



# PHOENIX

ENVIRONMENTAL SCIENCES

## Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla Infrastructure - Rail and Conveyor Project

Prepared for BBI Group Pty Ltd

March 2020

Final Report



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Port Project

Prepared for BBI Group Pty Ltd

**Version history**

Author/s	Reviewer/s	Version	Version number	Date submitted	Submitted to

## EXECUTIVE SUMMARY

BBI Group Pty Ltd (BBI) is seeking to expand the approved Balla Ball export facility footprint (EPA 2013, 2015) to include the additional area shown in Figure 1-1 (the 'study Area'), through submission of a section 45c (EPA Act part IV) application, with respect to the Railway approval (MS1006; (MS1006; Minister for the Environment 2015)). In June 2019, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by Preston Consulting on behalf of BBI to undertake flora, vegetation and terrestrial fauna reconnaissance surveys for the Project.

A flora and vegetation (reconnaissance survey) was conducted between 8 – 12 October 2019 and a terrestrial fauna survey between 12 – 18 November 2019 to assess the presence or likelihood of occurrence of significant species and habitats.

The purpose of the surveys was to document key environmental factors within the Study Area. These environmental factors were documented to allow comparison with the key environmental factors considered in EPA report 1540, for the Balla Balla Infrastructure - Rail and Conveyor Project (the 'Previous Study Area').

A total of 118 flora taxa, from 31 families and 70 genera were recorded in the Study Area during the reconnaissance field surveys. With a species richness ranging from 4 - 28 species between sites. The assemblage included 114 native species and 4 introduced species, including 78 perennial species, and 36 annual or short-lived species. None of the introduced species recorded are classified as Declared Pests or Weeds of National Significance.

Three significant flora species were recorded during the reconnaissance field survey; two Priority species and one considered significant because its collection in the Study Area represents an extension to its known range.

*Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479) (P3) was recorded in eight of the thirteen mapped vegetation units and is obviously a generalist in terms of habitat, not being restricted to one or a few vegetation types. As well as being a Priority category species, the records at Balla Balla represent a minor range extension for this species. *Heliotropium muticum* (P3) is well known from the north-eastern Pilbara, often being recorded as a single specimen rather than a stand. At Balla Balla it is recorded in four of the 13 vegetation units, seeming to prefer *Acacia* shrublands/*Triodia* hummock grasslands, and the open gilgaied plains of the Horseflat Land System of the Roebourne Plains. *Polygala isingii* is widely spread through the Eremaean zone of Western Australia as far south as Wiluna. There are, however, few records from the Pilbara bioregion and the records from Balla Balla represent an extension of approximately 180 km to the north-west of its known range.

Thirteen vegetation types were defined for the Study Area based on statistical analysis. They comprised *Acacia* shrublands over *Triodia* hummock grasslands on plains, low hills and outcrops, and drainages. Three defined drainage types are present, with broad drainages/plains surrounding them. Drainages are characterised by the presence of *Eucalyptus* and *Corymbia* species. The plains and drainage plains are characterised by *Acacia* shrublands/*Triodia* hummock grasslands except for the gilgaied plains of the Horseflat Land System of the Roebourne Plains which are open grasslands dominated by *Eragrostis xerophila* with *Acacia* spp. sometimes present. The Horseflat Land System is also represented in a mosaic unit incorporating *Acacia*/*Triodia* vegetation.

The Horseflat Land System of the Roebourne Plains is a Priority Ecological Community and is of great significance. Extending from Karratha to Balla Balla, it is at the eastern end of its range in the Study Area and is also host to two Priority species recorded during the survey.

Nine other vegetation units defined during the survey also host significant species, and these may be considered to have significance because of these species' presence.

Except for the Horseflat Land System of the Roebourne Plains PEC, these units and others of similar structure and definition are common throughout the region and have been recorded in previous surveys used in the desktop assessment of the Study Area, leading to the expectation that these significant species will be found elsewhere if targeted searches are undertaken.

The condition assessment of the vegetation has 97.9% in Excellent condition despite the grazing history of the area. The remaining 2.1% is ranked as Very Good. None of the vegetation surveyed was found to be in a lower condition. Similar vegetation in the region has also been assessed as primarily in Excellent condition.

Five distinct fauna habitats were identified: shrubland over spinifex hummocks, tussock grassland, spinifex hummock grassland, drainage and rocky hills or outcrops. Of these habitats, three (shrubland over spinifex hummocks, tussock grassland, and spinifex hummock grassland) comprised over 96% of the Study Area. Drainages made up only a small proportion of the proposed expansion footprint (3.1%) and included two large drainages running through the northeast and northwest corners of the proposed expansion footprint. Rocky hills or outcrops are often important habitat for conservation significant species in the Pilbara but this habitat type was sparse and confined to three small, isolated patches which covered only 0.8% of the proposed expansion footprint.

One Threatened and three Priority vertebrate fauna were recorded in the survey; Northern Quoll (*Dasyurus hallucatus*) (EN, EPBC & BC Acts), Brush-tailed Mulgara (*Dasyercus blythi*) (P4, DBCA list), Northern Coastal Free-tailed Bat (*Ozimops cobourgianus*) (P1, DBCA list) and Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4 (DBCA list)). Two of these species – Northern Quoll and Brush-tailed Mulgara – were evaluated as likely to occur in the Previous Study Area. Drainages which cross into the proposed expanded footprint probably provide important landscape connectivity between foraging and denning habitats for Northern Quolls and may also contain useful denning sites due to the presence of trees with large hollows.

Significant impacts from the development are not expected for any of the significant fauna species recorded during the survey with the exception of Northern Quoll. Brush Tailed Mulgara and Western Pebble-mound Mouse are widespread throughout the region and use habitats that are common both throughout the region and in the vicinity of the Study Area. Northern Coastal Free-tailed Bat uses habitats found within the Study Area for foraging but is unlikely to roost regularly within the Study Area. Impacts to Northern Quoll can be minimised by diverting planned development away from major drainages.



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# 1 INTRODUCTION

BBI Group Pty Ltd (BBI) is seeking to expand the approved footprint of Balla Balla Infrastructure – Rail and Conveyor Project (EPA 2013, 2015) to include the additional area shown in Figure 1-1 (the ‘Study Area’), through submission of a section 45c (*Environmental Protection Act 1986* (EPA Act) part IV) application, with respect to the Ministerial Statement 1006 (Minister for the Environment 2015).

In June 2019, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by Preston Consulting on behalf of BBI to undertake flora, vegetation and terrestrial fauna reconnaissance surveys for the Project.

The purpose of the surveys was to document key environmental factors within the Study Area and to compare them with those factors considered by the EPA in its original assessment of the Project (report No. 1540; EPA 2015) (the ‘Previous Study Area’).

The Study Area is located in the Shire of Roebourne and the Eremaean Botanical Province as defined by EPA (2016c).

## 1.1 SCOPE OF WORK

### 1.1.1 Flora and vegetation

The scope of work for the flora and vegetation survey was as follows:

- conduct a flora and vegetation reconnaissance survey of the Study Areas comprising
  - traverse the survey area to determine the likely number of vegetation types present
  - revisit areas of known significant flora species and areas likely to support additional populations of such species
  - determine whether any unique vegetation types are likely to occur, if possible
  - target searches for significant flora and mapping of populations
  - target searches for significant vegetation and mapping of extent
  - record any declared pests or weeds of national significance (WoNS)
- prepare a brief report detailing:
  - methods
  - results
  - assessment of significant species and habitats
  - undertake a likelihood of occurrence assessment for significant species
  - review the results against the key environmental factors considered in EPA report 1540 (EPA 2015).

### 1.1.2 Fauna

The scope of work for the fauna survey was as follows:

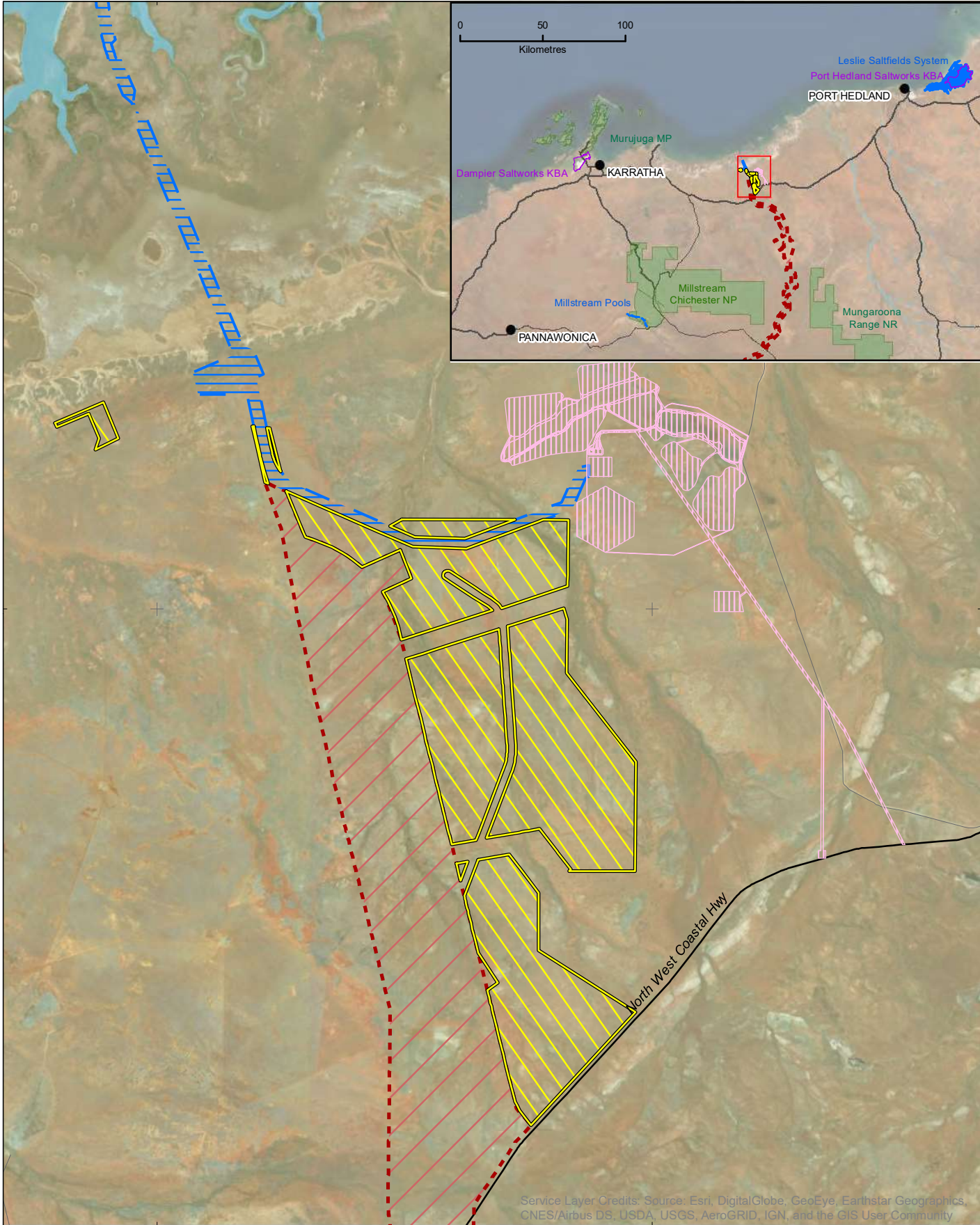
- conduct a desktop review of available technical reports and relevant databases area to determine the potential vertebrate fauna species and habitats within the Study Area

- conduct a reconnaissance field survey for terrestrial fauna within the Study Area
- prepare maps showing species records and habitat for Threatened species
- prepare a brief report detailing:
  - methods
  - results
  - assessment of significant species and habitats
  - undertake a likelihood of occurrence assessment for significant species
  - review the results against the key environmental factors considered in EPA report 1540 (EPA 2015).

## 1.2 STUDY AREA

The Study Area for the Project is 3,134 ha in area and is located immediately adjacent the Balla Balla Infrastructure - Rail and Conveyor Project (Minister for the Environment 2015) and DFS Transshipment Corridor (Minister for the Environment 2013), and is west of the Magnetite Mining Project (Minister for the Environment 2009, 2014) approved development envelopes(Figure 1-1).





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Forge Swan Resources Pty Ltd  
 Balla Balla Infrastructure - Rail and Conveyor Project

Project No	1283-1284
Date	18-Feb-20
Drawn by	AJ
Map author	MH & JC

0 2 4  
Kilometres

1:100,000 (at A4) GDA 1994 MGA Zone 50

- Study Area
- Approved mine layout
- Approved port footprint
- Approved Development Envelope
- Protected areas
- Nationally important wetlands
- Important bird areas
- River
- Road

**Figure 1-1**  
 Project location including both the Study Area and approved development envelopes



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## 2 LEGISLATIVE CONTEXT

The protection of flora and fauna in Western Australia (WA) is principally governed by three acts:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- State *Biodiversity Conservation Act 2016* (BC Act)
- State EP Act.

The BC Act came into full effect on 1 January 2019 and replaced the functions of the *Wildlife Conservation Act 1950* (WC Act).

### 2.1 COMMONWEALTH

The EPBC Act is administered by the Federal Department of the Agriculture, Water, and Environment (formerly the Department of Environment and Energy (DoEE)). The EPBC Act provides for the listing of Threatened flora, Threatened fauna and Threatened Ecological Communities (TECs) as matters of National Environmental Significance (NES). Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of NES, require approval from the Australian Government Minister for the Environment through a formal referral process.

Conservation categories applicable to Threatened flora and fauna species under the EPBC Act are as follows:

- Extinct (EX)<sup>1</sup> – there is no reasonable doubt that the last individual has died
- Extinct in the Wild (EW) – taxa known to survive only in captivity
- Critically Endangered (CR) – taxa facing an extremely high risk of extinction in the wild in the immediate future
- Endangered (EN) – taxa facing a very high risk of extinction in the wild in the near future
- Vulnerable (VU) – taxa facing a high risk of extinction in the wild in the medium-term
- Conservation Dependent (CD)<sup>1</sup> – taxa whose survival depends upon ongoing conservation measures; without these measures, a conservation dependent taxon would be classified as Vulnerable, Endangered or Critically Endangered.

Ecological communities are defined as ‘naturally occurring biological assemblages that occur in a particular type of habitat’ (English & Blyth 1997). There are three categories under which ecological communities can be listed as TECs under the EPBC Act: Critically Endangered, Endangered and Vulnerable.

The EPBC Act is also the enabling legislation for protection of Migratory species as matters of NES under several international agreements:

- Japan-Australia Migratory Bird Agreement (JAMBA)
- China-Australia Migratory Bird Agreement (CAMBA)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn)
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

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<sup>1</sup> Species listed as Extinct and Conservation Dependent are not matters of NES and therefore do not trigger the EPBC Act.

## 2.2 STATE

### 2.2.1 Threatened and Priority species

In WA, the BC Act provides for the listing of Threatened flora and fauna species<sup>2</sup> in the following categories:

- Critically Endangered (CR) – species facing an extremely high risk of extinction in the wild in the immediate future<sup>3</sup>
- Endangered (EN) – species facing a very high risk of extinction in the wild in the near future<sup>3</sup>
- Vulnerable (VU) – species facing a high risk of extinction in the wild in the medium term future<sup>3</sup>.

Species may also be listed as specially protected (SP) under the BC Act in one or more of the following categories:

- species of special conservation interest (conservation dependent fauna, CD) – species with a naturally low population, restricted natural range, of special interest to science, or subject to or recovering from a significant population decline or reduction in natural range
- migratory species (Mig.), including birds subject to international agreement
- species otherwise in need of special protection (OS).

The Department of Biodiversity, Conservation and Attractions (DBCA) administers the BC Act and also maintains a non-statutory list of Priority flora and fauna. Priority species are still considered to be of conservation significance – that is they may be Threatened – but cannot be considered for listing under the BC Act until there is adequate understanding of threat levels imposed on them. Species on the Priority flora and fauna lists are assigned to one of four Priority (P) categories, P1 (highest) – P4 (lowest), based on level of knowledge/concern.

### 2.2.2 Critical habitat

Under the BC Act, habitat is eligible for listing as critical habitat if it is critical to the survival of a Threatened species or a TEC and its listing is otherwise in accordance with the ministerial guidelines.

### 2.2.3 Threatened and Priority Ecological Communities

The BC Act provides for the listing of TECs in the following categories:

- Critically Endangered – facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future<sup>3</sup>
- Endangered – facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future<sup>3</sup>

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

<sup>3</sup> As determined in accordance with criteria set out in the ministerial guidelines.

- Vulnerable – facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium term future<sup>3</sup>.

An ecological community may be listed as a collapsed ecological community under the BC Act if there is no reasonable doubt that the last occurrence of the ecological community has collapsed or the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure.

The DBCA also maintains a non-statutory list of Priority Ecological Communities (PECs), which may become TECs in the future; however, do not currently meet survey criteria or that are not adequately defined. PECs are assigned to one of five categories depending on their priority for survey or definition, with Priority 1 of highest concern and Priority 5 of lowest concern.

## 2.2.4 Other significant flora, vegetation and fauna

Under the EPA's environmental factor guidelines, flora, vegetation and fauna may be considered significant for a range of reasons other than listing as a Threatened or Priority species or ecological community.

In addition to listing as Threatened or Priority, EPA (2016a) identifies the following:

- flora may be significant for
  - local endemism or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
  - new species or anomalous features that indicate a potential new species
  - representing the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
  - being unusual species, including restricted subspecies, varieties or naturally occurring hybrids
  - having relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape
- vegetation may be significant for:
  - having restricted distribution
  - subject to a degree of historical impact from threatening processes
  - having a role as a refuge
  - providing an important function required to maintain ecological integrity of a significant ecosystem.

In addition to listing as Threatened or Priority, EPA (2016b) identifies the following attributes that constitute significant fauna:

- species with restricted distribution
- species subject to a degree of historical impact from threatening processes
- providing an important function required to maintain the ecological integrity of a significant ecosystem.

Provided in the Guide for Assessment of Applications to Clear Native Vegetation (DER 2014) is a scale for assessing the bioregional conservation status of ecological vegetation classes (Table 2-1).

**Table 2-1 Bioregional conservation status of ecological vegetation classes**

Conservation status	Description
Presumed extinct	Probably no longer present in the bioregion
Endangered*	Less than 10% of pre-European extent remains
Vulnerable*	10-30% of pre-European extent exists
Depleted*	More than 30% and up to 50% pre-European extent exists
Least concern	More than 50% of pre-European extent exists and subject to little or no degradation over a majority of this area

\* or a combination of depletion, loss of quality, current threats and rarity gives a comparable status

## 2.2.5 Environmentally Sensitive Areas

Under section 51B of the EP Act the Minister for Environment may declare by notice either a specified area of the State or a class of areas of the State to be an Environmentally Sensitive Area (ESA). ESAs are declared in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, which was gazetted on 8 April 2005 (Government of Western Australia 2005).

ESAs are areas where the vegetation has high conservation value. Several types of areas are declared ESAs including:

- the area covered by vegetation within 50 metres (m) of Threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the Threatened flora is located
- the area covered by a TEC
- a defined wetland (Ramsar wetlands, conservation category wetlands and nationally important wetlands) and the area within 50 m of the wetland
- Bush Forever sites.

## 2.2.6 Introduced flora

Introduced flora (weeds) pose threats to biodiversity and natural values by successfully out-competing native species for available nutrients, water, space and sunlight; reducing the natural structural and biological diversity by smothering native plants or preventing them from growing back after clearing, fire or other disturbance; replacing the native plants that animals use for shelter, food and nesting; and altering fire regimes, often making fires hotter and more destructive (AWC 2007).

Management of some weed species is required under Commonwealth or State frameworks. Key classifications for significant introduced flora that are relevant to this report are:

- Declared Pest – the *Biosecurity and Agriculture Management Act 2007*, Section 22 makes provision for a plant taxon to be listed as a Declared Pest organism in parts of, or the entire State. Under the Biosecurity and Agriculture Management Regulations 2013 Declared Pests are assigned to one of three control categories that dictate the level of management required (Department of Primary Industries and Regional Development (DPIRD 2019)).

- Weed of National Significance (WoNS) – high impact, established introduced flora causing major economic, environmental, social and/or cultural impacts in a number of states/territories, and which have strong potential for further spread (Australian Weeds Committee 2012). Management is required in accordance with Department of Primary Industries and Regional Development (DPIRD) guidelines for particular WoNS.

Throughout this report, introduced flora species are indicated with an asterisk (\*).

### 3 EXISTING ENVIRONMENT

#### 3.1 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA

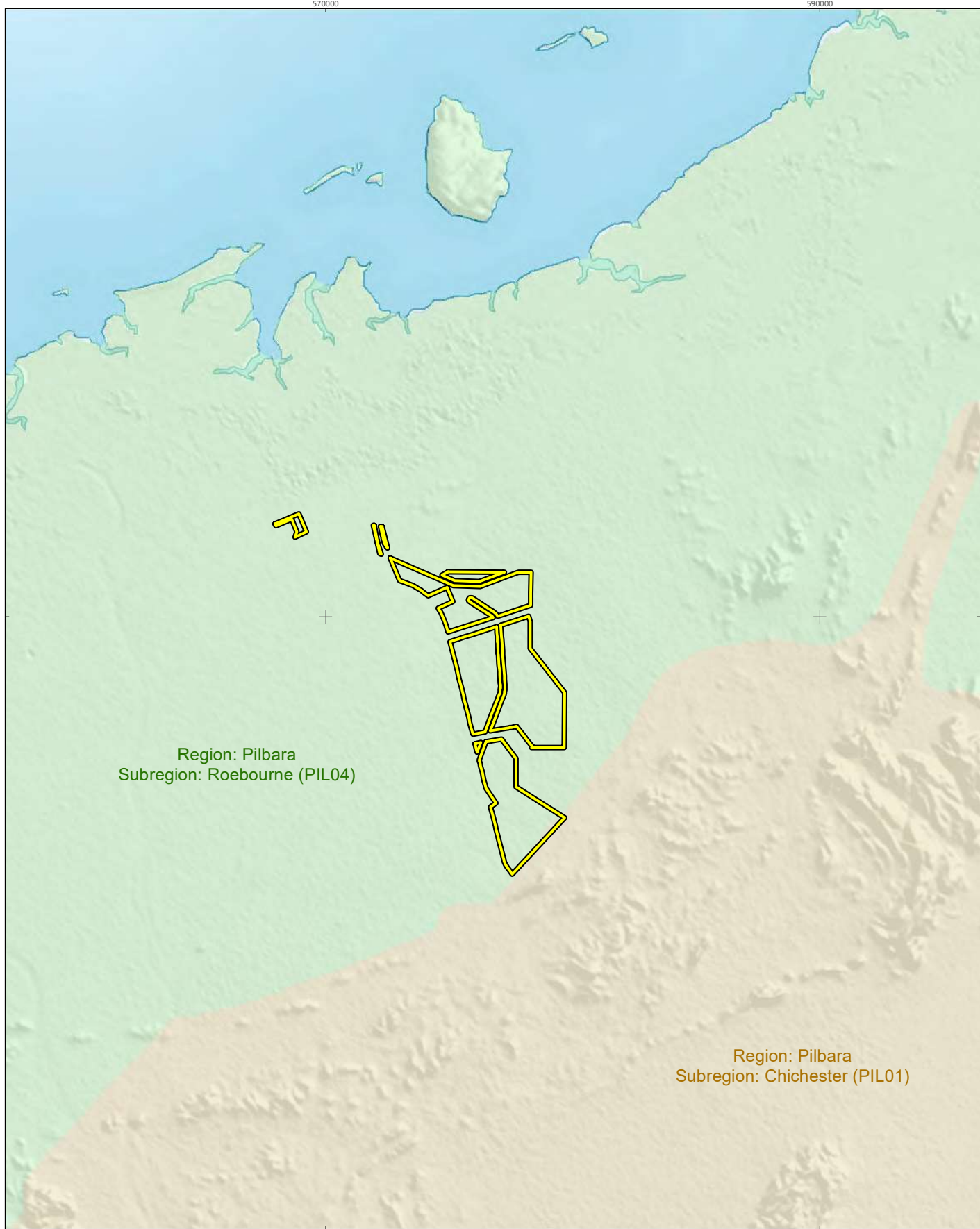
The Study Area occurs within two subregions of the Pilbara bioregion, Roebourne (98.8%) and Chichester (1.2%) (Figure 3-1). The Roebourne subregion is characterized by Kendrick and Stanley (2001):


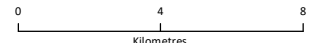
- Quaternary alluvial and older colluvial coastal and subcoastal plains with a shrub steppe of *Acacia stellaticeps* or *A. pyrifolia* and *A. inaequilatera* over a mixed hummock and tussock grassland
- Drainage lines with *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands
- Samphire, *Sporobolus* and mangal communities occur on marine alluvial flats and river deltas





The Chichester subregion is characterized by Kendrick and McKenzie (2001):

- Undulating Archaean granite and basalt plains with areas of basaltic ranges on *Acacia inaequilatera* shrubs over *Triodia wiseana* hummock grasslands
- *Eucalyptus leucophloia* tree steppes occur on ranges





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Project No 1283-1284	
Date 18-Feb-20	
Drawn by AJ Map author MH & JC	
	
1:200,000 (at A4)	GDA 1994 MGA Zone 50

-  Study Area
-  Ocean
- IBRA Region and Subregion**
-  Pilbara, Chichester (PIL01)
-  Pilbara, Roebourne (PIL04)

**Figure 3-1**  
**Study Area in relation to IBRA bioregions and subregions**



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### 3.2 LAND SYSTEMS AND SOILS

DPIRD undertakes land system mapping for WA using a nesting soil-landscape mapping hierarchy (Schoknecht & Payne 2011). While the primary purpose of the mapping is to inform pastoral and agricultural land capability, it is also useful for informing biological assessments. Under this hierarchy, land systems are defined as areas with recurring patterns of landforms, soils, vegetation and drainage (Payne & Leighton 2004).

The Study Area intersects five land systems and is dominated by the Horseflat and Mallina systems that together comprises 74.54% of the Study Area (Table 3-1; Figure 3-2).

**Table 3-1 Land systems and extent in Study Area**

Land system	Description	Area (ha)	% of Study Area
Horseflat System	Gilgaied clay plains supporting Roebourne Plains grass grasslands and minor grassy snakewood shrublands.	1181.89	38.14
Mallina System	Sandy surfaced alluvial plains supporting soft spinifex grasslands and minor hard spinifex and tussock grasslands.	1118.98	36.11
Macroy System	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex shrubby grasslands.	763.08	24.62
Calcrete System	Low calcrete platforms and plains supporting shrubby hard spinifex grasslands.	34.90	1.13
<b>Total</b>		<b>3098.85</b>	<b>100</b>

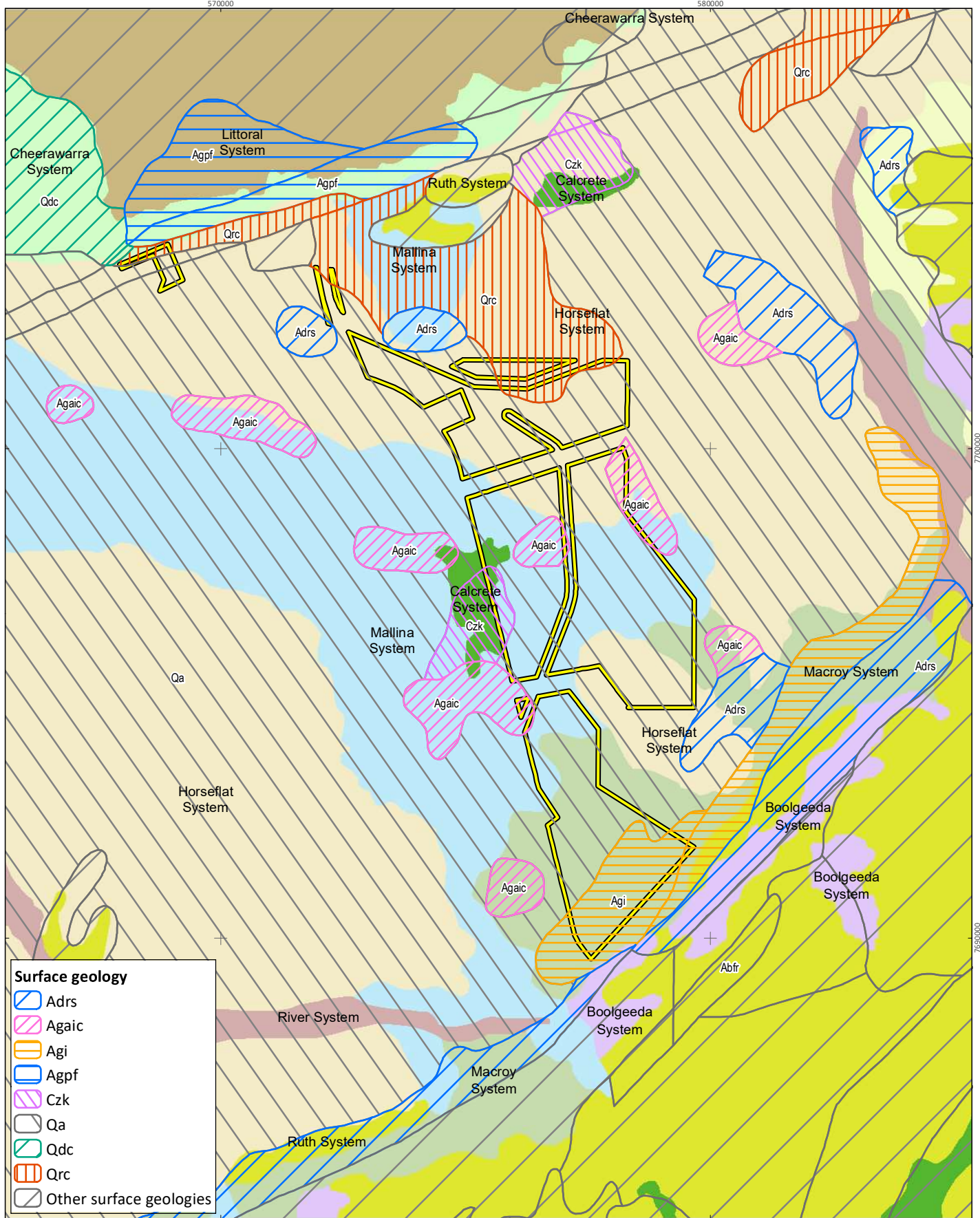
According to the Atlas of Australian Soils (Bureau of Rural Sciences 1991), the Study Area intersects six surface geology units (Table 3-2; Figure 3-2).

**Table 3-2 Surface geology and extent in Study Area**

Surface geology	Abbrev.	Description	Area (ha)	% of Study Area
alluvium 38485	Qa	Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted	2,527.16	81.55
Sisters Supersuite	Agi	Undifferentiated granitoid intrusions of the Sisters Supersuite; leucogranite (locally schlieric or pegmatitic), monzogranite, granodiorite, tonalite, diorite, tonalitic orthogneiss, rhyolite dykes, pegmatite; interleaved in places	301.81	9.74
Caines Well Granitoid Complex	Agaic	Monzogranite, syenogranite, granitic gneiss, migmatite	129.23	4.17
colluvium 38491	Qrc	Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite	94.51	3.05

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for BBI Group Pty Ltd**

Surface geology	Abbrev.	Description	Area (ha)	% of Study Area
calcrete 38497	Czk	Pisolitic, nodular or massive calcrete; ferruginous inclusions; calcareous cementing of bedrock and transported materials; locally with intercalated chalcedony; as low mounds, in playa lakes, or as valley calcrete; locally dissected and karstified	45.99	1.48
Sherlock Intrusion	Adrs	Olivine gabbro, leucogabbro, granophyric gabbro, granophyre	0.15	0.01
<b>Total</b>			<b>3,098.85</b>	<b>100</b>



	Forge Swan Resources Pty Ltd Balla Balla Infrastructure - Rail and Conveyor Project		<b>Study Area</b> 	<b>Land system</b> Boolgeeda System Calcrete System Cheerawarra System Horseflat System Littoral System Macroy System River System Ruth System Uaroo System	<b>Figure 3-2</b> <b>Land systems and surface geology in the Study Area</b>	
	Project No 1283-1284 Date 18-Feb-20 Drawn by AJ Map author MH & JC					
	1:100,000 (at A4) GDA 1994 MGA Zone 50					

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### 3.3 CLIMATE AND WEATHER

The climate of both the Roebourne and Chichester IBRA subregions is described as arid (semi-desert) tropical with highly variable rainfall, falling mainly in summer (Kendrick & McKenzie 2001; Kendrick & Stanley 2001). The nearest Bureau of Meteorology (BoM) weather station with comprehensive data collection and historic climate data is Roebourne (no. 004035), Latitude: 20.78°S Longitude 117.15°E), located 60 km west of the Study Area. This station stopped reporting weather data in 2015 and weather data from the year preceding the survey were derived from Roebourne Aero (no. 004090), Latitude: 20.76°S Longitude 117.16°E), located 60 km west of the Study Area.

**Roebourne** records the highest mean maximum monthly temperature (39.0°C) in December (lowest in July, 26.8°C) and the lowest minimum mean monthly temperature (13.6°C) in July (highest in January and February, 26.2°C) (BoM 2020) (Figure 3-3). Average annual rainfall is 314.6 mm with February and March recording the highest monthly averages (66.6 and 63.6 mm respectively; Figure 3-3). Cyclonic activity is significant, with several systems affecting the adjacent coast and inland areas annually (Kendrick & Stanley 2001).

Daily mean temperatures at Roebourne Aero preceding the surveys were slightly more extreme than those recorded historically with mean monthly minimum temperatures substantially below historical levels in May, June and September and mean monthly maximum temperatures substantially above historical levels. During the November surveys and in the preceding month of October (Figure 3-3), records from Roebourne Aero show substantially below average rainfall relative to historic data from the nearby Roebourne weather station. However, no rainfall data were recorded at this station in April or May. No rainfall was recorded in the month of the survey or the preceding seven months. Most of the preceding year's recorded rainfall occurred in March 2018 approximately eight months prior to the survey (Figure 3-3). The adjacent Sherlock Station (no. 004086) recorded 592.5 mm of rain in March of 2019 as a result of Cyclone Veronica but only 11 mm (June) between then and the survey dates.



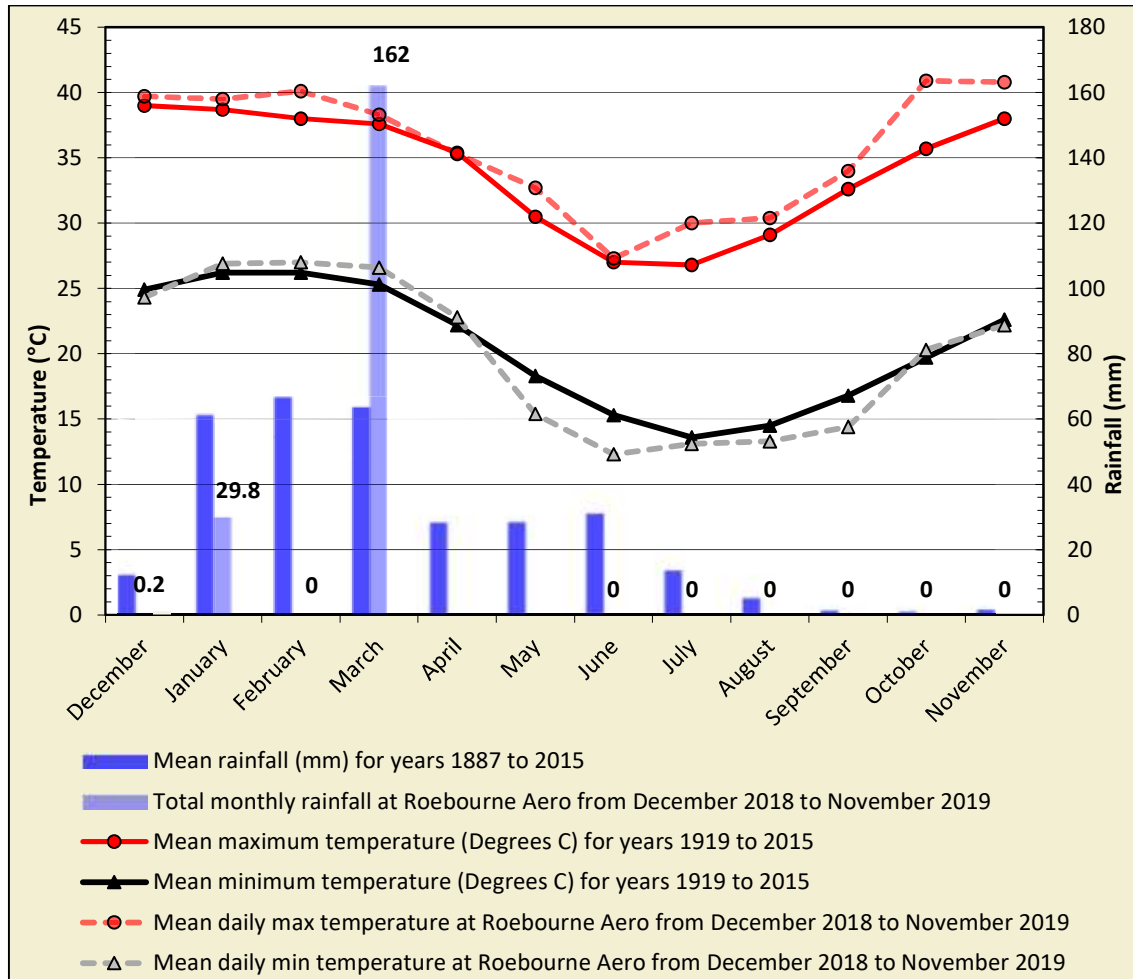


Figure 3-3 Annual climate and weather data for Roebourne (no. 004035) and mean monthly data for the 12 months preceding the survey for Roebourne Aero (no. 004090) (BoM 2020)

### 3.4 LAND USE

The Roebourne subregion is sparsely populated and primary land uses include grazing of native pastures, Aboriginal lands and reserves, conservation and mining leases. The Study Area itself is contained within Balla Balla Station which is actively operated as a cattle station.

### 3.5 CONSERVATION RESERVES AND ESAS

The nearest conservation reserve is the Millstream Chichester National Park, 53 km south of the Study Area. The nearest ESA is unnamed and occurs 14.3 km north of the Study Area (Figure 1-1).



