

APPENDICES

APPENDIX 1: FAUNA HABITAT ASSESSMENT REPORT



PHOENIX

ENVIRONMENTAL SCIENCES

Flora and Fauna Assessment of Lot 1416 for the Parker Range Project

Prepared for Mineral Resources Ltd

February 2021

Final Report



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Prepared for Mineral Resources Ltd

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EXECUTIVE SUMMARY

Mineral Resources Ltd (MRL) is required, in accordance with Condition 10 of MS 892 to set up the Parker Range Conservation Trust and acquire land suitable for rehabilitation to offset the residual impacts to conservation significant fauna and flora. MRL has identified Lot 1416 (the 'study area') as a potential offset site. The study area is located approximately 45 km east north-east of Merredin in the Shire of Yilgarn, Western Australia in the South-west botanical province, enclosing approximately 815 ha of mostly undisturbed remnant native vegetation.

MRL engaged Phoenix Environmental Sciences (Phoenix) in March 2020 to conduct a high-level assessment of the conservation values present within the study area including:

- high level vegetation-structure (NVIS Level 2) mapping
- general location, extent and condition of potentially significant vegetation and flora
- general location, extent and condition of potential habitat for significant fauna.

Lot 1416 was visited in Autumn, from 11 – 13 March 2020. Field methods for the flora and vegetation survey included relevé surveys, targeted searches for significant flora, Declared Pests and Weeds of National Significance (WoNS) and assessment of the presence of Threatened and Priority Ecological Communities (TECs and PECs). Field methods for the fauna component of the survey included habitat assessment, active diurnal searches and Malleefowl (*Leipoa ocellata*) habitat assessments.

Database searches identified 589 plant taxa recorded within a 20 km radius of the study area representing 73 families and 230 genera; of these 36 were introduced plant taxa. Six flora sites were surveyed for flora, with 39 vascular plant taxa recorded, representing 18 families and 24 genera. The most diverse genera were *Eucalyptus*, *Acacia*, *Eremophila*, *Melaleuca* and *Allocasuarina*. No Declared Pests and Weeds of National Significance (WoNS) were recorded.

One Priority 3 species was recorded during the survey, *Acacia crenulata*. This species is not known from the Parker Range Iron Ore Project (PRIOP) mine or proposed haul road. The study area has the potential to support a high number of significant flora species, including several taxa that will be impacted by PRIOP.

According to regional scale mapping, the vegetation associations present in Lot 1416 have been heavily cleared, holding the status of Vulnerable at the bioregional and subregional scale, and are poorly represented in the reserve system. Five broadly defined vegetation types were defined in the study area from the field survey, representing a mix of *Allocasuarina/Acacia* and *Eucalyptus* woodlands, *Allocasuarina*/ mallee and *Melaleuca* shrublands, and a *Borya* herbland on a granite outcropping. No presence of the Eucalypt Woodland of the Western Australian Wheatbelt TEC was identified in the study area.

Two significant fauna species of relevance PRIOP, Malleefowl (Threatened) and Chuditch *Dasyurus geoffroyi* (also Threatened) were recorded in the survey. Around 86% of the study area was found to be suitable breeding and foraging habitat for the Threatened fauna species Malleefowl and a single old, degraded mound was located in the south of the study area. An additional area of shrubland that was recently burnt is currently not suitable for Malleefowl but may become so once it recovers.

Chuditch was recorded from scats, indicating the study area is at least used for dispersal by the species; potentially suitable foraging and denning habitat was also recorded. The mere presence of Chuditch (whether breeding, foraging, or traversing the area between other habitat patches) is sufficient to meet criteria for habitat critical to its survival and maintenance. The eucalypt woodland present in the study area was identified as suitable for nesting by Western Rosella *Platycercus icterotis xanthogenys* (Priority 4); this species is also of relevance to PRIOP.

Lot 1416 connects the three adjacent conservation reserves, providing both a linkage between these and collectively (with the reserves) representing a large intact remnant within a heavily cleared landscape. Local fauna populations within the adjacent reserves are likely to be dependent on the fauna habitat and connectivity provided by Lot 1416. It also potentially has important value as a linkage between other reserves and remnants, although a wider regional assessment was not part of this scope.

Four introduced fauna were recorded from numerous records, indicating they are active within the study area and present a threat to native fauna, including Malleefowl and Chuditch, particularly predator species (cat, fox and dog).

Based on the findings of this study, Lot 1416 potentially presents a suitable site to offset the significant residual impacts of PRIOP. The site has potentially overlapping values to those that will be impacted by PRIOP and appears suitable for inclusion into the conservation estate in accordance with DBCA's strategic criteria, including:

- one confirmed significant flora species present and likely to contain several others
- provides habitat for significant fauna, including Threatened species
- contains vegetation communities that are not well represented in the conservation reserve system
- will contribute to better management outcomes for existing conservation reserves

The value of Lot 1416 as an offset site needs to be considered in more detail in the context of its connection to the adjacent reserves. Further investigation is required to better define the significant flora present, habitat value/utilisation by Malleefowl and Chuditch, and overall condition of vegetation/habitat both within Lot 1416 and the adjacent reserves. Ongoing monitoring and management of introduced predator species is recommended to reduce this threat on the local Malleefowl and Chuditch population.

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1 INTRODUCTION

1.1 OVERVIEW AND SCOPE

Mineral Resources Ltd (MRL) is developing the Parker Range Iron Ore Project (PRIOP), located approximately 15 km south-east of Marvel Loch and 45 km south-east of Southern Cross in the Goldfields region of Western Australia (WA). PRIOP is approved under the *Environmental Protection Act 1986* (EP Act) via Ministerial Statement (MS) 892 (Minister for Environment; Water 2012). In accordance with Condition 10 of MS 892, MRL is required to set up the Parker Range Conservation Trust and acquire land suitable for rehabilitation to offset the residual impacts to conservation significant fauna and flora.

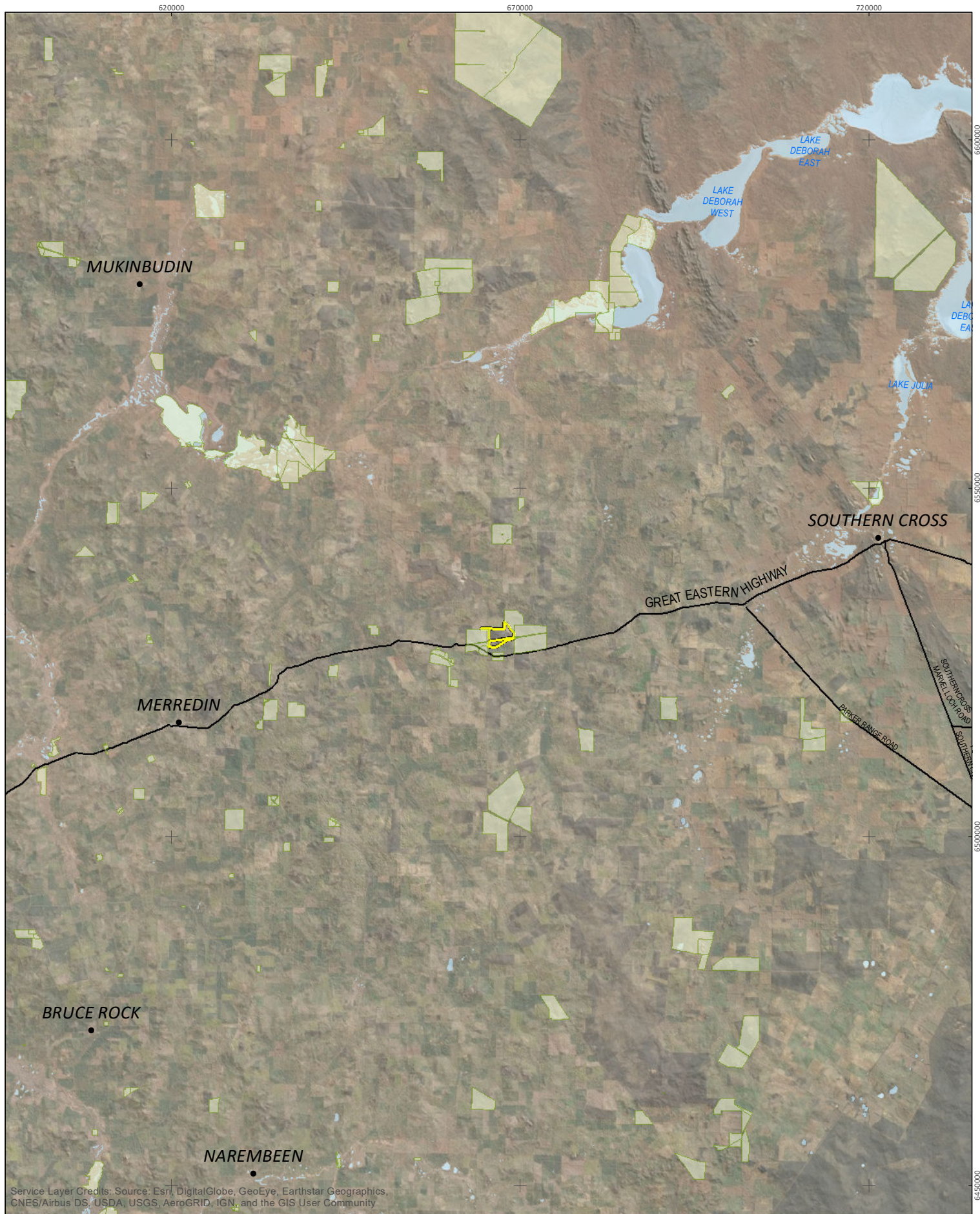
Lot 1416 (the 'study area') has been identified by MRL as a potential offset site for PRIOP. MRL engaged Phoenix Environmental Sciences (Phoenix) in March 2020 to conduct a high-level assessment of the conservation values present within the lot including:

- high level vegetation-structure (NVIS Level 2) mapping
- general location, extent and condition of potentially significant vegetation and flora, including an assessment for presence of the Eucalypt Woodland of the Western Australian Wheatbelt Threatened Ecological Community (TEC)
- general location, extent and condition of potential habitat for significant fauna including Malleefowl (*Leipoa ocellata*), Western Rosella (inland) (*Platycercus icterotis xanthogenys*) and Chuditch (*Dasyurus geoffroyi*).

This report also provides brief comment on the overlap of biological values between Lot 1416 and PRIOP, including those identified in the Public Environmental Review for the mine area (Cazaly Resources Limited 2010) and more recently for the proposed PRIOP haul road (Mineral Resources Ltd 2021; Phoenix 2021). Reference to potential impacts on significant flora is based on the impact assessment in Mineral Resources Ltd (2021).


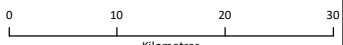
1.2 LOCATION

Lot 1416 is located approximately 45 km east north-east of Merredin in the Shire of Yilgarn, WA in the South-west botanical province (Figure 1-1). It is approximately 75 km west of PRIOP. Lot 1416 encloses approximately 815 ha of (mostly) undisturbed remnant native vegetation (Figure 1-2).



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Mineral Resources Ltd Parker Range Iron Ore Project	
Project No	1314
Date	19-May-20
Drawn by	AJ
Map author	SP
	
	
1:700,000 (at A4) GDA 1994 MGA Zone 50	





-  Study area
-  Nature Reserve
-  Road

Figure 1-1
Project location



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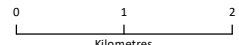
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Mineral Resources Ltd Parker Range Iron Ore Project	
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Date	19-May-20
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Map author	SP
	
	
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-  Study Area
-  Nature Reserve

Figure 1-2
Study area



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2 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)

2.1 DESKTOP ASSESSMENT

A review of background environmental information for the study area was undertaken prior to the survey, including climate (BoM), biogeography (IBRA 7) (DoEE 2016), soils (Stewart *et al.* 2008) and pre-European vegetation (Shepherd *et al.* 2002).

A search of several biological databases was undertaken using a 20 km search radius from the centre of the study area to identify potential significant flora and fauna values of the study area (Table 2-1).

To enable comparison of Lot 1416 with the PRIOP area, significant flora and fauna relevant to PRIOP were extracted from several documents:

- Cazaly Resources Limited (2010) – Parker Range Iron Ore Project - Mt Caudan Deposit, Environmental Impact Assessment (Public Environmental Review), for significant fauna of relevance to the mine
- Phoenix (2021) – Baseline flora, vegetation and fauna surveys for the Parker Range Haul Road Project, for significant fauna of relevance to the haul road
- Mineral Resources Ltd (2021) – for current list of significant flora that will be impacted by the mine and/or haul road.

Table 2-1 Database searches conducted for the desktop review

Database	Target group/s	Search extent
Protected Matters Search Tool (DoEE 2020)	EPBC Act Threatened flora, fauna and ecological communities	Study area plus a 20 km buffer
Department of Biodiversity, Conservation and Attractions (DBCA) NatureMap Database (DBCA 2020)	Flora and fauna records	Study area plus a 20 km buffer
Phoenix' biological database (Phoenix 2020). May include other clients records and previous desktop review data.	Flora and fauna records	Study area plus a 20 km buffer

2.2 FIELD WORK

2.2.1 Survey timing

Lot 1416 was visited in autumn, from 11–13 March 2020 by zoologist Simon Pynt and botanist Andrew Perkins. The vegetation condition rating system for the South-west botanical province, as defined by EPA (2016c) was used throughout the survey (Table 2-2).

Table 2-2 Vegetation condition rating scale (EPA 2016c)

Condition rating	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

2.2.2 Flora and vegetation

Field methods for the flora and vegetation survey included:

- relevé surveys
- targeted searches for significant flora, Declared Pests and Weeds of National Significance (WoNS)
- assessment of the presence of TEC/PEC.

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

2.2.2.1 Relevés

Relevé locations were selected to ensure that an accurate representation of the major vegetation types within the study area were sampled adequately. A total of six relevés were sampled (Figure 4-1; Appendix 1), data recorded included:

- a geographic coordinate
- a list of the prominent flora species present
- description of vegetation – a broad description utilising the structural formation and height classes based on National Vegetation Information System (ESCAVI 2003) to level II (NVIS Technical Working Group 2017)
- 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 South-west 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.

2.2.2.2 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.

2.2.2.3 Assessment of the presence of TEC/PEC

Assessment and mapping of the extent of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC was undertaken using a key and customised data collection template derived from conservation advice for the TEC (Threatened Species Scientific Committee 2015a).

In the field, six sites were selected for Eucalypt Woodland TEC assessments. Relevés were conducted for each of these sites, recording habitat description, vegetation condition, plant species and a representative photo was taken for each site (Appendix 1). TEC assessments were conducted at each relevé where the vegetation present was evaluated against the diagnostic criteria for the TEC (refer to Appendix 3). The data was captured electronically in the field using Phoenix's customised data collection template (Mobile Data Studio) for the TEC.

In determining the presence of the TEC, features of the remnant woodland patch including vegetation condition, patch size and the density of mature trees was considered. Suitable patches were foot-searched, and the number of mature trees counted to determine if density was sufficient for the patch to be considered representative of the TEC.

2.2.3 Significant flora likelihood of occurrence assessment

The likelihood of occurrence in Lot 1416 was assessed for each significant flora species identified in the database searches. Each species was 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.

Likelihood of occurrence was also assessed for all significant species that will be impacted by the PRIOP mine and/or haul road, as identified by Mineral Resources Ltd (2021) to evaluate the suitability of Lot 1416 as an offset site for PRIOP in relation to significant flora values.

2.3 TERRESTRIAL FAUNA

Field methods for the fauna component of the survey included:

- habitat assessment (see 2.3.1)
- active diurnal searches (2.3.2)
- Malleefowl habitat assessment (2.3.3) – 18 locations assessed.

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 Avon Wheatbelt bioregion. Tentative sites were selected for the terrestrial fauna survey to represent all habitat types. 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 and Malleefowl assessment sites (Appendix 4).

2.3.2 Active searches

Active searches were undertaken throughout the study area. Active searches primarily targeted significant fauna species from direct sightings and secondary evidence. Searches were undertaken in any observable microhabitats considered likely to support such species.

2.3.3 Malleefowl habitat assessment

Assessing the suitability of Lot 1416 to support Malleefowl was the primary aim of the survey, which was done in the field using a set of habitat/environmental variables considered critical to Malleefowl in Western and Central Australia, as described in the National Recovery Plan (Benshemesh 2007).

Sites were assessed with a numerical score as a basis for mapping areas of suitable habitat in the study area (Figure 4-1). The score used is an unweighted sum of binary values (0 = absent, 1 = present) for the following attributes:

1. sandy substrate (sand/sandy loam/sandy clay)
2. litter (leaf litter forming distinct patches under trees/shrubs or - rarely in this area - continuous blanket over soil)
3. canopy (tall shrubs or trees forming more or less continuous canopy, contributing to suitable ground microclimates and screen from aerial predators)
4. level (ground approximately level, tending to prevent disturbance of soil and litter by rainfall runoff)
5. mallee (presence of any mallee-form *Eucalyptus* sp.)
6. *Melaleuca* (presence of any *Melaleuca* sp.)
7. mulga s.l. (presence of any *Acacia* sp. of subgenus *Juliflorae*)
8. *Triodia* (presence of any *Triodia* sp.).

Scores of four or greater (meaning a site contained at least 50% of features that comprise critical Malleefowl habitat) were considered to represent potential Malleefowl habitat. Sites that attained a value of four or greater were applied to vegetation type polygons and the entire polygon (usually) assigned as potential Malleefowl habitat. Where two or more sites were assessed within a single polygon, the higher score was applied unless features of the lower-scored site(s) were more representative. Where no site occurred within a polygon, polygons were classified based on scores for similar vegetation nearby and inspection of relative vegetation density.

2.3.4 Significant fauna likelihood of occurrence assessment

Following the field survey, the likelihood of occurrence for each significant fauna species identified in the desktop review was assessed. Likelihood of occurrence in Lot 1416 was also assessed for any additional significant fauna species that were either recorded or considered to have potential to occur in the PRIOP mine area (Cazaly Resources Limited 2010) and/or haul road (Phoenix 2021). Species were 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.

