered areas of Squatter Pigeon habitat within the study area (**Figure 6**).

## Koala

Koala has been observed numerous times in areas in the vicinity of the study area and three Koalas were recorded within the floodplain and fringing riparian forest habitats in the study area during the February 2018 survey (**Figure 6**).

Koala has been previously recorded within the operational mine lease (EcoServe & LAMR, 2005). In 2016, two individuals were recorded in floodplain Eucalypt habitat adjacent to the study area along Walker and Carborough Creek. Species presence has also been recorded in 2015 along Humbug Creek, 10 km south-east of the study area. Two un-confirmed sightings of the species occurred in 2008 and 2013 by mine staff along the mine access road and haul road.

Targeted Koala habitat assessments identified the total extent of fringing riparian forest habitat as containing two known Koala food tree species, Queensland Blue Gum and River Red Gum (Australian Koala Foundation 2015). Only portions of the floodplain Eucalypt forest habitat and dry Eucalypt habitat were found to contain Koala food tree species. This ranged from containing two known species (Poplar Box (*Eucalypts populnea*) and Narrow-leaved Ironbark (*Eucalyptus crebra*)) to only one known food tree species dominating the canopy layer (i.e. >50% coverage).

Within these areas containing Koala food tree species, only the riparian forest habitat and floodplain Eucalypt forest habitat occurred on alluvial substrates where canopy trees could access the saturation zone along Walker Creek and Carborough Creek. In these areas, soil moisture is likely to be retained for extended periods in between creek flow events. In contrast, the dry Eucalypt forest habitat was found to contain deep sandy soils with limited water holding capacity.

Overall, the riparian forest habitat and portions of the floodplain Eucalypt forest habitat containing Koala food trees are considered areas of Koala habitat within the study area (**Figure 6**).

## **Ornamental Snake**

Ornamental Snake has been previously recorded in Brigalow habitat within the mine site (EcoServe & LAMR Pty Ltd, 2007). Queensland Essential Habitat Mapping also identifies three records within a 2 – 5 km radius of the study area. Targeted Ornamental Snake habitat assessments across the Brigalow / Belah woodland habitat revealed varying values for the species. Only three of the seven patches of Brigalow / Belah habitat were found to contain the essential microhabitat features necessary to support the species. This includes a structurally complex ground layer comprising extensive amounts of woody debris, wide soil cracks, as well as deep ephemeral gilgai (**Figure 6**).

	FPBC		Likelihood of Occurrence Assessment <sup>2</sup>			
Species	Act Status <sup>1</sup>	Habitat*	Previous assessment	Current assessment	Justification	
Fauna		-				
Allan's Lerista <i>Lerista allanae</i>	E	Found in association with <i>Eucalyptus orgadophila</i> (Mountain Coolabah), <i>E. erythrophloia</i> (Red Bloodwood) open woodlands and <i>Melaleuca bracteata</i> (Black Tea-tree). It is currently associated with altered landscapes that have areas with leaf litter and friable surface soils beneath trees and shrubs. These sites were characterised by dark chocolate non-cracking clay-based soils which are mapped as Regional Ecosystem 11.8.5 and 11.8.11.	Unlikely	Unlikely	The study area does not contain suitable habitat for the species and is not within its current range. Species is only known to occur within a small area south of Clermont.	
Australia Painted Snipe <i>Rostratula australis</i>	E	Species dependent on wetlands and can inhabit a variety of types including shallow terrestrial freshwater (occasionally brackish) wetlands, temporary and permanent lakes, swamps and claypans. Preferred wetland habitats are characterised by emergent vegetation (including tussocks, grasses, sedges, rushes, reeds, canegrass and/or paperbarks) where nesting will occur. Artificial habitats that are occasionally used include reservoirs, farm dams, sewage	Unlikely	Unlikely	The study area does not contain suitable habitat for the species due to the lack of wetland habitats containing fringing aquatic vegetation.	

## Table 4-3: Likelihood of occurrence results for threatened and migratory fauna species
			Likelihood of Occurrence Assessment <sup>2</sup>		
Species	Act Status <sup>1</sup>	Habitat*	Previous assessment	Current assessment	Justification
		ponds, inundated grasslands, and leaking irrigation channels.			
Curlew Sandpiper Calidris ferruginea	CE, M	Species usually forages and roosts in intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms.	Not assessed	Unlikely	Suitable coastal habitat is not present within the study area.
Fitzroy River Turtle Rheodytes leukops	V	Generally associated with instream habitats providing deep pool and riffle sequences, this species also prefers <i>Vallisneria</i> spp. (Ribbonweed) beds. Common riparian trees associated with the Fitzroy River Turtle habitat include Eucalyptus tereticornis (Queensland Blue Gum), <i>Casuarina cunninghamiana</i> (River She- oak), <i>Callistemon viminalis</i> (Weeping Bottlebrushes) and <i>Melaleuca linariifolia</i> (Paperbarks).	Unlikely	Unlikely	Walker Creek within the study area does not support the instream habitat requirements for the species.

Species	EPBC Act Status <sup>1</sup>		Likelihood of Occurrence Assessment <sup>2</sup>			
		Habitat*	Previous assessment	Current assessment	Justification	
Ghost Bat <i>Macroderma gigas</i>	V	Ghost bats occur in a wide range of habitats from rainforest, monsoon and vine scrub, to open woodlands in arid areas. These habitats are used for foraging, while roost habitat is more specific. Favoured roosting sites of the ghost bat are undisturbed caves or mineshafts which have several openings.	Not assessed	Unlikely	The species occurs in two disjunction distributions and 4 known disjunct subpopulations throughout Queensland. The study area overlaps one of the two disjunct distributions which occurs from coastal northeast Queensland from near the tip of Cape York Peninsula to approximately Gladstone. Microbat surveys were conducted during previous ecological surveys, however, the species (or its genus) was not detected. The study area also does not support potential rooting or foraging habitat.	
Greater Glider Petauroides volans	V	Largely restricted to eucalypt forest and woodlands, with a preference of old growth with abundant large tree hollows (den habitat).	Known	Known	Identified within the study area by Footprints Environmental (2013) prior to species' listing. Vegetation within the study area is contiguous with a large forested tract that extends further west of the study area. Riparian vegetation along Walker Creek within the study area, likely to contain hollow-bearing trees.	

	EDBC		Likelihood of Occurrence Assessment <sup>2</sup>			
Species	Act Status <sup>1</sup>	Habitat*	Previous assessment	Current assessment	Justification	
Koala Phascolarctos cinereus	V	Koala habitat can be broadly defined as any forest or woodland containing species that are known koala food trees, or shrubland with emergent food trees. Within inland environments (<800mm rainfall), this is limited to open forests and woodland where Koala food trees have a reliable access to soil moisture. Habitat in particular includes Box Gum or Red Gum woodlands on heavier soils in remnant or regrowth vegetation patches particularly riparian zones (DoE, 2014a)	Transient species	Known	Use of Walker Creek by the species determined to be infrequent based on scratch marks (Ecoserve & LAMR, 2006)) and the lack of direct and indirect sighting during targeted searches (Footprints, 2013). Two individuals have been recorded in 2016 directly adjacent to the study area along Walker and Carborough Creek. Suitable habitat for the species has been identified on the alluvial plains of Walker Creek within the study area. Three individuals were sighted in 2018 field surveys.	
Ornamental Snake Denisonia maculata	V	The Ornamental Snake inhabits remnant and non-remnant low-lying areas with cracking clay soils, where it can be locally abundant. Prefers moist areas and adjoining elevated ground, particularly areas associated with gilgai development. Areas dominated by Acacia harpophylla (Brigalow), Acacia cambagei (gidgee), Acacia argyrodendron (blackwood) and Eucalyptus coolabah (coolabah) are the habitats where the Ornamental Snake is most likely to be	Likely	Likely	Ornamental Snake has been previously recorded 2-5 km south- east of the study area in remnant vegetation. Three areas within the Brigalow habitat provide suitable microhabitat features for the species.	

Species	EPBC Act Status <sup>1</sup>	Habitat*	Likelih Occur Assess Buent assess Buent Bu	ood of rrence sment <sup>2</sup>	Justification
		found, which includes riparian woodlands and open forest on levees.			
Northern Quoll Dasyurus hallucatus	V	The species occupies a diversity of habitats across its range including Eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert. Northern Quoll are also known to occupy non rocky lowland habitats such as beach scrub communities in central Queensland. Northern Quolls appear to be most abundant in habitats within 150 km of the coast.	Unlikely	Unlikely	The study area does not contain suitable rocky habitats for the species.

Species	EPBC Act Status <sup>1</sup>		Likelihood of Occurrence Assessment <sup>2</sup>			
		Habitat*	Previous assessment	Current assessment	Justification	
Red Goshawk Erythrotriorchis radiatus	V	Occurs over wooded and forested lands, associated with different vegetation mosaics between south-east Queensland, northern Queensland and Cape York Peninsula. Prefers forest and woodland with a mosaic of vegetation types, large prey populations (birds), and permanent water. The vegetation types include eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest, and rainforest margins. Nesting habitat has been defined as a stand of tall trees within 1km of permanent water. The species is mainly associated with regional ecosystems at risk with rugged terrain in southern and northern Queensland.	Unlikely	Unlikely	The study area does not contain suitable habitat for the species, specifically extensive vegetated tracts of mosaic communities, and the presence of permanent water i.e. large river systems.	
South-eastern Long- eared Bat <i>Nyctophilus corbeni</i>	V	This species can occur in a range of inland woodland vegetation types, including box, ironbark, and cypress pine woodlands. Brigalow woodland and River Red Gum forests lining watercourses and lakes also provide habitat for the species Throughout inland Queensland, the species habitat is dominated by various eucalypt and bloodwood species and is most abundant in	Possible / Likely	Unlikely	Previous ecological studies determined the species to be 'likely' due to the presence of suitable refuge, foraging and breeding habitat within the study area. Suitable habitat present consists of poplar box woodlands on alluvial plains, Brigalow woodlands and riparian zones (Cardno, 2013 & Footprints, 2013). Targeted surveys were conducted for the species using harps and Anabat devices. <i>Nyctophilus</i> spp. was recorded during a	

	EPBC	ac	Likelihood of Occurrence Assessment <sup>2</sup>			
Species	Act Status <sup>1</sup>	Habitat*	Previous assessment	Current assessment	Justification	
		vegetation with a distinct canopy and a dense cluttered shrub. Captures have been made in open dry woodland and forest, which may include <i>Corymbia citriodora, C. bloxsomei, Eucalyptus</i> <i>crebra, E. melanophloia, E. populnea, E. major,</i> <i>E. pilligaensis, E. Chloroclada, E. fibrosa,</i> <i>Angophora leiocarpa, Allocasuarina luehmannii,</i> <i>Dodonaea viscosa, Callitris glaucophylla, Acacia</i> <i>harpophylla, Ac. leiocalyx, Ac. conferta,</i> <i>Casuarina cristata and Geijera parviflora.</i>			<ul> <li>2013 survey however, classification to species was not determined (Footprints, 2013).</li> <li>Further field validation was required to assess suitable habitat and quality within the study area. Eucalypt woodland and River Red Gum riparian forest (RE 11.3.25) is present within the study area which is stated habitat for the species. Also occurring are habitats dominated by several species associated with the Southeastern Long-eared Bat.</li> <li>Although this habitat is present, it is considered marginal due to the lack of a dense cluttered shrub layer, which the preferential habitat structure for the species.</li> <li>Whilst marginal habitat is present, the study area occurs outside of the likely distribution for the species, which is predominantly restricted to the Brigalow Belt South Bioregion and the Mulga Lands Bioregion. The most northern record for the species is within the Expedition National Park located approximately 390 km south of the study area.</li> <li>Collectively, these results have led to the reassessment of the species' occurrence from likely (previous) to unlikely (current).</li> </ul>	

	EDBC		Likelihood of Occurrence Assessment <sup>2</sup>			
Species	Act Status <sup>1</sup>	Habitat*	Previous assessment	Current assessment	Justification	
Squatter Pigeon (southern) Geophaps scripta scripta	V	Open-forests to sparse, open-woodlands and scrub that are mostly dominated in the overstorey by <i>Eucalyptus</i> , <i>Corymbia</i> , <i>Acacia</i> or <i>Callitris</i> species; remnant, regrowth or partly modified vegetation communities; within 3 km of water bodies or courses.	Likely	Known	Previous ecological studies have recorded the presence of the species within the surrounding area. Current field surveys recorded the species within the study area. Suitable habitat identified within portions of the fringing Eucalypt and dry Eucalypt forest.	
Star Finch Neochmia ruficauda ruficauda	E	Occurs in grasslands and grassy woodlands, near permanent water, and often in or near cleared suburban areas. Also reported along river banks dominated by native grasses and sedges.	Unlikely	Unlikely	The study area does not contain suitable habitat for the species due to the lack of grassy habitats adjacent to permanent water. No evidence of the species or its habitats were found during targeted survey in 2018.	
Yakka Skink <i>Egernia rugosa</i>	V	Known woodland habitats include <i>Eucalyptus populnea</i> (Poplar Box), <i>Acacia aneura</i> (Mulga), <i>Callitris glaucophylla</i> (White Cypress Pine), and disturbed, treated and cleared areas where suitable microhabitat features remain. Also been recorded, though less frequently, in <i>Acacia harpophylla</i> (Brigalow), <i>Acacia catenulata</i> (Bendee), <i>Casuarina cristata</i> (Belah), <i>Acacia cambagei</i> (Gidgee), <i>Acacia shirleyi</i> (Lancewood), and <i>Allocasuarina luehmannii</i> (Buloke) woodlands.	Possible	Unlikely	Previous ecological studies determined the species to be 'possible' due to the presence of suitable refuge, foraging and breeding habitat within the study area. Extensive ground searches and nocturnal surveys failed to detect the species or any signs of potential occurrence (Footprints, 2013). Current closest records of the species are located approximately 187 km south of the study area.	

	5550		Likelihood of Occurrence Assessment <sup>2</sup>		
Species	Act Status <sup>1</sup>	Habitat*	Previous assessment	Current assessment	Justification
White-throated / Southern Snapping Turtle <i>Elseya albagula</i>	CE	Found only in Queensland in the Fitzroy, Mary and Burnett Rivers and associated smaller drainages in south eastern Queensland. The white-throated snapping turtle is recognised as a habitat specialist. Within the river system the white-throated snapping turtle prefers clear, flowing, well-oxygenated waters.	Not assessed	Unlikely	The study area is outside of the known distribution for the species and contains no suitable habitat.

# **Migratory Species**

Black-faced Monarch Monarcha melanopsis	Μ	The species mainly occurs in rainforest ecosystems, including semi-deciduous vine- thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.	Not assessed	Unlikely	The required habitat (rainforest ecosystems) for the species does not occur within the study area.
Common Sandpiper Actitis hypoleucos	М	The species utilises saltwater and freshwater ecosystems for foraging and roosting. These include coastal and inland wetlands, and mangroves.	Not assessed	Unlikely	Sufficient wetland habitat not present within the study area

	EDBC		Likelihood of Occurrence Assessment <sup>2</sup>			
Species	Act Status <sup>1</sup>	Habitat*	Previous assessment	Current assessment	Justification	
Fork-tailed Swift <i>Apus pacificus</i>	М	The Fork-tailed Swift is predominantly aerial and occurs over inland areas and occasionally above the foothills in coastal areas with dry and open habitat. They can also occur over low scrub, heathland, saltmarsh and riparian woodlands and are associated with low pressure systems that favour the occurrence of insect prey.	Not assessed	Unlikely	The study area lacks suitable habitat for the species. The closest known recorded for the species was captured in 2012 over 50km to the west (ALA 2016).	
Latham's Snipe Gallinago hardwickii	Μ	Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies).	Not assessed	Unlikely	A small ephemeral wetland was identified within the west of the Project Area and described as RE 11.3.27. Although this habitat feature is present, the species is unlikely to occur due to the lack of foraging habitat (mud) coupled with some form of cover (low, dense vegetation) being present within the wetland.	
Oriental Cuckoo Cuculus optatus	Μ	Monsoon forest, rainforest edges, leafy trees in paddocks, river flats, roadsides, mangroves, islands.	Not assessed	Unlikely	The study area is dominated by dry Eucalypt woodlands and forests with some riparian habitat. The habitat occurring with the study area is not suitable for this species.	

	5550		Likelihood of Occurrence Assessment <sup>2</sup>			
Species	Act Status <sup>1</sup>	Habitat*	Previous assessment	Current assessment	Justification	
Osprey Pandion cristatus	М	Littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. Require extensive areas of open fresh, brackish or saline water for foraging. Frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes.	Not assessed	Unlikely	The study area does not possess extensive areas of open fresh, brackish or saline water for foraging in which the species requires.	
Pectoral Sandpiper Calidris melanotos	М	The species inhabits shallow fresh to saline wetlands and is usually found in coastal or near coastal habitat but occasionally found further inland.	Not assessed	Unlikely	Sufficient wetland habitat not present within the study area.	
Satin Flycatcher <i>Myiagra cyanoleuca</i>	Μ	Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses. They generally occur in moister, taller forests than <i>Myiagra rebecula</i> (Leaden Flycatcher), often occurring in gullies. They also occur in eucalypt woodlands with open understorey and grass ground cover, and are generally absent from rainforest. Mainly recorded in eucalypt forests, especially wet sclerophyll forest, often dominated by eucalypts such as <i>Eucalyptus fastigata</i> (Brown	Not assessed	Unlikely	No wet sclerophyll forest dominated by preferred species were recorded within the study area.	

Species	EPBC Act Status <sup>1</sup>			ood of rence sment <sup>2</sup>		
		Habitat*	Previous assessment	Current assessment	Justification	
		Barrel), <i>E. dalrympleana</i> (Mountain Gum), <i>Eucalyptus cypellocarpa</i> (Mountain Grey Gum), <i>Eucalyptus radiata</i> (Narrow-leaved Peppermint), <i>Eucalyptus viminalis</i> (Manna Gum), or occasionally <i>E. regnans</i> (Mountain Ash). They sometimes also occur in dry sclerophyll forests and woodlands, usually dominated by eucalypts such as <i>E. blakelyi</i> (Blakely's Red Gum), <i>E. sideroxylon</i> (Mugga Ironbark), <i>Eucalyptus melliodora</i> (Yellow Box), <i>Eucalyptus albens</i> (White Box), Manna Gum or stringybarks, including <i>E. macrorhyncha</i> (Red Stringybark), and <i>Eucalyptus caliginosa</i> , (Broad-leaved Stringybark), usually with open understorey.				
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	Μ	The species prefers muddy edges of shallow fresh or brackish wetlands, with suitable vegetation cover (sedges, grass or saltmarsh).	Not assessed	Unlikely	Sufficient wetland habitat not present within the study area.	
Yellow Wagtail <i>Motacilla flava</i>	М	Short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land, town lawns.	Not assessed	Unlikely	No suitable habitat for the species was recorded within the study area.	

<sup>1</sup> Current status under the EPBC Act: CE = Critically; V = Vulnerable; M = Migratory

<sup>2</sup> Known: Records from the study area.

Likely: Preferred habitat observed or mapped in the study area and known to occur in the region surrounding the study area and distribution overlaps with the study area.

Potential: Marginal habitat observed or mapped in the study area and known to occur in the region surrounding the alignment corridor and distribution overlaps with the study area.

Unlikely occurring: Not known from surrounding region or distribution does not overlap with the study area but at least marginal habitat present.

Does not occur. Not known from the surrounding region and distribution does not overlap with the study area (usually associated with errors in databases searched) or no habitat present on the study area.