## 4 METHODS

The survey was conducted in accordance with relevant survey guidelines and guidance, including:

- EPA Environmental Factor Guideline: Flora and vegetation (EPA 2016a)
- EPA Technical Guidance: Flora and vegetation surveys for Environmental Impact Assessment (EPA 2016c)
- EPA Environmental Factor Guideline: Terrestrial fauna (EPA 2016b)
- EPA Technical Guidance: Terrestrial fauna surveys (EPA 2016e)
- EPA Technical Guidance: Sampling methods for terrestrial vertebrate fauna (EPA 2016d)

### 4.1 DESKTOP REVIEW

Searches of several biological databases were undertaken to identify and prepare lists of significant flora, vegetation, and fauna that may occur within the Study Area (Table 4-1). A literature search was conducted for accessible reports for biological surveys conducted within 40 km of the Study Area to build on the lists developed from the database searches (Table 4-2). Additional records of conservation significant fauna from within a 40 km radius of the approximate centre point of Study Area (20.83076°S, 117.69943°E) were obtained from the Phoenix biological records database.

**Table 4-1 Database searches conducted for the desktop review**

Database	Target group/s	Search coordinates and extent
Protected Matters Search Tool 21/08/2019 14:42:39	EPBC Act Threatened flora, fauna and ecological communities	Approximate centre point of Study Area (-20.83076°S, 117.69943°E) with 40 km buffer
DBCA Threatened and Priority Flora Database (44-0819FL)	Threatened and Priority flora	Study Area plus a 40 km buffer
WA Herbarium Specimen Database (44-0819FL)	Threatened and Priority flora	Study Area plus a 40 km buffer
DBCA Threatened and Priority Fauna Database (2018/00514 #6081)	Threatened and Priority fauna	Approximate centre point of Study Area (-20.83076°S, 117.69943°E) with 20 km buffer
DBCA Threatened and Priority Ecological Communities Database 23/08/2019	TECs and PECs	Study Area plus a 40 km buffer
DBCA NatureMap Database 21/08/2019	Flora and fauna records	Approximate centre point of Study Area (-20.83076°S, 117.69943°E) with 40 km buffer

**Table 4-2 Survey reports included in the desktop review**

Report author	Survey description	Project
Mattiske (2006)	Level 1 Flora and Vegetation Survey	Aurox Resources, Balla Balla Vanadium Project
Phoenix (2018)	Flora survey, quadrats, relevés, targeted survey	Supplementary flora and vegetation survey and terrestrial survey for the Balla Balla Infrastructure Project
Ecoscope (2014)	Level 2 flora survey	Rutila Resources railway corridor flora and vegetation survey
Payne and Tille (1992)	Rangeland condition assessment	An inventory and condition survey of the Roebourne Plains and surrounds, Western Australia. Technical Bulletin 83.
WAM (1964)	Flora and Fauna of Depuch Island, Western Australia	Special Publication No. 2

## 4.2 FIELD SURVEY

### 4.2.1 Survey timing

Field survey dates are provided in Table 4-3.

**Table 4-3 Survey dates**

Survey type	Season	Dates
Flora and vegetation – reconnaissance survey	Spring	8 – 12 Oct 2019
Vertebrate Fauna – detailed (targeted) survey	Spring	12 – 18 Nov 2019

### 4.2.2 Flora and vegetation

Field methods for the flora and vegetation survey of the survey area included:

- surveying of quadrats and relevés (see 4.2.2.1)
- targeted flora searches (4.2.2.2)
- vegetation type and condition mapping (4.2.2.3, 4.2.2.4)
- TEC/PEC assessment (4.2.2.5).

Prior to the commencement of the field survey, data including satellite imagery, survey boundary, and pre-selected vegetation quadrats, and relevés were loaded onto electronic field devices. The field survey involved assessing and mapping vegetation boundaries, conducting quadrat and relevé sampling, and collecting opportunistic flora specimens. GPS locations of vegetation and condition boundaries, survey sites and flora specimen data were recorded digitally.

#### 4.2.2.1 Quadrats and relevés

Quadrat locations were selected to ensure that an accurate representation of the major vegetation types within the Study Area were sampled adequately, with a minimum of three quadrats per

vegetation type. Preliminary quadrat locations were pre-selected using aerial photography, with selection based on apparent changes in the vegetation visible in the aerial imagery. Final quadrat placement was determined in the field while ground-truthing the Study Area on foot. Some preliminary quadrats were moved to locations which better represented vegetation types and some quadrats were changed to relevés.

In total, 3 quadrats (50 m x 50 m) and 43 relevés were surveyed across the Study Area (Figure 4-1; Appendix 1). Quadrats were established in the Horseflat Land System vegetation to provide data for PEC/TEC analysis, relevés were recorded to provide data adequate for a Reconnaissance survey.

Quadrat sampling dimensions were 50 m x 50 m in accordance with EPA guidance for the Eremaean Botanical Province. The following information was recorded for each quadrat (Appendix 2):

- location – the geographic coordinates of all four corners of the quadrat in WGS84 projection
- description of vegetation – a broad description utilising the structural formation and height classes based on National Vegetation Information System (ESCAVI 2003) and in accordance with EPA (2016c) (Appendix 3)
- habitat – a brief description of landform and habitat
- geology – a broad description of surface soil type and rock type
- disturbance history – a description of any observed disturbance including an estimate of time since last fire, weed invasions, soil disturbance, human activity and fauna activity
- vegetation condition – using the condition scale in EPA (2016c) for the Eremaean Botanical Province
- height and percentage foliage cover (PFC) – a visual estimate of cover of total vegetation cover, cover of shrubs and trees >2 m tall, cover of shrubs <2 m, total grass cover and total herb cover
- photograph – a colour photograph of the vegetation within each quadrat in a south-easterly direction from the north-west corner of the quadrat
- flora species list – comprehensive list of all flora species recorded within the quadrat.

To ensure accurate taxonomic identification of flora species present within the Study Area, collections were made of each specimen at least once and each collection was pressed and documented for identification using the WA Herbarium resources.

For each species identified, records on FloraBase and the Australasian Virtual Herbarium were consulted to provide information on known ranges to determine whether the survey area represented a range extension for the species.

Relevés were sampled within vegetation types where dominant species, soils and topography were representative of vegetation surveyed in quadrats as well as for vegetation types without quadrats to reflect the reconnaissance nature of this survey. Information collected in relevés was the same as for quadrats with the exception that only a single geographic coordinate was recorded.

#### 4.2.2.2 Targeted flora searches

Targeted searches were undertaken for significant flora (Threatened and Priority), Declared Pests and WoNS. Remnant vegetation was traversed by foot in meandering transects with the searches focused on habitats considered likely to support significant flora, in addition to previously recorded locations of significant plants or populations in close proximity to the Study Area.

If a flora species was considered to potentially be a significant species (i.e. similar floristic characteristics and occurring within suitable habitat) the following information was collected:

- GPS coordinates, including population boundary where applicable
- description of the habitat and floristic community in which the potential significant species was located
- population size estimate (i.e. estimated number of individual plants) where applicable
- specimen collection for taxonomic identification and lodgement at the WA Herbarium
- photograph of live plant in situ and description of important details, such as flower colour, height of individual or average height of population.

Following the field survey, the likelihood of occurrence for each significant flora species identified in the desktop review was assessed and assigned to one of three ratings:

- recorded – species recorded within the Study Area by previous or current survey
- possible – Study Area within known range of species; potential habitat within the Study Area, records within 5 km of Study Area and may not have been detectible during survey (e.g. survey conducted outside flowering period, annual plant survey conducted outside likely period of occurrence, small herbaceous plant in dense vegetation), or entire area of habitat not thoroughly searched
- unlikely – Study Area outside known range of species and/or no suitable habitat present in Study Area and/or suitable/potential habitat present but Study Area considered adequately searched for the species.

#### 4.2.2.3 Vegetation type mapping

Vegetation mapping was undertaken at a scale of 1:10,000 using NVIS Association level (L5) for structural descriptions (ESCAVI 2003). The vegetation descriptions from quadrats and relevés from the survey were grouped according to similarity of community structure (i.e. canopy levels), species composition and combination of species and the prevalent community structure (i.e. woodland, shrubland, etc.). The vegetation boundaries were mapped utilising ArcGIS ESRI imagery and from vegetation boundaries recorded on GPS during the field survey.

To support delineation of vegetation types, a cluster analysis was conducted based on species presence in each quadrat. The fusion strategy for the site classification was flexible UPGMA with a beta value of -0.1 and Bray Curtis association measure in the software package PATN (Belbin 2003). A dendrogram was produced to illustrate the similarities between the vegetation units identified. Statistically distinct vegetation units (the floristic group) classified the vegetation at a local scale. Local scale vegetation units were described at NVIS Level V – Association (ESCAVI 2003). The term ‘vegetation type’ was used for local scale vegetation units in accordance with EPA technical guidance (EPA 2016c).

Existing vegetation mapping was used as a basis for vegetation unit descriptions and modified, updated, and extrapolated where necessary.

#### 4.2.2.4 Vegetation condition mapping

The condition of vegetation was mapped across the Study Area based on the appropriate condition scale for the Eremaean Botanical Province (Trudgen 1988 in EPA 2016c) (Table 4-4). The vegetation condition ratings relate to vegetation structure, the level of disturbance and weed cover at each

structural layer and the ability of the vegetation unit to regenerate. Vegetation condition ranges from Excellent being the highest rating to Completely Degraded as the lowest.

**Table 4-4 Vegetation condition rating scale (EPA 2016c)**

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

#### 4.2.2.5 TEC/PEC assessment

The description and locations provided in the DBCA TEC/PEC database search were compared to observations made in the field of significant vegetation types to arrive at conclusions regarding the presence/absence of ecological communities reported in the database searches.

#### 4.2.2.6 Analysis of survey completeness

A species accumulation curve based on accumulated species versus number of relevés surveyed was used to evaluate the level of adequacy of the survey effort. The species accumulation curve was generated using Colwell (2013) program EstimateS. The theoretical asymptotic value was determined by the incidence-based coverage estimator of species richness.

#### 4.2.2.7 Likelihood of Occurrence Assessment

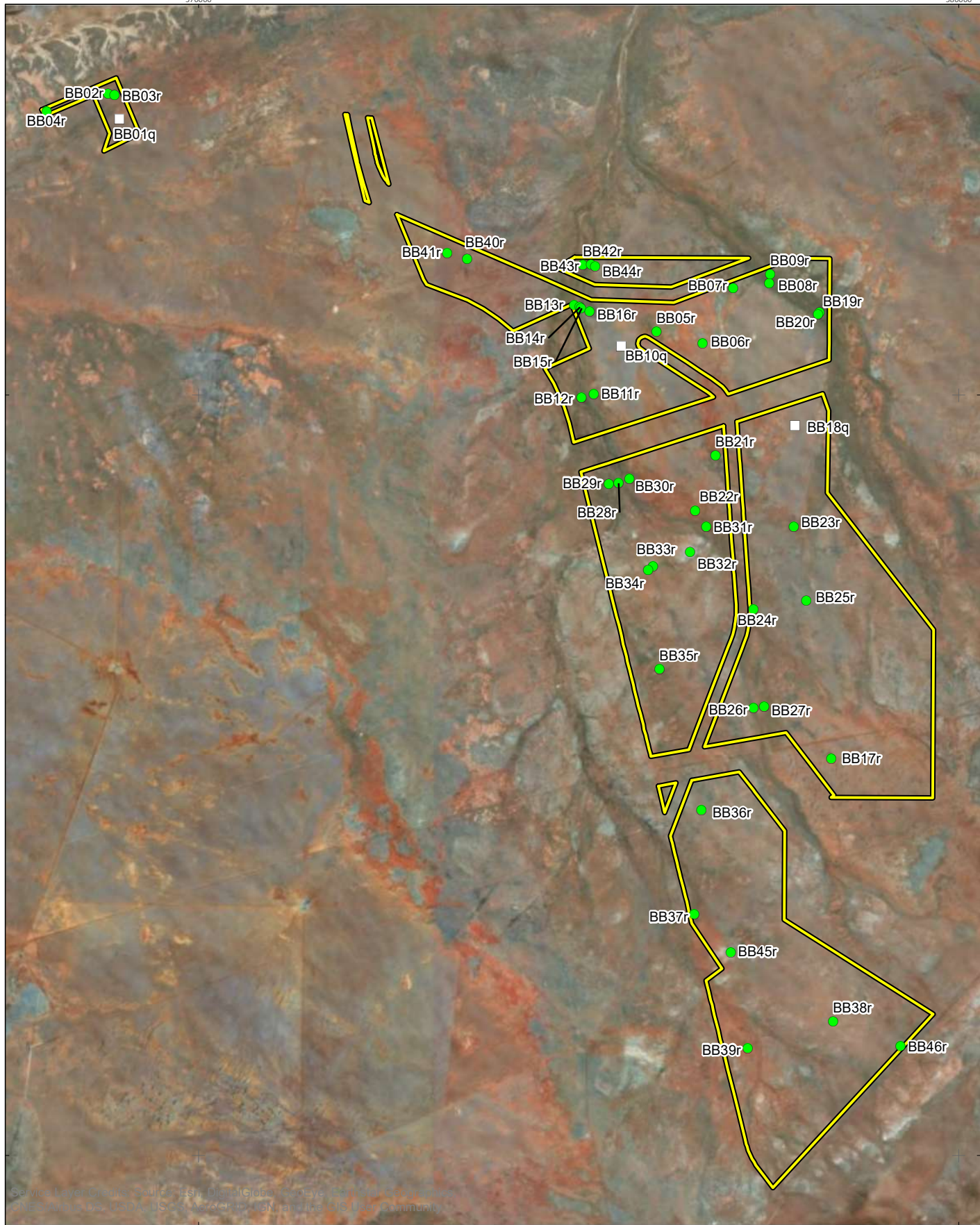
The potential for occurrence in the study area of the significant flora and vegetation identified in the database searches was assessed. The assessment was based on reviewed information relating to habitat preference (soils, landforms, elevation and vegetation associations) and locality records from the database searches.

The flora assessments assigned each taxon to one of four ratings:

- recorded – species recorded within the survey area by previous or current survey


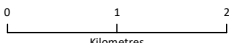
- likely – survey area within known range of species; suitable habitat within the survey area and/or records within 5 km of survey area
- possible – survey area within known range of species; optimal or potential habitat within the survey area, no records within 5 km of survey area
- unlikely – study area outside known range of species, no records within 5 km and/or no suitable habitat present in study area.








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Forge Swan Resources Pty Ltd Balla Balla Infrastructure - Rail and Conveyor Project	
Project No	1283-1284
Date	18-Feb-20
Drawn by	AJ
Map author	MH
	
	
1:65,000 (at A4)	GDA 1994 MGA Zone 50

-  Study Area
- Site type**
-  Quadrat
-  Relevé

**Figure 4-1**  
**Flora and vegetation survey sites**



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### 4.2.3 Terrestrial fauna

Field methods for the fauna survey of the survey area included:

- habitat assessment (see 4.2.3.1)
- active diurnal and nocturnal searches (4.2.3.2)
- Night Parrot audio recorder surveys (4.2.3.3)
- bat echolocation recordings (4.2.3.4)
- camera trapping (4.2.3.5)

A total of 12 survey sites were sampled (Figure 4-2; Appendix 1).

#### 4.2.3.1 Habitat assessment

Initial habitat characterisation was undertaken using various remote geographical tools, including aerial photography (Google Earth®), land system maps and topographic maps. Habitats with the potential to support significant terrestrial fauna species were identified based on known habitats of such species within the Pilbara bioregion. Tentative sites were selected for the terrestrial fauna survey to represent habitat types most likely to contain conservation significant species identified in the desktop study. Final survey site selection was conducted after ground-truthing of site characteristics.

At the broadest scale, site selection considered aspect, topography and land systems. At the finer scale, consideration was given to proximity to water bodies (drainage lines and creek), vegetation complexes and condition and soil type. Sites were primarily chosen to represent the best example of distinct habitats within the broader habitat associations of the Study Area with a focus on species of conservation significance identified in the desktop review. Habitat descriptions and characteristics were recorded at all Level 1 survey sites (Figure 4-2; Table 4-5; Appendix 4).

**Table 4-5 Terrestrial fauna survey effort**

Site	Sample type	Audio recording	Camera	Ultrasonic recording	Foraging	Nocturnal foraging
		Nights			Hours	
CAM001	Targeted fauna species site		12	4		
CAM002	Targeted fauna species site		12	4		
CAM004	Targeted fauna species site		12		2	
CAM005	Targeted fauna species site		12	4		1.44
CAM006	Targeted fauna species site					
CAM008	Targeted fauna species site			3		
F01	Targeted fauna species site				2	
F02	Targeted fauna species site				1	
F03	Targeted fauna species site				1.91	
NP01	Targeted fauna species site	9				2.7
NP02	Targeted fauna species site	9				
QH	Targeted fauna species site				1.28	
<b>Total</b>		<b>18</b>	<b>48</b>	<b>15</b>	<b>8.19</b>	<b>4.14</b>

#### 4.2.3.2 Active searches

Active searches were undertaken at five sites during the day and two sites at night (Figure 4-2). Both day and night searches primarily targeted herpetofauna and mammals from direct sightings and secondary evidence. Searches focused on significant species identified in the desktop review as potentially occurring within the Study Area, including Pilbara Olive Python, Northern Quoll, Western Pebble-mound Mouse, and Bilby.

Searches were undertaken in any observable microhabitats considered likely to support mammals, reptiles and amphibians. Techniques included: raking leaf and bark litter, overturning logs, searching beneath the bark of trees, investigating dead trees and logs, investigating burrows, investigating infrastructure ruins or disused building materials such as tin piles and identifying any secondary evidence including tracks, diggings, scats, fur or sloughs (shed skins), predation or feeding sites, and fauna constructed structures such as pebble mounds or nests. A minimum of one person hour was spent active searching at each site for a total of 8.89 hours over the duration of the field survey (Table 4-5).

#### 4.2.3.3 Night Parrot audio recorder surveys

SongMeter SM4 recording devices targeting Night Parrots were deployed at two sites to record calls and activity over a longer period than that of the field survey (sites NP01 and NP02; Figure 4-2). Devices were deployed during the survey on 14 November 2019 and retrieved 23 November 2019. Devices were deployed for a total of 18 nights (Table 4-5) and set to record during peak periods of

Night Parrot activity. The SongMeters were placed in locations representing the best potential nesting and roosting habitat for Night Parrot identified in the desktop review and through further observation during the study. However, no locations within the Study Area met DBCA descriptions of nesting and roosting habitat (long-unburnt ring-forming spinifex >40-50 cm in height) (DPaW 2017).

Additional avifauna observations were also recorded opportunistically while other field work was being completed, including observations made during travel and active searches.

#### 4.2.3.4 Bat echolocation recordings

Song Meter SM2 recording devices were used to record bat echolocation calls at four sites during the field survey (sites CAM001 CAM002, CAM005 and CAM008; Figure 4-2). Recording devices were deployed at each site for three or four nights of recording for between eight and 12 continuous hours per night (Table 4-5). Devices were aimed at a 45° angle to the ground. The SongMeters were positioned in areas of habitat likely to have increased insect activity and to attract bats (i.e. likely foraging areas or movement corridors) and/or potential roosting sites.

#### 4.2.3.5 Camera trapping

A total of 12 camera traps were placed at four sites throughout the Study Area. Sites were located in linear drainage habitat and rocky outcrops most likely to contain Northern Quoll. Each camera trapping site contained three camera traps baited with “universal bait” (a mixture of oats, peanut butter, and sardines) (DoE 2016). Camera traps were deployed for a minimum of four consecutive nights and positioned approximately 100m apart in accordance with DoEE survey guidelines for Northern Quoll (DoE 2016). Two cameras types were used (Reconyx Hyperfire 600 and Bushnell Trophy Cam), with settings configured to take between 3–10 photos per trigger at highest sensitivity.

#### 4.2.3.6 Likelihood of occurrence assessment

Following the field survey, the likelihood of occurrence for each significant fauna species identified in the desktop review was assessed and assigned to one of four ratings:

- recorded – species recorded within the Study Area by previous or current survey
- likely – Study Area within current known range of species, suitable habitat within the Study Area and home range of species intersects Study Area based on known records
- possible – Study Area within current known range of species, suitable habitat within the Study Area and home range of species does not intersect Study Area based on known records
- unlikely – Study Area outside current known range of species or no suitable habitat present in Study Area.

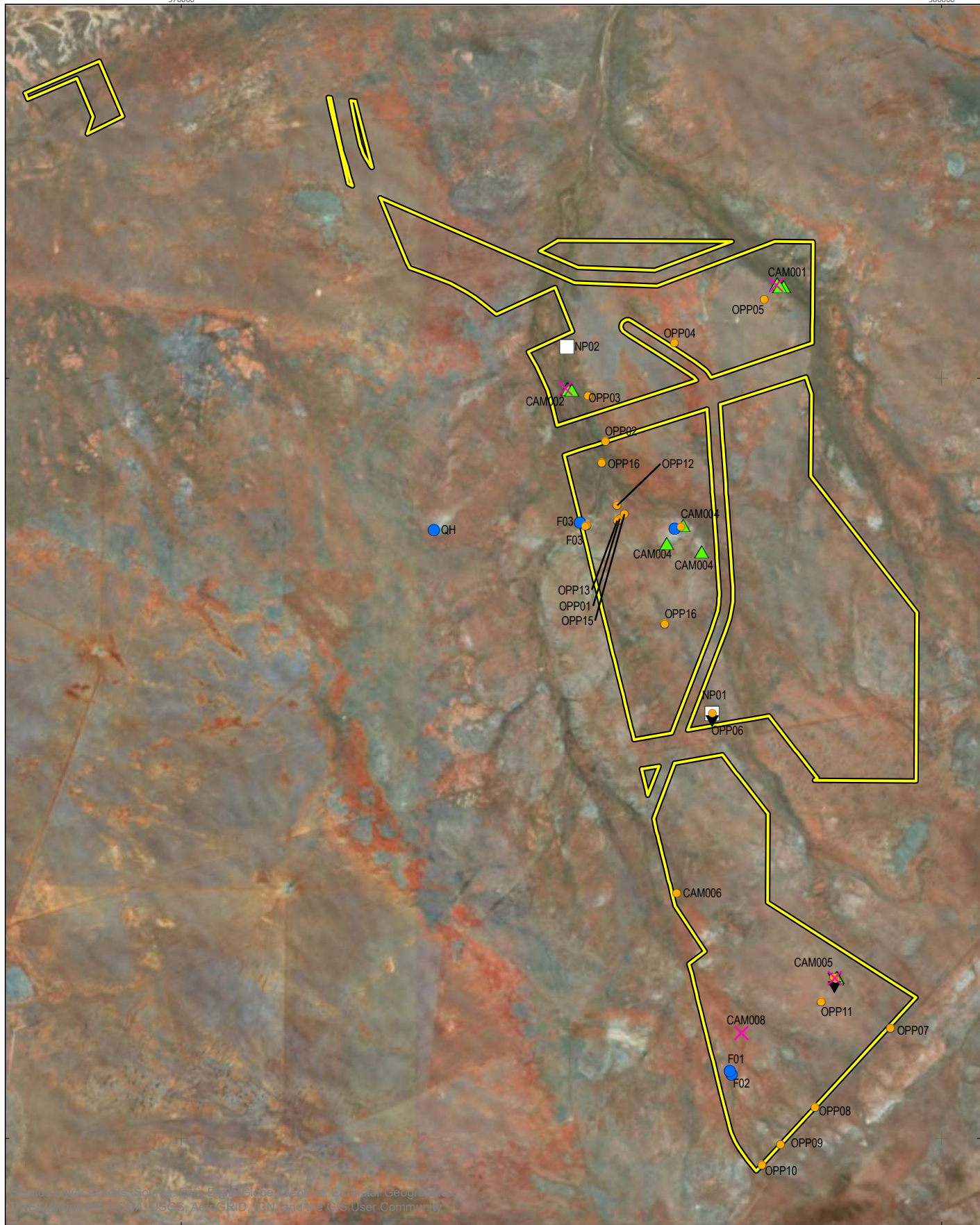
#### 4.2.4 Survey personnel

The personnel involved in the surveys are listed in Table 4-6. All survey work was carried out under relevant licences issued by DBCA under the BC Act (Table 4-6).



**Table 4-6 Survey personnel**

<b>Name</b>	<b>Permit</b>	<b>Qualifications</b>	<b>Role/s</b>
Martin Henson	Flora taking (biological assessment) licence FB62000110	BEnvSci (Hons)	Field survey, taxonomy, reporting
Dr David Leach	Flora taking (biological assessment) licence FB62000045	Ph.D. (Plant Biology), Ba.App.Sci (Hons) (Conservation and Park Management)	Field survey, GIS, mapping, data analysis, report review
Dr Grant Wells	Scientific or Other Prescribed Purposes Licence no. SL012495	Ph.D. (Botany)	Project Management, report review
Alice Watt	Flora taking (biological assessment) licence FB62000116	Ba.Sci. (Cons. Bio. & Botany) (Hons)	Taxonomy, reporting
Dr Andrew Perkins	Flora taking (biological assessment) licence FB62000181	Ph.D. (Botany), BSc (Hons)	Taxonomy
Jarrad Clark	Fauna taking (biological assessment) licence no. BA27000111	Ba.Sci.(Env.Mgt.)	Project management, reporting
Dr Michael Lohr		Ph.D. (Natural Sciences)	Field work, reporting
Simon Pynt		Ba.Sci. (Zoology)	Field work
Mrs Karen Crews	NA	Ba.Sci. (Env. Biol.) (Hons)	Report review



Source: Layer: Google, Google Earth, Digital Globe, Aerials, Earthstar, Geographics, CNR/Airphoto, IGN/USA, GeoEye, AeroGRID, IGN, and the GIS User Community



Forge Swan Resources Pty Ltd  
 Balla Balla Infrastructure - Rail and Conveyor Project

Project No	1283-1284
Date	18-Feb-20
Drawn by	AJ
Map author	JC

0 1 2  
Kilometres

1:65,000 (at A4) GDA 1994 MGA Zone 50

Study Area

- Fauna survey sites**
- Audio recording
  - Camera trap
  - Foraging
  - Foraging nocturnal
  - Opportunistic sighting
  - Ultrasonic recording

**Figure 4-2**  
**Terrestrial fauna survey sites**



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## 5 RESULTS

### 5.1 DESKTOP REVIEW

#### 5.1.1 Flora and vegetation

##### 5.1.1.1 Flora assemblage

The desktop review identified records of 464 flora taxa within the desktop search extent (DBCA 2019). Previous surveys within/in close proximity to the Study Area recorded 221 species (Phoenix 2018), 474 (Ecoscape 2014) and 174 (Mattiske 2006). Of these studies, Mattiske (2006) is the most similar in area and location as the others touch upon the Study Area but include long linear study areas for railway easements.

##### 5.1.1.2 Significant flora

Records of nine significant flora species were identified within the desktop search extent, comprising two Priority 1, six Priority 3 and one Priority 4 flora (Table 5-1).

No records of significant flora occurred in the Study Area (Figure 5-1):

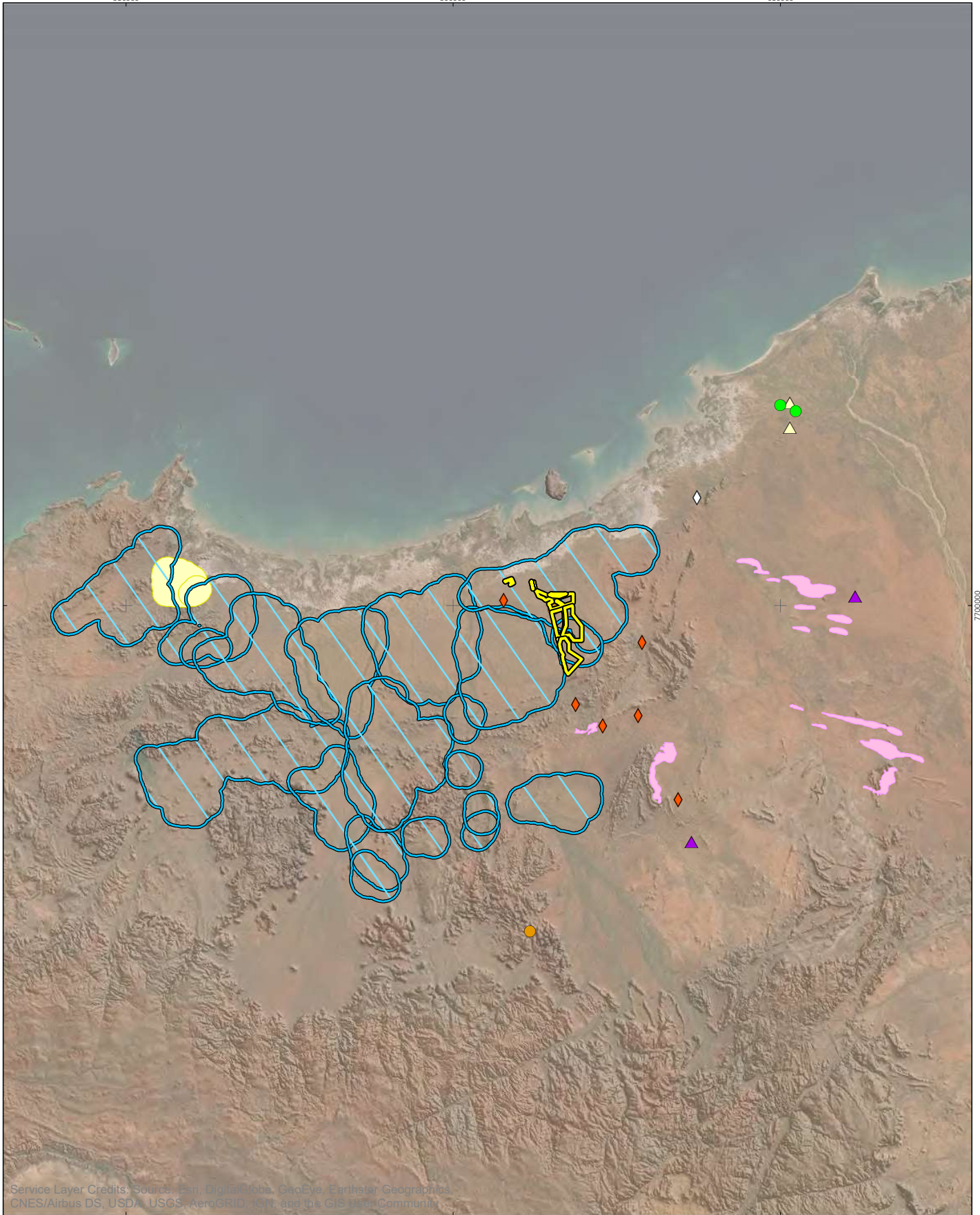
**Table 5-1 Significant flora identified in the desktop review**

Species	Status	Proximity to Study Area	Habitat
<i>Abutilon</i> sp. Pritzelianum (S. van Leeuwen 5095)	P1	31.8 km south-east of Study Area	On red sand plain or floodplain with dry red clay.
<i>Acacia glaucocaesia</i>	P3	NatureMap record, 34 km east of Study Area	Floodplains, drainages red and sandy loams, clay.
<i>Eragrostis crateriformis</i>	P3	41.6 km north-east of Study Area	Clayey loam or clay. Creek banks, depressions.
<i>Gomphrena cucullata</i>	P3	42.9 km north-east of Study Area	Red sandy loam, clayey sand. Open floodplains.
<i>Goodenia nuda</i>	P4	44 m south of Study Area	Erect to ascending herb, to 0.5 m high. Flowers yellow, April to August. Red-brown sandy loam on floodplains.
<i>Heliotropium muticum</i>	P3	2.6 km south-west of Study Area	On plain with brown loam sand or sandplain over calcrete, ironstone, quartz.

Species	Status	Proximity to Study Area	Habitat
<i>Solanum cataphractum</i> *	P3	14.8 km north-east of Study Area	Sand with sandstone rocks on undulating plateau
<i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114)	P1	24 km north-east of Study Area	Coastal and near-coastal locations in sandy and sandy loam soils often tan, deep sands in coastal dunes
<i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)	P3	No location, reported in Mattiske (2006)	Clay pans, cracking clays, grassy plains, drainages. Reported as present in Horseflat land system of the Roebourne Plains PEC.

\**Solanum cataphractum* was recorded in a 1962 survey on Depuch Island on the Pilbara coast. The record is included in NatureMap but not in FloraBase, which defines it as a Kimberley species. Record here included for completeness but for the purpose of this report FloraBase is taken as the authority and this record dismissed.





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Forge Swan Resources Pty Ltd  
 Balla Balla Infrastructure - Rail and Conveyor Project

Project No	1283-1284
Date	19-Feb-20
Drawn by	AL
Map author	MH

0 15 30  
 Kilometres

1:750,000 (at A4) GDA 1994 MGA Zone 50

- Study Area
- TEC and**
- Roebourne chenopod association, Priority 1 PEC
- Horseflat Land System, Priority 3 PEC
- Gregory Land system, Priority 3 PEC

- Significant flora**
- Abutilon* sp. Pritzelianum (S. van Leeuwen 5095), P1
  - Eragrostis crateriformis*, P3
  - Gomphrena cucullata*, P3
  - Goodenia nuda*, P4
  - Heliotropium muticum*, P3
  - Tephrosia rosea* var. Port Hedland (A.S. George 1114), P1

**Figure 5-1**  
**Desktop records of significant flora and vegetation**

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### 5.1.1.3 Introduced flora

The desktop review identified records of seven introduced species within the desktop search extent, of which one is a Declared Pest (Table 5-2; Appendix 5). Prohibited organisms may only be imported or kept subject to a permit system.

**Table 5-2 Desktop records of significant weeds**

Species	Declared Pest	WoNS
* <i>Indigofera hochstetteri</i>	s12 C1 (Prohibited)	No

### 5.1.1.4 Vegetation associations

Regional scale vegetation mapping by Shepherd *et al.* (2002) mapped three vegetation associations in the Study Area (Table 5-3; Figure 5-2). All three associations have over 95% of their pre-European extent remaining and they are therefore considered of Least Concern (Table 5-3). At the bioregion and subregion scale, these statistics are similar, with all three associations having over 97% remaining (DBCA 2018)

**Table 5-3 State-wide extent of pre-European vegetation associations present in the Study Area (Shepherd *et al.* 2002)**

Vegetation association	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	Current extent in DBCA lands (%)	% of Study Area
589 Mosaic: Short bunch grassland - savanna / grass plain (Pilbara) / Hummock grasslands, grass steppe; soft spinifex	807,698.58	802,713.40	99.38	1.89	24.0
647 Hummock grasslands, dwarf-shrub steppe; <i>Acacia translucens</i> over soft spinifex	195,860.89	191,711.41	97.88	0	73.3
649 Sedgeland; Various sedges with very sparse snakewood	40,364.42	40,178.20	99.54	0	2.7

### 5.1.1.5 Vegetation Condition

Reports reviewed as part of the Desktop Review has previously rated the vegetation as:

- Excellent to Very Good (Phoenix 2018), with the majority mapped as Excellent (94.79%);
- Excellent to Poor (Ecoscape 2014), with the majority mapped as Excellent (90.64%). Ecoscape mapped smaller areas as Very Good (6.23%), Good (1.7%) and Poor (075%), blaming the deterioration on grazing and weed invasion.

Vegetation Condition was not discussed in other documents reviewed.



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	Project No Date Drawn by Map author	1283-1284 18-Feb-20 AJ MH & JC				<b>Vegetation association</b> 11 43 93 117																										
1:200,000 (at A4)      GDA 1994 MGA Zone 50																																
<b>Figure 5-2</b> <i>Shepherd et al. (2002)</i> <b>vegetation associations</b> <b>of the Study Area</b>																																
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### 5.1.1.6 Significant vegetation

The DBCA Threatened and Priority Ecological Communities database search identified the presence of three PEC's within the desktop search extent (Table 5-4). The Horseflat land system of the Roebourne Plains PEC and its buffer zones intersect the Study Area (Figure 5-1).

**Table 5-4 TECs and PECs identified in the desktop review**

Community name	Status	Proximity to Study Area	Description	Total area of desktop (ha)
Horseflat land system of the Roebourne Plains	DBCA P3(iii)	Intersects (inc. buffer zones) 93.15 % of the Study Area	The Horseflat Land System of the Roebourne Plains are extensive, weakly gilgaied clay plains dominated by tussock grasslands on mostly alluvial non-gilgaied, red clay loams or heavy clay loams. Perennial tussock grasses include <i>Eragrostis xerophila</i> (Roebourne Plains grass) and other <i>Eragrostis</i> spp., <i>Eriachne</i> spp. and <i>Dichanthium</i> spp. The community also supports a suite of annual grasses including <i>Sorghum</i> spp. and rare <i>Astrebela</i> spp. The community extends from Cape Preston to Balla Balla surrounding the towns of Karratha and Roebourne.	262,594.7
Gregory System (land system)	DBCA P3	Outside, closest example ~8.4 km from Study Area	Linear dunes and restricted sandplains supporting shrubby hard spinifex (and occasionally soft spinifex) grasslands.	7,526.45
Stony Chenopod association of the Roebourne Plains area	DBCA P1	Outside, closest example ~50 km from Study Area	The community is dominated by <i>Eragrostis xerophila</i> and chenopods growing in saline clay soils with dense surface strew of pebbles and cobbles. The association appears to be uncommon and is likely to be linked with the Cheerawarra land system (Unit 3 - Saline clay plains); which does not occur in the Study Area.	6,137.66

### 5.1.2 Terrestrial fauna

The desktop review identified records of 334 vertebrate taxa and one invertebrate taxon within the desktop search extent (Table 5-5). These species include instances where EPBC Protected Matters Search has indicated that suitable habitat may occur but the species has not necessarily been observed. The list comprised 3 frogs, 81 reptiles (including one introduced species), 204 birds (including three introduced species) and 46 mammals (including ten introduced species) (Table 5-5; Appendix 6).

Sixty-one significant vertebrate species and one significant invertebrate species were identified in the desktop review, comprising 22 species listed as Threatened, Conservation Dependent or Specially Protected under the EPBC Act and/or BC Act (Table 5-6). Thirty-two avifauna species are listed as



Migratory under the EPBC Act and BC Act (Table 5-6). A further seven species are listed as Priority by DBCA (Table 5-6).