2.4 PERSONNEL

The personnel involved in the surveys are listed in Table 2-3. All survey work was carried out under relevant licences issued by DBCA under the BC Act.

Table 2-3 Survey personnel

Name	Permit	Qualifications	Role/s
Andrew Perkins	FB62000181	PhD Botany	Field survey, taxonomy and reporting
Simon Pynt	NA	BSc (Zoology)	Field survey and reporting

3 DESKTOP SURVEY RESULTS

3.1 CLIMATE

The Study Area is located in the Avon Wheatbelt bioregion (Beecham 2001) which is characterised as a region that experiences a dry Mediterranean climate with temperate, wet winters and warm dry summers. Most of the winter rainfall is derived from frontal systems originating in the south-west. The nearest Bureau of Meteorology (BoM) weather station with comprehensive data collection and recent historic climate data is Merredin (no. 010092) located 45 km east north-east from the study area (BoM 2020).

Daily mean temperatures at Merredin in the seven months preceding the surveys were above average. Records from Merredin show well above average rainfall in the month preceding the surveys but well below average falls for the three months prior (BoM 2020).

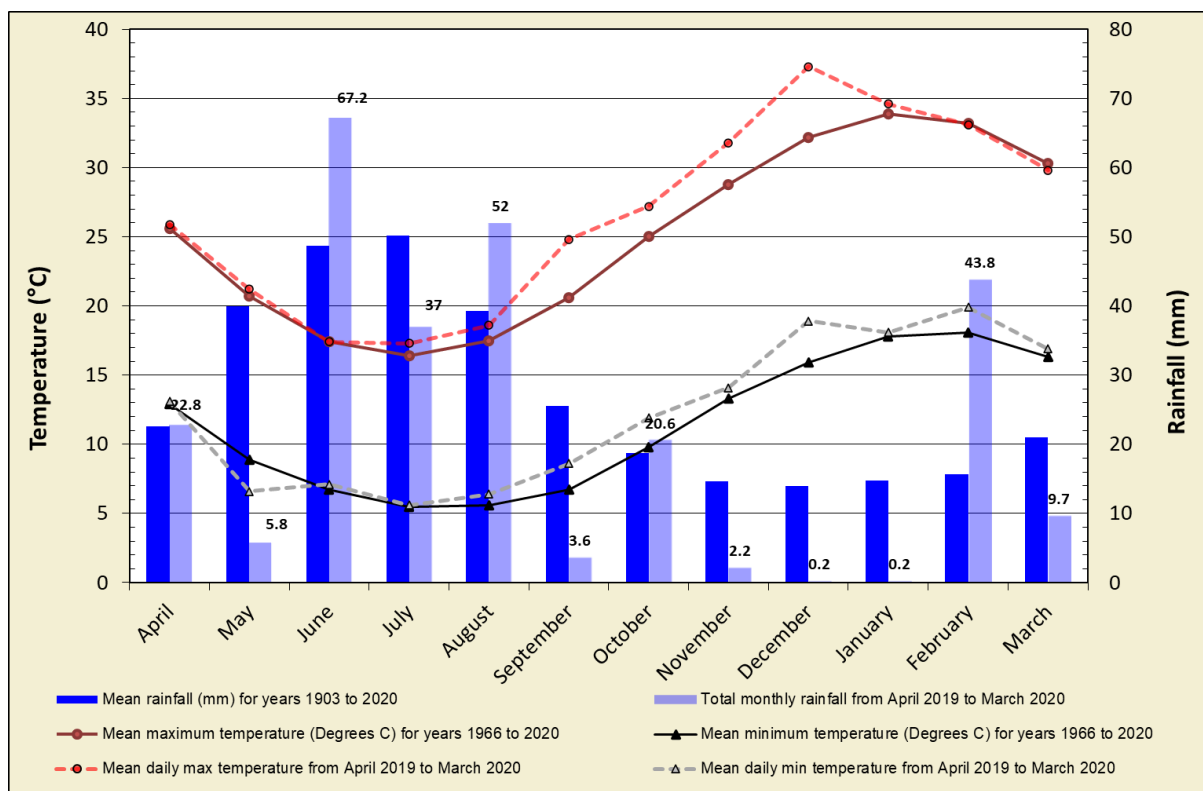


Figure 3-1 Annual climate and weather data for Merredin (no. 010092) and mean monthly data for the 12 months preceding the survey (BoM 2020)

3.2 INTERIM BIOGEOGRAPHIC REGIONALISATION FOR AUSTRALIA

The Interim Biogeographic Regionalisation of Australia (IBRA) classifies Australia’s landscapes into large ‘bioregions’ and ‘subregions’ based on climate, geology, landform, native vegetation and species information (DoEE 2016). The study area is located in the Merredin subregion (AVW01) of the Avon Wheatbelt bioregion which is characterised as dry and warm Mediterranean climate. Land use is dominated by a mixture of dryland agriculture and grazing. Undulating plain and disconnected drainage of salt lakes dissect a Tertiary plateau in Yilgarn Craton (Beecham 2001). Lateritic uplands are dominated by yellow sandplain and are vegetated with Proteaceous scrub heaths. Quaternary alluvials

and eluvials contain mixed eucalypt, *Allocasuarina huegeliana* and Jam-York Gum woodlands (Beecham 2001).

3.3 GEOLOGY, LAND SYSTEMS AND SOILS

The study area is located in the Yilgarn Craton and its geology is dominated by Archaean sedimentary rocks and granulite-facies metamorphics. The study area intersects two land systems (Table 3-1, Figure 3-2).

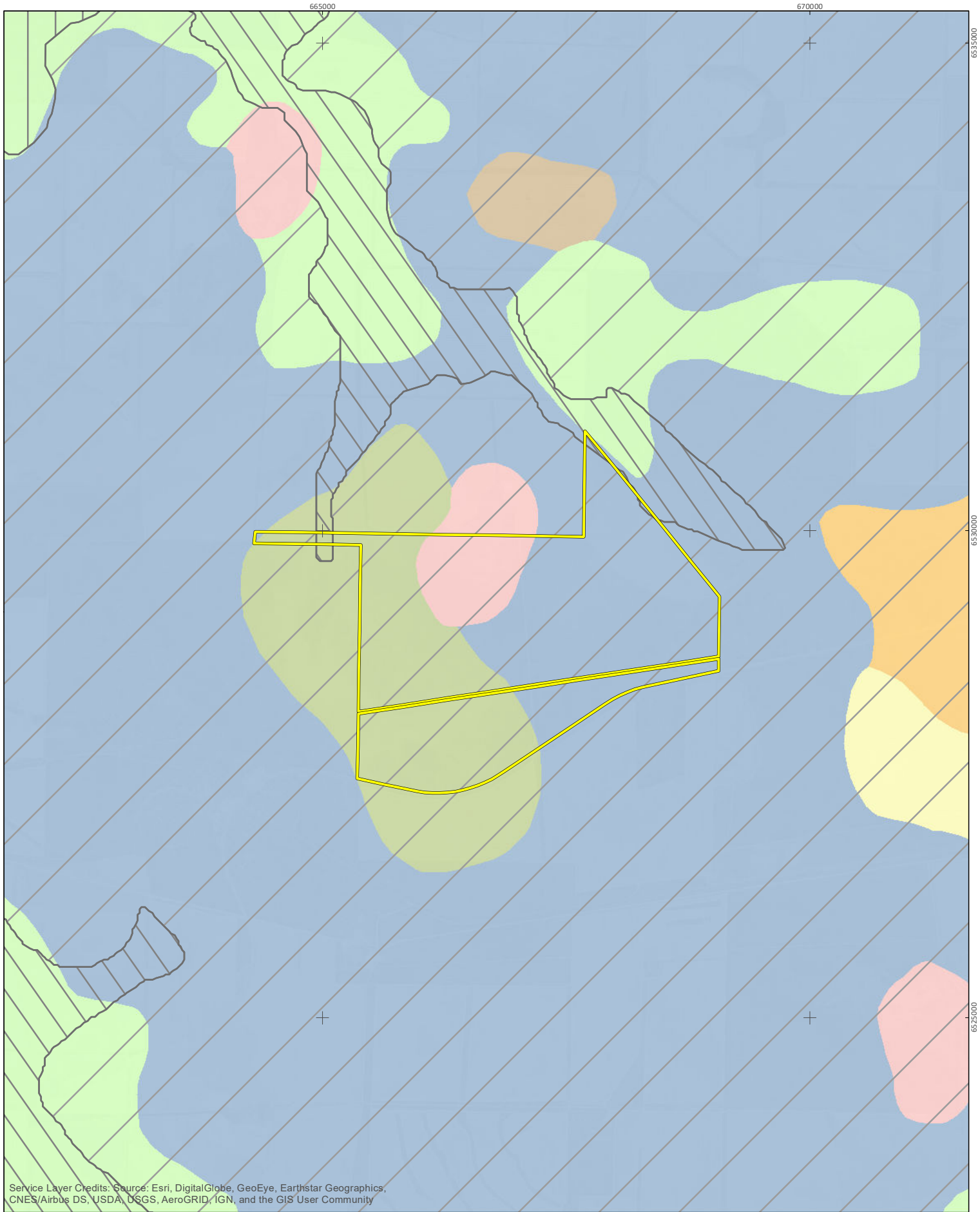
Table 3-1 Land systems and extent in study area

Land system	Description	Area (ha)	% of study area
Tandegin	Sandplain dominated interfluves with weakly indurated lateritised crests and upper slopes and long colluvial yellow sandplain upper to lower slopes. Unlateritised surfaces dominated by sodic and alkaline duplex soils.	810.0	99.4
Baladjie	Valley floors and lower slopes, in the northern Zone of Ancient Drainage, with calcareous loamy earth and alkaline red loamy duplex (mostly shallow). Woodland.	4.9	0.6

According to the Surface Geology of Australia 1:1,000,000 scale, Western Australia database (Stewart et al. 2008), the study area intersects three geological formations (Table 3-2).


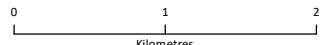
Table 3-2 Surface geology of the study area, extent by deposit type





Surface geology	Abbrev	Description	Area (ha)	% of study area
Ferruginous duricrust 38498	Czl	Pisolitic, nodular or vuggy ferruginous laterite; some lateritic soils; ferricrete; magnesite; ferruginous and siliceous duricrusts and reworked products, calcrete, kaolinised rock, gossan; residual ferruginous saprolite	406.41	49.9
Sand plain 38499	Czs	Sand or gravel plains; quartz sand sheets commonly with ferruginous pisoliths or pebbles, minor clay; local calcrete, laterite, silcrete, silt, clay, alluvium, colluvium, aeolian sand	320.99	39.4
Felsic intrusives 74292	Ag	Undifferentiated felsic intrusive rocks, including monzogranite, granodiorite, granite, tonalite, quartz monzonite, syenogranite, diorite, monzodiorite, pegmatite. Locally metamorphosed, foliated, gneissic. Local abundant mafic and ultramafic inclusions	87.45	10.7



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Date	19-May-20
Drawn by	AJ
Map author	SP
	
	
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-  Study area
- Landsystem**
-  Baladjie System
-  Holleton System
-  Tandegin System

- Surface geology**
-  Aey
-  Ag
-  An
-  Ayy
-  Cz1
-  Czs
-  Qrc

Figure 3-2
Landsystems and surface geology in the study area



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3.4 CONSERVATION RESERVES AND NATIONALLY IMPORTANT WETLANDS

Lot 1416 abuts three unnamed nature reserves immediately west (Unnamed WA18583), north east (Unnamed WA18584) and east (Unnamed WA16000), and another is approximately 1 km due south (Unnamed WA28562) (Figure 1-1). The Merredin subregion (AVW01) has 5.75% of its area in some form of conservation reserve (i.e. 5(1)(g) Reserve, 5(1)(h) Reserve, Conservation Covenant, Conservation Park, Conservation Reserve, Indigenous Protected Area, Nature Reserve, NRS Addition - Gazettal in Progress, Private Nature Reserve).

3.5 FLORA AND VEGETATION

3.5.1 Floristic diversity

The NatureMap (DBCA 2020) database search identified 589 plant taxa recorded within a 20 km radius of the study area representing 73 families and 230 genera and comprised of 36 introduced flora and 553 native flora. The most prominent families were the Myrtaceae (96 taxa), Fabaceae (78 taxa), Asteraceae (55 taxa), Proteaceae (40 taxa), Poaceae (27 taxa), Orchidaceae (23 taxa) and Goodeniaceae (22 taxa). The most diverse genera were *Acacia* (45 taxa), *Eucalyptus* (39 taxa), *Grevillea* (20 taxa), *Melaleuca* (17 taxa) and *Eremophila* (13 taxa).

3.5.2 Significant flora species

The NatureMap (DBCA 2020) database search identified 29 significant flora recorded within a 20 km radius of the study area (Table 3-3) comprised of 12 Threatened taxa, three Priority 1 taxa, one Priority 2 taxa, 11 Priority 3 taxa and two Priority 4 taxa.

Three significant flora species returned in the database search are of direct relevance to PRIOP, that is they have either been recorded within proposed clearing areas for the PRIOP mine and/or haul road, or are a risk of indirect impact (Cazaly Resources Limited 2010; Mineral Resources Ltd 2021; Phoenix 2021): *Lepidosperma lyonsii* (P1), *Verticordia mitodes* (P3) and *Banksia shanklandiorum* (P4) (Table 3-3).

Twenty additional significant flora species that were recorded in the PRIOP mine and/or haul road proposed clearing areas were not returned in the NatureMap search for Lot 1416 (Table 3-4).

Table 3-3 Significant flora identified in the database searches for Lot 1416

Species	Status	Habitat	Recorded flowering period	Relevance to PRIOP based on Mineral Resources Ltd (2021)
<i>Acacia ancistrophylla</i> var. <i>perarcuata</i>	P3 (DBC list)	Red sand, clay loam, loam. Undulating plains.	Aug.-Sep.	
<i>Acacia cerastes</i>	P1 (DBC list)	Skeletal soil. Rocky ironstone hillslopes.	Aug.-Nov.	
<i>Acacia crenulata</i>	P3 (DBC list)	Clay, sandy clay, yellow sand. Rocky rises, granite outcrops, breakaways.	Apr., Oct.	
<i>Acacia filifolia</i>	P3 (DBC list)	Yellow sand, gravelly lateritic sand. Sandplains.	May-Sep.	
<i>Acacia lobulata</i>	EN (EPBC & BC Acts)	Gritty loam or sand. Low granitic breakaways.	Jul.	
<i>Austrostipa blackii</i>	P3 (DBC list)	Hill slopes, winter wet depression, red sandy clay soils, orange clay.	Sep.-Nov.	
<i>Banksia horrida</i>	P3 (DBC list)	Sand, sometimes with gravel.	Apr.-Aug.	
<i>Banksia shanklandiorum</i>	P4 (DBC list)	White/yellow sand with lateritic gravel.	Jun.-Aug.	Directly impacted by PRIOP mine
<i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i>	VU (EPBC & BC Acts)	Lateritic gravel, grey sand.	Mar.-May	
<i>Boronia adamsiana</i>	VU (EPBC & BC Acts)	Yellow sand/loam over laterite. Flats, road verges.	Jul.-Oct.	
<i>Dasymalla axillaris</i>	CR (EPBC & BC Acts)	Plains, flats yellow sand, laterite	Jul.-Dec.	
<i>Dicrasyllis reticulata</i>	P3 (DBC list)	Sandy soils, often over granite. Amongst granite rock, hills, flats.	Sep.-Dec.	
<i>Eremophila resinosa</i>	EN (EPBC & BC Acts)	Clay loam, gravelly sandy clay. Road verges.	Apr., Oct.-Nov.	
<i>Eremophila virens</i>	EN (EPBC & BC Acts)	Red/brown sand. Granite hillsides	Aug.-Oct.	
<i>Eremophila viscida</i>	EN (EPBC & BC Acts)	Granitic soils, sandy loam. Stony gullies, sandplains.	Sep.-Nov.	
<i>Eucalyptus crucis</i> subsp. <i>crucis</i>	VU/EN (EPBC Act; BC Act)	Sand, loam. Granite outcrops.	Oct.-Mar.	

Species	Status	Habitat	Recorded flowering period	Relevance to PRIOP based on Mineral Resources Ltd (2021)
<i>Eutaxia acanthoclada</i>	P3 (DBCA list)	Light brown sandy clay, shallow sandy loam, red clay over banded ironstone, gravel. Gently undulating plains.	Oct.-Nov.	
<i>Gastrolobium diabolophyllum</i>	CR (EPBC & BC Acts)	Yellow-brown sand over laterite. Broadly undulating dunes.	Sept.	
<i>Glossostigma trichodes</i>	P1 (DBCA list)	Aquatic herb, granite pools	Sept.	
<i>Gompholobium cinereum</i>	P3 (DBCA list)	Yellow sand, clayey sand, brown loam, sandy gravel, laterite. Well-drained open sites, slopes, plains, roadsides.	Sept.-Nov.	
<i>Goodenia granitica</i>	P2 (DBCA list)	Brown sandy clay or loam over granite. Bases of outcrops, near water sources, valley floors.	Oct.-Nov., Feb.	
<i>Grevillea dryandroides</i> subsp. <i>hirsuta</i>	EN/VU (EPBC Act; BC Act)	White or yellow sand, laterite.	May, Sep.-Nov.	
<i>Hibbertia glabriuscula</i>	P3 (DBCA list)	Yellow sand over laterite. Sandplains with some laterite breakaways.	Sept.	
<i>Lepidosperma lyonsii</i>	P1 (DBCA list)	Pale orange skeletal sandy loam with banded ironstone gravel & rock, well-drained shallow stony loamy with quartz. Gentle hill slopes, upper slopes of large hill.	NA	Directly impacted by PRIOP haul road
<i>Myriophyllum petraeum</i>	P4 (DBCA list)	Strictly confined to ephemeral rock pools on granite outcrops.	Aug.-Dec.	
<i>Roycea pycnophylloides</i>	EN/VU (EPBC Act; BC Act)	Sandy soils, clay. Saline flats.	Sept.	
<i>Symonanthus bancroftii</i>	EN/CR (EPBC Act; BC Act)	Disturbed areas, fine grey sand, moist grey mud over granite, edge of ephemeral wetland	Jul.	
<i>Verticordia mitodes</i>	P3 (DBCA list)	Yellow sand. Undulating plains.	Oct.-Jan.	Directly impacted by PRIOP mine
<i>Verticordia stenopetala</i>	P3 (DBCA list)	Yellow sand, sometimes with gravel. Undulating plains.	Oct.-Jan.	