\* Derived from Species Profile and Threats Database (<u>http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl</u>) or A-Z of animals (<u>https://www.ehp.gld.gov.au/wildlife/animals-az/index.html</u>)

# Figure 6: Threatened fauna records & ground-truthed habitat





## 4.6 Groundwater Dependent Ecosystems

The groundwater system across the SWC Mine has been described as comprising of two distinct aquifers – the unconfined or 'water table' aquifer and the confined coal seam aquifer (Golders, 2018). The water table aquifer consists of an alluvial and regolith hydrostratigraphic units that are in hydraulic connection. The regolith unit covers the majority of the study area whilst the alluvial unit is limited to the creek channels associated with Walker and Carborough Creeks. The alluvium can be locally saturated where the water table is shallow enough to intersect the unit. The water table aquifer is recharged via direct precipitation (surface runoff percolating through the ground surface) and by ephemeral stream recharge during flow events (Golders, 2018). The confined coal seam aquifer occurs deep below the water table aquifer and is separated by unweathered bedrock, which acts as an aquitard (Golders, 2018).

Desktop GDE mapping indicates the potential presence of two types of GDEs that may be utilising the groundwater resources at SWC Mine. These area:

- Aquatic (Type 2 GDEs) ecosystems dependent on the surface expression of groundwater such as wetlands, lakes, seeps, springs, and river baseflow systems. In these cases, groundwater discharge provides water to support aquatic biodiversity
- Terrestrial (Type 3 GDEs) ecosystems dependent on subsurface presence of groundwater such as terrestrial vegetation which depends on groundwater on a seasonal, episodic or permanent basis. These types of ecosystems can exist wherever the water table capillary fringe is within the root zone of the plants, either permanently or episodically.

The current described hydrogeologic model for the SWC Mine does not identify any areas within or surrounding the study area where there is a surface expression of groundwater (Golders, 2013). As such aquatic GDEs (Type 2) are not considered to occur within or surrounding the study area.

However, based on available monitoring bore data across the SWC Mine (Golders, 2018), there are habitats where vegetation could potentially access groundwater (i.e. < 10 m depth to water) (Canadell *et al.*, 1996) and be considered a terrestrial GDE (Type 3). This is limited to the identified fringing riparian forest and portions of the floodplain Eucalypt forest habitat within the western portion of the study area along Walker Creek (**Figure 7**). In the broader area across the SWC Mine where shallow groundwater has also been identified, the habitats present are also limited to these two types. This includes areas within the upper branches of Walker Creek and along Carborough Creek.

For these habitat types, the groundwater that may potentially be accessed would be contained within the water table aquifer. This aquifer system does have limitations as a reliable and consistent groundwater source for vegetation as it is seasonally influenced. During dry periods when vegetation would be more reliant on this source of water, recharge rates and the influx of fresh water decreases, which impacts on water quality and water levels within the aquifer (Golders, 2018).

Nonetheless, these limitations would not necessarily discount the potential use of groundwater by these habitat types. Particularly for the habitat types that occur within the upper reaches of Walker Creek and along Carborough Creek where depth to water has been recorded at less than 5 m (Golders, 2018). Species composition within these habitat types also consist of native canopy species that have been recorded to access groundwater between depths of 6 to 10 m (i.e. *Eucalyptus calmedulensis* and *Corymbia clarksoniana*) (Orellana et al., 2011).

However, not all areas of these two habitat types occur in areas of shallow groundwater. The fringing riparian forest and floodplain Eucalypt forest habitat also extends along and adjacent to Walker Creek within the study area and further along Bee Creek, where depth to water within the water table aquifer are > 10m.

Therefore the likelihood of the study area supporting Type 3 GDEs is considered to be high in areas where shallow groundwater is present. This includes areas of fringing riparian forest and floodplain Eucalypt forest along the upper reaches of Walker Creek and Carborough Creek. The likelihood that these habitat types are Type 3 GDEs is lower along the downstream portions of Walker Creek, as well as outside of the study area along Bee Creek. This is due to the increase in depth to water within the water table aquifer.

# Figure 7: Terrestrial GDEs (Type 3) likely to occur within the study area





Mining Lease Study area

Brigalow TEC

Black Ironbox

GDE values

Flora values

Potential Terrestrial GDE (Type 3)

0 500 1,000 2,000 Metres Datum/Projection: GDA 1994 MGA Zone 55



Prepared by: RW Date: 03/05/2018 N:17BR/\GIS\8852 MRA2C Preliminary Documentation/mxd/Prelim Doc/Fig7 MNES values.mxd

# 5 Matter of National Environmental Significance

The MNES identified as occurring or likely to occur within the MRA Stage 2C study area are:

- One listed TEC (Brigalow dominant or co-dominant)
- Black Ironbox threatened flora species and a GDE component of a water resource
- Habitat for four threatened fauna species (Greater Glider, Ornamental Snake, Koala and Squatter Pigeon)

**Table 5-1** provides MNES values and extent (including species habitat), identified within the MRA Stage2C study area. Figure 8 illustrates the location of each MNES value.

#### Table 5-1: Summary of Field Verified MNES values

MNES Value	Study area (ha)	Disturbance footprint (ha) <sup>1</sup>
Threatened Ecological Communities		
Brigalow (dominant or co-dominant) TEC	32.7	32.7
Threatened Species' Habitat		
Black Ironbox	27.2	16.8
Koala	259.4	212.2
Ornamental Snake	33.7	33.7
Squatter Pigeon	401.6	295.3
Greater Glider	186.2	149.3

<sup>1</sup> = Excluding approved Stage 2A area (EPBC 2014/7272)

The following sections provide a description of each field verified MNES value including the determination of key characteristics such as important populations, ecologically significant proportions and habitat critical to the survival of the species. Interpretation of these key characteristics has been done in accordance with the definitions provided in Commonwealth Significant Impact Guidelines (EPBC Act Policy Statement 1.1).







Flora values



Squatter Pigeon, Koala

500 1,000 2,000 0 Metres Datum/Projection: GDA 1994 MGA Zone 55 Ν



Prepared by: RW Date: 03/05/2018 N:\17BRI\GIS\8852 MRA2C Preliminary Documentation\mxd\Prelim Doc\Fig7 MNES values.mxd

# 5.1 Threatened Ecological Communities

# 5.1.1 Brigalow (dominant or co-dominant)

Four patches of Brigalow (dominant or co-dominant) TEC were identified within the study area, comprising of a total area of approximately 32.7 ha (**Figure 8**). These patches met all key diagnostic criteria and condition thresholds for the TEC (**Appendix D**).

Three of the Brigalow TEC patches within the study area are only small occurrences encompassing a total area of less than 1.5 ha. The majority of Brigalow TEC occurs in one large patch located in the western portion of the study area.

# 5.2 Black Ironbox

Approximately 27.2 ha containing 525 individuals of Black Ironbox was ground-truthed within the study area (**Figure 8**). An assessment of the population and value of habitat within the project disturbance footprint to the survival of the species is provided in the following sections.

As well as being a listed threated flora species, Black Ironbox may also be considered a groundwater dependent ecosystem (GDE). This is relevant to this assessment, as GDEs are considered MNES if they form an environmental water resource user that may be impacted by coal seam gas or a large coal mine development (i.e. the water trigger applies). The extent to which Black Ironbox within the study area should be considered a GDE is also discussed below.

## Important population

Black Ironbox occurs in two disjunct distributions, Townsville to Nebo and around Rockhampton, which provide an extent of occurrence (EOO) in the order of 124,000 km<sup>2</sup> (DoE 2016e). Currently, there are no defined important populations for this species within its current range.

The Central Queensland population of Black Ironbox occurs within the Townsville to Nebo distribution and is separated into two catchments, the Bowen / Broken and Boogie River catchment and the Isaac / Fitzroy catchment. The study area occurs within the Isaac / Fitzroy catchment where the core and largest populations of Black Ironbox have been identified along Bee Creek, Funnel Creek and Dennison Creek (Queensland Herbarium, 2012). The density of mature Black Ironbox individuals along Bee Creek has been recorded at 165 individuals / km (Cardno, 2012), which falls within the upper quartile range of average measured density for the species (Queensland Herbarium, 2012). Walker Creek is a tributary of Bee Creek.

In consideration of the important population attributes defined in the Commonwealth Significant Impact Guidelines (EPBC Act Policy Statement 1.1), the study area is not considered to support an important population of Black Ironbox (**Table 5-2**). The density of mature Black Ironbox individuals along Walker Creek is approximately 76 individuals / km, which is similar to the average measured density for the species (Queensland Herbarium, 2012) and significantly lower than Bee Creek at 165 individuals / km. The large and denser population along Bee Creek provides a greater source a reproductive output (pollen) and plays a critical role in maintaining genetic diversity. At a catchment level scale, the Walker Creek Black Ironbox population is a localised occurrence of the species on a more minor tributary system, with the Bee Creek population being the main source population for the drainage system.

A summary of the assessment against the Commonwealth Significant Impact Guidelines (EPBC Act Policy Statement 1.1) important population criteria is provided in **Table 5-2.** The assessment is based on data, expert opinion and precedence.

Important Population Criteria	Assessment	Justification		
Key source population either for breeding or dispersal		<ul> <li>Density within the study area is 7.6 individuals / 100m.</li> <li>As a precedence the Sonoma Mine project recorded an important population at a density of 14.2 individuals / 100m along Coral</li> </ul>		
		<ul> <li>Creek, double that of the Walker Creek occurrence.</li> <li>Bee Creek (downstream from impact site) density equates to 16.5 individuals / 100m.</li> <li>Lower density along Walker Creek indicates that habitat</li> </ul>		
	No	conditions are of a lower quality for the species when compared to Bee Creek and Coral Creek. Areas of higher quality habitat supporting a greater density of individuals are considered to be of greater source value for the wider population.		
	<ul> <li>For Eucalypt species the reproductive output (pollen pool) of a population is frequently dominated by a small percentage of mature trees flowering synchronously. Given that Bee Creek has a high density of individuals compared to Walker Creek, reproductive output is likely to be greater due to a higher chance of more mature trees flowering.</li> </ul>			
Populations that are necessary for maintaining genetic diversity		<ul> <li>Gene flow between populations for Eucalypt species is limited. This is most likely attributed to differences in flowering phenology between population, pollination mechanism (localised dispersal of pollen by insects and birds) and localised distribution of seed.</li> </ul>		
		<ul> <li>Dispersal of seed and thus genetic material to other populations can be enhanced for riparian species; however this is still limited in Central Queensland due to the ephemeral nature of creek systems.</li> </ul>		
	No	• For Eucalypt species, most of the genetic diversity occurs within populations. This is more pronounced in disjunct populations like the Black Ironbox.		
	<ul> <li>Whilst Eucalypts are commonly self-compatible (hermaphroditic flowers), the breeding system is one of mixed mating with preferential outcrossing. As such genetic diversity within populations can be impacted by inbreeding.</li> </ul>			
	<ul> <li>Given that Bee Creek has a high density of individuals compared to Walker Creek, the chances of inbreeding are reduced. As such Walker Creek is less likely to be a population necessary for maintaining genetic diversity for the species in the local area.</li> </ul>			
Populations that are near the limit of the species	No	• Expert distribution estimates for the species (Atlas of Living Australia) locate the study area within the species range, rather than on the limit.		
range		• Study area is not the most western record for the Central Queensland population. The most western record for the		

#### Table 5-2: Important population assessment for Black Ironbox

Important Population Criteria	Assessment	Justification
		<ul> <li>population occurs approximately 77km north-west from the study area and is 16km further west along Exe Creek.</li> <li>The species distribution extends much further south (Rockhampton region) and north (Ayr). The extent of occurrence is about 90,000 km<sup>2</sup> (Queensland Herbarium, 2008).</li> </ul>

#### Habitat critical to the survival of the species

Black Ironbox is a riparian dependent species, mainly distributed along the banks of wide (>10 m) drainage lines, usually of middle-order streams, with river sand, rock cobble or gravel substrates. Stream environment is ephemeral but subject to periodic high-energy flood flows. Sun-exposed sandy channels with deep river sands, or narrow drainage line tended to be free of this species and is considered unsuitable habitat (Queensland Herbarium, 2012). Habitat for Black Ironbox within the study area is restricted to the stream banks of Walker Creek.

Riparian condition surveys within the Isaac / Fitzroy catchment determined Walker Creek and Bee Creek to be good condition (Queensland Herbarium, 2012). Habitat for the species is not limited to the area within the study area and opportunities exist for the species to disperse and inhabit areas elsewhere in the catchment. As such, whilst habitat is suitable and supports the species within the project disturbance footprint, it is not critical in maintaining the survival of the species in the area.

#### Black Ironbox as a GDE

Desktop GDE mapping indicates the potential presence of two types of GDEs that may be utilising the groundwater resources at SWC Mine along Walker Creek where Black Ironbox was identified. These area:

- Aquatic (Type 2 GDEs) ecosystems dependent on the surface expression of groundwater such as wetlands, lakes, seeps, springs, and river baseflow systems. In these cases, groundwater discharge provides water to support aquatic biodiversity
- Terrestrial (Type 3 GDEs) ecosystems dependent on subsurface presence of groundwater such as terrestrial vegetation which depends on groundwater on a seasonal, episodic or permanent basis. These types of ecosystems can exist wherever the water table capillary fringe is within the root zone of the plants, either permanently or episodically.

As discussed in **Section 4.6**, the fringing riparian forest habitat and the floodplain Eucalypt forest habitat within areas of shallow groundwater (<10m), are likely to be terrestrial (Type 3) GDEs. However, groundwater depth is not consistent across the study area. Shallow groundwater is limited to the areas of this habitat along the upper reaches of Carborough Creek and Walker Creek within the study area. However, further downstream depth to groundwater increases. The likelihood of these habitats being a terrestrial (Type 3) GDE further downstream in areas where groundwater is deeper (>10m), is considered to be low.

The occurrence of Black Ironbox across the SWC Mine occurs within the fringing riparian forest habitat where depth to water within the water table aquifer has been recorded to range from 10 - 15 m from adjacent monitoring bores (Golders, 2018). It does not occur along Carborough Creek or upper portions of Walker Creek west of the study area where groundwater is very shallow (<5m). The density of Black

Ironbox along Walker within the study area and then further downstream along Bee Creek also varies, but generally increases as the creeks progress downstream. Within the project footprint of MRA2C, the density of Black Ironbox along Walker Creek was found to be approximately 7.6 individuals / 100m<sup>2</sup>. This progresses to 8.27 individual / 100m<sup>2</sup> further downstream along Walker Creek within the mining lease. Along Bee Creek the density of Black Ironbox is substantially greater at 16.5 individuals / 100m<sup>2</sup>.

While the species is within areas of habitat that may have access to shallow groundwater (i.e. 10 m), it also occurs outside of these areas and increases in density as groundwater becomes deeper and is therefore less accessible. It also does not occur in areas where groundwater is highly accessible. The species is very much restricted to the riparian zone of watercourses, so there is a level of water dependency. However, the variation in occurrence of the species suggests that this water dependency may be from other sources such as surface flow rather than groundwater. The variation of occurrence also suggest that other factors may contribute to the persistence of the species in the area other than water dependency such as stream characteristics and recruitment strategy (Queensland Herbarium, personal communication, 8 August 2017).

Studies have found that Black Ironbox seldom occurs on very narrow (5-10 m wide) drainage systems and is mainly distributed along the banks of middle-order streams, usually with a meander pattern (Pollock, 2012). Most of the streams in which Black Ironbox has been recorded are ephemeral. Occurrences are generally on alluvial soil substrates of river sand, rock cobble or gravel, which are typically well-drained and remain moist for much of the year. Other factors noted to influence the occurrence of Black Ironbox is water flow velocity, with most watercourses systems where Black Ironbox is situated found to be subject to periodic high energy flood flows (Pollock, 2012). The reason attributed to this is that that the regeneration of the species appears to be dependent on bare seed-beds prepared by previously flood-scoured cobble and river sand banks (Pollock, 2012). The high-water flows preceding the seeding of the species reduces understorey competition from other herbs, grasses and forbs and allows seeds to successfully germinate. All such factors are present along Walker Creek within the study area.

The rooting depth or depth to water table range has not been studied for Black Ironbox so the ability of the species to tap into the groundwater within the study area and further downstream cannot be negated. However, the level of dependency that the species has on groundwater sources at SWC Mine is not considered to be high. The interaction with groundwater is likely to be intermittent, seasonally and situationally dependent at best. This concept is supported by other examples of the species persistence without groundwater sources, including along watercourse in Collinsville, Queensland where the underlying metamorphic geology prevents access to groundwater and in plantings in non-riparian environments in Biloela, Queensland (Queensland Herbarium, personal communication, 8 August 2017).

# 5.3 Threatened fauna species

# 5.3.1 Ornamental Snake (Denisonia maculata)

Approximately 33.7 ha of Ornamental Snake habitat has been identified in the study area (**Figure 8**). This is based on habitat assessments identifying known ecological requirements for the species (refer to **Section 4.5**). Whilst previous ecological studies did not record the presence of the species within the study area, the species has been previously recorded across the mine site. This includes three records 2-5 km south-east of the study area in remnant Brigalow habitat.

Habitat within the study area considered to support Ornamental Snake includes gilgai relief areas on cracking clays. Targeted habitat assessments identified three areas of this habitat within the study area. The habitat was found to contain a structurally complex ground layer comprising extensive amounts of

woody debris, wide soil cracks, as well as deep ephemeral gilgai. Given the abundance and high variety of essential microhabitat features, coupled with the predominantly low presence of threats, it is likely that the species would be utilising the study area for breeding, feeding and sheltering. As such the study area is considered to contain important habitat for the species.

As per the Draft Referral Guidelines for the Nationally listed Brigalow Belt Reptiles (DoE, 2011), important habitat is utilised as a surrogate for important populations due to the cryptic nature of reptile species such as Ornamental Snake. Subsequently, the study area would be considered as an area supporting an important population of Ornamental Snake.

Additional Brigalow / Belah habitat was ground-truthed within the study area; however these areas were not determined to be Ornamental Snake habitat due to the lack of essential microhabitat features including gilgai and soil cracks.

# 5.3.2 Koala (Phascolarctos cinereus)

#### Habitat critical to the survival of the species

As per the EPBC Act referral guidelines for the vulnerable Koala, Koala habitat value is categorised by five primary habitat attributes – vegetation composition, occurrence, recovery value, key existing threats and connectivity. By applying these five attributes as per the referral guideline's Koala habitat assessment tool, the study area is deemed to contain habitat critical to the survival of the Koala (habitat score of 9). Approximately 259.4 ha of Koala habitat occurs within the study area (**Figure 8**).

A determination on the critical role of this habitat is provided below covering the five primary Koala habitat attributes and includes the latest regional data, previous ecological assessment results for the study area and the recent results of the targeted habitat assessments and fauna survey.

#### Vegetation composition, structure and condition

As per the EPBC Act referral guidelines for the vulnerable Koala (DoE 2014a), vegetation with a reliable access to soil moisture is a key habitat requirement for inland environments. Long periods of drought are a natural climatic condition of inland environments, which can cause moisture stress for large canopy trees resulting in the release of chemicals (terpenes and phenols) that can deter Koala consumption. An alternate access to a reliable source of soil moisture other than surface rainfall runoff is critical during these dry conditions.

Within the study area, the fringing riparian forest habitat and floodplain Eucalypt forest habitat is likely to have access to some degree to the saturation zone associated with Walker and Carborough Creek. Whilst this is not considered a continual alternate source to surface runoff, seasonal replenishment would provide for an extended period of soil moisture.