One significant vertebrate species have previously been recorded within the Study Area (Figure 5-3):

- *Ozimops cobourgianus* Northern Coastal Free-tailed Bat (P1; DBCA list), recorded once within the Study Area in the DBCA Threatened and Priority Fauna Database. This record is from a large drainage in the northwest of the Study Area.

**Table 5-5 Summary of terrestrial fauna desktop results**

Class	Native	Introduced	Total
Invertebrates	1	0	1
Fish	0	0	0
Amphibians	3	0	3
Reptiles	80	1	81
Birds	201	3	204
Mammals	36	10	46
<b>Total</b>	<b>321</b>	<b>14</b>	<b>335</b>

Table 5-6 Significant vertebrate fauna identified in the desktop review

Species	Status	Proximity to Study Area (km)	Habitat
<b>Gastropods</b>			
<i>Dupucharopa millestriata</i> Depuch Island charopid land snail	P2 (DBC list)	16.64	Restricted to Depuch Island. The species is found in woodland, probably under logs (Stanisic <i>et al.</i> 2017).
<b>Reptiles</b>			
<i>Chelonia mydas</i> Green Turtle	VU/Mig./VU (EPBC Act; BC Act)	15.12	In Western Australia, Green Turtles nest on beaches from the Ningaloo coast northwards. Green Turtles nest very infrequently on the mainland beaches adjoining Cape Lambert (Biota 2008a). There are significant rookeries on Barrow Island, in the Montebello Islands, the Dampier Archipelago and the Lacepede Islands, with smaller rookeries on many smaller Pilbara islands, as well as in the Kimberley (Prince 1993).
<i>Lerista neviniae</i> Nevin's Slider	EN (BC Act)	*	The known distribution of this endemic Pilbara species was restricted to the coastal dunes between Popes Nose Creek and the south-east corner of Dixon Headland, with an estimated area of only 360ha of suitable habitat (Biota 2008b).
<i>Liasis olivaceus barroni</i> Pilbara Olive Python	VU (EPBC & BC Acts)	7.05	The Pilbara Olive Python is thought to be endemic to the Pilbara, with scattered records from across the region, including some offshore islands (Barker & Barker 1994; Pearson 2007; Smith 1981). It is commonly found in rocky areas in association with watercourses and pools and often associated with areas of permanent pooling water near rocky habitats, such as gullies, gorges and rocky ranges or boulder sites. It has also been recorded in riparian vegetation along major rivers, such as the Robe River (Barker, 1994 #8907; Pearson, 2003 #8918; Pearson, 2007 #8919

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Species	Status	Proximity to Study Area (km)	Habitat
<i>Natator depressus</i> Flatback Turtle	VU/Mig./VU (EPBC Act; BC Act)	15.12	Flatback Turtle is a marine species, which comes to land only to nest. All recorded nesting beaches are found in Australia (Limpus <i>et al.</i> 1989).
<i>Notoscincus butleri</i> Lined Soil-Crevice Skink	P4 (DBCA list)	0.93	Lined Soil-Crevice Skink is endemic to the Pilbara region, with records scattered across the far west of the region from south of Karratha and Dampier, including West Intercourse Island, to approximately 40 km northwest of Tom Price (Storr <i>et al.</i> 1999; Wilson & Swan 2013). Little is known on the species' preferred habitats; however, the limited records are often associated with spinifex dominated vegetation near creek and river margins (Cogger 2014; Wilson & Swan 2013; Wilson & Knowles 1988).
<b>Birds</b>			
<i>Actitis hypoleucos</i> Common Sandpiper	Mig. (EPBC & BC Acts)	8.89	In Western Australia the species is mostly coastal with some inland records (Geering <i>et al.</i> 2007). They are found across a wide range of wetlands: small ponds, large inlets, mudflats where they forage on the shore usually close to the vegetation.
<i>Anous stolidus</i> Common Noddy	Mig. (EPBC & BC Acts)	*	Occurs mainly in the ocean off the Queensland coast, but also off the north-west and central Western Australia coast (DoEE 2018). During the breeding season, it occurs on or near islands, on rocky islets and stacks with precipitous cliffs, or on shoals or cays of coral or sand (DoEE 2018). During the non-breeding period, the species occurs in groups in the open ocean (Higgins & Davies 1996).
<i>Apus pacificus</i> Fork-tailed Swift	Mig. (EPBC & BC Acts)	12.08	The Fork-tailed Swift is a widespread migratory species that overwinters in Australia. It can be found across most of WA and is uncommon to moderately common in the north-west. They occur in a wide range of dry or open habitats, including riparian woodlands, tea-tree swamps, low scrub, heathland, saltmarsh, grassland and spinifex sandplains, open farmland and inland and coastal sand-dunes. Fork-tailed Swifts are often found in areas that experience updraughts

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Species	Status	Proximity to Study Area (km)	Habitat
			around cliffs, and normally forage several hundred metres above ground level (DSEWPaC 2011b).
<i>Ardenna pacifica</i> Wedge-tailed Shearwater	Mig. (EPBC & BC Acts)	14.14	The Wedge-tailed Shearwater is a pelagic, marine bird known from tropical and subtropical waters (Del Hoyo <i>et al.</i> 1996). It breeds on the east and west coasts of Australia in summer (Del Hoyo <i>et al.</i> 1996).
<i>Arenaria interpres</i> Ruddy Turnstone	Mig. (EPBC & BC Acts)	4.44	It is usually found on ocean coasts with exposed rock, stones, or shell beaches (Morcombe 2004).
<i>Calidris acuminata</i> Sharp-tailed Sandpiper	Mig. (EPBC & BC Acts)	9.42	The distribution of the species in Australia depends on water quantity conditions; some large wetlands may be available inland after important rainfall, but only occasionally. The distribution on the coast is more regular, the conditions being more consistent.
<i>Calidris alba</i> Sanderling	Mig. (EPBC & BC Acts)	4.96	Sanderlings are often seen in flocks foraging along the shoreline. They forage actively on sandy beaches following the wave backwash movement. At high tide they usually roost together and flocks are larger than when foraging.
<i>Calidris canutus</i> Red Knot	EN/Mig./EN (EPBC Act; BC Act)	4.44	Around 135,000 individuals winter in Australia (Geering <i>et al.</i> 2007). The large majority of this population occurs at 80 Miles Beach, near Broome (Bamford <i>et al.</i> 2008) but the species is widespread across coastal Australia. On wintering grounds Red Knots congregate to form large flocks of several thousands of individuals and feed in intertidal flats with a preference for sandy substrate.
<i>Calidris ferruginea</i> Curlew Sandpiper	CR/Mig./CR (EPBC Act; BC Act)	7.36	In Australia they are mostly found on the coast but can also forage inland, in open shallow wetlands.
<i>Calidris melanotos</i> Pectoral Sandpiper	Mig. (EPBC & BC Acts)	14.79	Found in wetlands, inland as well as on the coast. The species typically uses shallow fresh to saline wetlands such as coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.



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Species	Status	Proximity to Study Area (km)	Habitat
<i>Calidris ruficollis</i> Red-necked Stint	Mig. (EPBC & BC Acts)	8.30	Red-necked Stints are found in great numbers along the East Asian – Australasian Flyway (325.000 individuals overall, 270.000 in Australia (Geering <i>et al.</i> 2007)). They are found across a wide range of open mudflat-like habitats in salt as well as in freshwater systems.
<i>Calidris subminuta</i> Long-toed Stint	Mig. (EPBC & BC Acts)	10.30	This small shorebird is an arctic circumpolar breeder found in Australia only during the northern hemisphere winter. On wintering grounds, the species is mostly solitary and hard to sight due to its feeding habits, in dense inundated vegetation (Geering <i>et al.</i> 2007)
<i>Calidris tenuirostris</i> Great Knot	CR/Mig./CR (EPBC Act; BC Act)	8.30	This medium size shorebird breeds in Eastern Siberia and winters across most of coastal Australia. They are rarely found inland. While wintering the species congregates in large flocks of up to several thousand individuals that feed in intertidal mudflats among other species of shorebirds.
<i>Calonectris leucomelas</i> Streaked Shearwater	Mig. (EPBC & BC Acts)	*	The species occurs over pelagic and inshore waters. In northern Australia, the streaked shearwater is usually found in offshore waters more than 18 kilometres from the mainland coast (Marchant & Higgins 1990).
<i>Charadrius leschenaultii</i> Greater Sand Plover	VU/Mig./VU (EPBC Act; BC Act)	4.96	The Greater Sand Plover is a gregarious species, often found in mixed flocks on intertidal zones and estuaries (Morcombe 2004).
<i>Charadrius mongolus</i> Lesser Sand Plover	EN/Mig. (EPBC & BC Acts)	6.17	The Lesser Sand Plover is a small plover species which may be found on intertidal sandflats, mudflats, beaches, sandbars, and reef flats (Morcombe 2004).
<i>Charadrius veredus</i> Oriental Plover	Mig. (EPBC & BC Acts)	*	The Oriental Plover is a non-breeding visitor to Australia (Department of the Environment and Energy 2019). It has a widespread distribution but most records are along the north-western coast between Exmouth Gulf and Derby (Department of the Environment and Energy 2019). Inland habitats occupied by the species include sparsely vegetated plains or recently burnt open areas.

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Species	Status	Proximity to Study Area (km)	Habitat
<i>Falco hypoleucos</i> Grey Falcon	VU (BC Act)	*	The Grey Falcon is a widespread but rare species inhabiting much of the semi-arid interior of Australia. Its distribution is centred on inland drainage systems. It has a large foraging range extending from timbered plains, such as Acacia shrublands, into open grasslands (Garnett & Crowley 2000).
<i>Falco peregrinus</i> Peregrine Falcon	OS (BC Act)	15.12	The Peregrine Falcon's preferred habitat includes cliffs and wooded watercourses. Nesting occurs mainly on cliff ledges, granite outcrops, quarries and in trees with old raven or Wedge-tailed Eagle nests (Johnstone & Storr 1998).
<i>Fregata ariel</i> Lesser Frigatebird	Mig. (EPBC & BC Acts)	*	It is usually seen in tropical or warmer waters off northern Western Australia, Northern Territory, Queensland and northern New South Wales (DSEWPaC 2012). The species is usually pelagic and often found far from land, but is also found over shelf waters, in inshore areas, and inland over continental coastlines (Marchant & Higgins 1990).
<i>Glareola maldivarum</i> Oriental Pratincole	Mig. (EPBC & BC Acts)	15.58	In non-breeding grounds in Australia, they inhabit open plains, floodplains or short grassland, wetlands, saltworks and sewage farms. The species also occurs along the coast, inhabiting beaches, mudflats and islands, or around coastal lagoons (Department of the Environment and Energy 2019). During the heat of the day they usually loaf near water at the edges of terrestrial wetlands.
<i>Hirundo rustica</i> Barn Swallow	Mig. (EPBC & BC Acts)	*	Barn Swallows only occur in Australia as migrants. In WA, they occur in coastal Pilbara and coastal Kimberley. They feed on a wide range of invertebrates they catch in flight, usually over the water (sea shore but also inland freshwater) (Johnstone & Storr 2004).
<i>Limicola falcinellus</i> Broad-billed Sandpiper	Mig. (BC Act)	8.30	The species breeds in Siberia and Scandinavia and occurs in Australia only during the northern hemisphere winter. While wintering they mostly forage in open coastal mudflats in small flocks or individually.
<i>Limosa lapponica</i>	Mig. (EPBC & BC Acts)	8.41	The Bar-tailed Godwit is a common migratory wader, inhabiting coastal mudflats, sandbars, estuaries and salt marshes.

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Species	Status	Proximity to Study Area (km)	Habitat
Bar-tailed Godwit			
<i>Limosa lapponica baueri</i> Bar-tailed Godwit (western Alaskan)	VU/Mig. (EPBC & BC Acts)	*	The Bar-tailed Godwit is a common migratory wader, inhabiting coastal mudflats, sandbars, estuaries and salt marshes.
<i>Limosa lapponica menzbieri</i> Bar-tailed Godwit (northern Siberian)	CR/Mig./VU/Mig. (EPBC Act; BC Act)	*	The Bar-tailed Godwit is a common migratory wader, inhabiting coastal mudflats, sandbars, estuaries and salt marshes.
<i>Limosa</i> Black-tailed Godwit	Mig. (BC Act)	14.77	The species utilizes tidal mudflats, sand spits of estuaries, mangroves, lake shores and ocean beaches (Morcombe 2004).
<i>Macronectes giganteus</i> Southern Giant Petrel	EN/Mig./Mig. (EPBC Act; BC Act)	*	Pelagic. Breeds on six subantarctic and Antarctic islands in Australian territory (Department of the Environment and Energy 2019). They will forage within 200km of their breeding grounds (Quintana <i>et al.</i> 2009).
<i>Motacilla cinerea</i> Grey Wagtail	Mig. (EPBC & BC Acts)	*	A vagrant visitor to Australia that inhabits fast flowing streams and rivers (IUCN 2019).
<i>Motacilla flava</i> Yellow Wagtail	Mig. (EPBC & BC Acts)	*	Primary inhabits a range of damp or wet habitats with low vegetation including damp meadows, marshes, waterside pastures, and sewage farms (IUCN 2019).
<i>Numenius madagascariensis</i> Eastern Curlew	CR/Mig./CR (EPBC Act; BC Act)	8.89	The species utilizes tidal mudflats, sand spits of estuaries, mangroves, lake shores and ocean beaches (Morcombe 2004).
<i>Numenius phaeopus</i> Whimbrel	Mig. (EPBC & BC Acts)	5.49	The Whimbrel often feeds in small flocks of mixed waders on coastal mudflats, beaches and reefs (Morcombe 2004).

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Species	Status	Proximity to Study Area (km)	Habitat
<i>Onychoprion anaethetus</i> Bridled Tern	Mig. (EPBC & BC Acts)	14.14	Bridled Tern almost only occurs in Australia during the breeding season (October-February)(Johnstone & Storr 1998). It is a common breeder on the reefs and islands of the north and west Australian coasts.
<i>Pandion cristatus</i> Osprey	Mig. (EPBC & BC Acts)	8.61	Eastern Osprey is present across most of coastal Australia. Forages in shallow waters and nests on the ground or in trees, sometimes on human infrastructures (Johnstone & Storr 1998).
<i>Pezoporus occidentalis</i> Night Parrot	EN/CR (EPBC Act; BC Act)	*	Night Parrot appears to favour areas of dense vegetation comprising old-growth (often > 50 years unburnt) Spinifex ( <i>Triodia</i> spp.) especially hummocks that are ring-forming for roosting and nesting. Such areas may also be associated with dense chenopod shrubs. It is thought that Spinifex hummocks that are <40-50 cm in height are not likely to provide adequate shelter for roosting and nesting (DPaW 2017). Foraging appears to take place in habitats containing various native grasses and herbs in addition to Spinifex, and these areas may or may not contain shrubs or low trees.
<i>Plegadis falcinellus</i> Glossy Ibis	Mig. (EPBC & BC Acts)	14.45	Glossy Ibis predominantly inhabit terrestrial wetlands, foraging in shallow water over soft substrate or on grassy or muddy verges of wetlands providing a variety of water depths (Marchant & Higgins 1990). Inland, freshwater wetlands are preferred, in particular permanent or ephemeral waterbodies on floodplains and shallow swamps with abundant aquatic flora.
<i>Pluvialis fulva</i> Pacific Golden Plover	Mig. (EPBC & BC Acts)	8.87	Pacific Golden Plover is a migrant to Australia during the non-breeding season and can be found feeding singly or in flocks in open mudflats, salt marshes and rocky shores.
<i>Rostratula australis</i> Australian Painted Snipe	EN (EPBC & BC Acts)	*	The species is found inland as well as on the coast across continental Australia. West Australian records are almost exclusively from the south-west and the Kimberley. The Australian Painted Snipe feeds and breeds in shallow water surrounded with dense vegetation.

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Species	Status	Proximity to Study Area (km)	Habitat
<i>Sterna bergii</i> Crested Tern	Mig. (EPBC & BC Acts)	*	The species inhabits tropical and subtropical coastlines, foraging in the shallow waters, in mangrove swamps, and far out to sea on open water. Nesting occurs on islands, coastal spits, lagoon mudflats, and artificial islets in salt pans and sewage within 3 km of the coast (Woinarski & Burbidge 2019).
<i>Sterna dougallii</i> Roseate Tern	Mig. (EPBC & BC Acts)	8.89	Roseate Tern breeds on several Australian Islands, including in WA. Will forage within 30km of breeding grounds (BirdLife International 2000). The species is strictly coastal and does not occur inland.
<i>Sterna hirundo</i> Common Tern	Mig. (EPBC & BC Acts)	10.30	This species visits Australia only during migration. The Common Tern breeds in the northern hemisphere, below the Arctic Circle, and winters in the Antarctic waters, they consequently never stay in Australia for an extended period of time.
<i>Tringa brevipes</i> Grey-tailed Tattler	(Mig. EPBC & BC Acts; P4 DBCA list)	7.92	Grey-tailed Tattler occurs in coastal habitat, foraging in inter-tidal pools, mudflats and sand beaches. The species is a common summer migrant to northern Australia.
<i>Tringa glareola</i> Wood Sandpiper	Mig. (EPBC & BC Acts)	14.87	Wood Sandpiper is most abundant in north-west Australia, with all areas of national importance located in Western-Australia (Watkins 1993). It uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes (Department of the Environment and Energy 2019).
<i>Tringa nebularia</i> Common Greenshank	Mig. (EPBC & BC Acts)	7.92	Common Greenshank is present in summer across all Australian states, mostly on the coast but sometimes inland. It prefers coastal open mudflats.
<i>Tringa stagnatilis</i> Marsh Sandpiper	Mig. (EPBC & BC Acts)	8.61	Marsh Sandpiper occurs along the Western Australian coast and throughout parts of eastern Australia. It inhabits coastal and inland wetlands, estuarine and mangrove mudflats, beaches, swamps, lakes and several other types of wetlands (Morcombe 2004).

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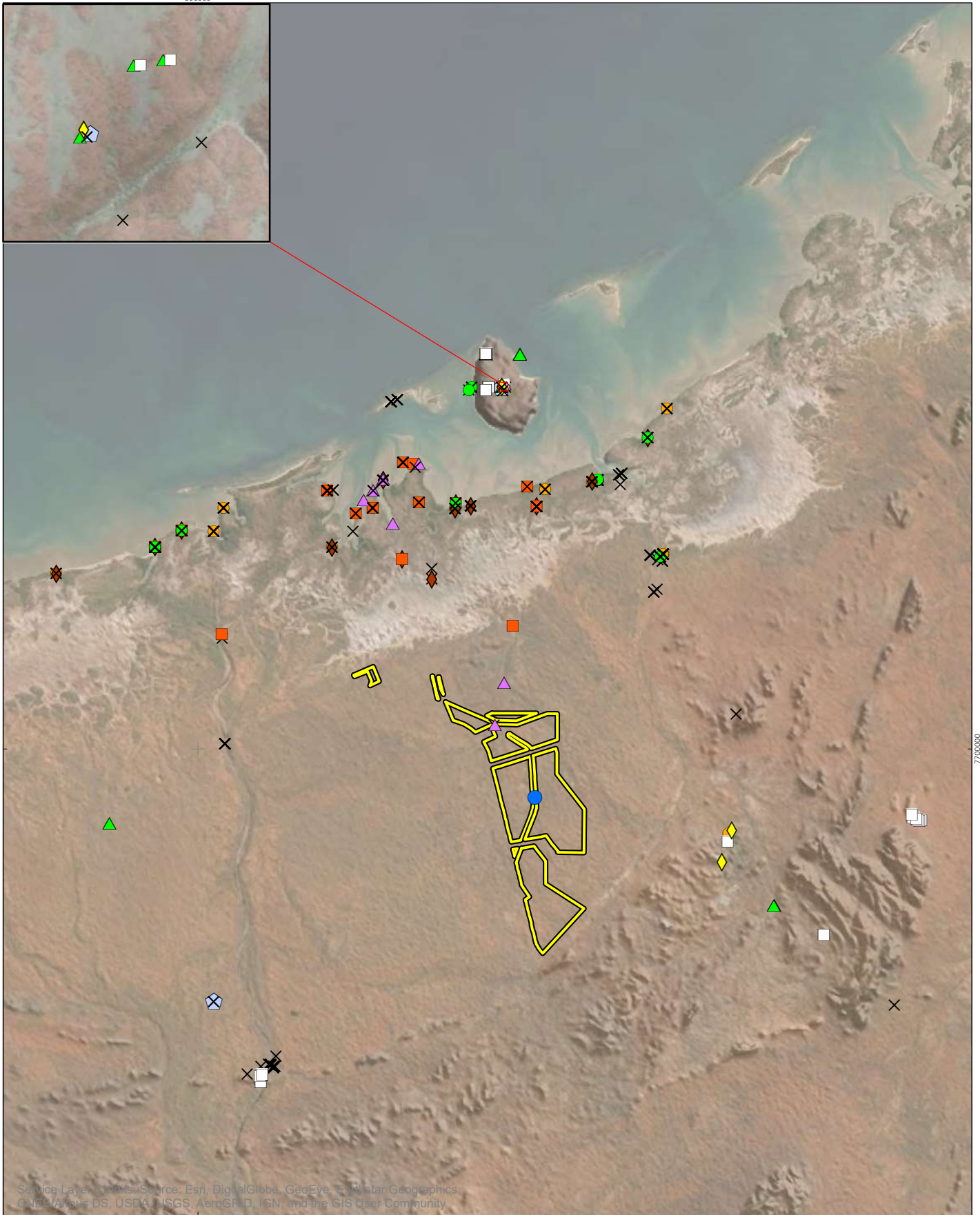
Species	Status	Proximity to Study Area (km)	Habitat
<i>Xenus cinereus</i> Terek Sandpiper	Mig. (EPBC & BC Acts)	8.30	Terek Sandpiper has a primarily coastal distribution, with occasional records inland. It inhabits coastal mudflats, sheltered estuaries and lagoons (Morcombe 2004).
<b>Mammals</b>			
<i>Dasyercus blythi</i> Brush-tailed Mulgara	P4 (DBCA list)	0.25	Brush-tailed Mulgara is most frequently found in habitats dominated by mature spinifex ( <i>Triodia</i> spp.) (Woolley 2005, 2006, 2008), digging their burrows in the flats between low sand dunes (Van Dyck & Strahan 2008). Records in WA are from the Great Victoria Desert, Goldfields, Gascoyne, Sandy Desert and Pilbara regions.
<i>Dasyurus hallucatus</i> Northern Quoll	EN (EPBC & BC Acts)	7.33	Northern Quoll uses a variety of habitats; however, rocky areas provide high prey densities and diversity, and protection from predators, fire and livestock grazing (Hill & Ward 2010). Dens are found in rock crevices, tree holes or occasionally termite mounds.
<i>Hydromys chrysogaster</i> Water-rat	P4 (DBCA list)	15.12	Water-rat is found in permanent aquatic habitats including most types of freshwater habitats, artificially irrigated sites, mangroves, and estuarine areas. Nests are in bankside tunnels or logs. Most food is taken from the water but foraging may occur in riparian vegetation (IUCN 2019).
<i>Leggadina lakedownensis</i> northern short-tailed mouse, Lakeland Downs mouse, kerakenga	P4 (DBCA list)	17.87	Northern Short-tailed Mouse occupies a variety of habitats including hummock and tussock grasslands, tropical woodlands, samphire, sedgeland and stony ranges (Moro & Kutt 2008).
<i>Macroderma gigas</i> Ghost Bat	VU (EPBC & BC Acts)	7.53	Ghost Bat prefers to roost in caves beneath bluffs of low, rounded hills composed of Marra Mamba geology, and granite rock piles in the Pilbara. It has been recorded roosting in large colonies within sandstone caves, within boulder piles and in abandoned mines (Churchill 2008). Ghost bats were thought within 2km of a roost



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Species	Status	Proximity to Study Area (km)	Habitat
			(Tidemann <i>et al.</i> 1985) however there is evidence that some individuals will fly much further than this (B. Bullen pers. comm. 14/06/2010).
<i>Macrotis lagotis</i> Bilby	VU (EPBC & BC Acts)	0.08	Bilby habitat preferences include hummock grassland in plains and alluvial areas, open tussock grassland on uplands and hills, and mulga woodland/shrubland on ridges and rises (DSEWPaC 2011a) but areas where it is now regionally extinct include many other habitat types.
<i>Ozimops cobourgianus</i> Northern Coastal Free-tailed Bat	P1 (DBCA list)	within Study Area	North-western Free-tailed Bat mostly occurs in mangrove forests and woodlands (Start <i>et al.</i> 2012), as well as near-coastal Melaleuca forests, rainforests, eucalyptus forests, woodlands, open floodplains and saline coastal flats (Milne 2008).
<i>Petrogale lateralis</i> Black-flanked Rock-wallaby	EN (EPBC & BC Acts)	14.82	Black-flanked Rock-wallaby is mostly found in rocky country, gorges and granite outcrops. They feed at night and shelter in caves and under bushes during the day.
<i>Pseudomys chapmani</i> Western Pebble-mound Mouse	P4 (DBCA list)	9.68	The Western Pebble-mound Mouse is widespread in the ranges of the central and southern Pilbara and extends into the Little Sandy Desert Ranges (Van Dyck & Strahan 2008). This species constructs large mounds from small pebbles. It is found on gentle slopes of rocky ranges covered in rocky mulch, hard spinifex and sparse trees and shrubs ( <i>Eucalyptus</i> , <i>Senna</i> , <i>Acacia</i> and <i>Ptilotus</i> ). It is often found near Acacia-dominated drainage lines (Van Dyck & Strahan 2008).
<i>Rhinonictis aurantia</i> Orange Leaf-nosed Bat	(VU EPBC Act; P4 DBCA list)	*	Orange Leaf-nosed Bat roosts in caves and mines with stable, warm and humid microclimates but will spread to other areas when wetter conditions provide the opportunity for shallower caves to provide humid microclimates (Armstrong 2001).

\* EPBC Protected Matters Search does not return species record locations and may include instances where suitable habitat may occur but the species has not necessarily been observed.



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Project No	1283-1284
Date	19-Feb-20
Drawn by	AJ
Map author	JC

0 5 10  
 Kilometres

1:250,000 (at A4) GDA 1994 MGA Zone 50

- Study Area
- Conservation status (DBCAs)**
- Critically Endangered
- Critically Endangered & Migratory
- Endangered
- Endangered & Migratory
- Vulnerable
- Vulnerable & migratory
- Migratory
- Other specially protected
- Priority 1
- Priority 2
- Priority 4
- Macrotis lagotis*, Bilby (VU), old burrow (Phoenix 2018)

**Figure 5-3**  
 Desktop records of significant vertebrate fauna



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## 5.2 FIELD SURVEY

### 5.2.1 Flora and vegetation

#### 5.2.1.1 Flora assemblage

A total of 118 flora taxa representing 31 families and 70 genera identified to species level were recorded in the Study Area during the field surveys (Appendix 7). Species richness ranged from 4-28 species between sites (relevés and quadrats) (Appendix 2). The assemblage included 114 native species and 4 introduced species, including 78 perennial species, and 36 annual or short-lived species. The most prominent families recorded were Fabaceae (32 spp.), Poaceae (14 spp.), Malvaceae (10 spp.) and Chenopodiaceae (10 spp.).

The species accumulation curve shows that 76.5% of the theoretical number of species present in the Study Area were recorded. Considering the dryness of the season prior to the survey dates and the level of survey being Reconnaissance rather than Detailed this is a reasonable result.

Mattiske (2006) recorded 174 species from 41 families in their June 2006 survey. The most prolific families recorded were Fabaceae (Papilionaceae and Mimosaceae at the time) with 34 species, Poaceae (23) and Amaranthaceae (14). These results are not directly comparable with the current survey because of the timing following a wetter period, however the Mattiske study area was largely in the coastal regions adjacent to the current Phoenix survey so are relevant.

Ecoscope (2014) recorded 474 taxa from 63 families and 189 genera, with the most prolific families Fabaceae (106), Poaceae (68), Malvaceae (57) and Amaranthaceae (23) species. The higher total is no doubt because of the long linear study area, commenced in the coastal region, moving inland to the Hamersley Range, thus intersecting a greater number of vegetation types.

Phoenix (2018) recorded 221 species from 36 families and 97 genera, the most prominent families being Fabaceae (50), Poaceae (37), Malvaceae (23) and Amaranthaceae (18). The study area for this survey followed part of the Ecoscope (2014) corridor, defining the final potential disturbance area.

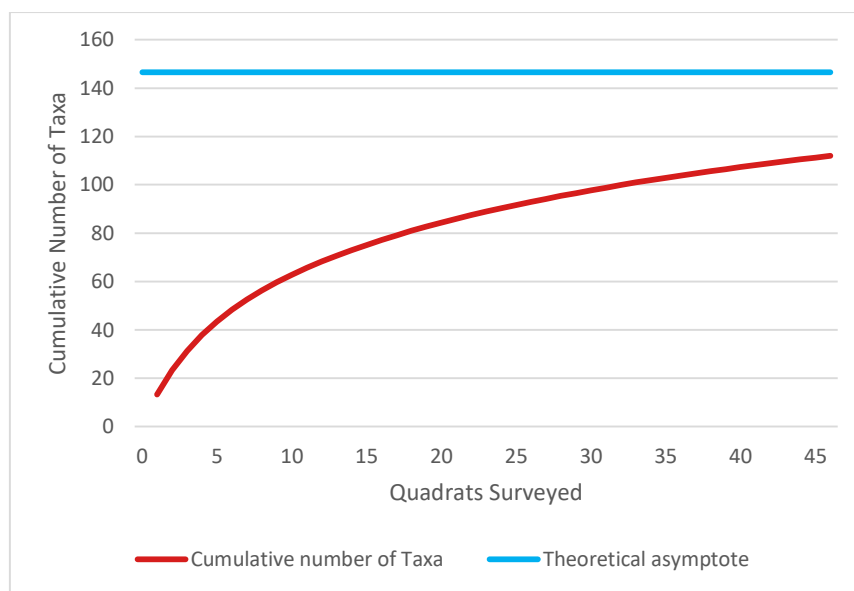


Figure 5-4 Species accumulation curve

### 5.2.1.2 Significant flora

No Threatened flora and two Priority flora species were recorded during the field survey; *Heliotropium muticum* (P3) and *Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479) (P3) (Table 5-7; Figure 5-5).

*Heliotropium muticum* (P3) has been recorded previously in the Balla Balla area (Ecoscape 2014; Phoenix 2018). During the current survey it was recorded at seven locations, which occur in four vegetation types in the Study Area: AsTw, AsTe(Tw), AbTw, Ex – one of which (Ex) is the Horseflat Land System PEC.



*Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479) has not been previously recorded in the near-coastal area around Balla Balla, although Ecoscape (2014) recorded the species inland in different habitat during their 2014 work. Fourteen records of this species were made in eight vegetation units; Ex, AsTw, AsppTe(Tw), EvAsTe, EvAtTe, AsTe, AsppTe, AiTe, representing *Acacia* shrublands/*Triodia* grasslands, drainages and the Horseflat Land System PEC.

The records of *Polygala isingii* represent a significant range extension of 180 km north-west of its current known range (Figure 5-5) and therefore these records are considered significant for the species (refer to section 2.2.4). Specimens of *P. isingii* were recorded in two vegetation units, AsTw and AsppTe, representing *Acacia* shrublands/*Triodia* grasslands. A specimen of *Polygala* was recorded by Phoenix (2018) but could not be identified to species and was reported in the species list as *Polygala ?isingii*. While FloraBase (DBCA 2020) holds 35 records of this species, it occurs widely across Western Australia, the Northern Territory and Queensland (CHAH 2020).

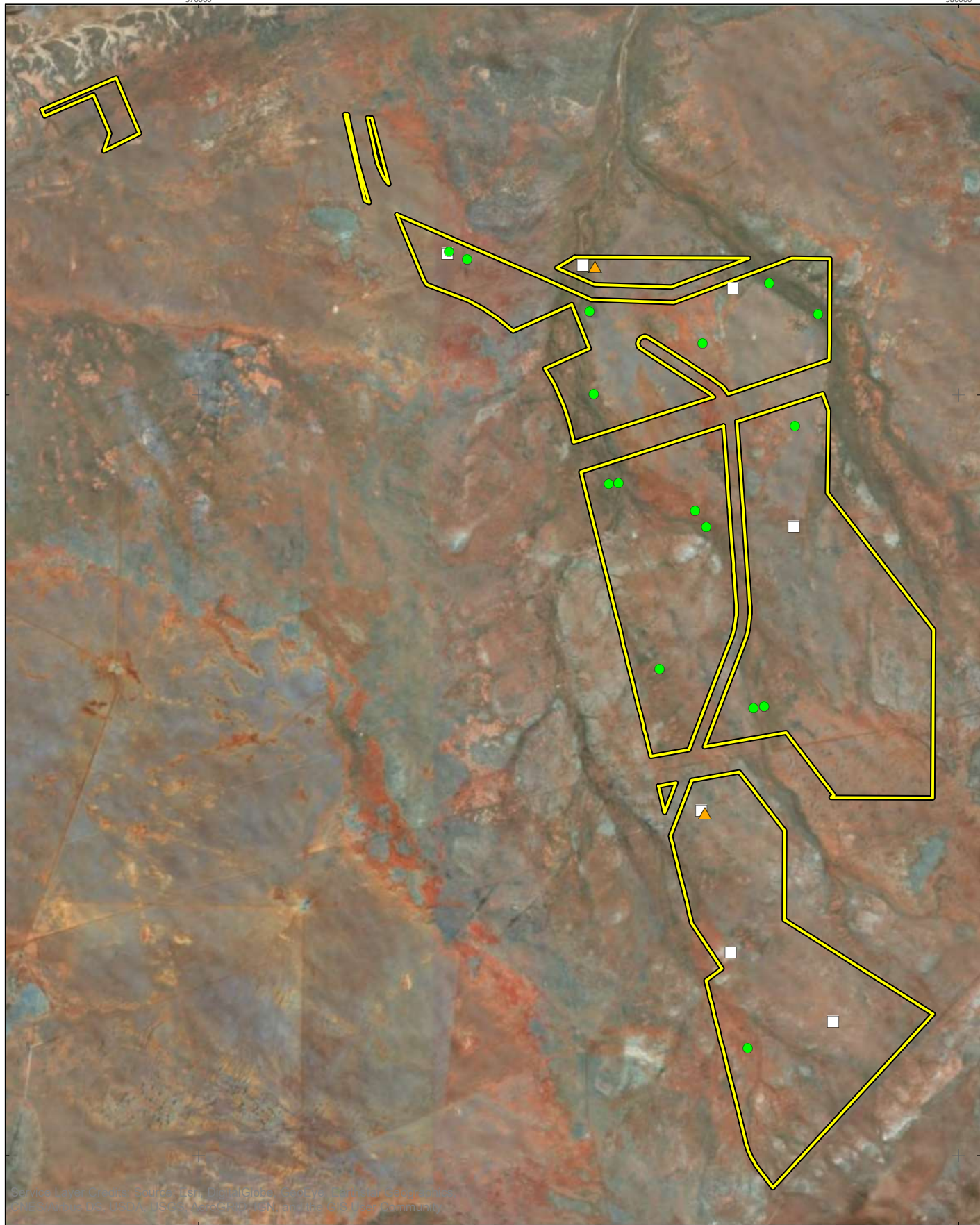
A specimen of all significant flora will be lodged with the WA Herbarium and a Threatened and Priority flora report form for each submitted to DBCA.



**Table 5-7 Details of significant flora recorded during the field survey**

<b>Species: <i>Heliotropium muticum</i></b>	
<b>Status:</b> P3 (DBCA)	
<b>Distribution and ecology:</b> Occurs in the Pilbara bioregion (DBCA 2020). FloraBase has 72 records of this species, with populations ranging from 1 plant to 100+. Grows on plains and gentle inclines in open shrublands and grasslands.	
<b>Survey records:</b> Seven populations recorded during survey, in Acacia /Triodia and Horseflat PEC units: BB07r, BB23, BB36r, BB38r, BB41r, BB45r.	
<b>Vegetation units:</b> AsTw, AaTe(Tw), AbTw, Ex	
<b>Species: <i>Oldenlandia</i> sp. Hamersley Station (AA Mitchell PRP 1479)</b>	
<b>Status:</b> P3 (DBCA)	
<b>Distribution and ecology:</b> Occurs in the Pilbara bioregion. FloraBase has 33 records of this species, populations ranging from 'infrequent to 'common' without numbers given (DBCA 2020). Grows on plains, pediments, grasslands and shrublands.	
<b>Survey records:</b> Fourteen records during survey, growing in shrublands, open woodlands and Horseflat PEC units: BB06r, BB08r, BB11r, BB16r, BB18, BB21r, BB26r, BB27, BB28r, BB29r, BB35r, BB39r, BB40r, BB42r	
<b>Vegetation units:</b> Ex, AsTw, AsppTe(Tw), EvAsTe, EvAtTe, AsTe, AsppTe, AiTe	
<b>Species: <i>Polygala isingii</i></b>	
<b>Status:</b> Not threatened	<b>No photo available</b>
<b>Distribution and ecology:</b> Occurs widely in the Eremaean botanical zone, FloraBase has 35 records with frequency from 'occasional' to 'locally common'. Grows on sandplains in shrublands and hummock grasslands.	
<b>Survey records:</b> Recorded twice in current survey, growing in Acacia shrublands over hummock grasslands: BB36r, BB44r	
<b>Vegetation units:</b> AsTw, AsppTe	

The likelihood of occurrence assessment (section 4.2.2.2) for the remaining significant species identified in the desktop review (section 5.1.1.2) determined three were likely to occur in the Study Area, two may possibly occur and three are unlikely to occur (Table 5-8).



