# Shire of Toodyay

# Bindi Bindi-Toodyay Rd Flora and Vegetation Survey, and Black Cockatoo Habitat Assessment

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Ngala kaaditj Noongar moort keyen kaadak nidja boodja.
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**System Certifications**

Environmental management system registered to ISO 14001:2015
Quality management system registered to ISO 9001:2015
Occupational health and safety management system registered to ISO 45001:2018

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| V1 | May 2024 | Final | | KG | Released |
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# Executive Summary

Natural Area Consulting Management Services (Natural Area) was commissioned by the Shire of Toodyay to undertake a spring flora and vegetation survey, and a black cockatoo habitat assessment for an area along Bindi Bindi-Toodyay Road, Bejoording. The outcome of the survey will be used to inform stakeholders of the environmental values of the site prior to proposed clearing for road upgrade works.

The survey aimed to determine:

- flora species present (native and non-native)
- vegetation type and condition
- the presence and location of declared rare or priority flora, fauna and/or ecological communities
- presence of habitat trees for black cockatoos.

The flora and vegetation survey within the site identified:

- 47 flora species from 15 families, comprised of 28 introduced (weeds), 17 native species and two species (*Eucalyptus* sp. and *Austrostipa* sp.) of an unknown status due to an inability to be identified to a species level
- no declared pests or Weeds of National Significance present
- no threatened or priority species recorded during the 2023 survey
- one vegetation type recorded across the survey area: *Eucalyptus loxophleba* Open Woodland
- vegetation condition of completely degraded across the entire survey area
- the presence of one threatened ecological community: *Eucalyptus Woodlands of the Western Australian Wheatbelt*.

The black cockatoo habitat assessment within the site identified:

- a total of 70 trees that satisfied the Commonwealth guidelines for potential black cockatoo habitat trees (DBH ≥ 300 mm), 20 of which had a DBH ≥ 500 mm
- ten potential black cockatoo habitat trees were observed to contain hollows; however all had a diameter too small for black cockatoo habitation (< 100 mm)
- five bird nests across four trees
- one hollow occupied by a Boobook Owl (*Ninox boobook*).

A number of minor limitations were present for the survey which may have a bearing on the results for the flora and fauna surveys of the site.

# Contents

# 1.0 Introduction

Natural Area Consulting Management Services (Natural Area) was commissioned by the Shire of Toodyay (the Shire) to conduct a detailed flora and vegetation survey, and black cockatoo habitat assessment along Bindi Bindi-Toodyay Rd. Information gathered during these surveys will be used to inform the Shire of the environmental values within the area.

