

Reconnaissance and Targeted Flora and Fauna Survey: Interim report

Boallia Road (SLK 1.0 to 6.5), Boallia

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Stream Environment and Water

Stream Environment and Water (Stream EW) was engaged by SW Environmental to prepare the flora and vegetation components (reconnaissance and targeted flora survey) of this report. SW Environmental has relied on the accuracy and information supplied by Stream EW directly in the preparation of the relevant sections of this report:

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Common terms/acronyms

BC Act	WA Biodiversity Conservation Act 2016
DAWE	Federal Department of Agriculture, Water and the Environment
DBCA	WA Department of Biodiversity, Conservation and Attractions
DBH	Diameter at Breast Height in centimetres
DWER	WA Department of Water and Environmental Regulation
EP Act	WA Environmental Protection Act 1986
EPBC Act	Federal Environment Protection and Biodiversity Conservation Act 1999
FRTBC	Forest Red-tailed Black Cockatoo
Project	The proposed action
Proposal area / site	The Project extent as provided by the client
Study area	A 10 km buffer around the proposal area
Suitable DBH tree	Tree of a suitable size to develop large hollows (>50cm DBH).
WA	Western Australia

Executive summary

The City of Busselton (the City) proposes to carry out road widening and maintenance work to improve the safety of Boallia Road (1.0 to 6.5 SLK), Boallia, within the City of Busselton. The 'project' will include widening of the road formation and require selected vegetation clearing. The exact locations of clearing are yet to be determined.

The City will be submitting a Clearing Permit application to the Department of Water and Environmental Regulation. This Flora and Fauna Survey report identifies baseline biodiversity values along the road verge and will be used to guide the project design and inform the Clearing Permit application.

This Flora and Fauna Survey is equivalent to a Level 1 survey and includes desktop, reconnaissance, and targeted surveys, in accordance with EPA Technical Guidance and other relevant State and Commonwealth guidelines.

A summary of the flora, fauna and vegetation values of the Boallia Road study area are provided below:

- Five native vegetation units were identified within the survey area. Vegetation condition ranged from Completely Degraded to Very Good.
- Two of the vegetation communities have potential affinities to State listed TECs:
 - Possible TEC (due to Degraded to Completely Degraded condition) – CcXp Woodland of *Corymbia calophylla* over shrubland of *Melaleuca preissiana* and *Xanthorrhoea preissii* over mixed grassland herbland of *Freesia alba x leichtlinii* and *Avena fatua* has potential affinities to the Vulnerable SCP1b *Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain..
 - Probable TEC - MpXp Open Shrubland of *Melaleuca preissiana* over *Hakea* sp. MB01, *Astartea fascicularis* and *Xanthorrhoea preissii* over low shrubland of *Melaleuca incana* has potential affinities to the Endangered SCP02 Southern wet shrublands, Swan Coastal Plain.
- 90 taxa of vascular plants were observed from 29 families. Fifteen of the 90 taxa are introduced.
- One threatened flora species *Grevillea brachystylis subsp. grandis* was recorded (102 individual plants recorded from the previously known population). The plants were recorded in roadside remnant vegetation, partly in cleared areas and partly in mapped communities CcXp and MpXp. The section of the population north of Payne Road appeared to be actively managed for conservation i.e. evidence of marking and weed control.
- Four priority flora species were also recorded during the survey.
 - *Acacia semitrullata* (P4) was recorded from two locations during the survey. The species was recorded during assessment of relevés for vegetation communities AfEm and KgAf. Approximately 10 individuals were estimated to occur across the two sites. Additional individuals may occur in the two vegetation communities, but the species was uncommon and abundance likely to be low.
 - *Calothamnus quadrifidus subsp. teretifolius* was recorded from one location during the survey. The occurrence is a previously recorded population near the

intersection of Boallia Road and Payne Road (A. Webb pers. Comm). The population was estimated to contain approximately 50 individual plants within an approximately 100 m section of road reserve.

- *Loxocarya magna* (P3) was recorded scattered through much of the area mapped as vegetation community MpXp. Up to approximately 100 individual plants were estimated to occur within the survey area.
- *Stylidium lowrieianum* (likely) (P3) was recorded from during assessment of the relevé (site 3) for vegetation community AfEm.
- Two species additional noteworthy species were recorded during the survey.
 - *Hakea marginata* was recorded in the MpXp vegetation community.
 - *Mesomelaena stygia subsp. stygia* was also recorded in vegetation community MpXp.
- Arum lily (*Zantedeschia aethiopica*), a declared pest BAM Act, and other environmental weeds were recorded, including *Watsonia meriana var. bulbillifera* and Blackberry (*Rubus fruticosus*), a Weed of National Significance.
- Twenty-three species of fauna were observed, including all three black cockatoos and WRP which are species of conservation significance.
- There were a total of 123 suitable DBH trees within the study area. Three trees had potential to be used by black cockatoos for breeding based on typical black cockatoo breeding hollow attributes such as orientation, access, and chamber size. Tree 131 and 166 showed possible evidence of use (chews). Tree 116 had a possibly large hollow but no evidence of use.
- There was no evidence of black cockatoo roosts at the site.
- Feed residue was observed within the study area from all three cockatoos. Vegetation communities with Jarrah and or Marri as key components are likely to represent quality foraging habitat (Units AfEm, CcAf and CcXp).
- Other fauna that may use the study area as part of a larger patch include Peregrine Falcon, Southern Brush-tailed Phascogale, Water rat and Bandicoot.

The following recommendations are made:

- The final impact footprints should be checked against the significant impact criteria (DEWHA 2013; SEWPAC 2012) for black cockatoos and other matters of NES to determine the need to refer the project to DAWE.
- Further work (such as camera pole or drone) would need to be carried out to confirm black cockatoo nesting status or hollow suitability in Trees 131, 166 and 116 if these trees are to be cleared.
- Clearing should be conducted outside of spring to minimise impacts to breeding fauna.
- A licensed fauna spotter should be on site during the clearing of hollow trees to mitigate impacts on hollow dependant fauna.

1 Introduction

1.1 Background

The City of Busselton (the City) proposes to carry out road widening and maintenance work to improve the safety of Boallia Road (1.0 to 6.5 SLK), Boallia, within the City of Busselton. The site location and study area are shown in Figure 1-1 (Appendix A). The 'project' will include widening of the road formation and require selected vegetation clearing. The exact locations of clearing are yet to be determined.

The City will be submitting a Clearing Permit application to the Department of Water and Environmental Regulation (DWER). This Flora and Fauna Survey report identifies baseline biodiversity values along the road verge and will be used to guide the project design and inform the Clearing Permit application.

1.2 Scope of work

This Flora and Fauna Survey is equivalent to a Level 1 survey and includes desktop, reconnaissance, and targeted surveys, in accordance with EPA Technical Guidance and other relevant State and Commonwealth guidelines. The fauna component is restricted to terrestrial vertebrate fauna. Threatened aquatic fauna and invertebrates were considered through desktop assessment only.

The survey report also identifies whether any Matters of National Environmental Significance afforded protection under the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are present or likely to occur within the area.

The surveys include

- Desktop assessment,
- Field survey - validation and habitat assessment,
- Consultation, reporting, mapping, and recommendations.

1.3 Regulatory context

1.3.1 Key legislation

Key environmental legislation that may be relevant to the fauna survey is outlined in Table 1-1.

Table 1-1 Environmental legislation that may be relevant to the Project

Legislation	Responsible Government Department	Aspect
<i>Federal Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	Federal Department of Agriculture, Water, and the Environment (DAWE)	Matters of National Environmental Significance including threatened fauna and environmental offsets.
<i>Biodiversity Conservation Act 2016</i> (BC Act)	WA Department of Biodiversity, Conservation and Attractions (DBCA)	Threatened species habitats, threatening processes, environmental pests and weeds.
<i>Biosecurity and Agricultural Management Act 2007</i> (BAM Act)	WA Department of Primary Industries and Regional Development	Weeds, feral animals and other pests.
<i>Environmental Protection Act 1986</i> (EP Act)	Environmental Protection Authority or DWER	Environmental impact assessment and management and offsets.

1.3.2 Flora, fauna and ecological communities

Flora, fauna and ecological communities in WA may be afforded protection under the WA BC Act and or federal EPBC Act.

Species listed as threatened or migratory under the above legislation are referred to collectively in this document as being 'conservation significant' or 'target' species. These terms include species and communities listed under the DBCA Priority lists.

BC Act

The WA BC Act and associated Regulations provide for the licensing and management of activities that affect biodiversity. The BC Act provides for the listing of threatened native plants (flora), threatened native animals (fauna) and threatened ecological communities that need protection as critically endangered, endangered or vulnerable species or ecological communities because they are under identifiable threat of extinction (species) or collapse (ecological communities).

The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* contain the lists of Threatened, Extinct and Specially Protected species under Part 2 of the BC Act. These are described below.

Threatened species and communities

- PD: Presumed totally destroyed (TECs only)

- CR: Critically endangered species
- EN: Endangered species
- VU: Vulnerable species

Extinct species

- EX: Extinct species
- EW: Extinct in the wild species

Specially protected species

- MI: Migratory species
- CD: Species of special conservation interest (conservation dependent fauna)
- OS: Other specially protected species

Priority species and communities

- Priority 1: Poorly-known species
- Priority 2: Poorly-known species
- Priority 3: Poorly-known species
- Priority 4: Rare, Near Threatened and other species in need of monitoring
- Priority Ecological Community (PEC): Where communities are considered rare but not (currently) threatened or there is insufficient information available for the community to be considered a TEC, communities can be listed as priority ecological communities (PECs).

A full description of conservation codes is provided in Appendix C.

EPBC Act

In accordance with Commonwealth legislation, the EPBC Act provides a list of 'Matters of National Environmental Significance' (NES), which includes significant fauna, flora and communities. Under the EPBC Act flora, fauna or ecological community matters of NES may be listed in any one of the following categories as defined in *Section 179* of the Act:

- Extinct,
- *Extinct in the wild,
- *Critically endangered,
- *Endangered,
- *Vulnerable,
- Conservation dependent.

*Only these categories are matters of NES under the Act.

The EPBC Act also lists migratory species that are recognized under international treaties including the Japan Australia Migratory Bird Agreement (JAMBA), the China Australia Migratory Bird Agreement (CAMBA) and the Bonn Convention (The Convention on the conservation of Migratory Species of Wild Animals). The EPBC Act is regulated by the DAWE.

IUCN Red List

The IUCN Red List is an inventory of the global conservation status of species and used to assist DBCA and other agencies in attributing a given threatened species status. It does not have any statutory authority and is not considered in detail in this assessment.

1.3.3 Guidelines

The survey considers the guidelines below.

- Technical Guidance - Terrestrial Fauna Surveys for Environmental Impact Assessment (EPA, 2020)
- Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016)
- Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3, EPA (2002).

The following were also generally considered:

- Commonwealth EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered), *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable), *Calyptorhynchus baudinii*, and Forest red-tailed black cockatoo (vulnerable) *Calyptorhynchus banksii naso* (SEWPaC 2012).
- Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo. (Commonwealth of Australia 2017)
- Significant impact guidelines for the vulnerable western ringtail possum (*Pseudocheirus occidentalis*) in the southern Swan Coastal Plain, Western Australia Department of the Environment, Water, Heritage and the Arts (DEWHA)', (2009)

2 Methods

2.1 Desktop Assessment

A desktop assessment biodiversity values (flora, terrestrial vertebrate fauna and vegetation) within and near the study area was undertaken. A key aim of the assessment was to determine the likelihood of any species of conservation significance (target species) occurring within the study area and the importance of the site to them. Common (non-target) species are also considered more generally.

Database searches using Western Australian Museum (WAM) Nature Map and the Protected Matters Search Tool (Appendix D) were carried out for the study area ((5 km for flora and 10 km for fauna; only the 10 km searches are attached). Atlas of Living Australia (ALA, 2020), Birddata (BirdLife Australia, 2020), Index of Biodiversity Surveys for Assessment (IBSA, 2020) aerial photography (Landgate, 2020), data from the Government of WA's Shared Land Information Platform (SLIP, 2020) were also searched. In addition, management plans, recovery plans, books, scientific journals and other publications, previous survey reports and expert consultation were considered.

Soil mapping from Tille and Lantzke (1990) was used to identify soil types and relevant literature utilised to develop a description of the landforms and geomorphology of the study area.

Mapping of vegetation associations and vegetation complexes, and other available regional studies, were reviewed to identify potential vegetation types occurring within the study area. Potential threatened ecological communities were identified through searches of NatureMap (DBCA 2020) and the Protected Matters Search Tool (DoEE 2020) and supplemented through review of relevant literature (e.g. Gibson et al. 1994).

A brief review of the ecology, habitat and range of target species were used in an evaluation matrix to determine the likelihood of occurrence of conservation significant flora and fauna (Appendix E). Flora and fauna of conservation significance that may occur locally are listed in Sections 3.3.2 and 3.4.2.

2.2 Field surveys

2.2.1 Flora and vegetation

A field survey incorporating reconnaissance level survey and targeted flora searches was completed by Stream Environment and Water, Principals Mike Braimbridge and Jane Wilshaw on 30th September 2020. A follow up site visit was conducted by Mike Braimbridge in January 2021 to map the distribution of an additional priority flora species (*Loxocarya magna*) which was still present and identifiable in summer.

Description of vegetation communities was completed using unmarked relevé sampling. At each location, the following information was recorded using standardised field sheets:

- Location and coordinates.
- Soil description and landforms.
- Vegetation condition (according to Table 2-1; EPA 2016).

- Vegetation structure and community description in accordance with the National Vegetation Information System (NVIS) structure and floristics (ESCAVI 2003) (Table 2-2).
- Vascular plant species (denoting native and introduced species).

Targeted searching for potential threatened flora species was completed through foot traverses of the survey area and immediately adjoining areas. Where located, the coordinates of potential threatened flora species were recorded along with the number of plants.

Observations on changes in vegetation condition were recorded opportunistically during foot traverses and species lists for community descriptions were supplemented by opportunistic recording of additional species.

Any flora species that were not able to be identified in the field were collected or photographed. Relevant taxonomic literature and databases were used to identify collected specimens.

2.2.2 Fauna

Field work consisted of a site reconnaissance on 20th November 2020 by SW Environmental Principal, Shane Priddle. The field visit was undertaken to validate the desktop assessment and ground truth fauna habitat. Habitat quality, opportunities, fauna evidence, presence or absence of water features, and habitat trees were also noted. Opportunistic fauna sightings were recorded. Fauna habitat quality was based on tables 2-1 to 2-3. Targeted surveys were conducted for black cockatoos.

Black cockatoos

Black cockatoo habitat surveys included:

- Foraging habitat assessment: The amount and quality of potential black cockatoo foraging habitat was noted, with presence of any feed residue observed.
- Roosting habitat survey: Direct and indirect evidence of black cockatoos roosting within trees on site were noted if observed.

Black cockatoo breeding requirements

Black cockatoos rely on large hollows for breeding, typically >20cm in diameter. Hollows take many years to form. The onset of hollow-formation is dependent on damage to the tree, from fire, animals (vertebrates or invertebrates), or dropping branches. Young and healthy trees can quickly heal after damage and subsequently trees less than 100 years old are unlikely to contain hollows.

For nesting, black cockatoos generally show a preference for

- large senescing trees,
- hollows not angled more than 45 degrees from vertical,
- entrances of at least 12cm but usually much larger (20-30cm),
- deep or well sheltered hollows in main trunk or large branches which are able to provide a floor space of at least 30cm diameter or more.

SW Environmental and Kirkby (2019)

All three species of black cockatoo are a similar size and utilise similar types of tree hollows when breeding. The actual species of tree is probably unimportant to each individual species, for example Carnaby's cockatoo use Wandoo when in the wheatbelt areas and Marri, when in the Marri forest and Karri when in Karri forest areas. All three species are known to use the same individual hollows when not occupied in the breeding season by another black cockatoo species (Kirkby pers comm, 2019).

Hollows take many years to form. The onset of hollow-formation is dependent on damage to the tree, from fire, animals (vertebrates or invertebrates), or dropping branches. Young and healthy trees can quickly heal after damage and subsequently trees less than 100 years old are unlikely to contain hollows. Marri, Jarrah and Blackbutt are considered by Commonwealth of Australia (2017) to be large enough to develop hollows once they are >50cm DBH.

Jarrah trees are much less likely than Marri to develop hollows with suitable characteristics required for black cockatoo nesting (Johnstone et al 2013a). It is estimated that upwards of 95% of hollows utilised by black cockatoos in the Jarrah Marri forest are in large Marri rather than Jarrah (Johnstone et al 2013a) (SW Environmental and Kirkby 2019). Wayne (2005) also notes that Marri trees are more likely to develop usable hollows than Jarrah.

BREEDING ASSESSMENT: Breeding and hollow assessments were based on the black cockatoo breeding requirements described in the section above.

Suitable DBH Trees were recorded over the site. These targeted trees with a DBH >50cm and considered old enough to start developing large hollows and provide ongoing hollow recruitment (SEWPAC 2017).

- Hollows were recorded with the number, height and size of hollows noted in size classes. Hollow classes were based on the following hollow entrance sizes
 - 20 cm plus - Large hollow, preferred by black cockatoos
 - 15-20 cm – Medium hollow, still used by black cockatoos in the absence of large hollows
 - 10-15 cm – Small hollow, less likely to be used by black cockatoos
 - <10 cm – not used by black cockatoos (too small to access). Not all small hollows were recorded.
- Evidence of use such as chews, wear and other factors were noted along with the suitability of the hollow for black cockatoo breeding, e.g. orientation, access, chamber size or use by other animals.

Publications

Publications consulted for general distribution of fauna included, but was not limited to:

- A Complete Guide to Reptiles of Australia (Wilson and Swan, 2017)
- A Field Guide to the Mammals of Australia (Menkhorst and Knight, 2013)
- Field guide to frogs of Western Australia (Doughty and Tyler, 2009)
- Frogs of Western Australia (Thomson-Dans and Wardell-Johnson, 2002)
- Handbook Western Australian Birds Vol I (Johnstone and Storr, 1998)
- Michael Morcombe's Birds of Australia eGuide, (Michael Morcombe, 2011)

- Reptiles and Frogs in the Bush: Southwestern Australia (Bush et al., 2007)
- Scats, Tracks and Other Traces: A field guide to Australian mammals (Triggs, 2008)
- The Field Guide to the Birds of Australia (Pizzey and Knight, 2012)
- Waterbirds of South-west Wetlands (Thomson-Dans and Halse, 2001)
- Numerous online publications, journal articles and other general species references (see References section).

Taxonomy and nomenclature

The taxonomy and nomenclature used in this report follows several sources, depending on the faunal group. It primarily follows the Naturemap database (2020) but also the following:

- Amphibians: Bush et al. (2007)
- Aves: Pizzey and Knight (2007)
- Mammals: Menkhorst and Knight (2013)
- Reptiles: Wilson and Swan (2017)

Table 2-1 Vegetation structure (Keighery 1994).

Life Form/Height Class	Canopy cover			
	100% to 70%	70%to 30%	30%to 10%	10% to 2%
Trees over 30 m	Tall Closed Forest	Tall Open Forest	Tall Woodland Woodland	Tall Open Woodland
Trees 10-30 m	Closed Forest	Open Forest		Open Woodland
Trees under 10 m	Low erased Forest	Low Open Forest	Low Woodland	Low Open Woodland ..
Mallee over 8 m (Tree Mallee)	Closed Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree. Mallee
Mallee under 8 m (Shrub Mallee)	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub
Shrubs over 2 m	Closed Tall Scrub	Tall Open Scrub	Tall Shrubland Shrubland	Tall Open Shrubland
Shrubs 1 2 m	Closed Heath	Open Heath	Low Shrubland	Open Shrubland
Shrubs under 1 m	Closed Low Heath	Open Low Heath		Very Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland.	Very Open Sedgeland

Table 2-2 Vegetation condition scale (EPA 2016).

Condition	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.

Table 2-3 Fauna habitat quality categories and descriptions (SW Environmental, undated).

Quality	Description
Good	<ul style="list-style-type: none"> Native vegetation with intact and diverse habitat structure. Different vegetation age classes present at most stratum levels (ground, understorey, midstorey, canopy). Forest/woodland: abundant hollow-bearing trees, including those with or likely to develop large hollows. Mature trees offer more foraging resources (nectar/seed). Presence of shelter/refuges at ground level (dense understorey plants, tussock, rocky outcrop, hollow logs). High habitat complexity (ecotones between vegetation types or habitat mosaic). This increases the range of foraging and shelter opportunities within a habitat. Presence of key foraging and microhabitat components for target species. Little to no obvious weed invasion or evidence of grazing. May be large patch and/or connected to other areas of native vegetation.
Moderate	<ul style="list-style-type: none"> Native flora species dominant with moderate habitat structure complexity appropriate to vegetation type. Ground litter intact or slightly disturbed. More than one age class present. Forest/woodland: low to moderate abundance of hollow-bearing trees or trees likely to develop hollows. Some shelter and refuge present for ground dwelling fauna. Some habitat complexity (ecotones between vegetation types or areas forming a habitat mosaic). Marginal presence of key microhabitat components for target species. May be small or large in scale, and isolated or well connected.

Quality	Description
Poor	<ul style="list-style-type: none"> Habitat highly disturbed and simplified with low structural complexity. Ground litter layer absent or highly modified. Complexity reduced by only one age class present. Little or no shelter and refuge for ground dwelling fauna. Forest/woodland: not likely to support hollow-bearing trees. Lack of key foraging and microhabitat components for target species. May have evidence of weed invasion or grazing. May be narrow or small area and substantially influenced by edge effects, isolated from other areas of native vegetation.

2.3 Limitations

In accordance with relevant *Technical Guidance* (EPA 2016 & 2020) survey limitations are shown below.

Table 2-4 Assessment of survey limitations for flora and vegetation survey components

Aspect	Constraint	Comment
Available regional and local information	Negligible	The region is well surveyed with regional vegetation association and complex mapping available.
Competency of personnel	Negligible	The survey was completed by Mike Braimbridge and Jane Wilshaw who have >20 years' experience in conducting flora and vegetation surveys in the Western Australia, including the south west.
Proportion of flora identified	Low	The survey was completed during spring flowering period. Where required specimens were collected or photographed and identified using relevant taxonomic literature. An additional follow up site visit was conducted in summer to map the distribution of an additional priority species still present and identifiable after spring.
Survey effort and extent	Negligible	The survey area is relatively small. Targeted searching covered the entire proposed development area. The first site visit coincided with peak spring flowering period. A follow up site visit was conducted to map the distribution of an additional priority species (still present and identifiable after spring).
Accessibility	Negligible	Relevés were considered suitable given the scale of the proposed disturbance and size of the project area.
Survey timing and season	Negligible	Site is on public land. There were no constraints on access
Disturbance	Negligible	The survey was completed in late September.