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Drawn by	AJ
Map author	MH

0 1 2  
Kilometres

1:65,000 (at A4) GDA 1994 MGA Zone 50



Study Area

**Significant species**

- Heliotropium muticum* , P3
- Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479), P3
- Polygala isingii*, Range extension

**Figure 5-5**

**Significant flora records in the Study Area**



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**Table 5-8 Likelihood of occurrence for significant flora identified in the desktop review**

Species	Status	Likelihood of occurrence	Vegetation types for likely, possible species
<i>Abutilon</i> sp. Pritzelianum (S. van Leeuwen 5095)	P1 (DBCA)	Likely, habitat similar and closest record 31 km from Study Area.	Acacia shrublands over Triodia hummock grasslands.
<i>Acacia glaucocaesia</i>	P3 (DBCA)	Likely, habitat similar and closes record 34 km from study area.	Mixed shrublands over hummock grasslands.
<i>Eragrostis crateriformis</i>	P3 (DBCA)	Possible, habitat may exist but closest record 41 km from study area.	Open woodlands and shrublands over hummock grasslands.
<i>Gomphrena cucullata</i>	P3 (DBCA)	Possible, habitat similar but closest record over 40 km from study area.	Low shrublands over hummock grassland.
<i>Goodenia nuda</i>	P4 (DBCA)	Likely, closest record just outside Study Area and habitat exists inside Study Area.	Tussock grasslands.
<i>Solanum cataphractum</i>	P3 (DBCA)	Unlikely. FloraBase records this species as a Kimberley endemic.	
<i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114)	P1 (DBCA)	Unlikely. While this species has been recorded relatively close to the Current Survey Area, it is endemic to coastal sands and habitat does not exist in the study area.	
<i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)	P3 (DBCA)	Unlikely. Habitat does not occur in Study Area.	

### 5.2.1.3 Introduced flora

Four introduced flora species were recorded during the survey, none of which are a WoNS/Declared Pest (Table 5-9).

**Table 5-9 Introduced flora recorded in the field survey**

Family	Species	Declared Pest	WoNS
Poaceae	* <i>Cenchrus ciliaris</i>	No	No
Malvaceae	* <i>Malvastrum americanum</i>	No	No
Aizoaceae	* <i>Trianthema portulacastrum</i>	No	No
Fabaceae	* <i>Vachellia farnesiana</i>	No	No

### 5.2.1.4 Unidentified flora

Four specimens collected during the survey could not be identified to species level (Table 5-10), as a result of insufficient taxonomic characters due to material being sterile (lacking reproductive structures), being too desiccated, or juvenile for determination with confidence. It is considered unlikely that any of these specimens represents a significant species as there are no known conservation significant species from these genera known from the vicinity of the Study Area.

**Table 5-10 Unidentified taxa recorded during the field survey**

Taxon	Comments
<i>Cullen</i> sp.	Sterile, damaged sample
<i>Euphorbia</i> ? <i>biconvexa</i>	Sterile, desiccated
<i>Eragrostis</i> sp. kinked grass	Sterile, desiccated
<i>Indigofera</i> sp.	Sterile, juvenile specimen

### 5.2.1.5 Vegetation types

Thirteen vegetation types were defined for the Study Area based on the cluster analysis (

Figure 5-6). They comprised *Acacia* shrublands over *Triodia* hummock grasslands on plains, low hills and outcrops, and drainages. (Table 5-11; Figure 5-7). Three defined drainage types are present, with broad drainages/plains surrounding them. Drainages are characterised by the presence of *Eucalyptus* and *Corymbia* species. The plains and drainage plains are characterised by *Acacia* shrublands/*Triodia* hummock grasslands except for the gilgaied plains of the Horseflat Land System of the Roebourne Plains which are open grasslands dominated by *Eragrostis xerophila* with *Acacia* spp. sometimes present. The Horseflat Land System is also represented in a mosaic unit incorporating *Acacia*/*Triodia* vegetation.

Within the Study Area, the drainages represent restricted vegetation types due to their low area and percentage representation (24%), although this is a feature of their landscape function and not of any uniqueness of the vegetation assemblage. Matiske (2006) defines a number of shallow drainage units

and drainage zones with similar vegetation in their survey to the north and east of the Study Area, so the vegetation types are repeated and common regionally even if restricted in the current survey.

Plains make up the dominant landform of the Study Area and the vegetation is largely characterised by *Acacia* shrublands over *Triodia* hummock grasslands. This vegetation type occupies 70.12% of the study area and is by far the dominant type present. One subset of the plains vegetation type (Ex)–, however, does not contain hummock grasslands to any great degree but is instead characterised by tussock grasses, particularly *Eragrostis xerophila*. This vegetation type is considered to be the Horseflat Land System of the Roebourne Plains.

The Horseflat Land System of the Roebourne Plains has historically suffered from degradation in the Balla Balla area (Payne & Tille 1992) but the areas visited in the Study Area appeared to be in Excellent condition. The Horseflat Land System is classified as a Priority 3 PEC and it is calculated that 27.34% (856.9 ha) of the Study Area fall into this vegetation type based on the description provided (Table 5-4).

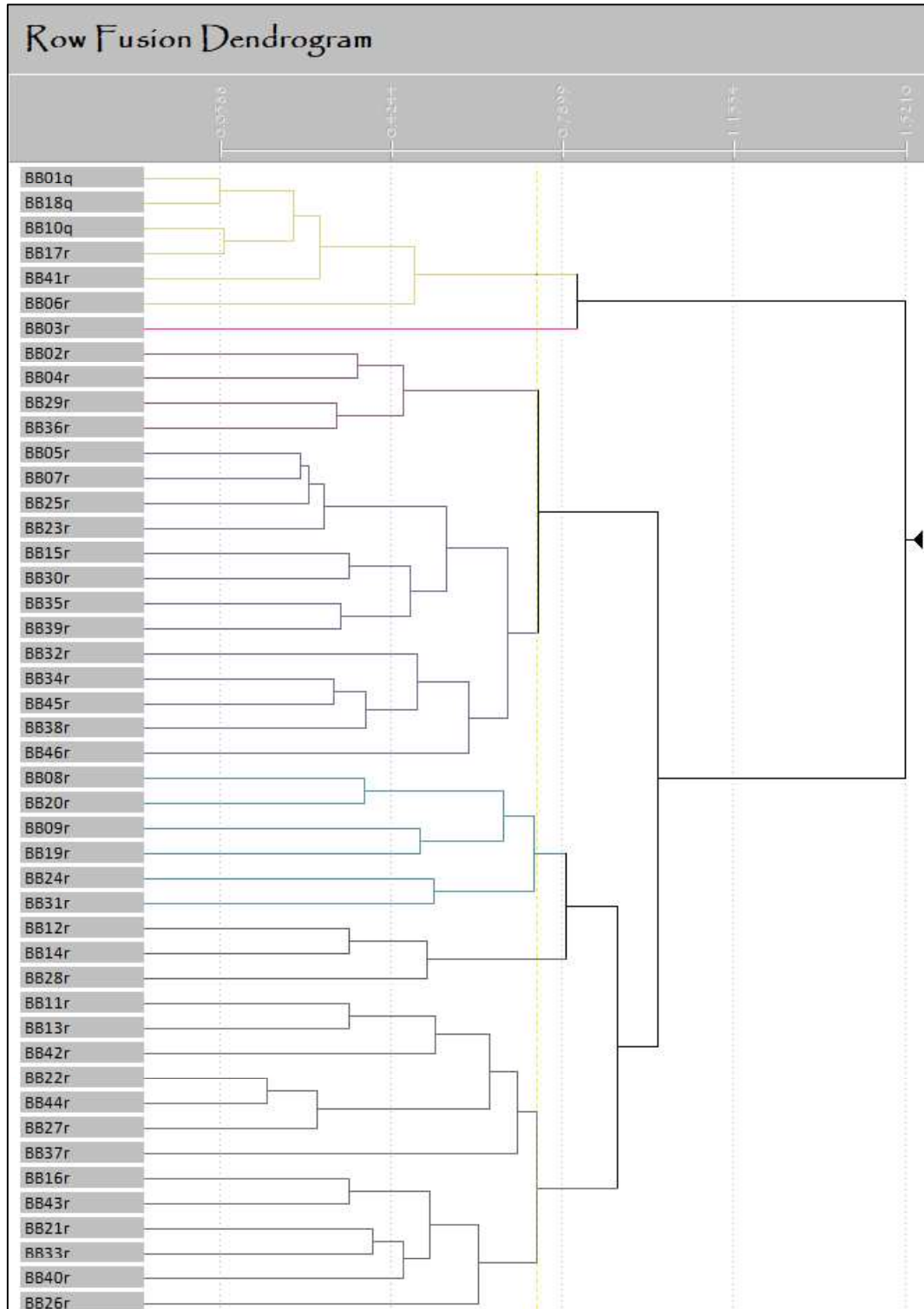






Figure 5-6). They comprised *Acacia* shrublands over *Triodia* hummock grasslands on plains, low hills and outcrops, and drainages. (Table 5-11; Figure 5-7). Three defined drainage types are present, with broad drainages/plains surrounding them. Drainages are characterised by the presence of *Eucalyptus* and *Corymbia* species. The plains and drainage plains are characterised by *Acacia* shrublands/*Triodia*



Table 5-11 Vegetation types, description and extent in the Study Area

Vegetation type	Site/s	Vegetation description	Extent in Study Area (ha) and % of Study Area	Representative photograph
Ex	BB01q BB06r BB10q BB17r BB18q BB41r	Isolated plants of <i>Rhynchosia minima</i> and <i>Streptoglossa bubakii</i> over a low tussock grassland of <i>Eragrostis xerophila</i> and variably present <i>Dichanthium sericeum</i> subsp. <i>humilius</i> .	836.9 ha, 26.7%	
AsSIEx	BB03r	Mid open shrubland to shrubland of <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> and <i>Carissa lanceolata</i> over low isolated shrubs of <i>Solanum lasiophyllum</i> , <i>Ptilotus obovatus</i> , and <i>Cleome viscosa</i> over low isolated tussock grassland of <i>Eragrostis xerophila</i> and <i>Chrysopogon fallax</i> .	10.7 ha, 0.3%	

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Vegetation type	Site/s	Vegetation description	Extent in Study Area (ha) and % of Study Area	Representative photograph
AsTw	BB02r BB04r BB29r BB36r	Mid to tall open shrubland to shrubland of <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> , <i>Acacia stellaticeps</i> and occasionally <i>Acacia arida</i> over a hummock grassland to closed hummock grassland of <i>Triodia wiseana</i> and <i>Triodia epactia</i> .	216 ha, 6.9%	
AaTe(Tw)	BB05r BB07r BB23r BB25r	Low to mid open shrubland of <i>Acacia ancistrocarpa</i> , <i>Acacia inaequilatera</i> and occasionally <i>Acacia bivenosa</i> over a hummock grassland of <i>Triodia epactia</i> and <i>Triodia wiseana</i> .	342.8 ha, 10.9%	

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Vegetation type	Site/s	Vegetation description	Extent in Study Area (ha) and % of Study Area	Representative photograph
AsppTe(Tw)	BB15r BB30r BB35r BB39r	Variably present isolated trees of <i>Corymbia hamersleyana</i> , over variably present isolated shrubs of <i>Acacia pyrifolia</i> , <i>Acacia arida</i> and <i>Acacia bivenosa</i> over hummock grassland of <i>Triodia epactia</i> and <i>Triodia wiseana</i> .	247.7 ha, 7.9%	
AbTw	BB32r BB34r BB38r BB45r BB46r	Low to mid sparse shrubland of <i>Acacia bivenosa</i> , <i>Acacia pyrifolia</i> and <i>Acacia ancistrocarpa</i> over an open hummock grassland to hummock grassland of <i>Triodia wiseana</i> (with minor presence of <i>Triodia epactia</i> ).	757.1 ha, 24.2%	





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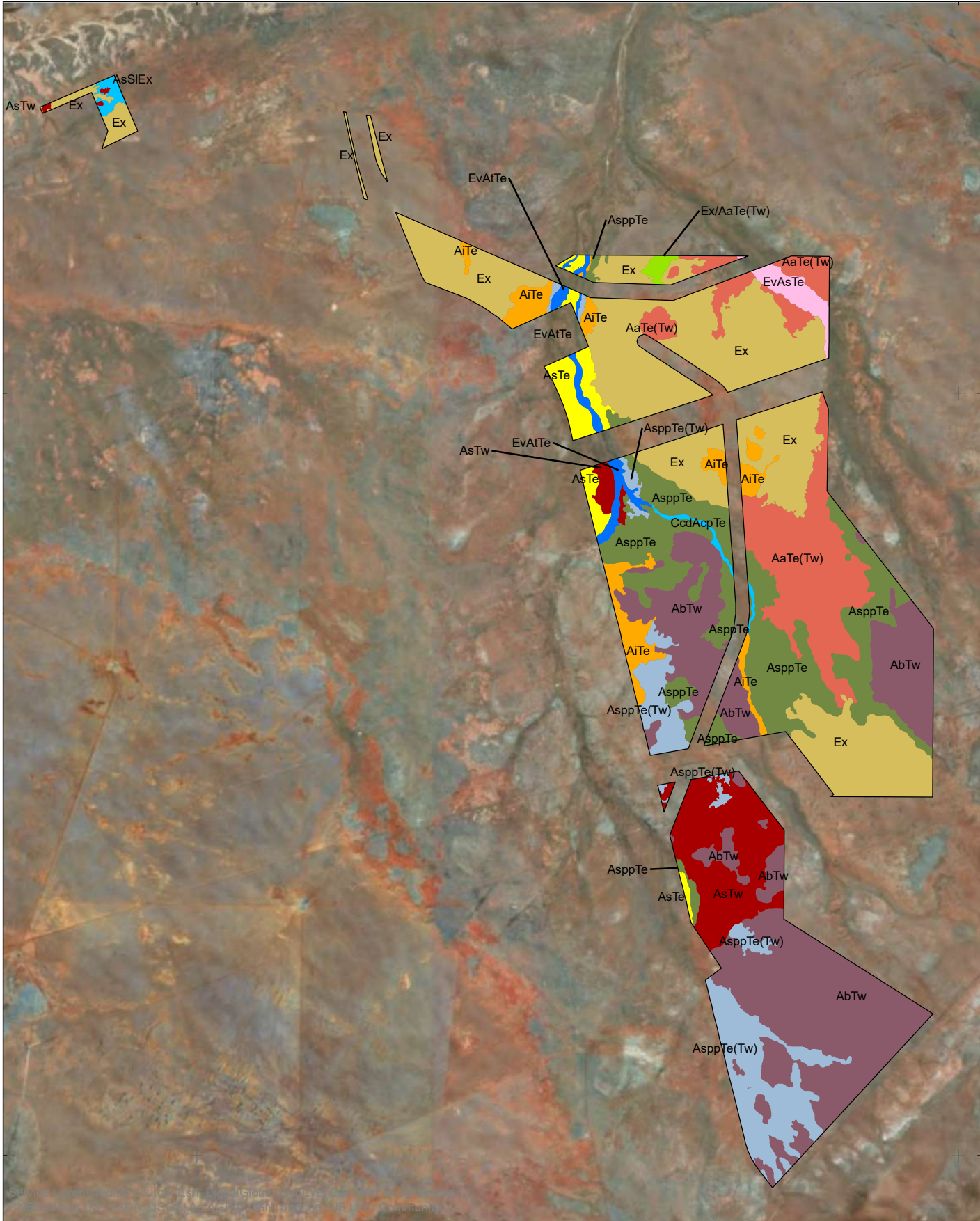
Vegetation type	Site/s	Vegetation description	Extent in Study Area (ha) and % of Study Area	Representative photograph
EvAsTe	BB08r BB09r BB19r BB20r	Broad drainage or drainage plains with variably present mid open woodland of <i>Eucalyptus victrix</i> and <i>Corymbia hamersleyana</i> , over mid open shrubland of <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> , <i>Acacia coriacea</i> subsp. <i>pendens</i> and <i>Acacia pyrifolia</i> over sparse hummock grassland of <i>Triodia epactia</i> .	33.3 ha, 1.1%	
CcdAcpTe	BB24r BB31r	Drainage of low sparse to open woodland of <i>Corymbia candida</i> subsp. <i>dipsodes</i> over mid sparse shrubland of <i>Acacia coriacea</i> subsp. <i>pendens</i> , <i>Acacia bivenosa</i> and occasionally <i>Acacia trachycarpa</i> over sparse hummock grassland of <i>Triodia epactia</i> with <i>Cenchrus ciliaris</i> .	9.9 ha, 0.3%	

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Vegetation type	Site/s	Vegetation description	Extent in Study Area (ha) and % of Study Area	Representative photograph
EvAtTe	BB12r BB14r BB28r	Drainage lines of mid woodland of <i>Eucalyptus victrix</i> and <i>Corymbia hamersleyana</i> over tall sparse shrubland to shrubland of <i>Acacia trachycarpa</i> over mid isolated shrubs of <i>Carissa lanceolata</i> , <i>Cajanus cinereus</i> and <i>Acacia pyrifolia</i> over sparse hummock grassland of <i>Triodia epactia</i> .	36.3 ha, 1.2%	
AsTe	BB11r BB13r BB42r	Mid open shrubland to shrubland of <i>Acacia stellaticeps</i> and <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> over hummock grassland of <i>Triodia epactia</i> .	73.9 ha, 2.4%	

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Vegetation type	Site/s	Vegetation description	Extent in Study Area (ha) and % of Study Area	Representative photograph
AsppTe	BB22r BB27r BB37r BB44r	Isolated shrubs of mixed <i>Acacia</i> spp. (often <i>Acacia synchronicia</i> and <i>Acacia pyrifolia</i> ), over a hummock grassland of <i>Triodia epactia</i> .	444.6 ha, 14.2%	
AiTe	BB16r BB21r BB26r BB33r BB40r BB43r	Mid sparse shrubland of <i>Acacia inaequilatera</i> with occasional stands of <i>Acacia sclerophylla</i> , over isolated shrubs of <i>Carissa lanceolata</i> , <i>Corchorus walcottii</i> , and <i>Solanum lasiophyllum</i> , over a hummock grassland of <i>Triodia epactia</i> .	114.9 ha, 3.7%	
Ex/AaTe(Tw)		Mosaic of Ex and AaTe(Tw) vegetation units	9.3 ha, 0.3%	



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 Project No 1283-1284  
 Date 18-Feb-20  
 Drawn by AJ  
 Map author JMH

0 1 2  
 Kilometres

1:65,000 (at A4) GDA 1994 MGA Zone 50

Study Area	AsSIEx	CcdAcpTe
<b>Vegetation type</b>	AsTe	EvAsTe
AaTe(Tw)	AsTw	EvAtTe
AbTw	AspTe	Ex
AiTe	AspTe(Tw)	Ex/AaTe(Tw)

**Figure 5-7**  
**Vegetation types in the Study Area**



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### 5.2.1.6 Vegetation condition

Remnant vegetation in the Study Area was recorded to be in Very Good to Excellent condition (Figure 5-8) with the majority (97.9%) in Excellent condition and 2.1% in Very Good condition (Table 5-12). This assessment of the condition aligns with that reported in documents reviewed as part of the Desktop review, with both reports that included vegetation condition having over 90% of the vegetation surveyed as Excellent condition. The major disturbances affecting the vegetation have been grazing and weed invasion.

**Table 5-12 Vegetation condition – extent of each condition rating in Study Area**

Condition rating	Area (ha)	% of Study Area
Excellent	3066.0	97.9
Very Good	67.3	2.1
Good	0	0
Poor	0	0
Degraded	0	0
Completely Degraded	0	0
Cleared	0	0





### 5.2.1.7 Significant vegetation

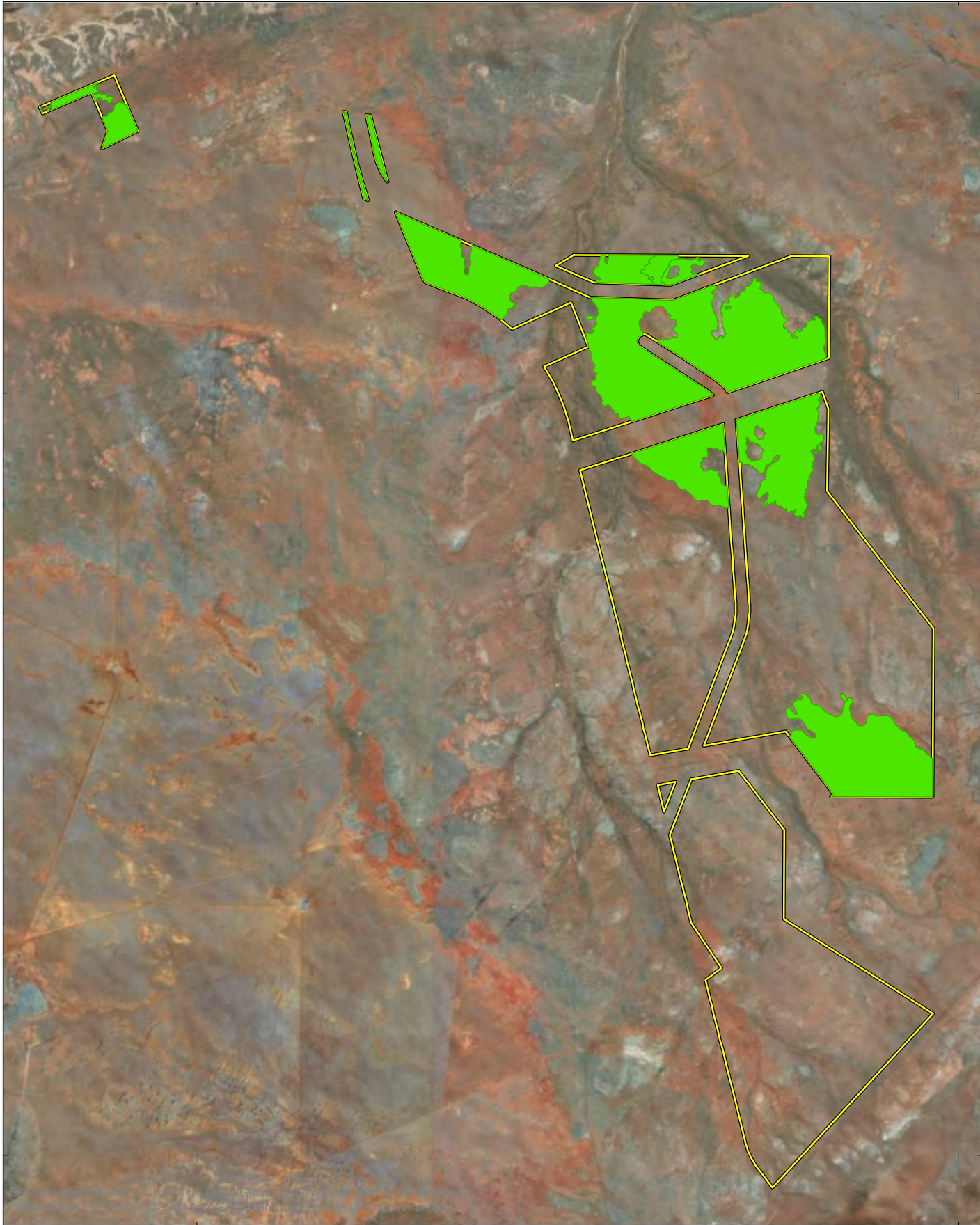
Desktop database searches showed the Horseflat land system of the Roebourne Plains PEC and its buffer zones occurring over the majority of the study area. This field survey identified 847.9 ha of vegetation attributable to the Horseflat Land System PEC, or 27.2% of the total area. The vegetation types Ex, AsSIEx and Ex/AaTe(Tw) define the PEC on the vegetation map (Figure 5-9). The Gregory System and Stony Chenopod Association of the Roebourne Plains area PECs were not found to occur within the Study Area.

In total, 11 vegetation types were considered to have local or regional significance due to their role as habitat for conservation significant flora or as Priority Ecological Community (Table 5-13).

A Threatened and Priority ecological community report form will be submitted to DBCA.

**Table 5-13 Significant vegetation types in the Study Area**

Vegetation type	Significance	Area (ha) and % of Study Area	Level of significance
Ex, AsSIEx, Ex/AaTe(Tw)	Represents the Horseflat PEC either in the entirety of its description or as a mosaic with shrub communities. The PEC is habitat for the significant species <i>Heliotropium muticum</i> and <i>Oldenlandia</i> sp. Hamersley Station (AA Mitchell PRP 1479)	847.9 ha (27.2%)	Regionally significant
AsTw	Provides habitat for significant species <i>Heliotropium muticum</i> , <i>Polygala isingii</i> , <i>Oldenlandia</i> sp. Hamersley Station (AA Mitchell PRP 1479)	216 ha (6.9%)	Regionally significant
AaTe(Tw)	Provides habitat for the significant species <i>Heliotropium muticum</i>	342.8 ha (10.9%)	Regionally significant
AbTw	Provides habitat for the significant species <i>Heliotropium muticum</i>	757.1 ha (24.2%)	Regionally significant
AsppTe(Tw)	Provides habitat for the significant species <i>Oldenlandia</i> sp. Hamersley Station (AA Mitchell PRP 1479)	247.7 ha (7.9%)	Regionally significant
EvAsTe	Provides habitat for the significant species <i>Acacia tumida</i> var. <i>tumida</i> and <i>Oldenlandia</i> sp. Hamersley Station (AA Mitchell PRP 1479)	33.3 ha (1.1%)	Locally significant
EvAtTe	Provides habitat for the significant species <i>Oldenlandia</i> sp. Hamersley Station (AA Mitchell PRP 1479)	36.3 ha (1.2%)	Locally significant
AsTe	Provides habitat for the significant species <i>Oldenlandia</i> sp. Hamersley Station (AA Mitchell PRP 1479)	73.9 ha (2.4%)	Locally significant
AsppTe	Provides habitat for the significant species <i>Oldenlandia</i> sp. Hamersley Station (AA Mitchell PRP 1479), <i>Acacia tumida</i> var. <i>tumida</i> and <i>Polygala isingii</i>	444.6 ha (14.2%)	Regionally significant
AiTe	Provides habitat for the significant species <i>Oldenlandia</i> sp. Hamersley Station (AA Mitchell PRP 1479)	114.9 ha (3.7%)	Locally significant
CcdAcpTe	This drainage unit provides habitat for <i>Corymbia candida</i> subsp. <i>dipsodes</i> , considered significant because of the range extension	9.9 ha (0.3%)	Regionally significant



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 Balla Balla Infrastructure - Rail and Conveyor Project

Project No	1283-1284
Date	18-Feb-20
Drawn by	AJ
Map author	MH

0 1 2  
Kilometres

1:65,000 (at A4) GDA 1994 MGA Zone 50

Study Area

PEC

Horseflat land system of the Roebourne Plains, P3

**Figure 5-9**  
**PECs recorded in the Study Area**



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## 5.2.2 Terrestrial fauna



### 5.2.2.1 Vertebrate fauna

#### 5.2.2.1.1 Habitats

Five broad fauna habitat types were identified in the Study Area, comprising tussock grasslands, spinifex hummock grasslands, shrublands over spinifex hummocks, drainages, and rocky hills and outcrops (Table 5-14; Figure 5-10). Habitat categories included in this report differ slightly from previous fauna habitat mapping (Phoenix 2014, 2018). Previous fauna habitat mapping combined tussock grassland and spinifex hummock grassland into one unit "tussock and hummock grassland" (Table 5-15). This is not preferred as they are different habitats, one of which is the vegetation Horseflat PEC. There are also differences in boundaries between current and previous fauna mapping due to the broader scale involved in the scope of previous projects.



Sparse grassy shrublands (shrublands over spinifex hummocks) and grasslands (tussock grasslands and spinifex hummock grasslands) comprised the majority of the Study Area (47.25%, 27.0% and 21.9% of land area respectively). Drainages made up only a small proportion of the Study Area (3.1%). They ran in a predominantly south to north direction across the Study Area, with two larger drainages running through the northeast and northwest corners of the Study Area. About 24.3 ha of low rocky hills occurred near the centre of the Study Area. Two small rock outcrops of <0.2 ha occurred in the southern portion of the Study Area. Together these rocky hills and outcrops covered only 0.8% of the Study Area and were isolated from one another by a minimum of 1.7 km.

**Table 5-14 Extent and description of each fauna habitat in the Study Area**


Habitat type	Site/s	Description	Extent in Study Area and % of Study Area	Representative photograph
shrubland over spinifex hummock grassland (SSHG)	CAM007, NP01, NP02, NP02	Scattered patches of shrubland are found throughout the Study Area. Shrublands are not specifically required by any likely or recorded conservation significant species but may be used for foraging by habitat generalists including Bilby, Northern Quoll and bat species. Sparser areas have similar habitat values to spinifex hummock grasslands.	1,480.6 ha, 47.3%	
tussock grasslands (TG)	None	Tussock grasslands occur mostly in the north and southeast of the Study Area. This habitat is typically heavily grazed and degraded and is therefore not likely to support the majority of the significant fauna species potentially present, with the exception of the Northern Short-tailed Mouse.	846.2 ha, 27.0%	



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Habitat type	Site/s	Description	Extent in Study Area and % of Study Area	Representative photograph
spinifex hummock grasslands (SHG)	CAM008, F02	Spinifex hummock grasslands are widespread throughout the Study Area. This habitat type is used by Bilby and is the primary habitat where Brush-tailed Mulgara is likely to be found. Long-unburnt ring-forming spinifex >40-50 cm in height is used by Night Parrots for roosting and nesting (DPaW 2017) but no spinifex of this age, size and growth form was observed within the Study Area. Northern Quoll may forage in spinifex hummock grasslands but suitable den sites are absent.	685.5 ha, 21.9%	
drainage (D)	CAM001, CAM002, CAM006, F03	Two large drainages pass through the northeast and northwest portions of the Study Area. Smaller drainages flow through central and western areas. Larger drainages support eucalypts large enough to contain hollows potentially used by conservation significant fauna including Northern Quoll and North-Western Free-Tailed Bat. Large drainages may also facilitate movement across the landscape by Northern Quolls due to the presence of linear escape cover. Higher productivity resulting from greater availability of water increases the value of drainages for foraging in habitat generalist species.	96.7 ha, 3.1%	

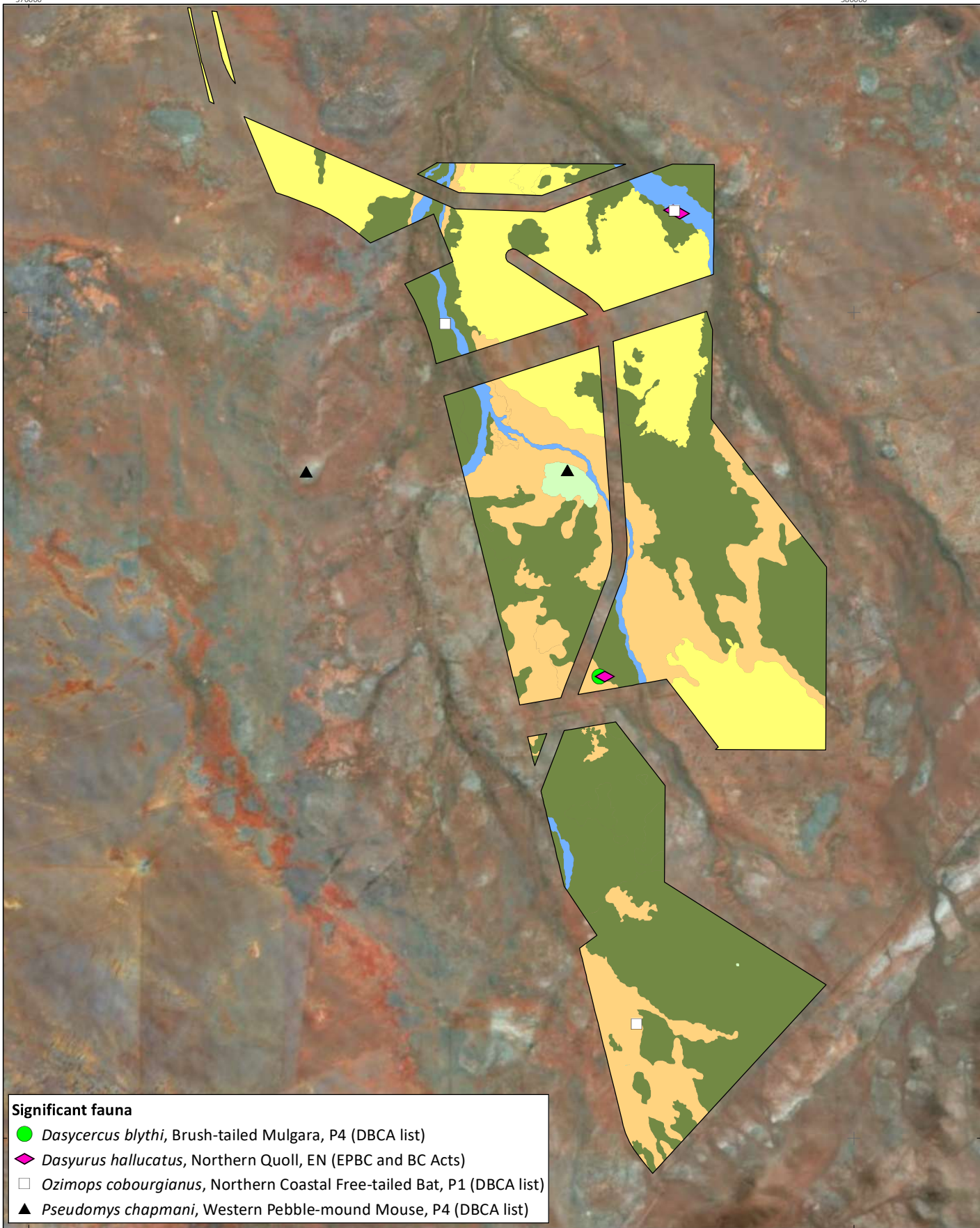
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Habitat type	Site/s	Description	Extent in Study Area and % of Study Area	Representative photograph
rocky hills and outcrops (RO)	CAM004, CAM005, F01	A series of low rocky hills occurs near the centre of the Study Area. Lower slopes provide habitat for Western Pebble-mound Mouse. Additional small rocky outcrops are found in a few scattered locations throughout the Study Area. Rocky outcrops in the Pilbara region are preferred habitat for Northern Quoll and Pilbara Olive Python but all rocky outcrops within the Study Area are small, isolated, and do not contain large caves or crevices. Northern Quoll and Pilbara Olive Python were targeted in this habitat using camera traps and opportunistic searches.	24.4 ha, 0.8%	



**Table 5-15** Equivalent fauna habitat categories in this report and two previous reports adjacent to the Study Area (Phoenix 2014, 2018)

Phoenix 2020	Phoenix 2018	Phoenix 2014	Comment
Drainage	Minor creek and drainage line	Minor creeks and drainage lines	
Tussock grassland	Hummock and tussock grassland	Tussock and hummock grassland	Horseflat PEC
Spinifex hummock grassland	Hummock and tussock grassland	Tussock and hummock grassland	Not Horseflat PEC
Shrubland over spinifex hummock grassland	Open and closed shrubland	Open shrubland	
Rocky hills or outcrops	Rocky hill slope	Rocky outcrops and boulder piles	



**Significant fauna**

- *Dasyercus blythi*, Brush-tailed Mulgara, P4 (DBC list)
- ◆ *Dasyurus hallucatus*, Northern Quoll, EN (EPBC and BC Acts)
- *Ozimops cobourgianus*, Northern Coastal Free-tailed Bat, P1 (DBC list)
- ▲ *Pseudomys chapmani*, Western Pebble-mound Mouse, P4 (DBC list)



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Project No	1283-1284
Date	20-Feb-20
Drawn by	AJ
Map author	JC

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Kilometres

1:60,000 (at A4) GDA 1994 MGA Zone 50

- Study Area
- Fauna habitat**
- drainage
- rocky hills or outcrops
- shrubland over spinifex hummock grassland
- spinifex hummock grassland
- tussock grassland

**Figure 5-12**

**Fauna habitats and significant fauna records from the field survey**

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#### 5.2.2.1.2 Assemblage

A total of 47 terrestrial vertebrate species representing 25 families and 40 genera were recorded in the Study Area during the field survey (Appendix 6). The assemblage included 45 native species and two introduced species (Table 5-16).

The recorded assemblage represents 14% of the species identified in the desktop review.

**Table 5-16 Number of vertebrate species recorded in survey in comparison to desktop results, by Class**

Class	No. species identified in desktop review			No. species recorded in survey		
	Native	Introduced	Total	Native	Introduced	Total
Amphibians	3		3	0		0
Reptiles	80	1	81	12	0	12
Birds	201	3	204	22	0	22
Mammals	36	10	46	11	2	15
<b>Total</b>	<b>321</b>	<b>14</b>	<b>335</b>	<b>45</b>	<b>2</b>	<b>47</b>

Three species – all of them reptiles – were detected during the survey but were not recorded in the desktop study: Western Bluetongue (*Tiliqua occipitalis*), Black-headed Python (*Aspidites melanocephalus*) and Yellow-spotted Monitor (*Varanus panoptes*).

#### 5.2.2.1.3 Significant vertebrate fauna

One Threatened and three Priority vertebrate fauna species were recorded in the survey (Table 5-17; Figure 5-10):

- Northern Quoll (EN; EPBC & BC Acts)
- Brush-tailed Mulgara (P4; DBCA list)
- Northern Coastal Free-tailed Bat (P1; DBCA list)
- Western Pebble-mound Mouse (P4; DBCA list).

No suitable nesting habitat (mature ring-forming spinifex >50cm) was observed for Night Parrots and audio recorders placed in areas of the largest and densest spinifex available failed to detect any Night Parrot calls.

**Table 5-17 Details of significant vertebrate fauna recorded during the field survey**

Species	Status	Distribution and ecology	Survey records
<i>Dasyercus blythi</i> Brush-tailed Mulgara	P4 (DBCA list)	Brush-tailed Mulgara is most frequently found in habitats dominated by mature spinifex ( <i>Triodia</i> spp.) (Woolley 2005, 2006, 2008), digging their burrows in the flats between low sand dunes (Woolley 2008). Records in WA are from the Great Victoria Desert, Goldfields, Gascoyne, Sandy Desert and Pilbara regions.	One scat was recorded at site NP01 in dense spinifex hummock grassland.
<i>Dasyurus hallucatus</i> Northern Quoll	EN (EPBC & BC Acts)	Northern Quoll uses a variety of habitats; however, rocky areas provide high prey densities and diversity, and protection from predators, fire and livestock grazing (Hill & Ward 2010). Dens are found in rock crevices, tree holes or occasionally termite mounds.	Recorded on two cameras at Site CAM001 on 15/11/2019 in a large wooded drainage. Two scats were also collected at the site NP01 in dense spinifex hummock grassland.
<i>Ozimops cobourgianus</i> Northern Coastal Free-tailed Bat	P1 (DBCA list)	North-western Free-tailed Bat mostly occurs in mangrove forests and woodlands (McKenzie & Bullen 2012), as well as near-coastal Melaleuca forests, rainforests, eucalyptus forests, woodlands, open floodplains and saline coastal flats (Milne 2008).	Calls recorded on ultrasonic recorders at three sites within the Study Area (CAM001, CAM002, CAM008) in drainages (major and minor).
<i>Pseudomys chapmani</i> Western Pebble-mound Mouse	P4 (DBCA list)	The Western Pebble-mound Mouse is widespread in the ranges of the central and southern Pilbara and extends into the Little Sandy Desert Ranges (Van Dyck & Strahan 2008). This species constructs large mounds from small pebbles. It is found on gentle slopes of rocky ranges covered in rocky mulch, hard spinifex and sparse trees and shrubs ( <i>Eucalyptus</i> , <i>Senna</i> , <i>Acacia</i> and <i>Ptilotus</i> ). It is often found near Acacia-dominated drainage lines (Van Dyck & Strahan 2008).	Four mounds were recorded at site CAM004 inside the Study Area and two mounds were recorded at site QH, 1.9 km west of the Study Area. All mounds were in gently sloping stony areas at the bases of quartz hills (rocky hills or outcrops).