Table 3-4 Significant flora that will be impacted by PRIOP mine and/or haul road that were not identified in the database searches for Lot 1416

Species	Status	Relevance to PRIOP based on Mineral Resources Ltd (2021)
<i>Acacia asepala</i>	P2 (DBCA)	Directly impacted by PRIOP haul road
<i>Acacia concolorans</i>	P2 (DBCA)	Directly impacted by PRIOP mine and haul road
<i>Acacia desertorum</i> var. <i>nudipes</i>	P3 (DBCA)	Directly impacted by PRIOP haul road
<i>Baeckea grandibracteata</i> subsp. Parker Range	P1 (DBCA)	Directly impacted by PRIOP mine and haul road
<i>Bossiaea</i> sp. Jackson Range (G. Cockerton & S. McNee LCS 13614)	P3 (DBCA)	Directly impacted by PRIOP haul road
<i>Chamelaucium</i> sp. Parker Range (B.H. Smith 1255)	P1 (DBCA)	Directly impacted by PRIOP mine
<i>Cryptandra crispula</i>	P3 (DBCA)	Directly impacted by PRIOP mine and haul road
<i>Cyathostemon verrucosus</i>	P3 (DBCA)	Directly impacted by PRIOP haul road
<i>Hakea pendens</i>	P2 (DBCA)	Directly impacted by PRIOP mine and haul road
<i>Isopogon robustus</i>	T (CR EPBC Act; BC Act)	Potential for indirect impact by PRIOP mine
<i>Lepidosperma ferricola</i>	P3 (DBCA)	Directly impacted by PRIOP haul road
<i>Lepidosperma</i> sp. Mt Caudan (N. Gibson & M. Lyons 2081)	P1 (DBCA)	Directly impacted by PRIOP mine and haul road
<i>Lepidosperma</i> sp. Parker Range (N. Gibson & M. Lyons 2094)	P1 (DBCA)	Directly impacted by PRIOP mine
<i>Lissanthe scabra</i>	P2 (DBCA)	Directly impacted by PRIOP haul road
<i>Microcorys</i> sp. nov. (Parker Range)	New species	Directly impacted by PRIOP mine
<i>Phebalium drummondii</i>	P3 (DBCA)	Directly impacted by PRIOP haul road
<i>Rinzia torquata</i>	P3 (DBCA)	Directly impacted by PRIOP mine
<i>Stenanthemum bremerense</i>	P4 (DBCA)	Directly impacted by PRIOP haul road
<i>Verticordia multiflora</i> subsp. <i>solox</i>	P2 (DBCA)	Directly impacted by PRIOP haul road
<i>Westringia acifolia</i>	P1 (DBCA)	Directly impacted by PRIOP mine and haul road

3.5.3 Introduced flora

Of the 36 introduced flora, two are a WoNS and three are declared pests in Western Australia (Table 3-5).

Table 3-5 Declared pests and WoNS identified from the NatureMap (DBCA 2020) search occurring within 20 km of the study area

Taxa	Declared Pest	WoNS
* <i>Chondrilla juncea</i>	Y	
* <i>Chrysanthemoides monilifera</i>		Y
* <i>Echium plantagineum</i>	Y	
* <i>Tamarix aphylla</i>	Y	Y

3.5.4 Vegetation associations

Regional scale vegetation mapping by Shepherd *et al.* (2002) defined three vegetation associations in the study area (Table 3-6). Vegetation association 36 occupies most of the study area (92.8%) and is described as shrubland thicket with acacia-casuarina alliance. Remaining vegetation (association 8) is described as a salmon gum and gimlet woodland. The third association (128) represents rock outcrops and/or bare areas.

At the bioregional scale, associations 8 and 36 have between 10–30% of original extent remaining (Table 3-6) and are therefore assigned the status of Vulnerable. Both associations occur exclusively (or almost exclusively) within the Merredin subregion. All of the associations are poorly represented in DBCA managed lands, particularly 8 and 36 (Table 3-6).

According to the Shepherd *et al.* (2002) mapping, one of the associations, 128, is also mapped within part of the PRIOP area.

Table 3-6 Statewide extent of Pre-European vegetation associations present in the study area (Government of Western Australia 2019)

Veg. assoc.	Description	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%) ¹	Current extent in DBCA lands (%)	Extent in study area (ha, %)	Present in PR?
8	Medium woodland; salmon gum & gimlet	WA	694,638.1	346,425.8	49.9	13.6	46.1 ha, 5.7%	Yes
		AVW bioregion	356,571.8	50,340.3	14.1	8.6		
		AVW01 subregion	353,871.8	49941.6	14.1	8.7		
36	Shrublands; thicket, acacia-casuarina alliance	WA	495,430.7	226242.2	45.7	12.1	756.2 ha, 92.8%	No
		AVW bioregion	300,997.0	72,745.1	24.2	13.3		
		AVW01 subregion	300,997.0	72745.1	24.2	13.3		
128	Bare areas; rock outcrops	WA	329,836.2	288,813.5	87.6	24.0	12.0 ha, 1.5%	Yes
		AVW bioregion	41,967.2	22998.9	54.8	19.0		
		AVW01 subregion	35455.8	20055.5	56.6	19.6		

¹Red cells = Vulnerable community (10-30% remaining), yellow cells = Depleted community (>30-50% remaining).

3.6 FAUNA

The desktop review identified a total of 152 vertebrate species as potentially occurring, as well as three significant invertebrate taxa (Table 3-7). A total of 16 significant species were returned, including three invertebrates, ten birds and three mammals (Table 3-8; Table 3-9).

Table 3-7 Summary of terrestrial fauna potentially occurring

Class	Introduced	Native	Total
Invertebrates ¹	0	3	3
Amphibia	0	3	3
Reptiles	0	24	24
Birds	3	103	107
Mammals	7	12	19
Total	10	145	155

1 – significant invertebrates only.

Table 3-8 Summary of Threatened and Priority taxa within Classes

Class	Number of Priority species	Number of BC Act listed species	Number of EPBC Act listed species	Total significant fauna
Invertebrates	2	1	1	3
Birds	0	10	8	10
Mammals	0	3	3	3
Total	2	14	12	16

Significant species records were dominated by birds, in particular Malleefowl (minimum distance of a record from the study area was 1.04 km). Three significant species identified in the desktop review have also been recorded from the PRIOP mine area (Cazaly Resources Limited 2010) and/or haul road (Phoenix 2021) (Table 3-9): Malleefowl (*Leipoa ocellata*), Tree-stem Trapdoor Spider (*Aganippe castellum*) and Chuditch (*Dasyurus geoffroii*).

Five additional significant species that were recorded or considered to have potential to occur in the PRIOP mine area or haul road were not identified in the desktop review for Lot 1416:

- Lake Cronin Snake *Paroplocephalus atriceps* (P3) – possible in haul road
- Hooded Plover *Thinornis rubricollis* (P4) – possible in haul road (northern salt lakes)
- Common Greenshank *Tringa nebularia* (Mig.) – possible in haul road (northern salt lakes)
- Western Rosella (inland) *Platycercus icterotis xanthogenys* (P4) – recorded in mine area, likely in haul road
- *Isoodon* sp. bandicoot, likely new taxon related to Quenda *Isoodon fusciventer* (K. Travouillon pers. comm.) – recorded in the haul road.

Four species identified as having medium or high potential to occur in the PRIOP mine area (Cazaly Resources Limited 2010) no longer hold a conservation status: Rainbow Bee-eater, Shy Groundwren, White-browed Babbler (western wheatbelt) and Crested Bellbird (southern).

Table 3-9 Threatened and Priority species identified in desktop review

Scientific name	Vernacular	Status	Distance to study area (km)	Relevance to PRIOP based on Cazaly Resources Limited (2010) and Phoenix (2021)
Invertebrates				
<i>Aganippe castellum</i>	Tree-stem Trapdoor Spider	P4	4.7	Recorded mine area
<i>Idiosoma nigrum</i>	Shield-backed Trapdoor Spider	EN (BC Act), VU (EPBC Act)	Unknown	
<i>Daphnia jollyi</i>	a water flea (inland south west)	P1	Unknown	
Birds				
<i>Actitis hypoleucos</i>	Common Sandpiper	Mig.	Unknown	
<i>Apus pacificus</i>	Fork-tailed Swift	Mig.	Unknown	Likely but low relevance
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mig.	Unknown	Possible in haul road (northern salt lakes)
<i>Calidris ferruginea</i>	Curlew Sandpiper	CR/Mig.	Unknown	Possible in haul road (northern salt lakes)
<i>Calidris melanotos</i>	Pectoral Sandpiper	Mig.	Unknown	Possible in haul road (northern salt lakes)
<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo	EN	Unknown	
<i>Falco peregrinus</i>	Peregrine Falcon	OS (BC Act)	1.57	Likely in haul road
<i>Leipoa ocellata</i>	Malleefowl	VU	1.04	Recorded mine area and haul road
<i>Motacilla cinerea</i>	Grey Wagtail	Mig.	Unknown	
<i>Pezoporus occidentalis</i>	Night Parrot	CR (BC Act), EN (EPBC Act)	Unknown	
Mammals				
<i>Dasyurus geoffroii</i>	Chuditch	VU	Unknown	Recorded haul road
<i>Leporillus conditor</i>	Greater Stick-nest Rat	CD (BC Act), VU (EPBC Act)	Unknown	
<i>Phascogale calura</i>	Red-tailed Phascogale	CD (BC Act), VU (EPBC Act)	Unknown	Possible in haul road, although targeted surveys did not detect presence

4 FIELD SURVEY RESULTS

4.1 FLORA DIVERSITY

A total of 39 vascular plant taxa were identified from the six relevé surveys within the study area (Figure 4-1; Appendix 1), representing 18 families and 24 genera. The most diverse families were the Myrtaceae (myrtles) (10 taxa), Fabaceae (legumes) (6 taxa), Asteraceae (daisies) (three taxa) and Poaceae (grasses) (three taxa). The most diverse genera were *Eucalyptus* (8) and *Acacia* (6). No Declared Pests and Weeds of National Significance (WoNS) were recorded.

4.2 SIGNIFICANT FLORA

One Priority 3 species, *Acacia crenulata*, was recorded during the survey. This species is not known from the PRIOP mine or haul road areas.

Likelihood of occurrence within Lot 1416 for the majority of significant flora identified in the database searches was assessed as possible, including two species that will be impacted by PRIOP, *Banksia shanklandiorum* and *Verticordia mitodes* (Table 4-1). It is also considered possible that a further 12 additional significant flora that will be impacted by PRIOP may occur in Lot 1416 (Table 4-2).

Table 4-1 Likelihood of occurrence in Lot 1416 for significant flora identified by database searches

Species ¹	Status	Potential to occur in Lot 1416
<i>Acacia ancistrophylla</i> var. <i>perarcuata</i>	P3 (DBCA list)	Possible
<i>Acacia cerastes</i>	P1 (DBCA list)	Unlikely
<i>Acacia crenulata</i>	P3 (DBCA list)	Recorded
<i>Acacia filifolia</i>	P3 (DBCA list)	Possible
<i>Acacia lobulata</i>	EN (EPBC & BC Acts)	Possible
<i>Austrostipa blackii</i>	P3 (DBCA list)	Unlikely
<i>Banksia horrida</i>	P3 (DBCA list)	Possible
<i>Banksia shanklandiorum</i>	P4 (DBCA list)	Possible
<i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i>	VU (EPBC & BC Acts)	Possible
<i>Boronia adamsiana</i>	VU (EPBC & BC Acts)	Possible
<i>Dasymalla axillaris</i>	CR (EPBC & BC Acts)	Possible
<i>Dicrasyllis reticulata</i>	P3 (DBCA list)	Possible
<i>Eremophila resinosa</i>	EN (EPBC & BC Acts)	Unlikely
<i>Eremophila virens</i>	EN (EPBC & BC Acts)	Possible
<i>Eremophila viscida</i>	EN (EPBC & BC Acts)	Possible
<i>Eucalyptus crucis</i> subsp. <i>crucis</i>	VU/EN (EPBC Act; BC Act)	Possible
<i>Eutaxia acanthoclada</i>	P3 (DBCA list)	Unlikely
<i>Gastrolobium diabolophyllum</i>	CR (EPBC & BC Acts)	Possible
<i>Glossostigma trichodes</i>	P1 (DBCA list)	Possible
<i>Gompholobium cinereum</i>	P3 (DBCA list)	Possible
<i>Goodenia granitica</i>	P2 (DBCA list)	Possible
<i>Grevillea dryandroides</i> subsp. <i>hirsuta</i>	EN/VU (EPBC Act; BC Act)	Possible
<i>Hibbertia glabriuscula</i>	P3 (DBCA list)	Possible

Species ¹	Status	Potential to occur in Lot 1416
<i>Lepidosperma lyonsii</i>	P1 (DBCA list)	Unlikely
<i>Myriophyllum petraeum</i>	P4 (DBCA list)	Possible
<i>Roycea pycnophylloides</i>	EN/VU (EPBC Act; BC Act)	Unlikely
<i>Symonanthus bancroftii</i>	EN/CR (EPBC Act; BC Act)	Possible
<i>Verticordia mitodes</i>	P3 (DBCA list)	Possible
<i>Verticordia stenopetala</i>	P3 (DBCA list)	Possible

1 – species in bold will be directly impacted by PRIOP mine and/or haul road.

Table 4-2 Likelihood of occurrence in Lot 1416 for significant flora that will be impacted by PRIOP mine and/or haul road

Species ¹	Status	Potential to occur in Lot 1416
<i>Acacia asepala</i>	P2 (DBCA)	Unlikely
<i>Acacia concolorans</i>	P2 (DBCA)	Possible
<i>Acacia desertorum</i> var. <i>nudipes</i>	P3 (DBCA)	Unlikely
<i>Baeckea grandibracteata</i> subsp. Parker Range	P1 (DBCA)	Possible
<i>Bossiaea</i> sp. Jackson Range (G. Cockerton & S. McNee LCS 13614)	P3 (DBCA)	Unlikely
<i>Chamelaucium</i> sp. Parker Range (B.H. Smith 1255)	P1 (DBCA)	Possible
<i>Cryptandra crispula</i>	P3 (DBCA)	Possible
<i>Cyathostemon verrucosus</i>	P3 (DBCA)	Unlikely
<i>Hakea pendens</i>	P2 (DBCA)	Possible
<i>Isopogon robustus</i>	T (CR EPBC Act; BC Act)	Unlikely
<i>Lepidosperma ferricola</i>	P3 (DBCA)	Unlikely
<i>Lepidosperma</i> sp. Mt Caudan (N. Gibson & M. Lyons 2081)	P1 (DBCA)	Unlikely
<i>Lepidosperma</i> sp. Parker Range (N. Gibson & M. Lyons 2094)	P1 (DBCA)	Possible
<i>Lissanthe scabra</i>	P2 (DBCA)	Possible
<i>Microcorys</i> sp. nov. (Parker Range)	New species	Possible
<i>Phebalium drummondii</i>	P3 (DBCA)	Possible
<i>Rinzia torquata</i>	P3 (DBCA)	Possible
<i>Stenanthemum bremerense</i>	P4 (DBCA)	Unlikely
<i>Verticordia multiflora</i> subsp. <i>solox</i>	P2 (DBCA)	Possible
<i>Westringia acifolia</i>	P1 (DBCA)	Possible

1 – excludes species already covered in Table 4-1.