Based on targeted habitat assessments across the study area, Koala food trees listed for the Isaac Regional Council Area (AKF, 2015) were confirmed within the floodplain of Walker and Carborough Creek. The entirety of the fringing riparian forest habitat was found to contain two known Koala food trees; however only portions (approximately 45%) of the floodplain Eucalypt forest habitat was found to contain Koala food trees dominating the canopy layer (>50% coverage) (refer to **Section 4.4**). Koala food trees identified within these habitat types include:

- Poplar Box
- Narrow-leaved Ironbox
- Queensland Blue Gum
- River Red Gum

Suitable vegetation composition, structure and condition to support Koalas was therefore only identified within two habitat areas within the study area – the fringing riparian forest and portions of the floodplain Eucalypt forest habitat.

#### **Occurrence**

Surveys conducted in 2018 identified three Koalas within the study area, all restricted to the riparian and fringing floodplain Eucalypt forests. Additionally, survey data for the SWC Mine spanning over 11 years from 2005 – 2016, has also two confirmed sightings within proximity to the study area.

#### Recovery value

As per the EPBC Act referral guidelines for the vulnerable Koala, the interim recovery objectives for inland environments is protecting and conserving refuge habitat. Given the Koala was recorded within riparian habitats during the 2018 field assessment, it is considered that the study area and in particular the riparian and fringing floodplain Eucalypt forests, would contribute to the recovery of the Koala.

#### Key existing threats

The study area has historically been utilised for grazing purposes. Key threats to the species such as dog attacks and vehicle strikes would have been low. Operational mining activities do not currently extend into the study area. Vehicle traffic associated with mining activities are infrequent and occur as part of routine maintenance and inspection checks across the lease. Clearing or construction of infrastructure within the study area has not occurred to the extent that it would create a barrier to Koala movement.

Overall, key existing threats to Koala within the study area are considered to be low.

#### **Connectivity**

The study area forms the eastern edge of a large vegetation tract that extends west of the South Walker mining lease. Connectivity to the west and south of the study area is therefore high. The large vegetation tract provides a landscape linkage between the Carborough Ranges and Dipperu National Park.

The operational mining area fragments the study area from areas to the north and east, creating a significant barrier to fauna movement. However, Walker Creek does provide a corridor that links to other eastern areas of habitat along Bee Creek.

#### Determination of habitat critical to the survival of the species

All habitats within the study area form the eastern extent of a larger vegetation tract, contributing to a landscape in which fauna species can readily disperse. Due to the study area's dominant grazing land use key existing threats to Koalas such as dog attacks and vehicle strikes are uniformly low. However, the 2018 survey confirmed the occurrence of three Koalas only in riparian and fringing floodplain Eucalypt forests in the study area. These areas are also the only habitat types within the study area that provide suitable vegetation composition, structure and condition for the species. These habitats contain the foraging resources capable of supporting species utilisation of the area.

Based on the Koala referral guidelines, the riparian and fringing floodplain Eucalypt forest habitat within the study area is considered to be habitat critical to the survival of the species due to three confirmed sightings in 2018, good connectivity to the west, high vegetation structure and composition value, high recovery value of the habitat and low existing threats.

#### Important population

At present, there are no species-specific policy guidelines on what constitutes an important population for the Koala. As such, an assessment of an 'important population' was made based on guidance within the *Matters of National Environmental Significance Significant impact guidelines 1.1* (DoE 2013).

The species is known to occur within the study area and surrounds and has been identified as using both riparian and floodplain eucalypt woodland habitat areas. Based on available evidence and regional species records to date, concentration of sightings occur around specific habitat nodes within the Conor Ranges, Dipperu National Park and the Funnel Creek riparian habitat, as well as Blair Athol State Forest Park (ALA, 2016). The Carborough Ranges to the west of the study area are also likely to provide a large habitat area for Koalas. Given the high connectivity value that Walker Creek provides to these areas, as well as numerous recent records, the study area is likely to:

- Contain a key source population for breeding or dispersal; and
- Contain a population large enough that is necessary for maintaining genetic diversity.

The study area does not contain a population that is near the limit of its range, as Koala are found throughout eastern Queensland and southern states.

# 5.3.3 Squatter Pigeon (Geophaps scripta scripta)

Approximately 401.6 ha of Squatter Pigeon habitat was identified within the study area (**Figure 8**). This is based on positive identification of the species within the study area and targeted habitat assessments identifying known ecological requirements for the species (refer to **Section 4.5**). In addition to the recent survey record, previous ecological studies recorded the presence of the species adjacent to the study area. Habitat considered to support Squatter Pigeon within the study area includes Eucalypt dominated forest habitat with the following characteristics:

- Within 1km of a permanent water source (artificial and non-artificial)
- Consists of a diverse groundcover with bare ground (approximately 30%) available for foraging
- Occurs on a well-draining sandy substrate (Land zone 5)

An assessment of the population status of individuals utilising the study area, as well as the value of habitat to the survival of the species is provided in the following sections.

# Important population

Squatter Pigeon is a far ranging species with the extent of occurrence (EOO) in the order of 1,684,230 km<sup>2</sup> across north Queensland to central New South Wales (ELA, 2015). The southern EOO for the species has been determined as contracting northwards and as a result all relatively small, isolated and sparsely distributed sub-populations occurring south of the Carnarvon Ranges are considered important (DoE 2016d). The study area occurs in the northern EOO for the species and is well north of the Carnarvon Ranges.

In addition to this, the study area is not considered to support an important population of Squatter Pigeon as it does not comprise the attributes defined in the Commonwealth Significant Impact Guidelines (EPBC Act Policy Statement 1.1) (**Table 5-3**). The key component of this determination is that suitable habitat within the study area is small in extent and would not be considered source habitat supporting a source population. At a regional scale (1:500,000), the study area forms a potential sink area where individuals disperse to from larger areas of higher quality habitat. Source areas surrounding the study area include the lateritic jump ups and old alluvial plains of the Isaac River and Funnel Creek as well as the ridge lines of Crediton State Forest and Carborough Ranges adjacent to Eungella Dam. This is supported by the numerous species records within these areas. As a sink habitat, the study area would not play a critical role in maintaining genetic diversity of the species. This would be a primary role of a source population.

A summary of the assessment against the Commonwealth Significant Impact Guidelines (EPBC Act Policy Statement 1.1) important population criteria is provided in **Table 5-3.** The assessment is based on data and expert opinion.

Important Population Criteria	Assessment	Justification
Key source population either for breeding or dispersal	No	<ul> <li>Large areas of higher quality habitat can support a greater number of individuals, which would be considered source populations.</li> <li>Areas of high quality habitat within the region include the lateritic jump ups and old alluvial plains of the Isaac River and Funnel Creek, and the ridges within Carborough ranges and Crediton State Forest located to the west, east and north of the study area, respectively</li> <li>The study area contains areas of suitable habitat; however in a regional and overall species distribution context this habitat is of a smaller extent and would be considered a sink area - habitat where individuals disperse to from a source area</li> </ul>
Populations that are necessary for maintaining genetic diversity	No	<ul> <li>Squatter Pigeon is a mobile species with a widespread EOO (1,684,230 km<sup>2</sup>) and a substantial AOO (2,888 km<sup>2</sup>). It's not a sedentary species that occurs in isolated and disjunct populations.</li> <li>Due to the nature of the species, genetic flow is not constrained for the greater population and the risk of inbreeding is low.</li> <li>There are no distinct populations that are necessary for maintaining genetic diversity; however source populations are considered important for maintaining EOO and AOO, which in turn effects the genetic flow characteristics of the species. The study area is not considered to contain a source population.</li> </ul>
Populations that are near the limit of the species range	No	<ul> <li>Study area located within the central portion of the species known range</li> <li>Other records further west of the study area</li> </ul>

Table 5-3: Important population assessment for Squatter Pigeon

#### Habitat critical to the survival of the species

The Squatter Pigeon occupies a wide array of habitat types, however, requires specific habitat values to support breeding and foraging opportunities. This includes open forest and woodland communities on sandy or gravelly substrates with low vegetated ground cover and within 1 km of permanent water sources to fulfil the species daily requirements (DoE 2016d). The habitat identified within the study area consists of the Tertiary loamy and sandy plains of the older alluvial terraces of Walker Creek and Carborough Creek that were found to consist of a sparse groundcover and sufficient areas of bare ground. This also includes similar habitat ground-truthed within 1 km of a large farm dam.

Whilst suitable habitat does occur within the study area, it is not considered to play a critical role in maintaining the survival of the species in the area. In addition to the source habitat areas located in the surrounding landscape, there is a large extent that could provide similar sink habitat for the species. Numerous water sources are also provided by mine site dams where the species has been previously recorded. Thus other areas of habitat are available in the region and the persistence of the species is not reliant on habitat within the study area.

### 5.3.4 Greater Glider (Petauroides volans)

Approximately 186.2 ha of Greater Glider habitat was identified within the study area (refer to **Section 4.5**) (**Figure 8**). Nocturnal surveys carried out along Walker Creek in 2018 confirmed the presence of 22 individuals. Previous ecological studies have also recorded the presence of the species within the study area and five species records occur directly upstream of the study area along Walker Creek. Habitat considered to support Greater Glider within the study area includes Eucalypt dominated forest habitat with an abundance of hollow-bearing trees. This was associated with the fringing riparian habitat along Walker Creek.

An assessment of the population status of individuals utilising the study area, as well as the value of habitat to the survival of the species is provided in the following sections.

## Important population

Currently, there are no defined important populations for this species within its current range. Greater Glider is a far ranging species with the extent of occurrence (EOO) in the order of 1,586 870 km<sup>2</sup> across north Queensland to Victoria (ELA, 2015). Current population density estimates across its distribution range between 0.01 to 5 individuals per hectare (TSSC 2016).

In consideration of the important population attributes defined in the Commonwealth Significant Impact Guidelines (EPBC Act Policy Statement 1.1), the study area is considered to support an important population of Greater Glider (**Table 5-4**). The key component of this determination is the identification of 22 individuals across five nights of survey within 153.2 ha of suitable habitat (equating to a density of 0.14 per ha). Additionally, the study area contains a high abundance of important habitat resources such as hollow-bearing trees both within and adjacent to Walker Creek. Additionally, pre-clearance surveys across approximately 70 ha of suitable Greater Glider habitat directly north of the study area along Walker Creek also identified five individuals.

Greater Glider have low dispersal ability and are sensitive to fragmentation. Large vegetation tracts containing old growth vegetation with a high density of hollow-bearing trees would be required to support a population large enough to be considered a source population. The study area contains a high density of hollow bearing trees and is highly connected to large tracts of vegetation such as the Carborough Ranges in the west and Dipperu National Park in the south. Records of Greater Glider exists within the Carborough Ranges and due to the high connectivity, the Greater Glider population within the study area would be contiguous with the western population. This population is likely to be a source population, where individuals would most likely be dispersing from to sink populations in the south, which contains fewer records (ALA 2018). As a source population, the study area would play a role in maintaining genetic diversity of the species.

A summary of the assessment against the Commonwealth Significant Impact Guidelines (EPBC Act Policy Statement 1.1) important population criteria is provided in **Table 5-4**.

#### Table 5-4: Important population assessment for Greater Glider

Important Population Criteria	Assessment	Justification
Key source population either for breeding or dispersal	Yes	Modelling indicates that native forest patches of at least 160 km <sup>2</sup> are required to maintain a viable population of Greater Glider. Whilst home ranges are small the species requires up to four den sites / 2 ha of suitable habitat (DoE, 2015). Large forest patches within the region that have the potential to contain suitable habitat and a high density of den sites include the Carborough ranges and Connor Ranges. The study area is considered to form part of a large tract of suitable habitat (> 160 km <sup>2</sup> ) that contains a high density of hollow bearing trees (> 4 sites per 2 ha). Habitat areas connect west to the Carborough Ranges and south to Dipperu National Park. Records in the wider area are considered to form part of the same population that exists within the study area, and
Populations that are necessary for maintaining genetic diversity	Yes	Large habitat tracts supporting a source populations are considered important for maintaining genetic diversity. The study area is considered to contain a source population.
Populations that are near the limit of the species range	No	The population within the study area is not near the limit of its range as the study area is located within the central portion of the species known range, with exiting records to the west.

#### Habitat critical to the survival of the species

The survival of Greater Glider within an area is heavily dependent on the presence of contiguous vegetation containing hollow bearing trees. Areas that have been cleared of such habitat resources have shown rapid and significant population declines (DoE, 2015). Even areas where vegetation has regrown such as forestry reserves, Greater Glider populations have not been able to recover due to the lack of nesting hollows (DoE, 2015).

A similar strong correlation exists between tree hollows and species abundance. With the species small home ranges, areas containing a high density of hollow bearing trees have the capacity to support a high abundance of the species (DoE 2015). The species preference is for 2 - 4 den sites / 2 ha of suitable habitat (DoE, 2015). To support a viable population of Greater Glider, an extensive area containing hollow bearing trees is required. Habitat modelling has indicated areas in the order of 160 km<sup>2</sup> (DoE, 2015).

Based on these habitat requirements, habitat critical to the survival of the species is considered to consist of large vegetation patches containing a high density of hollow bearing trees. The study area is highly connected to vegetation the west and south creating large tracts of suitable habitat. Riparian and eucalypt floodplain vegetation also contain a high density of hollow bearing trees. As such, the study area is considered to contain habitat critical to the survival of the Greater Glider.

# 6 Impact Assessment

In determining the significance of impact associated with the MRA Stage 2C, the relevant criteria listed in the Matters of National Environmental Significance – Significant Impact Guidelines 1.1 (DoE) dated 2013 were applied.

# 6.1 Threatened Ecological Communities

## 6.1.1 Brigalow (dominant or co-dominant)

**Table 6-1** outlines the significant impact assessment for the Brigalow TEC, listed as endangered under the EPBC Act. A maximum of approximately 32.7 ha of Brigalow TEC will be impacted by the Project, which will adversely affect habitat critical to the survival of the ecological community (**Figure 9**). Project impacts are likely to be significant on this MNES value.

Significant Impact Criteria	Assessment	Response to Criteria
Reduce the extent of an ecological community	No	The extent of occurrence for Brigalow TEC across the region will remain unchanged following the development of the project.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	No	Clearing for the project will not fragment any patches of Brigalow TEC. Connectivity between remaining Brigalow TEC patches will remain following the development of the project.
Adversely affect habitat critical to the survival of an ecological community	Yes	Approximately 32.7 ha of Brigalow TEC habitat will be lost as a result of the project.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	Yes	The progression of the Mulgrave pit and construction of associated infrastructure will ultimately remove 32.7 ha of Brigalow TEC and associated habitat.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	No	The progression of the Mulgrave pit and construction of associated infrastructure will ultimately remove 32.7 ha of Brigalow TEC rather than cause a substantial change in species composition.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:	No	The progression of the Mulgrave pit and construction of associated infrastructure will ultimately remove 32.7 ha of Brigalow TEC rather than cause a substantial reduction in the quality or integrity.

Significant Impact Criteria	Assessment	Response to Criteria
<ul> <li>assisting invasive species, that are harmful to the listed ecological community, to become established, or</li> <li>causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community</li> </ul>		
Interfere with the recovery of an ecological community	No	The project will result in 32.7 ha of Brigalow TEC being impacted. This equates to only 0.2% of the mapped Brigalow TEC extent (based on RE associations) occurring within the Northern Bowen Basin (subregion).



#### Legend



- Flora values Brigalow TEC Black Ironbox
- Fauna values Greater Glider Koala Koala, Greater Glider Ornamental Snake
  - Squatter Pigeon Squatter Pigeon, Koala

500 1,000 2,000 0 Metres Datum/Projection: GDA 1994 MGA Zone 55



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# 6.2 Black Ironbox

### Threatened species impact assessment

**Table 6-2** outlines the significant impact assessment for Black Ironbox, as per its listing as a vulnerable flora species under the EPBC Act. Approximately 405 individuals across 16.8 ha of suitable riparian habitat will be impacted by the project (**Figure 9**). This habitat has been assessed as not critical for the survival of the species and the occurrence of Black Ironbox within the study area is not considered to be part of an important population (refer to **Section 5.2**). Project impacts are not considered to be significant on Black Ironbox.

In addition to the remaining undisturbed habitat within the study area, it is proposed to use Black Ironbox in the revegetation of the constructed diversion channel to assist in mitigating impacts associated with the removal of mature individuals within the project disturbance footprint. This is discussed further in **Section 7.0**.

Significant Impact Criteria	Assessment	Response to Criteria
Lead to a long-term decrease in the size of an important population of a species	No	The occurrence of Black Ironbox is not considered to be part of an important population. Larger more densely populated occurrences occur in the region and immediate surrounding areas (e.g. Bee Creek). Revegetation of the creek diversion utilising the species would mitigate the long-term decrease of Black Ironbox within the impact area.
Reduce the area of occupancy of an important population	No	The occurrence of Black Ironbox is not considered to be part of an important population. Larger more densely populated occurrences occur in the region and immediate surrounding areas (e.g. Bee Creek). Impacts are expected on approximately 405 individuals across 16.8 ha. Nearby important populations downstream on Bee Creek will not be impacted by this Project. Revegetation of the creek diversion utilising the species would mitigate the reduction of area of occupancy of Black Ironbox within the impact area
Fragment an existing important population into two or more populations	No	Project clearing will not fragment habitat supporting an important population.
Adversely affect habitat critical to the survival of the species	No	Habitat within the study area is not considered critical to the survival of the species due good quality habitat still occurring downstream of the study area. Loss equates to only 0.04 % of potential Black Ironbox habitat modelled within the region.
Disrupt the breeding cycle of an important population	No	The occurrence of Black Ironbox is not considered to be part of an important population. Larger more densely populated occurrences occur in the region and immediate surrounding areas (e.g. Bee Creek).

#### Table 6-2: Significant Impact Criteria (vulnerable species) – Black Ironbox

Significant Impact Criteria	Assessment	Response to Criteria
		This population would have a greater reproductive output (pollen) in comparison to population within the study area.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline		Habitat within the study area is not considered critical to the survival of the species due good quality habitat occurring downstream of the study area and in numerous other large watercourse systems in the nearby region.
		The loss equates to only 0.04% of potential Black Ironbox habitat modelled within the region. It is unlikely that this will result in a decline of the species.
	No	Rubber Vine is a threat to the species and has the potential to cause extensive degradation. No Rubber Vine infestations were located along Walker Creek. Current mining operations have not introduced this species and it is unlikely that this will occur as a result of the expansion project. Exotic grasses were prevalent along Walker Creek and likely a result of previous grazing land use rather than current mining activities. Management of diversion rehabilitation will include weed and exotic grass control which are identified as threatening processes.
Introduce disease that may cause the species to decline	No	No diseases listed as a threat to the species
Interfere substantially with the recovery of the species	No	Based on the percentage of potential modelled habitat impacted, the project is not considered to substantially interfere with the recovery of the species. Rehabilitation of creek diversion will include Black Ironbox to mitigate impacts.

#### GDE impact assessment

Groundwater impacts have been assessed based on the level of risk that predicted drawdown will affect Black Ironbox within SWC Mine. The level of risk has been determined on:

- Likelihood of drawdown impacts;
- Likelihood of Black Ironbox utilising groundwater (i.e. inferred degree of dependency);
- Consequences of drawdown on Black Ironbox (considering associated ecological value and severity of threat);

Drawdown within the water table aquifer has been predicted within a 0.2 - 2 km radius around the life of mine extent at SWC Mine. Approximately 2 km of fringing riparian forest containing Black Ironbox occurs within the effected drawdown area. Black Ironbox outside of the predicted draw down area along the lower reaches of Walker Creek and Bee Creek are unlikely to be impacted by changes in groundwater levels.