The likelihood of occurrence assessment (section 4.2.3.6) for the significant species identified in the current desktop review (section 5.1.1.2) (but not recorded in the field) determined that seven species were likely to occur in the Study Area, two may possibly occur and 49 are unlikely to occur (Table 5-18).

A total of 20 conservation significant species were identified as recorded (three), likely (seven) or possible (ten) in the Previous Study Area. Three species of conservation significance, were identified in the previous desktop study (Phoenix 2014) but not recorded in the current desktop study: Gane's Blind Snake (*Anilius ganej*; likely), Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*; likely), and Northern Marsupial Mole (*Notoryctes caurinus*; possible). Seven species recorded in the Previous Study Area or captured in the previous desktop study (Phoenix 2014) are no longer listed as conservation significant: *Ardea modesta*, *Ardeotis australis*, *Burhinus grallarius*, *Haliaeetus leucogaster*, *Merops ornatus*, *Neochima rificauda subclarescens*, *Phaps histrionica*. These species were not included in Table 5-18.

**Table 5-18 Likelihood of occurrence for significant vertebrate fauna identified in the desktop review. Species only identified in the desktop study of the Previous Study Area are marked in grey**

Species	Status	Likelihood of occurrence in Previous Study Area	Likelihood of occurrence in Study Area	Study Area habitats				
				TG	SHG	SSHG	D	RO
<b>Gastropods (1)</b>								
<i>Dupucharopa millestriata</i> Depuch Island charopid land snail	P2 (DBCAs list)	Not assessed.	Unlikely. Study Area outside current known range of species.					
<b>Reptiles (6)</b>								
<i>Anilius ganei</i> Gane's Blind Snake	P1	Likely. Limited knowledge of habitat and occurrence of species. Nearest record approximately 66 km west of the study area.	Not assessed. Did not appear in Study Area desktop searches.					
<i>Chelonia mydas</i> Green Turtle	VU/Mig./VU (EPBC Act; BC Act)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Lerista neviniae</i> Nevin's Slider	EN (BC Act)	Not assessed.	Unlikely. Study Area outside current known range of species.					
<i>Liasis olivaceus</i> subsp. <i>barroni</i> Pilbara Olive Python	VU (EPBC & BC Acts)	Likely. Species likely to occur in rocky habitats where water persists for long periods including gully habitat within study area. Nearest record approximately 10 km east of the northern most point of the study area.	Possible. Limited and isolated patches of low-quality habitat present in Study Area. Recorded approximately 7km from the Study Area. Possible occasional dispersal into Study Area.				✓	✓
<i>Natator depressus</i> Flatback Turtle	VU/Mig./VU (EPBC Act; BC Act)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Notoscincus butleri</i> Lined Soil-Crevise Skink	P4 (DBCAs list)	Recorded. The species was recorded three times during the survey from direct observation. Little known of species habitat preferences or ecology; however,	Unlikely. Study Area outside current known range of species.		✓	✓	✓	



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Species	Status	Likelihood of occurrence in Previous Study Area	Likelihood of occurrence in Study Area	Study Area habitats				
				TG	SHG	SSHG	D	RO
		habitats consistent with other records of the species are present within the study area.						
<b>Birds (46)</b>								
<i>Actitis hypoleucos</i> Common Sandpiper	Mig. (EPBC & BC Acts)	Possible. Species may occur within the study area, particularly after rainfall events when water is present within drainage lines.	Unlikely. No suitable habitat present in Study Area.					
<i>Anous stolidus</i> Common Noddy	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Apus pacificus</i> Fork-tailed Swift	Mig. (EPBC & BC Acts)	Likely. Species likely to forage in flight; however, unlikely to land or nest in the vicinity of the Project. Nearest record located approximately 10 km north east of the study area.	Likely. Study Area within current known range of species, suitable habitat within the Study Area and individuals range widely during the non-breeding season.	✓	✓	✓	✓	✓
<i>Ardenna pacifica</i> Wedge-tailed Shearwater	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Arenaria interpres</i> Ruddy Turnstone	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Calidris acuminata</i> Sharp-tailed Sandpiper	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Calidris alba</i> Sanderling	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Calidris canutus</i> Red Knot	EN/Mig./EN (EPBC Act; BC Act)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Calidris ferruginea</i> Curlew Sandpiper	CR/Mig./CR (EPBC Act; BC Act)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Calidris melanotos</i> Pectoral Sandpiper	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Calidris ruficollis</i> Red-necked Stint	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					

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Species	Status	Likelihood of occurrence in Previous Study Area	Likelihood of occurrence in Study Area	Study Area habitats				
				TG	SHG	SSHG	D	RO
<i>Calidris subminuta</i> Long-toed Stint	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Calidris tenuirostris</i> Great Knot	CR/Mig./CR (EPBC Act; BC Act)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Calonectris leucomelas</i> Streaked Shearwater	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Charadrius leschenaultii</i> Greater Sand Plover	VU/Mig./VU (EPBC Act; BC Act)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Charadrius mongolus</i> Lesser Sand Plover	EN/Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Charadrius veredus</i> Oriental Plover	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Falco hypoleucos</i> Grey Falcon	VU (BC Act)	Likely. The species is likely to forage within and in the vicinity of the study area, particularly grassland and shrubland habitats and possibly nest where suitable tall trees or suitable infrastructure are present, particularly along rivers and drainage lines.	Possible. Study Area within current known range of species and suitable habitat within the Study Area but no confirmed records within the search area of the desktop study.	✓	✓	✓	✓	✓
<i>Falco peregrinus</i> Peregrine Falcon	OS (BC Act)	Likely. The species is likely to forage within and in the vicinity of the study area, particularly grassland and shrubland habitats and possibly nest on cliff edges of suitably sized gullies present within the study area. Where suitable tall trees or suitable infrastructure are present, particularly along rivers and drainage lines.	Likely. Study Area within current known range of species, suitable habitat within the Study Area and home range of species intersects Study Area based on known records.	✓	✓	✓	✓	✓
<i>Fregata ariel</i> Lesser Frigatebird	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					

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Species	Status	Likelihood of occurrence in Previous Study Area	Likelihood of occurrence in Study Area	Study Area habitats				
				TG	SHG	SSHG	D	RO
<i>Glareola maldivarum</i> Oriental Pratincole	Mig. (EPBC & BC Acts)	Possible. Potential habitat present in northern third of study area	Likely. Study Area within current known range of species, suitable habitat within the Study Area and individuals range widely during the non-breeding season.	✓				
<i>Hirundo rustica</i> Barn Swallow	Mig. (EPBC & BC Acts)	Not assessed.	Likely. Study Area within current known range of species, suitable habitat within the Study Area and individuals range widely during the non-breeding season.	✓	✓		✓	✓
<i>Limicola falcinellus</i> Broad-billed Sandpiper	Mig. (BC Act)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Limosa lapponica</i> Bar-tailed Godwit	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Limosa lapponica baueri</i> Bar-tailed Godwit (western Alaskan)	VU/Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Limosa lapponica menzbieri</i> Bar-tailed Godwit (northern Siberian)	CR/Mig./VU/Mig. (EPBC Act; BC Act)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Limosa limosa</i> Black-tailed Godwit	Mig. (BC Act)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Macronectes giganteus</i> Southern Giant Petrel	EN/Mig./Mig. (EPBC Act; BC Act)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Motacilla cinerea</i> Grey Wagtail	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Motacilla flava</i> Yellow Wagtail	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					

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Species	Status	Likelihood of occurrence in Previous Study Area	Likelihood of occurrence in Study Area	Study Area habitats				
				TG	SHG	SSHG	D	RO
<i>Numenius madagascariensis</i> Eastern Curlew	CR/Mig./CR (EPBC Act; BC Act)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Numenius phaeopus</i> Whimbrel	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Onychoprion anaethetus</i> Bridled Tern	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Pandion cristatus</i> Osprey	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Pezoporus occidentalis</i> Night Parrot	EN/CR (EPBC Act; BC Act)	Not assessed.	Unlikely. No suitable habitat present in Study Area. No calls detected.		✓			
<i>Plegadis falcinellus</i> Glossy Ibis	Mig. (EPBC & BC Acts)	Possible. Species may occur within study area following rainfall events when flooding occurs, particularly in northern third of study area.	Unlikely No suitable habitat present in Study Area.					
<i>Pluvialis fulva</i> Pacific Golden Plover	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Rostratula australis</i> Australian Painted Snipe	EN (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Sterna bergii</i> Crested Tern	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Sterna dougallii</i> Roseate Tern	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Sterna hirundo</i> Common Tern	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Tringa brevipes</i> Grey-tailed Tattler	(Mig. EPBC & BC Acts; P4 DBCA list)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Tringa glareola</i> Wood Sandpiper	Mig. (EPBC & BC Acts)	Possible. Species may occur within the study area, particularly after rainfall events when water is present within drainage lines.	Unlikely. No suitable habitat present in Study Area.					

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Species	Status	Likelihood of occurrence in Previous Study Area	Likelihood of occurrence in Study Area	Study Area habitats				
				TG	SHG	SSHG	D	RO
<i>Tringa nebularia</i> Common Greenshank	Mig. (EPBC & BC Acts)	Possible. Species may occur within the study area, particularly after rainfall events when water is present within drainage lines.	Unlikely. No suitable habitat present in Study Area.					
<i>Tringa stagnatilis</i> Marsh Sandpiper	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Xenus cinereus</i> Terek Sandpiper	Mig. (EPBC & BC Acts)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<b>Mammals (13)</b>								
<i>Dasyercus blythi</i> Brush-tailed Mulgara	P4 (DBCA list)	Possible. Species may occur in grassland and shrubland habitat where suitable burrowing substrates are present. Previously recorded 75 km east of the study area.	Recorded.		✓	✓		
<i>Dasyurus hallucatus</i> Northern Quoll	EN (EPBC & BC Acts)	Recorded. Recorded during Level 1 and targeted survey from various locations within the study area.	Recorded.		✓	✓	✓	✓
<i>Hydromys chrysogaster</i> Water-rat	P4 (DBCA list)	Not assessed.	Unlikely. No suitable habitat present in Study Area.					
<i>Lagorchestes conspicillatus leichardti</i> Spectacled Hare-wallaby	P4 (DBCA list)	Likely. Species may occur in grassland and shrubland habitats within the study area. Species previously recorded within 10 km of central third of study area.	Not assessed. Did not appear in Study Area desktop searches.					
<i>Leggadina lakedownensis</i> Northern Short-tailed Mouse, Lakeland Downs mouse, Kerakenga	P4 (DBCA list)	Possible. Species may occur within the study area, particularly in shrubland and grassland habitats. Previously recorded within 10 km of the study area.	Likely. Study Area within current known range of species, suitable habitat within the Study Area and previously recorded within 18 km of the Study Area.	✓	✓	✓		
<i>Macroderma gigas</i> Ghost Bat	VU (EPBC & BC Acts)	Likely. Likely to forage within the study area in drainage and woodland habitat and occasionally roost in	Likely. No suitable roosting habitat present in Study Area and no calls were recorded during audio	✓	✓	✓	✓	✓

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla Port Project**  
Prepared for BBI Group Pty Ltd

Species	Status	Likelihood of occurrence in Previous Study Area	Likelihood of occurrence in Study Area	Study Area habitats				
				TG	SHG	SSHG	D	RO
		suitable sites within gully habitat. Previously recorded within the central third of the study area.	surveys but previously recorded within 8km of the Study Area. Probably an infrequent visitor when foraging.					
<i>Macrotis lagotis</i> Bilby	VU (EPBC & BC Acts)	Possible. Species may occur in grassland and shrubland habitat where suitable burrowing substrates are present. Previously recorded 90 km east of the study area; however, species distribution in the Pilbara patchy.	Likely. Study Area within current known range of species, suitable habitat within the Study Area. In 2017 an unoccupied Bilby burrow was recorded inside a 200m wide strip between two sections of the Study Area.	✓	✓	✓	✓	
<i>Notoryctes caurinus</i> Northern Marsupial Mole	P4 (DFCA list)	Possible. Species may occur in loose sands in sandplain and sand dune habitats within the study area. Previous record of the species over 200 km from study area (Benshemesh 2004).	Not assessed. Did not appear in Study Area desktop searches.					
<i>Ozimops cobourgiensis</i> Northern Coastal Free-tailed Bat	P1 (DFCA list)	Not assessed.	Recorded.	✓	✓	✓	✓	✓
<i>Petrogale lateralis lateralis</i> Black-flanked Rock-wallaby	EN (EPBC & BC Acts)	Possible. Potential habitat present for the species; however, no evidence of presence recorded. Only Rothschild's Rock Wallaby was recorded during the survey and the nearest mainland record of the species is located over 150 km west of the study area.	Unlikely. Recorded on Depuch Island but not adjacent areas of the mainland.					✓
<i>Pseudomys chapmani</i> Western Pebble-mound Mouse	P4 (DFCA list)	Recorded. Recorded once during the survey from secondary evidence (pebble-mound) in the northern third of the study area. No active mounds recorded; however, species likely to occur in grassland and shrubland habitat where suitable stony substrate present.	Recorded.					✓



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla Port Project  
Prepared for BBI Group Pty Ltd

Species	Status	Likelihood of occurrence in Previous Study Area	Likelihood of occurrence in Study Area	Study Area habitats				
				TG	SHG	SSHG	D	RO
<i>Rhinonictis aurantia</i> Orange Leaf-nosed Bat	(VU EPBC Act; P4 DBCA list)	Not assessed.	Unlikely. No suitable roosting habitat present in Study Area, no calls were recorded during audio surveys, and no confirmed records within the search area of the desktop study.					
<i>Sminthopsis longicaudata</i> Long-tailed Dunnart	P4 (DBCA list)	Possible. Species may occur in rock hill slope or gully habitat where suitable rock cover present. Previously recorded within 10 km of southern third of study area.	Not assessed. Did not appear in Study Area desktop searches.					

### 5.3 SURVEY LIMITATIONS

The limitations of the flora and vegetation survey and terrestrial fauna survey have been considered in accordance with EPA (2016c, e) (Table 5-19).

**Table 5-19 Consideration of potential survey limitations**

Limitations	Comments
Availability of contextual information at a regional and local scale	<p>Fauna: There was ample information concerning species and habitats in the vicinity of the Study Area from nearby surveys and research.</p> <p>Flora: Previous reports were available combined with database searches to provide adequate background to the flora and vegetation survey.</p>
Competency/experience of the team carrying out the survey	<p>Fauna: The field team and report authors have sufficient experience in terrestrial fauna surveys within the Pilbara region and were competent in sampling the target fauna.</p> <p>Flora: The field team had a combined 30 years of experience in flora survey, much of it in the Pilbara.</p>
Scope and completeness	<p>Fauna: Target groups were adequately sampled for the purposes of the survey.</p> <p>Flora: The survey scope was Reconnaissance, the entirety of the Study Area was covered and all vegetation types sampled.</p>
Proportion of flora and fauna recorded and/or collected, any identification issues	<p>Fauna: No difficulties were encountered in identifying targeted fauna species when encountered.</p> <p>Flora: Approximately 75% of the theoretical flora present (from Accumulation curve) was collected. Due to the dryness of the season several species were unable to be identified completely.</p>
Access within the Study Area	Access within the Study Area was adequate to allow full surveys of the Study Area.
Timing, rainfall, season	<p>Balla Balla received heavy rainfall from Cyclone Veronica in March preceding the survey little rain was recorded in the eight months prior to the survey. Seminomadic species like Bilby may not have been present at the time of the survey due to lack of recent rainfall and consequent reductions in food availability.</p> <p>Flora: fewer annuals were present or identifiable due to the dryness of the season, which may constitute the theoretical portion of flora not encountered</p>
Disturbance that may have affected the results of the survey	There were no notable recent disturbances that may have impacted the surveys.

## 6 DISCUSSION

### 6.1 FLORA AND VEGETATION

The total of 118 taxa recorded during this survey should be viewed in the context of a Reconnaissance survey conducted later in the season after an extended dry period. Reconnaissance surveys, being single season, do not assess flora with the same intensity as a multi-season Detailed survey. Due to the drier nature of the survey's timing it is likely that fewer annuals and ephemerals were encountered in the survey area, and the more cryptic species would be difficult to find. Compared to the majority of previous surveys reviewed as part of the desktop component of this work, their greater species lists reflect the study areas being in the form of long, linear easements that cover greater distances and intersect a larger number of habitats. The exception to this is the Mattiske survey conducted to the NE of the Study Area (Mattiske 2006). This survey was a single season survey, recording 174 species in similar vegetation types and habitat to the current survey. The Mattiske work was conducted in June and the report noted that it was after a significantly wetter season, this may have contributed to the greater number of species recorded.

#### 6.1.1 Significant flora

Three significant species were recorded during the field survey; two Priority species and one considered significant because its collection in the Study Area represents an extension to the known range of the species.

*Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479) (P3) is known from 33 records in FloraBase (DBCA 2020), with these records primarily from the west and south of the Pilbara. At Balla Balla, it is present in eight of thirteen vegetation units and is obviously a generalist in terms of habitat, not being restricted to one or few units. As well as being a Priority category species, the records at Balla Balla represent a minor range extension for this species (<100 km). Because of this ability to occur in a variety of habitats this species will be more able to recover from any impact to these habitats and is likely to be found to a greater extent in the Study Area and beyond if additional targeted searches are conducted at an appropriate time or year.

*Heliotropium muticum* (P3) is known from 72 records in FloraBase (DBCA 2020) from the north-eastern Pilbara. While it is well known, population sizes are usually small or often recorded as a single specimen. At Balla Balla it is recorded in four of the 13 vegetation units, seeming to prefer *Acacia* shrublands/*Triodia* hummock grasslands, and the open gilgaied plains of the Horseflat Land System. Phoenix considers that by extending the known range of this species its conservation significance may be given cause for reconsideration by DBCA.

*Polygala isingii* is known from 35 records on FloraBase (DBCA 2020) that are widely spread through the Eremaean zone of Western Australia and as far south as Wiluna. The species is also known from the Northern Territory and Queensland. Its significance here lies in the fact that there are few records in the Pilbara bioregion and these are from the south-eastern region of the bioregion. Two records were made of the species during the current survey, both from *Acacia* shrublands/*Triodia* grassland units. Given the widespread range of this species and its annual lifecycle, the occurrences encountered at Balla Balla don't represent major significance to the species as the favoured vegetation types are the most common within the Study Area and beyond. It is likely that targeted surveys for the species at an appropriate time of year will show this species to be common in the area and outside the Study Area.

## 6.1.2 Introduced flora

None of the introduced species recorded are classified as Declared Pests or Weeds of National Significance.

## 6.1.3 Vegetation

The Horseflat Land System PEC is of great significance here. Extending from Karratha to Balla Balla, it is at the eastern end of its range in the Study Area and is also host to two Priority species recorded during the survey.

Nine other vegetation units defined during the survey also host significant species, and these may be considered to have significance because of these species' presence.

**Ex:** *Heliotropium muticum*, *Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479)

**AsTw:** *Heliotropium muticum*, *Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479), *Polygala isingii*

**AaTe(Tw):** *Heliotropium muticum*

**AbTw:** *Heliotropium muticum*

**AsppTe(Tw):** *Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479)

**EvAsTe:** *Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479),

**EvAtTe:** *Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479)

**AsTe:** *Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479)

**AsppTe:** *Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479), *Polygala isingii*

**AtTe:** *Oldenlandia* sp. Hamersley Station (AA Mitchell PRP 1479).

Except for the Horseflat Land System of the Roebourne Plains PEC (Ex), these units and others of similar structure and definition are common throughout the region and have been recorded in previous surveys used in the desktop assessment of the Study Area, leading to the expectation that these significant species will be found elsewhere if targeted searches are undertaken.

The condition assessment of the vegetation (

Table 5-12) has 97.9% in Excellent condition despite the grazing history of the area. The remaining 2.1% is ranked as Very Good. None of the vegetation surveyed was found to be in a lower condition. Similar vegetation in the region has also been assessed as primarily in Excellent condition.

## 6.2 TERRESTRIAL FAUNA

### 6.2.1 Vertebrate fauna

A Brush-tailed Mulgara scat was found during nocturnal foraging at site NP01. Scats were also found about 250 m east of the Study Area on a previous survey in 2017 (Phoenix 2018). Brush-tailed Mulgara is most frequently found in habitats dominated by mature spinifex (*Triodia* spp.) (Woolley 2005, 2006, 2008). Site NP01, where the Brush-tailed Mulgara scat was found, was specifically targeted for Night Parrot surveys because it contained some of the largest and densest spinifex found within the Study Area. Approximately 685.5 ha of spinifex grassland is present across the Study Area with approximately 1480.6 ha of shrubland over spinifex hummock grassland providing additional potential habitat. Similar habitats are abundant in areas adjacent to the Study Area. Brush-tailed Mulgara is

widespread throughout the Pilbara and Goldfields regions. Habitat within the Study Area is not likely to be significant for local or range-wide populations.

Northern quoll was detected on two camera traps at site CAM001 on the night of 15/11/2019 in a large wooded drainage. The “National Recovery Plan of the Northern Quoll” notes that quolls are habitat generalists and designates critical habitat for the species as areas “where northern quolls are least exposed to threats or least likely to be in the future” (Hill & Ward 2010). Specific habitats listed include offshore islands and rocky areas which provide refuge from introduced predators (Hill & Ward 2010). A large rocky hill which meets this definition exists outside the Study Area at site QH. Within the Study Area, the only rocky area large enough to create usable denning sites exists at site CAM05 but the rock pile is small (about 0.1 ha), isolated from other similar habitat, and no quolls were detected on camera traps at the site; it is considered unviable as denning habitat.

The large drainage line where a Northern Quoll was detected on two camera traps and another large wooded drainage in the northwest of the Study Area contain eucalypts large enough to potentially provide hollows suitable for use as denning sites. Occasional exposed rocky areas also occur along the banks of these drainages. These drainages likely provide the best available refuge from fire and introduced predators within the Study Area but on a range-wide scale, they probably do not meet the criteria for designation as critical habitat.

It is more likely that the two large drainages function as corridors which facilitate dispersal between other areas of more suitable denning habitat outside the Study Area. Satellite imagery shows substantial vegetative cover along the larger drainage which lies mostly to the east of the Study Area. The escape cover present in the drainage connects suitable denning habitat in the hills to the south of the Study Area with coastal areas to the north which likely provide substantial food resources. In the Pilbara, marine food resources including crustaceans and molluscs have been documented in Northern Quoll diets, with crustaceans making up a substantial portion of the diet on Dolphin Island despite high availability of vertebrate prey species (Dunlop *et al.* 2017). Dolphin Island is only approximately 90 km northwest of the Study Area. If quolls in both areas behave similarly, the two large drainages may be important for movement of local quolls between habitats containing different, important resources.

Two Northern Quoll scats were also collected at the site NP01 in dense spinifex grassland. Such areas may provide suitable foraging habitat for Northern Quoll but are probably only used for foraging and less so, dispersal.

Northern Coastal Free-tailed Bat was detected using ultrasonic recorders at three locations (CAM001, CAM002, CAM008). Calls were infrequently detected, with only three, ten and two calls recorded at each site respectively. Sites CAM001 and CAM002 were located in major drainages in the northern end of the Study Area, while the site CAM008 was in a minor drainage toward the southern end of the Study Area. No calls were detected by the ultrasonic recorder at site CAM005 in another minor drainage. North-western Free-tailed Bat mostly occurs in mangrove forests and woodlands (McKenzie & Bullen 2012). Local populations probably roost primarily in mangroves north of the Study Area and use drainages within the Study Area foraging corridors.

While some roosting may occur in the two major drainages in the northeast and northwest corners of the Study Area due to the presence of eucalypts with large hollows, small drainages throughout the Study Area lack large trees and are not suitable roosting habitat. Both small and large drainages are probably used primarily as foraging habitat. Larger drainages are likely to be more valuable as foraging habitat due to higher productivity and associated insect abundance and closer proximity to mangrove roosting habitat. Due to the lack of primary roosting habitat, the Study Area does not support habitats which are critical for local Northern Coastal Free-tailed Bat populations.

Four Western Pebble-mound Mouse mounds were observed within the Study Area at site CAM004. An additional two mounds were observed at site QH approximately 1.9 km west of the Study Area. In

both locations, burrows occurred on the bases of quartz hills with gentle slopes and abundant quartz pebbles. One of the mounds at CAM004 was well-maintained and appeared to be active but no activity was recorded on camera traps set facing the entrance of the mound. All other mounds were relatively flat and weathered and did not appear to be active. The preferred habitat for the Western Pebble-mound Mouse is spinifex grassland on rolling hills, of which there is approximately 24.5 ha within the Study Area. However, areas with suitable small pebbles required for mound building are restricted to the immediate vicinity of small rocky outcrops near site CAM004 and F02. This species is common and widespread throughout the Pilbara and larger areas of suitable habitat exist at the bases of extensive hills immediately south of the Study Area. Suitable habitat patches within the Study Area are small and isolated from both each other and the larger continuous areas of suitable habitat to the south. The small and isolated nature of these habitat patches suggests that they are unlikely to support viable populations on their own and may be population sinks dependant on immigration from a larger source population outside the Study Area.

Nine additional conservation significant fauna species were considered likely (Fork-tailed Swift, Peregrine Falcon, Oriental Pratincole, Barn Swallow, Northern Short-tailed Mouse, Ghost Bat, Bilby) or possible (Grey Falcon, Pilbara Olive Python) to occur within the Study Area.

Fork-tailed Swift, Oriental Pratincole and Barn Swallow are migratory birds which visit the Pilbara region during the non-breeding season. These species utilise a variety of habitats and are likely to forage within the Study Area. Similarly, Peregrine Falcon is widespread across Australia and forage over a large home range in diverse habitat types. This species is likely to occur within the Study Area but are unlikely to breed there because of a lack of cliffs or large trees. Peregrine Falcons seen in the area would likely be transiting across the Study Area between nesting and roosting sites in the hills to the south of the Study Area and mudflats to the north of the Study Area with abundant prey species (particularly shorebirds). None of the conservation significant bird species considered likely to occur in the Study Area are likely to be substantially impacted by development within the Study Area.

Northern Short-tailed Mouse is a habitat generalist which occupies a variety of habitats including hummock and tussock grasslands, tropical woodlands, samphire, sedgelands and stony ranges (Moro & Kutt 2008) and is found across the Pilbara and Kimberley regions. Most of the Study Area and surrounding region are likely to contain suitable habitat for this species. It is not expected that development within the Study Area would have a significant impact on local or regional populations of Northern Short-tailed Mouse.

Ghost Bat was not detected on ultrasonic recorders during the survey but the desktop study revealed a record of this species within 8 km of the Study Area. Permanent roost sites are restricted to deep natural caves and abandoned mines ((Threatened Species Scientific Committee 2016)) which are absent from the Study Area. Ghost bats were thought to forage within 2 km of a roost (Tidemann *et al.* 1985) however there is evidence that some individuals will fly much further than this (B. Bullen pers. comm. 14/06/2010). Detection of Ghost Bat within 8 km of the Study Area and an absence of suitable roosting habitat suggests that occasional foraging within the Study Area is likely but development within the study is not likely to have significant impacts on local populations.

Bilby was not documented during this survey but in 2017 an unoccupied Bilby burrow was recorded inside a 200m wide strip between two sections of the Study Area (Phoenix 2018) and suitable habitat is present throughout the Study Area. The species is highly mobile and can have large foraging ranges. Home ranges may shift in response to changes in food availability (Van Dyck & Strahan 2008) and Bilby presence or absence in the Study Area may vary with local conditions.

Grey Falcon was listed as possibly occurring within the Study Area but this species has not been recorded within the desktop study search area and the habitats present would support foraging but not nesting. While it is possible that Pilbara Olive Python occasionally disperses into the Study Area, rocky areas which this species prefers are small, isolated, and uncommon within the Study Area and



are not likely to support a viable population. Neither species listed as “Possible” is likely to be significantly impacted by development within the Study Area.

### 6.3 CONCLUSION

The recording of two conservation significant flora species and a further species considered significant in a variety of vegetation types indicates that the vegetation has local significance for flora. However, given the spread of the significant flora across the site and the variety of habitats it occurs in, and the occurrence of these vegetation types in the region, conservation significant flora should not present a barrier to development. The major issue of consideration is the impact upon 847.9 ha of the Horseflat land system of the Roebourne Plains PEC at the eastern extremity of its range. While a Priority Ecological Community doesn’t have the statutory protection of a Threatened Ecological Community the PEC and its location will be taken into consideration in any regulatory decision-making process.

Four conservation significant mammal species were documented during the survey; Brush-tailed Mulgara (P4), Northern Quoll (EN), Northern Coastal Free-tailed Bat (P1) and Western Pebble-mound Mouse (P4). Two of these species –Northern Quoll and Western Pebble-mound Mouse– were recorded in the Previous Study Area. Brush-tailed Mulgara was considered likely in the Previous Study Area and, of the species recorded, only Northern Coastal Free-tailed Bat was not considered in the previous study.

Brush-tailed Mulgara was detected at one location by a single scat. This species is widespread throughout the Pilbara and its preferred habitat is common within the Study Area and in the surrounding coastal region. Development within the Study Area is expected to cause direct loss of individuals during earthworks and localised displacement during clearing and construction but is unlikely to have significant impacts on Brush-tailed Mulgara populations outside the development footprint.

Similarly, Western Pebble-mound Mouse was detected at a single location within the Study Area from apparently inactive nest mounds. The possibility of direct loss of individuals during earthworks exists if small areas of preferred habitat are developed. However, areas of suitable habitat are fairly small and isolated and may only be occupied during rainfall-driven increases in populations in surrounding areas.

Northern Quoll was detected at two locations via scats and camera traps. No habitats matching the definitions of critical habitats as described by the National Recovery Plan for the Northern Quoll were present in the Study Area. However, large drainages running through the northeast and northwest portions of the Study Area may be important movement corridors connecting critical denning habitat and food resources which occur outside the Study Area. Development of these drainages could impact local populations of Northern Quolls.

Northern Coastal Free-tailed Bat was detected within the Study Area but likely only uses habitats within the Study area for aerial foraging. Infrequent roosting potentially occurs in large trees located in drainages but mangroves to the north of the study area are preferred roosting habitat. Development within the study area is unlikely to substantially impact Northern Coastal Free-tailed Bat.

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**Appendix 1 Survey site locations**

Site	Site type	Sample type	Latitude	Longitude
CAM001	Targeted fauna species site	Camera trap	-20.78706	117.747607
CAM001	Targeted fauna species site	Camera trap	-20.787426	117.748415
CAM001	Targeted fauna species site	Camera trap	-20.787381	117.747883
CAM001	Targeted fauna species site	Site description	-20.787146	117.747764
CAM001	Targeted fauna species site	Ultrasonic recording	-20.787146	117.747764
CAM002	Targeted fauna species site	Camera trap	-20.799677	117.721143
CAM002	Targeted fauna species site	Camera trap	-20.799707	117.721264
CAM002	Targeted fauna species site	Camera trap	-20.799782	117.721709
CAM002	Targeted fauna species site	Site description	-20.799707	117.721264
CAM002	Targeted fauna species site	Ultrasonic recording	-20.799617	117.721141
CAM004	Targeted fauna species site	Camera trap	-20.815836	117.735833
CAM004	Targeted fauna species site	Camera trap	-20.817951	117.73379
CAM004	Targeted fauna species site	Camera trap	-20.8189	117.738226
CAM004	Targeted fauna species site	Foraging	-20.816181	117.735439
CAM004	Targeted fauna species site	Opportunistic sighting	-20.815937	117.735843
CAM004	Targeted fauna species site	Site description	-20.815836	117.735833
CAM005	Targeted fauna species site	Camera trap	-20.869535	117.755608
CAM005	Targeted fauna species site	Camera trap	-20.86964	117.755511
CAM005	Targeted fauna species site	Camera trap	-20.869464	117.755512
CAM005	Targeted fauna species site	Foraging nocturnal	-20.86965	117.755512
CAM005	Targeted fauna species site	Opportunistic sighting	-20.869608	117.755602
CAM005	Targeted fauna species site	Opportunistic sighting	-20.869408	117.755398
CAM005	Targeted fauna species site	Site description	-20.869464	117.755512
CAM005	Targeted fauna species site	Ultrasonic recording	-20.869522	117.755564
CAM006	Targeted fauna species site	Opportunistic sighting	-20.859496	117.735522
CAM006	Targeted fauna species site	Site description	-20.859496	117.735522
CAM007	Targeted fauna species site	Site description	-20.816656	117.753138
CAM008	Targeted fauna species site	Site description	-20.876104	117.743785
CAM008	Targeted fauna species site	Ultrasonic recording	-20.876104	117.743785
F01	Targeted fauna species site	Foraging	-20.881007	117.743
F01	Targeted fauna species site	Site description	-20.880628	117.742677

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla Port Project**  
**Prepared for BBI Group Pty Ltd**

Site	Site type	Sample type	Latitude	Longitude
F02	Targeted fauna species site	Foraging	-20.880614	117.742762
F02	Targeted fauna species site	Site description	-20.880614	117.742762
F03	Targeted fauna species site	Foraging	-20.815519	117.723483
F03	Targeted fauna species site	Opportunistic sighting	-20.815836	117.723928
F03	Targeted fauna species site	Opportunistic sighting	-20.815974	117.72374
F03	Targeted fauna species site	Site description	-20.815974	117.72374
NP01	Targeted fauna species site	Audio recording	-20.838091	117.739894
NP01	Targeted fauna species site	Foraging nocturnal	-20.838103	117.739886
NP01	Targeted fauna species site	Site description	-20.838091	117.739894
NP02	Targeted fauna species site	Audio recording	-20.794615	117.721366
NP02	Targeted fauna species site	Audio recording	-20.794615	117.721366
NP02	Targeted fauna species site	Site description	-20.794615	117.721366
NP02	Targeted fauna species site	Site description	-20.794615	117.721366
OPP01	Targeted fauna species site	Opportunistic sighting	-20.815041	117.728108
OPP02	Targeted fauna species site	Opportunistic sighting	-20.805832	117.726204
OPP03	Targeted fauna species site	Opportunistic sighting	-20.800459	117.723995
OPP04	Targeted fauna species site	Opportunistic sighting	-20.794135	117.734872
OPP05	Targeted fauna species site	Opportunistic sighting	-20.788902	117.746224
OPP06	Targeted fauna species site	Opportunistic sighting	-20.838095	117.739887
OPP07	Targeted fauna species site	Opportunistic sighting	-20.875464	117.762547
OPP08	Targeted fauna species site	Opportunistic sighting	-20.884869	117.753082
OPP09	Targeted fauna species site	Opportunistic sighting	-20.889335	117.748798
OPP10	Targeted fauna species site	Opportunistic sighting	-20.891785	117.746432
OPP11	Targeted fauna species site	Opportunistic sighting	-20.872288	117.753812
OPP12	Targeted fauna species site	Opportunistic sighting	-20.81346	117.727746
OPP13	Targeted fauna species site	Opportunistic sighting	-20.815252	117.72779
OPP14	Targeted fauna species site	Opportunistic sighting	-20.787873	117.649333
OPP15	Targeted fauna species site	Opportunistic sighting	-20.814497	117.728681
OPP16	Targeted fauna species site	Opportunistic sighting	-20.808369	117.725749
OPP16	Targeted fauna species site	Opportunistic sighting	-20.827516	117.733841
QH	Targeted fauna species site	Foraging	-20.816463	117.70506
QH	Targeted fauna species site	Site description	-20.816463	117.70506

**Appendix 2**    **Flora survey site descriptions**

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB01	Position (WGS84)	-20.765838, 117.662521
Slope	gentle	Topography	plain
Soil colour	red-brown	Soil texture	loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	08-Oct-2019	50 m x 50 m	Martin Henson

Observation details - visit 1 (08 Oct 2019)			
Vegetation description	Isolated plants of <i>Rhynchosia minima</i> and <i>Streptoglossa bubakii</i> , over a low tussock grassland of <i>Eragrostis xerophila</i> .		
Habitat	Grass plain		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	50	Tree cover (%)	0
Shrub cover (%)	0	Grass cover (%)	50
Herb cover (%)	1		



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd

Species (9)	Status	Cover (%)	Height (m)
<i>Eragrostis xerophila</i>		50	0.3
<i>Cleome viscosa</i>		0.1	0.1
<i>Euphorbia ?biconvexa</i>		0.1	0.1
<i>Sporobolus australasicus</i>		0.1	0.1
<i>Rhynchosia minima</i>		0.1	0.1
<i>Streptoglossa bubakii</i>		0.1	0.1
<i>Ptilotus aervoides</i>		0.1	0.1
<i>Corchorus walcottii</i>		0.1	0.1
<i>Indigofera trita</i>		0.1	0.05



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB02r	Position (WGS84)	-20.762778, 117.661078
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	08-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (08 Oct 2019)			
Vegetation description	Mid to tall open shrubland to shrubland of <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> and <i>Acacia stellaticeps</i> over hummock grassland of <i>Triodia wiseana</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	70	Tree cover (%)	30
Shrub cover (%)	5	Grass cover (%)	45
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Species (13)	Status	Cover (%)	Height (m)
<i>Triodia wiseana</i>		50	0.4
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		20	2.5
<i>Carissa lanceolata</i>		5	2
<i>Acacia stellaticeps</i>		1	4
<i>Chrysopogon fallax</i>		1	1
<i>Acacia inaequilatera</i>		0.1	2
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>		0.1	0.4
<i>Tephrosia densa</i>		0.1	0.4
<i>Trichodesma zeylanicum</i>		0.1	0.3
<i>Corchorus walcottii</i>		0.1	0.15
<i>Sporobolus australasicus</i>		0.1	0.1
<i>Euphorbia australis</i>		0.1	0.1
<i>Streptoglossa bubakii</i>		0.1	0.1