Table 2-5 Assessment of survey limitations for fauna survey component

Aspect	Constraint	Comment
Competency / experience of the survey team	Negligible	Suitably qualified individuals carried out the work - Shane Priddle (Ba Marine Science; CEnvP No. 310) with nearly 20 years' experience conducting fauna surveys throughout NSW and WA.
Scope, e.g. where faunal groups were excluded from the survey	Negligible	The scope is adequate to provide information required to support a clearing assessment. Fish and invertebrates were not sampled in the field but were considered in the desktop assessment.
Adequacy of the survey intensity and proportion of survey achieved	Negligible	Suitable survey effort has been adopted to identify the fauna constraints associated with the study area. A precautionary approach has also been adopted.
The proportion of the task achieved and further work	No	The surveys were completed adequately, to a sufficient level with respect to the scope.
Timing/weather/season	No	The surveys were completed in spring 2020. The survey timing and weather conditions were suitable to detect most target species.
Disturbances that may have affected results of survey	No	There were no disturbances that affected the survey.
Intensity	No	Based on the results the survey is considered adequate to meet the project scope.
Completeness	No	The entire survey area was surveyed.
Resources	No	The surveys were completed adequately.
Access problems;	No	Site was on public land and accessible.
Identification of hollows	Low	<p>There are known limitations inherent in the ground survey of hollows - bias with multiple surveyors / survey times due to differing familiarity with tree types, levels of training / expertise, survey conditions such as weather and time of day, and survey technique (Gorrod & Keith 2008, Rayner et al. 2011). Poor visibility (such as overcast weather) is known to affect results also (Rayner et al. 2011).</p> <p>Ground-based counts of hollows are subjective, it is not possible to be certain that the feature is a hollow as seen from the ground. Limitations include the likelihood that some hollows may be missed, may not be observable or may be obscured, particularly hollows in branches and vertical hollows.</p> <p>As well as providing inaccurate counts of hollow abundance, ground-based surveys provide incomplete or inaccurate information on hollow dimensions and use of hollows by fauna (Koch 2008). Generally, ground-based surveys lead to overestimation of hollows (Rayner et al. 2011, Author pers obs).</p> <p>The suitability of hollow may change over time. There is some risk, though low, that black cockatoos may be breeding in a hollow where evidence of use was not visible or hollow characteristics were atypical.</p> <p>It is also noted that not all active cockatoo hollows show signs of heavy chewing and active or past breeding hollows therefore may be missed.</p>

3 Desktop study

3.1 Local and regional context

3.1.1 Land use

The project passes through largely cleared farmland, with ribbons of native vegetation throughout. Much of the road reserve is vegetated with mostly naturally regenerated regrowth native vegetation. The main local land uses are mainly grazing (improved pastures) and dry land agriculture, forestry (of native forest), and conservation.

3.1.2 Interim Biogeographic Regionalisation of Australia (IBRA) values

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies Australia's landscapes into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information. IBRA also provides for the national and regional planning framework for the systematic development of a comprehensive, adequate and representative (CAR) National Reserve System, endorsed by all levels of government as a key tool for identifying land for conservation under Commonwealth's Australia's Strategy for the National Reserve System 2009-2030 (DE, 2017).

The Project occurs within the Swan Coastal Plain Sub-region (SWA02) of the Swan Coastal Plain IBRA region. This bioregion consists of a low lying coastal plain, mainly covered with woodland. Woodlands are dominated by Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah woodland. Three phases of marine sand dune development provide relief. The outwash plains, once dominated by *C. obesa*-Marri woodlands and Melaleuca shrublands, are extensive only in the south (Mitchell et al 2002) (Williams et al 2002).

3.1.3 DBCA managed lands

There are no DBCA managed reserves in the immediate vicinity of the project area. The closest, the Blackwood State Forest, is nearly four kilometres south of the project, and joins significant tracts of contiguous State Forest and National Park through the southern Jarrah Forest.

3.1.4 Habitat connectivity, linkage, or corridor values

In a local context there is approximately 10,500 ha of native vegetation mapped (or 25%) remaining within 10 km of the study area (42,300 ha) (Government of Western Australia 2020).

Linkages (SWREL) project identifies regional scale ecological linkages and aims to respond to the issues of fragmentation and climate change through land use planning policy and procedures. It also seeks to retain native vegetation and fauna habitat and reduce the loss of biodiversity and ecological function

in the South West. The SWREL axis lines can be summarised as a series of vegetation patches which due to their proximity, act as habitat stepping stones thereby facilitating ecological processes and movement of organisms within and across the landscape (i.e. at the landscape scale) (Molloy et al 2009).

The project fall within an area of mapped and unmapped north south SWREL axis line (Molloy et al 2009)

- *1a: with an edge touching or < 100m from a linkage*
- *1b: with an edge touching or < 100m from a natural area selected in 1a*
- *1c: with an edge touching or < 100m from a natural area selected in 1b*
- *2b: with an edge touching or < 100m from a natural area selected in 2a*

From a regional linkage perspective, the highest values occur within the northern third and southern third of the site.

3.1.5 Important Bird Areas (IBA)

Important Bird Areas (IBAs) are areas identified by Birdlife International. IBAs are considered conservation priorities, sites able to be conserved in their entirety and are usually part of a protected-area network or recognised as having global bird conservation importance (Birdlife International, 2020). There are no IBAs nearby, the closest is nearly five kilometres away (Busselton Wetlands IBA).

3.2 Environmental values of the study area

3.2.1 Climate, landform and soils

The southwest of WA has a Mediterranean climate with mild wet winters and hot dry summers. The following climate summary is based on data from the nearby Busselton data station (Weatherzone 2020). The temperature ranges from an average maximum of 28.9°C in the hottest month of February to an average minimum of 7.9°C in August with an average annual rainfall of 800 mm, with most of the rain falling between June and August (Weatherzone, 2020).

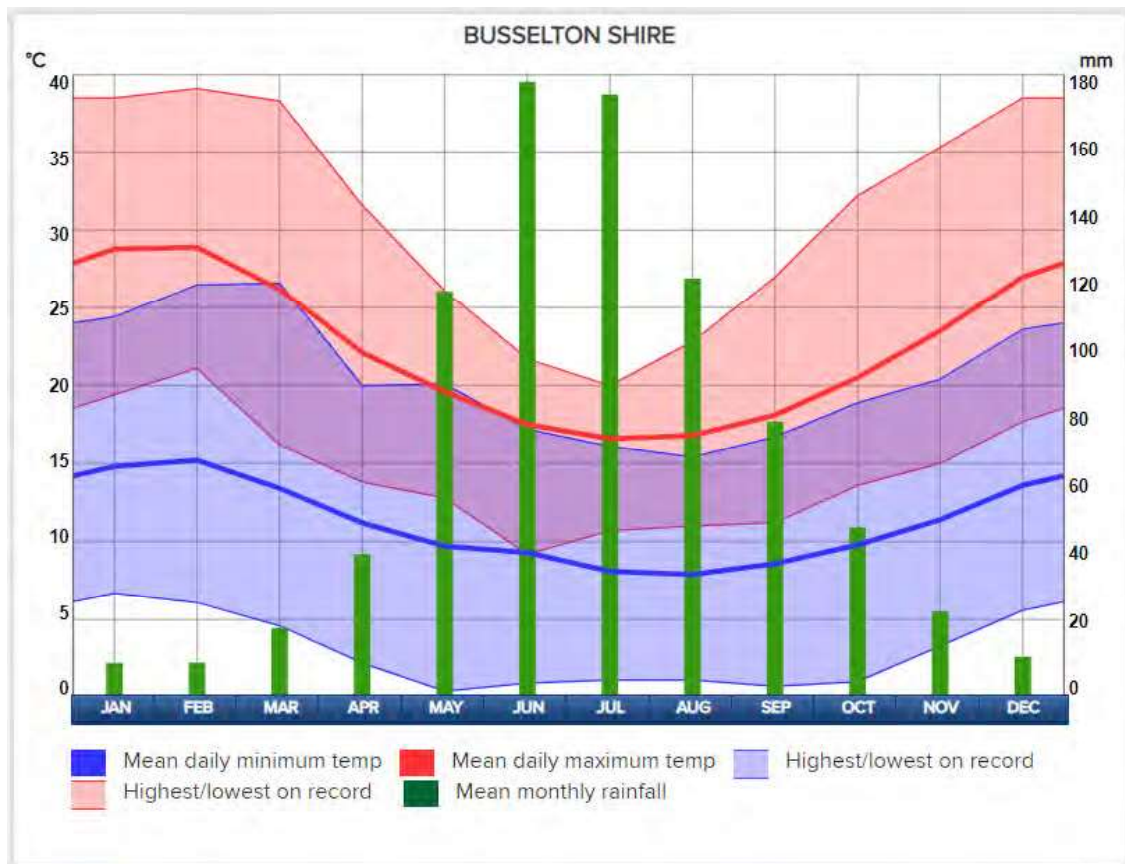


Figure 3 Annual temperatures and rainfall near the study area (Weatherzone 2020)

The project occurs over flat topography and passes through several soil units, as mapped by Department of Agriculture and Food (Tille and Lantzke 1990):

- 212BsGCd2 Bassendean Golf Course deep sandy rises Phase - Gently sloping low dunes and rises (0-5% gradients) with deep bleached sands.
- 213AbAB1 Abba Flats Phase - Flats and low rises with sandy grey brown duplex (Abba) and gradational (Busseton) soils.
- 213AbAB2 Abba gentle slopes Phase - Very gently sloping terrain. Pale sandy earths, Semi-wet soils, Pale deep sands and Duplex sandy gravels
- 213AbABw Abba wet flats Phase - Winter wet flats and slight depressions with sandy grey brown duplex (Abba) and gradational (Busseton) soils.
- 213AbABwi Abba wet ironstone flats Phase - Winter wet flats and slight depressions with shallow red brown sands and loams over ironstone (i.e. bog iron ore soils).
- 213AbJD1 Jindong flats Phase - Well drained flats with sandy gradational grey brown (Busseton) soils, some red brown sands and loams (Marybrook Soils).

The Abba wet flats phase is most common (by area) soil type within the survey area

3.2.2 Wetlands and watercourses

The project passes over a minor, non-perennial unnamed drainage line near 4.93 SLK.

The term 'wetlands' refers to damplands, estuary-peripheral and water body, floodplains, palusplain and sumplands. The wetland categories are recognised by the EPA, DBCA, DWER and other decision making authorities.

Guidance on protecting the environment during planning and development is set out in the *Environmental Protection Authority's Guidance Statement 33 - Environmental Guidance for Planning and Development* (EPA 2008) Chapter B4 describes the requirements for the protection of wetlands. The EPA considers wetlands in terms of the three broad wetland management categories: Conservation (0-5% disturbed), Resource Enhancement (5-90%) and Multiple Use (90-100% disturbed).

The project passes over a Conservation Category wetland (ID 15215) (between 5.17 and 5.65 SLK) and Multiple Use mapped palusplain wetlands in the Geomorphic Wetlands dataset (Government of Western Australia, 2020). The study area does not contain any wetlands listed under the Directory of Important Wetlands in Australia or RAMSAR (List of Wetlands of International Importance) (Government of Western Australia, 2020).

3.2.3 Vegetation

Existing vegetation mapping associated with the site is described below.

Vegetation Associations

The site predominately intersects the *Pinjarra 1136 - Medium woodland; marri with some jarrah, wandoo, river gum and casuarina* Vegetation Association mapped by Beard (1981). It also passes through Pinjarra 949 - Low woodland; banksia, in two small sections. Refer to Figure 2 (Appendix A).

The 1136 Vegetation Association contains tree species that may develop large hollows. Hollow bearing trees are critical elements for many fauna species, including many arboreal mammals (such as phascogales and possums), bats and bird species (such as owls and black cockatoos). Animals can be selective in their use of tree hollows, preferentially using hollows of a particular size, shape and orientation. Many hollow dependant fauna are considered threatened, which is often at least partially attributed to a lack of suitable nesting sites (Koch 2008).

Vegetation Complexes

Vegetation complexes in the area were mapped by Webb et al. (2009) as an extension of earlier work by Heddle et al. (1980) and revised through Webb et al. (2016). Two vegetation complexes are mapped and described across the site (Figure 3, Appendix A).

- Abba Complex: A mixture of open forest of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - Banksia species and woodland of *Corymbia calophylla* (Marri) with minor occurrences of *Corymbia haematoxylon* (Mountain Marri). Woodland of *Eucalyptus rudis* (Flooded Gum) - Melaleuca species along creeks and on flood plains.

- Southern River Complex: Open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - Banksia species with fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca raphiophylla* (Swamp Paperbark) along creek beds.

Threatened Ecological Communities

The desktop survey found identified four federally listed threatened ecological communities (TEC), four State listed TEC and seven priority ecological communities (PEC) (Table 3-1). The Banksia Woodlands of the Swan Coastal Plain TEC/Banksia dominated woodlands PEC was mapped as potentially occurring within the survey area.

Table 3-1 Threatened and Priority Ecological Communities potentially occurring at the site.

Community Code	Community description	State status	Commonwealth status
Banksia WL SCP	Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region	Priority 3	Endangered
Coastal Saltmarsh	Subtropical and Temperate Coastal Saltmarsh	Priority 3	Vulnerable
SCP02	Southern wet shrublands, Swan Coastal Plain	Endangered	
SCP07	Herb rich saline shrublands in clay pans	Vulnerable	Critically Endangered
SCP10b	Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)	Critically Endangered	Endangered
SCP1b	<i>Eucalyptus calophylla</i> woodlands on heavy soils of the southern Swan Coastal Plain	Vulnerable	
Vasse Blackbutt (near Busselton)	<i>Eucalyptus patens</i> , <i>Corymbia calophylla</i> , <i>Agonis flexuosa</i> Closed Low Forest	Priority 1	
Whicher Scarp C1	Central Whicher Scarp Jarrah woodland	Priority 1	
Whicher Scarp C2	Whicher Scarp Jarrah woodland of deep coloured sands	Priority 1	
Whicher Scarp G2	Shrublands of near permanent wetlands in creeklines of the Whicher Scarp (Whicher Scarp community G2)	Priority 1	
Whicher Scarp Paluslope Wetlands	Swan Coastal Plain Paluslope Wetlands	Priority 1	

3.3 Flora records

3.3.1 *Flora recorded locally*

A search of Naturemap (2020) yielded 281 plant species from five kilometres.

3.3.2 *Flora of conservation significance*

The results of the database searches identified 22 priority species and 12 threatened flora species potentially occurring within the survey area (based on Nature Map search results for 5 km radius and previous search data provided by the City of Busselton).

The likelihood of potentially occurring threatened and priority flora was assessed as part of the desktop survey prior to the field survey, using information on previous records and taking into consideration soils and landforms within the survey area. Likelihood assessment results are detailed in Table 2 below. Fourteen of the combined 34 conservation significant species were identified highly likely to occur within the survey area.

Table 3-2 Potential Threatened and Priority Flora occurring within the desktop survey area

Taxon	WA Status	EPBC Status	Description	Preferred Habitat	Likelihood of occurrence
<i>Acacia flagelliformis</i>	P4		Rush-like, erect or sprawling shrub, 0.3-0.75(-1.6) m high. Fl. yellow, May to Sep.	Sandy soils. Winter-wet areas	High
<i>Acacia semitrullata</i>	P4		Slender, erect, pungent shrub, (0.1-)0.2-0.7(-1.5) m high. Fl. cream-white, May to Oct.	White/grey sand, sometimes over laterite, clay. Sandplains, swampy areas	Moderate
<i>Andersonia barbata</i>	P 2		Erect shrub, ca 0.4 m high. Fl. blue & pink, Nov.	White sand. Swampy areas.	Moderate
<i>Andersonia ferricola</i>	P1		Shrub, 0.2-0.5 m high. Fl. purple, Oct.	White sand or red-brown loam over ironstone. Seasonally wet flats.	Low
<i>Banksia nivea subsp. uliginosa</i>	T	E	Dense, erect, non-lignotuberous shrub, 0.2-1.5 m high. Fl. yellow-brown, Aug to Sep. Sandy clay, gravel.	Sandy clay, gravel.	Low
<i>Banksia squarrosa subsp. argillacea</i>	T	V	Erect, open, non-lignotuberous shrub, 1.2-4 m high. Fl. yellow, Jun to Nov.	White/grey sand, gravelly clay or loam. Winter-wet flats, clay flats.	Low
<i>Caladenia busselliana</i>	T	E	Tuberous, perennial, herb, 0.2-0.3 m high. Fl. green & yellow & cream, Sep to Oct. Sandy loam.	Winter-wet swamps.	Low
<i>Caladenia procera</i>	T		Tuberous, perennial, herb, 0.35-0.9 m high. Fl. yellow, Sep to Oct.	Rich clay loam,. Alluvial loamy flats, jarrah/marri/peppermint woodland, dense heath, sedges.	Moderate
<i>Calothamnus lateralis var. crassus</i>	P3		No description	Winter wet ironstone	Low
<i>Calothamnus quadrifidus</i>	P4		Shrub to 5m, Leaves terete, obtuse or shortly mucronate, 15–35 mm long, 0.6–1 mm wide, glabrous	Clay winter wet areas, ironstone.	High

Taxon	WA Status	EPBC Status	Description	Preferred Habitat	Likelihood of occurrence
<i>subsp. teretifolius</i>					
<i>Chamelaucium erythrochlorum</i>	P4		Not available	Clay winter wet areas, ironstone.	Moderate
<i>Chamelaucium roycei</i>	T		Tuberous, perennial, herb, 0.35-0.9 m high. Fl. yellow, Sep to Oct.	Rich clay loam,. Alluvial loamy flats, jarrah/marri/peppermint woodland, dense heath, sedges.	Moderate
<i>Chordifex gracilior</i>	P3		Rhizomatous, erect perennial, herb, 0.3-0.5 m high. Fl. brown, Sep to Dec.	Peaty sand. Swamps.	Moderate
<i>Daviesia elongata</i>	T	V	Spreading or sprawling shrub, 0.4-1 m high. Fl. yellow&orange & red, Sep or Dec or Jan to Feb.	Sand, laterite.	High
<i>Drakaea micrantha</i>	T	V	Tuberous, perennial, herb, 0.15-0.3 m high. Fl. red & yellow, Sep to Oct.	White-grey sand.	Moderate
<i>Gastrolobium modestum</i>	T		Prostrate to clumped shrub, to 0.5 m high. Fl. cream-green-pink, Sep to Nov.	Shallow red clay-loam or grey sand, ironstone. Gullies and edges of flats.	Low
<i>Grevillea brachystylis subsp. brachystylis</i>	P3		Much-branched, prostrate or decumbent, non-lignotuberous shrub, 0.2-0.5 m high, to 3 m wide. Fl. red, Aug to Nov.	Black sand, sandy clay. Swampy situations.	High
<i>Grevillea brachystylis subsp. grandis</i>	T	CE	Shrub to 1.8m tall. Large red flowers from August to December. Known from 6 populations.	Brown lateritic clay loam soils in Marri woodland	High
<i>Hakea oldfieldii</i>	P3		Open, straggling shrub, up to 2.5 m high. Fl. white-cream/yellow, Aug to Oct.	Red clay or sand over laterite. Seasonally wet flats.	High
<i>Isopogon formosus subsp. dasylepis</i>	P3		Low, bushy or slender, upright, non-lignotuberous shrub, 0.2-2 m high. Fl. pink-purple/red, Jun to Dec.	Sand, sandy clay, gravelly sandy soils over laterite. Often swampy areas.	High

Taxon	WA Status	EPBC Status	Description	Preferred Habitat	Likelihood of occurrence
<i>Johnsonia inconspicua</i>	P3		Rhizomatous, tufted perennial, grass-like or herb, 0.1-0.3 m high, to 0.2 m wide. Fl. green-white/pink, Oct to Nov.	White-grey or black sand. Low dunes, winter-wet flats.	Low
<i>Lambertia rariflora</i> subsp. <i>rariflora</i>	P4		Small tree or shrub, to 7 m high. Fl. green/yellow-green, Feb to Mar or May.	Red-brown clay soils, black organic loam, laterite. Near intermittent streams.	Low
<i>Lasiopetalum laxiflorum</i>	P3		Shrub. Stems hairy. Leaves 20-105 mm long, 8-55 mm wide, not lobed; margins entire; indumentum present, with stellate hairs; stipules present but early deciduous (only visible on youngest leaves). Flowering time October or November.	Whicher Scarp	Low
<i>Leptomeria furtiva</i>	P2		Lax, sprawling shrub, 0.2-0.45 m high. Fl. orange-brown, Aug to Oct.	Grey or black peaty sand. Winter-wet flats.	High
<i>Lepyrodia heleocharoides</i>	P3		Rhizomatous, slender, tufted perennial, herb (sedge-like), 0.15-0.25 m high. Fl. Dec.	Moist peaty sand. Dry or seasonally inundated heath or woodland, swamps.	High
<i>Loxocarya magna</i>	P3		Rhizomatous, perennial, herb (sedge-like), 0.5-1.5 m high. Fl. Sep or Nov.	Sand, loam, clay, ironstone. Seasonally inundated or damp habitats	High
<i>Ornduffia submersa</i>	P4		Aquatic/semi aquatic herb	Seasonally inundated wetlands	Low
<i>Pultenaea pinifolia</i>	P3		Erect, slender shrub, 1-3 m high. Fl. yellow-orange, Oct to Nov.	Loam or clay. Floodplains, swampy areas.	Moderate
<i>Synaphea petiolaris</i> subsp. <i>simplex</i>	P3		Tufted shrub, 0.1-0.6 m high. Fl. yellow, Sep to Oct.	Sandy soils. Flats, winter-wet areas.	Low
<i>Tetralia australiensis</i>	T	V	Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Fl. brown, Nov to Dec.	Low lying swampy flats	High
<i>Thysanotus glaucus</i>	P4		Caespitose perennial herb to 15 cm; flowers purple, largely in bud	Deep grey over white sand.	Low

Taxon	WA Status	EPBC Status	Description	Preferred Habitat	Likelihood of occurrence
<i>Verticordia densiflora</i> var. <i>pedunculata</i>	T	E	Erect to spreading shrub, 0.3-0.6 m high. Fl. pink/pink-white, Dec or Jan	Grey/yellow sand, sandy loam. Winter-wet low-lying areas	High
<i>Verticordia lehmannii</i>	P4		Slender shrub, 0.2-1 m high. Fl. pink, Jan or Apr to Jun or Aug or Dec.	Sandy clay. Winter-wet flats.	High
<i>Verticordia plumosa</i> var. <i>vassensis</i>	T		Shrub, 0.3-1 m high. Fl. pink, Sep to Dec or Jan to Feb.	White/grey sand. Winter-wet flats.	High

3.4 Fauna records

3.4.1 *Fauna recorded locally*

Desktop searches (Naturemap, 2020 and ALA, 2020) within a 10 km study area, yielded 260 vertebrate terrestrial fauna species (Appendix C):

- 28 mammals,
- 183 birds,
- 39 reptiles, and
- 10 amphibians.