The level of dependency that the species has on groundwater sources at SWC Mine is not considered to be high. The interaction with groundwater is likely to be intermittent, seasonally and situationally dependent at best. Due to the lower level of reliance on groundwater, the severity of threat is considered to be low.

In addition to drawdown, other groundwater impacts can occur as a result of mining operations such as aquifer fragmentation. Water table aquifer within the alluvium at SWC Mine is already fragmented so impacts associated with interrupted connectivity is not anticipated. Overall, indirect impacts to Black Ironbox as a result of groundwater drawdown are not anticipated to be significant. Based on the low risk of indirect impacts, approximately 120 individuals across approximately 10.4 ha of riparian habitat will remain undisturbed within the study area.

As it is highly likely that Black Ironbox requires water from the riparian saturation zone, the maintenance of the current hydrological flows along Walker Creek is of importance. The constructed diversion channel will divert the current catchment area associated with Walker Creek. Connectivity of subsurface flows (hyporheic) will remain through deliberate design and over excavation of the diversion channel to provide a hyporheic zone. As such, water flow and volume to downstream areas will be equivalent to current conditions, which will further reduce the likelihood of indirect impacts to downstream populations.

# 6.3 Threatened Fauna Species

#### 6.3.1 Ornamental Snake (Denisonia maculata)

**Table 6-3** outlines the significant impact assessment for Ornamental Snake, listed as vulnerable under the EPBC Act. A maximum of approximately 33.7 ha of Ornamental Snake habitat supporting an important population will be impacted by the project (**Figure 9**). Project impacts are therefore likely to be significant for this MNES value.

Significant Impact Criteria	Assessment	Response to Criteria
Lead to a long-term decrease in the size of an important population of a species	Yes	Habitat within the study area is considered to support an important population due to the presence of important habitat (gilgai habitat in good condition). The determination of important habitat is supported by species records $2 - 5$ km south-east of the study area. The project will impact on 33.7 ha of Ornamental Snake habitat. No undisturbed Ornamental Snake habitat will remain within the study area following the development of the project, resulting in the reduction of the local important population.
Reduce the area of occupancy of an important population	Yes	Habitat within the study area is considered to support an important population due to the presence of high quality habitat. The project will impact on 33.7 ha of Ornamental Snake habitat. No undisturbed Ornamental Snake habitat will remain within the study area following the development of the project,

#### Table 6-3: Significant Impact Criteria – Ornamental Snake

Significant Impact Criteria	Assessment	Response to Criteria
		resulting in the reduction of area of occupancy for the local important population.
Fragment an existing important population into two or more populations	No	Project clearing will not fragment Ornamental Snake habitat supporting an important population.
Adversely affect habitat critical to the survival of the species	Yes	The project will impact on 33.7 ha of Ornamental Snake habitat. No undisturbed Ornamental Snake habitat will remain within the study area following the development of the project.
Disrupt the breeding cycle of an important population	No	The project will not specifically disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No	The species is also known to persist in disturbed environments as long as key microhabitat features are present (gilgai, soil cracks)
Introduce disease that may cause the species to decline	No	There are no known diseases that threatened the species
Interfere substantially with the recovery of the species	No	The project does not interfere with the recovery actions outlined in the Draft Recovery Plan for Queensland Brigalow Belt Reptiles.

# 6.3.2 Koala (Phascolarctos cinereus)

**Table 6-4** describes the significant impact criteria for the Koala, listed as vulnerable under the EPBC Act. A maximum of 212.2 ha of Koala habitat will be impacted by the project (**Figure 9**). This habitat has been assessed as critical for the survival of the species and is considered to support an important population (refer to **Section 5.3.2**).

The diversion channel has been designed to maintain the hydrology of Walker Creek and indirect impacts on habitat further downstream along Walker Creek are unlikely. The inclusion of Koala food trees in the revegetation of the constructed diversion channel is proposed to assist in mitigating impacts on habitat within study area. This is discussed further in **Section 7.0**.

Project impacts are likely to adversely affect habitat critical to the survival of the species.

Table 6-4: Significant Impact Criteria – Koala

Significant Impact Criteria	Assessment	Response to Criteria
Lead to a long-term decrease in the size of an important population of a species	No	The study area is considered to support an important population of Koalas. Three individuals were confirmed within the study area during the 2018 survey. Based on current information and concentrations of species records, important populations are likely to occur in the Conor Ranges, Carborough Ranges, Dipperu National Park and the Funnel Creek riparian habitat, as well as Blair Athol State Forest Park. The study area is highly

Significant Impact Criteria	Assessment	Response to Criteria
		connected to these areas enabling a contiguous population The project is unlikely to lead to a long-term decrease in the size of the population. The connectivity with
		surrounding habitat will remain following the creek diversion project, allowing for breeding males to still disperse across the area. Whilst some connectivity along the riparian corridor will be lost until rehabilitation of the creek diversion is established, the species will be able to utilise adjacent eucalypt woodland habitats to disperse.
		The existing hydrology of Walker Creek will also be maintained within the diversion channel, which will retain habitat values within the study area. Rehabilitation of the creek diversion will include Koala food trees to mitigate impacts.
Reduce the area of occupancy of an important population	No	The study area is considered to support an important population of Koalas. Three individuals were confirmed within the study area during the 2018 survey. Based on current information and concentrations of species records, important populations are likely to occur in the Conor Ranges, Carborough Ranges, Dipperu National Park and the Funnel Creek riparian habitat, as well as Blair Athol State Forest Park. The study area is highly connected to these areas enabling a contiguous population.
		The project is unlikely to lead to a reduction in area occupancy of the population. The connectivity with surrounding habitat will remain following the creek diversion project, allowing for breeding males to still disperse across the area. Whilst some connectivity along the riparian corridor will be lost until rehabilitation of the creek diversion is established, the species will be able to utilise adjacent eucalypt woodland habitats to disperse.
		The existing hydrology of Walker Creek will also be maintained within the diversion channel, which will retain habitat values within the study area. Rehabilitation of the creek diversion will include Koala food trees to mitigate impacts.
Fragment an existing important populations	No	The project is unlikely to fragment an existing population into two or more populations. The study area is well connected to large tracts of surrounding habitat within the Conor Ranges, Carborough Ranges, Dipperu National Park and the Funnel
Significant Impact Criteria	Assessment	Response to Criteria
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		Creek riparian habitat, as well as Blair Athol State Forest Park.
		The connectivity with surrounding habitat will remain following the construction of the project. Whilst some connectivity along the riparian corridor will be lost until rehabilitation of the creek diversion is established, the species will be able to utilise adjacent eucalypt woodland habitats to disperse.
		Habitat within the study area is considered critical to the survival of the species. This is in accordance with the Koala referral guidelines (habitat score of 9). Two key considerations are outlined in referral guidelines as to whether a proposed action will have or is likely to have a significant impact on the koala.
Adversely affect habitat critical to the survival of the species	Yes	<ul> <li>Adversely affecting habitat critical to the survival of the species (specifically, &gt; 20 ha with a habitat score of &gt;8), and/or</li> <li>Interfering substantially with the recovery of the species through the introduction or exacerbation of key threats in areas of habitat critical to the survival of the species</li> </ul>
		A total of 212.2 ha of habitat (habitat score of 9) will be impacted by the project, as such the project is likely to have a significant impact on the Koala.
		Based on current information and concentrations of species records, important populations are likely to occur in the Conor Ranges, Carborough Ranges, Dipperu National Park and the Funnel Creek riparian habitat, as well as Blair Athol State Forest Park. The study area is highly connected to these areas enabling a contiguous population.
Disrupt the breeding cycle of an important population	No	The project is unlikely to disrupt the breeding cycle of the population. The connectivity with surrounding habitat will remain following the creek diversion project, allowing for breeding males to still disperse across the area. Whilst some connectivity along the riparian corridor will be lost until rehabilitation of the creek diversion is established, the species will be able to utilise adjacent eucalypt woodland habitats to disperse.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No	The project is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of the habitat. A total of 212.2 ha of Koala habitat will be impacted by the project. The area provides suitable

Significant Impact Criteria	Assessment	Response to Criteria
		foraging resources for the species. However, the connectivity with surrounding habitat will remain following the creek diversion project, allowing for breeding males to still disperse across the area. Whilst some connectivity along the riparian corridor will be lost until rehabilitation of the creek diversion is established, the species will be able to utilise adjacent eucalypt woodland habitats to disperse.
Introduce disease that may cause the species to decline	No	It is unlikely that the project will facilitate the introduction or spread of diseases specific to the species such as Chlamydia, or diseases that can significantly degrade critical habitat such as root rot ( <i>Phytophthora cinnamomi</i> ). Whilst dieback was noted to occur in the study area, this was highly localised and not to the extent that occurs as a result of root rot. No other signs of root rot such as yellow and wilting of the leaves was observed across the vegetation communities within the study area.
Interfere substantially with the recovery of the species	No	The project will not increase Koala fatalities due to dog attacks, vehicle strike or introduced pathogens. Mining activities are limited to operational land and will not encroach into remaining habitat areas. The retention of vegetation within undisturbed portions of the study area will retain connectivity across the landscape, allowing Koalas to continue to disperse to surrounding areas of suitable habitat. Maintaining existing hydrology of Walker Creek within the diversion channel will also retain refuge habitat values within the study area. Rehabilitation of the creek diversion will include Koala food trees to mitigate impacts.

### 6.3.3 Squatter Pigeon (Geophaps scripta scripta)

**Table 6-5** outlines the significant impact assessment for Squatter Pigeon, listed as vulnerable under the EPBC Act. A maximum of approximately 295.3 ha of Squatter Pigeon habitat will be potentially impacted by the project (**Figure 9**). This habitat has been assessed as not critical for the survival of the species and is not considered to support an important population (refer to **Section 5.3.3**). Project impacts are not considered to be significant on Squatter Pigeon.

Significant Impact Criteria	Assessment	Response to Criteria
Lead to a long-term decrease in the size of an important population of a species	No	Not considered an important population as current occurrence not considered to be part of a source population and playing a critical role in maintaining genetic diversity.
Reduce the area of occupancy of an important population	No	Not considered an important population as current occurrence not considered to be part of a source population and playing a critical role in maintaining genetic diversity.
Fragment an existing important population into two or more populations	No	Project clearing will not fragment Squatter Pigeon habitat supporting an important population.
Adversely affect habitat critical to the survival of the species	No	Habitat within the study area is not considered critical to the survival of the species due to the abundance of habitat (including breeding) that occurs in the region. Potential breeding habitat for the species will be cleared as a result of the project. The diversion will result in the relocation of a suitable water source for the species further south. Current extent of breeding habitat ground-truthed within the study area is 401.6 ha, of which 295.3 ha will be impacted. Following the construction of the project, including the diversion, critical water resources may be available to the surrounding suitable foraging habitat for the species.
Disrupt the breeding cycle of an important population	No	Not considered an important population as current occurrence not considered to be part of a source population and playing a critical role in maintaining genetic diversity.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No	The project will result in the potential loss of 295.3 ha of Squatter Pigeon habitat. This equates to only 0.3% of potential Squatter Pigeon habitat modelled within the region (1:500,000). It is unlikely that this will result in a decline of the species. Other threats to the species including overgrazing, weed incursion of Buffel Grass and predation by pest species are already noted and are likely the result of the current grazing land use.
Introduce disease that may cause the species to decline	No	No diseases are listed as a threat to the species.
Interfere substantially with the recovery of the species	No	Based on the percentage of potential modelled habitat impacted, the project is not considered to substantially interfere with the recovery of the species.

### Table 6-5: Significant Impact Criteria – Squatter Pigeon

Significant Impact Criteria	Assessment	Response to Criteria
		Rehabilitation of creek diversion to ensure the catchment size and volume of water flow through the diversion is similar to that of Walker Creek will assist in mitigating impacts on breeding habitat.

### 6.3.1 Greater Glider (Petauroides volans)

**Table 6-6** outlines the significant impact assessment for Greater Glider, listed as vulnerable under the EPBC Act. Approximately 149.3 ha of Greater Glider habitat will be potentially impacted by the project (**Figure 9**). This habitat is considered to support an important population and to be habitat critical to the survival of the species.

The persistence of the species in a fragmented and disturbed landscape like that of the Northern Brigalow Belt is heavily dependent on forest connectivity, sizeable habitat tracts and the presence of hollow-bearing trees. Hollow-bearing trees are a particularly critical component as they are a limited resource due to the association with old growth forest.

The project will result in the removal of habitat containing a high density of breeding resources. Riparian corridors along Walker Creek provide high quality connectivity for the Greater Glider to Carborough Range in the west, Conor Range and Dipperu National Park in the east. Diversion of the creek will reduce the riparian connectivity and the ability of the species to disperse between sink and source populations. The project is therefore likely to have a significant impact on the Greater Glider.

Table 6-6:	: Significant	Impact	Criteria –	Greater	Glider
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Significant Impact Criteria	Assessment	Response to Criteria
Lead to a long-term decrease in the size of an important population of a species	Yes –within the study area	The study area is considered to contain an important population of Greater Glider. 22 individuals were identified across five nights of survey within 153.2 ha of suitable habitat. 149.3 ha of habitat will be removed for the project, including trees with high densities of hollows, which are a key resource for the species. It is considered likely that this impact will reduce the size of the population with in the study area.
Reduce the area of occupancy of an important population	Yes	The study area is considered to contain an important population of Greater Glider and 149.3 ha of habitat will be removed for the project. This will reduce the area of occupancy of the species.
Fragment an existing important population into two or more populations	Yes	The study area is considered to contain an important population of Greater Glider. 22 individuals were identified across five nights of survey within 153.2 ha of suitable habitat. This population is likely to form part of a larger source population to the west in the Carborough Ranges. Riparian habitat with old growth forest provide connectivity corridors between suitable habitat areas and Walker Creek is likely to provide

Significant Impact Criteria	Assessment	Response to Criteria
		connection to larger habitat areas in the east, such as Dipperu National Park.
		Removal of old growth forest within the riparian corridor of Walker Creek may reduce Greater Glider movement between habitat areas and fragment populations east and west of the study area. Greater Glider is known to be sensitive to even small levels of fragmentation and this is therefore considered to be significant.
Adversely affect habitat critical to the survival of the species	Yes	The study are is considered to contain habitat critical to the survival of the Greater Glider. 149.3 ha of habitat will be removed for the project and this is considered to be significant.
Disrupt the breeding cycle of an important population	Yes	The study area contains a high density of tree hollows which is a key breeding resource for Greater Gliders. It is likely the removal of this resource would have some disruptive effected on the important population of Greater Glider in the study area.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Yes – within the local area	The study are is considered to contain habitat critical to the survival of the Greater Glider. High density suitable hollows were identified within Walker Creek that are known to be utilised by the species. Riparian habitat with old growth forest provide connectivity corridors between suitable habitat areas and Walker Creek is likely to provide connection to larger habitat areas east and west of the study area. Greater Glider are considered particularly sensitive to removal of old growth forests containing hollows and have little dispersal ability between cleared areas. The project will result in the potential impact on 149.3 ha of riparian habitat containing the essential breeding resource of hollow-bearing trees. As hollow-bearing trees are a limited resource with density concentrated along Walker Creek, the removal of this riparian habitat will reduce the carrying capacity of the area. This is likely to result in localised population decline.
Introduce disease that may cause the species to decline	No	There are no known diseases that threaten the species.
Interfere substantially with the recovery of the species	Yes	<ul> <li>The project is likely to interfere with the primary conservation action listed in the species conservation advice (TSSC 2016), specifically;</li> <li>Protect and retain hollow-bearing trees, suitable habitat and habitat connectivity</li> </ul>

Significant Impact Criteria	Assessment	Response to Criteria
		Greater Glider are considered particularly sensitive to removal of old growth forests containing hollows and have little dispersal ability between cleared areas. Removal of old growth forest within the riparian corridor of Walker Creek may reduce movement between east and west habitat areas and diminish the availability of suitable hollow-bearing trees. These actions may interfere with the recovery of the species in the area

## 7 Mitigation and Management

### 7.1 Avoidance and minimisation

The diversion channel alignment has been chosen to predominantly traverse an existing drainage line, which will reduce the extent of excavation and clearing required. In doing so the pit will be limited to the available area north of the diversion. Whilst clearing impacts will occur to develop the pit and establish the diversion and associated water management infrastructure, further disturbance to surrounding MNES values within the study area will be minimised.

### 7.2 Mitigation and management

The proposed diversion channel presents an opportunity to rehabilitate in consideration of MNES values impacted by the MRA Stage 2C project. The diversion channel has been specifically designed to provide features that are characteristic of incised alluvial streams within the Bowen Basin with the purpose of creating a riparian environment close to natural conditions. The design includes a lower bench that is inundated by flows around the 2 year ARI events, and a higher bench that is inundated by flows around the 50 year ARI events in the downstream sections of the diversion (**Figure 10**). The benches will act as an inset floodplain, providing a suitable environment to facilitate ongoing riparian zone regeneration and long term vegetation cover and stability of the channel.

A hyporheic zone will develop over time as the sand bed level accumulates, which will provide a similar saturation zone present along the existing Walker Creek. The saturation zone will provide a source of soil moisture for surrounding vegetation (including planted Koala food trees and Black Ironbox) as well as retaining sub-surface flow connectivity to downstream environments.



Figure 10: Generalised cross section of proposed diversion channel

A revegetation plan has been prepared for the constructed channel that specifies the use of Koala food tree species as well as the threatened Black Ironbox in the planting mix along the channel (Alluvium, 2016). The area available for revegetation along the diversion channel in consideration of lost Koala habitat is estimated to be 157.5 ha and 46.3 ha for Black Ironbox.

The preparation of a revegetation plan specific for the diversion channel ensures appropriate planning, site preparation and maintenance, which in turn increases the rate of rehabilitation success. A number of risks to revegetation failure have been specifically identified for the diversion channel, which have been addressed through the proposed implementation of the following key strategies:

- Permian bedrock to be deeply ripped and left with a surface layer of rock rubble to provide armouring for topsoil, and allow for suitable rooting depth and water retention in sub-soils
- Addition of topsoil to provide an appropriate growth medium for seeding and compensate for deficiencies associated with current weathered soils
- Further testing to determine geo-chemical properties of Permian bedrock as well as nutrient content and structure of weathered soils
- Addition of soil ameliorants to supplement tested deficiencies
- On-site seed sourcing to ensure local provenance and adaptability to local conditions
- Follow up monitoring and maintenance, including additional planting of Black Ironbox if initial seeding fails

The establishment of the diversion channel for MRA Stage 2A has provided insight into the conditions of the area, which has been considered in the design and planning of the diversion channel for Stage 2C. Black Ironbox was not utilised in Stage 2A plantings due to expected hydrological differences between MRA2A and MRA2C (i.e. inclusion of Carborough Creek); however consultation with the former Biloela district group of Landcare Australia has revealed that the species has been successfully utilised in revegetation projects and plantings across the Central Queensland Township. Whilst the distribution of Black Ironbox does not extend as far south as Biloela, seed was sourced from a certified merchant, successfully propagated into tube stock, planted and has since matured to large fertile trees across the Township area (Donna Davis, personal communication, 30 June 2016). The establishment of Black Ironbox along the diversion channel for MRA Stage 2C is therefore considered a viable mitigation strategy.

The construction of the diversion channel will commence in the first stage of project construction and will be completed and revegetated as far as practicable before substantial progression of the mining put occurs. As such mitigation efforts will have occurred prior to the disturbance of MNES values.