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Site details			
Site	BB03r	Position (WGS84)	-20.762912, 117.661935
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	08-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (08 Oct 2019)			
Vegetation description	Mid open shrubland of <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> and <i>Carissa lanceolata</i> , over low isolated shrubs of <i>Ptilotus obovatus</i> and <i>Cleome viscosa</i> over low sparse tussock grassland of <i>Eragrostis xerophila</i> and <i>Chrysopogon fallax</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	60	Tree cover (%)	5
Shrub cover (%)	40	Grass cover (%)	10
Herb cover (%)	2		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Species (10)	Status	Cover (%)	Height (m)
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		25	2
<i>Carissa lanceolata</i>		5	1.8
<i>Eragrostis xerophila</i>		5	0.3
<i>Chrysopogon fallax</i>		1	1.25
<i>Solanum lasiophyllum</i>		0.2	0.3
<i>Ptilotus obovatus</i>		0.1	0.3
<i>Cleome viscosa</i>		0.1	0.3
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>		0.1	0.15
<i>Euphorbia biconvexa</i>		0.1	0.15
<i>Streptoglossa bubakii</i>		0.1	0.15

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Site details			
Site	BB04r	Position (WGS84)	-20.764891, 117.65329
Slope	gentle	Topography	drainage line
Soil colour	red-brown	Soil texture	loam, silt
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	08-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (08 Oct 2019)			
Vegetation description	Mid to tall shrubland of <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> , over a hummock grassland of <i>Triodia wiseana</i> and <i>Triodia epactia</i> .		
Habitat	riparian zone		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	65	Tree cover (%)	0
Shrub cover (%)	50	Grass cover (%)	30
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Species (9)	Status	Cover (%)	Height (m)
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		50	2
<i>Triodia wiseana</i>		15	0.4
<i>Triodia epactia</i>		15	0.3
* <i>Vachellia farnesiana</i>	Weed	0.1	1.2
<i>Chrysopogon fallax</i>		0.1	1
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>		0.1	0.8
* <i>Cenchrus ciliaris</i>	Weed	0.1	0.3
<i>Streptoglossa bubakii</i>		0.1	0.15
<i>Sporobolus australasicus</i>		0.1	0.1



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB05r	Position (WGS84)	-20.790786, 117.730487
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Low to mid open shrubland of <i>Acacia ancistrocarpa</i> and <i>Acacia inaequilatera</i> over a hummock grassland of <i>Triodia epactia</i> and <i>Triodia wiseana</i> .		
Habitat	shrubland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	70	Tree cover (%)	25
Shrub cover (%)	5	Grass cover (%)	60
Herb cover (%)	1		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Species (14)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		40	0.4
<i>Acacia ancistrocarpa</i>		20	2.1
<i>Triodia wiseana</i>		20	0.4
<i>Acacia inaequilatera</i>		2.5	3
* <i>Malvastrum americanum</i>	Weed	0.1	0.3
<i>Indigofera monophylla</i>		0.1	0.3
<i>Senna notabilis</i>		0.1	0.2
<i>Solanum diversiflorum</i>		0.1	0.2
<i>Solanum horridum</i>		0.1	0.2
<i>Triumfetta clementii</i>		0.1	0.2
<i>Bonamia erecta</i>		0.1	0.15
<i>Euphorbia australis</i>		0.1	0.1
<i>Cucumis variabilis</i>		0.1	0.1
<i>Sida fibulifera</i>		0.1	0.1

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Site details			
Site	BB06r	Position (WGS84)	-20.792181, 117.736333
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Isolated low shrubs of <i>Acacia bivenosa</i> over isolated plants of <i>Rhynchosia minima</i> and <i>Streptoglossa bubakii</i> over a low open tussock grassland of <i>Eragrostis xerophila</i> .		
Habitat	grassland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	55	Tree cover (%)	0
Shrub cover (%)	1	Grass cover (%)	55
Herb cover (%)	1		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Species (8)	Status	Cover (%)	Height (m)
<i>Eragrostis xerophila</i>		25	0.2
<i>Acacia bivenosa</i>		0.5	1.5
* <i>Vachellia farnesiana</i>	Weed	0.1	1.5
<i>Corchorus walcottii</i>		0.1	0.3
<i>Solanum lasiophyllum</i>		0.1	0.3
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.2
<i>Streptoglossa bubakii</i>		0.1	0.1
<i>Polymeria ambigua</i>		0.1	0.05

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB07r	Position (WGS84)	-20.785582, 117.740153
Slope	negligible	Topography	plain
Soil colour	red-orange	Soil texture	clay loam
Rock cover (%)	0	Rock type	quartz

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Low to mid open shrubland of <i>Acacia ancistrocarpa</i> , <i>Acacia inaequilatera</i> and <i>Acacia bivenosa</i> over a hummock grassland of <i>Triodia epactia</i> and <i>Triodia wiseana</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	55	Tree cover (%)	20
Shrub cover (%)	1	Grass cover (%)	50
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (10)	Status	Cover (%)	Height (m)
<i>Triodia wiseana</i>		30	0.3
<i>Acacia ancistrocarpa</i>		20	2.25
<i>Triodia epactia</i>		20	0.4
<i>Acacia inaequilatera</i>		1	3
<i>Acacia bivenosa</i>		0.5	1
<i>Pterocaulon sphacelatum</i>		0.1	0.3
<i>Euphorbia drummondii</i>		0.1	0.25
<i>Indigofera monophylla</i>		0.1	0.2
<i>Senna notabilis</i>		0.1	0.2
<i>Heliotropium muticum</i>	P3 (DBCA list)	0.1	0.15



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Prepared for Forge Resources Swan Pty Ltd**

Site details			
Site	BB08r	Position (WGS84)	-20.784946, 117.744676
Slope	gentle	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Mid open shrubland of <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> , <i>Acacia coriacea</i> subsp. <i>pendens</i> , and <i>Acacia inaequilatera</i> over open hummock grassland of <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	65	Tree cover (%)	10
Shrub cover (%)	30	Grass cover (%)	15
Herb cover (%)	1		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Prepared for Forge Resources Swan Pty Ltd**

Species (18)	Status	Cover (%)	Height (m)
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		25	3.5
<i>Triodia epactia</i>		15	0.4
<i>Hakea lorea</i> subsp. <i>lorea</i>		3	5
<i>Acacia inaequilatera</i>		2	4
<i>Acacia coriacea</i> subsp. <i>pendens</i>		2	3
* <i>Vachellia farnesiana</i>	Weed	1	3
<i>Acacia pyrifolia</i>		1	1.9
<i>Chrysopogon fallax</i>		0.1	1
<i>Carissa lanceolata</i>		0.1	1
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.3
* <i>Cenchrus ciliaris</i>	Weed	0.1	0.3
<i>Corchorus walcottii</i>		0.1	0.3
* <i>Malvastrum americanum</i>	Weed	0.1	0.2
<i>Pterocaulon sphacelatum</i>		0.1	0.2
<i>Cleome viscosa</i>		0.1	0.2
<i>Sporobolus australasicus</i>		0.1	0.1
<i>Euphorbia australis</i>		0.1	0.1
<i>Ipomoea muelleri</i>		0.1	0.1

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
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Site details			
Site	BB09r	Position (WGS84)	-20.783913, 117.744859
Slope	negligible	Topography	drainage line
Soil colour	red-brown	Soil texture	sand
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Woodland of <i>Eucalyptus victrix</i> over mid open shrubland of <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> , <i>Acacia coriacea</i> subsp. <i>pendens</i> , over open hummock grassland of <i>Triodia epactia</i> .		
Habitat	riparian zone		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	40	Tree cover (%)	1
Shrub cover (%)	25	Grass cover (%)	15
Herb cover (%)	0		



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (6)	Status	Cover (%)	Height (m)
<i>Eucalyptus victrix</i>		30	10
<i>Eragrostis xerophila</i>		15	0.4
<i>Triodia epactia</i>		2.5	0.4
<i>Acacia coriacea</i> subsp. <i>pendens</i>		2	3
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		0.2	1.2
<i>Chrysopogon fallax</i>		0.1	1.2

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Site details			
Site	BB10	Position (WGS84)	-20.79258, 117.726053
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Isolated plants of <i>Rhynchosia minima</i> and <i>Streptoglossa bubakii</i> over a low tussock grassland of <i>Eragrostis xerophila</i> .		
Habitat	grassland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	65	Tree cover (%)	0
Shrub cover (%)	0	Grass cover (%)	65
Herb cover (%)	0		



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (4)	Status	Cover (%)	Height (m)
<i>Eragrostis xerophila</i>		65	0.25
<i>Rhynchosia minima</i>		0.1	0.05
<i>Euphorbia biconvexa</i>		0.1	0.05
<i>Streptoglossa bubakii</i>		0.1	0.05



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
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Site details			
Site	BB11r	Position (WGS84)	-20.798257, 117.722606
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	sandy loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Mid open shrubland to shrubland of <i>Acacia stellaticeps</i> and <i>Acacia sclerophylla</i> subsp. <i>sclerophylla</i> over hummock grassland of <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	50	Tree cover (%)	0
Shrub cover (%)	8	Grass cover (%)	50
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Species (6)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		50	0.4
<i>Acacia stellaticeps</i>		5	0.9
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		1	1.8
<i>Chrysopogon fallax</i>		0.1	1
<i>Acacia synchronicia</i>		0.1	0.5
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.3

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
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Site details			
Site	BB12r	Position (WGS84)	-20.798674, 117.721056
Slope	gentle	Topography	drainage line
Soil colour	brown	Soil texture	loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Mid open woodland of <i>Corymbia hamersleyana</i> and <i>Eucalyptus victrix</i> and over tall shrubland of <i>Acacia trachycarpa</i> over mid isolated shrubs of <i>Carissa lanceolata</i> and <i>Cajanus cinereus</i> over sparse hummock grassland of <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	55	Tree cover (%)	40
Shrub cover (%)	5	Grass cover (%)	8
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (16)	Status	Cover (%)	Height (m)
<i>Acacia trachycarpa</i>		35	3
<i>Corymbia hamersleyana</i>		10	8
<i>Triodia epactia</i>		10	0.4
<i>Eucalyptus victrix</i>		2.5	10
<i>*Vachellia farnesiana</i>	Weed	0.5	1.75
<i>Acacia pyrifolia</i>		0.2	3
<i>Ehretia saligna</i> var. <i>saligna</i>		0.1	1
<i>Cajanus cinereus</i>		0.1	0.8
<i>Senna notabilis</i>		0.1	0.7
<i>Carissa lanceolata</i>		0.1	0.5
<i>Eriachne obtusa</i>		0.1	0.35
<i>Triumfetta ramosa</i>		0.1	0.3
<i>Waltheria indica</i>		0.1	0.25
<i>*Cenchrus ciliaris</i>	Weed	0.1	0.2
<i>Chrysopogon fallax</i>		0.1	0.2
<i>Bonamia pilbarensis</i>		0.1	0.05

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Site details			
Site	BB13r	Position (WGS84)	-20.787728, 117.720084
Slope	gentle	Topography	undulating plain
Soil colour	red-orange	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Mid shrubland of <i>Acacia stellaticeps</i> and <i>Acacia sclerosperma</i> subsp. <i>Sclerosperma</i> over hummock grassland of <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	60	Tree cover (%)	2
Shrub cover (%)	30	Grass cover (%)	40
Herb cover (%)	0		



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
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Species (5)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		40	0.3
<i>Acacia stellaticeps</i>		30	1
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		5	2
<i>Carissa lanceolata</i>		1	1
<i>Pluchea dentex</i>		0.1	0.15



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB14r	Position (WGS84)	-20.787888, 117.720783
Slope	gentle	Topography	drainage line
Soil colour	brown, whitish	Soil texture	sand
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Mid open woodland of <i>Corymbia hamersleyana</i> , <i>Eucalyptus victrix</i> over tall sparse shrubland to shrubland of <i>Acacia trachycarpa</i> , <i>A. pyrifolia</i> and <i>A. acradenia</i> over mid isolated shrubs of <i>Carissa lanceolata</i> and <i>Cajanus cinereus</i> over sparse hummock grassland of <i>Triodia epactia</i> .		
Habitat	riparian zone		
Disturbance	none		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	55	Tree cover (%)	40
Shrub cover (%)	10	Grass cover (%)	20
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
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Species (16)	Status	Cover (%)	Height (m)
<i>Corymbia hamersleyana</i>		15	8
<i>Acacia trachycarpa</i>		5	3.5
<i>Eucalyptus victrix</i>		2	10
<i>Triodia epactia</i>		2	0.4
<i>Carissa lanceolata</i>		1	1.75
<i>Acacia acradenia</i>		0.1	2
<i>Crotalaria cunninghamii</i>		0.1	1
<i>Chrysopogon fallax</i>		0.1	1
<i>Acacia pyrifolia</i>		0.1	0.4
<i>Heliotropium cunninghamii</i>		0.1	0.35
<i>Indigofera trita</i>		0.1	0.3
* <i>Cenchrus ciliaris</i>	Weed	0.1	0.25
<i>Phyllanthus maderaspatensis</i>		0.1	0.25
<i>Cajanus cinereus</i>		0.1	0.2
<i>Sporobolus australasicus</i>		0.1	0.15
<i>Euphorbia australis</i>		0.1	0.15

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
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Site details			
Site	BB15r	Position (WGS84)	-20.78806, 117.721
Slope	gentle	Topography	undulating plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	ferrous – ironstone, quartz

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Isolated trees of <i>Corymbia hamersleyana</i> over variably present isolated shrubs of <i>Acacia arida</i> , <i>Dolichandrone occidentalis</i> and <i>Acacia pyrifolia</i> over hummock grassland of <i>Triodia epactia</i> with isolated <i>Triodia wiseana</i> .		
Habitat	shrubland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	80	Tree cover (%)	15
Shrub cover (%)	30	Grass cover (%)	70
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (9)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		65	0.35
<i>Corymbia hamersleyana</i>		7	8
<i>Acacia arida</i>		5	2.5
<i>Dolichandrone occidentalis</i>		1	3
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>		1	1.5
<i>Triodia wiseana</i>		1	0.4
<i>Acacia pyriformis</i>		0.1	0.5
<i>Indigofera monophylla</i>		0.1	0.4
<i>Bonamia erecta</i>		0.1	0.2

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Site details			
Site	BB16r	Position (WGS84)	-20.788396, 117.722037
Slope	negligible	Topography	plain
Soil colour	brown	Soil texture	loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Mid sparse shrubland of <i>Acacia inaequilatera</i> , <i>A. sclerosperma</i> subsp. <i>sclerosperma</i> over isolated shrubs of <i>Corchorus walcottii</i> and <i>Gossypium australe</i> over hummock grassland of <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	70	Tree cover (%)	15
Shrub cover (%)	10	Grass cover (%)	65
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
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Species (12)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		65	0.4
<i>Acacia inaequilatera</i>		5	3
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		5	3
<i>Chrysopogon fallax</i>		1	1.3
<i>Acacia arida</i>		0.1	1.8
<i>Cucumis variabilis</i>		0.1	0.3
<i>Gossypium australe</i>		0.1	0.3
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>		0.1	0.25
<i>Corchorus walcottii</i>		0.1	0.2
<i>Pterocaulon sphacelatum</i>		0.1	0.1
<i>Rhynchosia minima</i>		0.1	0.1
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.05



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Site details			
Site	BB17r	Position (WGS84)	-20.841479, 117.752878
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	09-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (09 Oct 2019)			
Vegetation description	Isolated plants of <i>Rhynchosia minima</i> and <i>Streptoglossa bubakii</i> over a low tussock grassland of <i>Eragrostis xerophila</i> .		
Habitat	grassland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	58	Tree cover (%)	0
Shrub cover (%)	0	Grass cover (%)	58
Herb cover (%)	0		



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (4)	Status	Cover (%)	Height (m)
<i>Eragrostis xerophila</i>		55	0.25
<i>Sporobolus australasicus</i>		0.1	0.1
<i>Rhynchosia minima</i>		0.1	0.1
<i>Euphorbia biconvexa</i>		0.1	0.05

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB18	Position (WGS84)	-20.801925, 117.748054
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	10-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (10 Oct 2019)			
Vegetation description	Isolated plants of <i>Cleome viscosa</i> , <i>Rhynchosia minima</i> and <i>Streptoglossa bubakii</i> over a low tussock grassland of <i>Eragrostis xerophila</i> and <i>Dicanthium sericium</i> subsp. <i>humilius</i> .		
Habitat	grassland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	50	Tree cover (%)	0
Shrub cover (%)	0	Grass cover (%)	50
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (8)	Status	Cover (%)	Height (m)
<i>Eragrostis xerophila</i>		50	0.25
<i>Dichanthium sericeum</i> subsp. <i>humilius</i>		5	0.05
<i>Cleome viscosa</i>		0.1	0.2
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.15
<i>Corchorus walcottii</i>		0.1	0.1
<i>Sporobolus australasicus</i>		0.1	0.05
<i>Rhynchosia minima</i>		0.1	0.05
<i>Streptoglossa bubakii</i>		0.1	0.05

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB19	Position (WGS84)	-20.788414, 117.751056
Slope	gentle	Topography	drainage line
Soil colour	red-brown	Soil texture	sandy loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	10-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (10 Oct 2019)			
Vegetation description	Mid open woodland of <i>Eucalyptus victrix</i> and <i>Corymbia hamersleyana</i> , over mid open shrubland of <i>Acacia coriacea</i> subsp. <i>pendens</i> , <i>Acacia pyrifolia</i> and <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> over hummock grassland of <i>Triodia epactia</i> and scattered tussocks of <i>*Cenchrus ciliaris</i> .		
Habitat	riparian zone		
Disturbance	grazing – low		
Vegetation condition	Very Good	Fire age	not evident
Total veg. cover (%)	65	Tree cover (%)	30
Shrub cover (%)	20	Grass cover (%)	40
Herb cover (%)	1		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (29)	Status	Cover (%)	Height (m)
<i>Eucalyptus victrix</i>		15	12
<i>Acacia coriacea</i> subsp. <i>pendens</i>		10	10
* <i>Cenchrus ciliaris</i>	Weed	7.5	0.1
<i>Corymbia hamersleyana</i>		5	8
<i>Carissa lanceolata</i>		5	3.25
<i>Triodia epactia</i>		5	0.4
<i>Acacia inaequilatera</i>		1	3.5
<i>Acacia pyrifolia</i>		1	2.5
* <i>Vachellia farnesiana</i>	Weed	0.1	2.5
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		0.1	2
<i>Chrysopogon fallax</i>		0.1	1.2
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		0.1	1.2
<i>Acacia tumida</i> var. <i>tumida</i>		0.1	1
<i>Enteropogon ramosus</i>		0.1	1
<i>Ehretia saligna</i> var. <i>saligna</i>		0.1	0.5
<i>Cucumis variabilis</i>		0.1	0.5
<i>Cullen leucochaites</i>		0.1	0.4
<i>Eriachne obtusa</i>		0.1	0.4
<i>Pterocaulon sphacelatum</i>		0.1	0.3
* <i>Malvastrum americanum</i>	Weed	0.1	0.3
<i>Cleome viscosa</i>		0.1	0.3
<i>Cullen leucanthum</i>		0.1	0.3
<i>Senna notabilis</i>		0.1	0.2
<i>Euphorbia biconvexa</i>		0.1	0.2
<i>Phyllanthus maderaspatensis</i>		0.1	0.15
<i>Euphorbia australis</i>		0.1	0.15
<i>Rostellularia adscendens</i> var. <i>clementii</i>		0.1	0.1
* <i>Trianthema portulacastrum</i>	Weed	0.1	0.05
<i>Streptoglossa bubakii</i>		0.1	0.05



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Site details			
Site	BB20	Position (WGS84)	-20.788645, 117.750894
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	sandy loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	10-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (10 Oct 2019)			
Vegetation description	Mid shrubland of <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> , <i>Acacia coriacea</i> subsp. <i>pendens</i> and <i>Hakea lorea</i> subsp. <i>lorea</i> over low isolated <i>Carissa lanceolata</i> and <i>Pterocaulon sphacelatum</i> shrubs over hummock grassland of <i>Triodia epactia</i> and scattered tussocks of <i>*Cenchrus ciliaris</i> .		
Habitat	shrubland		
Disturbance	none		
Vegetation condition	Very Good	Fire age	not evident
Total veg. cover (%)	60	Tree cover (%)	30
Shrub cover (%)	30	Grass cover (%)	2
Herb cover (%)	5		



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Species (18)	Status	Cover (%)	Height (m)
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		35	4
<i>Acacia coriacea</i> subsp. <i>pendens</i>		2.5	7
<i>Hakea lorea</i> subsp. <i>lorea</i>		2	4
<i>Carissa lanceolata</i>		2	3.5
<i>Acacia pyrifolia</i>		2	2
<i>Pterocaulon sphacelatum</i>		2	0.3
* <i>Cenchrus ciliaris</i>	Weed	2	0.2
<i>Triodia epactia</i>		0.5	0.4
* <i>Vachellia farnesiana</i>	Weed	0.1	1
<i>Cucumis variabilis</i>		0.1	0.4
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>		0.1	0.3
<i>Corchorus walcottii</i>		0.1	0.3
<i>Senna notabilis</i>		0.1	0.3
* <i>Malvastrum americanum</i>	Weed	0.1	0.3
<i>Cleome viscosa</i>		0.1	0.2
<i>Streptoglossa bubakii</i>		0.1	0.2
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>		0.1	0.1
<i>Sporobolus australasicus</i>		0.1	0.05

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Site details			
Site	BB21r	Position (WGS84)	-20.805505, 117.738037
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	quartz

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	10-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (10 Oct 2019)			
Vegetation description	Mid sparse shrubland of <i>Acacia inaequilatera</i> and <i>Acacia synchronicia</i> over isolated shrubs of <i>Corchorus walcottii</i> , <i>Senna notabilis</i> and <i>Solanum lasiophyllum</i> over a hummock grassland of <i>Triodia epactia</i> with sparse <i>Triodia wiseana</i> .		
Habitat	spinifex grassland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	65	Tree cover (%)	0
Shrub cover (%)	1	Grass cover (%)	65
Herb cover (%)	0		



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Species (22)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		60	0.4
<i>Triodia wiseana</i>		5	0.4
<i>Carissa lanceolata</i>		0.5	1.25
<i>Acacia inaequilatera</i>		0.3	2.5
* <i>Vachellia farnesiana</i>	Weed	0.3	1.25
<i>Acacia synchronicia</i>		0.3	1.2
<i>Hakea lorea</i> subsp. <i>lorea</i>		0.1	2
<i>Euphorbia biconvexa</i>		0.1	2
<i>Cucumis variabilis</i>		0.1	0.5
<i>Solanum lasiophyllum</i>		0.1	0.3
<i>Pterocaulon sphacelatum</i>		0.1	0.3
<i>Triumfetta maconochieana</i>		0.1	0.3
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.3
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>		0.1	0.25
<i>Corchorus walcottii</i>		0.1	0.25
<i>Senna notabilis</i>		0.1	0.2
<i>Tephrosia densa</i>		0.1	0.2
<i>Alysicarpus muelleri</i>		0.1	0.2
<i>Euphorbia australis</i>		0.1	0.1
<i>Sporobolus australasicus</i>		0.1	0.1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>		0.1	0.05
<i>Polymeria ambigua</i>		0.1	0.05

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Site details			
Site	BB22r	Position (WGS84)	-20.812046, 117.735478
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	10-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (10 Oct 2019)			
Vegetation description	Isolated shrubs of <i>Acacia synchronica</i> and <i>Acacia pyrifolia</i> over a hummock grassland of <i>Triodia epactia</i> .		
Habitat	spinifex grassland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	50	Tree cover (%)	0
Shrub cover (%)	2	Grass cover (%)	50
Herb cover (%)	0		



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Species (10)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		50	0.4
<i>Acacia synchronicia</i>		0.3	1.2
<i>Acacia pyrifolia</i>		0.3	1
<i>Eragrostis xerophila</i>		0.1	0.2
<i>Ptilotus helipteroides</i>		0.1	0.2
<i>Ptilotus aervoides</i>		0.1	0.2
<i>Dichanthium sericeum</i> subsp. <i>humilius</i>		0.1	0.1
<i>Sporobolus australasicus</i>		0.1	0.1
<i>Streptoglossa bubakii</i>		0.1	0.1
<i>Ptilotus murrayi</i>		0.1	0.03



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Site details			
Site	BB23	Position (WGS84)	-20.813888, 117.747957
Slope	negligible	Topography	plain
Soil colour	red-orange	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	10-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (10 Oct 2019)			
Vegetation description	Low to mid open shrubland of <i>Acacia ancistrocarpa</i> , <i>Acacia inaequilatera</i> over a hummock grassland of <i>Triodia epactia</i> , <i>Triodia wiseana</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	70	Tree cover (%)	15
Shrub cover (%)	10	Grass cover (%)	60
Herb cover (%)	0		



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Species (17)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		40	0.4
<i>Triodia wiseana</i>		20	0.4
<i>Acacia ancistrocarpa</i>		15	2.5
<i>Acacia inaequilatera</i>		5	4
* <i>Vachellia farnesiana</i>	Weed	0.1	1.25
<i>Acacia bivenosa</i>		0.1	1
<i>Acacia pyrifolia</i>		0.1	1
<i>Solanum lasiophyllum</i>		0.1	0.4
<i>Corchorus walcottii</i>		0.1	0.3
<i>Heliotropium muticum</i>	P3 (DBCA list)	0.1	0.2
* <i>Trianthema portulacastrum</i>	Weed	0.1	0.15
<i>Sporobolus australasicus</i>		0.1	0.1
<i>Bonamia erecta</i>		0.1	0.1
<i>Euphorbia australis</i>		0.1	0.1
<i>Streptoglossa bubakii</i>		0.1	0.1
<i>Rhynchosia minima</i>		0.1	0.05
<i>Pterocaulon sphacelatum</i>		0.1	0.05

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Site details			
Site	BB24	Position (WGS84)	-20.823779, 117.742945
Slope	negligible	Topography	drainage line
Soil colour	red-brown	Soil texture	sand, sandy loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	10-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (10 Oct 2019)			
Vegetation description	Low sparse woodland of <i>Corymbia candida</i> subsp. <i>dipsodes</i> , over mid sparse shrubland of <i>Acacia coriacea</i> subsp. <i>pendens</i> and <i>Acacia bivenosa</i> over sparse hummock grassland of <i>Triodia epactia</i> with * <i>Cenchrus ciliaris</i> .		
Habitat	riparian zone		
Disturbance	grazing – medium		
Vegetation condition	Very Good	Fire age	not recorded
Total veg. cover (%)	30	Tree cover (%)	15
Shrub cover (%)	2	Grass cover (%)	15
Herb cover (%)	0		



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Species (12)	Status	Cover (%)	Height (m)
<i>Corymbia candida</i> subsp. <i>dipsodes</i>		10	5
<i>Triodia epactia</i>		10	0.4
<i>Acacia coriacea</i> subsp. <i>pendens</i>		2.5	6
<i>Acacia bivenosa</i>		2.5	2
* <i>Cenchrus ciliaris</i>	Weed	2.5	0.25
<i>Hakea lorea</i> subsp. <i>lorea</i>		1	2.5
<i>Acacia synchronicia</i>		0.1	1.2
<i>Acacia colei</i> var. <i>colei</i>		0.1	1
<i>Solanum lasiophyllum</i>		0.1	0.3
<i>Streptoglossa bubakii</i>		0.1	0.3
<i>Pluchea dentex</i>		0.1	0.15
<i>Bonamia pilbarensis</i>		0.1	0.05

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Site details			
Site	BB25	Position (WGS84)	-20.822704, 117.749609
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	10-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (10 Oct 2019)			
Vegetation description	Low to mid open shrubland of <i>Acacia ancistrocarpa</i> and <i>Acacia inaequilatera</i> over a hummock grassland of <i>Triodia epactia</i> and <i>Triodia wiseana</i> .		
Habitat	shrubland		
Disturbance	grazing – low, vehicle tracks		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	70	Tree cover (%)	1
Shrub cover (%)	15	Grass cover (%)	65
Herb cover (%)	0		



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Species (12)	Status	Cover (%)	Height (m)
<i>Triodia wiseana</i>		40	0.4
<i>Triodia epactia</i>		20	0.4
<i>Acacia ancistrocarpa</i>		10	1.9
<i>Acacia inaequilatera</i>		5	3
<i>Cucumis variabilis</i>		0.1	1.2
<i>Acacia pyrifolia</i>		0.1	1
<i>Indigofera monophylla</i>		0.1	0.4
<i>Cleome viscosa</i>		0.1	0.2
<i>Corchorus walcottii</i>		0.1	0.2
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>		0.1	0.05
<i>Euphorbia biconvexa</i>		0.1	0.05
<i>Sporobolus australasicus</i>		0.1	0.05



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Site details			
Site	BB26	Position (WGS84)	-20.835511, 117.743001
Slope	gentle	Topography	drainage line
Soil colour	red-brown	Soil texture	clay loam,
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	10-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (10 Oct 2019)	
Vegetation description	Low sparse woodland of <i>Corymbia candida</i> subsp. <i>dipsodes</i> over mid sparse shrubland of <i>Acacia pyrifolia</i> and <i>Acacia inaequilatera</i> over isolated shrubs of <i>Carissa lanceolata</i> , <i>Indigofera monophylla</i> and <i>Neptunia dimorphantha</i> over a hummock grassland of <i>Triodia epactia</i> and open tussock grassland of <i>Eragrostis xerophila</i> .

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<b>Habitat</b>	riparian zone		
<b>Disturbance</b>	grazing – low		
<b>Vegetation condition</b>	Excellent	<b>Fire age</b>	not evident
<b>Total veg. cover (%)</b>	60	<b>Tree cover (%)</b>	15
<b>Shrub cover (%)</b>	20	<b>Grass cover (%)</b>	50
<b>Herb cover (%)</b>	0		



Species (22)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		40	0.4
<i>Eragrostis xerophila</i>		15	0.4
<i>Acacia pyrifolia</i>		5	1.8
<i>Corymbia candida</i> subsp. <i>dipsodes</i>		3.5	8
<i>Acacia inaequilatera</i>		2.5	3
<i>Acacia ancistrocarpa</i>		1	2
<i>Carissa lanceolata</i>		0.1	1.7
<i>Acacia bivenosa</i>		0.1	1.5
<i>Chrysopogon fallax</i>		0.1	1
<i>Panicum decompositum</i>		0.1	0.7
<i>Acacia colei</i> var. <i>colei</i>		0.1	0.4
<i>Eriachne obtusa</i>		0.1	0.4
<i>Indigofera monophylla</i>		0.1	0.3

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<i>Pterocaulon sphacelatum</i>		0.1	0.2
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.15
<i>Cullen</i> sp.		0.1	0.15
<i>Cucumis variabilis</i>		0.1	0.15
<i>Ipomoea muelleri</i>		0.1	0.15
<i>Euphorbia biconvexa</i>		0.1	0.1
<i>Sporobolus australasicus</i>		0.1	0.1
<i>Streptoglossa bubakii</i>		0.1	0.1
<i>Neptunia dimorphantha</i>		0.1	0.05

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Site details			
Site	BB27	Position (WGS84)	-20.835307, 117.744305
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	granite rocks

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	10-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (10 Oct 2019)			
Vegetation description	Isolated shrubs <i>Acacia synchronica</i> and <i>Acacia pyrifolia</i> over a hummock grassland of <i>Triodia epactia</i> .		
Habitat	spinifex grassland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	60	Tree cover (%)	0
Shrub cover (%)	1	Grass cover (%)	60
Herb cover (%)	0		



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Species (15)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		60	0.4
<i>Hakea lorea</i> subsp. <i>lorea</i>		0.3	2
<i>Acacia pyrifolia</i>		0.3	1.8
<i>Acacia synchronicia</i>		0.3	1.6
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>		0.1	0.4
<i>Eragrostis xerophila</i>		0.1	0.3
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.2
<i>Senna notabilis</i>		0.1	0.2
<i>Alysicarpus muelleri</i>		0.1	0.15
<i>Streptoglossa bubakii</i>		0.1	0.15
<i>Sporobolus australasicus</i>		0.1	0.1
<i>Neptunia dimorphantha</i>		0.1	0.1
<i>Dichanthium sericeum</i> subsp. <i>humilius</i>		0.1	0.05
<i>Rhynchosia minima</i>		0.1	0.05
<i>Indigofera trita</i>		0.1	0.05

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Site details			
Site	BB28r	Position (WGS84)	-20.808796, 117.725768
Slope	gentle	Topography	drainage line
Soil colour	red-orange, brown	Soil texture	sand
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	11-Oct-2019	unbound	David Leach

Observation details - visit 1 (11 Oct 2019)			
Vegetation description	Mid open woodland of <i>Eucalyptus victrix</i> over tall open shrubland of <i>Acacia trachycarpa</i> over low isolated shrubs of <i>Corchorus tectus</i> , <i>Crotalaria cunninghamii</i> and <i>Senna notabilis</i> over open hummock grassland of <i>Triodia epactia</i> with * <i>Cenchrus ciliaris</i> .		
Habitat	riparian zone		
Disturbance	none		
Vegetation condition	Very Good	Fire age	not evident
Total veg. cover (%)	40	Tree cover (%)	30
Shrub cover (%)	5	Grass cover (%)	10
Herb cover (%)	0		





**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (24)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		10	0.3
<i>Eucalyptus victrix</i>		7.5	10
<i>Acacia trachycarpa</i>		7.5	4
* <i>Cenchrus ciliaris</i>	Weed	5	0.2
<i>Carissa lanceolata</i>		0.1	1
<i>Crotalaria cunninghamii</i>		0.1	0.4
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.3
<i>Triumfetta clementii</i>		0.1	0.3
<i>Waltheria indica</i>		0.1	0.3
<i>Corchorus tectus</i>		0.1	0.3
<i>Senna notabilis</i>		0.1	0.2
<i>Pterocaulon sphacelatum</i>		0.1	0.2
<i>Cajanus cinereus</i>		0.1	0.2
<i>Hybanthus aurantiacus</i>		0.1	0.2
<i>Cleome viscosa</i>		0.1	0.2
<i>Indigofera monophylla</i>		0.1	0.15
<i>Cucumis variabilis</i>		0.1	0.15
<i>Euphorbia australis</i>		0.1	0.15
<i>Pluchea dentex</i>		0.1	0.15
<i>Sporobolus australasicus</i>		0.1	0.1
<i>Dysphania rhadinostachya</i>		0.1	0.1
<i>Bonamia pilbarensis</i>		0.1	0.1
<i>Boerhavia gardneri</i>		0.1	0.05
<i>Euphorbia biconvexa</i>		0.1	0.05

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB29r	Position (WGS84)	-20.808905, 117.724565
Slope	gentle	Topography	undulating plain
Soil colour	red-brown	Soil texture	loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	11-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (11 Oct 2019)			
Vegetation description	Mid to tall open shrubland of <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> , <i>Acacia arida</i> and <i>Acacia stellaticeps</i> over a hummock grassland of <i>Triodia wiseana</i> and <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	65	Tree cover (%)	10
Shrub cover (%)	20	Grass cover (%)	55
Herb cover (%)	0		



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (13)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		30	0.35
<i>Triodia wiseana</i>		30	0.3
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		15	2.5
<i>Acacia arida</i>		5	2.5
<i>Acacia stellaticeps</i>		2	0.6
<i>Corymbia hamersleyana</i>		0.1	4
<i>Carissa lanceolata</i>		0.1	1
<i>Cassutha racemosa</i>		0.1	0.4
<i>Corchorus tectus</i>		0.1	0.3
<i>Goodenia microptera</i>		0.1	0.3
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.2
<i>Streptoglossa bubakii</i>		0.1	0.15
<i>Tephrosia densa</i>		0.1	0.1

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB30r	Position (WGS84)	-20.808292, 117.72715
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	sandy loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	11-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (11 Oct 2019)			
Vegetation description	Isolated trees of <i>Corymbia hamersleyana</i> over variably present isolated shrubs of <i>Acacia arida</i> , <i>Acacia pyrifolia</i> and <i>Acacia tumida</i> var. <i>tumida</i> over hummock grassland of <i>Triodia epactia</i> and <i>Triodia wiseana</i> .		
Habitat	spinifex grassland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	50	Tree cover (%)	0
Shrub cover (%)	1	Grass cover (%)	50
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Prepared for Forge Resources Swan Pty Ltd**

Species (9)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		35	0.4
<i>Triodia wiseana</i>		15	0.4
<i>Acacia arida</i>		0.3	1.75
<i>Corymbia hamersleyana</i>		0.1	4
<i>Acacia tumida</i> var. <i>tumida</i>		0.1	1
<i>Acacia pyriformis</i>		0.1	0.4
<i>Scaevola spinescens</i>		0.1	0.4
<i>Indigofera monophylla</i>		0.1	0.2
<i>Streptoglossa bubakii</i>		0.1	0.15

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB31r	Position (WGS84)	,
Slope	negligible	Topography	drainage line
Soil colour	red-orange, yellow	Soil texture	sand
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Quadrat	1	11-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (11 Oct 2019)			
Vegetation description	Isolated trees of <i>Corymbia candida</i> subsp. <i>dipsodes</i> over isolated shrubs of <i>Acacia trachycarpa</i> and <i>Acacia coriacea</i> subsp. <i>pendens</i> over isolated hummock grasses of <i>Triodia epactia</i> and isolated * <i>Cenchrus ciliaris</i> .		
Habitat	riparian zone		
Disturbance	grazing - low, vehicle tracks		
Vegetation condition	Very Good	Fire age	moderate (>5 years)
Total veg. cover (%)	30	Tree cover (%)	30
Shrub cover (%)	22	Grass cover (%)	5
Herb cover (%)	0		





**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (15)	Status	Cover (%)	Height (m)
<i>Acacia trachycarpa</i>		10	1.25
<i>Triodia epactia</i>		5	0.4
<i>Corymbia candida</i> subsp. <i>dipsodes</i>		4	4
<i>Acacia coriacea</i> subsp. <i>pendens</i>		2.5	3
* <i>Cenchrus ciliaris</i>	Weed	1	0.45
<i>Acacia bivenosa</i> x <i>sclerosperma</i> subsp. <i>sclerosperma</i>		0.3	1
<i>Chrysopogon fallax</i>		0.1	0.75
<i>Carissa lanceolata</i>		0.1	0.6
<i>Senna notabilis</i>		0.1	0.4
<i>Hybanthus aurantiacus</i>		0.1	0.3
<i>Streptoglossa bubakii</i>		0.1	0.25
<i>Corchorus walcottii</i>		0.1	0.2
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>		0.1	0.15
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.1
<i>Sporobolus australasicus</i>		0.1	0.1