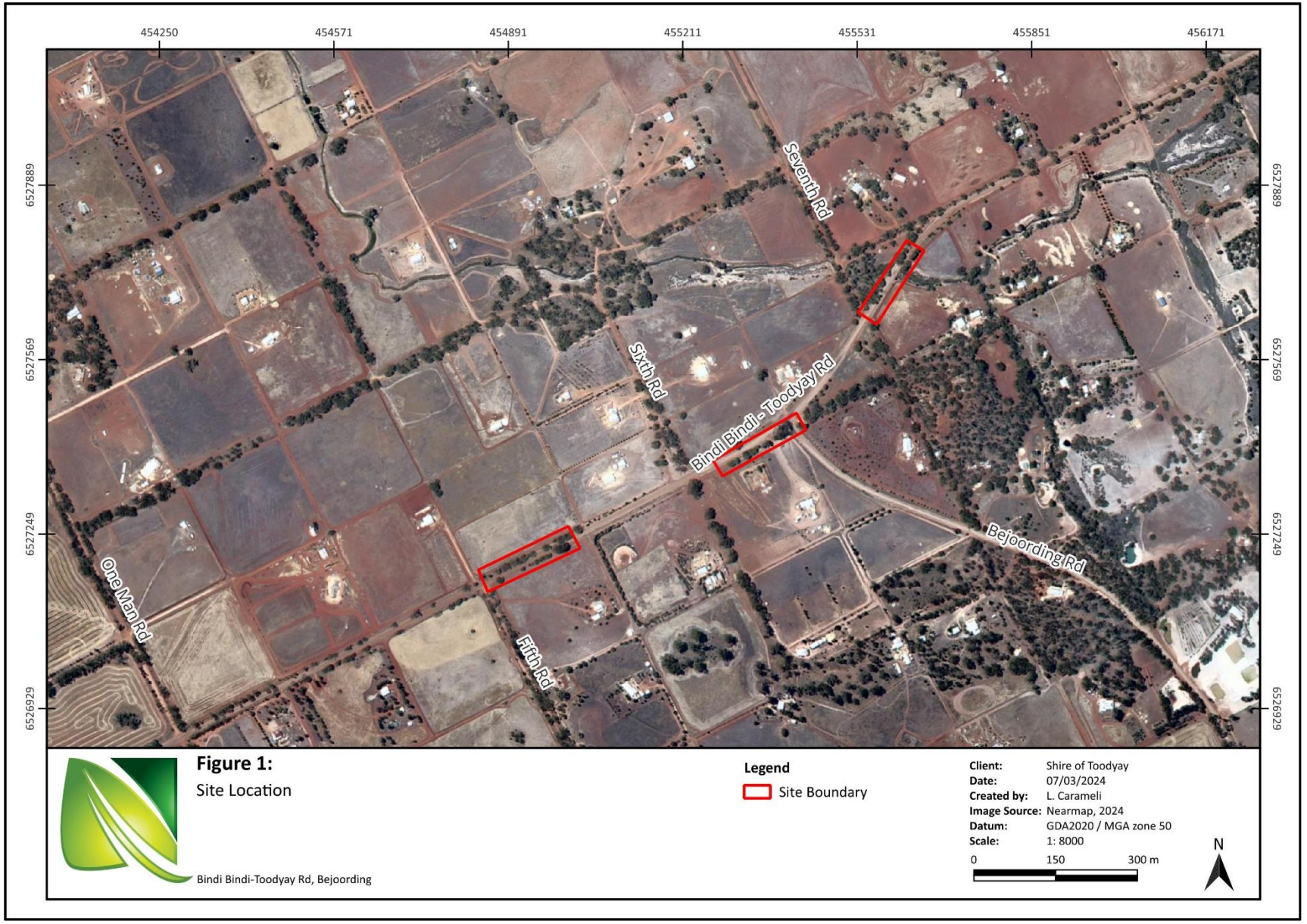
## 1.1 Location

The survey area is located centrally within the town of Bejoording, approximately 19 km north-east of the Toodyay townsite. The survey area consists of three sections of roadside vegetation along Bindi Bindi-Toodyay Rd between Fifth Rd and Tenth Rd totalling an area of approximately 2.06 ha (Figure 1).

## 1.2 Scope

Natural Area undertook a detailed flora and vegetation survey, and black cockatoo habitat assessment in an area along Bindi Bindi-Toodyay Rd. The scope of these works included the following:

- a desktop assessment to gain contextual knowledge about site characteristics including undertaking searches of the Department of Biodiversity, Conservation, and Attractions (DBCA) databases, NatureMap, and Protected Matters Search Tool to identify potential conservation significant flora species and any threatened or priority ecological communities
- a Birdlife Australia black cockatoo database search to identify any roosting/nesting sites present
- a detailed flora and vegetation survey including the establishment of three quadrats/transects per vegetation type present in accordance with *EPA Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (2016)
- identification and mapping of any threatened, priority or other significant flora species (DRF) listed under the *Environment Protection and Biodiversity Conservation* (*EPBC*) *Act 1999* (Cwlth) and the *Biodiversity Conservation* (BC) *Act 2016* (WA)
- identification and mapping of any declared pests and Weeds of National Significance (WoNS)
- a black cockatoo habitat assessment undertaken in accordance with *Referral guideline for 3 WA threatened black cockatoo species* (Department of Agriculture, Water and Environment (DAWE), 2022) to identify and record trees with a diameter at breast height (DBH) of ≥300 mm, with the following recorded:
    - species
    - condition and health
    - DBH
    - presence, size, type (e.g., chimney, side) and approximate height of suitable hollows
    - evidence of feeding (via presence of chewed fruit)
- presentation of findings in a formal report, and provision of maps representing assessment outcomes
- preparation of GIS shapefiles in IBSA format.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Seventh Rd
Sixth Rd
Bindi Bindi - Toodyay Rd
Bejoording Rd
One Man Rd
Fifth Rd
Figure 1:
Site Location
Bindi Bindi-Toodyay Rd, Bejoording
Legend
Site Boundary
Client: Shire of Toodyay
Date: 07/03/2024
Created by: L. Carameli
Image Source: Nearmap, 2024
Datum: GDA2020 / MGA zone 50
Scale: 1: 8000
0
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300 m
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# 2.0 Site Characteristics

The characteristics of a site have a strong bearing on the flora, vegetation, fauna, and ecological communities present. The key characteristics of the survey area at Bindi Bindi-Toodyay Rd are outlined in this section.