At least nine of the listed fauna are introduced or naturalised species. Invertebrates, marine or aquatic dependant species (fish) are not included. Some near coastal or wetland taxa may be included in the list even though they may not occur within the study area. This list is not exhaustive, nor would all species occur within the study area.

3.4.2 *Fauna of conservation significance*

Based on the evaluation provided in Appendix E, there are 14 terrestrial vertebrate fauna of conservation significance that may occur locally (not necessarily within the study area). Additionally, one fish and six invertebrates of conservation significance may also potentially occur.

4 Results

4.1 Vegetation units and condition

Five native vegetation units were identified within the survey area. Community descriptions (Table 4-1) are based on the results of relevés surveyed in each, supplemented by opportunistic recording of additional species during targeted searches. Cleared and planted areas, predominantly devoid of native vegetation were also mapped within the survey area.

The vegetation communities are consistent with the broader vegetation complex descriptions of Webb et al. (2016) for the desktop area.

The condition of vegetation was mapped during the field survey and included areas classed as Completely Degraded to Very Good. Vegetation condition was generally poor with the majority of native vegetation (by area) mapped as degraded to completely degraded. The relatively poor condition of the survey area is likely due to the impact of adjoining agricultural land use and historic disturbance resulting in greater ingress of weed species.

4.1.1 Threatened and Priority Ecological Communities


Two of the vegetation communities described and mapped for the survey area have potential affinities to State listed TEC. The Woodland of *Corymbia calophylla* over shrubland of *Melaleuca preissiana* and *Xanthorrhoea preissii* over mixed grassland herbland of *Freesia alba x leichtlinii* and *Avena fatua* has potential affinities to the Vulnerable SCP1b *Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain. However, the condition of the community was ranged from Good to Completely Degraded, and was predominantly Degraded to Completely Degraded within the survey area which:

- makes inference of FCT difficult (Floristic Community Types or FCT are the basis for determination of many TEC and PEC on the Swan Coastal Plain)
- may mean the condition of the vegetation is too poor to be classified as the TEC.



The Open Shrubland of *Melaleuca preissiana* over *Hakea marginata*, *Astartea scoparia* and *Xanthorrhoea preissii* over low shrubland of *Melaleuca incana* has potential affinities to the Endangered SCP02 Southern wet shrublands, Swan Coastal Plain. Given the location and soils observed at the site this area should be treated as the TEC or additional assessment (through formal FCT analysis) should be undertaken to confirm its status.

Although identified through the desktop survey as potentially occurring within the survey area, the Banksia Woodlands of the Swan Coastal Plain TEC was not recorded within the survey area. None of the vegetation communities had an overstorey dominated (or co-dominated) by Banksia species characteristic of the TEC (Commonwealth of Australia 2016).

Table 4-1 Vegetation communities described for the study area.

Community Code	Description	Condition	Site reference	Example photo of community
Cleared	Cleared or parkland cleared	NA	NA	NA
Planted	Planted exotic vegetation	NA	NA	NA
AfEm	Open Woodland of <i>Eucalyptus marginata</i> and <i>Agonis flexuosa</i> over shrubland of <i>Dasyogon bromeliifolius</i> and <i>Lyginia barbata</i>	Good	Site 03	

<p>CcAf</p>	<p>Forest of <i>Corymbia calophylla</i> over low open woodland of <i>Agonis flexuosa</i> over grassland of <i>Ehrharta calycina</i> and <i>Avena fatua</i></p>	<p>Ranges from Completely Degraded to Good</p>	<p>Site02</p>	
<p>CcXp</p>	<p>Woodland of <i>Corymbia calophylla</i> over shrubland of <i>Melaleuca preissiana</i> and <i>Xanthorrhoea preissii</i> over mixed grassland herbland of <i>Freesia alba x leichtlinii</i> and <i>Avena fatua</i></p> <p>Possible TEC</p>	<p>Predominantly Degraded to Completely Degraded</p>	<p>Site04</p>	

<p>KgAf</p>	<p>Very open woodland <i>Allocasuarina fraseriana</i> over shrubland of <i>Kunzea glabrescens</i> over sedgeland of <i>Dasyogon bromelifolius</i> and <i>Lyginia barbata</i></p>	<p>Predominantly Very Good with areas of Degraded and Good.</p>	<p>Site05</p>	
<p>MpXp</p>	<p>Open Shrubland of <i>Melaleuca preissiana</i> over <i>Hakea</i> sp. MB01, <i>Astartea fascicularis</i> and <i>Xanthorrhoea preissii</i> over low shrubland of <i>Melaleuca incana</i>.</p> <p>Probable TEC</p>	<p>Completely Degraded to Good</p>	<p>Site01</p>	

4.2 Flora

4.2.1 Flora recorded

The field survey recorded 90 taxa of vascular plants from 29 families (Appendix E). 15 of the 90 taxa are introduced. The most common families were Myrtaceae (13 taxa), Fabaceae (10 taxa) and Proteaceae (10 taxa). The representation of these families is consistent with the flora of the area and the location in the landscape of the survey area.

4.2.2 Flora of conservation significance

One threatened flora species *Grevillea brachystylis subsp. grandis* was recorded during the survey. 102 individual plants were recorded from the previously known population of the species. The plants were recorded in roadside remnant vegetation, partly in cleared areas and partly in mapped communities CcXp and MpXp. The section of the population north of Payne Road appeared to be actively managed for conservation i.e. evidence of marking and weed control.

Four priority flora species were also recorded during the survey.

Priority 4 flora species *Acacia semitrullata* was recorded from two locations during the survey. The species was recorded during assessment of relevés for vegetation communities AfEm and KgAf (see Table 4-1). Approximately 10 individuals were estimated to occur across the two sites. Additional individuals may occur in the two vegetation communities, but the species was uncommon and abundance likely to be low.

Calothamnus quadrifidus subsp. teretifolius (P4) was recorded from one location during the survey. The occurrence is a previously recorded population near the intersection of Boallia Road and Payne Road (A. Webb pers. Comm). The population was estimated to contain approximately 50 individual plants within an approximately 100 m section of road reserve. Both mature adult plants and young saplings (<1 m in height) were observed, indicating recruitment of the species was occurring.

Priority three species *Loxocarya magna* was recorded during the follow up survey in January. The species was scattered through much of the area mapped as vegetation community MpXp. Up to approximately 100 individual plants were estimated to occur within the survey area.

An additional species considered likely to be Priority 3 species *Stylidium lowrieianum* was collected. At the time of the survey the specimen was immature (not fully flowering) and full identification was not possible. The specimen was identified as *Stylidium ?lowrieianum* and it is recommended that for the purposes of the assessment and planned works it be considered the Priority species. The species was recorded from during assessment of the relevé (site 3) for vegetation community AfEm.

Flora survey results are mapped in Figure 4, Appendix A.

4.2.3 Other significant flora

Two species additional noteworthy species were recorded during the survey. Both species are uncommon to the southern Swan Coastal Plain and whilst not of formal conservation significance (i.e.

listed as threatened or priority species), both are likely to be considered unusual for the area and of elevated conservation significance.

Hakea marginata was recorded in the MpXp vegetation community. The species occurs in winter wet depressions associated with laterite/gravel across the Avon Wheatbelt, Esperance Plains, Geraldton Sandplains, Jarrah Forest, Mallee and Swan Coastal Plain IBRA regions. The distribution of the species on the southern Swan Coastal Plain is restricted and record of the species unusual for the region (A. Webb pers. comm).

Mesomelaena stygia subsp. stygia was also recorded in vegetation community MpXp. The distribution of this species on the Swan Coastal Plain is restricted and the record is unusual for the region. It is therefore considered of elevated conservation significance (A. Webb pers. comm.).

4.2.4 Declared weeds

Arum lily (*Zantedeschia aethiopica*) is a declared pest under s22(2) of the BAM Act. It is a widespread and common weed in the far south west of WA. Arum lily was recorded at several locations within the survey area.

Blackberry (*Rubus fruticosus*) is a Weed of National Significance (WoNS) federally and listed as a declared pest in Western Australia (under the BAM Act). Blackberry was recorded from one location in the survey area.

Several other environmental weeds were recorded, including *Watsonia meriana var. bulbifera*. The abundance of introduced species reflects the historical disturbance and agricultural landuse of adjoining areas. Weeds are mapped in Figure 4, Appendix A.

4.3 Fauna habitat

4.3.1 General fauna habitat

Key fauna habitat types generally correspond with the structural vegetation types from Table 4-1, summarised in Table 4-2. In considering the habitat quality categories in Table 2-1, fauna habitat quality within the study area was mostly Poor due to the limited structural and species diversity. This in turn limits fauna refuge and food resources. The Poor to Moderate habitat quality areas included the woodland and areas where the native woodland had a native midstorey and/or understorey.

Table 4-2 Fauna habitat types over the study area

Community code	Vegetation structure	Fauna habitat quality
Cleared	Cleared or parkland cleared and/or exotic planted trees	Poor
AfEm	Jarrah and Peppermint open woodland over shrubland	Poor - Moderate

CcAf	Marri forest over low open woodland of Peppermint over grass	Poor - Moderate
CcXp	Marri woodland with <i>Melaleuca preissiana</i> and Grass trees	Poor
KgAf	Sheoak open woodland over shrubland	Poor - Moderate
MpXp	<i>Melaleuca preissiana</i> open shrubland	Poor - Moderate

No intact drainage lines occur within the study area. The drainage line near 4.93 SLK was in a completely degraded condition offering little fauna habitat value at the bridge crossing.



Photo 1 Degraded drainage crossing at 4.93 SLK.

4.3.2 Suitable DBH trees and hollows

There were a total of 123 suitable DBH trees (i.e. Dead, Jarrah, Marri, Blackbutt or Bullich >50cm DBH) within the study area (Appendix F). Suitable DBH trees and trees with hollows are mapped in Figure 5 Appendix A.

Ground surveys identified 13 trees with hollows, nine with hollows greater than 10 cm in size. These are summarised in Table 4-3 below. It is unlikely that all of the hollows will actually be hollow – see Limitations in Section 2.3.

Table 4-3 Summary of hollows within the study area

ID	Tree	DBH cm	Hollows	Hollow size	Hollow type	Hollow height
131	dead	50_75	1	15_20	spout angle suitable	<10m
140	dead	50_75	1	10_15cm	vertical	<10m
151	dead	50_75	1	20cm_plus	vertical	<10m
80	jarrah	50_75	1	10_15cm	spout angle suitable	<10m
99	marri	>100	1	20cm_plus	vertical	<10m
104	marri	75_100	1	<10cm	knot angle suitable	<10m
105	marri	75_100	1	10_15cm	Fissure not suitable	<10m

ID	Tree	DBH cm	Hollows	Hollow size	Hollow type	Hollow height
110	marri	50_75	1	<10cm	knot angle suitable	<10m
116	marri	>100	1	20cm_plus	spout angle suitable	<10m
123	marri	50_75	1	<10cm	spout angle not suitable	<10m
138	marri	75_100	1	<10cm	knot angle suitable	10 15m
158	marri	>100	1	20cm_plus	knot angle suitable	<10m
166	blackbutt	75_100	1	20cm_plus	knot angle suitable	<10m

4.4 Fauna recorded

Twenty-three species of fauna were observed within the study area (Table 4-4). The fauna recorded included 20 birds and three mammals. Most are common species, with the exceptions of the black cockatoos and Western Ringtail Possum which are species of conservation significance. Other faunal groups are likely to occur but are more cryptic, nocturnal or would not have been detected during the diurnal reconnaissance visit (such as bats and reptiles). In addition, a number of species may only use the site as a part of a larger patch, such as other bird species.

Table 4-4 Fauna recorded within the study area

Class	Family	Scientific Name	Vernacular Name	Boallia Rd	Status
AVES	ACANTHIZIDAE	<i>Acanthiza chrysorrhoa</i>	Yellow-Rumped Thornbill	x	
AVES	ALCEDINIDAE	<i>Dacelo novaeguineae</i>	Kookaburra*	x	
AVES	ALCEDINIDAE	<i>Todiramphus sanctus</i>	Sacred Kingfisher	x	
AVES	ARTAMIDAE	<i>Artamus cyanopterus</i>	Dusky Woodswallow	x	
AVES	ARTAMIDAE	<i>Cracticus torquatus</i>	Grey Butcherbird	x	
AVES	CACATUIDAE	<i>Calyptorhynchus banksii naso</i>	Forest Red-Tailed Black Cockatoo	X	T
AVES	CACATUIDAE	<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	Feed residue	T
AVES	CACATUIDAE	<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	Feed residue	T
AVES	CAMPEPHAGIDAE	<i>Coracina novaehollandiae</i>	Black-Faced Cuckoo-Shrike	x	
AVES	COLUMBIDAE	<i>Ocyphaps lophotes</i>	Crested Pigeon	x	
AVES	CORVIDAE	<i>Corvus coronoides</i>	Australian Raven	x	
AVES	CORVIDAE	<i>Gymnorhina tibicen</i>	Australian Magpie	x	
AVES	MELIPHAGIDAE	<i>Anthochaera carunculata</i>	Red Wattlebird	x	
AVES	MELIPHAGIDAE	<i>Anthochaera lunulata</i>	Western Wattlebird	x	
AVES	MONARCHIDAE	<i>Grallina cyanoleuca</i>	Magpie-Lark	x	
AVES	PACHYCEPHALIDAE	<i>Pachycephala pectoralis</i>	Golden Whistler	x	
AVES	PARDALOTIDAE	<i>Pardalotus striatus</i>	Striated Pardalote	x	
AVES	PSITTACIDAE	<i>Barnardius zonarius</i>	Australian Ringneck	x	
AVES	PSITTACIDAE	<i>Platycercus spurius</i>	Red-Capped Parrot	Feed residue	
AVES	RHIPIDURIDAE	<i>Rhipidura leucophrys</i>	Willie Wagtail	x	
MAMMALIA	BOVIDAE	<i>Bos taurus</i>	Cattle*	Tracks	
MAMMALIA	LEPORIDAE	<i>Oryctolagus cuniculus</i>	Rabbit*	Burrow	
MAMMALIA	PSEUDOCHEIRIDAE	<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	Scat	T

4.5 Fauna of conservation significance

4.5.1 Local records

Database searches and other sources identified 21 fauna of conservation significance, recorded or likely to occur within 10 km of the study area (see Appendix D).

A threatened fauna evaluation table was prepared for conservation significant fauna based on the desktop assessment and site reconnaissance (Appendix E). It excludes marine, marine migratory and regionally extinct species and has been updated with other records where the species may occur. Fauna of conservation significance that possibly occur or encountered within the study area are summarised in Table 4-5. Taxa in green are considered further in Section 5.

Table 4-5 Conservation significant fauna that may occur within the study area, based on habitat suitability.

Genus species	Vernacular	Status Federal	Stat. WA	Presence of habitat	Likelihood of occurrence
<i>Botaurus poiciloptilus</i>	Australasian Bittern	EN	EN	Absent	Unlikely
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	VU	VU	Present	Present
<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	EN	EN	Present	Feed residue
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	EN	EN	Present	Feed residue
<i>Falco peregrinus</i>	Peregrine Falcon	-	OS	Present	Possible visitor
<i>Pandion haliaetus</i>	Osprey	IA	IA	Marginal	Unlikely
<i>Cacatua pastinator subsp. pastinator</i>	Muir's Corella (Western Corella SW WA)	-	S	Suitable	Unlikely
<i>Plegadis falcinellus</i>	Glossy Ibis, Black Curlew	M	S	Marginal	Unlikely
<i>Dasyurus geoffroii</i>	Chuditch	VU	VU	Marginal	Unlikely
<i>Phascogale tapoatafa</i>	Southern Brush-tailed Phascogale	-	S	Present	Possible
<i>Notamacropus irma</i>	Western Brush Wallaby		P4	Marginal	Unlikely
<i>Hydromys chrysogaster</i>	Water Rat	-	P4	Present	Possible
<i>Isoodon obesulus fusciventer</i>	Southern Brown Bandicoot	-	P4	Present	Possible
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	CR	CR	Present	Scats observed
<i>Nannatherina balstoni</i>	Balston's Pygmy Perch	VU	VU	Absent	Nil
<i>Bothriembryon irvineanus</i>	Irvine's land snail (Cape Naturaliste)	P2	-	Marginal	Unlikely
<i>Westralunio carteri</i>	Carters Freshwater Mussel	VU	VU	Marginal	Unlikely
<i>Cherax tenuimanus</i>	Margaret River hairy marron	CR	CR	Marginal	Nil
<i>Engaewa pseudoreducta</i>	Margaret River Burrowing Crayfish	CR	CR	Marginal	Unlikely
<i>Engaewa reducta</i>	Dunsborough Burrowing Crayfish	CR	CR	Marginal	Nil

Genus species	Vernacular	Status Federal	Stat. WA	Presence of habitat	Likelihood of occurrence
<i>Pachysaga strobila</i>	Vasse Pachysaga	-	P1	Marginal	Unlikely

4.5.2 Species profiles and site values

Baudin's Cockatoo (*Calyptorhynchus baudinii*) EN, EN

Baudin's Cockatoo is a large, iconic forest cockatoo endemic to the south west corner of WA. It has suffered a substantial decline in number in the past 50 years. Direct causes of this decline include large numbers shot by orchardists, fragmentation of habitat and the impact of hollow competitors (Johnstone and Kirkby 2008). Depending on their region of origin, Baudin's cockatoo is a resident, a post nuptial nomad or migrant with the bulk of the population vacating the coldest parts of their range (i.e. the Karri forest block) in the autumn and migrating northwards during the non-breeding season. Small numbers also appear resident in a few places including Leeuwin – Naturaliste Ridge and Manjimup (Johnstone and Kirkby 2008). Flock sizes vary from small family groups to large aggregations at roosting sites.

In the non-breeding season, Baudin's Cockatoo is mainly an inhabitant of the Jarrah Marri forest but is also frequently seen in farmland and orchards. It feeds on a variety of foods including nectar and seeds from hakeas and banksia spp. also apples, persimmons and macadamias. Overall, its main food is Marri from which it takes seeds, grubs and nectar. Its long bill is adapted to removing seeds from Marri fruit capsules.

Roost sites are usually in smooth barked eucalypts (occasionally rough barked eucalypts, i.e. Marri, Jarrah and Blackbutt) including Wandoo, Flooded Gum, Bullich and smooth barked exotic eucalypts including plantations (Johnstone and Kirkby 2008). Feed residue was observed within the study area.

Carnaby's Cockatoo (*Calyptorhynchus latirostris*) EN, EN

This species is a postnuptial nomad, tending to move west after breeding. Carnaby's cockatoo mainly occurs in or near eucalypt woodlands, especially those dominated by Wandoo or Salmon Gum, and sometimes reported in forests of Marri, Jarrah, Karri and Tuart. Nesting hollows may be located anywhere over two metres from ground, mainly in the Wheatbelt (Cale 2003, SPRAT 2019, WA Museum 2010).

It is known to forage in native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as Banksia spp. Hakea spp. and Grevillea spp. Forages in pine plantations, eucalypt woodland and forest that contains foraging species, individual trees and small stands of these species (SEWPAC 2012).

This species is currently expanding its breeding range westward and south into the Jarrah-Marri forests of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain. This may be due to climate change. Breeding occurs mainly from early July to mid-December. Breeding success is largely dependent on suitable feeding habitat adjacent to the nest site to provide the necessary food for the

survival of the chick, for example adjacent pine forest or remnant vegetation (Johnstone and Kirkby, Undated). Carnaby's Cockatoo is also known to breed in Karri forest at Porongurup, Walpole, Albany, Denmark and Mount Manypeaks.

Carnaby's Cockatoos are known to roost in Jarrah, Marri, Blackbutt, Bullich, exotic eucalypt species and pines. Feed residue was observed within the study area.

Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (FRTBC) VU, VU

The FRTBC is a large, iconic forest cockatoo, endemic to the south-west corner of Western Australia. Formerly common, but now rare to uncommon and patchily distributed, it has disappeared from about 30% of its former range. It has suffered a marked decline in numbers over the past 60 years. The main reasons for this decline include the destruction and fragmentation of habitat (especially Jarrah-Marri forest), the apparent decline in Marri along the eastern side of the Darling Scarp, logging, the impact of hollow competitors, fire and possibly climate change (Johnstone, Kirkby and Sarti 2013a, b). FRTBC occurs throughout the Jarrah Marri Karri forested areas but in recent years has been foraging out on to the Swan Coastal Plain feeding on the seeds of Cape Lilac. Group sizes vary from small family groups and pairs to larger gatherings at roost sites.

FRTBC nest in hollows Jarrah, Marri, Blackbutt, Bullich and Wandoo. Hollows have been recorded from 6.5 – 33 m above ground (Johnstone Kirkby and Sarti 2015). FRTBC have been recorded breeding in all months but with peaks in Spring and Autumn. There are also years when very little if any breeding takes place i.e. 2008 and 2009 (Johnstone and Kirkby unpublished data). The nearest known breeding location to the project area is 36 km to the north west at Nannup.

FRTBC feed mainly on the seeds of Jarrah and Marri but also Blackbutt, Albany Blackbutt, Sheoak, Snottygobble and introduced native and non-native species such as Lemon-scented Gum, Spotted Gum and Cape Lilac (SPRAT 2019).

FRTBC are known to roost in Jarrah, Marri, Blackbutt, Bullich and introduced eucalypt species. The species was seen, and feed residue was observed across the study area.

BREEDING HABITAT

Black cockatoo breeding requirements are outlined in Section 2.2.2. The numbers of hollows and suitable DBH trees within the study area are discussed in Section 4.3.2 and mapped in Figure 5 Appendix A. Hollow suitability and likelihood of black cockatoo breeding are shown in Table 4-6.

There were a total of 123 suitable DBH trees within the study area that may develop hollows in the medium to longer term. Three trees had potential to be used by black cockatoos for breeding based on typical black cockatoo breeding hollow attributes such as orientation, access, and chamber size. Tree 131 and 166 showed possible evidence of use (chews). Tree 116 had a possibly large hollow but no evidence of use. The chews could have been made by other species, such as Galah, or may be natural flaking. Further work (such as camera pole or drone) would need to be carried out to confirm black cockatoo nesting status. There was no evidence of roosts observed at the site.