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Site details			
Site	BB32r	Position (WGS84)	-20.817002, 117.734867
Slope	moderate	Topography	hill top
Soil colour	red-orange	Soil texture	loam
Rock cover (%)	0	Rock type	quartz;

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	11-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (11 Oct 2019)			
Vegetation description	Low to mid open shrubland of <i>Acacia bivenosa</i> and <i>Acacia ancistrocarpa</i> over open hummock grassland of <i>Triodia wiseana</i> and <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	0	Tree cover (%)	0
Shrub cover (%)	10	Grass cover (%)	20
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (17)	Status	Cover (%)	Height (m)
<i>Triodia wiseana</i>		10	0.3
<i>Acacia ancistrocarpa</i>		5	1.2
<i>Acacia bivenosa</i>		5	1
<i>Triodia epactia</i>		5	0.3
<i>Triodia wiseana</i>		5	0.3
<i>Eriachne mucronata</i>		1	0.3
<i>Acacia inaequilatera</i>		0.3	1
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>		0.1	1.4
<i>Acacia pyrifolia</i>		0.1	1
<i>Hakea lorea</i> subsp. <i>lorea</i>		0.1	1
<i>Carissa lanceolata</i>		0.1	0.6
<i>Ptilotus clementii</i>		0.1	0.4
<i>Bonamia erecta</i>		0.1	0.3
<i>Indigofera monophylla</i>		0.1	0.3
<i>Streptoglossa bubakii</i>		0.1	0.2
<i>Triumfetta maconochieana</i>		0.1	0.15
<i>Hybanthus aurantiacus</i>		0.1	0.01

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Site details			
Site	BB33r	Position (WGS84)	-20.818682, 117.730194
Slope	gentle	Topography	undulating plain
Soil colour	red-brown	Soil texture	sandy loam
Rock cover (%)	0	Rock type	quartz;

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	11-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (11 Oct 2019)			
Vegetation description	Mid isolated trees of <i>Corymbia hamersleyana</i> over mid open shrubland of <i>Acacia inaequilatera</i> over isolated shrubs of <i>Corchorus tectus</i> , <i>Corchorus walcottii</i> and <i>Triumfetta clementii</i> over a hummock grassland of <i>Triodia epectia</i> and <i>Triodia wiseana</i> .		
Habitat	open woodland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	62	Tree cover (%)	10
Shrub cover (%)	2	Grass cover (%)	60
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (12)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		55	0.4
<i>Acacia inaequilatera</i>		6	3.75
<i>Corymbia hamersleyana</i>		3	5
<i>Triodia wiseana</i>		2.5	0.3
<i>Ptilotus clementii</i>		0.1	0.4
<i>Corchorus tectus</i>		0.1	0.4
<i>Corchorus walcottii</i>		0.1	0.4
<i>Solanum lasiophyllum</i>		0.1	0.35
<i>Euphorbia australis</i>		0.1	0.1
<i>Triumfetta clementii</i>		0.1	0.05
<i>Triumfetta maconochieana</i>		0.1	0.05
<i>Tribulus hirsutus</i>		0.1	0.05

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB34r	Position (WGS84)	-20.819151, 117.729598
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	11-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (11 Oct 2019)			
Vegetation description	Low to mid isolated shrubs of <i>Acacia inaequilatera</i> , <i>Acacia pyrifolia</i> and <i>Acacia ancistrocarpa</i> over an open hummock grassland to hummock grassland of <i>Triodia wiseana</i> and isolated <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	60	Tree cover (%)	4
Shrub cover (%)	6	Grass cover (%)	60
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Prepared for Forge Resources Swan Pty Ltd**

Species (12)	Status	Cover (%)	Height (m)
<i>Triodia wiseana</i>		55	0.4
<i>Triodia epactia</i>		5	0.4
<i>Acacia inaequilatera</i>		3	3
<i>Acacia ancistrocarpa</i>		2	3
<i>Acacia pyrifolia</i>		2	1
<i>Acacia bivenosa</i>		0.1	1.2
<i>Indigofera monophylla</i>		0.1	0.4
<i>Hybanthus aurantiacus</i>		0.1	0.3
<i>Goodenia microptera</i>		0.1	0.25
<i>*Trianthema portulacastrum</i>	Weed	0.1	0.2
<i>Streptoglossa bubakii</i>		0.1	0.15
<i>Euphorbia australis</i>		0.1	0



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Site details			
Site	BB35r	Position (WGS84)	-20.830914, 117.731066
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	11-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (11 Oct 2019)			
Vegetation description	Mid isolated shrubs of <i>Acacia inaequilatera</i> and <i>Acacia bivenosa</i> over hummock grassland of <i>Triodia epactia</i> and <i>Triodia wiseana</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	50	Tree cover (%)	3
Shrub cover (%)	5	Grass cover (%)	50
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (11)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		35	0.3
<i>Triodia wiseana</i>		15	0.3
<i>Acacia inaequilatera</i>		3	3
<i>Acacia bivenosa</i>		2	1.5
<i>Indigofera monophylla</i>		1	0.3
<i>Acacia synchronicia</i>		0.1	3
<i>Hakea lorea</i> subsp. <i>lorea</i>		0.1	1.75
<i>Hybanthus aurantiacus</i>		0.1	0.4
* <i>Trianthema portulacastrum</i>	Weed	0.1	0.2
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.15
<i>Streptoglossa bubakii</i>		0.1	0.1

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Site details			
Site	BB36r	Position (WGS84)	-20.847659, 117.73642
Slope	negligible	Topography	plain
Soil colour	red-orange	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	11-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (11 Oct 2019)			
Vegetation description	Mid to tall open shrubland to shrubland of <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> , <i>Acacia stellaticeps</i> and <i>Acacia arida</i> over closed hummock grassland of <i>Triodia wiseana</i> and <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	62	Tree cover (%)	2
Shrub cover (%)	4	Grass cover (%)	60
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (22)	Status	Cover (%)	Height (m)
<i>Triodia wiseana</i>		60	0.4
<i>Triodia epactia</i>		20	0.4
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		10	2.5
<i>Acacia stellaticeps</i>		5	0.6
<i>Acacia arida</i>		2	2.2
<i>Acacia ancistrocarpa</i>		0.5	2
<i>Acacia pyriformis</i>		0.5	1.75
<i>Acacia synchronicia</i>		0.1	2
<i>Grevillea pyramidalis</i> subsp. <i>pyramidalis</i>		0.1	1
<i>Euphorbia biconvexa</i>		0.1	0.3
<i>Goodenia microptera</i>		0.1	0.25
<i>Corchorus walcottii</i>		0.1	0.2
<i>Heliotropium cunninghamii</i>		0.1	0.2
<i>Triumfetta maconochieana</i>		0.1	0.2
<i>Heliotropium muticum</i>	P3 (DBCA list)	0.1	0.2
* <i>Cenchrus ciliaris</i>	Weed	0.1	0.15
<i>Polygala isingii</i>		0.1	0.15
<i>Streptoglossa bubakii</i>		0.1	0.15
<i>Euphorbia australis</i>		0.1	0.1
<i>Pluchea dentex</i>		0.1	0.1
<i>Sporobolus australasicus</i>		0.1	0.05
<i>Eragrostis</i> sp. kinked grass		0.1	0.05

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB37r	Position (WGS84)	-20.860064, 117.735582
Slope	gentle	Topography	drainage line
Soil colour	red-brown, whitish	Soil texture	sand
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	11-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (11 Oct 2019)			
Vegetation description	Isolated shrubs of <i>Acacia tumida</i> var. <i>tumida</i> and <i>Acacia pyrifolia</i> over an open hummock grassland of <i>Triodia epactia</i> .		
Habitat	riparian zone		
Disturbance	grazing – low		
Vegetation condition	Very Good	Fire age	not evident
Total veg. cover (%)	35	Tree cover (%)	8
Shrub cover (%)	7	Grass cover (%)	20
Herb cover (%)	0		



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (10)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		10	0.4
<i>Triodia epactia</i>		10	0.35
* <i>Vachellia farnesiana</i>	Weed	0.1	1.5
<i>Acacia tumida</i> var. <i>tumida</i>		0.1	1.5
<i>Chrysopogon fallax</i>		0.1	1
<i>Acacia pyrifolia</i>		0.1	0.8
<i>Sesbania cannabina</i>		0.1	0.4
<i>Eriachne obtusa</i>		0.1	0.4
<i>Indigofera</i> sp.		0.1	0.3
<i>Eragrostis cumingii</i>		0.1	0.1

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd

Site details			
Site	BB38r	Position (WGS84)	-20.872675, 117.753226
Slope	gentle	Topography	undulating plain
Soil colour	red-brown	Soil texture	loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	11-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (11 Oct 2019)			
Vegetation description	Low to mid sparse shrubland of <i>Acacia bivenosa</i> , <i>Acacia pyrifolia</i> and <i>Acacia ancistrocarpa</i> over a hummock grassland of <i>Triodia wiseana</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not recorded
Total veg. cover (%)	65	Tree cover (%)	0
Shrub cover (%)	5	Grass cover (%)	65
Herb cover (%)	0		





**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (14)	Status	Cover (%)	Height (m)
<i>Triodia wiseana</i>		65	0.4
<i>Acacia ancistrocarpa</i>		1	1.5
<i>Acacia pyrifolia</i>		1	1.4
<i>Acacia bivenosa</i>		1	1.25
<i>Hakea lorea</i> subsp. <i>lorea</i>		0.3	1.85
<i>Heliotropium cunninghamii</i>		0.1	0.2
<i>Corchorus tectus</i>		0.1	0.2
<i>Goodenia microptera</i>		0.1	0.2
<i>Aristida contorta</i>		0.1	0.15
<i>Euphorbia biconvexa</i>		0.1	0.15
<i>Heliotropium muticum</i>	P3 (DBCA list)	0.1	0.15
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>		0.1	0.05
<i>Sporobolus australasicus</i>		0.1	0.05
<i>Euphorbia australis</i>		0.1	0.05

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project  
Prepared for Forge Resources Swan Pty Ltd**

Site details			
Site	BB39r	Position (WGS84)	-20.875939, 117.742448
Slope	negligible	Topography	undulating plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	11-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (11 Oct 2019)			
Vegetation description	Mid isolated shrubs of <i>Acacia pyrifolia</i> , <i>Acacia synchronicia</i> and <i>Acacia bivenosa</i> over hummock grassland of <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	grazing – low,		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	60	Tree cover (%)	0
Shrub cover (%)	12	Grass cover (%)	60
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (17)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		40	0.4
<i>Triodia wiseana</i>		20	0.4
<i>Acacia pyrifolia</i>		4	2.25
<i>Acacia synchronicia</i>		1	1.9
<i>Acacia bivenosa</i>		1	1.25
<i>Hakea lorea</i> subsp. <i>lorea</i>		0.5	1.25
<i>Sida clementii</i>		0.1	1
<i>Corchorus tectus</i>		0.1	0.4
<i>Goodenia microptera</i>		0.1	0.4
<i>Indigofera monophylla</i>		0.1	0.3
<i>Ptilotus astrolasius</i>		0.1	0.3
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.2
<i>Senna notabilis</i>		0.1	0.2
<i>Bonamia erecta</i>		0.1	0.15
<i>Trigastrotheca molluginea</i>		0.1	0.05
<i>Euphorbia australis</i>		0.1	0.05
<i>Sporobolus australasicus</i>		0.1	0.05

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Site details			
Site	BB40r	Position (WGS84)	-20.7823, 117.706522
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	12-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (12 Oct 2019)			
Vegetation description	Mid open shrubland of <i>Acacia inaequilatera</i> over isolated shrubs of <i>Carissa lanceolata</i> , <i>Corchorus walcottii</i> and <i>Solanum lasiophyllum</i> over an open hummock grassland of <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	grazing – low,		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	50	Tree cover (%)	10
Shrub cover (%)	2	Grass cover (%)	50
Herb cover (%)	0		



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Species (17)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		25	0.4
<i>Eragrostis xerophila</i>		25	0.4
<i>Acacia inaequilatera</i>		10	2.5
<i>Carissa lanceolata</i>		0.1	2
<i>Hakea lorea</i> subsp. <i>lorea</i>		0.1	1.7
<i>Cleome viscosa</i>		0.1	0.3
<i>Triumfetta maconochieana</i>		0.1	0.25
<i>Corchorus walcottii</i>		0.1	0.25
<i>Solanum lasiophyllum</i>		0.1	0.2
<i>Cucumis variabilis</i>		0.1	0.2
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.2
<i>Euphorbia australis</i>		0.1	0.1
<i>Rhynchosia minima</i>		0.1	0.05
<i>Boerhavia gardneri</i>		0.1	0.05
<i>Gomphrena cunninghamii</i>		0.1	0.05
<i>Pterocaulon sphacelatum</i>		0.1	0.05
<i>Calotis plumulifera</i>		0.1	0.05

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Site details			
Site	BB41r	Position (WGS84)	-20.781587, 117.704019
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	12-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (12 Oct 2019)			
Vegetation description	Isolated plants of <i>Dichanthium sericeum</i> subsp. <i>humilius</i> , <i>Rhynchosia minima</i> and <i>Neptunia dimorphantha</i> over a low tussock grassland of <i>Eragrostis xerophila</i> .		
Habitat	spinifex grassland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	48	Tree cover (%)	0
Shrub cover (%)	0	Grass cover (%)	48
Herb cover (%)	0		



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Species (6)	Status	Cover (%)	Height (m)
<i>Eragrostis xerophila</i>		47.5	0.3
<i>Dichanthium sericeum</i> subsp. <i>humilius</i>		1	0.05
<i>Euphorbia biconvexa</i>		0.1	0.2
<i>Rhynchosia minima</i>		0.1	0.05
<i>Neptunia dimorphantha</i>		0.1	0.05
<i>Heliotropium muticum</i>	P3 (DBCA list)	0.1	0.05



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Site details			
Site	BB42r	Position (WGS84)	-20.782935, 117.721166
Slope	gentle	Topography	drainage line
Soil colour	red-orange	Soil texture	sandy loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	12-Oct-2019	unbounded	David Leach

Observation details - visit 1 (12 Oct 2019)			
Vegetation description	Mid isolated trees of <i>Eucalyptus victrix</i> over mid isolated shrubs of <i>Acacia stellaticeps</i> over hummock grassland of <i>Triodia epactia</i>		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	55	Tree cover (%)	1
Shrub cover (%)	4	Grass cover (%)	55
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (16)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		45	0.3
<i>Acacia stellaticeps</i>		2	0.85
<i>Eucalyptus victrix</i>		0.5	7
<i>Acacia arida</i>		0.1	1.9
<i>Acacia trachycarpa</i>		0.1	1.75
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>		0.1	1
<i>Carissa lanceolata</i>		0.1	0.8
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)	0.1	0.2
<i>Hybanthus aurantiacus</i>		0.1	0.2
<i>Goodenia microptera</i>		0.1	0.2
<i>Heliotropium muticum</i>	P3 (DBCA list)	0.1	0.2
<i>Streptoglossa bubakii</i>		0.1	0.15
<i>Pluchea dentex</i>		0.1	0.1
<i>Cassutha racemosa</i>		0.1	0.1
<i>Trigastrotheca molluginea</i>		0.1	0.05
<i>Corchorus tectus</i>		0.1	0.05

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Site details			
Site	BB43r	Position (WGS84)	-20.782903, 117.722184
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	12-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (12 Oct 2019)			
Vegetation description	Mid open shrubland of <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> and <i>Acacia inaequilatera</i> over isolated shrubs of <i>Carissa lanceolata</i> , <i>Corchorus walcottii</i> and <i>Solanum lasiophyllum</i> over a hummock grassland of <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	75	Tree cover (%)	1
Shrub cover (%)	20	Grass cover (%)	70
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (15)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		70	0.4
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		20	2
<i>Acacia inaequilatera</i>		2	1.8
<i>Chrysopogon fallax</i>		0.5	1
<i>Carissa lanceolata</i>		0.1	1.8
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>		0.1	1.8
<i>Acacia acradenia</i>		0.1	1.5
<i>Acacia synchronicia</i>		0.1	1.5
<i>Acacia pyrifolia</i>		0.1	1
<i>Corchorus walcottii</i>		0.1	0.25
<i>Solanum lasiophyllum</i>		0.1	0.25
<i>Indigofera monophylla</i>		0.1	0.25
<i>Eragrostis xerophila</i>		0.1	0.2
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>		0.1	0.05
<i>Rhynchosia minima</i>		0.1	0.05

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Site details			
Site	BB44r	Position (WGS84)	-20.783066, 117.722688
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	12-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (12 Oct 2019)			
Vegetation description	Mid isolated shrubs of <i>Acacia synchronicia</i> over a hummock grassland of <i>Triodia epactia</i> .		
Habitat	spinifex grassland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	60	Tree cover (%)	0
Shrub cover (%)	1	Grass cover (%)	60
Herb cover (%)	0		



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Species (8)	Status	Cover (%)	Height (m)
<i>Triodia epactia</i>		60	0.3
<i>Acacia synchronicia</i>		1	1.8
<i>Eragrostis xerophila</i>		0.1	0.2
<i>Sporobolus australasicus</i>		0.1	0.15
<i>Streptoglossa bubakii</i>		0.1	0.15
<i>Rhynchosia minima</i>		0.1	0.05
<i>Euphorbia australis</i>		0.1	0.05
<i>Polygala isingii</i>		0.1	0.05

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Site details			
Site	BB45r	Position (WGS84)	-20.864527, 117.740202
Slope	gentle	Topography	undulating plain
Soil colour	red-brown	Soil texture	clay loam
Rock cover (%)	0	Rock type	chert, limestone

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	12-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (12 Oct 2019)			
Vegetation description	Low to mid isolated shrubs of <i>Acacia pyrifolia</i> , <i>Acacia bivenosa</i> and <i>Acacia ancistrocarpa</i> over a hummock grassland of <i>Triodia wiseana</i> with isolated <i>Triodia epactia</i> .		
Habitat	shrubland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	50	Tree cover (%)	1
Shrub cover (%)	15	Grass cover (%)	50
Herb cover (%)	0		





**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (20)	Status	Cover (%)	Height (m)
<i>Triodia wiseana</i>		45	0.4
<i>Triodia epactia</i>		5	0.3
<i>Acacia pyrifolia</i>		2	1.5
<i>Acacia ancistrocarpa</i>		1.8	15
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>		1	1.5
<i>Acacia bivenosa</i>		1	1
<i>Ptilotus clementii</i>		0.3	0.3
<i>Hakea lorea</i> subsp. <i>lorea</i>		0.1	2
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>		0.1	0.4
<i>Ptilotus calostachyus</i>		0.1	0.3
<i>Corchorus tectus</i>		0.1	0.25
<i>Cullen</i> sp.		0.1	0.2
<i>Goodenia microptera</i>		0.1	0.2
<i>Heliotropium muticum</i>	P3 (DBCA list)	0.1	0.2
<i>Tribulus hirsutus</i>		0.1	0.2
<i>Hybanthus aurantiacus</i>		0.1	0.15
<i>Eragrostis</i> sp. kinked grass		0.1	0.15
<i>Streptoglossa bubakii</i>		0.1	0.15
<i>Euphorbia australis</i>		0.1	0.1
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>		0.1	

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Site details			
Site	BB46r	Position (WGS84)	-20.87563, 117.761753
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	loam
Rock cover (%)	0	Rock type	none

Sample and effort summary				
Sample method	Visit	Sample date	Dimensions	Observer
Releve	1	12-Oct-2019	unbound	Martin Henson

Observation details - visit 1 (12 Oct 2019)			
Vegetation description	Low to mid open shrubland of <i>Acacia acradenia</i> , <i>Acacia pyrifolia</i> and <i>Acacia bivenosa</i> over an open hummock grassland of <i>Triodia wiseana</i> .		
Habitat	open woodland		
Disturbance	grazing – low		
Vegetation condition	Excellent	Fire age	relatively recent (1-5 years)
Total veg. cover (%)	40	Tree cover (%)	2
Shrub cover (%)	10	Grass cover (%)	30
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Species (24)	Status	Cover (%)	Height (m)
<i>Triodia wiseana</i>		25	0.3
<i>Acacia acradenia</i>		10	1
<i>Acacia pyrifolia</i>		2.5	1
<i>Acacia bivenosa</i>		2.5	1
<i>Corymbia hamersleyana</i>		2	5
<i>Streptoglossa bubakii</i>		1	0.15
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>		0.1	1
<i>Carissa lanceolata</i>		0.1	1
<i>Ptilotus obovatus</i>		0.1	0.3
<i>Ptilotus calostachyus</i>		0.1	0.25
<i>Corchorus tectus</i>		0.1	0.2
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>		0.1	0.2
<i>Goodenia microptera</i>		0.1	0.2
<i>Hybanthus aurantiacus</i>		0.1	0.15
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>		0.1	0.15
<i>Bulbostylis barbata</i>		0.1	0.15
<i>Gomphrena canescens</i> subsp. <i>canescens</i>		0.1	0.1
<i>Eragrostis</i> sp. kinked grass		0.1	0.1
<i>Pterocaulon sphacelatum</i>		0.1	0.1
<i>Trigastrotheca molluginea</i>		0.1	0.05
<i>Euphorbia biconvexa</i>		0.1	0.05
<i>Cucumis variabilis</i>		0.1	0.05
<i>Euphorbia australis</i>		0.1	0.05
<i>Sporobolus australasicus</i>		0.1	0.05

**Appendix 3 NVIS hierarchy**

Western Australia Current Practice			National Standard		
Hierarchy of terms	Brief description in WA	Indicative scale	NVIS Level	Description	NVIS structural/floristic components required
Vegetation formation	Structure and growth form – Forest, Woodland.	1:5 000 000	I	Class	Dominant growth form for the ecologically or structurally dominant stratum.
Vegetation sub-formation	Structural and dominant vegetation layer - Eucalypt Forest, Banksia Woodland	1:2 500 000	II	Structural Formation	Dominant growth form, cover and height for the ecologically or structurally dominant stratum.
Vegetation association	Structural form and dominant species - Medium woodland; York gum (Eucalyptus loxophleba) & Wandoo	1:1 000 000 to 1:250 000	III	Broad Floristic Formation	Dominant growth form, cover, height and dominant land cover genus for the uppermost or dominant stratum.
Vegetation complex	Structural and floristic description linked to geomorphology – Quindalup Complex.	1:250 000 to 1:100 000	IV	Sub-Formation	Dominant growth form, cover, height and dominant genus and Family for the three traditional strata. (i.e. Upper, Mid and Ground).
Vegetation type	Floristic definition by strata with structural detail. Often represented with a code and floristic description.	1:100 000 to 1:10 000	V	Association	Dominant growth form, height, cover and up to 3 species for the three traditional strata. (i.e. Upper, Mid and Ground).
Plant community	Basic unit of vegetation classification, site specific and highly localised with detailed floristics for each stratum.	1:10 000	VI	Sub-Association	Dominant growth form, height, cover and up to 5 species for all layers/ strata.
Floristic Community Type	Floristic composition definition; e.g. Northern banksia woodlands over herb rich shrublands on the Swan Coastal Plain.	No absolute scale			

**Appendix 4 Terrestrial fauna survey site descriptions**

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Site details			
Site	CAM001	Position (WGS84)	-20.787146, 117.747764
Slope	gentle	Topography	drainage line
Soil colour	red-orange	Soil texture	gravel-alluvial, sandy loam
Rock cover (%)		Rock type	ferrous - Ironstone, granite - rocks, quartz

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Camera trap	280.17	13 Nov 2019	17 Nov 2019
1	Ultrasonic recording	93.33	13 Nov 2019	17 Nov 2019

Site description - visit 1 (13 Nov 2019)			
Major drainage channel. Open eucalypt woodland over mixed <i>Acacia</i> shrubs with spinifex on banks. Tree hollows in some large eucalypts.			
Habitat	open woodland		
Disturbance	evidence of feral animals; livestock tracks		
Vegetation condition	Very Good	Fire age	moderate (>5 years)
Total veg. cover (%)	70	Litter cover (%)	
Tree cover (%)	60	Litter depth(cm)	
Shrub cover (%)	15	Litter distribution	not recorded
Grass cover (%)	10		
Herb cover (%)	0		



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**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Site details			
Site	CAM002	Position (WGS84)	-20.799707, 117.721264
Slope	negligible	Topography	drainage line
Soil colour	red-orange	Soil texture	gravel-alluvial, rocks
Rock cover (%)		Rock type	ferrous - Ironstone, granite - rocks, quartz

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Camera trap	285.00	13 Nov 2019	17 Nov 2019
1	Ultrasonic recording	95.00	13 Nov 2019	17 Nov 2019

Site description - visit 1 (13 Nov 2019)			
Major drainage channel. Open eucalypt woodland over mixed <i>Acacia</i> shrubs with spinifex on banks. Leaf litter and tree hollows present.			
Habitat	open woodland		
Disturbance	evidence of feral animals; livestock tracks		
Vegetation condition	Very Good	Fire age	moderate (>5 years)
Total veg. cover (%)	60	Litter cover (%)	
Tree cover (%)	60	Litter depth(cm)	
Shrub cover (%)	15	Litter distribution	not recorded
Grass cover (%)	5		
Herb cover (%)	0.05		



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**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Site details			
Site	CAM004	Position (WGS84)	-20.815836, 117.735833
Slope	gentle	Topography	hill top
Soil colour	red-orange	Soil texture	clay loam, rocks
Rock cover (%)		Rock type	quartz

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Camera trap	290.10	13 Nov 2019	17 Nov 2019
1	Foraging	2.00	13 Nov 2019	13 Nov 2019

Site description - visit 1 (13 Nov 2019)			
Quartz hill with open mixed <i>Acacia</i> shrubs over spinifex.			
Habitat	shrubland		
Disturbance	evidence of feral animals; vehicle tracks		
Vegetation condition	Very Good	Fire age	moderate (>5 years)
Total veg. cover (%)	95	Litter cover (%)	
Tree cover (%)	1	Litter depth(cm)	
Shrub cover (%)	10	Litter distribution	not recorded
Grass cover (%)	90		
Herb cover (%)	1		



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**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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Site details			
Site	CAM005	Position (WGS84)	-20.869464, 117.755512
Slope	negligible	Topography	plain
Soil colour	red-orange	Soil texture	clay loam, clay
Rock cover (%)		Rock type	granite - bolders, granite - rocks, quartz

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Camera trap	275.33	13 Nov 2019	17 Nov 2019
1	Foraging nocturnal	1.47	14 Nov 2019	14 Nov 2019
1	Ultrasonic recording	91.43	13 Nov 2019	17 Nov 2019

Site description - visit 1 (13 Nov 2019)			
Small granite outcrop with many fissures. <i>Capparis</i> and <i>Ficus</i> shrubs to 2 m in rocks. Surrounded by spinifex grassland.			
Habitat	spinifex grassland		
Disturbance	evidence of feral animals; litter; vehicle tracks		
Vegetation condition	Very Good	Fire age	moderate (>5 years)
Total veg. cover (%)	30	Litter cover (%)	
Tree cover (%)	0.05	Litter depth(cm)	
Shrub cover (%)	5	Litter distribution	not recorded
Grass cover (%)	30		
Herb cover (%)	0		



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**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project**

Site details			
<b>Site</b>	CAM006	<b>Position (WGS84)</b>	-20.859496, 117.735522
<b>Slope</b>	negligible	<b>Topography</b>	drainage line
<b>Soil colour</b>	red-brown	<b>Soil texture</b>	gravel-alluvial, sandy loam
<b>Rock cover (%)</b>		<b>Rock type</b>	ferrous - Ironstone, quartz

Site description - visit 1 (13 Nov 2019)			
Minor drainage in spinifex floodplain with <i>Acacia</i> to 1.5 m over spinifex to 30 cm.			
<b>Habitat</b>	spinifex grassland		
<b>Disturbance</b>	grazing – medium; livestock tracks; vehicle tracks		
<b>Vegetation condition</b>	Very Good	<b>Fire age</b>	moderate (>5 years)
<b>Total veg. cover (%)</b>	60	<b>Litter cover (%)</b>	
<b>Tree cover (%)</b>	0	<b>Litter depth(cm)</b>	
<b>Shrub cover (%)</b>	20	<b>Litter distribution</b>	not recorded
<b>Grass cover (%)</b>	40		
<b>Herb cover (%)</b>	0		





Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla Infrastructure - Rail and Conveyor Project

Site details			
Site	CAM007	Position (WGS84)	-20.816656, 117.753138
Slope	negligible	Topography	drainage line
Soil colour	red-orange	Soil texture	clay loam, clay
Rock cover (%)		Rock type	ferrous - Ironstone, quartz

Site description - visit 1 (13 Nov 2019)			
Minor drainage with <i>Acacia</i> shrubs over spinifex.			
Habitat	shrubland		
Disturbance	evidence of feral animals; livestock tracks		
Vegetation condition	Very Good	Fire age	moderate (>5 years)
Total veg. cover (%)	90	Litter cover (%)	
Tree cover (%)	2	Litter depth(cm)	
Shrub cover (%)	50	Litter distribution	not recorded
Grass cover (%)	80		
Herb cover (%)	1		



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla Infrastructure - Rail and Conveyor Project

Site details			
Site	CAM008	Position (WGS84)	-20.876104, 117.743785
Slope	negligible	Topography	drainage line
Soil colour	red-brown	Soil texture	sandy clay
Rock cover (%)		Rock type	ferrous - Ironstone, granite - rocks, quartz

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Ultrasonic recording	72.15	14 Nov 2019	17 Nov 2019

Site description - visit 1 (14 Nov 2019)			
Minor drainage with <i>Grevillea</i> and <i>Acacia</i> to 2 m over spinifex and mixed low shrubs to 30 cm.			
Habitat	spinifex grassland		
Disturbance	evidence of feral animals; grazing – medium; livestock tracks; vehicle tracks		
Vegetation condition	Good	Fire age	moderate (>5 years)
Total veg. cover (%)	60	Litter cover (%)	
Tree cover (%)	0	Litter depth(cm)	
Shrub cover (%)	15	Litter distribution	not recorded
Grass cover (%)	45		
Herb cover (%)	0		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project**

Site details			
Site	F01	Position (WGS84)	-20.880628, 117.742677
Slope	negligible	Topography	plain
Soil colour	red-orange	Soil texture	clay loam, rocks
Rock cover (%)		Rock type	ferrous - Ironstone, quartz

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Foraging	2.00	14 Nov 2019	14 Nov 2019

Site description - visit 1 (14 Nov 2019)			
Small rocky outcrop in spinifex plain adjacent to a minor drainage.			
Habitat	spinifex grassland		
Disturbance	evidence of feral animals; vehicle tracks		
Vegetation condition	Very Good	Fire age	moderate (>5 years)
Total veg. cover (%)	80	Litter cover (%)	
Tree cover (%)	0.05	Litter depth(cm)	
Shrub cover (%)	15	Litter distribution	not recorded
Grass cover (%)	80		
Herb cover (%)	1		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project**

Site details			
Site	F02	Position (WGS84)	-20.880614, 117.742762
Slope	negligible	Topography	plain
Soil colour	red-orange	Soil texture	sandy clay, rocks
Rock cover (%)		Rock type	quartz

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Foraging	1.00	14 Nov 2019	14 Nov 2019

Site description - visit 1 (14 Nov 2019)			
Small linear quartz outcrop surrounded by low spinifex grassland.			
Habitat	spinifex grassland		
Disturbance	livestock tracks; vehicle tracks		
Vegetation condition	Very Good	Fire age	moderate (>5 years)
Total veg. cover (%)	85	Litter cover (%)	
Tree cover (%)	0.05	Litter depth(cm)	
Shrub cover (%)	0.05	Litter distribution	not recorded
Grass cover (%)	85		
Herb cover (%)	0.05		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project**

Site details			
Site	F03	Position (WGS84)	-20.815974, 117.72374
Slope	negligible	Topography	drainage line
Soil colour	red-brown	Soil texture	gravel-alluvial, sand
Rock cover (%)		Rock type	granite - outcropping

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Foraging	1.93	16 Nov 2019	16 Nov 2019

Site description - visit 1 (15 Nov 2019)			
Drainage with exposed granite rocks. Sparse eucalpts to 6 m with sparse <i>Acacia</i> to 3 m over spinifex to 30 cm.			
Habitat	open woodland		
Disturbance	evidence of feral animals; grazing – medium; livestock tracks; vehicle tracks		
Vegetation condition	Good	Fire age	moderate (>5 years)
Total veg. cover (%)	30	Litter cover (%)	
Tree cover (%)	5	Litter depth(cm)	
Shrub cover (%)	5	Litter distribution	not recorded
Grass cover (%)	20		
Herb cover (%)	0		



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project**

Site details			
Site	NP01	Position (WGS84)	-20.838091, 117.739894
Slope	negligible	Topography	plain
Soil colour	red-orange	Soil texture	sandy clay
Rock cover (%)		Rock type	ferrous - Ironstone, quartz

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Audio recording	209.00	14 Nov 2019	23 Nov 2019
1	Foraging nocturnal	2.70	14 Nov 2019	14 Nov 2019

Site description - visit 1 (14 Nov 2019)			
Dense spinifex grassland with scattered shrubs.			
Habitat	spinifex grassland		
Disturbance	evidence of feral animals; livestock tracks; vehicle tracks		
Vegetation condition	Very Good	Fire age	moderate (>5 years)
Total veg. cover (%)	85	Litter cover (%)	
Tree cover (%)	3	Litter depth(cm)	
Shrub cover (%)	2	Litter distribution	not recorded
Grass cover (%)	85		
Herb cover (%)	1		





**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla Infrastructure - Rail and Conveyor Project**

Site details			
Site	NP02	Position (WGS84)	-20.794615, 117.721366
Slope	negligible	Topography	plain
Soil colour	red-orange	Soil texture	sandy clay
Rock cover (%)		Rock type	none

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Audio recording		14 Nov 2019	

Site description - visit 1 (14 Nov 2019)			
Dense spinifex grassland with scattered shrubs. Few spinifex rings present.			
Habitat	spinifex grassland		
Disturbance	grazing – low; livestock tracks; vehicle tracks;		
Vegetation condition	Very Good	Fire age	moderate (>5 years)
Total veg. cover (%)	90	Litter cover (%)	0
Tree cover (%)	0.05	Litter depth(cm)	0
Shrub cover (%)	2	Litter distribution	not recorded
Grass cover (%)	90		
Herb cover (%)	0.05		



**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project**

Site details			
<b>Site</b>	NP02	<b>Position (WGS84)</b>	-20.794615, 117.721366
<b>Slope</b>	negligible	<b>Topography</b>	plain
<b>Soil colour</b>	red-orange	<b>Soil texture</b>	sandy clay
<b>Rock cover (%)</b>		<b>Rock type</b>	none

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Audio recording	208.55	14 Nov 2019	23 Nov 2019

**Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
Infrastructure - Rail and Conveyor Project**

Site details			
Site	QH	Position (WGS84)	-20.816463, 117.70506
Slope	steep	Topography	hill top
Soil colour	whitish	Soil texture	rocks
Rock cover (%)		Rock type	quartz,

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Foraging	1.30	16 Nov 2019	16 Nov 2019

Site description - visit 1 (16 Nov 2019)			
Quartz hill with scattered figs to 2 m and sparse grasses to 25 cm.			
Habitat	spinifex grassland		
Disturbance	grazing – medium; livestock tracks		
Vegetation condition	Very Good	Fire age	moderate (>5 years)
Total veg. cover (%)	10	Litter cover (%)	0
Tree cover (%)	5	Litter depth(cm)	0
Shrub cover (%)	0	Litter distribution	not recorded
Grass cover (%)	5		
Herb cover (%)	0		



Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla  
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**Appendix 5 Introduced flora identified in the desktop review**

Family	Species	Declared Pest
Amaranthaceae	* <i>Aerva javanica</i>	
Poaceae	* <i>Cenchrus ciliaris</i>	
Poaceae	* <i>Cenchrus setiger</i>	
Poaceae	* <i>Cynodon dactylon</i>	
Cyperaceae	* <i>Cyperus rotundus</i>	
Poaceae	* <i>Echinochloa colona</i>	
Poaceae	* <i>Eragrostis pilosa</i>	
Asteraceae	* <i>Flaveria trinervia</i>	
Fabaceae	* <i>Indigofera hochstetteri</i>	s12 C1 (Prohibited)
Malvaceae	* <i>Malvastrum americanum</i>	
Portulacaceae	* <i>Portulaca pilosa</i>	
Asteraceae	* <i>Pseudognaphalium luteoalbum</i>	
Poaceae	* <i>Setaria verticillata</i>	
Solanaceae	* <i>Solanum nigrum</i>	
Asteraceae	* <i>Sonchus oleraceus</i>	
Fabaceae	* <i>Vachellia farnesiana</i>	

Reconnaissance flora and vegetation survey and targeted terrestrial fauna survey for the Balla Balla Port Project  
Prepared for BBI Group Pty Ltd

Appendix 6 Vertebrate fauna desktop and field survey results

Class	Family	Species	Common name	Status	Introduced	EPBC	NM	TFA	This survey	UPR
Amphibia	Hylidae	<i>Cyclorana maini</i>	Sheep Frog				1			
Amphibia	Hylidae	<i>Litoria rubella</i>	Little Red Tree Frog				1			
Amphibia	Limnodynastidae	<i>Notaden nicholli</i>	Desert Spadefoot				1			
Aves	Acanthizidae	<i>Gerygone fusca</i>	Western Gerygone				1			
Aves	Acanthizidae	<i>Gerygone tenebrosa</i>	Dusky Gerygone				1			
Aves	Acanthizidae	<i>Smicrornis brevirostris</i>	Weebill				1			
Aves	Accipitridae	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk				1			
Aves	Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk				1			
Aves	Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle				1		1	
Aves	Accipitridae	<i>Circus approximans</i>	Swamp Harrier				1			
Aves	Accipitridae	<i>Circus assimilis</i>	Spotted Harrier				1		1	
Aves	Accipitridae	<i>Elanus caeruleus</i>	Black-shouldered Kite				1			
Aves	Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle			1	1			
Aves	Accipitridae	<i>Haliastur indus</i>	Brahminy Kite				1			
Aves	Accipitridae	<i>Haliastur sphenurus</i>	Whistling Kite				1		1	
Aves	Accipitridae	<i>Hieraetus morphnoides</i>	Little Eagle				1			
Aves	Accipitridae	<i>Milvus migrans</i>	Black Kite				1			
Aves	Accipitridae	<i>Pandion cristatus</i>	Osprey	Mig. (EPBC & BC Acts)		1	1	2		
Aves	Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar				1			
Aves	Alaudidae	<i>Mirafra javanica</i>	Horsfield's Bushlark				1			
Aves	Anatidae	<i>Anas gracilis</i>	Grey Teal				1			
Aves	Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck				1			
Aves	Anatidae	<i>Aythya australis</i>	Hardhead				1			
Aves	Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck				1			