## 2.1 Regional Context

The site is located within the Avon Wheatbelt 2 (AVW02) IBRA subregion (Department of Primary Industries and Regional Development (DPIRD), 2024). This region is characterised by gently undulating landscapes. Soils are generally comprised of lateritic uplands and sandplain lowlands formed in colluvium or in-situ weathered rock. Mixed *Eucalyptus* spp. woodlands with *Allocasuarina huegeliana,* and *Acacia acuminata-Eucalyptus loxophleba* woodlands are typical of this area (Beecham, 2001).

## 2.2 Climate

The climate experienced in the area is Mediterranean, with hot, dry summers and cool, wet winters. According to the Bureau of Meteorology (2024); Goomalling, site number 010058, 2024, the region has an average:

- rainfall of 368.0 mm pa, with rain falling predominantly between May and August
- maximum temperatures ranging from 17.7 $^{o}$C in winter to 33.3 $^{o}$C in summer, with a maximum recorded temperature of 46.9 $^{o}$C
- minimum temperatures ranging from 6.9 $^{o}$C in winter to 16.3 $^{o}$C in summer, with a minimum recorded temperature of -1.5 $^{o}$C
- predominant wind directions include morning easterlies from spring to autumn and north-westerly breezes during the winter months, with an average annual morning wind speed of 8.3 km/h and gusts of more than 100 km/h.

## 2.3 Topography and Soils

Using the NRInfo Portal, one soil type was identified on site, the Jelcobine York subsystem (256JcYO). This soil type is described as an area of soils derived from freshly exposed rock, typified by Avon Valley red soils and similar but usually greyer and lighter textured soils east of the valley (DPIRD, 2024). The site ranges from 216 m Australian Height Datum (AHD) in the north-east corner and gently rises to 222 m AHD in the south-west (DPRID, 2024) (Figure 2).

## 2.4 Vegetation Complex

One pre-European vegetation complex exists within the site boundary: York_352. Its presence in the Wheatbelt is described as consisting of a mix of *Eucalyptus loxophleba* and *E. salmonophloia* (DPIRD, 2024).

The pre-European extent of this vegetation complex remaining is:

- 19.61% within Western Australia
- 13.83% within the Shire of Toodyay (Government of Western Australia, 2019).