Further, the construction and progression of the Mulgrave pit removing the Koala habitat will occur over a period of 30+ years allowing a considerable amount of time for habitat to be regenerated in the diversion, its riparian zone and any land based offset location.

Other management measures to be incorporated pre- and post-construction to assist in mitigating impacts on MNES include:

- Weed management including controlling infestations of Restricted Matters (as classified under the *Biosecurity Act 2014*) or Weed of National Significance (WoNS), (i.e. *Parthenium hysterophorus* or *Harrisia* spp.) as well as regular wash downs for vehicle and equipment, particularly for those that have been operating in an area of known weed infestation
- Fauna management during construction such as key habitat identification (nesting trees) and spotter-catchers to remove fauna and relocate to surrounding areas prior to clearing
- Sensitive vegetation clearing techniques i.e. targeted, staged and sequential clearing as well as demarcated 'no go' zones for areas of conservation value

- Standard fire, waste water management, pest, sediment, dust and noise control implemented as part of the mine's Environmental Management Plan
- Topsoil salvage, stockpiling and rehabilitation of disturbed mine areas to be undertaken in accordance with the mine's Plan of Operation, topsoil management and rehabilitation plans.

## 8 Offsets Strategy

The MRA Stage 2C project is likely to have a significant impacts on the following MNES values:

- 32.7 ha of Brigalow TEC
- 33.7 ha of Ornamental Snake habitat
- 212.2 ha of Koala habitat
- 149.3 ha of Greater Glider habitat

Proposed mitigation and management measures will limit the severity and magnitude of significant impacts to the listed above for all MNES values. However, significant residual impacts are unavoidable.

In accordance with the EPBC Act, significant residual impacts to MNES values are required to be offset as per the requirements of the EPBC Act Offset Policy. This requires the delivery of a land based offset that is suitable to offset a minimum of 90% of the significant residual impact (in combination with other offset delivery options).

BMC is currently undergoing land brokerage activities with third party owned properties to secure suitable land for Mulgrave Stage 2C offset requirements. The properties will legally secure the potential offset areas. Further assessment will be undertaken on the suitability of the potential properties in offsetting project specific impacts utilising the Commonwealth Offset Assessment Guidelines (OAG).

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## Appendix A Targeted Habitat Assessment Data

### Koala

		Habitat aspect													
Site	Vegetation	Abundance of food trees	Soil type	Presence / absence of water source	Water source type	Slope / aspect	Connectivity	Severity of disturbance							
K1	Remnant	>2 food trees	Sandy	N/A	Ephemeral	5% south	High	Low							
K2	Remnant	1 food tree >50%	Silt	N/A	Ephemeral	None	High	None							
КЗ	Remnant	1 food tree <50%	Silt	Yes	N/A	None	Low canopy connectivity	Previously cleared							
K4	Remnant	1 food tree <50%	Sandy	N/A	Ephemeral	None	High	None							
K5	Remnant	1 food tree >50%	N/A	N/A Permanent		None Moderate canopy connectivity		Some dieback							
K6	Remnant	1 food tree >50%	Silt	N/A	Ephemeral	None	None High								
K7	Remnant	N/A	Silt	N/A	Ephemeral	5% east	Moderate canopy connectivity	Previously cleared							
K8	Remnant	1 food tree <50%	Sandy loam	Yes	N/A	7% west	High	Dieback							
K9	Remnant	1 food tree >50%	Sandy	Yes	N/A	7% west	High	None							
K10	Remnant	1 food tree <50%	Sandy	Yes	N/A	None	High	None							
K11	Remnant	1 food tree >50%	Sandy loam	N/A	Ephemeral	None	High	None							
K12	Remnant	1 food tree >50%	Sandy loam	Yes	Ephemeral	None	High	Some dieback							
K13	Remnant	>2 food trees	N/A	N/A	Ephemeral	10% north	High	None							

		Habitat aspect													
Site	Abundance of Vegetation food trees		Soil type	Presence / absence of water source	Water source type	Slope / aspect	Connectivity	Severity of disturbance							
K14	HVR	N/A	Sandy	Yes	N/A	2% west	Low canopy connectivity	None							
K15	Remnant	1 food tree >50%	N/A	Yes	N/A	None	Low	None							
K16	Remnant	>2 food trees	Silt	N/A	Ephemeral	None	Low	Severe dieback							
K17	Remnant	1 food tree >50%	Sandy loam	N/A	Ephemeral	None	High	None							
K18	Remnant	>2 food trees	Sandy	N/A	Ephemeral	None	High	None							
K19	Remnant	N/A	Sandy	N/A	Ephemeral	None	Low	None							
K20	Remnant	1 food tree >50%	Sandy loam	N/A	Ephemeral	None	High	None							
K21	Remnant	>2 food trees	Sandy	N/A	Ephemeral	15% south	High	None							
K22	Remnant	N/A	Sandy	N/A	Ephemeral	None	High	None							
K23	HVR	1 food tree >50%	Sandy	Yes	N/A	None	Low	None							
K24	Remnant	N/A	Sandy loam	Yes	N/A	None	High	None							
K25	Remnant	>2 food trees	Sandy loam	N/A	Ephemeral	None	High	None							
K26	Remnant	1 food tree >50%	Sandy	N/A	Ephemeral	None	High	None							
K27	Remnant	1 food tree >50%	Sandy	N/A	Ephemeral	None	Moderate	None							
K28	Remnant	1 food tree >50%	Sandy	N/A	Ephemeral	None	High	None							
K29	Remnant	1 food tree >50%	Sandy loam	N/A	Ephemeral	None	High	None							
K30	Remnant	1 food tree >50%	Sandy loam	N/A	Ephemeral	None	High	None							

#### **Ornamental Snake**

	Habitat aspect															
		Gilgais			Soil crack					Threats						
Ornamental SnakeSite	Presence	Abundance	Type	Presence	Abundance	Type	Water	Aquatic vegetation	FWD	Habitat clearing	Cattle	Fire	Weeds	Weed Species	Pest	Pest Species
os1	×	Nil	-	×	Nil	-	×	No	Occasional to Common	No	Moderate	No	No	-	No	-
os2	✓	Common to Abundant	Diverse	~	Common to Abundant	Deep	×	No	Abundant	No	Moderate	No	No	-	No	-
os3	✓	Abundant	Deep	✓	Abundant	Deep	×	Yes	Abundant	No	No	No	Low	Harissa cactus	low	Pigs
os4	✓	Abundant	Deep	✓	Common	Deep	×	No	Abundant	No	No	No	Low	Harissa cactus	low	Pigs
os5	×	Nil	-	~	Occasional	Diverse	×	No	Occasional	No	No	No	Low	-	No	-
osô	×	Nil	-	×	Nil	-	×	No	Occasional	No	No	No	Low	Buffel Grass, Harrisia cactus	No	-

### Squatter Pigeon

								На	bitat aspect								
													T	hreats	5		
Site	Landform	Pattern	Soil type	Canopy cover %	Native ground cover %	Litter cover %	Weed cover %	Distance to water (km)	Water	Water type	Bank slope	Habitat clearing	Cattle	Fire	Pests	Pest Species	Other
SP1	Plain	Gently Undulating Plain	sandy silt	50	20	70	5	0.2	No but ephemeral	Stream/ River	gentle	No	No	No	No	-	-
SP10	Hillslope	Gently Undulating Plain	sandy Ioam	60	10	80	1	0.5	Yes	Stream/ River	gentle	No	No	No	No	-	-
SP11	Hillcrest	Gently Undulating Plain	sandy Ioam	75	20	35	1	2	Yes	Dam	gentle	No	low	No	No	-	-
SP12	Plain	Gently Undulating Plain	sandy	40	40	10	0	0	No but ephemeral	Stream/ River	gentle	No	No	No	No	-	-
SP13	Plain	Gently Undulating Plain	sandy	35	40	50	20	0.1	No but ephemeral	Gilgai	gentle	No	No	No	No	-	-

								На	bitat aspect								
													٦	hreat	5		
Site	Landform	Pattern	Soil type	Canopy cover %	Native ground cover %	Litter cover %	Weed cover %	Distance to water (km)	Water	Water type	Bank slope	Habitat clearing	Cattle	Fire	Pests	Pest Species	Other
SP14	Plain	Gently Undulating Plain	sandy	10	25	2	0	0.5	No but ephemeral	Wetland	gentle	Moderate	No	No	No	-	-
SP15	Swamp	Gently Undulating Plain	silt	10	15	25	30	0	No but ephemeral	Wetland	gentle	No	Moderat e	No	No	-	-
SP16	Hillslope	Gently Undulating Plain	sandy	20	25	20	7	0.5	No but ephemeral	Wetland	gentle	Moderate	No	No	No	-	-
SP17	Stream Bank	Gently Undulating Plain	sandy	60	20	10	5	0	No but ephemeral	Stream/ River	gentle	No	Moderat e	No	No	-	-
SP18	Plain	Gently Undulating Plain	sandy Ioam	25	45	55	30	0	No but ephemeral	Stream/ River	gentle	No	No	No	No	-	-
SP19	Plain	Gently Undulating Plain	sandy Ioam	30	20	70	20	1	No but ephemeral	Stream/ River	steep	No	No	No	Mod erat e	-	-

								На	bitat aspect								
													T	hreat	5		
Site	Landform	Pattern	Soil type	Canopy cover %	Native ground cover %	Litter cover %	Weed cover %	Distance to water (km)	Water	Water type	Bank slope	Habitat clearing	Cattle	Fire	Pests	Pest Species	Other
SP2	Plain	Gently Undulating Plain	sandy silt	25	40	55	5	2	No but ephemeral	Stream/ River	gentle	low	No	No	No	-	-
SP20	Plain	Gently Undulating Plain	sandy	5	40	60	60	0.1	No but ephemeral	Stream/ River	steep	No	No	No	No	-	weeds
SP21	Plain	Gently Undulating Plain	sandy	0	40	60	70	2	No but ephemeral	Stream/ River	gentle	Moderate	No	No	No	-	weeds
SP3	Drainage Depression	Gently Undulating Plain	sandy	65	25	70	7	0	No but ephemeral	Stream/ River	gentle	No	low	No	No	-	-
SP4	Hillslope	Gently Undulating Plain	sandy silt	20	10	30	2	0.1	No but ephemeral	Stream/ River	gentle	No	Moderat e	No	No	-	-
SP5	Plain	Gently Undulating Plain	sandy Ioam	30	20	25	2	0.1	Yes	Dam	gentle	No	High	No	No	-	-

								На	bitat aspect								
													T	hreat	5		
Site	Landform	Pattern	Soil type	Canopy cover %	Native ground cover %	Litter cover %	Weed cover %	Distance to water (km)	Water	Water type	Bank slope	Habitat clearing	Cattle	Fire	Pests	Pest Species	Other
SP6	Plain	Gently Undulating Rises	sandy	20	10	25	0	0	No			No	No	No	No	-	-
SP7	Plain	Gently Undulating Plain	sandy Ioam	20	15	10	2	1.5	Yes	Dam	gentle	No	Moderat e	No	No	-	-
SP8	Plain	Badlands	sandy	20	30	15	0	0	Yes	Stream/ River	gentle	No	No	No	No	-	-
SP9	Plain	Gently Undulating Plain	sandy Ioam	40	30	60	1	0.1	No but ephemeral	Stream/ River	steep	No	No	No	No	-	-
SP22	Plain	Gently Undulating Plain	Sandy loam	35	40	15	5	0.5	No but ephemeral	Stream/ River	steep	No	No	No	No	-	-
SP23	Plain	Gently Undulating Plain	Sandy Ioam	25	60	10	30	0.8	No but ephemeral	Stream/ River	steep	No	No	No	No	-	-

								На	bitat aspect								
												Threats					
Site	Landform	Pattern	Soil type	Canopy cover %	Native ground cover %	Litter cover %	Weed cover %	Distance to water (km)	Water	Water type	Bank slope	Habitat clearing	Cattle	Fire	Pests	Pest Species	Other
SP24	Plain	Gently Undulating Plain	Sandy Ioam	25	60	10	10	1	No but ephemeral	Stream/ River	steep	No	No	No	No	-	-
SP25	Plain	Gently Undulating Plain	sandy	35	30	20	2	0.2	No but ephemeral	Stream/ River	gentle	No	No	No	No	-	-
SP26	Plain	Gently Undulating Plain	sandy	40	40	30	2	0.3	No but ephemeral	Stream/ River	gentle	No	No	No	No	-	-
SP27	Plain	Gently Undulating Plain	sandy	35	45	20	0	0.2	No but ephemeral	Stream/ River	gentle	No	No	No	No	-	-

### Greater Glider

		Habitat aspect											
	oed er		Tree hollow	s	Threats								
Site	Well-develor canopy lay	Presence	Abundance	Size	Habitat clearing	Cattle							
GG1	Yes	$\checkmark$	sparse	small / med	Not present	Not present							
GG2	Yes	×	-	-	Not present	Not present							
GG3	Yes	$\checkmark$	sparse	small / med	Not present	Not present							
GG4	Yes	×	-	-	Not present	Not present							
GG5	Yes	~	sparse	small / med	Not present	Not present							

## Appendix B Desktop Results

Australian Government

Department of the Environment and Energy

# **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.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about <u>Environment Assessments</u> and the EPBC Act including significance guidelines, forms and application process details.

Report created: 06/02/18 16:26:09

Summary Details Matters of NES Other Matters Protected by the EPBC Act Extra Information Caveat

**Acknowledgements** 



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates Buffer: 20.0Km



## Summary

### Matters of National Environmental 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 <u>Administrative Guidelines on Significance</u>.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	24
Listed Migratory Species:	13

### 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 environment anywhere.

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 <u>permit</u> 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 Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

### **Extra Information**

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

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	19
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

# Details

## Matters of National Environmental Significance

### Listed Threatened Ecological Communities

[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, 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.

Name	Status	Type of Presence
Brigalow (Acacia harpophylla dominant and co-	Endangered	Community known to occur
dominant)		within area
Natural Grasslands of the Queensland Central	Endangered	Community likely to occur
Highlands and northern Fitzroy Basin Somi overgroop vine thickets of the Brigalow Belt	Endangorod	Within area
(North and South) and Nandewar Bioregions	Enuangereu	within area
		within area
Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus		
Red Goshawk [942]	Vulnerable	Species or species habitat
		likely to occur within area
Geophaps scripta scripta		
Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat
		known to occur within area
Neochmia ruficauda ruficauda		
Star Finch (eastern) Star Finch (southern) [26027]	Endangered	Species or species habitat
		likely to occur within area
		-
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat
		may occur within area
Poenhila cineta, cineta		
Southern Black-throated Finch [64447]	Endangered	Species or species habitat
	Lindangered	likely to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat
		may occur within area
Mammala		
Desvurus ballucatus		
Northorn Quell, Digul [Gogo-Vimidir], Wiiingadda	Endangorod	Species or species habitat
[Dambimangari] Wiminii [Martu] [331]	Lindangered	likely to occur within area
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Species or species habitat
		likely to occur within area
Nu sete a la iluza de arabi		
Nyctophilus cordeni		
Corben's Long-eared Bat, South-eastern Long-	vuinerable	Species or species

Name	Status	Type of Presence
eared Bat [83395]		habitat may occur within
Potouroidoo volono		area
<u>Petauroides voians</u> Greater Glider [254]	Vulnerable	Spacias or spacias habitat
Greater Glider [254]	vullielable	may occur within area
Phascolarctos cinereus (combined populations of Qld, N	<u>ISW and the ACT)</u>	
Koala (combined populations of Queensland, New	Vulnerable	Species or species habitat
South Wales and the Australian Capital Territory)		known to occur within area
Plants		
Cycas ophiolitica		
[55797]	Endangered	Species or species habitat
		likely to occur within area
Dichanthium guconclandioum		
King Blue-grass [5/81]	Endangered	Species or species habitat
	Lindangered	known to occur within area
Dichanthium setosum		
bluegrass [14159]	Vulnerable	Species or species habitat
		known to occur within area
Eucalyptus raveretiana		
Black Ironbox [16344]	Vulnerable	Species or species habitat
		known to occur within area
Omehalaa aalata		
<u>Omphalea celata</u>	Vulnarabla	Spaciae or epociae babitat
[04500]	vullielable	likely to occur within area
		intery to booth within a ba
Samadera bidwillii		
Quassia [29708]	Vulnerable	Species or species habitat
		likely to occur within area
Reptiles		
Denisonia maculata		
Ornamental Snake [1193]	Vulnerable	Species or species habitat
		known to occur within area
Egernia rugosa		
Yakka Skink [1420]	Vulnerable	Species or species habitat
	Vaniorabio	may occur within area
Elseya albagula		
Southern Snapping Turtle, White-throated Snapping	Critically Endangered	Species or species habitat
		likely to occur within alea
<u>Furina dunmalli</u>		
Dunmall's Snake [59254]	Vulnerable	Species or species habitat
		may occur within area
Lorista allanao		
Allan's Lerista, Betro Slider [1378]	Endangered	Species or species habitat
	Endangered	may occur within area
		-
Rheodytes leukops		
Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle,	Vulnerable	Species or species habitat
white-eyed River Diver [1761]		may occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the	ne EPBC Act - Threatened	Species list.
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Switt [6/8]		Species or species habitat
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
<u>Monarcha melanopsis</u>		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
<u>Myiagra cyanoleuca</u>		
Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat

## Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name or	n the EPBC Act - Thre	atened Species list.
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata		
Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species

Name	Threatened	Type of Presence
Ardea ibis		habitat likely to occur within area
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<u>Calidris ferruginea</u> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat
Calidris melanotos		may occur within area
Pectoral Sandpiper [858]		Species or species habitat may occur within area
<u>Cuculus saturatus</u> Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
<u>Gallinago hardwickii</u> Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<u>Merops ornatus</u> Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		known to occur within area
<u>Motacilla flava</u> Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat

Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]

Pandion haliaetus Osprey [952]

Rhipidura rufifrons Rufous Fantail [592]

Rostratula benghalensis (sensu lato) Painted Snipe [889]

Endangered\*

Species or species habitat may occur within area

Critically Endangered

Species or species habitat may occur within area

likely to occur within area

Species or species habitat likely to occur within area

Species or species habitat

may occur within area

### **Extra Information**

State and Territory Reserves	[Resource Information]
Name	State
Dipperu	QLD

### **Invasive Species**

[Resource Information] Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat
		likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina		
Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus		
Goat [2]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area

Mus musculus

House Mouse [120]

Oryctolagus cuniculus Rabbit, European Rabbit [128]

Sus scrofa Pig [6]

Vulpes vulpes Red Fox, Fox [18]

### **Plants**

Acacia nilotica subsp. indica Prickly Acacia [6196]

Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]

Species or species habitat likely to occur within area

Species or species habitat likely to occur within area

Species or species habitat likely to occur within area

Species or species habitat likely to occur within area

Species or species habitat may occur within area

Species or species habitat likely to occur within area

Name	Status	Type of Presence
Jatropha gossypifolia		
Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara		
Lantana, Common Lantana, Kamara Lantana, Large- leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892] Opuntia spp		Species or species habitat likely to occur within area
Prickly Poars [82753]		Species or species habitat
		likely to occur within area
Parkinsonia aculeata		
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Parthenium hysterophorus		
Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Vachellia nilotica Driekky Associa, Disektherra, Driekky Mirrosov, Disek		On a size, an an a size, habitat
Prickly Acacia, Blackthorn, Prickly Milmosa, Black Piquant, Babul [84351]		Species or species nabitat likely to occur within area

# Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, 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 distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