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Class	Family	Species	Common name	Status	Introduced	EPBC	NM	TFA	This survey	UPR
Aves	Anatidae	<i>Cygnus atratus</i>	Black Swan				1			
Aves	Anatidae	<i>Dendrocygna eytoni</i>	Plumed Whistling Duck				1			
Aves	Anatidae	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck				1			
Aves	Anhingidae	<i>Anhinga novaehollandiae</i>	Australasian Darter				1			
Aves	Apodidae	<i>Apus pacificus</i>	Fork-tailed Swift	Mig. (EPBC & BC Acts)		1	1	1		
Aves	Ardeidae	<i>Ardea garzetta</i>	Little Egret				1			
Aves	Ardeidae	<i>Ardea ibis</i>	Cattle Egret			1				
Aves	Ardeidae	<i>Ardea intermedia</i>	Intermediate Egret				1			
Aves	Ardeidae	<i>Ardea modesta</i>	great egret			1	1			
Aves	Ardeidae	<i>Ardea novaehollandiae</i>	White-faced Heron				1			
Aves	Ardeidae	<i>Ardea pacifica</i>	White-necked Heron				1			
Aves	Ardeidae	<i>Ardea sacra</i>	Eastern Reef Egret				1			
Aves	Ardeidae	<i>Butorides striata</i>	Striated Heron				1			
Aves	Ardeidae	<i>Ixobrychus flavicollis</i>	Black Bittern				1			
Aves	Ardeidae	<i>Nycticorax caledonicus</i>	Rufous Night Heron				1			
Aves	Artamidae	<i>Artamus cinereus</i>	Black-faced Woodswallow				1		1	
Aves	Artamidae	<i>Artamus leucorhynchus</i>	White-breasted Woodswallow				1			
Aves	Artamidae	<i>Artamus minor</i>	Little Woodswallow				1			
Aves	Artamidae	<i>Artamus personatus</i>	Masked Woodswallow				1			
Aves	Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow				1			
Aves	Burhinidae	<i>Burhinus grallarius</i>	Bush Stone-curlew				1			
Aves	Burhinidae	<i>Esacus magnirostris</i>	Beach Stone-curlew				1			
Aves	Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike				1		1	
Aves	Campephagidae	<i>Lalage tricolor</i>	White-winged Triller				1			
Aves	Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar				1			
Aves	Centropodidae	<i>Centropus phasianinus</i>	Pheasant Coucal				1			



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Class	Family	Species	Common name	Status	Introduced	EPBC	NM	TFA	This survey	UPR
Aves	Charadriidae	<i>Charadrius leschenaultii</i>	Greater Sand Plover	VU/Mig./VU (EPBC Act; BC Act)			1	120		
Aves	Charadriidae	<i>Charadrius mongolus</i>	Lesser Sand Plover	EN/Mig. (EPBC & BC Acts)			1	80		
Aves	Charadriidae	<i>Charadrius ruficapillus</i>	Red-capped Plover				1			
Aves	Charadriidae	<i>Charadrius veredus</i>	Oriental Plover	Mig. (EPBC & BC Acts)		1				
Aves	Charadriidae	<i>Erythronyx cinctus</i>	Red-kneed Dotterel				1			
Aves	Charadriidae	<i>Pluvialis fulva</i>	Pacific Golden Plover	Mig. (EPBC & BC Acts)			1	3		
Aves	Charadriidae	<i>Vanellus tricolor</i>	Banded Lapwing				1			
Aves	Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork				1			
Aves	Columbidae	<i>Columba livia</i>	Domestic Pigeon		*	1				
Aves	Columbidae	<i>Geopelia cuneata</i>	Diamond Dove				1		1	
Aves	Columbidae	<i>Geopelia humeralis</i>	Bar-shouldered Dove				1			
Aves	Columbidae	<i>Geopelia striata</i>	Zebra Dove				1		1	
Aves	Columbidae	<i>Geophaps plumifera</i>	Spinifex Pigeon				1		1	
Aves	Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon				1		1	
Aves	Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing				1			
Aves	Columbidae	<i>Phaps histrionica</i>	Flock Bronzewing				1			
Aves	Corvidae	<i>Corvus bennetti</i>	Little Crow				1			
Aves	Corvidae	<i>Corvus coronoides</i>	Australian Raven				1			
Aves	Corvidae	<i>Corvus orru</i>	Torresian Crow				1			
Aves	Corvidae	<i>Corvus orru ceciliae</i>	Western Crow				1			
Aves	Cracticidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird				1			
Aves	Cracticidae	<i>Cracticus tibicen</i>	Australian Magpie				1			
Aves	Cuculidae	<i>Cacomantis pallidus</i>	Pallid Cuckoo				1			
Aves	Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze Cuckoo				1			

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Class	Family	Species	Common name	Status	Introduced	EPBC	NM	TFA	This survey	UPR
Aves	Cuculidae	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo			1				
Aves	Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark				1			
Aves	Dicruridae	<i>Rhipidura albiscapa</i>	Grey Fantail				1			
Aves	Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail				1			
Aves	Dicruridae	<i>Rhipidura phasiana</i>	Mangrove Grey Fantail				1			
Aves	Dromaiidae	<i>Dromaius novaehollandiae</i>	Emu				1			
Aves	Estrilidae	<i>Emblema pictum</i>	Painted Finch				1			
Aves	Estrilidae	<i>Heteromunia pectoralis</i>	Pictorella Mannikin				1			
Aves	Estrilidae	<i>Neochmia ruficauda</i>	Star Finch				1			
Aves	Estrilidae	<i>Taeniopygia guttata</i>	Zebra Finch				1			
Aves	Falconidae	<i>Falco berigora</i>	Brown Falcon				1		1	
Aves	Falconidae	<i>Falco cenchroides</i>	Australian Kestrel				1		1	
Aves	Falconidae	<i>Falco hypoleucos</i>	Grey Falcon	VU (BC Act)			1			
Aves	Falconidae	<i>Falco longipennis</i>	Australian Hobby				1			
Aves	Falconidae	<i>Falco peregrinus</i>	Peregrine Falcon	OS (BC Act)			1	1		
Aves	Fregatidae	<i>Fregata ariel</i>	Lesser Frigatebird	Mig. (EPBC & BC Acts)		1				
Aves	Glareolidae	<i>Glareola maldivarum</i>	Oriental Pratincole	Mig. (EPBC & BC Acts)		1	1	1		
Aves	Glareolidae	<i>Stiltia isabella</i>	Australian Pratincole				1		1	
Aves	Gruidae	<i>Grus rubicunda</i>	Brolga				1			
Aves	Haematopodidae	<i>Haematopus fuliginosus</i>	Sooty Oystercatcher				1			
Aves	Haematopodidae	<i>Haematopus longirostris</i>	Pied Oystercatcher				1			
Aves	Halcyonidae	<i>Dacelo leachii</i>	Blue-winged Kookaburra				1			
Aves	Halcyonidae	<i>Todiramphus chloris</i>	Collared Kingfisher				1			
Aves	Halcyonidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher				1			
Aves	Halcyonidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher				1			
Aves	Hirundinidae	<i>Cheramoeca leucosterna</i>	White-backed Swallow				1			

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Class	Family	Species	Common name	Status	Introduced	EPBC	NM	TFA	This survey	UPR
Aves	Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow				1			
Aves	Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow	Mig. (EPBC & BC Acts)		1				
Aves	Laridae	<i>Anous stolidus</i>	Common Noddy	Mig. (EPBC & BC Acts)		1				
Aves	Laridae	<i>Larus novaehollandiae</i>	Silver Gull				1			
Aves	Laridae	<i>Onychoprion anaethetus</i>	Bridled Tern	Mig. (EPBC & BC Acts)			1	1		
Aves	Laridae	<i>Sterna bengalensis</i>	Lesser Crested Tern				1			
Aves	Laridae	<i>Sterna bergii</i>	Crested Tern	Mig. (EPBC & BC Acts)			1			
Aves	Laridae	<i>Sterna dougallii</i>	Roseate Tern	Mig. (EPBC & BC Acts)			1	4		
Aves	Laridae	<i>Sterna hirundo</i>	Common Tern	Mig. (EPBC & BC Acts)			1	58		
Aves	Laridae	<i>Sterna hybrida</i>	Whiskered Tern				1			
Aves	Maluridae	<i>Amytornis striatus</i>	Striated Grasswren				1			
Aves	Maluridae	<i>Malurus lamberti</i>	Variiegated Fairy-wren				1			
Aves	Maluridae	<i>Malurus leucopterus</i>	White-winged Fairy-wren				1		1	
Aves	Maluridae	<i>Stipiturus ruficeps ruficeps</i>	Rufous-crowned Emu-wren				1			
Aves	Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater				1			
Aves	Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater				1			
Aves	Meliphagidae	<i>Epthianura tricolor</i>	Crimson Chat				1		1	
Aves	Meliphagidae	<i>Gavicalis virescens</i>	Singing Honeyeater				1		1	
Aves	Meliphagidae	<i>Lichmera indistincta</i>	Brown Honeyeater				1			
Aves	Meliphagidae	<i>Manorina flavigula</i>	Yellow-throated Miner				1			
Aves	Meliphagidae	<i>Melithreptus gularis</i>	Black-chinned Honeyeater				1			
Aves	Meliphagidae	<i>Ptilotula keartlandi</i>	Grey-headed Honeyeater				1		1	
Aves	Meliphagidae	<i>Ptilotula penicillata</i>	White-plumed Honeyeater				1			
Aves	Meliphagidae	<i>Ptilotula plumula</i>	Grey-fronted Honeyeater				1			
Aves	Meliphagidae	<i>Sugomel nigrum</i>	Black Honeyeater				1			
Aves	Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater			1	1			

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Class	Family	Species	Common name	Status	Introduced	EPBC	NM	TFA	This survey	UPR
Aves	Motacillidae	<i>Anthus australis</i>	Australian Pipit				1		1	
Aves	Motacillidae	<i>Motacilla cinerea</i>	Grey Wagtail	Mig. (EPBC & BC Acts)		1				
Aves	Motacillidae	<i>Motacilla flava</i>	Yellow Wagtail	Mig. (EPBC & BC Acts)		1				
Aves	Otididae	<i>Ardeotis australis</i>	Australian Bustard				1		1	
Aves	Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush				1			
Aves	Pachycephalidae	<i>Pachycephala lanioides</i>	White-breasted Whistler				1			
Aves	Pachycephalidae	<i>Pachycephala melanura</i>	Mangrove Golden Whistler				1			
Aves	Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler				1			
Aves	Pardalotidae	<i>Pardalotus rubricatus</i>	Red-browed Pardalote				1			
Aves	Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote				1			
Aves	Passeridae	<i>Passer montanus</i>	Eurasian Tree Sparrow		*	1				
Aves	Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian Pelican				1			
Aves	Petroicidae	<i>Eopsaltria pulverulenta</i>	Mangrove Robin				1			
Aves	Petroicidae	<i>Petroica goodenovii</i>	Red-capped Robin				1			
Aves	Phalacrocoracidae	<i>Phalacrocorax carbo</i>	Great Cormorant				1			
Aves	Phalacrocoracidae	<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant				1			
Aves	Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant				1			
Aves	Phalacrocoracidae	<i>Phalacrocorax varius</i>	Pied Cormorant				1			
Aves	Phasianidae	<i>Coturnix pectoralis</i>	Stubble Quail				1			
Aves	Phasianidae	<i>Coturnix ypsilophora</i>	Brown Quail				1			
Aves	Phasianidae	<i>Pavo cristatus</i>	Common Peafowl		*		1			
Aves	Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth				1			
Aves	Podicipedidae	<i>Podiceps cristatus</i>	Great Crested Grebe				1			
Aves	Podicipedidae	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe				1			
Aves	Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe				1			
Aves	Pomatostomidae	<i>Pomatostomus temporalis</i>	Grey-crowned Babbler				1			

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Aves	Procellariidae	<i>Ardenna pacifica</i>	Wedge-tailed Shearwater	Mig. (BC Act)		1	1	1		
Aves	Procellariidae	<i>Calonectris leucomelas</i>	Streaked Shearwater	Mig. (EPBC & BC Acts)		1				
Aves	Procellariidae	<i>Macronectes giganteus</i>	Southern Giant Petrel	EN/Mig./Mig. (EPBC Act; BC Act)		1				
Aves	Psittacidae	<i>Cacatua roseicapilla</i>	Galah				1			
Aves	Psittacidae	<i>Cacatua sanguinea</i>	Little Corella				1			
Aves	Psittacidae	<i>Melopsittacus undulatus</i>	Budgerigar				1			
Aves	Psittacidae	<i>Nymphicus hollandicus</i>	Cockatiel				1			
Aves	Psittacidae	<i>Pezoporus occidentalis</i>	Night Parrot	EN/CR (EPBC Act; BC Act)		1				
Aves	Psittacidae	<i>Platycercus zonarius</i>	Australian Ringneck				1			
Aves	Ptilonorhynchidae	<i>Ptilonorhynchus maculatus</i>	Spotted Bowerbird				1			
Aves	Rallidae	<i>Fulica atra</i>	Eurasian Coot				1			
Aves	Rallidae	<i>Gallirallus philippensis</i>	Buff-banded Rail				1			
Aves	Rallidae	<i>Porphyrio porphyrio</i>	Purple Swamphen				1			
Aves	Rallidae	<i>Porzana fluminea</i>	Australian Spotted Crake				1			
Aves	Rallidae	<i>Porzana pusilla</i>	Baillon's Crake				1			
Aves	Recurvirostridae	<i>Cladorhynchus leucocephalus</i>	Banded Stilt				1			
Aves	Recurvirostridae	<i>Himantopus himantopus</i>	Black-winged Stilt				1			
Aves	Recurvirostridae	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet				1			
Aves	Rostratulidae	<i>Rostratula australis</i>	Australian Painted Snipe	EN (EPBC & BC Acts)		1				
Aves	Rostratulidae	<i>Rostratula benghalensis</i>	Painted Snipe			1				
Aves	Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper	Mig. (EPBC & BC Acts)		1	1	5		
Aves	Scolopacidae	<i>Arenaria interpres</i>	Ruddy Turnstone	Mig. (EPBC & BC Acts)			1	25		
Aves	Scolopacidae	<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mig. (EPBC & BC Acts)		1	1	2		
Aves	Scolopacidae	<i>Calidris alba</i>	Sanderling	Mig. (EPBC & BC Acts)			1	57		

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Aves	Scolopacidae	<i>Calidris canutus</i>	Red Knot	EN/Mig./EN (EPBC Act; BC Act)		1	1	2		
Aves	Scolopacidae	<i>Calidris ferruginea</i>	Curlew Sandpiper	CR/Mig./CR (EPBC Act; BC Act)		1	1	1		
Aves	Scolopacidae	<i>Calidris melanotos</i>	Pectoral Sandpiper	Mig. (EPBC & BC Acts)		1	1	1		
Aves	Scolopacidae	<i>Calidris ruficollis</i>	Red-necked Stint	Mig. (EPBC & BC Acts)			1	70		
Aves	Scolopacidae	<i>Calidris subminuta</i>	Long-toed Stint	Mig. (EPBC & BC Acts)			1	2		
Aves	Scolopacidae	<i>Calidris tenuirostris</i>	Great Knot	CR/Mig./CR (EPBC Act; BC Act)			1	48		
Aves	Scolopacidae	<i>Limicola falcinellus</i>	Broad-billed Sandpiper	Mig. (BC Act)			1	5		
Aves	Scolopacidae	<i>Limosa lapponica</i>	Bar-tailed Godwit	Mig. (EPBC & BC Acts)				33 0		
Aves	Scolopacidae	<i>Limosa lapponica baueri</i>	Bar-tailed Godwit (western Alaskan)	VU/Mig. (EPBC & BC Acts)		1				
Aves	Scolopacidae	<i>Limosa lapponica menzbieri</i>	Bar-tailed Godwit (northern Siberian)	CR/Mig./VU/Mig. (EPBC Act; BC Act)		1				
Aves	Scolopacidae	<i>Limosa limosa</i>	Black-tailed Godwit	Mig. (BC Act)			1	20		
Aves	Scolopacidae	<i>Numenius madagascariensis</i>	Eastern Curlew	CR/Mig./CR (EPBC Act; BC Act)		1	1	6		
Aves	Scolopacidae	<i>Numenius phaeopus</i>	Whimbrel	Mig. (EPBC & BC Acts)			1	28		
Aves	Scolopacidae	<i>Tringa brevipes</i>	Grey-tailed Tattler	(Mig. EPBC & BC Acts; P4 DBCA list)			1	50		
Aves	Scolopacidae	<i>Tringa glareola</i>	Wood Sandpiper	Mig. (EPBC & BC Acts)			1	1		
Aves	Scolopacidae	<i>Tringa nebularia</i>	Common Greenshank	Mig. (EPBC & BC Acts)		1	1	5		
Aves	Scolopacidae	<i>Tringa stagnatilis</i>	Marsh Sandpiper	Mig. (EPBC & BC Acts)			1	3		
Aves	Scolopacidae	<i>Xenus cinereus</i>	Terek Sandpiper	Mig. (EPBC & BC Acts)			1	60		
Aves	Strigidae	<i>Ninox boobook</i>	Boobook Owl				1			

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Aves	Sylviidae	<i>Acrocephalus australis</i>	Australian Reed Warbler				1			
Aves	Sylviidae	<i>Eremiornis carteri</i>	Spinifex-bird				1		1	
Aves	Sylviidae	<i>Megalurus cruralis</i>	Brown Songlark				1		1	
Aves	Sylviidae	<i>Megalurus gramineus</i>	Little Grassbird				1			
Aves	Sylviidae	<i>Megalurus mathewsi</i>	Rufous Songlark				1		1	
Aves	Threskiornithidae	<i>Platalea flavipes</i>	Yellow-billed Spoonbill				1			
Aves	Threskiornithidae	<i>Platalea regia</i>	Royal Spoonbill				1			
Aves	Threskiornithidae	<i>Plegadis falcinellus</i>	Glossy Ibis	Mig. (EPBC & BC Acts)			1	1		
Aves	Threskiornithidae	<i>Threskiornis moluccus</i>	Australian White Ibis				1			
Aves	Threskiornithidae	<i>Threskiornis spinicollis</i>	Straw-necked Ibis				1			
Aves	Turnicidae	<i>Turnix velox</i>	Little Button-quail				1		1	
Aves	Zosteropidae	<i>Zosterops luteus</i>	Yellow White-eye				1			
Gastropoda	Charopidae	<i>Dupucharopa millestriata</i>	Depuch Island charopid land snail	P2 (DBCA list)			1	1		
Mammalia	Bovidae	<i>Bos taurus</i>	European Cattle		*		1		1	
Mammalia	Camelidae	<i>Camelus dromedarius</i>	Dromedary		*	1	1			
Mammalia	Canidae	<i>Canis familiaris</i>	Dog		*	1	1			
Mammalia	Canidae	<i>Vulpes vulpes</i>	Red Fox		*	1	1			
Mammalia	Dasyuridae	<i>Dasyurus blythi</i>	Brush-tailed Mulgara	P4 (DBCA list)					1	1
Mammalia	Dasyuridae	<i>Dasykaluta rosamondae</i>	Little Red Kaluta				1			
Mammalia	Dasyuridae	<i>Dasyurus hallucatus</i>	Northern Quoll	EN (EPBC & BC Acts)		1	1	1	1	
Mammalia	Dasyuridae	<i>Ningau timealeyi</i>	Pilbara Ningau				1			
Mammalia	Dasyuridae	<i>Planigale sp.</i>					1			
Mammalia	Dasyuridae	<i>Pseudantechinus woolleyae</i>	Woolley's Pseudantechinus				1			
Mammalia	Dasyuridae	<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart				1			
Mammalia	Dasyuridae	<i>Sminthopsis macroura</i>	Stripe-faced Dunnart				1			
Mammalia	Dasyuridae	<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart				1			



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Mammalia	Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tailed Bat				1		1	
Mammalia	Emballonuridae	<i>Taphozous georgianus</i>	Common Sheath-tailed Bat				1		1	
Mammalia	Equidae	<i>Equus asinus</i>	Donkey		*	1				
Mammalia	Equidae	<i>Equus caballus</i>	Horse		*	1	1			
Mammalia	Felidae	<i>Felis catus</i>	Cat		*	1	1		1	
Mammalia	Hipposideridae	<i>Rhinonicteris aurantia</i>	orange leaf-nosed bat	(VU EPBC Act; P4 DBCA list)		1				
Mammalia	Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit		*	1				
Mammalia	Macropodidae	<i>Macropus robustus</i>	Euro				1			
Mammalia	Macropodidae	<i>Macropus rufus</i>	Red Kangaroo				1		1	
Mammalia	Macropodidae	<i>Petrogale lateralis</i>					1			
Mammalia	Macropodidae	<i>Petrogale lateralis lateralis</i>	Black-flanked Rock-wallaby	EN (EPBC & BC Acts)				50		
Mammalia	Macropodidae	<i>Petrogale rothschildi</i>	Rothschild's Rock-wallaby				1			
Mammalia	Megadermatidae	<i>Macroderma gigas</i>	Ghost Bat	VU (EPBC & BC Acts)		1	1			
Mammalia	Molossidae	<i>Chaerephon jobensis</i>	Greater Northern Freetail-bat				1		1	
Mammalia	Molossidae	<i>Ozimops cobourgianus</i>	Northern Coastal Free-tailed Bat	P1 (DBCA list)			1	1	1	
Mammalia	Muridae	<i>Hydromys chrysogaster</i>	Water-rat	P4 (DBCA list)			1	1		
Mammalia	Muridae	<i>Leggadina lakedownensis</i>	northern short-tailed mouse, Lakeland Downs mouse, kerakenga	P4 (DBCA list)			1	1		
Mammalia	Muridae	<i>Mus musculus</i>	House Mouse		*	1	1			
Mammalia	Muridae	<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	P4 (DBCA list)			1	1	1	
Mammalia	Muridae	<i>Pseudomys delicatulus</i>	Delicate Mouse				1			
Mammalia	Muridae	<i>Pseudomys desertor</i>	Desert Mouse				1			
Mammalia	Muridae	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse				1			
Mammalia	Muridae	<i>Rattus rattus</i>	Black Rat		*	1	1			
Mammalia	Muridae	<i>Rattus tunneyi</i>	Pale Field-rat				1			

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Mammalia	Muridae	<i>Zyromys argurus</i>	Common Rock-rat				1			
Mammalia	Pteropodidae	<i>Pteropus alecto</i>	Black Flying-fox				1			
Mammalia	Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna				1			
Mammalia	Thylacomyidae	<i>Macrotis lagotis</i>	Bilby	VU (EPBC & BC Acts)		1				1
Mammalia	Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat				1		1	
Mammalia	Vespertilionidae	<i>Nyctophilus arnhemensis</i>	Arnhem Land Long-eared Bat				1			
Mammalia	Vespertilionidae	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat				1		1	
Mammalia	Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed Bat				1			
Mammalia	Vespertilionidae	<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat				1		1	
Reptilia	Agamidae	<i>Amphibolurus gilberti</i>	Ta-ta				1			
Reptilia	Agamidae	<i>Amphibolurus longirostris</i>	Long-nosed Dragon				1		1	
Reptilia	Agamidae	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon				1		1	
Reptilia	Agamidae	<i>Ctenophorus isolepis</i>	Crested Dragon				1		1	
Reptilia	Agamidae	<i>Ctenophorus nuchalis</i>	Central Netted Dragon				1			
Reptilia	Agamidae	<i>Diporiphora valens</i>	Southern Pilbara Tree Dragon				1			
Reptilia	Agamidae	<i>Diporiphora vescus</i>					1			
Reptilia	Agamidae	<i>Pogona minor minor</i>	Dwarf Bearded Dragon				1			
Reptilia	Agamidae	<i>Pogona minor mitchelli</i>	Dwarf Bearded Dragon				1			
Reptilia	Agamidae	<i>Tympanocryptis cephalus</i>	Pebble Dragon				1			
Reptilia	Boidae	<i>Antaresia perthensis</i>	Pygmy Python				1			
Reptilia	Boidae	<i>Antaresia stimsoni stimsoni</i>	Stimson's Python				1			
Reptilia	Boidae	<i>Aspidites melanocephalus</i>	Black-headed Python						1	
Reptilia	Boidae	<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	VU (EPBC & BC Acts)		1	1	1		
Reptilia	Carphodactylidae	<i>Nephrurus levis</i>					1			
Reptilia	Cheloniidae	<i>Chelonia mydas</i>	Green Turtle	VU/Mig./VU (EPBC Act; BC Act)			1	1		

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Reptilia	Cheloniidae	<i>Natator depressus</i>	Flatback Turtle	VU/Mig./VU (EPBC Act; BC Act)			1	1		
Reptilia	Diplodactylidae	<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko				1			
Reptilia	Diplodactylidae	<i>Diplodactylus galaxias</i>	Northern Pilbara Beak-faced Gecko				1			
Reptilia	Diplodactylidae	<i>Lucasium stenodactylum</i>					1			
Reptilia	Diplodactylidae	<i>Lucasium wombeyi</i>					1			
Reptilia	Diplodactylidae	<i>Rhynchoedura ornata</i>	Western Beaked Gecko				1			
Reptilia	Diplodactylidae	<i>Strophurus elderi</i>					1			
Reptilia	Elapidae	<i>Demansia rufescens</i>	Rufous Whipsnake				1			
Reptilia	Elapidae	<i>Pseudechis australis</i>	Mulga Snake				1			
Reptilia	Elapidae	<i>Pseudonaja mengdeni</i>	Western Brown Snake				1			
Reptilia	Elapidae	<i>Suta fasciata</i>	Rosen's Snake				1			
Reptilia	Elapidae	<i>Suta punctata</i>	Spotted Snake				1			
Reptilia	Elapidae	<i>Vermicella snelli</i>					1			
Reptilia	Gekkonidae	<i>Gehyra pilbara</i>					1			
Reptilia	Gekkonidae	<i>Gehyra punctata</i>					1		1	
Reptilia	Gekkonidae	<i>Gehyra purpurascens</i>					1			
Reptilia	Gekkonidae	<i>Gehyra variegata</i>					1		1	
Reptilia	Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's Gecko				1			
Reptilia	Gekkonidae	<i>Heteronotia spelea</i>	Desert Cave Gecko				1			
Reptilia	Pygopodidae	<i>Delma pax</i>					1			
Reptilia	Pygopodidae	<i>Delma tinca</i>					1			
Reptilia	Scincidae	<i>Carlia triacantha</i>	Desert Rainbow Skink				1			
Reptilia	Scincidae	<i>Cryptoblepharus buchanani</i>					1			
Reptilia	Scincidae	<i>Cryptoblepharus metallicus</i>					1			
Reptilia	Scincidae	<i>Cryptoblepharus plagiocephalus</i>					1			

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Reptilia	Scincidae	<i>Ctenotus australis</i>					1			
Reptilia	Scincidae	<i>Ctenotus duricola</i>					1			
Reptilia	Scincidae	<i>Ctenotus grandis</i>					1			
Reptilia	Scincidae	<i>Ctenotus helenae</i>					1			
Reptilia	Scincidae	<i>Ctenotus pantherinus</i>	Leopard Ctenotus				1			
Reptilia	Scincidae	<i>Ctenotus piankai</i>					1			
Reptilia	Scincidae	<i>Ctenotus rubicundus</i>					1			
Reptilia	Scincidae	<i>Ctenotus saxatilis</i>	Rock Ctenotus				1			
Reptilia	Scincidae	<i>Ctenotus schomburgkii</i>					1			
Reptilia	Scincidae	<i>Ctenotus serventyi</i>					1			
Reptilia	Scincidae	<i>Egernia cygnitos</i>	Western Pilbara Spiny-tailed Skink				1		1	
Reptilia	Scincidae	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink				1			
Reptilia	Scincidae	<i>Egernia eos</i>	Central Pygmy Spiny-tailed Skink				1			
Reptilia	Scincidae	<i>Egernia epsisolus</i>	Eastern Pilbara Spiny-tailed Skink				1			
Reptilia	Scincidae	<i>Egernia pilbarensis</i>	Pilbara Skink				1			
Reptilia	Scincidae	<i>Eremiascincus isolepis</i>					1			
Reptilia	Scincidae	<i>Eremiascincus musivus</i>	Mosaic Desert Skink				1			
Reptilia	Scincidae	<i>Eremiascincus pallidus</i>	Western Narrow-banded Skink				1			
Reptilia	Scincidae	<i>Lerista bipes</i>					1			
Reptilia	Scincidae	<i>Lerista clara</i>					1			
Reptilia	Scincidae	<i>Lerista jacksoni</i>					1			
Reptilia	Scincidae	<i>Lerista muelleri</i>					1			
Reptilia	Scincidae	<i>Lerista neviniae</i>	Nevin's Slider	EN (BC Act)			1			
Reptilia	Scincidae	<i>Lerista verhmens</i>					1			
Reptilia	Scincidae	<i>Menetia greyii</i>					1			
Reptilia	Scincidae	<i>Morethia ruficauda</i>					1		1	

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Reptilia	Scincidae	<i>Notoscincus butleri</i>	lined soil-crevice skink (Dampier)	P4 (DBCA list)						1
Reptilia	Scincidae	<i>Notoscincus ornatus ornatus</i>					1			
Reptilia	Scincidae	<i>Proablepharus reginae</i>					1			
Reptilia	Scincidae	<i>Tiliqua multifasciata</i>	Central Blue-tongue				1			
Reptilia	Scincidae	<i>Tiliqua occipitalis</i>	Western Bluetongue						1	
Reptilia	Typhlopidae	<i>Anilius ammodytes</i>					1			
Reptilia	Typhlopidae	<i>Anilius grypus</i>					1			
Reptilia	Typhlopidae	<i>Indotyphlops braminus</i>			*	1				
Reptilia	Varanidae	<i>Varanus acanthurus</i>	Spiny-tailed Monitor				1			
Reptilia	Varanidae	<i>Varanus brevipauda</i>	Short-tailed Pygmy Monitor				1			
Reptilia	Varanidae	<i>Varanus eremius</i>	Pygmy Desert Monitor				1			
Reptilia	Varanidae	<i>Varanus giganteus</i>	Perentie				1			
Reptilia	Varanidae	<i>Varanus gouldii</i>	Bungarra or Sand Monitor				1		1	
Reptilia	Varanidae	<i>Varanus panoptes</i>	Yellow-spotted Monitor						1	
Reptilia	Varanidae	<i>Varanus panoptes rubidus</i>					1			
Reptilia	Varanidae	<i>Varanus pilbarensis</i>	Pilbara Rock Monitor				1			
Reptilia	Varanidae	<i>Varanus tristis</i>	Racehorse Monitor				1		1	

Appendix 7 Flora species inventory

Family	Species	Status
Acanthaceae	<i>Rostellularia adscendens</i> var. <i>clementii</i>	
Aizoaceae	* <i>Trianthema portulacastrum</i>	Weed
Amaranthaceae	<i>Gomphrena canescens</i> subsp. <i>canescens</i>	
Amaranthaceae	<i>Gomphrena cunninghamii</i>	
Amaranthaceae	<i>Ptilotus aevoides</i>	
Amaranthaceae	<i>Ptilotus astrolasius</i>	
Amaranthaceae	<i>Ptilotus calostachyus</i>	
Amaranthaceae	<i>Ptilotus clementii</i>	
Amaranthaceae	<i>Ptilotus helipteroides</i>	
Amaranthaceae	<i>Ptilotus murrayi</i>	
Amaranthaceae	<i>Ptilotus obovatus</i>	
Apocynaceae	<i>Carissa lanceolata</i>	
Asteraceae	<i>Calotis plumulifera</i>	
Asteraceae	<i>Pluchea dentex</i>	
Asteraceae	<i>Pterocaulon sphacelatum</i>	
Asteraceae	<i>Streptoglossa bubakii</i>	
Bignoniaceae	<i>Dolichandrone occidentalis</i>	
Boraginaceae	<i>Ehretia saligna</i> var. <i>saligna</i>	
Boraginaceae	<i>Heliotropium cunninghamii</i>	
Boraginaceae	<i>Heliotropium muticum</i>	P3 (DBCA list)
Boraginaceae	<i>Trichodesma zeylanicum</i>	
Brassicaceae	<i>Lepidium pholidogynum</i>	
Chenopodiaceae	<i>Dysphania rhadinostachya</i>	
Chenopodiaceae	<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
Chenopodiaceae	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	
Cleomaceae	<i>Cleome viscosa</i>	
Convolvulaceae	<i>Bonamia erecta</i>	
Convolvulaceae	<i>Bonamia pilbarensis</i>	
Convolvulaceae	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
Convolvulaceae	<i>Ipomoea muelleri</i>	
Convolvulaceae	<i>Polymeria ambigua</i>	
Cucurbitaceae	<i>Cucumis variabilis</i>	
Cyperaceae	<i>Bulbostylis barbata</i>	
Euphorbiaceae	<i>Euphorbia ?biconvexa</i>	
Euphorbiaceae	<i>Euphorbia australis</i>	
Euphorbiaceae	<i>Euphorbia biconvexa</i>	
Euphorbiaceae	<i>Euphorbia drummondii</i>	
Fabaceae	* <i>Vachellia farnesiana</i>	Weed
Fabaceae	<i>Acacia acradenia</i>	

Family	Species	Status
Fabaceae	<i>Acacia ancistrocarpa</i>	
Fabaceae	<i>Acacia arida</i>	
Fabaceae	<i>Acacia bivenosa</i>	
Fabaceae	<i>Acacia bivenosa x sclerosperma</i> subsp. <i>sclerosperma</i>	
Fabaceae	<i>Acacia colei</i> var. <i>colei</i>	
Fabaceae	<i>Acacia coriacea</i> subsp. <i>pendens</i>	
Fabaceae	<i>Acacia inaequilatera</i>	
Fabaceae	<i>Acacia pyrifolia</i>	
Fabaceae	<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>	
Fabaceae	<i>Acacia stellaticeps</i>	
Fabaceae	<i>Acacia synchronicia</i>	
Fabaceae	<i>Acacia trachycarpa</i>	
Fabaceae	<i>Acacia tumida</i> var. <i>pilbarensis</i>	
Fabaceae	<i>Acacia tumida</i> var. <i>tumida</i>	
Fabaceae	<i>Alysicarpus muelleri</i>	
Fabaceae	<i>Cajanus cinereus</i>	
Fabaceae	<i>Crotalaria cunninghamii</i>	
Fabaceae	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	
Fabaceae	<i>Cullen leucanthum</i>	
Fabaceae	<i>Cullen leucochaites</i>	
Fabaceae	<i>Indigofera monophylla</i>	
Fabaceae	<i>Indigofera trita</i>	
Fabaceae	<i>Neptunia dimorphantha</i>	
Fabaceae	<i>Rhynchosia minima</i>	
Fabaceae	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
Fabaceae	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
Fabaceae	<i>Senna notabilis</i>	
Fabaceae	<i>Sesbania cannabina</i>	
Fabaceae	<i>Tephrosia densa</i>	
Goodeniaceae	<i>Goodenia microptera</i>	
Goodeniaceae	<i>Scaevola spinescens</i>	
Lauraceae	<i>Cassytha racemosa</i>	
Malvaceae	* <i>Malvastrum americanum</i>	Weed
Malvaceae	<i>Corchorus tectus</i>	
Malvaceae	<i>Corchorus walcottii</i>	
Malvaceae	<i>Gossypium australe</i>	
Malvaceae	<i>Sida clementii</i>	
Malvaceae	<i>Sida fibulifera</i>	
Malvaceae	<i>Triumfetta clementii</i>	
Malvaceae	<i>Triumfetta maconochieana</i>	
Malvaceae	<i>Triumfetta ramosa</i>	



Family	Species	Status
Malvaceae	<i>Waltheria indica</i>	
Meliaceae	<i>Owenia reticulata</i>	
Myrtaceae	<i>Corymbia candida</i> subsp. <i>dipsodes</i>	
Myrtaceae	<i>Corymbia hamersleyana</i>	
Myrtaceae	<i>Eucalyptus victrix</i>	
Nyctaginaceae	<i>Boerhavia gardneri</i>	
Phyllanthaceae	<i>Phyllanthus maderaspatensis</i>	
Poaceae	* <i>Cenchrus ciliaris</i>	Weed
Poaceae	<i>Aristida contorta</i>	
Poaceae	<i>Chrysopogon fallax</i>	
Poaceae	<i>Dichanthium sericeum</i> subsp. <i>humilius</i>	
Poaceae	<i>Enteropogon ramosus</i>	
Poaceae	<i>Eragrostis cumingii</i>	
Poaceae	<i>Eragrostis xerophila</i>	
Poaceae	<i>Eriachne mucronata</i>	
Poaceae	<i>Eriachne obtusa</i>	
Poaceae	<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	
Poaceae	<i>Panicum decompositum</i>	
Poaceae	<i>Sporobolus australasicus</i>	
Poaceae	<i>Triodia epactia</i>	
Poaceae	<i>Triodia wiseana</i>	
Polygalaceae	<i>Polygala isingii</i>	
Proteaceae	<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	
Proteaceae	<i>Grevillea pyramidalis</i> subsp. <i>pyramidalis</i>	
Proteaceae	<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	
Proteaceae	<i>Hakea lorea</i> subsp. <i>lorea</i>	
Rubiaceae	<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3 (DBCA list)
Solanaceae	<i>Solanum diversiflorum</i>	
Solanaceae	<i>Solanum horridum</i>	
Solanaceae	<i>Solanum lasiophyllum</i>	
Thymelaeaceae	<i>Pimelea ammocharis</i>	
Violaceae	<i>Hybanthus aurantiacus</i>	
Zygophyllaceae	<i>Tribulus hirsutus</i>	