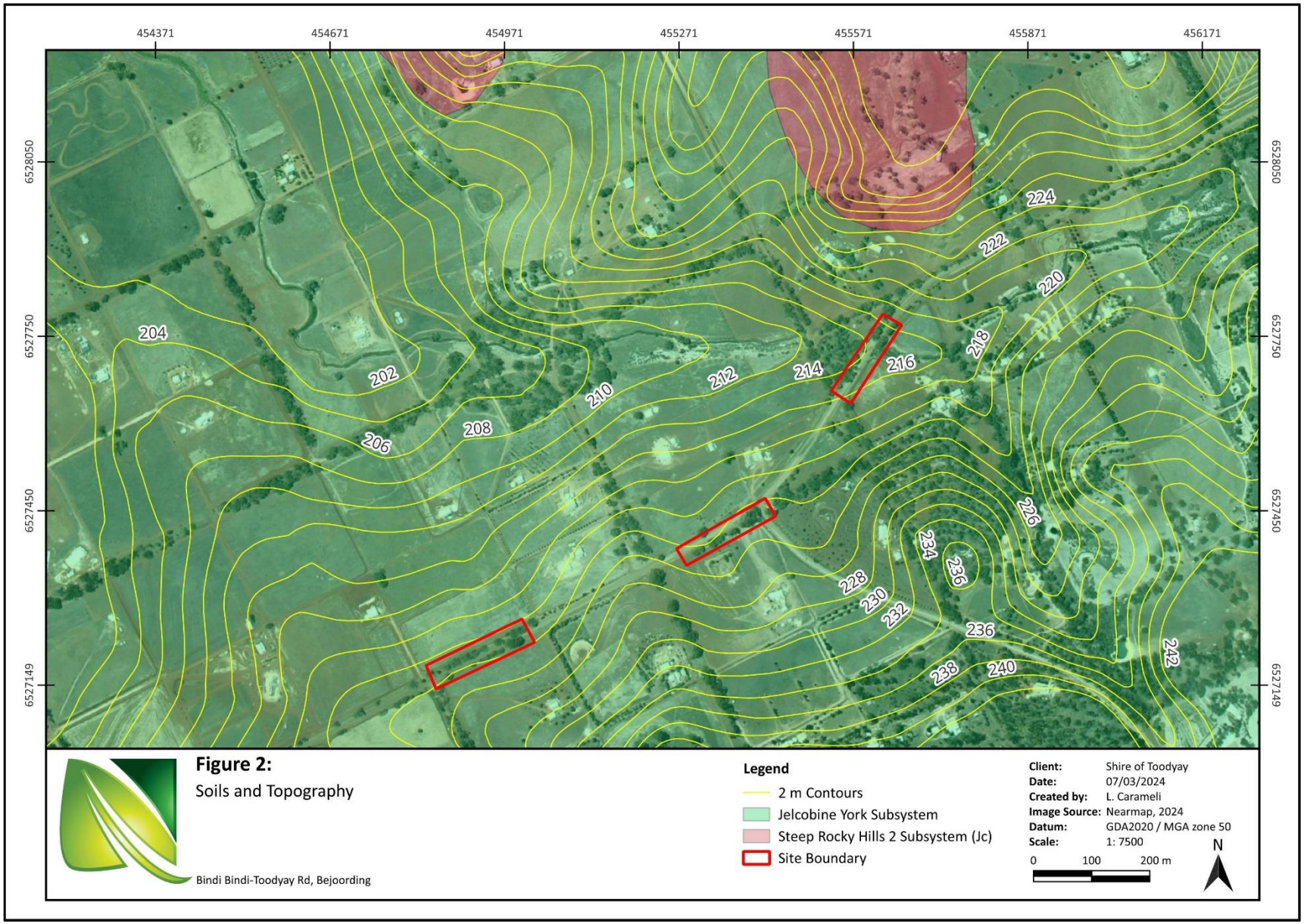
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Figure 2:
Soils and Topography
Bindi Bindi-Toodyay Rd, Bejoording
Legend
2 m Contours
Jelcobine York Subsystem
Steep Rocky Hills 2 Subsystem (Jc)
Site Boundary
Client: Shire of Toodyay
Date: 07/03/2024
Created by: L. Carameli
Image Source: Nearmap, 2024
Datum: GDA2020 / MGA zone 50
Scale: 1: 7500
0 100 200 m
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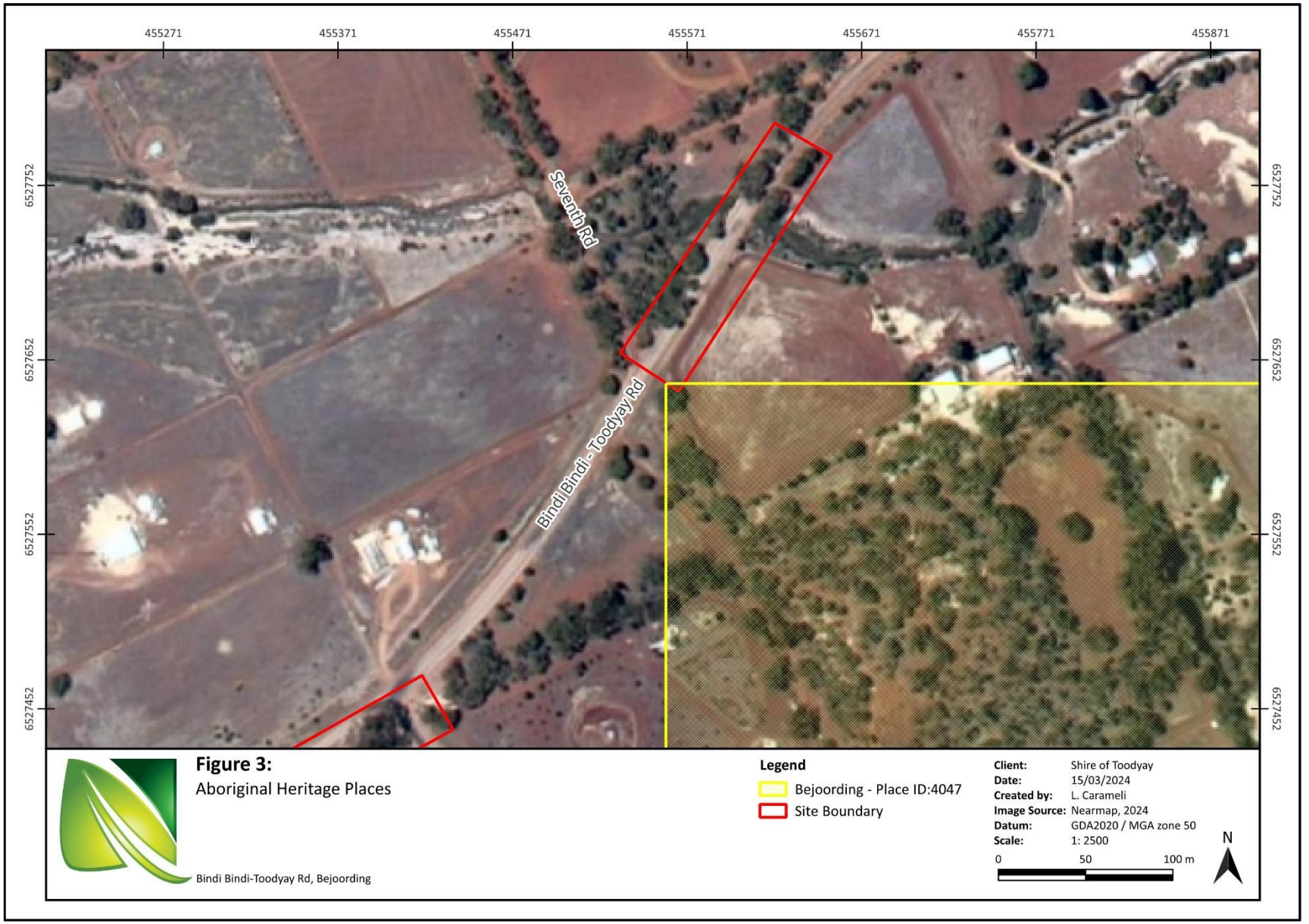
## 2.5 Black Cockatoo Habitat