## Coordinates

-21.728652 148.361995,-21.722911 148.400791,-21.745554 148.454349,-21.768194 148.500697,-21.787323 148.496234,-21.74683 148.376415,-21.728971 148.361995,-21.728652 148.361995

## 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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### Wildlife Online Extract

Search Criteria: Species List for a Defined Area Species: All Type: All Status: All Records: All Date: All Latitude: 21.5765 to 21.9166 Longitude: 148.2402 to 148.6271 Email: kateb@ecoaus.com.au Date submitted: Tuesday 06 Feb 2018 15:18:17 Date extracted: Tuesday 06 Feb 2018 15:20:11

The number of records retrieved = 509

### **Disclaimer**

As the DSITIA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided should only be used for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

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Feedback about Wildlife Online should be emailed to wildlife.online@science.dsitia.qld.gov.au

Kingdom	Class	Family	Scientific Name	Common Name	I Q	А	Records
animals	amphibians	Hylidae	Litoria inermis	bumpy rocketfrog	С		1
animals	amphibians	Hylidae	Litoria rubella	ruddy treefrog	С		2
animals	amphibians	Hylidae	Litoria caerulea	common green treefrog	С		4
animals	amphibians	Hylidae	Cyclorana alboguttata	greenstripe frog	С		1
animals	amphibians	Limnodynastidae	Limnodynastes peronii	striped marshfrog	С		4
animals	amphibians	Limnodynastidae	Limnodynastes salmini	salmon striped frog	С		1
animals	amphibians	Limnodynastidae	Platyplectrum ornatum	ornate burrowing frog	С		1
animals	amphibians	Limnodynastidae	Limnodynastes tasmaniensis	spotted grassfrog	С		4
animals	birds	Acanthizidae	Acanthiza nana	yellow thornbill	С		2
animals	birds	Acanthizidae	Gerygone olivacea	white-throated gerygone	С		2
animals	birds	Acanthizidae	Smicrornis brevirostris	weebill	С		7
animals	birds	Accipitridae	Aviceda subcristata	Pacific baza	С		1
animals	birds	Accipitridae	Haliastur sphenurus	whistling kite	С		3
animals	birds	Aegothelidae	Aegotheles cristatus	Australian owlet-nightjar	С		4
animals	birds	Anatidae	Cvonus atratus	black swan	С		1
animals	birds	Anatidae	Avthva australis	hardhead	С		1
animals	birds	Anatidae	Anas superciliosa	Pacific black duck	Ċ		4
animals	birds	Anatidae	Chenonetta iubata	Australian wood duck	С		3
animals	birds	Anatidae	Nettapus coromandelianus	cotton pyamy-goose	Ċ		1
animals	birds	Anatidae	Malacorhynchus membranaceus	pink-eared duck	Ċ		1
animals	birds	Anatidae	Anas gracilis	grev teal	Ċ		1
animals	birds	Anhingidae	Anhinga novaehollandiae	Australasian darter	Č		1
animals	birds	Ardeidae	Ardea pacifica	white-necked heron	Ċ		1
animals	birds	Ardeidae	Ardea intermedia	intermediate earet	С		1
animals	birds	Ardeidae	Ardea alba modesta	eastern great egret	Č		1
animals	birds	Ardeidae	Bubulcus ibis	cattle egret	Ċ		1
animals	birds	Ardeidae	Egretta novaehollandiae	white-faced heron	Č		3
animals	birds	Artamidae	Strepera graculina	pied currawong	Č		1
animals	birds	Artamidae	Cracticus torquatus	arev butcherbird	Č		5
animals	birds	Artamidae	Cracticus nigrogularis	pied butcherbird	č		6
animals	birds	Artamidae	Cracticus tibicen	Australian magpie	Č		10
animals	birds	Cacatuidae	Cacatua galerita	sulphur-crested cockatoo	Č		5
animals	birds	Cacatuidae	Calvptorhvnchus funereus	vellow-tailed black-cockatoo	Č		1
animals	birds	Cacatuidae	Eolophus roseicapilla	galah	Č		4
animals	birds	Campephagidae	Coracina papuensis	white-bellied cuckoo-shrike	Č		1
animals	birds	Campephagidae	Coracina novaehollandiae	black-faced cuckoo-shrike	č		4
animals	birds	Charadriidae	Vanellus miles	masked lapwing	č		1
animals	birds	Charadriidae	Elsevornis melanons	black-fronted dotterel	č		1
animals	birds	Ciconiidae	Ephippiorhynchus asiaticus	black-necked stork	č		i
animals	birds	Cisticolidae	Cisticola exilis	golden-headed cisticola	č		1
animals	birds	Columbidae	Geophans scripta scripta	squatter pigeon (southern subspecies)	v	V	5
animals	birds	Columbidae	Phans chalcontera	common bronzewing	ċ	•	1
animals	birds	Columbidae	Ocvphaps lophotes	crested pigeon	č		1
animals	birds	Columbidae	Geopelia striata	peaceful dove	č		1
animals	birds	Coraciidae	Furvstomus orientalis	dollarbird	č		1
animals	birds	Corcoracidae	Struthidea cinerea	apostlebird	č		7
		00.00.00.000		apoonoona	<u> </u>		,

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	А	Records
animals	birds	Corvidae	Corvus orru	Torresian crow		С		11
animals	birds	Cuculidae	Cuculus optatus	oriental cuckoo		SL		1
animals	birds	Cuculidae	Eudynamys orientalis	eastern koel		С		1
animals	birds	Cuculidae	Scythrops novaehollandiae	channel-billed cuckoo		С		1
animals	birds	Cuculidae	Cacomantis flabelliformis	fan-tailed cuckoo		С		1
animals	birds	Cuculidae	Centropus phasianinus	pheasant coucal		С		2
animals	birds	Cuculidae	Cacomantis variolosus	brush cuckoo		С		1
animals	birds	Cuculidae	Chalcites lucidus	shining bronze-cuckoo		С		1
animals	birds	Estrildidae	Taeniopygia bichenovii	double-barred finch		С		2
animals	birds	Falconidae	Falco longipennis	Australian hobby		С		1
animals	birds	Falconidae	Falco cenchroides	nankeen kestrel		С		1
animals	birds	Gruidae	Grus rubicunda	brolga		С		1
animals	birds	Halcyonidae	Dacelo leachii	blue-winged kookaburra		С		2
animals	birds	Halcyonidae	Todiramphus sanctus	sacred kingfisher		С		2
animals	birds	Halcvonidae	, Dacelo novaequineae	laughing kookaburra		С		5
animals	birds	Hirundinidae	Petrochelidon nigricans	tree martin		Ċ		1
animals	birds	Jacanidae	Irediparra gallinacea	comb-crested jacana		Ċ		1
animals	birds	Maluridae	Malurus lamberti	variegated fairy-wren		С		1
animals	birds	Maluridae	Malurus melanocephalus	red-backed fairy-wren		Ċ		2
animals	birds	Meliphagidae	Manorina flavigula	vellow-throated miner		С		2
animals	birds	Meliphagidae	Lichmera indistincta	brown honeveater		С		4
animals	birds	Meliphagidae	Melithreptus gularis	black-chinned honeveater		Ċ		1
animals	birds	Meliphagidae	Philemon corniculatus	noisy friarbird		Ċ		4
animals	birds	Meliphagidae	Manorina melanocephala	noisv miner		Ċ		4
animals	birds	Meliphagidae	Philemon citreoqularis	little friarbird		Ċ		2
animals	birds	Meliphagidae	Melithreptus alboqularis	white-throated honeveater		Ċ		8
animals	birds	Meliphagidae	Plectorhyncha lanceolata	striped honeveater		Č		2
animals	birds	Meliphagidae	Entomyzon cvanotis	blue-faced honeveater		Č		8
animals	birds	Meliphagidae	Stomiopera flava	vellow honeveater		Ċ		1
animals	birds	Meliphagidae	Meliphaga lewinii	Lewin's honeveater		Č		1
animals	birds	Meropidae	Merops ornatus	rainbow bee-eater		Č		2
animals	birds	Monarchidae	Mviagra rubecula	leaden flycatcher		Č		1
animals	birds	Monarchidae	Grallina cvanoleuca	magpie-lark		Č		9
animals	birds	Monarchidae	Monarcha melanopsis	black-faced monarch		ŠL		1
animals	birds	Nectariniidae	Dicaeum hirundinaceum	mistletoebird		Ċ		2
animals	birds	Neosittidae	Daphoenositta chrvsoptera	varied sittella		Č		3
animals	birds	Oriolidae	Oriolus sagittatus	olive-backed oriole		Ċ		2
animals	birds	Otididae	Ardeotis australis	Australian bustard		Č		1
animals	birds	Pachycephalidae	Pachycephala rufiventris	rufous whistler		Č		5
animals	birds	Pachycephalidae	Colluricincla harmonica	arev shrike-thrush		Č		5
animals	birds	Pardalotidae	Pardalotus striatus	striated pardalote		Č		12
animals	birds	Phalacrocoracidae	Microcarbo melanoleucos	little pied cormorant		Č		2
animals	birds	Podaraidae	Podargus strigoides	tawny frogmouth		Č		7
animals	birds	Podicipedidae	Tachybaptus novaehollandiae	Australasian grebe		Ċ		1
animals	birds	Pomatostomidae	Pomatostomus temporalis	grey-crowned babbler		Č		7
animals	birds	Psittacidae	Trichoglossus haematodus moluccanus	rainbow lorikeet		С		12
Kingdom	Class	Family	Scientific Name	Common Name		Q	А	Records
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animals	birds	Psittacidae	Platycercus adscitus	pale-headed rosella		С		10
animals	birds	Psittacidae	Aprosmictus erythropterus	red-winged parrot		С		3
animals	birds	Ptilonorhynchidae	Ptilonorhynchus nuchalis	great bowerbird		С		1
animals	birds	Rallidae	Fulica atra	Eurasian coot		С		1
animals	birds	Rallidae	Gallinula tenebrosa	dusky moorhen		С		2
animals	birds	Rhipiduridae	Rhipidura albiscapa	grey fantail		С		8
animals	birds	Rhipiduridae	Rhipidura leucophrys	willie wagtail		С		4
animals	birds	Threskiornithidae	Threskiornis spinicollis	straw-necked ibis		С		1
animals	mammals	Cervidae	Axis axis	chital	Y			1
animals	mammals	Emballonuridae	Saccolaimus flaviventris	vellow-bellied sheathtail bat		С		7
animals	mammals	Felidae	Felis catus	cat	Y			1
animals	mammals	Leporidae	Orvctolagus cuniculus	rabbit	Y			1
animals	mammals	Macropodidae	Lagorchestes conspicillatus	spectacled hare-wallaby		С		2
animals	mammals	Macropodidae	Macropus dorsalis	black-striped wallaby		Ċ		1
animals	mammals	Macropodidae	Wallabia bicolor	swamp wallaby		Č		1
animals	mammals	Macropodidae	Macropus parrvi	whiptail wallaby		č		1
animals	mammals	Macropodidae	Macropus giganteus	eastern grev kangaroo		č		3
animals	mammals	Molossidae	Mormonterus norfolkensis	east coast freetail bat		č		1
animals	mammals	Petauridae	Petaurus norfolcensis	squirrel alider		č		2
animals	mammals	Petauridae	Petaurus brevicens	sugar glider		č		3
animals	mammals	Phascolarctidae	Phascolarctos cinereus	koala		v	V	3
animals	mammals	Potoroidae	Aenvnrvmnus rufescens	rufous bettong		ċ	·	2
animals	mammals	Pseudocheiridae	Petauroides volans minor	northern greater glider		v	V	8
animals	mammals	Suidae	Sus scrofa	nia	Y	•	•	2
animals	mammals	Tachyglossidae	Tachyolossus aculeatus	short-beaked echidna		SI		1
animals	mammals	Vespertilionidae	Chalinolobus gouldii	Gould's wattled bat		C_		21
animals	mammals	Vespertilionidae	Chalinolobus morio	chocolate wattled bat		č		2
animals	rentiles	Agamidae	Pogona barbata	bearded dragon		č		2
animals	rentiles	Boidae	Antaresia maculosa	spotted nython		č		- 1
animals	rentiles	Chelidae	Chelodina Iongicollis	eastern snake-necked turtle		č		1
animals	rentiles	Colubridae	Boiga irregularis	brown tree snake		č		2
animals	rentiles	Colubridae	Tropidonophis mairii	freshwater snake		č		2
animals	rentiles	Diplodactylidae	Nedura monilis	ocellated velvet decko		č		11
animals	rentiles	Diplodactylidae	Dinlodactylus vittatus	wood aecko		č		2
animals	rentiles	Flanidae	Pseudonaia textilis	eastern brown snake		č		6
animals	rentiles	Flanidae	Demansia psammonhis	vellow-faced whinsnake		č		1
animals	rentiles	Gekkonidae	Gehvra dubia	dubious dtella		č		57
animals	rentiles	Gekkonidae	Gebyra sp			0		1
animals	rentiles	Gekkonidae	Heteronotia hinoei	Bynoe's gecko		C		7
animals	rentiles	Gekkonidae	Gebyra versicolor	Dynoe 3 geeko		ĉ		16
animale	rontilos	Pygopodidae	Lialis hurtonis	Burton's lealess lizard		õ		3
animale	rentiles	Pygopodidae	Delma tincta	excitable delma		č		1
animale	rentilee	Scincidae	Carlia rubido	orange-flanked rainhow ekink		č		і Л
animale	rontilos	Scincidae	Ctenotus ingrami	unspotted vellow-sided standus		č		
animala	reptiles	Scincidae	Egernia striolata	trop skink		č		1
animala	roptilos	Scincidae	Lyonnia Sinolala Otopotus spoldingi	etraight-browed standtus		č		ו ס
anniais	repuies	Juliuae	olenolus spainingi	รแลเนาเราเบพยน เเยาเป็นร		U		3