4.3 VEGETATION

4.3.1 Vegetation types

Five broadly defined vegetation types were observed in the field for the study area:

- *Allocasuarina/ Acacia* woodland over tussock (*Ecdeiocolea monostachya*) and sedges

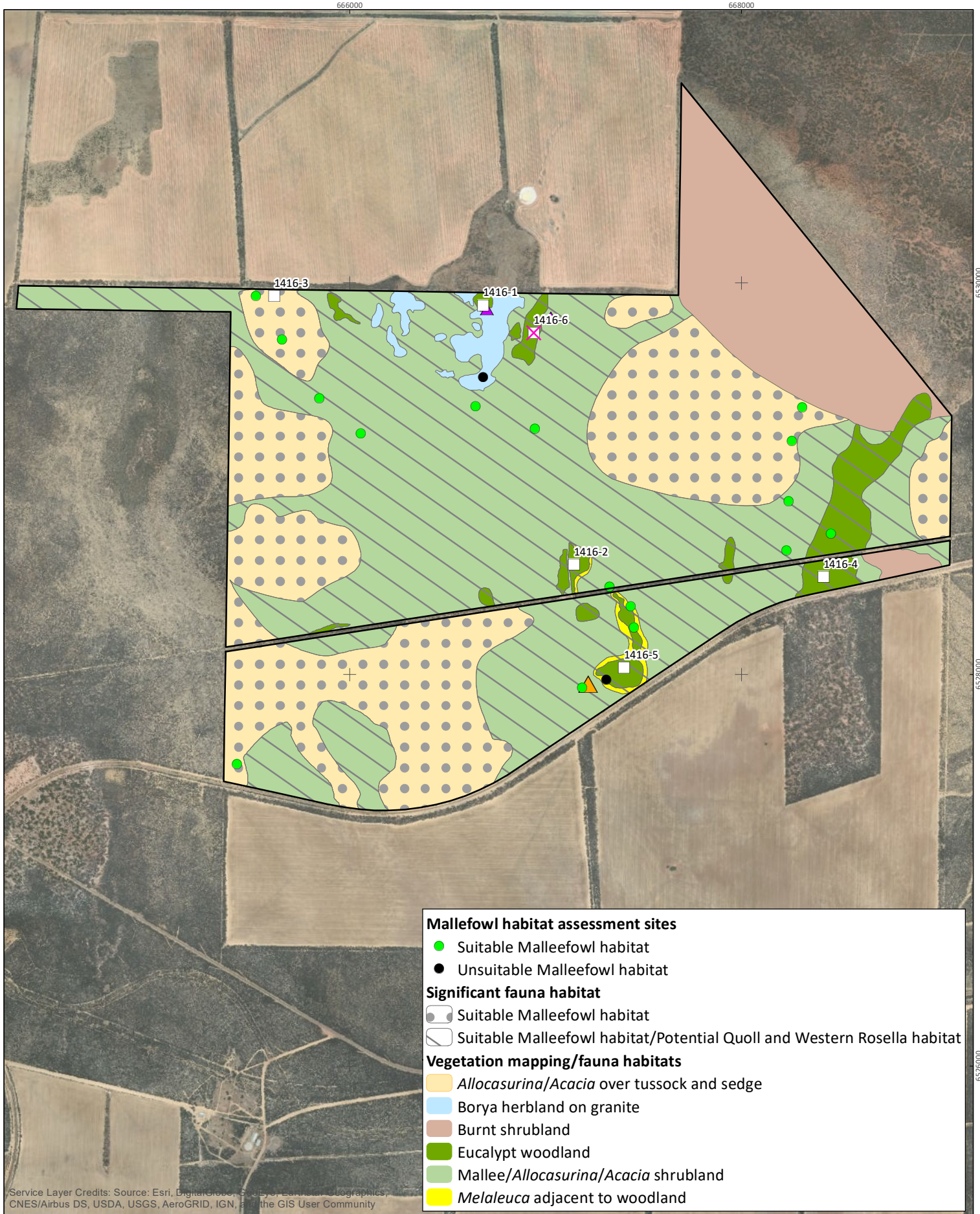
- *Allocasuarina*/ mallee eucalypt shrubland
- *Melaleuca* dominant shrubland
- *Borya* herbland on granite outcropping
- *Eucalyptus* woodland.

Each of these vegetation types correspond to the fauna habitats and are displayed below in Figure 4-1.

4.3.2 Eucalypt Woodland TEC assessment

All of the six sites assessed of presence of the Eucalypt Woodland TEC, indicated this community is not present due to absence or a lack of tree cover (<10%) of the diagnostic *Eucalyptus* species. One site, 1416-3, is characterised as *Allocasuarina* dominant shrubland (with occasional mallee eucalypts), which is the largest vegetation component at Lot 1416.

The remaining five sites were *Eucalyptus* woodland sites dominated by mallee species, all of which lacked suitable levels of diagnostic tree species (*Eucalyptus*) to qualify as Eucalypt Woodland TEC (Table 4-3). The condition of the vegetation is excellent with minimal disturbance evident, except in one area adjacent to the railway line [-31.366677 S, 118.769473 E]. This was the only location where weeds were evident.



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Project No	1314
Date	19-May-20
Drawn by	AJ
Map author	SP
1:25,000 (at A4) GDA 1994 MGA Zone 50	

- Study area
- Flora and vegetation survey sites
- Significant flora species**
- Acacia crenulata* (P3)
- Significant fauna species**
- Chuditch (*Dasyurus geoffroii*), VU, scats
- Malleefowl (*Leipoa ocellata*), VU, Mound

Figure 4-1
Survey sites, vegetation types, fauna habitats and significant species records in the study area



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Table 4-3 Eucalypt Woodland of the Western Australian Wheatbelt TEC assessment

Sample Site	General vegetation type	Dominant canopy species	Codominant canopy species	Crown assessment	TEC Indicator species present	Indicator Eucalypt species dominance	Vegetation condition (Keighery 1994)	Eucalypt Woodland TEC assessment
1416-1	Eucalypt Woodland	<i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>	None	Yes, > 10%	No	No	Excellent	No, NOT TEC
1416-2	Eucalypt Woodland	<i>Eucalyptus erythronema</i> subsp. <i>erythronema</i>	<i>Eucalyptus flocktoniae</i> subsp. <i>flocktoniae</i> , <i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i> , <i>Eucalyptus moderata</i> , <i>Melaleuca lateriflora</i>	Yes, <10%	<i>Eucalyptus salmonophloia</i>	No	Excellent	No, NOT TEC
1416-3	Mallee/ <i>Allocasuarina</i> /Acacia shrubland	<i>Allocasuarina acutivalvis</i> subsp. <i>acutivalvis</i> , <i>Allocasuarina spinosissima</i>	<i>Eucalyptus leptopoda</i> subsp. <i>leptopoda</i>	No, NOT TEC	No, NOT TEC	No, NOT TEC	Excellent	No, NOT TEC
1416-4	Eucalypt Woodland	<i>Eucalyptus erythronema</i> subsp. <i>erythronema</i>	<i>Eucalyptus salmonophloia</i> , <i>Melaleuca lateriflora</i>	Yes, >10%	<i>Eucalyptus salmonophloia</i>	No	Excellent	No, NOT TEC
1416-5	Eucalypt Woodland	<i>Eucalyptus erythronema</i> subsp. <i>erythronema</i>	None	Yes, > 10%	No	No	Excellent	No, NOT TEC
1416-6	Eucalypt Woodland	<i>Eucalyptus erythronema</i> subsp. <i>erythronema</i>	<i>Eucalyptus flocktoniae</i> subsp. <i>flocktoniae</i> , <i>Melaleuca lateriflora</i>	Yes, > 10%	No	No	Excellent	No, NOT TEC

4.4 FAUNA AND HABITAT

4.4.1 Fauna habitats

Six fauna habitats were identified in the study area, four of which were considered suitable for significant fauna species that have been recorded from the PRIOP mine area or haul road (see sections 4.4.2.1 and 4.4.2.2).

Table 4-4 Fauna habitats of the study area

Fauna habitat	Area (ha)	Area (%)	Comments
<i>Allocasuarina</i> / <i>Acacia</i> over tussock and sedge	252.3	31.0	Suitable Malleefowl breeding/foraging habitat
<i>Borya</i> herbland on granite	12.4	1.5	
Burnt shrubland	103.6	12.7	
Eucalypt woodland	35.6	4.4	Suitable Malleefowl breeding/foraging habitat Chuditch presence (scat recorded) and potential Western Rosella habitat
Mallee/ <i>Allocasuarina</i> / <i>Acacia</i> shrubland	407.1	50.0	Suitable Malleefowl breeding/foraging habitat (mound recorded) Chuditch presence (scat recorded) and potential Western Rosella habitat
<i>Melaleuca</i> adjacent to woodland	3.7	0.5	Suitable Malleefowl breeding/foraging habitat Potential Chuditch and Western Rosella habitat
Total	814.8	100.0	

4.4.2 Significant fauna

Two species of significant fauna that have been recorded within the PRIOP mine area and/or haul road were recorded during the field survey of Lot 1416:

- Malleefowl (see 4.4.2.1)
- Chuditch (see 4.4.2.2).

4.4.2.1 Malleefowl

One old, degraded Malleefowl mound was recorded in the study area (Figure 4-1).

The potential of fauna habitat within Lot 1416 to support Malleefowl was assessed at 18 locations (Figure 4-1; Table 4-5) and 16 of these recorded a score of >4, indicating suitable Malleefowl breeding and foraging habitat.

Four of the six fauna habitats within the study area, covering 820.97 ha (90.4% of the study area), were considered suitable for Malleefowl (Table 4-4).

Table 4-5 Malleefowl habitat assessment scores

Site	Sand	Canopy	Litter	Ground Level	Mallee	<i>Melaleuca</i>	Mulga	<i>Triodia</i>	Score	Malleefowl Habitat
MF001	1	1	1	1	0	0	1	0	5	Yes
MF002	1	1	1	1	1	0	0	0	5	Yes
MF003	1	1	0	1	1	1	0	0	5	Yes
MF004	1	1	0	1	1	1	0	0	5	Yes
MF005	1	0	0	1	1	0	0	0	3	No
MF006	1	1	0	1	1	0	0	0	4	Yes
MF007	1	1	0	1	1	1	0	0	5	Yes
MF008	1	1	0	1	1	0	0	0	4	Yes
MF009	1	1	0	1	1	0	0	0	4	Yes
MF010	1	1	1	1	1	0	0	1	6	Yes
MF011	1	1	1	1	0	0	0	0	4	Yes
MF012	1	1	0	1	1	0	0	0	4	Yes
MF013	0	0	0	1	0	0	0	0	1	No
MF014	1	1	1	1	1	1	0	0	6	Yes
MF015	1	1	0	1	1	1	0	0	5	Yes
MF016	1	1	0	1	1	1	0	0	5	Yes
MF017	1	1	1	1	1	1	0	0	6	Yes
MF018	1	1	1	1	1	1	0	0	6	Yes

4.4.2.2 Chuditch

Chuditch (*Dasyurus geoffroii*; VU) was recorded from three scats at two locations in the north of the study area (Figure 4-1). Three of the six fauna habitats within the study area, covering 446.4 ha (50.9% of the study area), contained evidence of Chuditch or were considered suitable for this species (Table 4-4).

Historically occurring across 70% of Australia, Chuditch are capable of occupying a variety of habitats from wet sclerophyll forest, eucalypt woodland and mallee shrubland to arid desert (DEC 2012). As a result, it is not possible to list a specific set of characteristics that are indicative of habitat suitability or to accurately predict the likelihood of occurrence; however, some key aspects are considered important for Chuditch survival in an area. These include adequate den resources (hollow logs, burrows or rock crevices), adequate prey resources (particularly large invertebrates) and sizeable areas of >20,000 ha (DEC 2012).

The 815 ha study area (and collectively the study area and adjacent remnants comprising ~5,000 ha) are well under the 20,000 ha threshold; however, den resources, including hollow logs and rock crevices were observed during the survey. Further, the evidence of presence indicates Chuditch are utilising the study area to some extent, at least for dispersal and possibly foraging and denning. Observations of prey resources were not undertaken during the survey.

4.4.2.3 Other significant fauna species

Based on the likelihood of occurrence assessment (see 2.3.4), five additional significant fauna species from the desktop review may occur in the study area (Table 4-6). One of these, Western Rosella (inland) *Platyercus icterotis xanthogenys*, was previously recorded for PRIOP in the mine area.

Although not identified in either the desktop database searches for Lot 1416, or the field survey, the study area represents suitable habitat within its known range, so it is considered possible.

The Red-tailed Phascogale and Western Brush Wallaby possibly occur, with suitable habitat present for the species and both having been recorded in small fragments of remnant vegetation in the wheatbelt throughout their range (Short *et al.* 2011). Both species were also considered to have potential to occur in the PRIOP haul road (Phoenix 2021), although fauna surveys did not record their presence.

A Peregrine Falcon was identified in the desktop review approximately 1.5 km to the west. The species is likely to visit the study area as part of its wider foraging range. Within the Wheatbelt, this species has been recorded roosting and nesting on telecommunications towers, wheat silos and similar infrastructure (Ecoscape 2012).

Unconfirmed foraging traces of a bandicoot likely to be an undescribed species of *Isoodon* smaller than the Quenda *I. fusciventer* (Travouillon 2019) were recorded in the PRIOP haul road (Phoenix 2021) in dense, low *Allocasuarina* shrubland. No evidence of this species was recorded during the field survey and it is considered unlikely to occur in the taller, more open *Allocasuarina* shrubland in the study area.

Table 4-6 Significant fauna likelihood of occurrence assessment

Species	Status	Relevance to PRIOP based on Cazaly Resources Limited (2010) and Phoenix (2021)	Likelihood of occurrence in Lot 1416
Invertebrates			
<i>Idiosoma (Aganippe) castellum</i> Tree-stem Trapdoor Spider	P4 (DBCAs list)	Recorded in mine area	Unlikely; study area lacks flood prone depressions and flats that support myrtaceous shrub communities necessary to support the species (Inglis 2007).
Reptiles			
<i>Paroplocephalus atriceps</i> Lake Cronin Snake	P3 (DBCAs list)	Possible in haul road	Unlikely; outside known distribution.
Birds			
<i>Apus pacificus</i> Fork-tailed Swift	Mig. (EPBC & BC Acts)	Likely but low relevance	Possible; may occur over the study area intermittently in summer.
<i>Falco peregrinus</i> Peregrine Falcon	OS (BC Act)	Likely in haul road	Likely to occur or as part of foraging range. Possible resident in vicinity, but more likely to nest on artificial structures outside the study area than on trees.
<i>Leipoa ocellata</i> Malleefowl	VU (EPBC & BC Acts)	Recorded mine area and haul road	Recorded (old, degraded mound); habitat suitable for foraging and breeding.
<i>Thinornis rubricollis</i> Hooded Plover	P4 (DBCAs)	Possible in haul road (northern salt lakes)	Unlikely; no suitable wetland or saltlake habitat.
<i>Calidris acuminata</i>	Mig. (EPBC & BC Acts)	Possible in haul road (northern salt lakes)	Unlikely; no suitable wetland or saltlake habitat.

Species	Status	Relevance to PRIOP based on Cazaly Resources Limited (2010) and Phoenix (2021)	Likelihood of occurrence in Lot 1416
Sharp-tailed Sandpiper			
<i>Calidris ferruginea</i> Curlew Sandpiper	CR, Mig. (EPBC & BC Acts)	Possible in haul road (northern salt lakes)	Unlikely; no suitable wetland or saltlake habitat.
<i>Calidris melanotos</i> Pectoral Sandpiper	Mig. (EPBC & BC Acts)	Possible in haul road (northern salt lakes)	Unlikely; no suitable wetland or saltlake habitat.
<i>Tringa nebularia</i> Common Greenshank	Mig. (EPBC & BC Acts)	Possible in haul road (northern salt lakes)	Unlikely; no suitable wetland or saltlake habitat.
<i>Platycercus icterotis xanthogenys</i> Western Rosella (inland)	P4 (DBCA)	Recorded in mine area, Likely in haul road	Possible; suitable woodland habitat and potential breeding hollows present.
Mammals			
<i>Dasyurus geoffroii</i> Western Quoll, Chuditch	VU (EPBC & BC Acts)	Recorded in haul road	Recorded (scats); study area used at least for dispersal, potentially suitable foraging and denning habitat is present.
<i>Phascogale calura</i> Red-tailed Phascogale	EN (EPBC); CD (BC Act)	Possible in haul road	Possible; suitable habitat present.
<i>Notamacropus irma</i> Western Brush Wallaby	P4 (DBCA)	Possible in haul road	Possible; suitable habitat present, but viability dependent on habitat fragmentation and intensity of fox predation.
<i>Isoodon</i> sp. Bandicoot, likely new taxon related to Quenda <i>Isoodon fusciventer</i> (K. Travouillon pers. comm.)	Not assigned, equivalent to Priority at least (cf. Quenda P4)	Recorded in haul road	Unlikely; no suitable habitat present.

4.4.3 Introduced fauna

Fourteen records of introduced fauna were obtained, including three predator species (Table 4-7).

Table 4-7 Introduced fauna recorded from the study area

Species	Record evidence
Dog (<i>Canis familiaris</i>)	scat, track
Rabbit (<i>Oryctolagus cuniculus</i>)	scat, foraging evidence
Cat (<i>Felis catus</i>)	scat, track
Fox (<i>Vulpes vulpes</i>)	burrow, carcass, scat

5 DISCUSSION

5.1 FLORA AND VEGETATION

Lot 1416 is adjacent to three nature reserves (unnamed) and has the potential to contain a high diversity of flora, as suggested by results of the database searches (see 4.1). From high level sampling of six sites, 39 species were recorded representing 18 families and 24 genera; this result should be considered a small subset of the potential species diversity. Detailed sampling of each vegetation type in appropriate seasons is required to better understand the floral diversity.

The single significant flora species recorded in the survey, *Acacia crenulata*, is not known from the PRIOP project areas. However, the study area has the potential to support a high number of significant flora species, including several taxa that will be impacted by the Parker Range Iron Ore Project (Table 4-1; Table 4-2). Targeted surveys at an appropriate seasonal time would be required to confirm presence, location and numbers of these species.

5.2 TERRESTRIAL FAUNA

Around 86% of the study area was found to be suitable for Malleefowl breeding and foraging, and an area of shrubland that was recently burnt is currently not suitable for Malleefowl but may be suitable once it recovers. Some indication of utilisation of Lot 1416 by the species was observed in the survey, with a single old mound located in the south of the study area. While suitable, current utilisation of the study area by Malleefowl is unclear, the presence and persistence of the species within the study area is likely tied to the connectivity and habitat suitability of the adjacent reserves.

Similarly, the survey identified presence of Chuditch in the study area and potential denning habitat is present, but it is unclear whether the species is utilising the site for breeding and foraging, or as a move corridor between larger remnants. DEC (2012) gives a very inclusive definition of habitat critical to Chuditch survival and maintenance of important populations, which includes areas of natural vegetation used by Chuditch to breed, forage, or move from one area to another. More detailed investigation of the value of Lot 1416, adjacent reserves and nearby remnants to Malleefowl and Chuditch is warranted to understand how these species are utilising these areas, but at least part of Lot 1416 meets criteria for habitat critical to survival.

More broadly, Lot 1416 contains a range of fauna habitats (and therefore likely supports a diverse assemblage of ground-dwelling reptiles and mammals, and bird species) which should act to provide added protection from predators and increased foraging and reproductive opportunities for common and significant fauna species.

The large number of introduced fauna records from limited survey effort, indicates they are active within the study area and present a threat to native fauna, including Malleefowl and Chuditch, particularly predator species (cat, fox and dog).

5.3 CONSIDERATION OF INCLUSION OF LOT 1416 INTO CONSERVATION ESTATE

MRL has received advice from DBCA (N. Smith, MRL, pers. comm., 11 November 2020) that Lot 1416 is a 'property of interest' for potential inclusion into the conservation estate. Further to this, DBCA has advised its strategic approach for additions to the conservation estate included the acquisition of lands:

- containing significant flora and fauna values
- containing communities and/or habitat that are not well represented in the reserve system

- those areas that contribute to better management outcomes for the existing reserves.