Table 4-6 Summary of hollows within the study area relating to black cockatoo breeding suitability

ID	Tree	DBH cm	Hollow size	Hollow type	Hollow height	BC suitability
131	dead	50_75	15_20	spout angle suitable	<10m	Suitable with evidence of use
140	dead	50_75	10_15cm	vertical	<10m	Unlikely to be suitable
151	dead	50_75	20cm_plus	vertical	<10m	Unlikely to be suitable
80	jarrah	50_75	10_15cm	spout angle suitable	<10m	Unlikely to be suitable
99	marri	>100	20cm_plus	vertical	<10m	Unlikely to be suitable
104	marri	75_100	<10cm	knot angle suitable	<10m	Unlikely to be suitable
105	marri	75_100	10_15cm	Fissure not suitable	<10m	Unlikely to be suitable
110	marri	50_75	<10cm	knot angle suitable	<10m	Unlikely to be suitable
116	marri	>100	20cm_plus	spout angle suitable	<10m	Suitable with no evidence of use
123	marri	50_75	<10cm	spout angle not suitable	<10m	Unlikely to be suitable
138	marri	75_100	<10cm	knot angle suitable	10 15m	Unlikely to be suitable
158	marri	>100	20cm_plus	knot angle suitable	<10m	Unlikely to be suitable
166	blackbutt	75_100	20cm_plus	knot angle suitable	<10m	Suitable with evidence of use

FORAGING HABITAT

Feed residue (chewed Marri cones and Jarrah nuts) were observed within the study area from all three cockatoos. Marri and Jarrah are plant species foraging known to be utilised by all three black cockatoos.

Vegetation communities with Jarrah and or Marri as key components are likely to represent quality foraging habitat (Units AfEm, CcAf and CcXp). These account for 5.22 ha over the study area.

Peregrine Falcon (*Falco peregrinus*) OS

Peregrine Falcons occur in woodland, plains, gorges, wetlands but tend to breed either in stick-nests in trees or nest on cliff ledges. Hollows and large abandoned nests of other birds may be used where cliff ledges are limited. Breeds Aug-Dec. Where good habitat occurs, and the density of Peregrine Falcons is high, active nests may occur within 2.5km of each other. The diet of the Peregrine Falcon includes wood duck, pigeons and doves, galahs, rosellas and cockatoo, starlings and larks (Olsen et al. 2006).

Peregrine Falcons are wide ranging, with abundant habitat locally. They weren't observed at the site but may utilise it as a patch of a larger patch.

Southern Brush-tailed Phascogale (*Phascogale tapoatafa*) CD (BC Act)

This arboreal species is found in a variety of forest types. Ideal habitat for this species consists of dry sclerophyll forest and open woodland (Jarrah, Marri, and mixed Jarrah Karri) that contain hollow bearing trees and sparse ground cover. Their many nesting sites include hollow tree limbs, rotten stumps and even birds' nests. Lactating females prefer a large tree cavity with a small entrance with a nest made of bark, feathers and fur. A female's home range covers 20 to 70 hectares, a male's home ranges over laps females and increases during breeding season. It is predominantly carnivorous, foraging on arthropods, invertebrates, small vertebrates and nectar (Strahan 1995).

The study area provides marginal habitat but would only be a portion of a larger patch given the species large home range requirements.

Water Rat (*Hydromys chrysogaster*) P4

The Water rat is usually found in permanent fresh or brackish water but can be found in marine environments. Fresh water habitats include swamps, lakes, dams even urban drainage swamps. Typically forages close to the shoreline, restricting its movements to shallow water (up to 2m in depth) (CSIRO, 2004).

There is marginal habitat for this species at the site. They may periodically pass through the drainage line between better habitat offsite.

Southern Brown Bandicoot (*Isodon obesulus fusciventer*) P4

Bandicoot habitat consists of dense scrubby, often swampy vegetation with a dense cover up to one metre high particularly near watercourses/wetlands. It often feeds in adjacent forest (Jarrah and Wandoo) and woodlands that are burnt on a regular basis. Nests can be concealed next to or under old logs, shrubs or piles of debris and are made up of ground litter piled up over a shallow depression providing internal chambers. Home ranges vary with population density and range from 5-8.6 ha for males and 1-6 ha for females (DEC 2010). Feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogeous fungi. Their searches for food often create distinctive conical holes in the soil though there were none observed in the study area (DECC 2010).

Bandicoot was not detected at the site, and would have been due to the characteristic diggings, had they been present in any numbers. They may occur at the site as part of a larger connected habitat area.

Western Ringtail Possum (*Pseudocheirus occidentalis*) CR, CR

populations mostly inhabit Peppermint and Peppermint-Tuart associations from Bunbury to Albany (SPRAT 2018). In dense, coastal Peppermint forest, home ranges are about 0.5 hectares to 1.5 ha and in eucalypt forests about 2.5 ha. In the northern jarrah forests, home ranges are larger and have been recorded to at least 5.6 ha.

Peppermint leaves form the basis of the WRP diet in coastal areas (between 79-100% based on a study of WRP near Busselton by Jones et al. 1994), but when unavailable, the dominant myrtaceous species are preferred. In the inland forest, Jarrah and Marri the main food source. Garden plant varieties are also exploited in urban areas.

WRP use a range of nest and shelter sites to avoid predators and exposure to the weather. Dreys are constructed in the canopy if hollows are not available. Adequate nest and shelter sites are necessary components of good quality habitat (Jones 1994, Shedley and Williams 2014).

No records within 5km in Naturemap (2020), though scat observed throughout the site in suitable habitat.

WRP occur along the study area, with low densities of scats found within the dense vegetation in the north of the site and other areas where there were Peppermints present. No dreys were identified so any WRP present are likely to be using hollows.

5 Conclusions and Recommendations

The following points summarise the flora, fauna and vegetation values of the Boallia Rd study area:

- Five native vegetation units were identified within the survey area. Vegetation condition ranged from Completely Degraded to Very Good.
- Two of the vegetation communities have potential affinities to State listed TECs. These include
 - Possible TEC (due to Degraded to Completely Degraded condition) – CcXp Woodland of *Corymbia calophylla* over shrubland of *Melaleuca preissiana* and *Xanthorrhoea preissii* over mixed grassland herbland of *Freesia alba x leichtlinii* and *Avena fatua* has potential affinities to the Vulnerable SCP1b *Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain..
 - Probable TEC - MpXp Open Shrubland of *Melaleuca preissiana* over *Hakea* sp. MB01, *Astartea fascicularis* and *Xanthorrhoea preissii* over low shrubland of *Melaleuca incana* has potential affinities to the Endangered SCP02 Southern wet shrublands, Swan Coastal Plain.
- 90 taxa of vascular plants were observed from 29 families. Fifteen of the 90 taxa are introduced.
- One threatened flora species *Grevillea brachystylis subsp. grandis* was recorded (102 individual plants recorded from the previously known population). The plants were recorded in roadside remnant vegetation, partly in cleared areas and partly in mapped communities CcXp and MpXp. The section of the population north of Payne Road appeared to be actively managed for conservation i.e. evidence of marking and weed control.
- Four priority flora species were also recorded during the survey.
 - *Acacia semitrullata* (P4) was recorded from two locations during the survey. The species was recorded during assessment of relevés for vegetation communities AfEm and KgAf. Approximately 10 individuals were estimated to occur across the two sites. Additional individuals may occur in the two vegetation communities, but the species was uncommon and abundance likely to be low.
 - *Calothamnus quadrifidus subsp. teretifolius* was recorded from one location during the survey. The occurrence is a previously recorded population near the intersection of Boallia Road and Payne Road (A. Webb pers. Comm). The population was estimated to contain approximately 50 individual plants within an approximately 100 m section of road reserve.
 - *Loxocarya magna* (P3) was recorded scattered through much of the area mapped as vegetation community MpXp. Up to approximately 100 individual plants were estimated to occur within the survey area.

- *Stylidium lowrieianum* (likely) (P3) was recorded from during assessment of the relevé (site 3) for vegetation community AfEm.
- Two species additional noteworthy species were recorded during the survey.
 - *Hakea marginata* was recorded in the MpXp vegetation community.
 - *Mesomelaena stygia subsp. stygia* was also recorded in vegetation community MpXp.
- Arum lily (*Zantedeschia aethiopica*), a declared pest BAM Act, and other environmental weeds were recorded, including *Watsonia meriana var. bulbillifera* and Blackberry (*Rubus fruticosus*), a Weed of National Significance.
- Twenty-three species of fauna were observed, including all three black cockatoos and WRP which are species of conservation significance.
- There were a total of 123 suitable DBH trees within the study area. Three trees had potential to be used by black cockatoos for breeding based on typical black cockatoo breeding hollow attributes such as orientation, access, and chamber size. Tree 131 and 166 showed possible evidence of use (chews). Tree 116 had a possibly large hollow but no evidence of use.
- There was no evidence of black cockatoo roosts at the site.
- Feed residue was observed within the study area from all three cockatoos. Vegetation communities with Jarrah and or Marri as key components are likely to represent quality foraging habitat (Units AfEm, CcAf and CcXp).
- Other fauna that may use the study area as part of a larger patch include Peregrine Falcon, Southern Brush-tailed Phascogale, Water rat and Bandicoot.

The following recommendations are made:

- Clearing should be minimised in the vegetation communities CcXp and MpXp that may have TEC status.
- Impacts to flora of conservation significance should be avoided, particularly the threatened flora *Grevillea brachystylis subsp. Grandis*.
- Weed control should be carried out prior to works commencing.
- The final impact footprints should be checked against the significant impact criteria (DEWHA 2013; SEWPAC 2012) for black cockatoos and other matters of NES to determine the need to refer the project to DAWE.
- Further work (such as camera pole or drone) would need to be carried out to confirm black cockatoo nesting status or hollow suitability in Trees 131, 166 and 116 if these trees are to be cleared.
- Clearing should be conducted outside of spring to minimise impacts to breeding fauna.
- A licensed fauna spotter should be on site during the clearing of hollow trees to mitigate impacts on hollow dependant fauna.

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Appendix A Figures

Figure 1 Study area and locality

Figure 2 Vegetation Associations mapped across the study area

Figure 3 Vegetation Complexes mapped across the study area

Figure 4 Vegetation units and condition and flora results across the study area

Figure 5 Suitable DBH trees and trees with hollows



**Boallia Road (1.0 to 6.5 SLK),
Boallia**

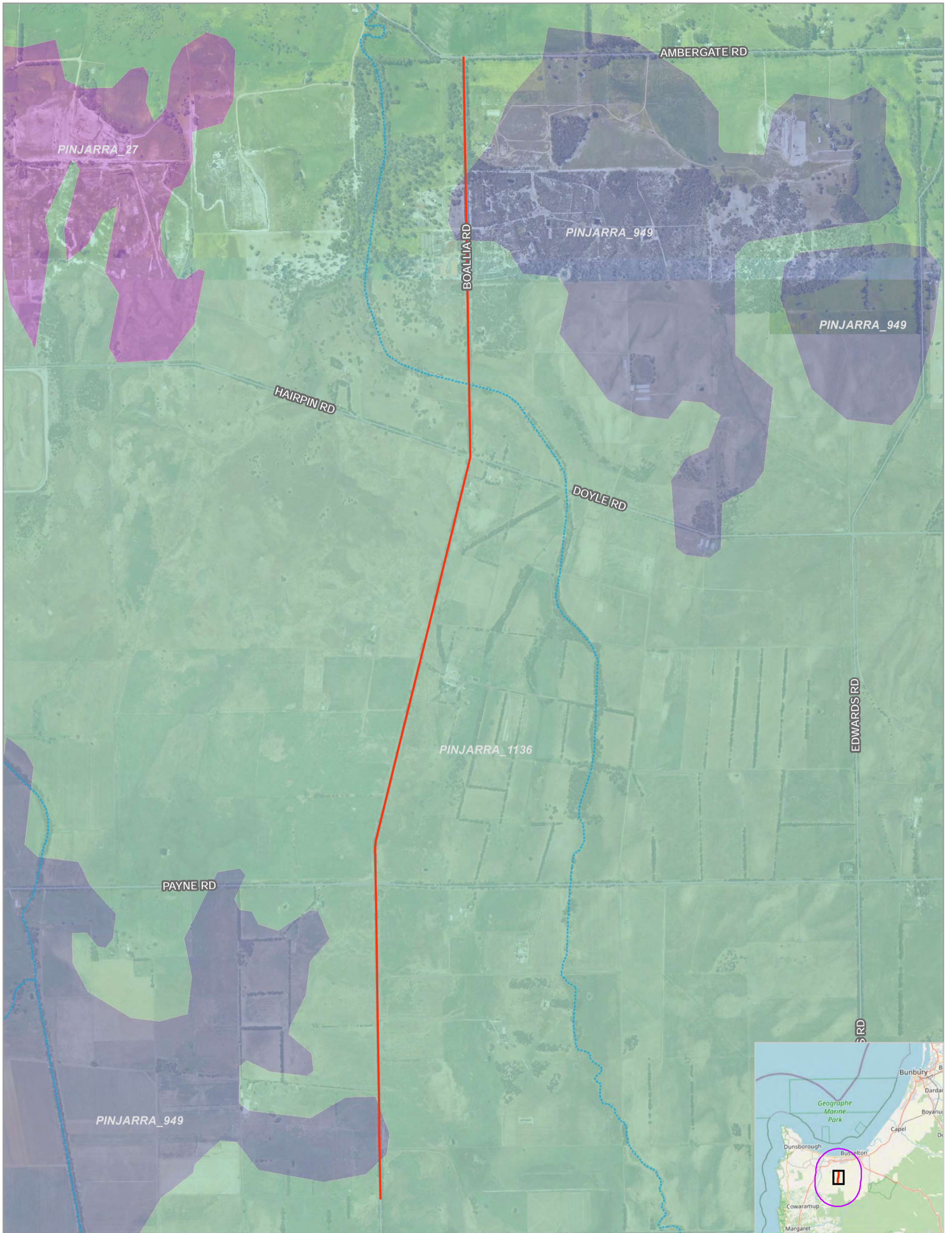
— Boallia Road study area

Figure 1 Study area and locality

0 100 200 400 m

A3 @ 1:16000
Author: SP
Ref: SW283 F1





**Boallia Road (1.0 to 6.5 SLK),
Boallia**

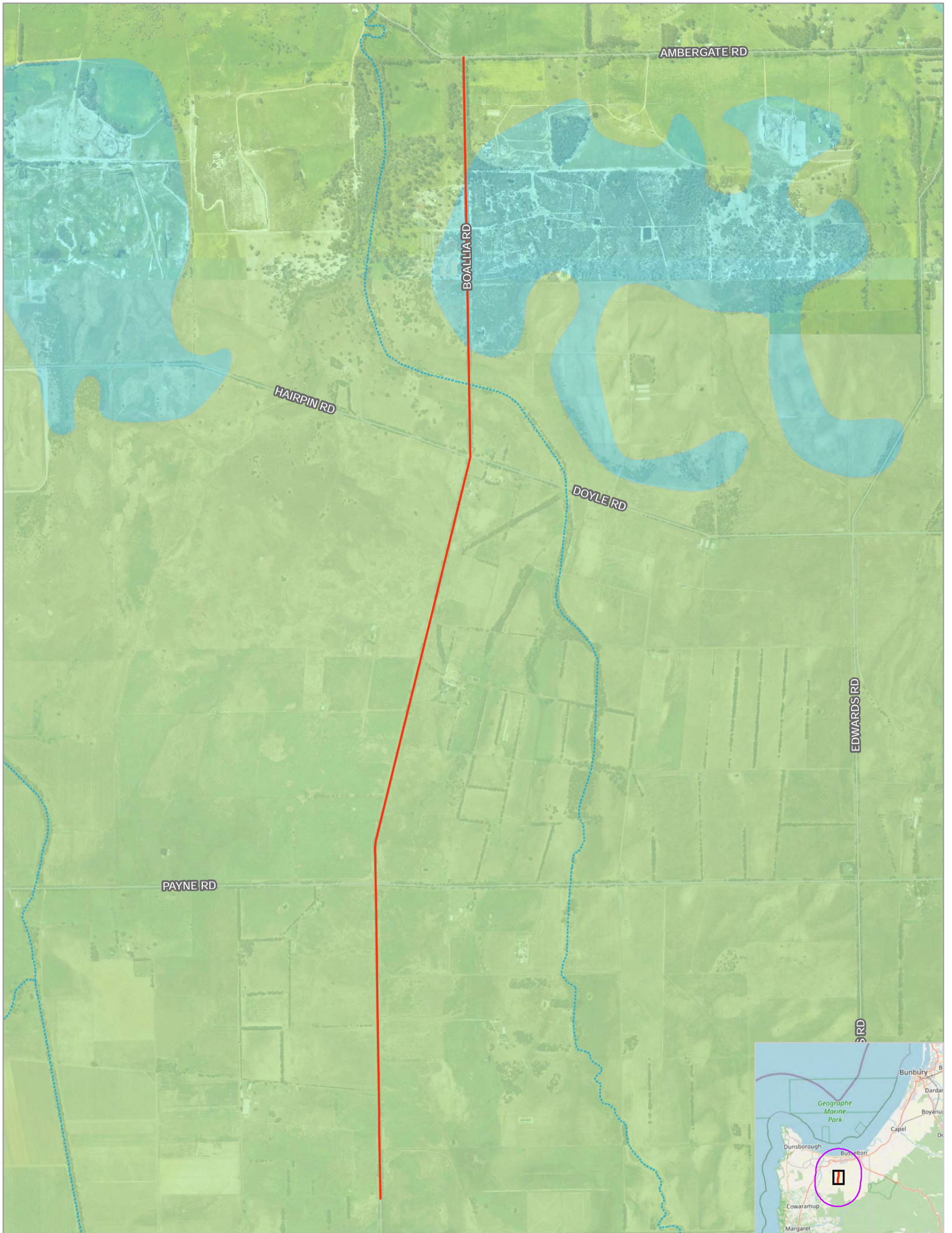
Figure 2 Vegetation Associations mapped across the study area

- Boallia Road study area
- PINJARRA_1136
- PINJARRA_27
- PINJARRA_949

0 100 200 400 m

A3 @ 1:16000
Author: SP
Ref: SW283 F3





**Boallia Road (1.0 to 6.5 SLK),
Boallia**

- Boallia Road study area
- Abba Complex
- Southern River Complex

Figure 3 Vegetation Complexes mapped across the study area

0 100 200 400 m

A3 @ 1:16000
Author: SP
Ref: SW283 F3

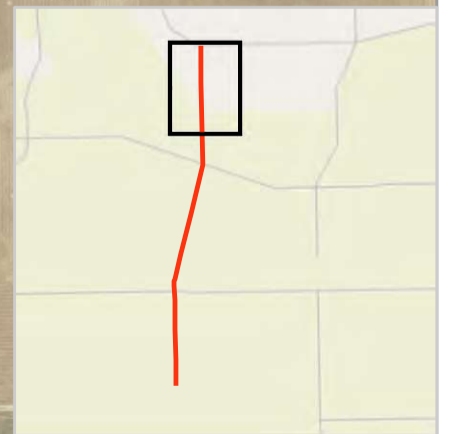




Boallia Road (1.0 to 6.5 SLK), Boallia

Figure 4 Vegetation units and condition and flora results across the study area

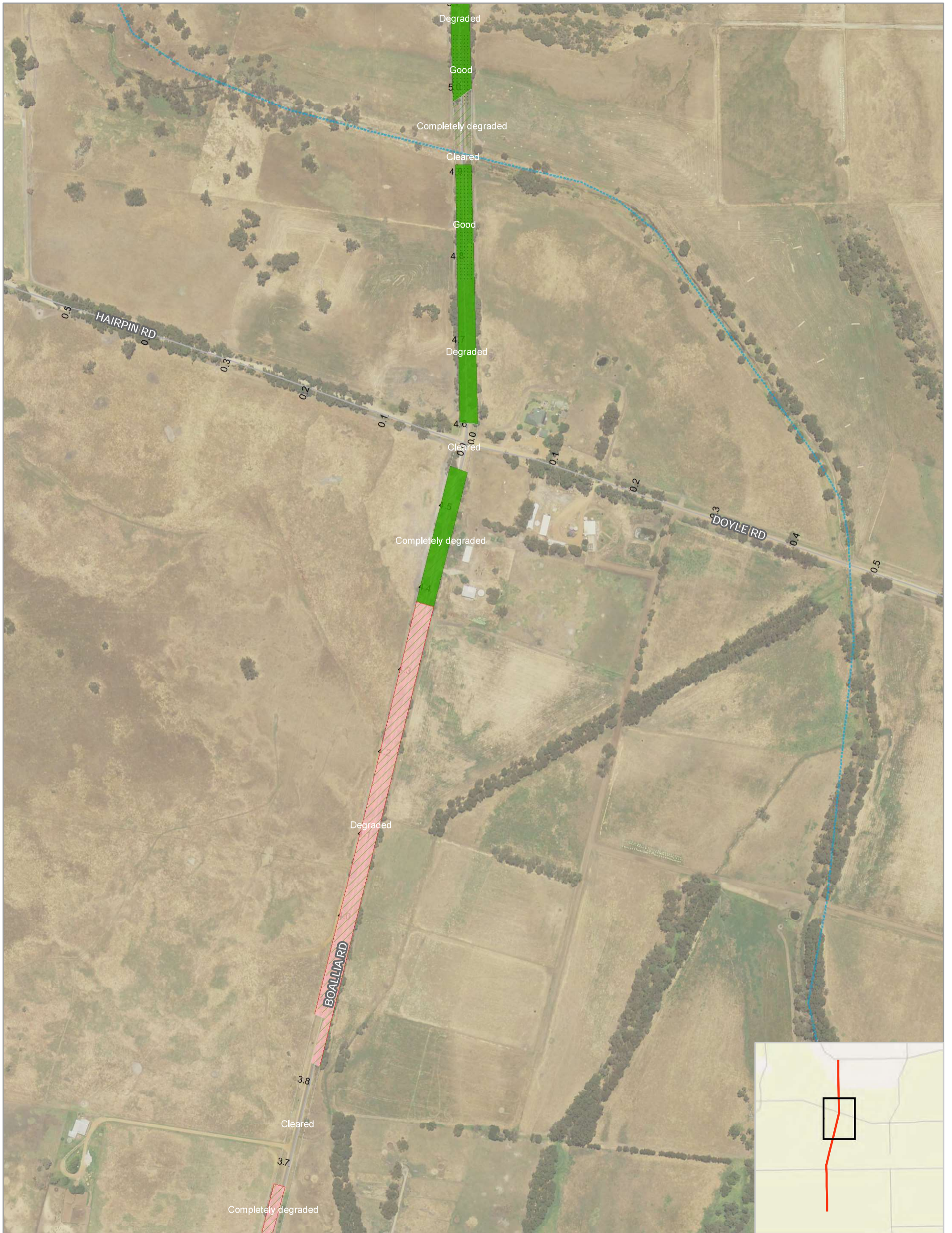
- Sample site
- ★ Conservation significant flora
- ★ *Acacia semitrullata* (P4)
- ★ *Stylidium ?lowrieianum* (P3)
- Vegetation Unit
- KgAf
- AfEm
- CcAf
- Vegetation Condition
- ▨ Degraded to Completely Degraded
- ▤ Good to Very Good