Kingdom	Class	Family	Scientific Name	Common Name	l	Q	А	Records
animals	reptiles	Scincidae	Lygisaurus foliorum	tree-base litter-skink		С		2
animals	reptiles	Scincidae	Ćryptoblepharus pulcher pulcher	elegant snake-eyed skink		С		3
animals	reptiles	Scincidae	Carlia pectoralis sensu lato	<b>C</b> <i>i</i>		С		4
animals	reptiles	Scincidae	Ctenotus taeniolatus	copper-tailed skink		С		1
animals	reptiles	Scincidae	Cryptoblepharus pannosus	ragged snake-eyed skink		С		2
animals	reptiles	Scincidae	Glaphvromorphus punctulatus	fine-spotted mulch-skink		С		1
animals	reptiles	Scincidae	Pvomaeascincus timlowi	dwarf litter-skink		С		1
animals	reptiles	Varanidae	Varanus tristis	black-tailed monitor		С		4
animals	uncertain	Indeterminate	Indeterminate	Unknown or Code Pending		С		1
plants	ferns	Adiantaceae	Cheilanthes sieberi subsp. sieberi	5		Ċ		6
plants	ferns	Adiantaceae	Cheilanthes distans	bristly cloak fern		Ċ		1/1
plants	higher dicots	Acanthaceae	Rostellularia adscendens	· · · <b>,</b> · · · · ·		Ċ		9
plants	higher dicots	Acanthaceae	Brunoniella australis	blue trumpet		Č		20/1
plants	higher dicots	Acanthaceae	Pseuderanthemum tenellum			Ċ		13
plants	higher dicots	Aizoaceae	Trianthema triguetra	red spinach		Ċ		2/1
plants	higher dicots	Aizoaceae	Zaleva galericulata			Č		1/1
plants	higher dicots	Amaranthaceae	Amaranthus cochleitepalus			Č		1/1
plants	higher dicots	Amaranthaceae	Alternanthera nana	hairy joyweed		Č		16
plants	higher dicots	Amaranthaceae	Achvranthes aspera			Č		4
plants	higher dicots	Amaranthaceae	Alternanthera denticulata	lesser joyweed		Č		2
plants	higher dicots	Amaranthaceae	Gomphrena celosioides	gomphrena weed	Y	•		2
plants	higher dicots	Amaranthaceae	Amaranthus mitchellii	Boggabri weed	•	С		1/1
plants	higher dicots	Anacardiaceae	Pleioavnium timorense	Burdekin plum		Č		1
plants	higher dicots	Apocynaceae	Secamone elliptica			Č		1
plants	higher dicots	Apocynaceae	Marsdenia microlepis			č		2
plants	higher dicots	Apocynaceae	Parsonsia lanceolata	northern silknod		õ		13/1
plants	higher dicots	Apocynaceae	Gomphocarpus physocarpus	balloon cottonbush	Y	Ŭ		1
plants	higher dicots	Apocynaceae	Cvnanchum viminale subsp. brunonianum		•	С		7
plants	higher dicots	Apocynaceae	Marsdenia viridiflora subsp. viridiflora			õ		5
plants	higher dicots	Apocynaceae	Carissa ovata	currantbush		č		13
plants	higher dicots	Araliaceae	Astrotricha biddulphiana	Carrandour		č		1/1
plants	higher dicots	Asteraceae	Calotis cuneata			õ		1/1
plants	higher dicots	Asteraceae	Cirsium vulgare	spear thistle	Y	Ŭ		1/1
plants	higher dicots	Asteraceae	Sonchus oleraceus	common sowthistle	Ý			6
plants	higher dicots	Asteraceae	Xanthium spinosum	Bathurst burr	Ý			1/1
plants	higher dicots	Asteraceae	Calotis cuneifolia	burr daisy		С		4/1
plants	higher dicots	Asteraceae	Emilia sonchifolia	Sur daloy	Y	Ŭ		5
nlants	higher dicots	Asteraceae	Vittadinia sulcata	native daisv		С		1/1
nlants	higher dicots	Asteraceae	l agenophora gracilis	haive daloy		č		2
plants	higher dicots	Asteraceae	Cvanthillium cinereum			č		10
nlants	higher dicots	Asteraceae	Acanthospermum hispidum	star burr	Y	Ŭ		1
plants	higher dicots	Asteraceae	Parthenium hysterophorus	narthenium weed	Ý			4/1
plants	higher dicots	Asteraceae	Chrysocephalum aniculatum	vellow buttons		С		4
nlante	higher dicots	Asteraceae	Snhaeromornhaea australis	yonow battono		č		ч Д
nlants	higher dicots	Asteraceae	Anowollastonia spilanthoides			č		q
plants	higher dicots	Asteraceae	Peripleura hispidula var. hispidula			č		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	А	Records
plants	higher dicots	Asteraceae	Pterocaulon serrulatum var. serrulatum			С		1/1
, plants	higher dicots	Asteraceae	Pluchea dentex	bowl daisy		С		1/1
, plants	higher dicots	Boraginaceae	Heliotropium			С		1
, plants	higher dicots	Boraginaceae	Ehretia membranifolia	weeping koda		С		12
, plants	higher dicots	Boraginaceae	Trichodesma zeylanicum	1 5		С		3
plants	higher dicots	Brassicaceae	Lepidium virginicum	Virginian peppercress	Y			1/1
, plants	higher dicots	Byttneriaceae	Waltheria indica	3 1 11		С		7
, plants	higher dicots	Cactaceae	Opuntia tomentosa	velvety tree pear	Y			12
, plants	higher dicots	Cactaceae	, Harrisia martinii	, i	Y			10
, plants	higher dicots	Caesalpiniaceae	Cassia tomentella			С		10
, plants	higher dicots	Caesalpiniaceae	Senna coronilloides			С		1
, plants	higher dicots	Caesalpiniaceae	Chamaecrista concinna			С		2
, plants	higher dicots	Caesalpiniaceae	Cassia brewsteri			С		1/1
, plants	higher dicots	Caesalpiniaceae	Lysiphyllum carronii	ebony tree		С		1
, plants	higher dicots	Caesalpiniaceae	Chamaecrista absus	,		С		5
, plants	higher dicots	Campanulaceae	Wahlenbergia gracilis	sprawling bluebell		С		1
, plants	higher dicots	Campanulaceae	Lobelia concolor	1 5		С		1
, plants	higher dicots	Capparaceae	Capparis canescens			С		1
, plants	higher dicots	Capparaceae	Capparis lasiantha	nipan		С		6
, plants	higher dicots	Casuarinaceae	Allocasuarina luehmannii	bull oak		С		3
, plants	higher dicots	Casuarinaceae	Casuarina cristata	belah		С		13/1
, plants	higher dicots	Celastraceae	Elaeodendron australe			С		1
, plants	higher dicots	Celastraceae	Denhamia cunninghamii			С		10
plants	higher dicots	Celastraceae	Denhamia oleaster			С		2
plants	higher dicots	Chenopodiaceae	Dysphania melanocarpa forma melanocarpa			С		2
, plants	higher dicots	Chenopodiaceae	Enchylaena tomentosa var. tomentosa			С		1/1
plants	higher dicots	Chenopodiaceae	Chenopodium auricomiforme			С		1/1
plants	higher dicots	Chenopodiaceae	Einadia polygonoides	knotweed goosefoot		С		1
, plants	higher dicots	Chenopodiaceae	Enchylaena tomentosa	Ū.		С		6
plants	higher dicots	Chenopodiaceae	Maireana microphylla			С		2
plants	higher dicots	Combretaceae	Terminalia oblongata			С		10
plants	higher dicots	Convolvulaceae	Convolvulus erubescens	Australian bindweed		С		1
plants	higher dicots	Convolvulaceae	Polymeria longifolia	polymeria		С		5
plants	higher dicots	Convolvulaceae	Evolvulus alsinoides			С		11
plants	higher dicots	Convolvulaceae	Ipomoea plebeia	bellvine		С		7
plants	higher dicots	Convolvulaceae	Ipomoea brownii			С		1
plants	higher dicots	Convolvulaceae	Jacquemontia paniculata			С		14
plants	higher dicots	Cucurbitaceae	Cucumis anguria var. anguria	West Indian gherkin	Y			4
plants	higher dicots	Droseraceae	Drosera	-		С		4
plants	higher dicots	Ebenaceae	Diospyros humilis	small-leaved ebony		С		8/1
plants	higher dicots	Erythroxylaceae	Erythroxylum australe	cocaine tree		С		15
plants	higher dicots	Euphorbiaceae	Euphorbia coghlanii			С		1/1
plants	higher dicots	Euphorbiaceae	Euphorbia drummondii			С		10
plants	higher dicots	Euphorbiaceae	Adriana tomentosa var. tomentosa			С		2/2
plants	higher dicots	Euphorbiaceae	Euphorbia tannensis subsp. eremophila			С		3
plants	higher dicots	Euphorbiaceae	Croton phebalioides	narrow-leaved croton		С		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	А	Records
plants	higher dicots	Euphorbiaceae	Bertya pedicellata			NT		1/1
plants	higher dicots	Euphorbiaceae	Euphorbia hyssopifolia		Y			8
plants	higher dicots	Fabaceae	Glycine falcata			С		1/1
plants	higher dicots	Fabaceae	Crotalaria mitchellii subsp. mitchellii			С		1
plants	higher dicots	Fabaceae	Tephrosia juncea			С		5
, plants	higher dicots	Fabaceae	Vigna lanceolata			С		6
plants	higher dicots	Fabaceae	Desmodium varians	slender tick trefoil		С		3
plants	higher dicots	Fabaceae	Zornia muriculata			С		8
, plants	higher dicots	Fabaceae	Crotalaria montana			С		3
plants	higher dicots	Fabaceae	Desmodium muelleri			Ċ		1/1
plants	higher dicots	Fabaceae	Glvcine tomentella	woolly alvcine		Ċ		10/1
plants	higher dicots	Fabaceae	Indigofera colutea	sticky indigo		Ċ		6
plants	higher dicots	Fabaceae	Indigofera linnaei	Birdsville indigo		Č		6
plants	higher dicots	Fabaceae	Zornia muelleriana	go		č		1
plants	higher dicots	Fabaceae	Galactia tenuiflora			č		2
plants	higher dicots	Fabaceae	Stylosanthes scabra		Y	Ũ		15
plants	higher dicots	Fabaceae	Alvsicarnus muelleri		•	С		2/2
plants	higher dicots	Fahaceae	Indigofera linifolia			Č		1
plants	higher dicots	Fahaceae	Tenhrosia lentoclada			Č		3
plants	higher dicots	Fahaceae	Desmodium brachypodum	large ticktrefoil		Č		8
plants	higher dicots	Fahaceae	Tenhrosia dietrichiae			C		2
nlants	higher dicots	Fahaceae	Crotalaria medicaginea	trefoil rattlepod		C		2 4
nlants	higher dicots	Fahaceae	Crotalaria sessiliflora			0		8
nlante	higher dicots	Fabaceae	Indigofera sericovevilla			C		2
plants	higher dicots	Fabaceae	Vigna radiata var sublobata			č		1/1
nlante	higher dicots	Fabaceae	Rhynchosia minima var australis			Č		13/1
plants	higher dicots	Fabaceae	Zornia dvetiocarna var. filifolia			č		1/1
plants	higher dicots	Fabaceae	Tenbrosia brachvodon var longifolia			č		2
plants	higher dicots	Fabaceae	Glucino tabacino	alveino noo		Č		1/
plants	higher dicots	Goodoniacoao	Giyeline labacina Goodonia alabra	giycille pea		Č		14
plants	higher dicots	Goodeniaceae	Velleia			č		5
plants	higher dicots	Holorogoooo	Vellela Helerogia conora	raapwood		Č		
plants	higher dicots	Lamiacoao	Taluayis aspera Touorium intogrifolium	Taspweeu		Č		1/1
plants	higher dicots	Lamiaceae	Plastranthus panyiflarua			Č		1/1
plants	higher dicots	Lamiaceae	Cleredendrum fleribundum			Č		4
plants	higher dicots	Lamiaceae			V	C		ی ۱/۱
plants	higher dicots	Lamiaceae	Destronthus		ř	0		1/1
plants	higher dicots	Lamiaceae	Pieciraninus Recilieum nelveteebven			Č		1/1
plants	higher dicols	Lamaceae	Basilicum polystachyon			Č		
plants	higher dicols	Loganiaceae				Č		5
plants	nigner dicots	Loganiaceae	Mitrasacme pygmaea			C		8
plants	nigner dicots	Lythraceae	Lymrum paradoxum	ioun (ioun (		U C		1
plants	higher dicots	Lythraceae	Ammannia muitifiora	jerry-jerry				2
plants	nigner dicots	Malvaceae	Sida ashlara a			U C		<u>/</u>
plants	nigher dicots	Malvaceae	Sida ronienae			C		1
plants	nigher dicots	waivaceae	Sida Corditolla		Y	0		13/1
plants	nigher dicots	walvaceae	Sida nackettiana			C		5

Kingdom	Class	Family	Scientific Name	Common Name		Q	А	Records
plants	higher dicots	Malvaceae	Sida rhombifolia		Y			11
plants	higher dicots	Malvaceae	Sida cunninghamii			С		3
, plants	higher dicots	Malvaceae	Abutilon guineense		Y			3/3
plants	higher dicots	Malvaceae	Abutilon malvifolium	bastard marshmallow		С		1
plants	higher dicots	Malvaceae	Abutilon subviscosum			С		1/1
plants	higher dicots	Malvaceae	Hibiscus verdcourtii			С		1/1
plants	higher dicots	Malvaceae	Malvastrum americanum		Y			2
plants	higher dicots	Malvaceae	Hibiscus sturtii var. sturtii			С		8
plants	higher dicots	Malvaceae	Abutilon oxycarpum var. incanum			С		1/1
plants	higher dicots	Malvaceae	Abutilon oxycarpum var. subsagittatum			С		16
plants	higher dicots	Meliaceae	Owenia acidula	emu apple		С		1
plants	higher dicots	Mimosaceae	Vachellia farnesiana		Y			1/1
plants	higher dicots	Mimosaceae	Acacia bancroftiorum			С		1/1
plants	higher dicots	Mimosaceae	Vachellia bidwillii			С		3
plants	higher dicots	Mimosaceae	Acacia holosericea			С		2
, plants	higher dicots	Mimosaceae	Acacia harpophylla	brigalow		С		2
, plants	higher dicots	Mimosaceae	Acacia flavescens	toothed wattle		С		2
plants	higher dicots	Mimosaceae	Acacia salicina	doolan		С		4
, plants	higher dicots	Mimosaceae	Acacia oswaldii	miljee		С		1/1
, plants	higher dicots	Mimosaceae	Acacia julifera			С		2
plants	higher dicots	Mimosaceae	Acacia conferta			С		1/1
, plants	higher dicots	Mimosaceae	Acacia excelsa			С		4
, plants	higher dicots	Mimosaceae	Neptunia gracilis forma gracilis			С		3/1
, plants	higher dicots	Mimosaceae	Acacia blakei subsp. blakei			С		1/1
, plants	higher dicots	Mimosaceae	Archidendropsis basaltica	red lancewood		С		8
plants	higher dicots	Myrtaceae	Eucalyptus crebra x E.orgadophila			С		1/1
, plants	higher dicots	Myrtaceae	Eucalyptus camaldulensis			С		1
plants	higher dicots	Myrtaceae	Eucalyptus tereticornis			С		3
, plants	higher dicots	Myrtaceae	Eucalyptus tholiformis			С		1/1
plants	higher dicots	Myrtaceae	Eucalyptus raveretiana	black ironbox		С	V	2/2
plants	higher dicots	Myrtaceae	Eucalyptus platyphylla	poplar gum		С		3
, plants	higher dicots	Myrtaceae	Melaleuca fluviatilis			С		1/1
plants	higher dicots	Myrtaceae	Corymbia clarksoniana			С		7/1
plants	higher dicots	Myrtaceae	Corymbia tessellaris	Moreton Bay ash		С		4/1
, plants	higher dicots	Myrtaceae	Corymbia dallachiana	-		С		6
, plants	higher dicots	Myrtaceae	Eucalyptus tenuipes	narrow-leaved white mahogany		С		1/1
, plants	higher dicots	Myrtaceae	Eucalyptus populnea	poplar box		С		13
, plants	higher dicots	Myrtaceae	Melaleuca nervosa			С		5
plants	higher dicots	Myrtaceae	Eucalyptus crebra	narrow-leaved red ironbark		С		1/1
plants	higher dicots	Nyctaginaceae	Boerhavia dominii			С		9
, plants	higher dicots	Oleaceae	Jasminum didymum subsp. lineare			С		6
plants	higher dicots	Oleaceae	Notelaea microcarpa			С		1
plants	higher dicots	Onagraceae	Ludwigia			С		1/1
plants	higher dicots	Phyllanthaceae	Phyllanthus mitchellii			С		1
plants	higher dicots	Phyllanthaceae	Phyllanthus virgatus			С		16
plants	higher dicots	Phyllanthaceae	Phyllanthus lacunarius			С		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	Α	Records
plants	higher dicots	Phyllanthaceae	Phyllanthus maderaspatensis			С		6
, plants	higher dicots	Phyllanthaceae	Phyllanthus			С		1
, plants	higher dicots	Phyllanthaceae	Brevnia oblongifolia			С		11
, plants	higher dicots	Phyllanthaceae	Phyllanthus fuernrohrii			С		1
, plants	higher dicots	Picrodendraceae	Petalostigma pubescens	quinine tree		С		10
, plants	higher dicots	Pittosporaceae	Bursaria incana			С		10/1
, plants	higher dicots	Pittosporaceae	Pittosporum angustifolium			С		3
, plants	higher dicots	Plantaginaceae	Stemodia pubescens			С		1/1
, plants	higher dicots	Plantaginaceae	Scoparia dulcis	scoparia	Y			3
plants	higher dicots	Polygonaceae	Emex australis		Y			7
plants	higher dicots	Portulacaceae	Portulaca pilosa		Y			1
plants	higher dicots	Portulacaceae	Portulaca oleracea	piqweed	Y			1
plants	higher dicots	Portulacaceae	Portulaca filifolia	1.0		С		8
plants	higher dicots	Portulacaceae	Calandrinia pickeringii			Ċ		3/1
plants	higher dicots	Proteaceae	Grevillea striata	beefwood		Ċ		1
plants	higher dicots	Proteaceae	Hakea lorea			Ċ		5
plants	higher dicots	Proteaceae	Persoonia amaliae			C		1/1
, plants	higher dicots	Proteaceae	Grevillea parallela			С		1
plants	higher dicots	Rhamnaceae	Alphitonia excelsa	soap tree		Ċ		11
plants	higher dicots	Rhamnaceae	Ventilago viminalis	supplejack		C		11/1
, plants	higher dicots	Rubiaceae	Psvdrax saligna forma saligna	,		С		1/1
plants	higher dicots	Rubiaceae	Psydrax odorata forma buxifolia			C		7
, plants	higher dicots	Rubiaceae	Psydrax odorata subsp. australiana			С		1/1
plants	higher dicots	Rubiaceae	Psydrax oleifolia			С		2
, plants	higher dicots	Rubiaceae	Psydrax attenuata			С		4
, plants	higher dicots	Rubiaceae	Spermacoce multicaulis			С		13
, plants	higher dicots	Rubiaceae	Spermacoce brachystema			С		1/1
, plants	higher dicots	Rutaceae	Flindersia dissosperma			С		12
, plants	higher dicots	Rutaceae	Geijera salicifolia	brush wilga		С		13/1
, plants	higher dicots	Rutaceae	Citrus glauca	3		С		1/1
, plants	higher dicots	Rutaceae	Flindersia australis	crow's ash		С		1
, plants	higher dicots	Santalaceae	Santalum lanceolatum			С		2
, plants	higher dicots	Sapindaceae	Alectryon pubescens			С		1/1
, plants	higher dicots	Sapindaceae	Alectryon oleifolius subsp. elongatus			С		2
plants	higher dicots	Sapindaceae	Alectryon diversifolius	scrub boonaree		С		4
, plants	higher dicots	Sapindaceae	Atalava hemiqlauca			С		11
, plants	higher dicots	Sapotaceae	Planchonella pohlmaniana			С		1/1
plants	higher dicots	Sapotaceae	Planchonella pohlmaniana var. (Gilbert			С		1/1
	0	·	River C.T.White 1409)					
plants	higher dicots	Scrophulariaceae	Éremophila debilis	winter apple		С		5
, plants	higher dicots	Scrophulariaceae	Eremophila deserti			С		1
, plants	higher dicots	Scrophulariaceae	Eremophila mitchellii			С		10
plants	higher dicots	Scrophulariaceae	Myoporum acuminatum	coastal boobialla		С		6/2
plants	higher dicots	Solanaceae	Solanum parvifolium subsp. parvifolium			С		3
plants	higher dicots	Solanaceae	Solanum ellipticum	potato bush		С		3
plants	higher dicots	Solanaceae	Solanum esuriale	quena		С		2/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	А	Records
plants	hiaher dicots	Sparrmanniaceae	Grewia latifolia	dvsenterv plant		С		19
plants	higher dicots	Sparrmanniaceae	Corchorus trilocularis	5 51		С		1/1
plants	higher dicots	Sterculiaceae	Brachychiton australis	broad-leaved bottle tree		С		1/1
plants	higher dicots	Sterculiaceae	Brachychiton populneus subsp. trilobus			С		1/1
plants	higher dicots	Thymelaeaceae	Pimelea linifolia subsp. linifolia			С		3
plants	higher dicots	Violaceae	Afrohybanthus stellarioides			С		2
plants	higher dicots	Violaceae	Afrohybanthus enneaspermus			С		9
plants	higher dicots	Vitaceae	Clematicissus opaca			С		1
plants	lower dicots	Lauraceae	Cassytha filiformis	dodder laurel		С		1
plants	lower dicots	Menispermaceae	Tinospora smilacina	snakevine		С		1
plants	monocots	Amaryllidaceae	Crinum flaccidum	Murray lily		С		1
plants	monocots	Centrolepidaceae	Centrolepis exserta			С		1/1
plants	monocots	Commelinaceae	Cyanotis axillaris			С		5
plants	monocots	Commelinaceae	Murdannia graminea	murdannia		С		5
plants	monocots	Commelinaceae	Commelina diffusa	wandering jew		С		8
plants	monocots	Cyperaceae	Cyperus difformis	rice sedge		С		2
plants	monocots	Cyperaceae	Cyperus scariosus	Ũ		С		1
plants	monocots	Cyperaceae	Fimbristylis nuda			С		1
plants	monocots	Cyperaceae	Abildgaardia ovata			С		5/1
plants	monocots	Cyperaceae	Cyperus cyperoides			С		3
plants	monocots	Cyperaceae	Cyperus esculentus	yellow nutgrass	Y			1/1
plants	monocots	Cyperaceae	Cyperus leiocaulon	, ,		С		1/1
plants	monocots	Cyperaceae	Cyperus squarrosus	bearded flatsedge		С		7
plants	monocots	Cyperaceae	Cyperus cristulatus	C C		С		3
plants	monocots	Cyperaceae	Cyperus perangustus			С		1
, plants	monocots	Cyperaceae	Fimbristylis nutans			С		1
plants	monocots	Cyperaceae	Cyperus sesquiflorus		Y			1/1
plants	monocots	Cyperaceae	Scleria mackaviensis			С		13
, plants	monocots	Cyperaceae	Fimbristylis dichotoma	common fringe-rush		С		12
plants	monocots	Cyperaceae	Fimbristylis microcarya	Ũ		С		1/1
plants	monocots	Cyperaceae	Lipocarpha microcephala			С		2
, plants	monocots	Cyperaceae	Cyperus concinnus			С		3/1
plants	monocots	Cyperaceae	Cyperus gracilis			С		9
plants	monocots	Cyperaceae	Cyperus fulvus			С		1/1
, plants	monocots	Cyperaceae	Cyperus bifax	western nutgrass		С		1/1
plants	monocots	Cyperaceae	Cyperus iria	5		С		2
plants	monocots	Cyperaceae	Cyperus rigidellus			С		9
plants	monocots	Hemerocallidaceae	Dianella			С		2
plants	monocots	Hypoxidaceae	Hypoxis pratensis var. pratensis			С		4
plants	monocots	Johnsoniaceae	Tricoryne elatior	vellow autumn lily		С		4
plants	monocots	Laxmanniaceae	Lomandra multiflora	, ,		С		2
plants	monocots	Laxmanniaceae	Eustrephus latifolius	wombat berry		Ċ		6
plants	monocots	Laxmanniaceae	Lomandra longifolia	2		С		2
plants	monocots	Orchidaceae	Cymbidium canaliculatum			С		3
plants	monocots	Poaceae	Dichanthium fecundum	curly bluegrass		Ċ		6/3
plants	monocots	Poaceae	Dichanthium sericeum	, 3		С		4