Based on this high-level assessment, Lot 1416 potentially meets all of the above criteria. The site potentially supports several significant flora species, as well as Threatened fauna species of relevance to PRIOP, Chuditch and Malleefowl. Extent to which these species are utilising the site however is unclear.

The vegetation associations of Lot 1416 have been heavily cleared, holding the status of Vulnerable at the bioregional and subregional scale, and are poorly represented in the reserve system. The Avon Wheatbelt bioregion is one of the most heavily modified bioregions in Australia, with a total vegetation loss of around 85%. Aside from the immediate impact of habitat destruction and modification, remnant vegetation suffers ongoing, longer term effects of fragmentation (Abensperg-Traun *et al.* 1996).

Lot 1416 is of particular importance in this regard because it connects the three adjacent conservation reserves, providing both a linkage between these and collectively (with the reserves) representing a large intact remnant within a heavily cleared landscape. Local fauna populations within the adjacent reserves are likely to be dependent on the fauna habitat and connectivity provided by Lot 1416. It also potentially has important value as a linkage between other reserves and remnants, although a wider regional assessment was not part of this scope.

The value of Lot 1416 as an offset site needs to be considered in more detail in the context of its connection to the adjacent reserves. Further investigation is required to better define the significant flora present, habitat value/utilisation by Malleefowl and Chuditch, and overall condition of vegetation/habitat both within Lot 1416 and the adjacent reserves.

5.4 CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, Lot 1416 potentially presents a suitable site to offset the significant residual impacts of PRIOP. The site has potentially overlapping values to those that will be impacted by PRIOP and appears suitable for inclusion into the conservation estate in accordance with DBCA's strategic criteria.

Additional targeted fauna surveys of Lot 1416 and the surrounding reserves, particularly for Malleefowl and Chuditch are recommended to better define the value and utilisation of these areas by these species. Targeted flora surveys, at an appropriate seasonal time, are recommended to confirm the significant flora values of Lot 1416.

Ongoing monitoring and management of introduced predator species is recommended to reduce this threat on the local Malleefowl and Chuditch population. This can be achieved in part by 1080 baiting and cat trapping; however, to prevent the constant flow of predators into the site and adjacent reserves it is recommended that predator proof fences be installed around the perimeter of the Lot 1416 and the contiguous reserves.

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Appendix 1 **Flora survey site descriptions**

Site details			
Site	Site001	Position (WGS84)	-31.353586, 118.752356
Slope	negligible	Topography	plain
Soil colour	red-brown	Soil texture	sandy loam
Rock cover (%)	30	Rock type	granite bolders

Observation details - visit 1 (11 Mar 2020)

Sample description	Tall open woodland of <i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>		
Habitat	open woodland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	50	Tree cover (%)	30
Shrub cover (%)	20	Grass cover (%)	10
Herb cover (%)	5		



Sample and effort summary

Sample method	Visit	Sample date	Dimensions	Observer
Relevé	1	11-Mar-2020	unbounded	Andrew Perkins

Species (16)	Status	Cover (%)	Height (m)
<i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>		30	10
<i>Santalum acuminatum</i>		10	2
<i>Alyxia buxifolia</i>		5	1.8
<i>Acacia erinacea</i>		5	0.4
<i>Olearia muelleri</i>		2	0.5
<i>Eremophila ionantha</i>		2	0.4
<i>Platysace trachymenioides</i>		2	0.4
<i>Thysanotus manglesianus</i>		1	0.9
<i>Dianella revoluta</i> var. <i>divaricata</i>		1	0.6
<i>Acacia hemiteles</i>		1	0.6
<i>Acacia merrallii</i>		1	0.4
<i>Enchylaena lanata</i>		1	0.4
<i>Amphipogon caricinus</i>		1	0.2
<i>Waitzia acuminata</i>		1	0.1
<i>Podolepis capillaris</i>		1	0.1
<i>Sclerolaena diacantha</i>		1	0.1

Site details			
Site	Site002	Position (WGS84)	-31.365464, 118.757444
Slope	negligible	Topography	plain
Soil colour	red-orange, yellow	Soil texture	sandy loam
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (12 Mar 2020)

Sample description	Woodland with scattered emergent trees amongst mallee <i>Eucalyptus erythronema</i> , <i>Acacia erinacaea</i> and low isolated <i>Olearia muelleri</i> shrubs.		
Habitat	open woodland		
Disturbance	vehicle tracks		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	50	Tree cover (%)	50
Shrub cover (%)	10	Grass cover (%)	1
Herb cover (%)	1		



Sample and effort summary

Sample method	Visit	Sample date	Dimensions	Observer
Relevé	1	12-Mar-2020	unbounded	Andrew Perkins

Species (12)	Status	Cover (%)	Height (m)
<i>Eucalyptus erythronema</i> subsp. <i>erythronema</i>		30	6
<i>Eucalyptus horistes</i>		10	7
<i>Eucalyptus salmonophloia</i>		5	15
<i>Acacia erinacea</i>		5	0.4
<i>Eucalyptus moderata</i>		3	12
<i>Melaleuca lateriflora</i>		2	3.1
<i>Olearia muelleri</i>		2	0.5
<i>Alyxia buxifolia</i>		1	2.2
<i>Eremophila ionantha</i>		1	1.4
<i>Acacia hemiteles</i>		1	1
<i>Acacia merrallii</i>		1	0.6
<i>Sclerolaena diacantha</i>		1	0.1

Site details			
Site	Site003	Position (WGS84)	-31.353303, 118.741131
Slope	negligible	Topography	plain
Soil colour	yellow	Soil texture	sandy loam
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (12 Mar 2020)

Sample description	Isolated <i>Eucalyptus leptopoda</i> subsp. <i>leptopoda</i> over <i>Allocasuarina acutivalvis</i> subsp. <i>acutivalvis</i> and <i>A. spinosissima</i> dominant shrubland		
Habitat	shrubland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	80	Tree cover (%)	60
Shrub cover (%)	40	Grass cover (%)	10
Herb cover (%)	1		



Sample and effort summary

Sample method	Visit	Sample date	Dimensions	Observer
Relevé	1	12-Mar-2020	unbounded	Andrew Perkins

Species (7)	Status	Cover (%)	Height (m)
<i>Allocasuarina acutivalvis</i> subsp. <i>acutivalvis</i>		25	3.5
<i>Allocasuarina spinosissima</i>		25	3
<i>Ecdeiocolea monostachya</i>		20	0.6
<i>Eucalyptus leptopoda</i> subsp. <i>leptopoda</i>		10	3.5
<i>Grevillea didymobotrya</i> subsp. <i>didymobotrya</i>		1	1.7
<i>Acacia acuminata</i>		1	1.5
<i>Dianella revoluta</i> var. <i>divaricata</i>		1	1

Site details			
Site	Site004	Position (WGS84)	-31.365833, 118.770847
Slope	negligible	Topography	plain
Soil colour	yellow, grey, whitish	Soil texture	sandy loam
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (12 Mar 2020)

Sample description	Tall <i>Eucalyptus erythronema</i> subsp. <i>erythronema</i> woodland over low open shrubs of <i>Acacia erinacea</i> and <i>Olearia muelleri</i> .
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Habitat	woodland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	50	Tree cover (%)	45
Shrub cover (%)	15	Grass cover (%)	1
Herb cover (%)	1		



Sample and effort summary

Sample method	Visit	Sample date	Dimensions	Observer
Relevé	1	12-Mar-2020	unbounded	Andrew Perkins

Species (17)	Status	Cover (%)	Height (m)
<i>Eucalyptus erythronema</i> subsp. <i>erythronema</i>		35	5
<i>Acacia erinacea</i>		10	0.8
<i>Enchylaena lanata</i>		10	0.5
<i>Eucalyptus salmonophloia</i>		5	18
<i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>		5	12
<i>Melaleuca lateriflora</i>		5	3
<i>Acacia hemiteles</i>		2	1.6
<i>Phebalium tuberculosum</i>		2	1.1
<i>Acacia merrallii</i>		2	0.6
<i>Olearia muelleri</i>		2	0.5
<i>Cassutha melantha</i>		1	2.5
<i>Melaleuca hamata</i>		1	1.9
<i>Eremophila ionantha</i>		1	1.5
<i>Austrostipa</i>		1	0.7
<i>Westringia cephalantha</i>		1	0.4
<i>Sclerolaena diacantha</i>		1	0.1
<i>Waitzia acuminata</i> var. <i>acuminata</i>		1	0.1

Site details			
Site	Site005	Position (WGS84)	-31.370178, 118.760222
Slope	negligible	Topography	plain
Soil colour	yellow, grey	Soil texture	sandy loam
Rock cover (%)	0	Rock type	none

Observation details - visit 1 (18 Mar 2020)

Sample description	<i>Eucalyptus erythronema</i> subsp. <i>erythronema</i> woodland over tall <i>Melaleuca lateriflora</i> shrubs over low open <i>Olearia muelleri</i> and <i>Acacia hemiteles</i> shrubland		
Habitat	mallee woodland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	60	Tree cover (%)	50
Shrub cover (%)	15	Grass cover (%)	5
Herb cover (%)	1		



Sample and effort summary

Sample method	Visit	Sample date	Dimensions	Observer
Relevé	1	18-Mar-2020	unbounded	Andrew Perkins

Species (11)	Status	Cover (%)	Height (m)
<i>Eucalyptus erythronema</i> subsp. <i>erythronema</i>		40	8
<i>Eucalyptus moderata</i>		10	13
<i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>		10	12
<i>Eucalyptus subangusta</i> subsp. <i>cerina</i>		10	4.5
<i>Melaleuca lateriflora</i>		3	2.5
<i>Olearia muelleri</i>		2	0.5
<i>Acacia hemiteles</i>		1	1.5
<i>Dianella revoluta</i> var. <i>divaricata</i>		1	0.9
<i>Westringia cephalantha</i>		1	0.5
<i>Austrostipa</i>		1	0.5
<i>Waitzia acuminata</i> var. <i>acuminata</i>		1	0.1

Site details			
Site	Site006	Position (WGS84)	-31.354806, 118.755083
Slope	negligible	Topography	plain
Soil colour	yellow, grey, whitish	Soil texture	sandy loam
Rock cover (%)	20	Rock type	granite rocks

Observation details - visit 1 (19 Mar 2020)

Sample description	Woodland of <i>Eucalyptus erythronema</i> subsp. <i>erythronema</i> and <i>Eucalyptus loxophleba</i> subsp. <i>Lissophloia</i> over <i>Eremophila granitica</i> and <i>Melaleuca lateriflora</i> shrubs		
Habitat	mallee woodland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	not evident
Total veg. cover (%)	70	Tree cover (%)	40
Shrub cover (%)	20	Grass cover (%)	10
Herb cover (%)	5		



Sample and effort summary

Sample method	Visit	Sample date	Dimensions	Observer
Relevé	1	19-Mar-2020	unbounded	Andrew Perkins

Species (21)	Status	Cover (%)	Height (m)
<i>Eucalyptus erythronema</i> subsp. <i>erythronema</i>		30	8
<i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>		15	10
<i>Eremophila granitica</i>		5	1.8
<i>Triodia</i> sp.		5	0.5
<i>Borya constricta</i>		5	0.1
<i>Melaleuca lateriflora</i>		2	2.5
<i>Eucalyptus flocktoniae</i>		1	5
<i>Santalum acuminatum</i>		1	3.5
<i>Acacia crenulata</i>	P3 (DBCA list)	1	3.5
<i>Acacia colletioides</i>		1	2.5
<i>Melaleuca hamata</i>		1	1.9
<i>Alyxia buxifolia</i>		1	1.8
<i>Eremophila ionantha</i>		1	1.5
<i>Phebalium tuberculosum</i>		1	1.3
<i>Dianella revoluta</i> var. <i>divaricata</i>		1	1
<i>Acacia hemiteles</i>		1	0.9
<i>Thysanotus manglesianus</i>		1	0.7
<i>Platysace trachymenioides</i>		1	0.5
<i>Austrostipa</i>		1	0.4
<i>Amphipogon caricinus</i>		1	0.3
<i>Waitzia acuminata</i> var. <i>acuminata</i>		1	0.1

Appendix 2 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 – e.g. 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 I	II	Structural Formation	Dominant growth form, cover and height for the ecologically or structurally dominant stratum.
Vegetation association	Structural form and dominant species – e.g. Medium woodland; York gum (<i>Eucalyptus loxophleba</i>) & 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 – e.g. 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 3 Summary and Key to identification of Eucalypt woodlands of the Western Australian Wheatbelt TEC

Description based on (Department of the Environment 2015a): The Eucalypt woodlands of the Western Australian Wheatbelt TEC is composed of eucalypt woodlands dominated by a complex mosaic of eucalypt species with a single tree or mallet form over an understorey that is highly variable in structure and composition. A mallet habit refers to a eucalypt with a single, slender trunk and steep-angled branches that give rise to a dense crown. Many eucalypt species are considered iconic within the Wheatbelt landscape, for example, *Eucalyptus salmonophloia* (salmon gum), *E. loxophleba* subsp. *loxophleba* (York gum), *Eucalyptus rudis* subsp. *rudis*, *E. salubris* (gimlet), *E. wandoo* (wandoo) and the mallet group of species. Associated species may include *Acacia acuminata* (jam), *Corymbia calophylla* (marri) and *Eucalyptus marginata* (jarrah). The understorey structures are often bare to sparse, herbaceous, shrub of heath, chenopod-dominated, thickets (*Melaleuca* spp.) and saline areas with *Tecticornia* spp. The main diagnostic features include location, minimum crown cover of the tree canopy of 10% in a mature woodland, presence of key species and a minimum condition according to scale of Keighery (1994) that depends on size of a patch, weed cover and presence of mature trees. A patch is defined as a discrete and mostly continuous area of the ecological community and may include small-scale variations and disturbances, such as tracks or breaks, watercourses/drainage lines or localised changes in vegetation that do not act as a permanent barrier or significantly alter its overall functionality. Each patch of the community includes a buffer zone, an area that lies immediately outside the edge of a patch but is not part of the ecological community. The buffer zone is designed to minimise this risk to the ecological community.

Woodland vegetation with a very sparse eucalypt tree canopy and woodlands dominated by mallee forms characterised by multiple stems of similar size arising at or near ground level are not part of the ecological community. The ecological community is not likely to be present if it is dominated by non-eucalypt species in the tree canopy, for instance *Acacia acuminata* (jam) or *Allocasuarina huegeliana* (rock sheoak) even though these species may be present as an understorey or minor canopy component.

The community occupies a transitional zone between the wetter forests associated with the Darling Range and the southwest coast, and the low woodlands and shrublands of the semi-arid to arid interior. The Wheatbelt region where the ecological community occurs mostly encompasses two IBRA2 subregions: Avon Wheatbelt subregion AVW01 Merredin and Avon Wheatbelt subregion AVW02 Katanning. Patches of the ecological community may extend into adjacent areas of the primary Wheatbelt bioregions, such as the easternmost parts of the Jarrah Forest bioregion forming an extension of the Avon Wheatbelt landscape in that they comprise areas subject to similar climate, landscape and threats. These outlier patches generally occur south of Northam, extending around the vicinity of localities such as Wandering, Williams, Kojonup and Mount Barker (All locations south of Perth), and are limited to areas that are not on the Darling range, receive less than 600 mm mean annual rainfall and overlie the Yilgarn Craton geology. A third IBRA2 subregion includes Mallee subregion MAL02 Western Mallee and is located south of Perth. The ecological community is generally associated with the flatter, undulating relief, including drainage lines and saline areas.

The WA Wheatbelt woodlands ecological community potentially corresponds to 45 Beard (Shepherd et al. 2002) vegetation associations. The most likely equivalents are with the 37 associations that are dominant or unique within the Wheatbelt regions.

Diagnostic 1 Location

Survey location occurs within one of the following three regions:

- Avon Wheatbelt bioregion - subregions AVW01 Merredin and AVW02 Katanning
- Mallee bioregion - MAL02 Western Mallee only

- Jarrah Forest bioregion – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt, and are effectively an extension of the Avon Wheatbelt landscape. Within the Jarrah Forest bioregion, the ecological community occurs on landscapes that fall below 600 mm mean annual rainfall (Figure 1), are off the Darling Range, associated with the Yilgarn Craton geology and are generally heavily cleared. This covers the eastern to southeastern-most parts of the bioregion. The ecological community generally falls within the 300 to 600 mm average annual rainfall isohyets. The isohyets based on the latest 30-year average between 1976 to 2005 (BoM 2016) are most applicable to the current climatic regime.

.....2

Survey location occurs within region:

- Jarrah Forest bioregion – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt. Within the Jarrah Forest bioregion, the ecological community occurs on landscapes that ARE ABOVE the 600 mm isohyet, are ON the Darling Range, NOT associated with the Yilgarn Craton geology and are NOT generally heavily cleared. This covers the eastern to southeastern-most parts of the bioregion. It generally DOES NOT fall within the 300 to 600 mm average annual rainfall isohyets. The isohyets based on the latest 30-year average between 1976 to 2005 (BoM 2016) are most applicable to the current climatic regime.