There is the potential for two of the three threatened black cockatoos and their habitat to occur on site, including the Carnaby's Cockatoo (*Zanda latirostris*) listed as Endangered under the *EPBC Act*, and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*). Both are listed as Threatened under the *BC Act*. According to NationalMap the survey site occurs within:

- 4.5 km of Carnaby's Cockatoo Confirmed Breeding Areas within the Swan Coastal Plain and Jarrah Forest IBRA region (DBCA-054) (DBCA, 2018a)
- 8.5 km of Black Cockatoo Breeding Sites – Buffered (DBCA-063)(DBCA, 2019a)
- 10 km of known black cockatoo breeding hollows (DBCA, 2024c)
- 18 km of a black cockatoo roost site (DBCA, 2024c).

## 2.6 Heritage Values

One registered site of Aboriginal heritage, under the *Aboriginal Heritage Act 1972*, occurs within the survey area. This is listed as Bejoording Place ID: 4047. It is described as a place of camp, meeting and ochre (DPLH, 2024). The north-east corner of this heritage site is located along Bindi Bindi-Toodyay road across the road from the entrance to Seventh Rd. The survey area slightly overlaps this corner of the heritage site (Figure 3). No trees are contained within this overlapping area. No sites of European heritage were recorded as occurring within the survey area (Government of Western Australia, 2024).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455671
455771
455871
6527752
6527652
6527552
6527452
Seventh Rd
Bindi Bindi - Toodyay Rd
Figure 3:
Aboriginal Heritage Places
Bindi Bindi-Toodyay Rd, Bejoording
Legend
Bejoording - Place ID:4047
Site Boundary
Client: Shire of Toodyay
Date: 15/03/2024
Created by: L. Carameli
Image Source: Nearmap, 2024
Datum: GDA2020 / MGA zone 50
Scale: 1: 2500
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# 3.0 Methodology

## 3.1 Desktop and Literature Review

The desktop survey included reviewing online databases to gather contextual knowledge and determine preliminary site characteristics including:

- likely native and non-native flora and fauna species present
- current extent of native vegetation
- general floristic community types
- likely presence of threatened or priority flora, fauna and/or ecological communities.