0 50 100 200 m

A3 @ 1:4000
 Author: SP
 Ref: SW283 F4





Boallia Road (1.0 to 6.5 SLK), Boallia

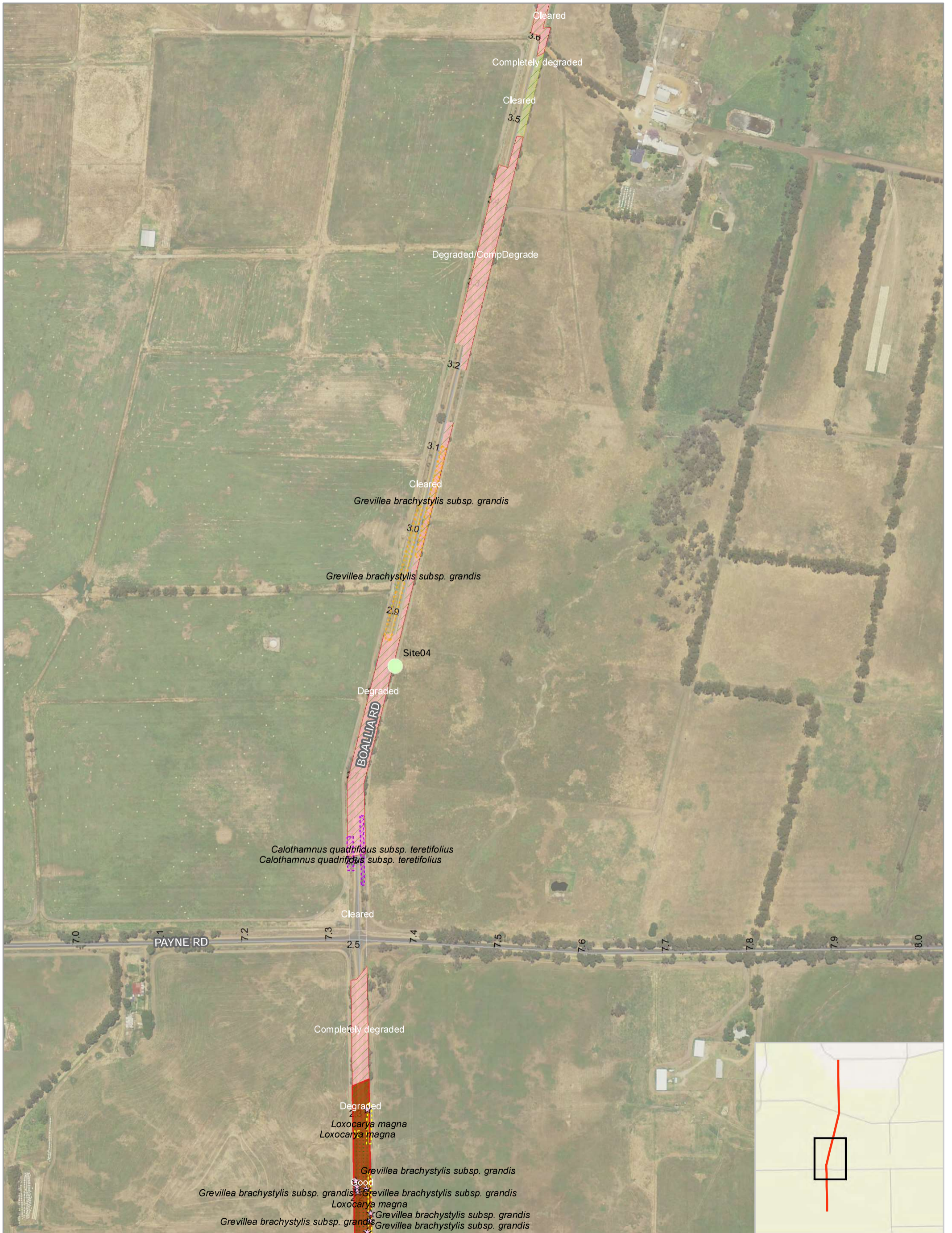
Figure 4 Vegetation units and condition and flora results across the study area

- Vegetation Condition**
 / Degraded to Completely Degraded
 :: Good to Very Good
- Vegetation Unit**
 CcXp (TEC)
 Cleared
 CcAf

0 50 100 200 m

A3 @ 1:4000
 Author: SP
 Ref: SW283 F4





Boallia Road (1.0 to 6.5 SLK), Boallia

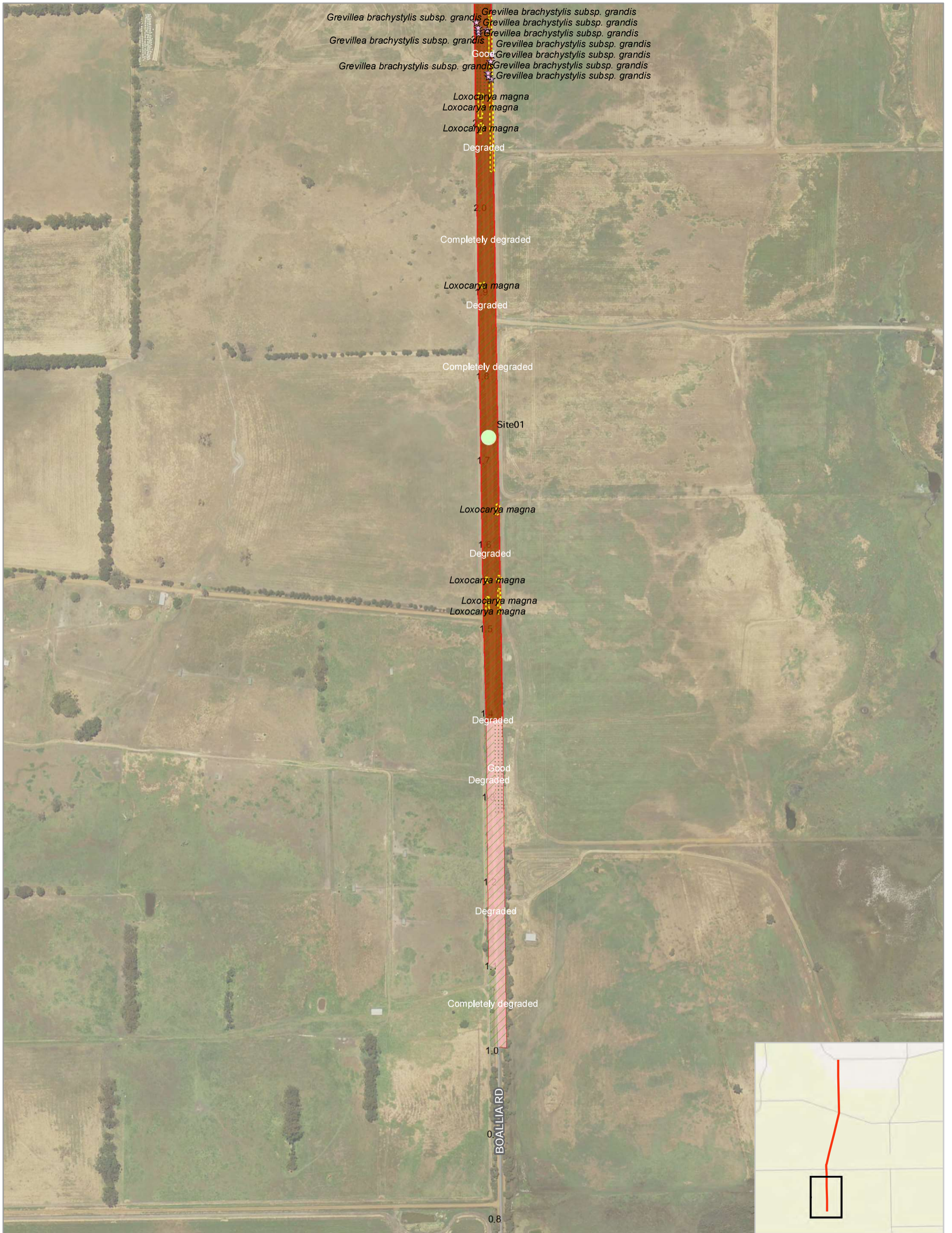
Figure 4 Vegetation units and condition and flora results across the study area

- Sample site
- ★ Conservation significant flora
- ☆ *Grevillea brachystylis subsp. grandis* (T)
- ✱ *Calothamnus quadrifidus subsp. teretifolius* (P4)
- ✱ *Grevillea brachystylis subsp. grandis* (T)
- ✱ *Loxocarya magna* (P3)
- Vegetation Condition
- ↗ Degraded to Completely Degraded
- ⋮ Good to Very Good
- Vegetation Unit
- CcXp (TEC)
- Cleared
- MpXp (TEC)
- Planted

0 50 100 200 m

A3 @ 1:4000
 Author: SP
 Ref: SW283 F4

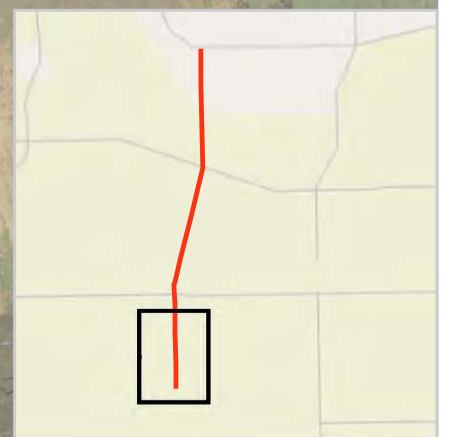




Boallia Road (1.0 to 6.5 SLK), Boallia

Figure 4 Vegetation units and condition and flora results across the study area

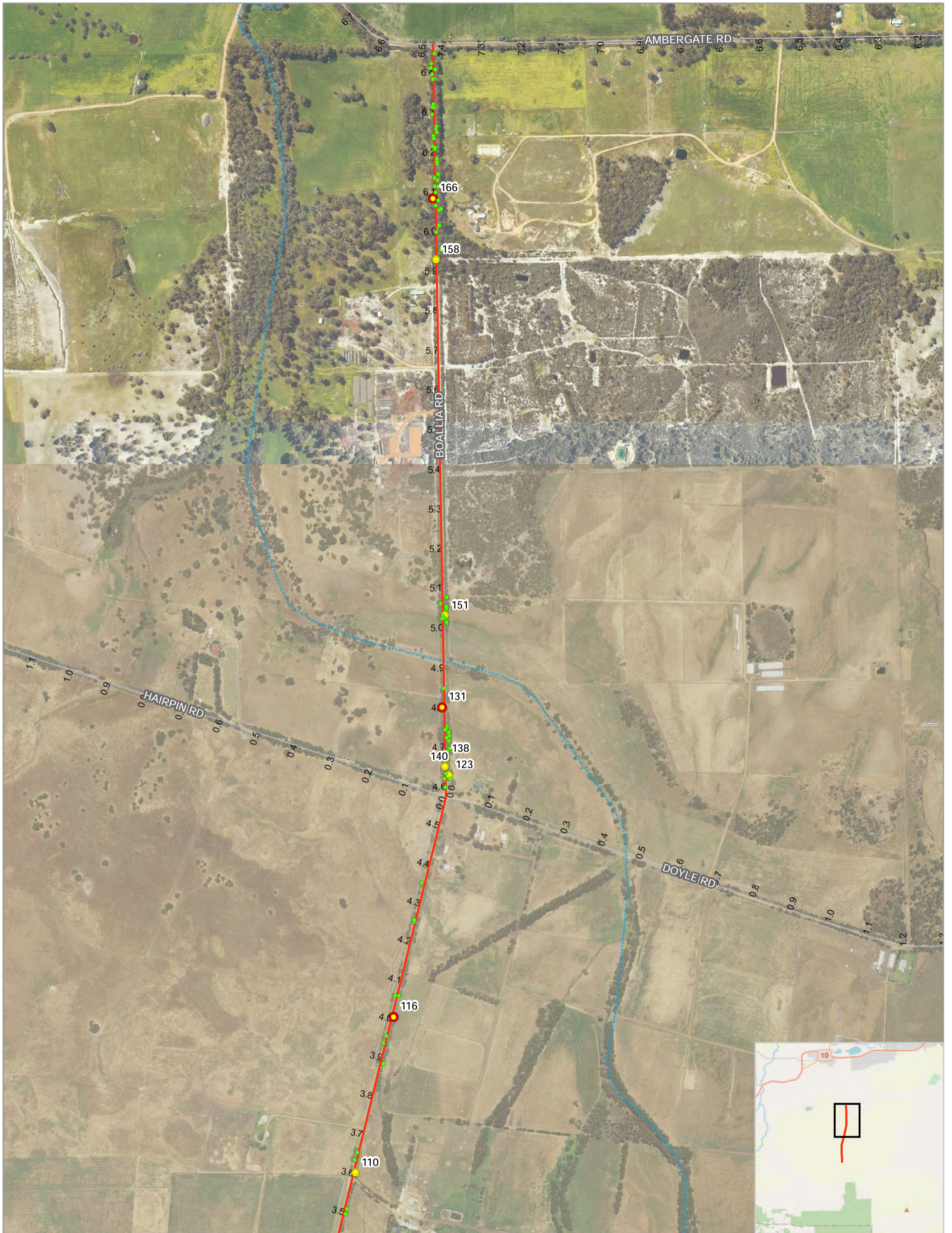
- Sample site
- ★ Conservation significant flora
- ☆ *Grevillea brachystylis subsp. grandis* (T)
- 🌿 *Loxocarya magna* (P3)
- Vegetation Unit
 - ▨ CcXp (TEC)
 - Cleared
 - MpXp (TEC)
- Vegetation Condition
 - ▨ Degraded to Completely Degraded
 - ▨ Good to Very Good



0 50 100 200 m

A3 @ 1:4000
 Author: SP
 Ref: SW283 F4





Boallia Road (1.0 to 6.5 SLK), Boallia

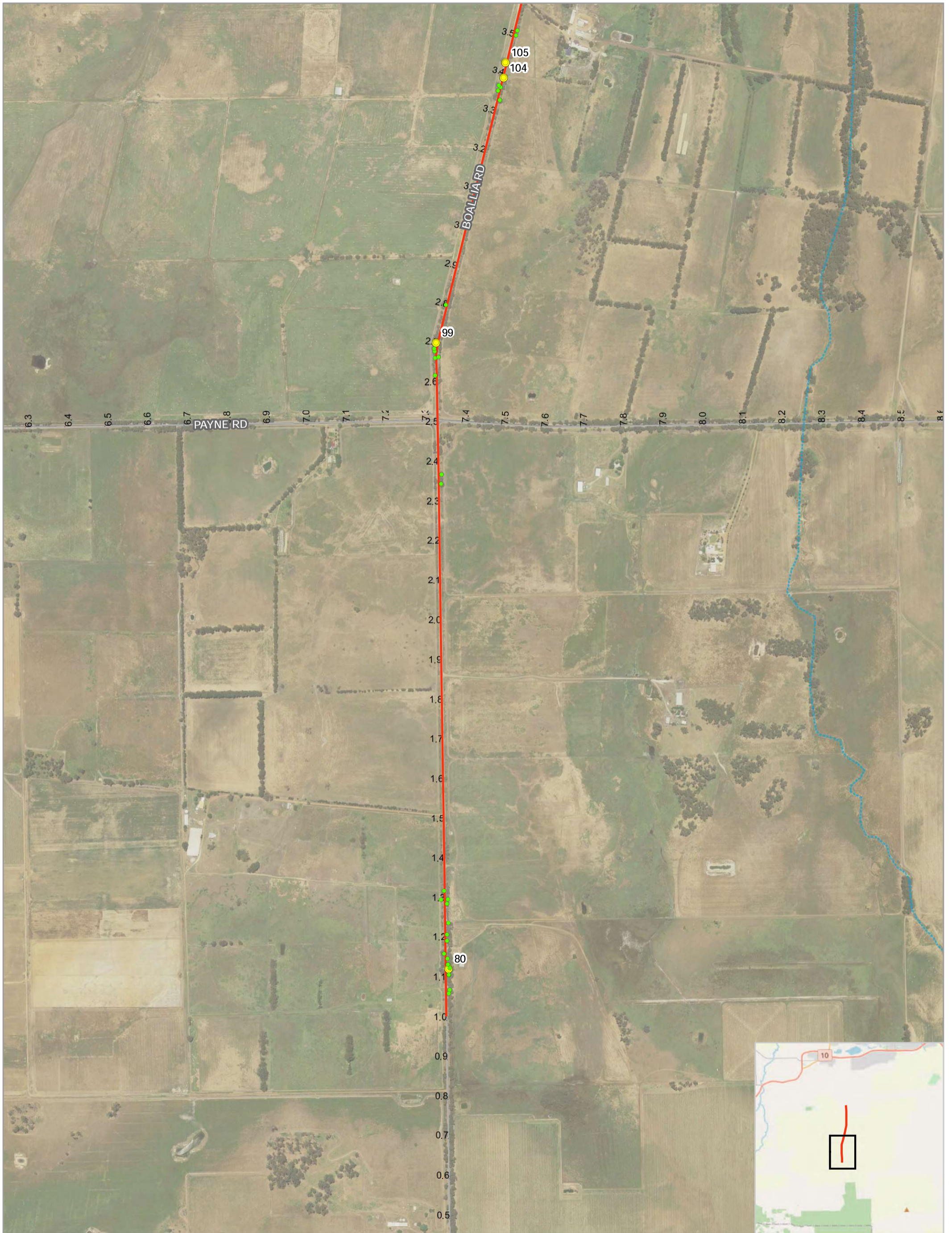
Figure 5 Suitable DBH trees and trees with hollows

- Black cockatoo breeding suitability**
- Suitable
 - Unlikely to be suitable
- Hollows**
- Hollow
 - DBH tree (not hollow)
- Boallia Road study area

0 100 200 400 m

A3 @ 1:8500
 Author: SP
 Ref: SW283 F5





Boallia Road (1.0 to 6.5 SLK), Boallia

Figure 5 Suitable DBH trees and trees with hollows

- Black cockatoo breeding suitability
- Unlikely to be suitable
- Hollows
- Hollow
- DBH tree (not hollow)
- Boallia Road study area

0 100 200 400 m

A3 @ 1:8500
 Author: SP
 Ref: SW283 F5



Appendix B Conservation codes



CONSERVATION CODES

For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora¹ are species² which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

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

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

T **Threatened species**

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

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR **Critically endangered species**

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

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

EN **Endangered species**

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

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU **Vulnerable species**

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

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Extinct species

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

EX Extinct species

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

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

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

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

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

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

MI Migratory species

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

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

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CD Species of special conservation interest (conservation dependent fauna)

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

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

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

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

P Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

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

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

1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

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

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

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

¹ The definition of flora includes algae, fungi and lichens

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

Appendix C Potential fauna list and fauna recorded

Class	Family	Scientific Name	Vernacular Name	Boallia Rd
AMPHIBIA	HYLIDAE	<i>Litoria adelaidensis</i>	Slender Tree Frog	
AMPHIBIA	HYLIDAE	<i>Litoria moorei</i>	Moore's Frog	
AMPHIBIA	LIMNODYNASTIDAE	<i>Heleioporus eyrei</i>	Moaning Frog	
AMPHIBIA	MYOBATRACHIDAE	<i>Crinia georgiana</i>	Quacking Froglet	
AMPHIBIA	MYOBATRACHIDAE	<i>Crinia glauerti</i>	Glauert's Froglet	
AMPHIBIA	MYOBATRACHIDAE	<i>Crinia insignifera</i>	Squelching Froglet	
AMPHIBIA	MYOBATRACHIDAE	<i>Crinia pseudinsignifera</i>	False Western Froglet	
AMPHIBIA	MYOBATRACHIDAE	<i>Geocrinia leai</i>	Ticking Frog	
AMPHIBIA	MYOBATRACHIDAE	<i>Metacrinia nicholli</i>	Nicholl's Toadlet	
AMPHIBIA	MYOBATRACHIDAE	<i>Pseudophryne guentheri</i>	Gunther's Toadlet	
AVES	ACANTHIZIDAE	<i>Acanthiza apicalis</i>	Inland Thornbill	
AVES	ACANTHIZIDAE	<i>Acanthiza chrysorrhoa</i>	Yellow-Rumped Thornbill	x
AVES	ACANTHIZIDAE	<i>Acanthiza inornata</i>	Western Thornbill	
AVES	ACANTHIZIDAE	<i>Gerygone fusca</i>	Western Gerygone	
AVES	ACANTHIZIDAE	<i>Sericornis frontalis</i>	White-Browed Scrubwren	
AVES	ACANTHIZIDAE	<i>Smicronis brevirostris</i>	Weebill	
AVES	ACCIPITRIDAE	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	
AVES	ACCIPITRIDAE	<i>Accipiter fasciatus</i>	Brown Goshawk	
AVES	ACCIPITRIDAE	<i>Aquila audax</i>	Wedge-Tailed Eagle	
AVES	ACCIPITRIDAE	<i>Circus approximans</i>	Swamp Harrier	
AVES	ACCIPITRIDAE	<i>Circus assimilis</i>	Spotted Harrier	
AVES	ACCIPITRIDAE	<i>Elanus axillaris</i>	Black-Shouldered Kite	
AVES	ACCIPITRIDAE	<i>Haliaeetus leucogaster</i>	White-Bellied Sea-Eagle	
AVES	ACCIPITRIDAE	<i>Haliastur sphenurus</i>	Whistling Kite	
AVES	ACCIPITRIDAE	<i>Hamirostra isura</i>	Square-Tailed Kite	
AVES	ACCIPITRIDAE	<i>Hieraaetus morphnoides</i>	Little Eagle	
AVES	ACCIPITRIDAE	<i>Pandion haliaetus</i>	Osprey	
AVES	ACROCEPHALIDAE	<i>Acrocephalus australis</i>	Australian Reed Warbler	
AVES	AEGOTHELIDAE	<i>Aegotheles cristatus</i>	Australian Owlet-Nightjar	
AVES	ALCEDINIDAE	<i>Dacelo novaeguineae</i>	Kookaburra*	x
AVES	ALCEDINIDAE	<i>Todiramphus sanctus</i>	Sacred Kingfisher	x
AVES	ANATIDAE	<i>Anas castanea</i>	Chestnut Teal	
AVES	ANATIDAE	<i>Anas gracilis</i>	Grey Teal	
AVES	ANATIDAE	<i>Anas platyrhynchos</i>	Mallard Duck	
AVES	ANATIDAE	<i>Anas rhynchotis</i>	Australian Shoveler	
AVES	ANATIDAE	<i>Anas superciliosa</i>	Pacific Black Duck	
AVES	ANATIDAE	<i>Aythya australis</i>	Hardhead	
AVES	ANATIDAE	<i>Biziura lobata</i>	Musk Duck	
AVES	ANATIDAE	<i>Chenonetta jubata</i>	Australian Wood Duck	
AVES	ANATIDAE	<i>Cygnus atratus</i>	Black Swan	
AVES	ANATIDAE	<i>Malacorhynchus membranaceus</i>	Pink-Eared Duck	
AVES	ANATIDAE	<i>Oxyura australis</i>	Blue-Billed Duck	
AVES	ANATIDAE	<i>Stictonetta naevosa</i>	Freckled Duck	
AVES	ANATIDAE	<i>Tadorna tadornoides</i>	Australian Shelduck	
AVES	ANHINGIDAE	<i>Anhinga novaehollandiae</i>	Australasian Darter	
AVES	ARDEIDAE	<i>Ardea alba</i>	Great Egret	
AVES	ARDEIDAE	<i>Ardea ibis</i>	Cattle Egret	
AVES	ARDEIDAE	<i>Ardea modesta</i>	Eastern Great Egret	
AVES	ARDEIDAE	<i>Ardea novaehollandiae</i>	White-Faced Heron	
AVES	ARDEIDAE	<i>Ardea pacifica</i>	White-Necked Heron	
AVES	ARDEIDAE	<i>Botaurus poiciloptilus</i>	Australasian Bittern	
AVES	ARDEIDAE	<i>Egretta garzetta</i>	Little Egret	