.....NOT TEC

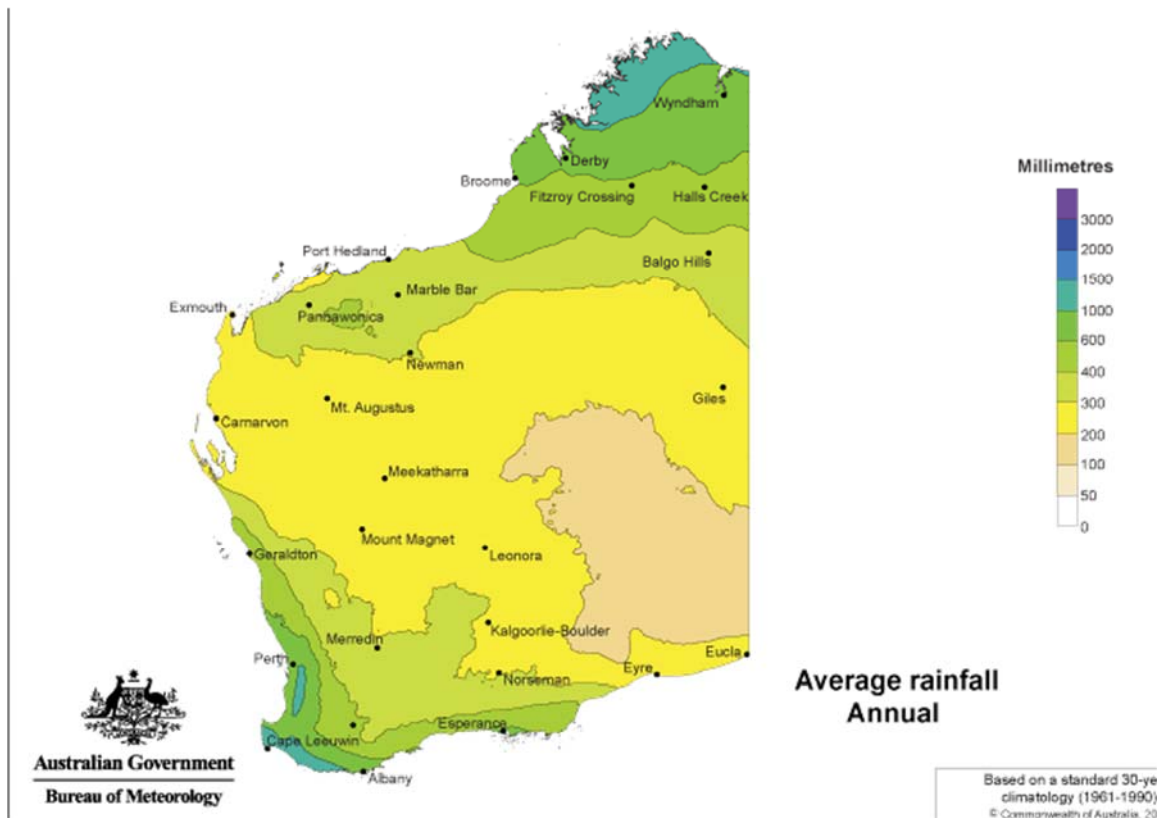


Figure 1 Isohyets of Western Australia (BoM 2016)

Diagnostic 2 Minimum crown canopy

The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature eucalypt woodland is 10% (crowns measured as if they are opaque). The maximum tree canopy cover usually is up to 40%. It may be higher in certain circumstances, for instance trees with a mallet growth form (multi-stemmed upper canopy) may be more densely spaced, or disturbances such as fire may result in an increased cover of canopy species during regeneration.

.....3

Crown cover of trees less than 10% but area recently disturbed (e.g. fire), presence of seedlings and/or saplings.

.....3

Crown cover of trees less than 10%, no evidence of recent disturbance, no presence of seedlings or saplings.

.....NOT TEC

Diagnostic 3 Dominant Eucalyptus tree canopy

One or more of the key tree species in Table 1 are dominant or co-dominant, the trees are predominantly single trunked, not mallee (multi-stemmed).

.....4

Other species are present in the tree canopy (e.g. species in Table 2 or other taxa) but these collectively do not occur as dominants in the tree canopy.

.....4

Dominant woodlands with a mallee subcanopy (lower tree layer of mallee or non-eucalypt tree species). Upper eucalypt tree canopy must be present dominated by key woodland species in Table 2 and have cover of 10% or more.

.....4

Other species are present in the tree canopy (e.g. species in Table 2 or other taxa) and these collectively do occur as dominants in the tree canopy.

.....NOT TEC

Table 1 Key eucalypt species. One or more of these species are dominant or co-dominant within a given patch of the ecological community

Scientific name	Common name/s
<i>Eucalyptus accedens</i>	powder-bark; powder-bark wandoo
<i>Eucalyptus aequioperta</i>	Welcome Hill gum
<i>Eucalyptus alipes</i>	Hyden mallet
<i>Eucalyptus astringens</i> subsp. <i>astringens</i>	brown mallet
<i>Eucalyptus capillosa</i>	wheatbelt wandoo
<i>Eucalyptus densa</i> subsp. <i>densa</i>	narrow-leaved blue mallet
<i>Eucalyptus extensa</i>	yellow mallet
<i>Eucalyptus falcata</i>	silver mallet
<i>Eucalyptus gardneri</i> subsp. <i>gardneri</i>	blue mallet
<i>Eucalyptus goniocarpa</i>	Lake King mallet

Scientific name	Common name/s
<i>Eucalyptus kondininensis</i>	Kondinin blackbutt
<i>Eucalyptus longicornis</i>	red morrel
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	York gum
<i>Eucalyptus melanoxydon</i>	black morrel
<i>Eucalyptus mimica</i> subsp. <i>continens</i>	hooded mallet
<i>Eucalyptus mimica</i> subsp. <i>mimica</i>	Newdegate mallet
<i>Eucalyptus myriadena</i>	small-fruited gum; blackbutt
<i>Eucalyptus occidentalis</i>	flat-topped yate
<i>Eucalyptus ornata</i>	ornamental silver mallet; ornate mallet
<i>Eucalyptus recta</i>	Mt Yule silver mallet; Cadoux mallet
<i>Eucalyptus rudis</i> subsp. <i>rudis</i>	flooded gum
<i>Eucalyptus salicola</i>	salt gum; salt salmon gum
<i>Eucalyptus salmonophloia</i>	salmon gum
<i>Eucalyptus salubris</i>	gimlet
<i>Eucalyptus sargentii</i> subsp. <i>sargentii</i>	salt river gum
<i>Eucalyptus singularis</i>	ridge-top mallet
<i>Eucalyptus spathulata</i> subsp. <i>spathulata</i>	swamp mallet
<i>Eucalyptus spathulata</i> subsp. <i>salina</i>	Salt River mallet
<i>Eucalyptus urna</i>	merrit
<i>Eucalyptus wandoo</i> subsp. <i>pulverea</i>	wandoo
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	wandoo

Table 2 Associated canopy species that may be present within the ecological community but are not dominant or co-dominant¹

Scientific name	Common name/s
<i>Acacia acuminata</i>	jam
<i>Allocasuarina huegeliana</i>	rock sheoak
<i>Corymbia calophylla</i>	marri
<i>Eucalyptus annulata</i>	prickly-fruited mallee
<i>Eucalyptus arachnaea</i> subsp. <i>arachnaea</i>	black-stemmed mallee
<i>Eucalyptus arachnaea</i> subsp. <i>arrecta</i>	black-stemmed mallet
<i>Eucalyptus armillata</i>	flanged mallee
<i>Eucalyptus calycogona</i> subsp. <i>calycogona</i>	square-fruited mallee
<i>Eucalyptus camaldulensis</i> subsp. <i>arida</i>	river red gum
<i>Eucalyptus celastroides</i> subsp. <i>virella</i>	wheatbelt mallee
<i>Eucalyptus cylindriflora</i>	Goldfields white mallee
<i>Eucalyptus decipiens</i>	redheart; moit
<i>Eucalyptus drummondii</i>	Drummond's mallee
<i>Eucalyptus eremophila</i>	sand mallee
<i>Eucalyptus erythronema</i> subsp. <i>erythronema</i>	red-flowered mallee
<i>Eucalyptus erythronema</i> subsp. <i>inornata</i>	yellow-flowered mallee
<i>Eucalyptus eudesmioides</i>	Kalbarri mallee
<i>Eucalyptus flocktoniae</i> subsp. <i>flocktoniae</i>	Flockton's mallee

Scientific name	Common name/s
<i>Eucalyptus gittinsii</i> subsp. <i>illucida</i>	northern sandplain mallee
<i>Eucalyptus incrassata</i>	ridge-fruited mallee
<i>Eucalyptus kochii</i> subsp. <i>plenissima</i>	Trayning mallee
<i>Eucalyptus leptopoda</i> subsp. <i>leptopoda</i>	Merredin mallee; Tammin mallee
<i>Eucalyptus loxophleba</i> subsp. <i>gratiae</i>	Lake Grace mallee
<i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>	smooth-barked York gum
<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i>	blackbutt York gum
<i>Eucalyptus macrocarpa</i>	mottlecah
<i>Eucalyptus marginata</i>	jarrah
<i>Eucalyptus moderata</i>	redwood mallee
<i>Eucalyptus obtusiflora</i>	Dongara mallee
<i>Eucalyptus olivina</i>	olive-leaved mallee
<i>Eucalyptus orthostemon</i>	diverse mallee
<i>Eucalyptus perangusta</i>	fine-leaved mallee
<i>Eucalyptus phaenophylla</i>	common southern mallee
<i>Eucalyptus phenax</i> subsp. <i>phenax</i>	white mallee
<i>Eucalyptus pileata</i>	capped mallee
<i>Eucalyptus platypus</i> subsp. <i>platypus</i>	moort
<i>Eucalyptus polita</i>	Parker Range mallet
<i>Eucalyptus sheathiana</i>	ribbon-barked mallee
<i>Eucalyptus sporadica</i>	Burngup mallee
<i>Eucalyptus subangusta</i> subsp. <i>subangusta</i>	grey mallee

The list is not comprehensive and presents the more common taxa encountered.

Diagnostic 4 Native understorey

A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs. A list of key species is summarised in Table 3. Any one of the structural understorey categories may or may not be present.

Bare to sparse understorey (e.g. under some mallet woodlands).

.....5

Herbaceous understorey – a ground layer of forbs and/or graminoids though a few, scattered shrubs may be present.

.....5

Scrub or heath understorey – comprises a mixture of diverse shrubs of variable height and cover. A ground layer of herbs and grasses is present to variable extent.

.....5

Chenopod-dominated understorey – a subset of the scrub category in which the prominent species present are saltbushes, bluebushes and related taxa (e.g. *Atriplex*, *Enchylaena*, *Maireana*, *Rhagodia* and *Sclerolaena*).

.....5

Thickets of taller shrub species understorey (e.g. *Melaleuca pauperiflora*, *M. acuminata*, *M. uncinata*, *M. lanceolata*, *M. sheathiana*, *M. adnata*, *M. cucullata* and/or *M. lateriflora*, *Allocasuarina campestris*

with *Melaleuca hamata* or *M. scalena*). A range of other shrub and ground layer species may occur among or below the thickets.

.....5

Salt tolerant species understorey (e.g. samphire, *Tecticornia* spp.).

.....5

Shrublands or herblands in which the tree canopy layer is very sparse to absent, either naturally or maintained so through long-term disturbance. Native vegetation where a tree canopy was formerly present is often referred to as 'derived' or 'secondary' vegetation. These sites would fall below the 10 per cent minimum canopy cover threshold for a woodland.

.....NOT TEC

Table 3 Understorey species

Scientific name	Common name/s
Shrubs	
<i>Acacia acuaria</i>	
<i>Acacia colletioides</i>	wait-a-while
<i>Acacia erinacea</i>	
<i>Acacia hemiteles</i>	
<i>Acacia lasiocalyx</i>	silver wattle
<i>Acacia lasiocarpa</i>	panjang
<i>Acacia leptospermoides</i>	
<i>Acacia mackeyana</i>	
<i>Acacia merrallii</i>	
<i>Acacia microbotrya.</i>	manna wattle
<i>Acacia pulchella</i>	prickly mores
<i>Allocasuarina acutivalvis</i>	
<i>Allocasuarina campestris</i>	
<i>Allocasuarina humilis</i>	dwarf sheoak
<i>Allocasuarina lehmanniana</i>	dune sheoak
<i>Allocasuarina microstachya</i>	
<i>Argyrolottis turbinata</i>	
<i>Astroloma epacridis</i>	
<i>Banksia armata</i>	prickly dryandra
<i>Banksia sessilis</i>	parrot bush
<i>Beyeria brevifolia</i>	
<i>Bossiaea divaricata</i>	
<i>Bossiaea eriocarpa</i>	common brown pea
<i>Bossiaea halophila</i>	
<i>Callistemon phoeniceus</i>	lesser bottlebrush
<i>Calothamnus quadrifidus</i>	one-sided bottlebrush
<i>Calothamnus quadrifidus</i> subsp. <i>asper</i>	one-sided bottlebrush
<i>Comesperma integerrimum</i>	
<i>Conostylis setigera</i>	
<i>Dampiera lavandulacea</i>	
<i>Darwinia</i> sp. <i>Karonie</i>	
<i>Daviesia nematophylla</i>	
<i>Daviesia triflora</i>	
<i>Dodonaea bursariifolia</i>	
<i>Dodonaea inaequifolia</i>	
<i>Dodonaea pinifolia</i>	

Flora and Fauna Assessment of Lot 1416 for the Parker Range Project
Prepared for Mineral Resources Ltd

Scientific name	Common name/s
<i>Dodonaea viscosa</i>	sticky hopbush
<i>Eremophila decipiens</i>	slender fuchsia
<i>Eremophila ionantha</i>	violet-flowered eremophila
<i>Eremophila oppositifolia</i>	weeooka
<i>Eremophila scoparia</i>	broom bush
<i>Exocarpos aphyllus</i>	leafless ballart
<i>Gastrolobium microcarpum</i>	sandplain poison
<i>Gastrolobium parviflorum</i>	
<i>Gastrolobium spinosum</i>	prickly poison
<i>Gastrolobium tricuspdatum</i>	
<i>Gastrolobium trilobum</i>	bullock poison
<i>Grevillea acuaria</i>	
<i>Grevillea huegelii</i>	
<i>Grevillea tenuiflora</i>	tassel grevillea
<i>Hakea laurina</i>	pincushion hakea
<i>Hakea lissocarpha</i>	honey bush
<i>Hakea multilineata</i>	grass-leaf hakea
<i>Hakea petiolaris</i>	sea urchin hakea
<i>Hakea preissii</i>	needle tree
<i>Hakea varia</i>	variable-leaved hakea
<i>Hibbertia commutata</i>	
<i>Hibbertia exasperata</i>	
<i>Hibbertia hypericoides</i>	yellow buttercups
<i>Hovea chorizemifolia</i>	holly-leaved hovea
<i>Hypocalymma angustifolium</i>	white myrtle
<i>Leptomeria preissiana</i>	
<i>Leptospermum erubescens</i>	roadside teatree
<i>Lycium australe</i>	
<i>Australian boxthorn</i>	
<i>Melaleuca acuminata</i>	
<i>Melaleuca adnata</i>	
<i>Melaleuca atroviridis</i>	
<i>Melaleuca brophyi</i>	
<i>Melaleuca cucullata</i>	
<i>Melaleuca cuticularis</i>	saltwater paperbark
<i>Melaleuca halmaturorum</i>	
<i>Melaleuca hamata</i>	
<i>Melaleuca hamulosa</i>	
<i>Melaleuca lanceolata</i>	
<i>Rottneest teatree</i>	
<i>Melaleuca lateriflora</i>	gorada
<i>Melaleuca marginata</i>	
<i>Melaleuca pauperiflora</i>	boree
<i>Melaleuca radula</i>	graceful honeymyrtle
<i>Melaleuca raphiophylla</i>	swamp paperbark
<i>Melaleuca scalena</i>	
<i>Melaleuca strobophylla</i>	
<i>Melaleuca teuthidooides</i>	
<i>Melaleuca thyoides</i>	
<i>Melaleuca uncinata group</i>	broom bush
<i>Melaleuca viminea</i>	mohan

Flora and Fauna Assessment of Lot 1416 for the Parker Range Project
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Scientific name	Common name/s
<i>Olearia muelleri</i>	
Goldfields daisy	
<i>Olearia</i> sp. Kennedy Range	
<i>Petrophile divaricata</i>	
<i>Petrophile shuttleworthiana</i>	
<i>Petrophile squamata</i>	
<i>Petrophile striata</i>	
<i>Phebalium filifolium</i>	slender phebalium
<i>Phebalium lepidotum</i>	
<i>Phebalium microphyllum</i>	
<i>Phebalium tuberosum</i>	
<i>Pimelea argentea</i>	silvery-leaved pimelea
<i>Pittosporum angustifolium</i>	
<i>Platysace maxwellii</i>	karno
<i>Rhadinothamnus rudis</i>	
<i>Santalum acuminata</i>	quandong
<i>Santalum spicatum</i>	sandalwood
<i>Scaevola spinescens</i>	currant bush
<i>Senna artemisioides</i>	
<i>Styphelia tenuiflora</i>	common pinheath
<i>Templetonia sulcata</i>	centipede bush
<i>Trymalium elachophyllum</i>	
<i>Trymalium ledifolium</i>	
<i>Westringia cephalantha</i>	
<i>Xanthorrhoea drummondii</i>	
Chenopods	
<i>Atriplex acutibractea</i>	toothed saltbush
<i>Atriplex paludosa</i>	marsh saltbush
<i>Atriplex semibaccata</i>	berry saltbush
<i>Atriplex stipitata</i>	mallee saltbush
<i>Atriplex vesicaria</i>	bladder saltbush
<i>Enchylaena lanata / tomentosa complex</i>	barrier saltbush
<i>Maireana brevifolia</i>	small-leaf bluebush
<i>Maireana erioclada</i>	
<i>Maireana marginata</i>	
<i>Maireana trichoptera</i>	downy bluebush
<i>Rhagodia drummondii</i>	
<i>Rhagodia preissii</i>	
<i>Sclerolaena diacantha</i>	grey copperburr
<i>Tecticornia</i> spp.	samphire
<i>Threlkeldia diffusa</i>	coast bonefruit
Forbs	
<i>Actinobole uliginosum</i>	flannel cudweed
<i>Asteridea athrixoides</i>	
<i>Blennospora drummondii</i>	
<i>Borya nitida</i>	pincushions
<i>Borya sphaerocephala</i>	pincushions
<i>Brachyscome ciliaris</i>	
<i>Brachyscome lineariloba</i>	
<i>Caesia micrantha</i>	pale fringe-lily
<i>Caladenia flava</i>	cowslip orchid