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	А	Records
plants	monocots	Poaceae	Enneapogon nigricans	niggerheads		С		1
plants	monocots	Poaceae	Enneapogon truncatus	33		Ċ		14
, plants	monocots	Poaceae	Eragrostis lacunaria	purple lovegrass		С		14/2
plants	monocots	Poaceae	Iseilema macratherum			Ċ		1/1
plants	monocots	Poaceae	Sporobolus elongatus			Ċ		1/1
, plants	monocots	Poaceae	Tripogon Ioliiformis	five minute grass		С		2
plants	monocots	Poaceae	Urochloa praetervisa	<b>3</b>		Ċ		2
, plants	monocots	Poaceae	Whiteochloa airoides			С		3/1
, plants	monocots	Poaceae	Alloteropsis cimicina			С		3
plants	monocots	Poaceae	Cenchrus polystachios		Y			1/1
, plants	monocots	Poaceae	Cymbopogon bombycinus	silky oilgrass		С		2
plants	monocots	Poaceae	Dichanthium aristatum	angleton grass	Y			2/2
plants	monocots	Poaceae	Elvtrophorus spicatus			С		2/1
plants	monocots	Poaceae	Eragrostis leptocarpa	drooping lovegrass		Č		5
plants	monocots	Poaceae	Eragrostis tenuifolia	elastic grass	Y	_		1/1
plants	monocots	Poaceae	Heteropogon contortus	black speargrass	-	С		15
plants	monocots	Poaceae	Heteropogon triticeus	giant speargrass		Ċ		4
plants	monocots	Poaceae	Alloteropsis semialata	cockatoo grass		Ċ		4
plants	monocots	Poaceae	Bothriochloa ewartiana	desert bluegrass		Č		1
plants	monocots	Poaceae	Dinebra decipiens var. decipiens			Č		6
plants	monocots	Poaceae	Aristida benthamii var. benthamii			Ċ		2
plants	monocots	Poaceae	Aristida holathera var. holathera			Č		4
plants	monocots	Poaceae	Panicum decompositum var. tenuius			Č		10
plants	monocots	Poaceae	Setaria pumila subsp. subtesselata		Y			1/1
plants	monocots	Poaceae	Bothriochloa bladhii subsp. bladhii			С		6
, plants	monocots	Poaceae	Megathvrsus maximus var. pubiglumis		Y			3
plants	monocots	Poaceae	Urochloa panicoides var. panicoides		Y			1/1
plants	monocots	Poaceae	Dichanthium sericeum subsp. sericeum			С		2/2
plants	monocots	Poaceae	Bothriochloa decipiens var. decipiens			C		7
plants	monocots	Poaceae	Urochloa holosericea subsp. holosericea			Ċ		3
plants	monocots	Poaceae	Aristida ierichoensis var. subspinulifera			Ċ		8
plants	monocots	Poaceae	Calvptochloa gracillima subsp. gracillima			Ċ		4
plants	monocots	Poaceae	Enneapogon intermedius			Č		1/1
plants	monocots	Poaceae	Enteropogon acicularis	curly windmill grass		C		4
, plants	monocots	Poaceae	Enteropogon unispiceus	, 0		С		13
plants	monocots	Poaceae	Moorochloa eruciformis		Y	-		1/1
plants	monocots	Poaceae	Paspalidium criniforme			С		1/1
plants	monocots	Poaceae	Urochloa mosambicensis	sabi grass	Y			5
plants	monocots	Poaceae	Ancistrachne uncinulata	hooky grass		С		10
, plants	monocots	Poaceae	Dactyloctenium radulans	button grass		С		4
, plants	monocots	Poaceae	Eragrostis leptostachva	5		С		11
plants	monocots	Poaceae	Eragrostis megalosperma			Ċ		1/1
plants	monocots	Poaceae	Eragrostis spartinoides			Ċ		2/2
plants	monocots	Poaceae	Paspalidium caespitosum	brigalow grass		Ċ		11/1
plants	monocots	Poaceae	Paspalidium constrictum	<u> </u>		Ċ		14
plants	monocots	Poaceae	Sporobolus actinocladus	katoora grass		С		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	А	Records
plants	monocots	Poaceae	Sporobolus iacauemontii		Y			1/1
, plants	monocots	Poaceae	Ċapillipedium spicigerum	spicytop		С		3
, plants	monocots	Poaceae	Walwhalleva subxerophila			С		1/1
plants	monocots	Poaceae	Bothriochloa erianthoides	satintop grass		Ċ		1/1
plants	monocots	Poaceae	Digitaria divaricatissima	spreading umbrella grass		Č		5
plants	monocots	Poaceae	Dichanthium queenslandicum	op		v	E	1/1
plants	monocots	Poaceae	Eriochloa pseudoacrotricha			Ċ	_	11/1
plants	monocots	Poaceae	Aristida calvcina var. calvcina			č		10
plants	monocots	Poaceae	Dinebra decipiens var. asthenes			Č		1
plants	monocots	Poaceae	Perotis rara	comet grass		č		1
plants	monocots	Poaceae	Friachne rara			č		4
plants	monocots	Poaceae	Fulalia aurea	silky browntop		č		12/1
plants	monocots	Poaceae	l olium perenne	perennial ryegrass	Y	Ŭ		1/1
plants	monocots	Poaceae	Melinis renens	red natal grass	Ý			12
nlants	monocots	Poaceae	Aristida ramosa	nurnle wiregrass	•	С		11
nlants	monocots	Poaceae	Chloris inflata	purpleton chloris	V	0		4
nlants	monocots	Poaceae	Eleusine indica	crowsfoot grass	v I			1/1
nlants	monocots	Poaceae	Panicum effusum	orowoloot grade	•	C		14
nlante	monocots	Poaceae	Sataria surgens			Č		14
nlante	monocots	Poaceae	Cynodon dactylon		V	0		
plante	monocots	Poaceae	Eriochloa crebra	enring grase	1	C		2
plants	monocots	Poaceae	Themeda avenacea	spring grass		č		<u> </u>
plants	monocots	Poaceae	Themeda triandra	kangaroo grass		č		11
plants	monocols	Pooooo		kangaroo grass		Č		11
plants	monocols	Pooceae	Conchrue ciliaria		V	U		1/1
plants	monocols	Poaceae	Diobanthium tonuo	amall bluggroop	I	0		10
plants	monocols	Poaceae	Dichanthium tenue	small bluegrass		Č		10
plants	monocols	Poaceae	Digitalia Diowilli Daniaum naludaaum	awama nania		Č		10
plants	monocols	Poaceae	Panicum paiudosum	swamp panic		Č		1/1
plants	monocols	Poaceae	Sporobolus caroli	lary grass		Č		/
plants	monocols	Poaceae	Orocnioa publigera			Č		8
plants	monocols	Poaceae				Č		ۍ ۱/۱
plants	monocols	Poaceae		toll oblavia		Č		1/1
plants	monocols	Poaceae	Chions ventricosa	tail chions		Č		12
plants	monocots	Poaceae	Chrysopogon fallax			C		19
plants	monocots	Poaceae	Digitaria bicornis		V	C		5/1
plants	monocots	Poaceae	Echinochioa colona	awniess barnyard grass	Y	~		6/3
plants	monocots	Poaceae		Brown's lovegrass		C		1/1
plants	monocots	Poaceae	Eragrostis sororia			C		4
plants	monocots	Poaceae	Eriachne mucronata			C		1
plants	monocots	Poaceae	Digitaria ammophila	silky umbrella grass		C		4
plants	monocots	Poaceae	Enneapogon pallidus	conetop nineawn		C		1
plants	monocots	Poaceae	Eragrostis elongata			C		13/1
plants	monocots	Poaceae	Imperata cylindrica	blady grass		C		1
plants	monocots	Poaceae	Leptochloa digitata			C		1/1
plants	monocots	Poaceae	Panicum larcomianum			C		1
plants	monocots	Poaceae	Paspalidium distans	shotgrass		С		4

Kingdom	Class	Family	Scientific Name	Common Name	<u> </u>	Q	А	Records
plants plants plants plants	monocots monocots monocots monocots	Poaceae Poaceae Poaceae Poaceae	Sporobolus fertilis Tragus australianus Bothriochloa pertusa Cymbopogon refractus	giant Parramatta grass small burr grass barbed-wire grass	Y Y	C C		1/1 4 20 7

## CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

- Q Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ().
- A Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.* The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).

This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon. This number is output as 999 if it equals or exceeds this value.

## Appendix C BioCondition Assessment Data

	RE 11.3.2	RE 11.3.25	RE 11.3.25	RE 11.3.27	RE 1	1.3.4a	RE 11.3.9	3.9 RE 11.4.9			RE 11.5.2a
<b>BioCondition Scoring Sheet</b>	Mrb1	Mrb17	Mrb21	Mrb13	Mrb15	Mrb18	Mrb3	Mrb9	Mrb10	SWC3	Mrb6
Site Condition											
Recruitment of woody perennials	5	5	5	3	5	5	5	5	5	5	5
Native plant species richness											
Trees	5	5	5	5	2.5	5	5	2.5	5	5	5
Shrubs	5	2.5	2.5	5	5	5	5	2.5	5	0	5
Grass	5	0	0	5	2.5	2.5	2.5	2.5	5	5	5
Forbs	2.5	0	2.5	2.5	0	0	2.5	2.5	5	5	5
Tree canopy height	5	5	5	5	5	5	5	5	5	5	5
Tree canopy cover	5	3	3	5	3	3	3	3	3	5	5
Shrub canopy cover	3	0	5	5	0	5	0	3	3	3	5
Native perennial grass cover	3	0	0	5	0	1	3	1	1	5	5
Organic litter cover	5	3	5	5	3	5	5	5	5	5	5
Large trees	10	15	15	5	5	5	10	5	5	5	5
Coarse woody debris	2	0	2	5	2	0	2	5	5	5	2
Weed cover	5	0	0	3	0	0	5	5	5	5	10
Total field based attributes	60.5	38.5	50.0	58.5	33.0	41.5	53.0	47.0	57.0	58.0	67.0

#### Mulgrave Stage 2C Impact Assessment

	RE 11.3.2	RE 11.3.25	RE 11.3.25	RE 11.3.27	RE 11.3.4a		RE 11.3.9	RE 11.4.9			RE 11.5.2a
<b>BioCondition Scoring Sheet</b>	Mrb1	Mrb17	Mrb21	Mrb13	Mrb15	Mrb18	Mrb3	Mrb9	Mrb10	SWC3	Mrb6
Site Context											
Patch size	10	5	10	10	10	5	10	10	10	10	10
Connectivity	5	5	5	4	5	5	5	5	5	5	5
Context	5	4	4	4	4	4	5	5	5	4	5
Distance from Water	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total GIS attributes	20.1	14.1	19.1	18.1	19.1	14.1	20.1	20.1	20.1	19.1	20.1
BioCondition Score	0.81	0.53	0.69	0.77	0.52	0.56	0.73	0.67	0.77	0.77	0.87
Average BioCondition Score	0.81	0.53	0.69	0.77	0.	.54	0.73		0.74		0.87

	RE 11.5.3				Regrowth	RE 11.5.8b		RE 11.5.8c		Regrowth		RE 11.5.9		
BioCondition Scoring Sheet	Mrb4	Mrb7	Mbr14	SWC1	SWC4	Mrb19	Mrb8	Mrb20	Mrb2	Mrb5	Mrb11	Mrb12	Mrb16	SWC2
Site Condition														
Recruitment of woody perennials	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Native plant species richness														
Trees	5	5	5	2.5	5	5	5	5	5	5	2.5	5	5	5
Shrubs	2.5	5	5	5	2.5	5	5	5	5	5	5	5	2.5	5

#### Mulgrave Stage 2C Impact Assessment

	RE 11.5.3					Regrowth	RE 11.5.8b RE 11.5.8c		1.5.8c	Regrowth		RE 11.5.9		
BioCondition Scoring Sheet	Mrb4	Mrb7	Mbr14	SWC1	SWC4	Mrb19	Mrb8	Mrb20	Mrb2	Mrb5	Mrb11	Mrb12	Mrb16	SWC2
Grass	2.5	5	5	5	5	5	5	2.5	5	5	2.5	5	2.5	2.5
Forbs	2.5	2.5	2.5	5	5	2.5	2.5	2.5	2.5	2.5	0	2.5	5	2.5
Tree canopy height	5	5	5	5	5	3	5	5	5	5	5	5	5	5
Tree canopy cover	5	3	5	5	5	5	5	5	5	5	2	5	5	5
Shrub canopy cover	3	5	3	3	3	5	0	0	0	3	0	0	3	3
Native perennial grass cover	3	5	3	5	1	5	3	1	3	3	3	3	5	5
Organic litter cover	5	3	3	5	5	3	5	3	5	5	5	5	5	5
Large trees	15	10	0	15	15	0	15	15	0	0	0	0	10	15
Coarse woody debris	2	5	5	5	2	2	5	5	5	2	5	5	2	2
Weed cover	5	10	5	5	0	0	10	3	5	5	10	5	10	5
Total field based attributes	60.5	68.5	51.5	70.5	58.5	45.5	68.5	57.0	50.5	50.5	45.0	50.5	65.0	65.0
Site Context														
Patch size	10	10	10	10	10	10	10	10	10	10	10	10	5	10
Connectivity	5	5	5	5	2	4	5	4	5	5	2	2	2	5
Context	5	5	5	5	4	2	5	4	5	5	4	4	4	5
Distance from Water	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total GIS attributes	20.1	20.1	20.1	20.1	16.1	16.1	20.1	18.1	20.1	20.1	16.1	16.1	11.1	20.1
BioCondition Score	0.81	0.89	0.72	0.91	0.75	0.62	0.89	0.75	0.71	0.71	0.61	0.67	0.76	0.85

	RE 11.5.3				Regrowth	RE 11.5.8b		RE 11.5.8c		Regrowth		RE 11.5.9		
BioCondition Scoring Sheet	Mrb4	Mrb7	Mbr14	SWC1	SWC4	Mrb19	Mrb8	Mrb20	Mrb2	Mrb5	Mrb11	Mrb12	Mrb16	SWC2
Average BioCondition Score			0.82			0.62	0.8	32	0.	71	0.6	64	0.8	0

# Appendix D TEC Assessments Results

Brigalow Patch ID	TEC Threshold Criteria	Field Evidence				
BTEC1	Tree layer	A. harpophylla dominant				
	Age	>15 years				
	Patch size	>0.5 ha				
	Weed cover	0 %				
BTEC2	Tree layer	A. harpophylla dominant				
	Age	>15 years				
	Patch size	>0.5 ha				
	Weed cover	5 %				
BTEC3	Tree layer	A. harpophylla dominant				
	Age	>15 years				
	Patch size	>0.5 ha				
	Weed cover	10 %				
BTEC4	Tree layer	A. harpophylla dominant				
	Age	>15 years				
	Patch size	>0.5 ha				
	Weed cover	5 %				

# Appendix E Bird Survey Abundance Data

Common Name	Species Name	Total Count	Average occurrence across 40 bird surveys
Apostle Bird	Struthidea cinerea	6	0.15
Australasian Pipit	Anthus novaeseelandiae	1	0.03
Australian Magpie	Cracticus tibicen	6	0.15
Black-faced Cuckoo-Shrike	Coracina novaehollandiae	25	0.63
Bar-shouldered Dove	Geopelia humeralis	4	0.10
Blue-faced Honeyeater	Entomyzon cyanotis	83	2.08
Blue-winged Kookaburra	Dacelo leachii	1	0.03
Brolga	Grus rubicunda	3	0.08
Brown Honeyeater	Lichmera indistincta	2	0.05
Brown Quail	Coturnix ypsilophora	5	0.13
Budgerigar	Melopsittacus undulatus	8	0.20
Channel-billed Cuckoo	Scythrops novaehollandiae	4	0.10
Cicadabird	Coracina tenuirostris	10	0.25
Dollarbird	Eurystomus orientalis	20	0.50
Double-barred Finch	Taeniopygia bichenovii	32	0.80
Spangled Drongo	Dicrurus bracteatus	25	0.63
Eastern Koel	Eudynamys orientalis	3	0.08
Emu	Dromaius novaehollandiae	2	0.05
Figbird	Sphecotheres vieilloti	33	0.83
Forest Kingfisher	Todiramphus macleayii	18	0.45
Eastern Great Egret	Ardea modesta	1	0.03
Grey Butcherbird	Cracticus torquatus	15	0.38
Grey-crowned Babbler	Pomatostomus temporalis	11	0.28
Grey Shrike-thrush	Colluricincla harmonica	1	0.03
Grey Teal	Anas gracilis	1	0.03
Hardhead	Aythya australis	4	0.10
Horsefield's Bronze Cuckoo	Chrysococcyx basalis	1	0.03
Intermediate Egret	Ardea intermedia	1	0.03
Laughing Kookaburra	Dacelo novaeguineae	45	1.13
Leaden Flycatcher	Myiagra rubecula	9	0.23
Little Bronze Cuckoo	Chrysococcyx minutillus	3	0.08
Little Friarbird	Philemon citreogularis	8	0.20
Magpie-lark	Grallina cyanoleuca	7	0.18
Masked Lapwing	Vanellus miles	4	0.10
Masked Woodswallow	Artamus personatus	50	1.25
Mistletoebird	Dicaeum hirundinaceum	2	0.05
Noisy Friarbird	Philemon corniculatus	47	1.18
Noisy Minor	Manorina melanocephala	32	0.80

Common Name	Species Name	Total Count	Average occurrence across 40 bird surveys
Olive-backed Oriole	Oriolus sagittatus	2	0.05
Pacific Baza	Aviceda subcristata	1	0.03
Pacific Black Duck	Anas superciliosa	2	0.05
Pale-headed Rosella	Platycercus adscitus	81	2.03
Peaceful Dove	Geopelia striata	30	0.75
Pheasant Coucal	Centropus phasianinus	7	0.18
Pied Butcherbird	Cracticus nigrogularis	41	1.05
Pied Currawong	Strepera graculina	8	0.20
Plumed Whistling-duck	Dendrocygna eytoni	2	0.05
Rainbow Bee-eater	Merops ornatus	15	0.38
Rainbow Lorikeet	Trichoglossus haematodus	68	1.70
Red-Backed Fairy-Wren	Malurus melanocephalus	71	1.78
Red-Winged Parrot	Aprosmictus erythropterus	15	0.38
Restless Flycatcher	Myiagra inquieta	1	0.03
Singing Honeyeater	Gavicalis virescens	7	0.18
Spotted Bowerbird	Ptilonorhynchus maculatus	4	0.10
Squatter Pigeon	Geophaps scripta	11	0.28
Striated Pardalote	Pardalotus striatus	90	2.25
Straw-Necked Ibis	Threskiornis spinicollis	2	0.05
Striped Honeyeater	Plectorhyncha lanceolata	1	0.03
Sulphur-crested Cockatoo	Cacatua galerita	15	0.38
Tawny Frogmouth	Podargus strigoides	1	0.03
Torresian Crow	Corvus orru	54	1.35
Varied Sittella	Daphoenositta chrysoptera	28	0.70
Wedge-tailed Eagle	Aquila audax	9	0.23
Weebill	Smicrornis brevirostris	89	2.23
Whistling Kite	Haliastur sphenurus	5	0.13
White-breasted Woodswallow	Artamus leucorynchus	2	0.05
White-Browed Woodswallow	Artamus superciliosus	85	2.13
White-faced Heron	Egretta novaehollandiae	5	0.13
White-necked Heron	Ardea pacifica	3	0.08
White-throated Gerygone	Gerygone olivacea	2	0.05
White-throated Honeyeater	Melithreptus albogularis	170	4.25
Willie Wagtail	Rhipidura leucophrys	1	0.03
White-bellied Cuckoo Shrike	Coracina papuensis	19	0.48
Australian Wood Duck	Chenonetta jubata	44	1.10
Yellow Honeyeater	Stomiopera flavus	1	0.03
Yellow-Throated Miner	Manorina flavigula	7	0.18









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