The following databases were accessed to obtain relevant information:

- NatureMap (DBCA, 2024a)
- Protected Matters Search Tool (Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2024) (Appendix 1)
- FloraBase (WA Herbarium, 1998-)
- Threatened and priority flora/ecological community database searches (DBCA, 2024b; DBCA, 2024c)
- Birdlife Australia Black Cockatoo database search (DBCA, 2024c).

Information relating to conservation significant species from database searches were summarised into field reference guides to aid with the on-ground flora survey which is provided in Appendix 2. Conservation code definitions for the State and Commonwealth are provided in Appendix 3.

## 3.2 On-ground Flora Survey

### 3.2.1 Detailed Flora

The flora and vegetation surveys were conducted in accordance with *Technical Guidance-Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016). Samples were collected, or photographs taken of unfamiliar species to enable later identification.

Natural Area environmental scientists undertook the survey on 10 November 2023, with key data recorded using Mappt software on a handheld tablet. Survey activities included:

- setting out a total of three 50 x 2 m quadrats across the three areas that make up the survey site (Figure 1)
- photographing each quadrat and recording GPS coordinates using GDA2020 Zone 50 datum
- recording landscape characteristics including soil types/colour, aspect, slope, surface rock, topography and drainage using Natural Area's modified recording sheets based on the NAIA templates developed for the Perth Biodiversity Project
- determining leaf litter depth, percentage cover, and percentage of bare ground
- recording percentage cover and height for each flora species in the quadrats
- marking locations of any conservation significant flora, declared pests and/or WoNS identified
- recording vegetation type including dominant over, middle and understorey species (Table 1) and condition using the scale attributed to Keighery (Table 2) (Government of Western Australia, 2000)
- the use of GPS to map significant species and boundaries of differing vegetation type and condition
- recording evidence of disturbance, such as fire.

### 3.2.2 Vegetation Type

The vegetation type was determined using the structural classes described in *Bush Forever Volume 2* (Government of Western Australia, 2000), and records dominant over, middle and understorey species. A description of the various structural classes is provided in Table 1.

**Table 1:** Vegetation structural classes

| Life Form/Height Class | Canopy Percentage Cover | | | |
|---|---|---|---|---|
| | **100 – 70%** | **70 – 30%** | **30 – 10%** | **10 – 2 %** |
| Trees over 30 m | Tall closed forest | Tall open forest | Tall woodland | Tall open woodland |
| Trees 10 – 30 m | Closed forest | Open forest | Woodland | Open woodland |
| Trees under 10 m | Low closed forest | Low open forest | Low woodland | Low open woodland |
| Tree Mallee | Closed tree mallee | Tree mallee | Open tree mallee | Very open tree mallee |
| Shrub Mallee | Closed shrub mallee | Shrub mallee | Open shrub mallee | Very open shrub mallee |
| Shrubs over 2 m | Closed tall scrub | Tall open scrub | Tall shrubland | Tall open shrubland |
| Shrubs 1 – 2 m | Closed heath | Open heath | Shrubland | Open shrubland |
| Shrubs under 1 m | Closed low heath | Open low heath | Low shrubland | Low 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 |

Source: Government of Western Australia, 2000

### 3.2.3 Vegetation Condition

Vegetation condition was assessed using the rating scale attributed to Keighery in *Technical Guidance-Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016). Table 2 provides a description of the rating scale.

**Table 2:** Vegetation condition ratings

| Category | | Description |
|---|---|---|
| 1 | Pristine | Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement. |
| 2 | 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. |
| 3 | 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. |

| Category | | Description |
|---|---|---|
| 4 | 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 some very aggressive weeds, partial clearing, dieback and grazing. |
| 5 | 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. |
| 6 | 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 or shrubs. |

Source: EPA, 2016

## 3.3 Black Cockatoo Habitat Assessment

A black cockatoo habitat assessment was conducted in accordance with *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black-cockatoo* (DAWE, 2022).