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Scientific name	Common name/s
<i>Calandrinia calyptata</i>	pink purslane
<i>Calandrinia eremaea</i>	twining purslane
<i>Calotis hispidula</i>	bindy eye
<i>Carpobrotus modestus</i>	inland pigface
<i>Centipeda crateriformis</i> subsp. <i>crateriformis</i>	
<i>Chamaescilla corymbosa</i>	blue squill
<i>Chamaexeros serra</i>	little fringe-leaf
<i>Cotula coronopifolia</i>	waterbuttons
<i>Crassula colorata</i>	dense stonecrop
<i>Crassula exserta</i>	
<i>Dampiera juncea</i>	rush-like dampiera
<i>Dampiera lindleyi</i>	
<i>Daucus glochidiatus</i>	Australian carrot
<i>Dianella brevicaulis</i>	
<i>Dichopogon capillipes</i>	
<i>Disphyma crassifolium</i>	round-leaved pigface
<i>Drosera macrantha</i>	bridal rainbow
<i>Erodium cygnorum</i>	blue heronsbill
<i>Gilberta tenuifolia</i>	
<i>Gnephosis drummondii</i>	
<i>Gnephosis tenuissima</i>	
<i>Gnephosis tridens</i>	
<i>Gonocarpus nodulosus</i>	
<i>Goodenia berardiana</i>	
<i>Helichrysum leucopsidium</i>	
<i>Helichrysum luteoalbum</i>	Jersey cudweed
<i>Lagenophora huegelii</i>	
<i>Lawrencella rosea</i>	
<i>Lepidium rotundum</i>	veined peppergrass
<i>Podolepis capillaris</i>	wiry podolepis
<i>Podolepis lessonii</i>	
<i>Podotheca angustifolia</i>	sticky longheads
<i>Poranthera microphylla</i>	small poranthera
<i>Pterostylis sanguinea</i>	
<i>Ptilotus spathulatus</i>	
<i>Rhodanthe laevis</i>	
<i>Senecio glossanthus</i>	slender groundsel
<i>Spergularia marina</i>	
<i>Stylidium calcaratum</i>	book triggerplant
<i>Thysanotus patersonii</i>	
<i>Trachymene cyanopetala</i>	
<i>Trachymene ornata</i>	spongefruit
<i>Trachymene pilosa</i>	native parsnip
<i>Velleia cynopotamica</i>	
<i>Waitzia acuminata</i>	orange immortal
<i>Zygophyllum ovatum</i>	dwarf twinleaf
Graminoids	
<i>Amphipogon caricinus - strictus complex</i>	greybeard grass
<i>Austrostipa elegantissima</i>	
<i>Austrostipa hemipogon</i>	
<i>Austrostipa nitida</i>	

Scientific name	Common name/s
<i>Austrostipa trichophylla</i>	
<i>Centrolepis polygyna</i>	wiry centrolepis
<i>Desmocladus asper</i>	
<i>Desmocladus flexuosus</i>	
<i>Gahnia ancistrophylla</i>	hook-leaf saw sedge
<i>Gahnia australis</i>	
<i>Harperia lateriflora</i>	
<i>Juncus bufonius</i>	toad rush
<i>Lachnagrostis filiformis</i>	blowngrass
<i>Lepidosperma leptostachyum</i>	
<i>Lepidosperma resinosum</i>	
<i>Lepidosperma sp. aff. tenue</i>	
<i>Lepidosperma tenue</i>	
<i>Lepidosperma viscidum</i>	sticky sword sedge
<i>Lomandra effusa</i>	scented matrush
<i>Lomandra micrantha</i> subsp. <i>micrantha</i>	small-flower matrush
<i>Lomandra nutans</i>	
<i>Meeboldina coangustata</i>	
<i>Mesomelaena preissii</i>	
<i>Neurachne alopecuroides</i>	foxtail mulga grass
<i>Rytidosperma caespitosum</i>	
<i>Rytidosperma setaceum</i> group	
<i>Schoenus nanus</i>	tiny bog-rush
<i>Schoenus sculptus</i>	gimlet bog-rush
<i>Schoenus subfascicularis</i>	

Diagnostic 5 Vegetation condition

Minimum condition for patches of the WA Wheatbelt Woodlands ecological community. For each category, both the weed cover and mature tree presence criteria must apply plus one of either patch size or patch width, depending on whether the patch is a roadside remnant or not.

Category A:

Patch corresponds to a condition of pristine / excellent / very good (Keighery, 1994) or a high RCV (RCC, 2014).

Exotic plant species account for 0 to 30% of total vegetation cover in the understorey layers (i.e. below the tree canopy).

Mature trees (diameter at breast height (dbh) of 30 cm or above) may be present or absent.

Patch size (non-roadside) 2 ha or more with no gap in native vegetation cover exceeding 50 m width.

.....TEC

Patch width roadside only (based on the native understorey component not width of the tree canopy) 5 m or more.

.....TEC

Patch corresponds to a condition of pristine / excellent / very good (Keighery, 1994) or a high RCV (RCC, 2014).

Exotic plant species account for 0 to 30% of total vegetation cover in the understorey layers (i.e. below the tree canopy).

Mature trees (diameter at breast height (dbh) of 30 cm or above) may be present or absent.

Patch size (non-roadside) less than 2 ha.

.....NOT TEC

Patch width roadside only (based on the native understorey component not width of the tree canopy) less than 5 m.

.....NOT TEC

Category B:

Patch corresponds to a condition of good (Keighery, 1994) or a medium-high RCV (RCC, 2014).

Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy).

Mature trees are present with at least 5 trees per 0.5 ha.

Patch size (non-roadside) 2 ha or more with no gap in native vegetation cover exceeding 50 m width.

.....TEC

Patch width roadside only (based on the native understorey component not width of the tree canopy) 5 m or more.

.....TEC

Patch corresponds to a condition of good (Keighery, 1994) or a medium-high RCV (RCC, 2014), AND retains important habitat features.

Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy).

Mature trees are present with at least 5 trees per 0.5 ha.

Patch size (non-roadside) less than 2 ha.

.....NOT TEC

Patch width roadside only (based on the native understorey component not width of the tree canopy) less than 5 m.

.....NOT TEC

Category C:

Patch corresponds to a condition of good (Keighery, 1994) or a medium-high RCV (RCC, 2014), AND retains important habitat features.

Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy).

Less than 5 mature trees per 0.5 ha are present.

Minimum patch size (non-roadside) 5 ha or more.

.....TEC

Patch size (non- roadside) less than 5 ha

.....NOT TEC

Category D:

Patch corresponds to a condition of degraded to good (Keighery, 1994) or a medium-Low to medium-high RCV (RCC, 2014).

Exotic plant species account for more than 50 to 70% of total vegetation cover in the understorey layers (i.e. below the tree canopy).

Mature trees are present with at least 5 trees per 0.5 ha.

Minimum patch size (non-roadside) 5 ha or more.

.....TEC

Patch width roadside only (based on the native understorey component not width of the tree canopy)
5 m or more

.....TEC

Patch corresponds to a condition of degraded to good (Keighery, 1994) or a medium-low to medium-high RCV (RCC, 2014).

Exotic plant species account for more than 50 to 70% of total vegetation cover in the understorey layers (i.e. below the tree canopy).

Less than 5 mature trees per 0.5 ha are present.

.....NOT TEC

Appendix 4 Terrestrial fauna survey site descriptions

Flora and Fauna Assessment of Lot 1416 for the Parker Range Project
Prepared for Mineral Resources Ltd

Site details			
Site	003	Position (WGS84)	-31.353666, 118.752557
Topography	hill slope	Soil texture	sandy loam
Slope	negligible	Rock type	granite - outcropping
Soil colour	not recorded	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.00	11 Mar 2020	11 Mar 2020

Site description - visit 1 (11 Mar 2020)			
Open low salmon gum eucalyptus woodland over <i>Santalum</i> , <i>Acacia</i> , <i>Melaleuca</i> and <i>Eremophila</i> shrubs over sparse tussock grass over sparse <i>Borya</i> herbs on thin layer of red brown sandy loam on granite outcropping.			
Habitat	open woodland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	60	Litter distribution	scattered
Tree cover (%)	40	Litter depth(cm)	0
Shrub cover (%)	15	Litter cover (%)	0
Grass cover (%)	5		
Herb cover (%)	2		

Flora and Fauna Assessment of Lot 1416 for the Parker Range Project
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Site details			
Site	005	Position (WGS84)	-31.354, 118.755989
Topography	hill slope	Soil texture	sandy loam, laterite
Slope	negligible	Rock type	none
Soil colour	not recorded	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Foraging	0.60	11 Mar 2020	11 Mar 2020
1	Site description	0.00	11 Mar 2020	11 Mar 2020

Site description - visit 1 (11 Mar 2020)

Open low mallee woodland with tall mulga trees over *Acacia*, *Allocasuarina*, *Melaleuca* and other mixed shrubs over tussock grass and some scattered *Triodia* and sparse herbs on whitish grey sandy loam with patches of leaf litter

Habitat	open woodland		
Disturbance			
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	80	Litter distribution	under vegetation
Tree cover (%)	60	Litter depth(cm)	0
Shrub cover (%)	30	Litter cover (%)	0
Grass cover (%)	5		
Herb cover (%)	1		

Flora and Fauna Assessment of Lot 1416 for the Parker Range Project
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Site details			
Site	010	Position (WGS84)	-31.375771, 118.738928
Topography	plain	Soil texture	sandy loam
Slope	negligible	Rock type	none
Soil colour	not recorded	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Birding	0.35	12 Mar 2020	12 Mar 2020
1	Foraging	0.17	12 Mar 2020	12 Mar 2020
1	Site description	0.00	12 Mar 2020	12 Mar 2020

Site description - visit 1 (12 Mar 2020)			
Open Mallee woodland over shrubs of <i>Allocasuarina</i> , <i>Hakea</i> , <i>Grevillea</i> and other shrubs over sedges with some herb cover on yellow white sandy loam with rare leaf litter			
Habitat	mallee woodland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	55	Litter distribution	under vegetation
Tree cover (%)	20	Litter depth(cm)	0
Shrub cover (%)	10	Litter cover (%)	0
Grass cover (%)	30		
Herb cover (%)	5		

Flora and Fauna Assessment of Lot 1416 for the Parker Range Project
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Site details			
Site	024	Position (WGS84)	-31.363379, 118.771389
Topography	undulating plain	Soil texture	sandy loam
Slope	negligible	Rock type	none
Soil colour	not recorded	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Foraging	0.53	12 Mar 2020	12 Mar 2020
1	Site description	0.00	12 Mar 2020	12 Mar 2020

Site description - visit 1 (12 Mar 2020)			
Mallee woodland over Mallee shrubs over <i>Triodia</i> grass on yellow orange sandy loam with continuous leaf litter			
Habitat	mallee woodland		
Disturbance			
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	65	Litter distribution	even/continuous
Tree cover (%)	40	Litter depth(cm)	0
Shrub cover (%)	15	Litter cover (%)	0
Grass cover (%)	40		
Herb cover (%)	1		

Flora and Fauna Assessment of Lot 1416 for the Parker Range Project
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Site details			
Site	040	Position (WGS84)	-31.354081, 118.751512
Topography		Soil texture	sandy loam
Slope	gentle	Rock type	granite - outcropping, granite - roc
Soil colour	not recorded	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Foraging	0.55	13 Mar 2020	13 Mar 2020
1	Site description	0.00	13 Mar 2020	13 Mar 2020

Site description - visit 1 (13 Mar 2020)

Melaleuca-Allocasuarina tall shrubland with some low Mallee and *Santalum* over *Acacia*, Myrtaceae and other shrubs over tussock and sedge grasses over *Borya* herbs on salmon orange sandy loam rising gently from granite outcropping patchy leaf litter

Habitat	shrubland		
Disturbance			
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	75	Litter distribution	under vegetation
Tree cover (%)	50	Litter depth(cm)	0
Shrub cover (%)	30	Litter cover (%)	0
Grass cover (%)	5		
Herb cover (%)	5		

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Site details			
Site	041	Position (WGS84)	
Topography	breakaway	Soil texture	sand, rock
Slope	gentle	Rock type	granite - outcropping, granite - roc
Soil colour	not recorded	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Foraging	0.40	13 Mar 2020	13 Mar 2020

Site description - visit 1 (13 Mar 2020)

tall melaleuca shrubland with Mallee , acacia tall shrubs over myrtacea dominant with some samtalum shrubs over tussock grass and some herbs on breakaway granite outcropping. patchy leaf litter. some rock hole and crevices

Habitat	woodland		
Disturbance			
Vegetation condition		Fire age	moderate (>5 years)
Total veg. cover (%)	80	Litter distribution	
Tree cover (%)	60	Litter depth(cm)	0
Shrub cover (%)		Litter cover (%)	0
Grass cover (%)	5		
Herb cover (%)	1		

Flora and Fauna Assessment of Lot 1416 for the Parker Range Project
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Site details			
Site	MF001	Position (WGS84)	-31.364642, 118.768863
Topography	hill slope	Soil texture	sandy loam, laterite
Slope	negligible	Rock type	none
Soil colour	not recorded	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.08	11 Mar 2020	11 Mar 2020

Site description - visit 1 (11 Mar 2020)

Shrubland with tall *Allocasuarina* shrubs over Myrtaceae dominant shrubs over sparse tussock and sporadic sedge grass on yellow sandy loam with continuous leaf litter

Habitat	shrubland		
Disturbance	historic operations, litter, vehicle tracks		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	65	Litter distribution	even/continuous
Tree cover (%)	40	Litter depth(cm)	1
Shrub cover (%)	35	Litter cover (%)	90
Grass cover (%)	5		
Herb cover (%)	0		



Flora and Fauna Assessment of Lot 1416 for the Parker Range Project
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Site details			
Site	MF002	Position (WGS84)	-31.362385, 118.768916
Topography	hill slope	Soil texture	sandy loam, laterite
Slope	negligible	Rock type	none
Soil colour	not recorded	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.23	11 Mar 2020	11 Mar 2020

Site description - visit 1 (11 Mar 2020)

Shrubland with tall *Allocasuarina* shrubs over Myrtaceae dominant shrubs over sparse tussock and sporadic sedge grass on yellow sandy loam with continuous leaf litter

Habitat	shrubland		
Disturbance	historic operations, litter, vehicle tracks		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	65	Litter distribution	even/continuous
Tree cover (%)	40	Litter depth(cm)	1
Shrub cover (%)	35	Litter cover (%)	90
Grass cover (%)	5		
Herb cover (%)	0		



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Site details			
Site	MF003	Position (WGS84)	-31.359601, 118.769059
Topography	hill slope	Soil texture	sandy loam
Slope	negligible	Rock type	none
Soil colour	red-orange	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.07	11 Mar 2020	11 Mar 2020

Site description - visit 1 (11 Mar 2020)

Mallee over *Allocasuarina* shrubland over Myrtaceae dominant and other shrubs over sedge and tussock grasses over negligible herb on red-orange sandy loam with patchy leaf litter

Habitat	shrubland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	80	Litter distribution	under vegetation
Tree cover (%)	40	Litter depth(cm)	1
Shrub cover (%)	50	Litter cover (%)	25
Grass cover (%)	15		
Herb cover (%)	1		



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Site details			
Site	MF004	Position (WGS84)	-31.35805, 118.769577
Topography	hill slope	Soil texture	sandy loam, laterite
Slope	negligible	Rock type	none
Soil colour	yellow	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.12	11 Mar 2020	11 Mar 2020

Site description - visit 1 (11 Mar 2020)

Mallee shrubland with tall *Allocasuarina*, *Melaleuca*, *Hakea* over Myrtaceae dominant shrubs over sparse tussock and negligible herb on yellow whitish sandy loam with some laterite patchy leaf litter

Habitat	shrubland		
Disturbance	vehicle tracks		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	85	Litter distribution	under vegetation
Tree cover (%)	70	Litter depth(cm)	1
Shrub cover (%)	50	Litter cover (%)	40
Grass cover (%)	2		
Herb cover (%)	1		



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Site details			
Site	MF005	Position (WGS84)	-31.374886, 118.739539
Topography	plain	Soil texture	sandy loam
Slope	negligible	Rock type	none
Soil colour	not recorded	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	2.80	12 Mar 2020	12 Mar 2020

Site description - visit 1 (12 Mar 2020)

Open Mallee woodland over shrubs of *Allocasuarina*, *Hakea*, *Grevillea* and other shrubs over sedges with some herb cover on yellow whitish sandy loam with patchy leaf litter

Habitat	mallee woodland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	55	Litter distribution	under vegetation
Tree cover (%)	20	Litter depth(cm)	1
Shrub cover (%)	10	Litter cover (%)	35
Grass cover (%)	30		
Herb cover (%)	5		



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Site details			
Site	MF006	Position (WGS84)	-31.353326, 118.740154
Topography	hill slope	Soil texture	sandy loam
Slope	negligible	Rock type	none
Soil colour	yellow	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.07	12 Mar 2020	12 Mar 2020

Site description - visit 1 (12 Mar 2020)

Mallee-*Allocasuarina* shrubland over Myrtaceae dominant low shrubs over tussock grasses over negligible herbs on yellow sandy loam with patchy leaf litter

Habitat	shrubland		
Disturbance	evidence of feral animals, litter, vehicle tracks		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	65	Litter distribution	under vegetation
Tree cover (%)	40	Litter depth(cm)	1
Shrub cover (%)	30	Litter cover (%)	20
Grass cover (%)	10		
Herb cover (%)	1		



Flora and Fauna Assessment of Lot 1416 for the Parker Range Project
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Site details			
Site	MF007	Position (WGS84)	-31.355302, 118.741596
Topography	hill slope	Soil texture	sandy loam
Slope	negligible	Rock type	none
Soil colour	not recorded	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.03	12 Mar 2020	12 Mar 2020

Site description - visit 1 (12 Mar 2020)