AVES	ARDEIDAE	<i>Ixobrychus flavicollis</i>	Black Bittern	
AVES	ARDEIDAE	<i>Nycticorax caledonicus</i>	Nankeen Night-Heron	
AVES	ARTAMIDAE	<i>Artamus cinereus</i>	Black-Faced Woodswallow	
AVES	ARTAMIDAE	<i>Artamus cyanopterus</i>	Dusky Woodswallow	x
AVES	ARTAMIDAE	<i>Cracticus nigrogularis</i>	Pied Butcherbird	
AVES	ARTAMIDAE	<i>Cracticus torquatus</i>	Grey Butcherbird	x
AVES	ARTAMIDAE	<i>Strepera versicolor</i>	Grey Currawong	
AVES	CACATUIDAE	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	
AVES	CACATUIDAE	<i>Cacatua pastinator</i>	Western Corella	
AVES	CACATUIDAE	<i>Cacatua pastinator subsp. pastinator</i>	Muir's Corella	
AVES	CACATUIDAE	<i>Cacatua roseicapilla</i>	Galah	
AVES	CACATUIDAE	<i>Cacatua sanguinea</i>	Little Corella	
AVES	CACATUIDAE	<i>Calyptorhynchus banksii naso</i>	Forest Red-Tailed Black Cockatoo	X
AVES	CACATUIDAE	<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	Feed residue
AVES	CACATUIDAE	<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	Feed residue
AVES	CAMPEPHAGIDAE	<i>Coracina novaehollandiae</i>	Black-Faced Cuckoo-Shrike	x
AVES	CAMPEPHAGIDAE	<i>Lalage sueurii</i>	White-Winged Triller	
AVES	CAPRIMULGIDAE	<i>Eurostopodus argus</i>	Spotted Nightjar	
AVES	CASUARIIDAE	<i>Dromaius novaehollandiae</i>	Emu	
AVES	CHARADRIIDAE	<i>Charadrius leschenaultii</i>	Greater Sand Plover	
AVES	CHARADRIIDAE	<i>Charadrius ruficapillus</i>	Red-capped Plover	
AVES	CHARADRIIDAE	<i>Euseyornis melanops</i>	Black-fronted Dotterel	
AVES	CHARADRIIDAE	<i>Erythronyx cinctus</i>	Red-kneed Dotterel	
AVES	CHARADRIIDAE	<i>Pluvialis fulva</i>	Pacific Golden Plover	
AVES	CHARADRIIDAE	<i>Vanellus tricolor</i>	Banded Lapwing	
AVES	CLIMACTERIDAE	<i>Climacteris rufus</i>	Rufous Treecreeper	
AVES	COLUMBIDAE	<i>Columba livia</i>	Rock Pigeon	
AVES	COLUMBIDAE	<i>Ocyphaps lophotes</i>	Crested Pigeon	x
AVES	COLUMBIDAE	<i>Phaps chalcoptera</i>	Common Bronzewing	
AVES	COLUMBIDAE	<i>Phaps elegans</i>	Brush Bronzewing	
AVES	COLUMBIDAE	<i>Streptopelia chinensis</i>	Spotted Dove	
AVES	COLUMBIDAE	<i>Streptopelia senegalensis</i>	Laughing Turtle-Dove*	
AVES	CORVIDAE	<i>Corvus bennetti</i>	Little Crow	
AVES	CORVIDAE	<i>Corvus coronoides</i>	Australian Raven	x
AVES	CORVIDAE	<i>Gymnorhina tibicen</i>	Australian Magpie	x
AVES	CUCULIDAE	<i>Cacomantis flabelliformis</i>	Fan-Tailed Cuckoo	
AVES	CUCULIDAE	<i>Cacomantis pallidus</i>	Pallid Cuckoo	
AVES	CUCULIDAE	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo	
AVES	CUCULIDAE	<i>Chrysococcyx lucidus</i>	Shining Bronze-Cuckoo	
AVES	ESTRILDIDAE	<i>Stagonopleura oculata</i>	Red-Eared Firetail	
AVES	FALCONIDAE	<i>Falco berigora</i>	Brown Falcon	
AVES	FALCONIDAE	<i>Falco cenchroides</i>	Nankeen Kestrel	
AVES	FALCONIDAE	<i>Falco longipennis</i>	Little Falcon	
AVES	FALCONIDAE	<i>Falco peregrinus</i>	Peregrine Falcon	
AVES	HIRUNDINIDAE	<i>Hirundo neoxena</i>	Welcome Swallow	
AVES	HIRUNDINIDAE	<i>Petrochelidon ariel</i>	Fairy Martin	
AVES	HIRUNDINIDAE	<i>Petrochelidon nigricans</i>	Tree Martin	
AVES	LARIDAE	<i>Chroicocephalus novaehollandiae</i>	Silver Gull	
AVES	MALURIDAE	<i>Malurus elegans</i>	Red-Winged Fairy-Wren	
AVES	MALURIDAE	<i>Malurus lamberti</i>	Variagated Fairy-Wren	
AVES	MALURIDAE	<i>Malurus splendens</i>	Splendid Fairy-Wren	

AVES	MALURIDAE	<i>Stipiturus malachurus</i>	Southern Emu-Wren	
AVES	MEGALURIDAE	<i>Cincloramphus cruralis</i>	Brown Songlark	
AVES	MEGALURIDAE	<i>Cincloramphus mathewsi</i>	Rufous Songlark	
AVES	MEGALURIDAE	<i>Megalurus gramineus</i>	Little Grassbird	
AVES	MEGAPODIIDAE	<i>Leipoa ocellata</i>	Malleefowl	
AVES	MELIPHAGIDAE	<i>Acanthorhynchus superciliosus</i>	Western Spinebill	
AVES	MELIPHAGIDAE	<i>Anthochaera carunculata</i>	Red Wattlebird	x
AVES	MELIPHAGIDAE	<i>Anthochaera lunulata</i>	Western Wattlebird	x
AVES	MELIPHAGIDAE	<i>Epthianura albifrons</i>	White-Fronted Chat	
AVES	MELIPHAGIDAE	<i>Gavicalis virescens</i>	Singing Honeyeater	
AVES	MELIPHAGIDAE	<i>Gliciphila melanops</i>	Tawny-Crowned Honeyeater	
AVES	MELIPHAGIDAE	<i>Lichmera indistincta</i>	Brown Honeyeater	
AVES	MELIPHAGIDAE	<i>Melithreptus brevirostris</i>	Brown-Headed Honeyeater	
AVES	MELIPHAGIDAE	<i>Melithreptus chloropsis</i>	Gilbert's Honeyeater	
AVES	MELIPHAGIDAE	<i>Melithreptus lunatus</i>	White-Naped Honeyeater	
AVES	MELIPHAGIDAE	<i>Phylidonyris niger</i>	White-Cheeked Honeyeater	
AVES	MELIPHAGIDAE	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	
AVES	MEROPIDAE	<i>Merops ornatus</i>	Rainbow Bee-Eater	
AVES	MONARCHIDAE	<i>Grallina cyanoleuca</i>	Magpie-Lark	x
AVES	MONARCHIDAE	<i>Myiagra inquieta</i>	Restless Flycatcher	
AVES	MOTACILLIDAE	<i>Anthus australis</i>	Australian Pipit	
AVES	NECTARINIIDAE	<i>Dicaeum hirundinaceum</i>	Mistletoebird	
AVES	NEOSITTIDAE	<i>Daphoenositta chrysoptera</i>	Varied Sittella	
AVES	PACHYCEPHALIDAE	<i>Colluricincla harmonica</i>	Grey Shrike-Thrush	
AVES	PACHYCEPHALIDAE	<i>Falcunculus frontatus</i>	Crested Shrike-Tit	
AVES	PACHYCEPHALIDAE	<i>Pachycephala occidentalis</i>	Western Whistler	
AVES	PACHYCEPHALIDAE	<i>Pachycephala pectoralis</i>	Golden Whistler	x
AVES	PACHYCEPHALIDAE	<i>Pachycephala rufiventris</i>	Rufous Whistler	
AVES	PARDALOTIDAE	<i>Pardalotus punctatus</i>	Spotted Pardalote	
AVES	PARDALOTIDAE	<i>Pardalotus striatus</i>	Striated Pardalote	x
AVES	PELECANIDAE	<i>Pelecanus conspicillatus</i>	Australian Pelican	
AVES	PETROICIDAE	<i>Eopsaltria georgiana</i>	White-Breasted Robin	
AVES	PETROICIDAE	<i>Eopsaltria griseogularis</i>	Western Yellow Robin	
AVES	PETROICIDAE	<i>Melanodryas cucullata</i>	Hooded Robin	
AVES	PETROICIDAE	<i>Petroica boodang</i>	Scarlet Robin	
AVES	PETROICIDAE	<i>Petroica goodenovii</i>	Red-Capped Robin	
AVES	PHAETHONTIDAE	<i>Phaethon rubricauda</i>	Red-Tailed Tropicbird	
AVES	PHALACROCORACIDAE	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant	
AVES	PHALACROCORACIDAE	<i>Phalacrocorax carbo</i>	Great Cormorant	
AVES	PHALACROCORACIDAE	<i>Phalacrocorax melanoleucos</i>	Little Cormorant	
AVES	PHALACROCORACIDAE	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant	
AVES	PHALACROCORACIDAE	<i>Phalacrocorax varius</i>	Pied Cormorant	
AVES	PHASIANIDAE	<i>Coturnix pectoralis</i>	Stubble Quail	
AVES	PHASIANIDAE	<i>Coturnix ypsilophora</i>	Brown Quail	
AVES	PODARGIDAE	<i>Podargus strigoides</i>	Tawny Frogmouth	
AVES	PODICIPEDIDAE	<i>Podiceps cristatus</i>	Great Crested Grebe	
AVES	PODICIPEDIDAE	<i>Poliiocephalus poliocephalus</i>	Hoary-Headed Grebe	
AVES	PODICIPEDIDAE	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	
AVES	PSITTACIDAE	<i>Barnardius zonarius</i>	Australian Ringneck	x
AVES	PSITTACIDAE	<i>Neophema elegans</i>	Elegant Parrot	

AVES	PSITTACIDAE	<i>Parvipsitta porphyrocephala</i>	Purple-Crowned Lorikeet	
AVES	PSITTACIDAE	<i>Platycercus icterotis</i>	Western Rosella	
AVES	PSITTACIDAE	<i>Platycercus spurius</i>	Red-Capped Parrot	Feed residue
AVES	PSITTACIDAE	<i>Polytelis anthopeplus</i>	Regent Parrot	
AVES	RALLIDAE	<i>Fulica atra</i>	Eurasian Coot	
AVES	RALLIDAE	<i>Gallinula tenebrosa</i>	Dusky Moorhen	
AVES	RALLIDAE	<i>Gallirallus philippensis</i>	Banded Rail	
AVES	RALLIDAE	<i>Porphyrio melanotos</i>	Australasian Swamphen	
AVES	RALLIDAE	<i>Porphyrio porphyrio</i>	Purple Swamphen	
AVES	RALLIDAE	<i>Porzana fluminea</i>	Australian Spotted Crake	
AVES	RALLIDAE	<i>Porzana pusilla</i>	Baillon's Crake	
AVES	RALLIDAE	<i>Porzana tabuensis</i>	Spotless Crake	
AVES	RALLIDAE	<i>Tribonyx ventralis</i>	Black-Tailed Native-Hen	
AVES	RECURVIROSTRIDAE	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet	
AVES	RHIPIDURIDAE	<i>Rhipidura albiscapa</i>	Grey Fantail	
AVES	RHIPIDURIDAE	<i>Rhipidura leucophrys</i>	Willie Wagtail	x
AVES	SCOLOPACIDAE	<i>Actitis hypoleucos</i>	Common Sandpiper	
AVES	SCOLOPACIDAE	<i>Arenaria interpres</i>	Turnstone	
AVES	SCOLOPACIDAE	<i>Calidris acuminata</i>	Sharp-Tailed Sandpiper	
AVES	SCOLOPACIDAE	<i>Calidris alba</i>	Sanderling	
AVES	SCOLOPACIDAE	<i>Calidris ferruginea</i>	Curlew Sandpiper	
AVES	SCOLOPACIDAE	<i>Calidris melanotos</i>	Pectoral Sandpiper	
AVES	SCOLOPACIDAE	<i>Calidris ruficollis</i>	Red-Necked Stint	
AVES	SCOLOPACIDAE	<i>Calidris subminuta</i>	Long-Toed Stint	
AVES	SCOLOPACIDAE	<i>Calidris tenuirostris</i>	Great Knot	
AVES	SCOLOPACIDAE	<i>Tringa brevipes</i>	Grey-tailed Tattler	
AVES	SCOLOPACIDAE	<i>Tringa glareola</i>	Wood Sandpiper	
AVES	SCOLOPACIDAE	<i>Tringa nebularia</i>	Greenshank	
AVES	SCOLOPACIDAE	<i>Tringa stagnatilis</i>	Marsh Sandpiper	
AVES	STRIGIDAE	<i>Ninox novaeseelandiae</i>	Southern Boobook	
AVES	SULIDAE	<i>Morus serrator</i>	Australasian Gannet	
AVES	THRESKIORNITHIDAE	<i>Platalea flavipes</i>	Yellow-Billed Spoonbill	
AVES	THRESKIORNITHIDAE	<i>Platalea regia</i>	Royal Spoonbill	
AVES	THRESKIORNITHIDAE	<i>Plegadis falcinellus</i>	Glossy Ibis	
AVES	THRESKIORNITHIDAE	<i>Threskiornis molucca</i>	Australian White Ibis	
AVES	THRESKIORNITHIDAE	<i>Threskiornis spinicollis</i>	Straw-Necked Ibis	
AVES	TIMALIIDAE	<i>Zosterops lateralis</i>	Silveryeye	
AVES	TURNICIDAE	<i>Turnix varius</i>	Painted Button-Quail	
AVES	TYTONIDAE	<i>Tyto alba</i>	Barn Owl	
AVES	TYTONIDAE	<i>Tyto novaehollandiae</i>	Masked Owl	
FISH	GALAXIIDAE	<i>Galaxiella munda</i>	Mud Minnow	
FISH	GEOTRIIDAE	<i>Geotria australis</i>	Pouched Lamprey	
FISH	PERCICHTHYIDAE	<i>Nannatherina balstoni</i>	Balston's Pygmy Perch	
INVERTEBRATE	AUSTROSAGINAE	<i>Pachysaga strobila</i>	Vasse Pachysaga (Busselton-Donnybrook) cricket	
INVERTEBRATE	HYRIIDAE	<i>Westralunio carteri</i>	Carter's Freshwater Mussel	
INVERTEBRATE	PARASTACIDAE	<i>Cherax cainii</i>	Marron	
INVERTEBRATE	PARASTACIDAE	<i>Cherax destructor</i>	Yabby*	

INVERTEBRATE	PARASTACIDAE	<i>Cherax quinquecarinatus</i>	Gilgie	
INVERTEBRATE	PARASTACIDAE	<i>Engaewa pseudoreducta</i>	Margaret River Burrowing Crayfish	
INVERTEBRATE	PARASTACIDAE	<i>Engaewa reducta</i>	Dunsborough Burrowing Crayfish	
MAMMALIA	BOVIDAE	<i>Bos taurus</i>	Cattle*	Tracks
MAMMALIA	BURRAMYIDAE	<i>Cercartetus concinnus</i>	Western Pygmy-Possum	
MAMMALIA	CANIDAE	<i>Vulpes vulpes</i>	Fox*	
MAMMALIA	DASYURIDAE	<i>Antechinus flavipes subsp. leucogaster</i>	Yellow-footed Antechinus	
MAMMALIA	DASYURIDAE	<i>Dasyurus geoffroii</i>	Chuditch	
MAMMALIA	DASYURIDAE	<i>Phascogale tapoatafa</i>	Brush-Tailed Phascogale	
MAMMALIA	DASYURIDAE	<i>Sminthopsis fuliginosus</i>	Dusky Dunnart	
MAMMALIA	DASYURIDAE	<i>Sminthopsis gilberti</i>	Gilbert's Dunnart	
MAMMALIA	DASYURIDAE	<i>Sminthopsis griseoventer</i>	Grey-Bellied Dunnart	
MAMMALIA	FELIDAE	<i>Felis catus</i>	Cat*	
MAMMALIA	LEPORIDAE	<i>Oryctolagus cuniculus</i>	Rabbit*	Burrow
MAMMALIA	MACROPODIDAE	<i>Macropus fuliginosus</i>	Western Grey Kangaroo	
MAMMALIA	MACROPODIDAE	<i>Notamacropus irma</i>	Western Brush Wallaby	
MAMMALIA	MACROPODIDAE	<i>Setonix brachyurus</i>	Quokka	
MAMMALIA	MURIDAE	<i>Hydromys chrysogaster</i>	Water-Rat	
MAMMALIA	MURIDAE	<i>Mus musculus</i>	House Mouse*	
MAMMALIA	MURIDAE	<i>Rattus fuscipes</i>	Western Bush Rat	
MAMMALIA	MURIDAE	<i>Rattus rattus</i>	Black Rat*	
MAMMALIA	PERAMELIDAE	<i>Isoodon fusciventer</i>	Quenda	
MAMMALIA	PHALANGERIDAE	<i>Trichosurus vulpecula</i>	Common Brushtail Possum	
MAMMALIA	PSEUDOCHIRIDAE	<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	Scat
MAMMALIA	SUIDAE	<i>Sus scrofa</i>	Pig*	
MAMMALIA	TARSIPEDIDAE	<i>Tarsipes rostratus</i>	Honey Possum	
MAMMALIA	VESPERTILIONIDAE	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	
MAMMALIA	VESPERTILIONIDAE	<i>Nyctophilus gouldii</i>	Gould's Wattled Bat	
MAMMALIA	VESPERTILIONIDAE	<i>Nyctophilus major</i>	Greater Long-eared Bat	
MAMMALIA	VESPERTILIONIDAE	<i>Nyctophilus morio</i>	Chocolate Wattled Bat	
MAMMALIA	VESPERTILIONIDAE	<i>Vespadelus regulus</i>	Southern Forest Bat	
REPTILIA	AGAMIDAE	<i>Pogona minor</i>	Western Bearded Dragon	
REPTILIA	CHELIDAE	<i>Chelodina colliei</i>	Oblong Turtle	
REPTILIA	ELAPIDAE	<i>Echiopsis curta</i>	Bardick	
REPTILIA	ELAPIDAE	<i>Elapognathus coronatus</i>	Western Crowned Snake	
REPTILIA	ELAPIDAE	<i>Elapognathus minor</i>	Short-nosed Snake	
REPTILIA	ELAPIDAE	<i>Neelaps calonotus</i>	Western Black-Striped Snake	
REPTILIA	ELAPIDAE	<i>Notechis scutatus</i>	Tiger Snake	
REPTILIA	ELAPIDAE	<i>Parasuta gouldii</i>	Gould's hooded Snake	
REPTILIA	ELAPIDAE	<i>Parasuta nigriceps</i>	Mitchell's Short-Tailed Snake	
REPTILIA	ELAPIDAE	<i>Pseudonaja affinis</i>	Dugite	
REPTILIA	ELAPIDAE	<i>Simoselaps bertholdi</i>	Jan's Banded Snake	
REPTILIA	GEKKONIDAE	<i>Christinus marmoratus</i>	Marbled Gecko	
REPTILIA	PYGOPODIDAE	<i>Aprasia pulchella</i>	Pretty Worm-Lizard	
REPTILIA	PYGOPODIDAE	<i>Aprasia repens</i>	Sedgelands Worm-Lizard	
REPTILIA	PYGOPODIDAE	<i>Lialis burtonis</i>	Burton's Snake-Lizard	
REPTILIA	PYGOPODIDAE	<i>Pygopus lepidopodus</i>	Common Scaly-Foot	
REPTILIA	SCINCIDAE	<i>Acritoscincus trilineatus</i>	Western Three-Lined Skink	
REPTILIA	SCINCIDAE	<i>Cryptoblepharus buchanani</i>	Buchanans Snake-Eyed Skink	
REPTILIA	SCINCIDAE	<i>Ctenotus catenifer</i>	Chain-Striped South-West Ctenotus	
REPTILIA	SCINCIDAE	<i>Ctenotus impar</i>	Odd-Striped Ctenotus	

REPTILIA	SCINCIDAE	<i>Ctenotus labillardieri</i>	Common South-West Ctenotus	
REPTILIA	SCINCIDAE	<i>Ctenotus ora</i>	Coastal Plains Skink	
REPTILIA	SCINCIDAE	<i>Egernia kingii</i>	King's Skink	
REPTILIA	SCINCIDAE	<i>Egernia napoleonis</i>	South-Western Crevice-Skink	
REPTILIA	SCINCIDAE	<i>Hemiergis gracilipes</i>	South-Western Mulch-Skink	
REPTILIA	SCINCIDAE	<i>Hemiergis peronii</i>	Lowlands Earless Skink	
REPTILIA	SCINCIDAE	<i>Hemiergis quadrilineata</i>	Two-Toed Earless Skink	
REPTILIA	SCINCIDAE	<i>Lerista distinguenda</i>	South-Western Orange-Tailed Slider	
REPTILIA	SCINCIDAE	<i>Lerista elegans</i>	Elegant Slider	
REPTILIA	SCINCIDAE	<i>Lerista lineata</i>	Perth Slider	
REPTILIA	SCINCIDAE	<i>Lerista microtis</i>	South-Western Slider	
REPTILIA	SCINCIDAE	<i>Lissolepis luctuosa</i>	Western Mourning Skink	
REPTILIA	SCINCIDAE	<i>Menetia greyii</i>	Common Dwarf Skink	
REPTILIA	SCINCIDAE	<i>Morethia lineocellata</i>	West Coast Morethia Skink	
REPTILIA	SCINCIDAE	<i>Tiliqua rugosa</i>	Bobtail	
REPTILIA	TYPHLOPIDAE	<i>Anilius australis</i>	Southern Blind Snake	
REPTILIA	TYPHLOPIDAE	<i>Anilius pinguis</i>	Rotund Blind Snake	
REPTILIA	VARANIDAE	<i>Varanus gouldii</i>	Gould's Goanna	
REPTILIA	VARANIDAE	<i>Varanus rosenbergi</i>	Heath Monitor	