Mallee-*Allocasuarina* shrubland over Myrtaceae dominant low shrubs over tussock grasses over negligible herbs on yellow sandy loam with patchy leaf litter

Habitat	shrubland		
Disturbance	evidence of feral animals, litter, vehicle tracks		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	65	Litter distribution	scattered
Tree cover (%)	40	Litter depth(cm)	1
Shrub cover (%)	30	Litter cover (%)	20
Grass cover (%)	10		
Herb cover (%)	1		



Flora and Fauna Assessment of Lot 1416 for the Parker Range Project
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Site details			
Site	MF008	Position (WGS84)	-31.357985, 118.743649
Topography	hill slope	Soil texture	sandy loam
Slope	negligible	Rock type	none
Soil colour	not recorded	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.43	12 Mar 2020	12 Mar 2020

Site description - visit 1 (12 Mar 2020)

Mallee-*Allocasuarina* shrubland over Myrtaceae dominant low shrubs over tussock grasses over negligible herbs on yellow sandy loam with patchy leaf litter

Habitat	shrubland		
Disturbance	evidence of feral animals, litter, vehicle tracks		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	65	Litter distribution	scattered
Tree cover (%)	40	Litter depth(cm)	1
Shrub cover (%)	30	Litter cover (%)	20
Grass cover (%)	10		
Herb cover (%)	1		



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Site details			
Site	MF009	Position (WGS84)	-31.359577, 118.745893
Topography	hill slope	Soil texture	sandy loam
Slope	negligible	Rock type	none
Soil colour	not recorded	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	2.07	12 Mar 2020	12 Mar 2020

Site description - visit 1 (12 Mar 2020)

Mallee-*Allocasuarina* shrubland over Myrtaceae dominant low shrubs over tussock grasses over negligible herbs on yellow sandy loam with patchy leaf litter

Habitat	shrubland		
Disturbance	evidence of feral animals, litter, vehicle tracks		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	65	Litter distribution	scattered
Tree cover (%)	40	Litter depth(cm)	1
Shrub cover (%)	30	Litter cover (%)	25
Grass cover (%)	10		
Herb cover (%)	1		



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Site details			
Site	MF010	Position (WGS84)	-31.363828, 118.771217
Topography	undulating plain	Soil texture	sandy loam
Slope	negligible	Rock type	none
Soil colour	yellow-orange	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	2.13	12 Mar 2020	12 Mar 2020

Site description - visit 1 (12 Mar 2020)				
Mallee woodland over Mallee shrubs over <i>Triodia</i> grass on yellow-orange sandy loam with patchy leaf litter				
Habitat	mallee woodland			
Disturbance	evidence of feral animals, litter, vehicle tracks			
Vegetation condition	Excellent	Fire age	moderate (>5 years)	
Total veg. cover (%)	65	Litter distribution	scattered	
Tree cover (%)	40	Litter depth(cm)	1	
Shrub cover (%)	15	Litter cover (%)	15	
Grass cover (%)	40			
Herb cover (%)	1			



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Site details			
Site	MF011	Position (WGS84)	-31.359216, 118.755244
Topography	hill slope	Soil texture	sandy loam, laterite
Slope	negligible	Rock type	none
Soil colour	yellow-whitish	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.05	12 Mar 2020	12 Mar 2020

Site description - visit 1 (12 Mar 2020)

Allocasuarina shrubland over Myrtaceae dominant shrubs on creamy yellow lateritic sandy loam with continuous leaf litter

Habitat	shrubland		
Disturbance	evidence of feral animals		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	85	Litter distribution	even/continuous
Tree cover (%)	80	Litter depth(cm)	1
Shrub cover (%)	50	Litter cover (%)	80
Grass cover (%)	0		
Herb cover (%)	0		



Site details			
Site	MF012	Position (WGS84)	-31.358236, 118.752046
Topography	undulating plain	Soil texture	sandy loam
Slope	negligible	Rock type	none
Soil colour	yellow-whitish	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.07	12 Mar 2020	12 Mar 2020

Site description - visit 1 (12 Mar 2020)

Mallee, *Allocasuarina* shrubland with *Callitris* over Myrtaceae, *Eremophila* and other shrubs over tussock grass on whitish grey sandy loam with patchy leaf litter

Habitat	shrubland		
Disturbance	evidence of feral animals		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	80	Litter distribution	under vegetation
Tree cover (%)	60	Litter depth(cm)	1
Shrub cover (%)	30	Litter cover (%)	25
Grass cover (%)	5		
Herb cover (%)	1		



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Site details			
Site	MF013	Position (WGS84)	-31.356896, 118.752408
Topography	undulating plain	Soil texture	granite rocks
Slope	negligible	Rock type	none
Soil colour	red-orange	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	-7.77	12 Mar 2020	12 Mar 2020

Site description - visit 1 (12 Mar 2020)			
<i>Borya</i> herbland on granite outcropping with the outer edge of granite dominated by Myrtaceae and other shrubs			
Habitat	herbland / forbland		
Disturbance	evidence of feral animals		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	90	Litter distribution	none
Tree cover (%)	0	Litter depth(cm)	0
Shrub cover (%)	1	Litter cover (%)	0
Grass cover (%)	5		
Herb cover (%)	90		



Site details			
Site	MF014	Position (WGS84)	-31.371118, 118.757996
Topography	undulating plain	Soil texture	sandy loam, loam, laterite
Slope	negligible	Rock type	none
Soil colour	red-orange	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.18	13 Mar 2020	13 Mar 2020

Site description - visit 1 (13 Mar 2020)

Mallee, *Acacia* and *Melaleuca* shrubland over Myrtaceae dominant shrubs and other mixed low shrubs lateritic yellow sandy loam with patchy leaf litter

Habitat	shrubland		
Disturbance	evidence of feral animals, vehicle tracks		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	85	Litter distribution	scattered
Tree cover (%)	65	Litter depth(cm)	1
Shrub cover (%)	30	Litter cover (%)	30
Grass cover (%)	0		
Herb cover (%)	0		



Site details			
Site	MF015	Position (WGS84)	-31.370733, 118.759294
Topography	undulating plain	Soil texture	sandy loam, laterite
Slope	negligible	Rock type	none
Soil colour	red-orange-whitish	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.05	13 Mar 2020	13 Mar 2020

Site description - visit 1 (13 Mar 2020)

Mallee woodland over tall melaleuca over mixed low shrubland dominant myrtacea with sporadic herbs on salmon colored lateritic sandy loam with patchy leaf litter

Habitat	mallee woodland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	70	Litter distribution	under vegetation
Tree cover (%)	60	Litter depth(cm)	1
Shrub cover (%)	15	Litter cover (%)	40
Grass cover (%)	0		
Herb cover (%)	1		



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Site details			
Site	MF016	Position (WGS84)	-31.368321, 118.760733
Topography	undulating plain	Soil texture	sandy loam
Slope	negligible	Rock type	none
Soil colour	yellow-whitish	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.10	13 Mar 2020	13 Mar 2020

Site description - visit 1 (13 Mar 2020)

Mallee woodland over tall *Melaleuca* shrubs over Myrtaceae and *Acacia* shrubs on whitish-salmon sandy loam with patchy leaf litter

Habitat	mallee woodland		
Disturbance	none		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	65	Litter distribution	scattered
Tree cover (%)	65	Litter depth(cm)	1
Shrub cover (%)	20	Litter cover (%)	35
Grass cover (%)	0		
Herb cover (%)	0		



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Site details			
Site	MF017	Position (WGS84)	-31.367341, 118.760527
Topography	undulating plain	Soil texture	sandy loam, laterite
Slope	negligible	Rock type	none
Soil colour	red-orange	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.05	13 Mar 2020	13 Mar 2020

Site description - visit 1 (13 Mar 2020)

Allocasurina woodland over melaleuca, Mallee and other myrtacea shrubs on yellow lateritic sandy loam with continuous leaf litter

Habitat	woodland		
Disturbance	evidence of feral animals, vehicle tracks		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	70	Litter distribution	even/continuous
Tree cover (%)	65	Litter depth(cm)	2
Shrub cover (%)	15	Litter cover (%)	80
Grass cover (%)	0		
Herb cover (%)	0		



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Site details			
Site	MF018	Position (WGS84)	-31.366446, 118.759382
Topography	undulating plain	Soil texture	sandy loam, laterite
Slope	negligible	Rock type	none
Soil colour	red-orange	Rock cover (%)	0

Sample and effort summary				
Visit	Sample method	Sample quant. (hrs)	Date start	Date stop
1	Site description	0.07	13 Mar 2020	13 Mar 2020

Site description - visit 1 (13 Mar 2020)

Allocasuarina woodland over mallee, *Melaleuca* and other Myrtaceae shrubs on yellow lateritic sandy loam with continuous leaf litter

Habitat	woodland		
Disturbance	evidence of feral animals, vehicle tracks		
Vegetation condition	Excellent	Fire age	moderate (>5 years)
Total veg. cover (%)	70	Litter distribution	even/continuous
Tree cover (%)	65	Litter depth(cm)	2
Shrub cover (%)	15	Litter cover (%)	75
Grass cover (%)	0		
Herb cover (%)	0		





APPENDIX 2: WA ENVIRONMENTAL OFFSETS TABLE

WA ENVIRONMENTAL OFFSETS TABLE									
Existing Environment / Impact	Mitigation			Significant Residual Impact	Offset Calculation Methodology				
	Avoid / Minimise	Rehabilitation Type	Likely Rehabilitation Success		Type	Risk	Likely Offset Success	Time Lag	Offset Quantification
Clearing of up to 298 ha of remnant vegetation (including clearing of 32 ha of Parker Range PEC)	<p>Avoid</p> <ul style="list-style-type: none"> Use of existing disturbance has occurred to avoid remnant vegetation impacts, where possible <p>Minimise</p> <ul style="list-style-type: none"> Bituminisation of road will minimise dust emissions during operations Dust suppression will occur during construction Surface water controls will be implemented to minimise erosion and sedimentation Vehicle weed hygiene procedure to be implemented <p>Workplace inspections to identify any weeds</p>	Rehabilitation of vegetation communities may occur if the Shire of Yilgarn and Department of Primary Industries and Regional Development (DPIRD) do not accept a transfer of ownership upon closure.	<p>Can the environmental values be rehabilitated/Evidence?</p> <ul style="list-style-type: none"> Yes, rehabilitation evidence is available. <p>Operator experience in undertaking rehabilitation?</p> <ul style="list-style-type: none"> MRL has significant experience in undertaking rehabilitation at other operations. <p>What is the type of vegetation being rehabilitated?</p> <ul style="list-style-type: none"> All vegetation communities <p>Time lag?</p> <ul style="list-style-type: none"> 10 years <p>Credibility of the rehabilitation proposed (evidence of demonstrated success)?</p> <ul style="list-style-type: none"> High credibility of success 	<p>Extent</p> <ul style="list-style-type: none"> 298 ha of remnant vegetation will be cleared <p>Quality</p> <ul style="list-style-type: none"> Vegetation quality ranged from Degraded to Pristine <p>Conservation Significance</p> <ul style="list-style-type: none"> No restricted vegetation communities were identified Restricted communities associated with the PEC are category 3 <p>Land Tenure</p> <ul style="list-style-type: none"> Mining tenure <p>Time Scale</p> <ul style="list-style-type: none"> Project operation will be six years <p>According to the agreed significance framework, residual impact is not considered to be significant because the impacted vegetation communities are widely distributed and impacts to PEC restricted communities are only 0.08% to the current mapped community.</p>	Offsets not required				
Impacts to Priority Flora	<p>Avoid</p> <ul style="list-style-type: none"> Use of existing disturbance has occurred to avoid remnant vegetation impacts, where possible <p>Minimise</p> <ul style="list-style-type: none"> Bituminisation of road will minimise dust emissions during operations Dust suppression will occur during construction Surface water controls will be implemented to minimise erosion and sedimentation Vehicle weed hygiene procedure to be implemented <p>Workplace inspections to identify any weeds</p>	It is unlikely that rehabilitation of Priority Flora will be undertaken. Some species may be included in seed mixes, if considered viable, however uncertainty exists regarding rehabilitation success of all species.	Not applicable	<p>Extent</p> <ul style="list-style-type: none"> Direct impacts to Priority flora species are below 10%. Potential for indirect impacts are considered low given bituminisation of haul road and design of suitable surface water controls. <p>Quality</p> <ul style="list-style-type: none"> Vegetation quality ranged from Degraded to Pristine <p>Conservation Significance</p> <ul style="list-style-type: none"> Species range from new species to Priority 1 to Priority 4. No Threatened species were identified. <p>Land Tenure</p> <ul style="list-style-type: none"> Mining tenure <p>Time Scale</p> <ul style="list-style-type: none"> Project operation will be six years <p>According to the agreed significance framework, residual impact is not considered to be significant because the direct impacts are not likely to change the conservation ranking of a species. Species are known to occur outside of the Project area. Indirect impacts will be minimised through bituminisation of the haul road.</p>	Offsets not required				
Clearing of up to 298 ha	<p>Avoid</p>	Rehabilitation of fauna habitat may occur if the	Can the environmental values be rehabilitated/Evidence?	<p>Extent</p> <ul style="list-style-type: none"> Fauna habitat impacts are detailed below 	Land acquisition,	Low	High	N/A.	Offset calculations

WA ENVIRONMENTAL OFFSETS TABLE																								
Existing Environment / Impact	Mitigation			Significant Residual Impact	Offset Calculation Methodology																			
	Avoid / Minimise	Rehabilitation Type	Likely Rehabilitation Success		Type	Risk	Likely Offset Success	Time Lag	Offset Quantification															
of Malleefowl and Chuditch habitat and potential direct impact to individuals	<ul style="list-style-type: none"> Use of existing disturbance has occurred where possible to avoid fauna habitats Preclearance surveys to identify active mounds and dens and avoidance to occur if identified, unless otherwise agreed by the CEO <p>Minimise</p> <ul style="list-style-type: none"> Haul road route follows current linear infrastructure to minimise further habitat fragmentation Fauna spotter onsite for any clearing activities, to identify active dens or mounds, deter fauna and provide emergency care Clearing activities to only occur during daylight hours Decreased speed limits within proximity to any active mounds or dens Workplace inspections to identify any injuries or mortalities Bituminisation of road will minimise dust emissions during operations Dust suppression will occur during construction Surface water controls will be implemented to minimise erosion and sedimentation Vehicle weed hygiene procedure to be implemented Workplace inspections to identify any weeds 	Shire of Yilgarn and DPIRD do not accept a transfer of ownership upon closure.	<ul style="list-style-type: none"> Yes, rehabilitation evidence is available <p>Operator experience in undertaking rehabilitation?</p> <ul style="list-style-type: none"> MRL has significant experience in undertaking rehabilitation at other operations. <p>What is the type of vegetation being rehabilitated?</p> <ul style="list-style-type: none"> All vegetation communities <p>Time lag?</p> <ul style="list-style-type: none"> 10 years <p>Credibility of the rehabilitation proposed (evidence of demonstrated success)?</p> <ul style="list-style-type: none"> The success of rehabilitation of Chuditch and Malleefowl breeding habitat is uncertain. 	<table border="1"> <thead> <tr> <th>Species</th> <th>Habitat</th> <th>Extent in Indicative Footprint (ha)</th> </tr> </thead> <tbody> <tr> <td>Chuditch</td> <td>Foraging only</td> <td>181.2</td> </tr> <tr> <td>Chuditch</td> <td>Breeding and Foraging</td> <td>91.6</td> </tr> <tr> <td>Malleefowl</td> <td>Foraging only</td> <td>121.3</td> </tr> <tr> <td>Malleefowl</td> <td>Breeding and Foraging</td> <td>176.0</td> </tr> </tbody> </table> <ul style="list-style-type: none"> Uncertainty exists over the level of impacts to Malleefowl individuals due to vehicle incidents. It is noted that evidence supports a continuous population with at least 4 + individuals expected Uncertainty exists over the level of impacts to Chuditch individuals due to vehicle incidents. It is noted that records represent an important population due to their location of the north eastern extent of the current distribution. In addition, there is uncertainty of the population size with at least one to four individuals expected. <p>Quality</p> <ul style="list-style-type: none"> Vegetation quality ranged from Degraded to Pristine <p>Conservation Significance</p> <p>Malleefowl and Chuditch are both Vulnerable under BC Act and EPBC Act.</p> <p>Land Tenure</p> <ul style="list-style-type: none"> Mining tenure <p>Time Scale</p> <ul style="list-style-type: none"> Project operation will be less than ten years <p>According to the agreed significance framework, residual impacts may be considered significant for Malleefowl and Chuditch because the potential impacts from vehicle interactions is uncertain.</p> <p>Impacts to fauna habitat are considered minor in proportion to mapped fauna habitat and the wider Great Western Woodlands area (16 million hectares). The potential for habitat fragmentation is also considered low due to the existing infrastructure (public road and State Barrier Fence) not appearing to result in any population fragmentation. Nevertheless, the clearing represents known breeding and foraging habitat and this combined with the potential for incidental mortality of individuals presents a potential for significant residual impacts. Therefore, offsets are proposed for clearing of up to 243 ha of Malleefowl and Chuditch habitat.</p>	Species	Habitat	Extent in Indicative Footprint (ha)	Chuditch	Foraging only	181.2	Chuditch	Breeding and Foraging	91.6	Malleefowl	Foraging only	121.3	Malleefowl	Breeding and Foraging	176.0	habitat improvement and management.	MRL is committed to providing funding to DBCA for the purchase and management of the Offset Site and the ongoing presence of species (due to current secondary evidence) is considered likely.	Land acquisition and management in the wheatbelt is well understood and has been previously implemented by DBCA as an offset for other proposals.		have been completed using the Commonwealth Calculator as a guide to provide a greater than 100% impact of offset, refer Table 12 in Section 5.2.
Species	Habitat	Extent in Indicative Footprint (ha)																						
Chuditch	Foraging only	181.2																						
Chuditch	Breeding and Foraging	91.6																						
Malleefowl	Foraging only	121.3																						
Malleefowl	Breeding and Foraging	176.0																						