Appendix D Naturemap and PMST database results

NatureMap Species Report

Created By Guest user on 19/11/2020

Conservation Status Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only Yes
Core Datasets Only Yes
Species Group All Animals
Method 'By Circle'
Centre 115° 16' 14" E, 33° 44' 37" S
Buffer 10km

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
2.	24049 <i>Balaenoptera musculus</i> subsp. <i>intermedia</i> (Antarctic Blue Whale)		T	
3.	34056 <i>Bothriembryon irvineanus</i> (Irvine's bothriembryontid land snail (Cape Naturaliste))		P2	Y
4.	24724 <i>Cacatua pastinator</i> subsp. <i>pastinator</i> (Muir's Corella, Muir's Corella (Western Corella SW WA))		S	
5.	24779 <i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
6.	24780 <i>Calidris alba</i> (Sanderling)		IA	
7.	24784 <i>Calidris ferruginea</i> (Curlew Sandpiper)		T	
8.	24786 <i>Calidris melanotos</i> (Pectoral Sandpiper)		IA	
9.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
10.	24789 <i>Calidris subminuta</i> (Long-toed Stint)		IA	
11.	24790 <i>Calidris tenuirostris</i> (Great Knot)		T	
12.	24731 <i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black Cockatoo)		T	
13.	24733 <i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)		T	
14.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		T	
15.	48400 <i>Calyptorhynchus</i> sp. (white-tailed black cockatoo)		T	
16.	24092 <i>Dasyurus geoffroii</i> (Chuditch, Western Quoll)		T	
17.	33945 <i>Engaewa pseudoreducta</i> (Margaret River Burrowing Crayfish)		T	
18.	33946 <i>Engaewa reducta</i> (Dunsborough Burrowing Crayfish)		T	
19.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
20.	24215 <i>Hydromys chrysogaster</i> (Water-rat, Rakali)		P4	
21.	48587 <i>Hydroprogne caspia</i> (Caspian Tern)		IA	
22.	48588 <i>Isodon fusciventer</i> (Quenda, southwestern brown bandicoot)		P4	
23.	24690 <i>Macronectes giganteus</i> (Southern Giant Petrel)		IA	
24.	48022 <i>Notamacropus irma</i> (Western Brush Wallaby)		P4	
25.	24328 <i>Oxyura australis</i> (Blue-billed Duck)		P4	
26.	33989 <i>Pachysaga strobila</i> (Vasse Pachysaga (Busselton-Donnybrook), cricket)		P1	
27.	48591 <i>Pandion cristatus</i> (Osprey, Eastern Osprey)		IA	
28.	48070 <i>Phascogale tapoatafa</i> subsp. <i>wambenger</i> (South-western Brush-tailed Phascogale, Wambenger)		S	
29.	24843 <i>Plegadis falcinellus</i> (Glossy Ibis)		IA	
30.	24382 <i>Pluvialis fulva</i> (Pacific Golden Plover)		IA	
31.	24166 <i>Pseudocheirus occidentalis</i> (Western Ringtail Possum, ngwayir)		T	
32.	48597 <i>Thalasseus bergii</i> (Crested Tern)		IA	
33.	24806 <i>Tringa glareola</i> (Wood Sandpiper)		IA	
34.	24808 <i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	
35.	24809 <i>Tringa stagnatilis</i> (Marsh Sandpiper, little greenshank)		IA	
36.	34113 <i>Westralunio carteri</i> (Carter's Freshwater Mussel)		T	

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 19/11/20 19:12:24

[Summary](#)

[Details](#)

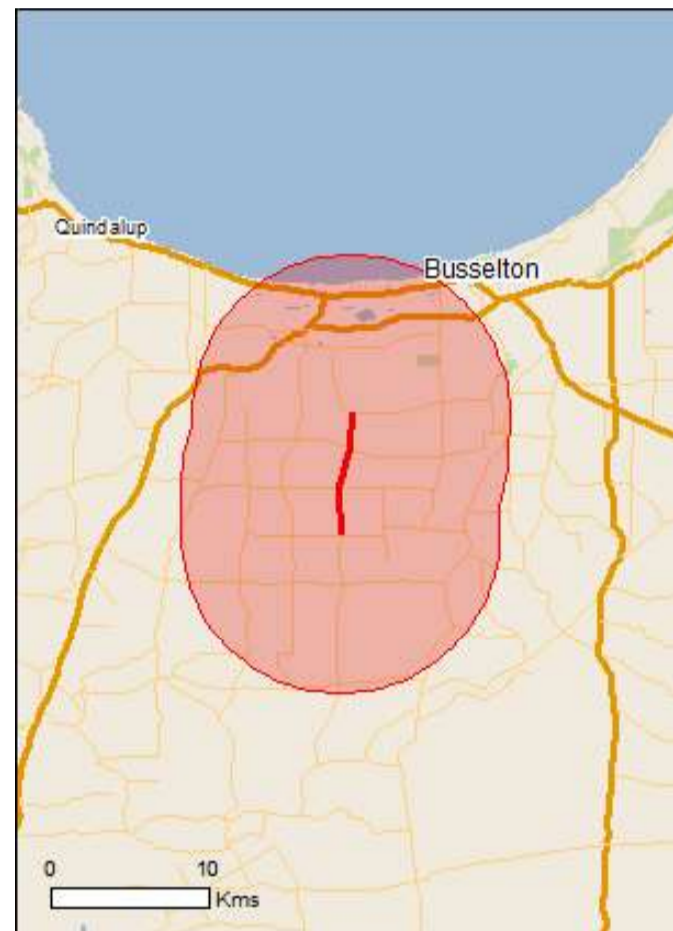
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

[Buffer: 10.0Km](#)



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	74
Listed Migratory Species:	48

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	74
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	11
Regional Forest Agreements:	1
Invasive Species:	25
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [\[Resource Information \]](#)

Name	Proximity
Vasse-wonnerup system	Within 10km of Ramsar

Listed Threatened Ecological Communities [\[Resource Information \]](#)

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Shrublands on southern Swan Coastal Plain ironstones	Endangered	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area

Listed Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Species or species habitat known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species

Name	Status	Type of Presence
Diomedea dabbenena Tristan Albatross [66471]	Endangered	habitat may occur within area Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Extinct within area
Phoebastria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Crustaceans		
Cherax tenuimanus Hairy Marron, Margaret River Hairy Marron, Margaret River Marron [78931]	Critically Endangered	Species or species habitat may occur within area
Engaewa reducta Dunsborough Burrowing Crayfish [82675]	Critically Endangered	Species or species habitat known to occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Breeding known to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Banksia mimica Summer Honey-pot [82765]	Endangered	Species or species habitat likely to occur within area
Banksia nivea subsp. uliginosa Swamp Honey-pot [82766]	Endangered	Species or species habitat known to occur within area
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat likely to occur within area
Caladenia busselliana Bussell's Spider-orchid [24369]	Endangered	Species or species habitat known to occur within area
Caladenia hoffmanii Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat may occur within area
Caladenia procera Carbunup King Spider Orchid [68679]	Critically Endangered	Species or species habitat known to occur within area
Caladenia viridescens Dunsborough Spider-orchid [56776]	Endangered	Species or species habitat may occur within area
Chamelaucium sp. S coastal plain (R.D.Royce 4872) Royce's Waxflower [87814]	Vulnerable	Species or species habitat known to occur within area
Daviesia elongata subsp. elongata Long-leaved Daviesia [64883]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat may occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus x phylacis Meelup Mallee [87817]	Endangered	Species or species habitat may occur within area
Gastrolobium modestum Broad-leaved Gastrolobium [78361]	Vulnerable	Species or species habitat known to occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Grevillea brachystylis subsp. grandis Large-flowered Short-styled Grevillea [85001]	Critically Endangered	Species or species habitat known to occur within area
Grevillea elongata Ironstone Grevillea [64578]	Vulnerable	Species or species habitat may occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat likely to occur within area
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat known to occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat known to occur within area
Verticordia plumosa var. ananeotes Tufted Plumed Featherflower [23871]	Endangered	Species or species habitat known to occur within area
Verticordia plumosa var. vassensis Vasse Featherflower [55804]	Endangered	Species or species habitat known to occur within area

Reptiles

Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Sharks

Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species

[[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or

Name	Threatened	Type of Presence
Diomedea exulans Wandering Albatross [89223]	Vulnerable	related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
Phoebastria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phoebastria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area

Mammals

Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area

Reptiles

Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans

Name	Status	Type of Presence
[Resource Information]		
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Broadwater	WA
Locke	WA
NTWA Bushland covenant (0069)	WA
NTWA Bushland covenant (0173)	WA
Sussex Location 2561	WA
Unnamed WA25836	WA
Unnamed WA26620	WA
Unnamed WA41597	WA
Unnamed WA42879	WA
Unnamed WA45533	WA
Unnamed WA48837	WA

Regional Forest Agreements	[Resource Information]
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Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species[\[Resource Information \]](#)

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

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within

Name	Status	Type of Presence area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-33.716997 115.274934,-33.733131 115.274247,-33.751545 115.268582,-33.77395 115.268925

Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact Us](#) page.

Appendix E Threatened fauna evaluation

Table E.1 provides an evaluation of the presence of habitat and the likelihood of occurrence for conservation significant (target) fauna species. The species list was derived species lists from database searches (ALA, Birddata, IBSA, Naturemap and PMST reporting tool, 2020), literature and expert consultation, assessed against habitat observed within the study area. The potential to be impacted depends on the final nature of the final impacts proposed, habitat utilised by the target species and the likelihood of occurrence.

In the evaluation, the presence of habitat is given three categories:

- **Present:** Potential or known habitat is present within the project area.
- **Marginal:** Habitat present is not typical but may be suitable, or habitat is typical, but condition and microhabitat requirements of species are not present.
- **Absent:** No potential or known habitat is present within the project area.

There are four categories for likelihood of occurrence:

- **Nil:** Species known or predicted to occur within the locality but no suitable habitat within the project area.
- **Unlikely:** Species known or predicted within the locality. Suitable habitat may be present in the project area, but the proximity of nearest records suggests it is unlikely to occur.
- **Possible:** Suitable habitat present and the species could occur in the project area based on the proximity of nearest records.
- **Present:** Species was recorded during the field investigations

The following have been excluded from the tables as they are not relevant to the proposal or would not be impacted:

- Marine (e.g. seals, dolphins, whales, penguins).
- Marine migratory species (e.g. Albatrosses) or where breeding is in the northern hemisphere, e.g. those from the family Scolopacidae: Sandpipers and other shorebirds and waders.
- Species considered regionally extinct (e.g. Malleefowl).
- Aquatic (Blue-billed Duck) where there are no large waterbodies.

Conservation status is as per the (federal) EPBC Act and (WA) DBCA Parks and Wildlife Service's Threatened and Priority Fauna List last updated 10/04/2019, under the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* made by the Minister for Environment under section 14(4) Part 2 of *Biodiversity Conservation Regulations 2018*.

Refer to Appendix B for Conservation Codes.

Table E.1 Evaluation of the presence of habitat and the likelihood of occurrence for conservation fauna significant species within the study area

Class	Family Genus species	Vernacular	Status Federal	Stat. WA	Requirements	Presence of habitat	Likelihood of occurrence
	ARDEIDAE <i>Botaurus poiciloptilus</i>	Australasian Bittern	EN	EN	The Australasian Bittern occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats. In the south-west it is found in beds of tall rush mixed with, or near, short fine sedge or open pools. The species also occurs around swamps, lakes, pools, rivers and channels fringed with lignum (<i>Muehlenbeckia</i> sp.), canegrass (<i>Eragrostis</i> sp.) or other dense vegetation. The species occasionally ventures into areas of open water or onto banks. In the SW WA, it is confined to a relatively small number of regularly occupied locations. These locations probably number less than 70, including: less than five north of Perth; less than 10 in the greater Perth metropolitan area; less than 10 south to Busselton; less than 10 in the Lake Muir district; less than 10 from Augusta to Walpole; less than 10 around Albany; and less than 10 around Esperance and Cape Arid. Most of these sites are discrete basin/sumpland wetlands with local catchments, and many depend on the surface expression of groundwater (SPRAT 2017).	Absent	Unlikely
	CACATUIDAE <i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	VU	VU	The Forest Red-tailed Black Cockatoo inhabits the dense Jarrah, Karri and Marri forests receiving more than 600 mm rainfall annually (SPRAT 2018). The FRTBC occurs within the same habitat as the Baudin's Cockatoo. FRTBC nest in Jarrah, Karri, Marri and Wandoo favouring large top entry hollows with entrances ranging from 12–14 cm in diameter and hollow depth one to five metres (SEWPac, 2012) (Johnson and Kirkby, Undated). It breeds between February to December (with a peak between October and December, also a peak in some years in April–May) probably every two years – on the Swan Coastal Plain breeding has been	Present	Present

Class	Family Genus species	Vernacular	Status Federal	Stat. WA	Requirements	Presence of habitat	Likelihood of occurrence
					recorded in November–December (Johnson and Kirkby, Undated). The species predominately feeds on seeds from Marri and Jarrah fruits and Blackbutt, Albany Blackbutt, Forest Sheoak, Snottygobble and the non-indigenous native Spotted Gum and Cape Lilac within its home range of about 116-187 ha (SPRAT 2018).		
	<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	EN	EN	<p>Baudin's Cockatoo is mainly found in eucalypt forests, especially Jarrah -Marri forest, Karri forest, and less frequently in woodlands of Wandoo, Blackbutt, Flooded Gum Yate, partly cleared farmlands and urban areas including roadside trees and house gardens. This cockatoo forages at all levels of the forest from the canopy to the ground, often feeding in the understorey on proteaceous trees and shrubs, especially Banksia, and in orchards both in trees and on dropped or fallen fruit on the ground (Johnson and Kirkby, Undated).</p> <p>Preferred roosts are in areas with a dense canopy close to permanent sources of water (SPRAT 2018). The range of the species during the non-breeding season (breeds in August though to late December) may be determined by the distribution of Marri, and that nesting might be confined to areas in which Karri occurs (SPRAT 2018). It is known to nest in hollows of Eucalypts usually at some height (Pizzey and Knight 2007), often 30-50m above ground (Jupp 2000). Tree hollows usually have an entrance of 30-40cm, >30cm deep and are mostly vertical (SPRAT 2018) (Johnson and Kirkby, Undated).</p>	Present	Feed residue
	<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	EN	EN	This species is a postnuptial nomad, moving west after breeding. Carnaby's Cockatoo mainly occurs in or near eucalypt woodlands, especially those dominated by Wandoo or Salmon Gum, and sometimes reported in forests	Present	Feed residue

Class	Family Genus species	Vernacular	Status Federal	Stat. WA	Requirements	Presence of habitat	Likelihood of occurrence
					<p>of Marri, Jarrah, Karri and Tuart. Nesting hollows may be located anywhere from 2 m to >10 m from ground, mainly in the Wheatbelt (Cale 2003, SPRAT 2009, WA Museum 2010).</p> <p>It is known to forage in native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as Banksia spp. (including Dryandra spp.), Hakea spp. and Grevillea spp. Forages in pine plantations, eucalypt woodland and forest that contains foraging species. Also individual trees and small stands of these species (SEWPAC 2012).</p> <p>This species is currently expanding its breeding range westward and south into the Jarrah-Marri forests of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain. This may be due to climate change. Breeding occurs mainly from early July to mid-December. Breeding success is largely dependent on suitable feeding habitat adjacent to the nest site to provide the necessary food for the survival of the chick, for example adjacent pine forest or remnant vegetation (Johnson and Kirkby, Undated).</p>		
	<p><i>FALCONIDAE</i> <i>Falco peregrinus</i></p>	Peregrine Falcon	-	OS	<p>Peregrine Falcons occur in woodland, plains, gorges, wetlands but tend to breed either in stick-nests in trees or nest on cliff ledges. It appears that hollows and large abandoned nests of other birds may be used where cliff ledges are limited. Breeds Aug-Dec. Where good habitat occurs, and the density of Peregrine Falcons is high, active nests may occur within 2.5km of each other. The diet of the Peregrine Falcon includes wood duck, pigeons and doves, galahs, rosellas and cockatoo, starlings and larks (Olsen et al. 2006).</p>	Present	Possible visitor

Class	Family Genus species	Vernacular	Status Federal	Stat. WA	Requirements	Presence of habitat	Likelihood of occurrence
MAMMALS	PANDIONIDAE <i>Pandion haliaetus</i>	Osprey	IA	IA	Generally coastal species that feeds on fish. Nests in large trees or on islands, pilons etc (Pizzey and Knight 2007).	Marginal	Unlikely
	PSITTACIDAE <i>Cacatua pastinator</i> <i>subsp. pastinator</i>	Muir's Corella (Western Corella SW WA)	Delisted 2016	S	Nests in the hollows of mature live eucalypts (often lone trees in paddocks or along roadsides). Feeds on the corms of the introduced 'Guildford Grass' or 'Onion Grass' <i>Romulea rosea</i> , <i>Drosera spp.</i> , Orchids, seeding Oat <i>Avena sativa</i> , Winter Grass <i>Poa annua</i> and Clover. Critical habitat comprises large live or dead eucalypts, particularly Marri and Jarrah, Flooded Gum, Yate and Paperbark in forested areas or as lone trees in paddocks and along roadsides in the region from Boyup Brook, McAlinden and Qualeup, south to Lake Muir and the lower Perup River, and east to Frankland and Rocky Gully (DEC 2008).	Suitable	Unlikely
	THRESKIORNITHIDAE <i>Plegadis falcinellus</i>	Glossy Ibis, Black Curlew	M	S	A non-breeding visitor to sw WA, it occurs in well vegetated wetlands, wet pastures, floodwaters, flood plains (Pizzey and Knight 2007).	Marginal	Unlikely
	DASYURIDAE <i>Dasyurus geoffroii</i>	Chuditch	VU	VU	Quolls may occupy a range of habitats including forest, woodland and desert, though in the SW they are largely restricted to Jarrah forest or scattered through the southern and eastern wheat belt (DEC 2010). Current records indicated that this only represents approximately 5% of their former range. Habitat critical to Western Quoll are large areas of undisturbed habitat which a sufficient variety of key food and other resources such as large hollow logs, burrows or small caves at ground level for denning. To be suitable as den sites, logs must have a diameter of at least 30 cm but usually greater than 50 cm, a hollow diameter of 7–20 cm and generally 1m long (Orell & Morris 1994). Annually, an adult female Chuditch will utilise an estimated	Marginal	Unlikely

Class	Family Genus species	Vernacular	Status Federal	Stat. WA	Requirements	Presence of habitat	Likelihood of occurrence
					average of 66 logs and 110 burrows within her home range. A large amount of den sites is required for both sexes. They occupy relatively large home ranges, with males utilizing over 15 km ² and females, 3-4 km ² (Orell & Morris 1994). No local records (Naturemap 2020).		
	<i>Phascogale tapoatafa</i>	Southern Brush-tailed Phascogale	-	S	This arboreal species is found in a variety of forest types. Ideal habitat for this species consists of dry sclerophyll forest and open woodland (Jarrah, Marri, and mixed Jarrah Karri) that contain hollow bearing trees and sparse ground cover. Their many nesting sites include hollow tree limbs, rotten stumps and even birds' nests. Lactating females prefer a large tree cavity with a small entrance with a nest made of bark, feathers and fur. A female's home range covers 20 to 70 hectares, a male's home ranges over laps females and increases during breeding season. It is predominantly carnivorous, foraging on arthropods, invertebrates, small vertebrates and nectar (Strahan 1995).	Present	Possible
	MACROPODIDAE <i>Notamacropus irma</i>	Western Brush Wallaby		P4	Optimum habitat for the Western Brush Wallaby includes open Jarrah forest or woodland and seasonally wet flats with low grasses and scrubby thickets, but also areas of mallee and heathland. Common dietary flora includes <i>Carpobrotus edulis</i> , <i>Cynodon dactylon</i> and <i>Nuytsia floribunda</i> (DEC, 2012). There are no nearby local records in Naturemap (2020) – the closest is in the forested areas to the south several kilometres away.	Marginal	Unlikely
	MURIDAE <i>Hydromys chrysogaster</i>	Water Rat	-	P4	The Water rat is usually found in permanent fresh or brackish water but can be found in marine environments. Fresh water habitats include swamps, lakes, dams even urban drainage swamps. Typically forages close to the shoreline, restricting its movements to shallow water (up to	Marginal	Possible

Class	Family Genus species	Vernacular	Status Federal	Stat. WA	Requirements	Presence of habitat	Likelihood of occurrence
					2 m in depth) (CSIRO, 2004). The nearest records are over 5 km east of the site.		
	PERAMELIDAE <i>Isoodon obesulus fusciventer</i>	Southern Brown Bandicoot	-	P4	Bandicoot habitat consists of dense scrubby, often swampy vegetation with a dense cover up to one metre high particularly near watercourses/wetlands. It often feeds in adjacent forest (Jarrah and Wandoo) and woodlands that are burnt on a regular basis. Nests can be concealed next to or under old logs, shrubs or piles of debris and are made up of ground litter piled up over a shallow depression providing internal chambers. Home ranges vary with population density and range from 5-8.6 ha for males and 1-6 ha for females (DEC 2010). Feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogeous fungi. Their searches for food often create distinctive conical holes in the soil (DECC 2010). There are no nearby local records in Naturemap (2020), the closest are in the forested areas to the south several kilometres away. No evidence observed.	Present	Possible
	PSEUDOCHEIRIDAE <i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	CR	CR	Present populations mostly inhabit Peppermint and Peppermint-Tuart associations from Bunbury to Albany (SPRAT 2018). In dense, coastal Peppermint forest, home ranges are about 0.5 hectares to 1.5 ha and in eucalypt forests about 2.5 ha. In the northern jarrah forests, home ranges are larger and have been recorded to at least 5.6 ha. Peppermint leaves form the basis of the WRP diet in coastal areas (between 79-100% based on a study of WRP near Busselton by Jones et al. 1994), but when unavailable, the dominant myrtaceous species are preferred. In the inland forest, Jarrah and Marri the main food source. Garden plant varieties are also exploited in urban areas.	Present	Scats observed

Class	Family Genus species	Vernacular	Status Federal	Stat. WA	Requirements	Presence of habitat	Likelihood of occurrence
					WRP use a range of nest and shelter sites to avoid predators and exposure to the weather. Dreys are constructed in the canopy if hollows are not available. Adequate nest and shelter sites are necessary components of good quality habitat (Jones 1994, Shedley and Williams 2014). No records within 5km in Naturemap (2020), though scat observed throughout the site in suitable habitat.		
	<i>PERCICHTHYIDAE</i> <i>Nannatherina balstoni</i>	Balston's Pygmy Perch	VU	VU	Balston's Pygmy Perch is a small freshwater fish that grows to a maximum length of around 90 mm (commonly 60 mm). This species is brownish dorsally and silver below, usually with a prominent brown mid-lateral stripe and a series of vertical brown bars on sides giving a cross-hatched pattern. Balston's Pygmy Perch inhabits acidic, tannin-stained freshwater pools, streams and lakes in peat flats within 30 km of the coast of south-west WA, preferring shallow water, and commonly associated with tall sedge thickets and inundated riparian vegetation (SPRAT 2018) (Bray et al. 2018). Associated with slow-flowing, low salinity, acidic and tannin-stained waters, and complex instream habitat – recorded locally (DWER 2020). No nearby records.	Absent	Nil
	<i>BOTHRIEMBRYONTID</i> AE <i>Bothriembryon</i> <i>irvineanus</i>	Irvine's bothriembryontid land snail (Cape Naturaliste) P2	P2	-	On bushes, open scrub, open heath. Among loose leaf litter and on limestone pebbles. Plain with dark grey, sandy soil. Burned within previous 5 years. Open marri (<i>Corymbia calophylla</i>) woodland with scattered jarrah (<i>Eucalyptus marginata</i>), over <i>Xanthorrhoea preissii</i> , <i>Kingia australis</i> , <i>Hypocalymma angustifolium</i> and <i>Hibbertia cf. hypericoides</i> , over sedges and herbs. They were found on grey sandy soils in open marri-jarrah woodland, often under fallen branches or among leaf litter near small grasses. <i>Bothriembryon irvineanus</i> was observed on damp, decomposing marri leaf litter that appeared to have been rasped. Introduced plants,	Marginal	Unlikely due to low local records and degraded site.

Class	Family Genus species	Vernacular	Status Federal	Stat. WA	Requirements	Presence of habitat	Likelihood of occurrence
					e.g. <i>Zantedeschia aethiopica</i> (arum lily), and land snails e.g. <i>Prietocella barbara</i> (WAM S99129) were noted on the edges of the site. Recorded at Ambergate Reserve (whisson 2019).		
	<i>HYRIIDAE</i> <i>Westralunio carteri</i>	Carters Freshwater Mussel	VU	VU	Carters Freshwater Mussel is the only freshwater mussel found in southwest WA. It is a bivalve found in freshwater streams, rivers, billabongs, ponds, wetlands and lakes inland from the coast mostly areas with muddy, silty and sandy bottoms and flowing permanent water. Tracks can be seen along banks and sandy/muddy patches of stream bed where they are present. Native fish are critical to the Mussel's lifecycle - larval mussels attach themselves to native fish to spread their population and develop into juvenile mussels. Mussels move along the bottom using a muscular tongue-like appendage known as a foot. Unlike their marine and estuarine cousins, they do not attach to structures. (Murdoch University, 2010). Not observed at the site and probably unlikely due to the lack of suitable habitat – pools and fish.	Marginal	Unlikely
	<i>PARASTACIDAE</i> <i>Cherax tenuimanus</i>	Margaret River hairy marron	CR	CR	The Hairy Marron only occurs in the Margaret River and upper headwaters in the SW of WA. Prefers fresh, highly oxygenated, clear-water habitats of the Margaret River, with complex shelter including large woody debris which it also utilises as a food source. It is omnivorous, feeding on both plant and animal matter (DWER 2020). Not modelled as likely to be found locally (DWER 2020)	Marginal	Nil
	<i>Engaewa pseudoreducta</i>	Margaret River Burrowing Crayfish	CR	CR	The Margaret River Burrowing Crayfish is endemic to southwest WA and occurs in two subpopulations, Treeton and Payne Road. At Treeton, it occurs in and adjoining State Forest No. 62 (Burnham 2014), in swampy headwaters of a tributary of the	Marginal	Unlikely, Extremely restricted range.

Class	Family Genus species	Vernacular	Status Federal	Stat. WA	Requirements	Presence of habitat	Likelihood of occurrence
					Margaret River, Osmington, about 9km north west of the site (Naturemap 2020). A burrow was found in the Bramley National Park. It is known from two sites in the area with individuals collected in 2003 and 2007 (Burnham et al. 2012). At Payne Road, the species occurs in Caribunup River catchment (south-east of Dunsborough), 16 km north of the Treeton Reserve sites (Burnham et al. 2012). No characteristic chimneys were observed though the species' cryptic, burrowing nature, the difficulty seeing and accessing burrows in often dense vegetation make it difficult to survey for.		
	<i>Engaewa reducta</i>	Dunsborough Burrowing Crayfish	CR	CR	The Dunsborough Burrowing Crayfish uses a variety of habitats that provide moist sandy/loamy soils and an accessible water table. These include vegetated seepages, swamp plains and swampy headwaters of streams (CALM 2008) (Burnham et al 2012). There are no records within the catchment (Naturemap 2020).	Marginal	Nil
	TETTIGONIIDAE <i>Pachysaga strobila</i>	Vasse Pachysaga	-	P1	The Vasse Pachysaga is known only from its type specimen with attempts to locate more all unsuccessful. Found near Vasse, the large, cumbersome Vasse Pachysaga is a relatively large component of the katydid fauna, mostly confined to the southern half of the continent in heath or mixed woodland. <i>P. strobila</i> is the most unusual of its genus in that it lacks a hind wing. All other Pachysaga species have either a distinctive red, yellow or grey hind wing ('The Conversation' website, http://theconversation.com/australian-endangered-species-katydids-12938 , accessed 2015).	Marginal	Unlikely

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Appendix F Suitable DBH Trees

Table 6-1 Summary of hollows based on black cockatoo breeding habitat requirements

Eastings	Northing	ID	Tree	DBH cm	Hollows	H1 size	H1 type	H1 height	Notes	BC suitability
340089	6266285	131	dead	50_75	1	15_20	spout angle suitable	<10m	chews current, potentially suitable breeding	Suitable with evidence of use
340096	6266137	140	dead	50_75	1	10_15cm	vertical	<10m	blocked or contains debris	Unlikely to be suitable
340096	6266518	151	dead	50_75	1	20cm_plus	vertical	<10m	Possibly just snap	Unlikely to be suitable
339676	6262654	80	jarrah	50_75	1	10_15cm	spout angle suitable	<10m	Possibly just snap	Unlikely to be suitable
339644	6264233	99	marri	>100	1	20cm_plus	vertical	<10m	bees	Unlikely to be suitable
339815	6264901	104	marri	75_100	1	<10cm	knot angle suitable	<10m	chews current	Unlikely to be suitable
339819	6264940	105	marri	75_100	1	10_15cm	Fissure not suitable	<10m	Fissure not suitable	Unlikely to be suitable
339871	6265113	110	marri	50_75	1	<10cm	knot angle suitable	<10m	chews current	Unlikely to be suitable
339967	6265504	116	marri	>100	1	20cm_plus	spout angle suitable	<10m	no evidence of use	Suitable with evidence of use
340108	6266116	123	marri	50_75	1	<10cm	spout angle not suitable	<10m	no evidence of use	Unlikely to be suitable
340098	6266157	138	marri	75_100	1	<10cm	knot angle suitable	10_15m	chews current	Unlikely to be suitable
340073	6267415	158	marri	>100	1	20cm_plus	knot angle suitable	<10m	bees	Unlikely to be suitable
340066	6267568	166	blackbutt	75_100	1	20cm_plus	knot angle suitable	<10m	potentially suitable breeding, chews current	Suitable with evidence of use

Table 6-2 Suitable DBH trees within the study area

Easting	Northing	ID	Tree	DBH cm	Hollows	H1 size	H1 type	H1 height	Notes	H2 size	H2 type	H2 height	Notes
339677	6262639	77	dead	50_75									
340089	6266285	131	dead	50_75	1	15_20	spout angle suitable	<10m	chews current, potentially suitable breeding				
340110	6266119	124	dead	50_75									
340108	6266182	126	dead	50_75									
340096	6266137	140	dead	50_75	1	10_15cm	vertical	<10m	blocked or contains debris				
340096	6266518	151	dead	50_75	1	20cm_plus	vertical	<10m	Possibly just snap				
340064	6267881	187	dead	50_75									
339676	6262654	80	jarrah	50_75	1	10_15cm	spout angle suitable	<10m	Possibly just snap				
340096	6266510	150	jarrah	50_75									
340067	6267727	192	jarrah	50_75									
339644	6264233	99	marri	>100	1	20cm_plus	vertical	<10m	bees				
339677	6262592	75	marri	50_75									
339679	6262601	76	marri	75_100									
339677	6262640	78	marri	50_75									
339677	6262640	79	marri	50_75									
339815	6264901	104	marri	75_100	1	<10cm	knot angle suitable	<10m	chews current				
339679	6262657	81	marri	50_75									
339674	6262666	82	marri	50_75									
339675	6262667	83	marri	50_75									
339674	6262680	84	marri	50_75									
339673	6262725	85	marri	50_75									
339672	6262740	86	marri	50_75									
339675	6262771	87	marri	50_75									
339665	6262693	88	marri	50_75									
339673	6262819	89	marri	50_75									
339674	6262830	90	marri	50_75									
339665	6262851	91	marri	50_75									

Easting	Northing	ID	Tree	DBH cm	Hollows	H1 size	H1 type	H1 height	Notes	H2 size	H2 type	H2 height	Notes
339658	6263878	92	marri	50_75									
339658	6263901	93	marri	50_75									
339642	6264151	94	marri	50_75									
339643	6264194	95	marri	50_75									
339651	6264198	96	marri	50_75									
339642	6264211	97	marri	50_75									
339640	6264218	98	marri	50_75									
339819	6264940	105	marri	75_100	1	10_15cm	Fissure not suitable	<10m					
339670	6264328	100	marri	50_75									
339749	6264655	101	marri	50_75									
339805	6264845	102	marri	50_75									
339807	6264877	103	marri	50_75									
339871	6265113	110	marri	50_75	1	<10cm	knot angle suitable	<10m	chews current				
339967	6265504	116	marri	>100	1	20cm_plus	spout angle suitable	<10m	no evidence of use				
339803	6264882	106	marri	50_75									
339802	6264869	107	marri	>100									
340108	6266116	123	marri	50_75	1	<10cm	spout angle not suitable	<10m	no evidence of use				
339868	6265144	111	marri	50_75									
339875	6265164	112	marri	50_75									
339941	6265385	113	marri	50_75									
339949	6265457	114	marri	50_75									
339941	6265438	115	marri	50_75									
339981	6265558	117	marri	50_75									
339971	6265559	118	marri	50_75									
340018	6265745	119	marri	50_75									
340018	6265750	120	marri	50_75									
340038	6265842	120	marri	50_75									
340109	6266105	122	marri	50_75									
340098	6266157	138	marri	75_100	1	<10cm	knot angle suitable	10 15m	chews current				
340102	6266174	125	marri	50_75									
340106	6266201	127	marri	50_75									

Easting	Northing	ID	Tree	DBH cm	Hollows	H1 size	H1 type	H1 height	Notes	H2 size	H2 type	H2 height	Notes
340107	6266213	128	marri	50_75									
340106	6266223	129	marri	50_75									
340094	6266334	130	marri	50_75									
340102	6266237	132	marri	50_75									
340099	6266232	133	marri	50_75									
340097	6266230	134	marri	50_75									
340101	6266208	135	marri	50_75									
340102	6266174	136	marri	50_75									
340101	6266163	137	marri	50_75									
340098	6266152	139	marri	50_75									
340073	6267415	158	marri	> 100	1	20cm_plus	knot angle suitable	<10m	bees				
340099	6266119	141	marri	50_75									
340095	6266105	142	marri	50_75									
340098	6266084	143	marri	> 100									
340086	6266548	144	marri	50_75									
340092	6266515	145	marri	50_75									
340089	6266509	146	marri	50_75									
340101	6266497	147	marri	50_75									
340102	6266498	148	marri	50_75									
340101	6266500	149	marri	50_75									
340098	6266533	152	marri	50_75									
340100	6266534	153	marri	50_75									
340101	6266535	154	marri	50_75									
340100	6266539	155	marri	50_75									
340100	6266563	156	marri	50_75									
340100	6266563	157	marri	50_75									
340087	6267439	159	marri	50_75									
340075	6267484	160	marri	50_75									
340072	6267584	167	marri	50_75									
340078	6267599	168	marri	> 100									
340079	6267630	170	marri	50_75									
340077	6267656	171	marri	50_75									

Easting	Northing	ID	Tree	DBH cm	Hollows	H1 size	H1 type	H1 height	Notes	H2 size	H2 type	H2 height	Notes
340076	6267661	172	marri	50_75									
340076	6267668	173	marri	50_75									
340070	6267692	174	marri	50_75									
340070	6267693	175	marri	50_75									
340067	6267727	177	marri	50_75									
340076	6267736	178	marri	50_75									
340074	6267744	179	marri	50_75									
340074	6267749	180	marri	50_75									
340070	6267797	181	marri	75_100									
340068	6267871	185	marri	75_100									
340072	6267895	183	marri	50_75									
340069	6267933	184	marri	50_75									
340061	6267898	186	marri	50_75									
340066	6267700	194	marri	50_75									
340071	6267623	195	marri	50_75									
340070	6267620	196	marri	50_75									
339846	6265008	108	bullich	50_75									
339849	6265021	109	bullich	50_75									
340066	6267568	166	blackbutt	75_100	1	20cm_plus	knot angle suitable	<10m	potentially suitable breeding, chews current				
340083	6267500	161	blackbutt	50_75									
340083	6267541	162	blackbutt	50_75									
340087	6267542	163	blackbutt	50_75									
340079	6267564	164	blackbutt	75_100									
340072	6267551	165	blackbutt	50_75									
340078	6267613	169	blackbutt	50_75									
340072	6267696	176	blackbutt	50_75									
340062	6267909	185	blackbutt	75_100									
340066	6267869	188	blackbutt	50_75									
340067	6267806	189	blackbutt	50_75									
340065	6267799	190	blackbutt	50_75									

Easting	Northing	ID	Tree	DBH cm	Hollows	H1 size	H1 type	H1 height	Notes	H2 size	H2 type	H2 height	Notes
340064	6267781	191	blackbutt	50_75									
340068	6267720	193	blackbutt	50_75									
340070	6267599	197	blackbutt	50_75									

Appendix G Flora recorded

Family	Genus	Species	Weed	Conservation	Site	Height	Cover	Site	Height	Cover	Site	Height	Cover	Site	Height	Cover	Site	Height	Cover
Anarthriaceae	Anarthria	prolifera															5		+
Anarthriaceae	Lyginia	barbata									3	0.8	8				5	0.4	5
Apiaceae	Daucus	glochidiatus															5		<1
Araceae	Zantedeschia	aethiopica	*		1	0.6	<1	2	0.8	1				4	1	1			
Asparagaceae	Asparagus	asparagoides	*											4		+			
Asparagaceae	Lomandra	purpurea						2	0.3	<1									
Asparagaceae	?Laxmania	sessiliflora									3		+						
Asparagaceae	Sowerbaea	laxiflora									3		<1						
Asparagaceae	Thysanotus	manglesii									3		<1				5		<1
Asteraceae	Arctotheca	calendula	*		1	0.1	<1	2	0.2	<1				4		+			
Asteraceae	Hypochaeris	glabra	*					2	0.1	<1	3	0.1	<1				5	0.1	<1
Asteraceae	Sonchus	oleraceus	*					2		+									
Asteraceae	Ursinia	anthemoides	*								3	0.4	2				5	0.2	<1
Casuarinaceae	Allocasuarina	fraseriana									3	8	4				5	15	2
Casuarinaceae	Allocasuarina	humilis			1		+												
Casuarinaceae	Allocasuarina	thuyoides			1		+												
Colchicaceae	Burchardia	congesta									3	0.5	1				5		<1
Colchicaceae	Burchardia	multiflora			1	0.3	<1												
Cyperaceae	Lepidosperma	pubisquamatum						2	0.3	<1									
Cyperaceae	Lepidosperma	squamata															5		<1
Cyperaceae	Mesomelaena	stygia	subsp.	stygia	LS	1	+												
Cyperaceae	Tetraria	capillaris						2		+									
Cyperaceae	Tetraria	octandra						2	0.4	<1									

Family	Genus	Species	Weed	Conservation	Site	Height	Cover	Site	Height	Cover	Site	Height	Cover	Site	Height	Cover	Site	Height	Cover
Dasypogonaceae	<i>Dasypogon</i>	<i>bromeliifolius</i>									3	0.4	12				5	0.5	30
Dasypogonaceae	<i>Kingia</i>	<i>australis</i>			1		+							4		+			
Dennstaedtiaceae	<i>Pteridium</i>	<i>esculentum</i>						2		+									
Dilleniaceae	<i>Hibbertia</i>	<i>cunninghamii</i>			1		+												
Dilleniaceae	<i>Hibbertia</i>	<i>hypericoides</i>									3		+				5		+
Droseraceae	<i>Drosera</i>	<i>sp.</i>															5		<1
Epacridaceae	<i>Leucopogon</i>	<i>australis</i>												4		+			
Fabaceae	<i>Acacia</i>	<i>extensa</i>						2		+									
Fabaceae	<i>Acacia</i>	<i>incurva</i>			1	0.5	1												
Fabaceae	<i>Acacia</i>	<i>pulchella</i>									3	0.6	<1	4		+	5		<1
Fabaceae	<i>Acacia</i>	<i>semitrullata</i>		P4							3		<1				5	0.5	1
Fabaceae	<i>Acacia</i>	<i>stenoptera</i>															5		<1
Fabaceae	<i>Dillwynia</i>	<i>uncinata</i>															5		+
Fabaceae	<i>Gastrolbium</i>	<i>praemorsum</i>						2	0.4	1									
Fabaceae	<i>Gomphilobium</i>	<i>knightianum</i>															5		<1
Fabaceae	<i>Hardenbergia</i>	<i>comptoniana</i>						2	T	2				4		+			
Fabaceae	<i>Jacksonia</i>	<i>furcellata</i>									3		<1						
Goodeniaceae	<i>Dampiera</i>	<i>linearis</i>			1	0.2	<1	2	0.2	<1							5		+
Hemerocallidaceae	<i>Tricoryne</i>	<i>elator</i>			1	0.3	<1												
Iridaceae	<i>Freesia</i>	<i>alba x leichtlinii</i>		*	1	0.4	2				3		1	4	0.3	10	5	0.4	<1
Iridaceae	<i>Patersonia</i>	<i>occidentalis</i>																	
Iridaceae	<i>Patersonia</i>	<i>umbrosa</i>	var.	<i>xanthina</i>							3		2						
Iridaceae	<i>Romulea</i>	<i>rosea</i>		*							3		<1						

Family	Genus	Species	Weed	Conservation	Site	Height	Cover	Site	Height	Cover	Site	Height	Cover	Site	Height	Cover	Site	Height	Cover
Juncaceae	Juncus	pallidus												4	1.5	2			
Loranthaceae	Nuytsia	floribunda			1		+				3	4	4				5	4	1
Myrtaceae	Agonis	flexuosa						2	15	5	3	10	10				5	3	2
Myrtaceae	Astartea	scoparia			1	1	5												
Myrtaceae	Beaufortia	squarrosa															5	0.5	2
Myrtaceae	Calothamnus	quadrifidus	subsp.	teretifolius				P4						4		+			
Myrtaceae	Corymbia	calophylla						2	30	60				4	25	25			
Myrtaceae	Eucalyptus	marginata						2		+	3	10	2				5	6	2
Myrtaceae	Hypocalymma	angustifolium			1	0.5	3							4		+			
Myrtaceae	Kunzea	glabrescens															5	3	70
Myrtaceae	Melaleuca	incana			1	1.2	4												
Myrtaceae	Melaleuca	preissiana			1	6	2	2		+				4	6	4			
Myrtaceae	Melaleuca	thymoides									3		1						
Myrtaceae	Pericalymma	ellipticum			1		+												
Myrtaceae	Taxandria	linearis												4		+			
Orchidaceae	Caladenia	flava									3		+				5		<1
Oxalidaceae	Oxalis	pes-caprae	*					2		+									
Poaceae	Avena	fatua	*		1	0.4	10	2	0.8	3				4	0.4	20			
Poaceae	Briza	maxima	*								3		+				5		<1
Poaceae	Cenchrus	clandestinus	*											4	0.4	15			
Poaceae	Ehrharta	calycina	*					2	0.5	70	3		2	4	0.5	5			
Poaceae	Eragrostis	curvula	*		1	0.6	4												
Poaceae	Lolium	sp.	*		1	0.1	2	2	0.3	<1				4		+			
Poaceae	Tetrarrhena	laevis						2	0.3	<1									
Proteaceae	Banksia	dallanneyi												4		+			

Family	Genus	Species	Weed	Conservation	Site	Height	Cover	Site	Height	Cover	Site	Height	Cover	Site	Height	Cover	Site	Height	Cover	
Proteaceae	Adenanthos	meisneri																	5	+
Proteaceae	Grevillea	brachystylis	subsp.	grandis		T	1			+										
Proteaceae	Hakea	ceratophylla					1			+										
Proteaceae	Hakea	lissocarpha							2				+							
Proteaceae	Hakea	marginata			LS		1	1		5										
Proteaceae	Hakea	varia					1	0.8		1				4				+		
Proteaceae	Persoonia	longifolia									2			+						
Proteaceae	Petrophile	squamata					1	1.2		2										
Proteaceae	Synaphea	petiolaris	subsp.	triloba			1			+										
Restionaceae	Hypolaena	exsulca																5	0.3	<1
Restionaceae	Leptocarpus	coangustatus					1			+										
Restionaceae	Loxocarya	magna			P3		1			+										
Rutaceae	Philotheca	spicata																5		+
Stylidiaceae	Stylidium	?lowrieianum			P3								3		<1					
Stylidiaceae	Stylidium	scandens											3		<1			5		+
Xanthorrhoeaceae	Chamaescilla	corymbosa											3		<1			5		<1
Xanthorrhoeaceae	Xanthorrhoea	gracilis							2	0.6		1								
Xanthorrhoeaceae	Xanthorrhoea	preissii					1	1.5		2				4	2	6				
Zamiaceae	Macrozamia	riedlei											3		+					