Natural Area environmental scientists undertook the survey on 10 November 2023 with key data recorded using Mappt software on a handheld tablet. Survey activities included:

- traversing the whole site in a systematic grid search
- recording the location and evidence of breeding, roosting and foraging activities (e.g. chew marks, feathers, scats)
- marking the GPS locations of each habitat tree with a DBH ≥ 300 mm
- recording the height, DBH, health, and species of each habitat tree
- recording evidence of hollows, including size, type, and location within the tree
- recording foraging habitat, vegetation type, and condition.

### 3.3.1 Foraging Habitat

The black cockatoo foraging quality scoring tool (DAWE, 2022) was applied to the survey areas to determine the quality of black cockatoo foraging habitat. This scoring tool assigns a habitat score between one and ten, with a score of ten representing the maximum possible score and very high-quality foraging habitat. Contextual adjustors (attributes that improve or reduce functionality of foraging habitat) such as tree species composition, distances from known breeding and roosting sites, distance from other foraging habitat, evidence of feeding debris, and presence of disease e.g. *Phytophthora* spp. or Marri Canker were used to evaluate habitat quality. The scoring tool template is provided in Table 3.

**Table 3**: Foraging quality scoring tool template

| Starting score | | Baudin's Cockatoo | Carnaby's Cockatoo | Forest Red-tailed Black-Cockatoo |
|---|---|---|---|---|
| 10 | | Start at a score of 10 if your site is native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly Marri, within the range of the species, including along roadsides and parkland cleared areas. Can include planted vegetation. This tool only applies to sites equal to or larger than 1 hectare in size. | Start at a score of 10 if your site is native shrubland, kwongan heathland or woodland, dominated by proteaceous plant species such as Banksia spp. (including Dryandra spp.), Hakea spp. and Grevillea spp., as well as native eucalypt woodland and forest that contains foraging species, within the range of the species, including along roadsides and parkland cleared areas. Also includes planted native vegetation. This tool only applies to sites equal to or larger than 1 hectare in size. | Start at a score of 10 if your site is Jarrah or Marri woodland and/or forest, or if it is on the edge of Karri forest, or if Wandoo and Blackbutt occur on the site, within the range of the subspecies, including along roadsides and parkland cleared areas. This tool only applies to sites equal to or larger than 1 hectare in size. |
| **Attribute** | **Sub-tractions** | **Context adjustor (attributes reducing functionality of foraging habitat)** | | |
| Foraging potential | -2 | Subtract 2 from your score if there is no evidence of feeding debris on your site. | Subtract 2 from your score if there is no evidence of feeding debris on your site. | Subtract 2 from your score if there is no evidence of feeding debris on your site. |
| Connectivity | -2 | Subtract 2 from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site. | Subtract 2 from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site. | Subtract 2 from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site. |
| Proximity to breeding | -2 | Subtract 2 if you have evidence to conclude that your site is more than 12 km from breeding habitat. | Subtract 2 if you have evidence to conclude that your site is more than 12 km from breeding habitat | Subtract 2 if you have evidence to conclude that your site is more than 12 km from breeding habitat. |
| Proximity to roosting | -1 | Subtract 1 if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat. | Subtract 1 if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat. | Subtract 1 if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat. |
| Impact from significant plant disease | -1 | Subtract 1 if your site has disease present (e.g. Phytophthora spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present. | Subtract 1 if your site has disease present (e.g. Phytophthora spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present. | Subtract 1 if your site has disease present (e.g. Phytophthora spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present. |
| Total score | | Enter score | Enter score | Enter score |
| Appraisal | | To support your habitat score, you should provide an overall appraisal of the habitat on the impact site and within 20km of the impact area to clearly explain and justify the score. It should include discussion on the foraging habitat's proximity to other resources (e.g. exact distance to proximate resources), frequency of use of proximate sites, the degree of evidence and description of vegetation type and condition. | | |

Source: DAWE, 2022

## 3.4 Limitations

Several potential limitations associated with flora, vegetation, and black cockatoo surveys exist. Potential survey limitations and their impacts are outlined Table 4.

**Table 4:** Potential survey limitations

| Potential Limitation | Degree of Limitation | Comments |
|---|---|---|
| Availability of data and information | Not a limitation | Government data on flora, and the three black cockatoo species as well as published guidelines are readily available. |
| Competency/experience of the survey team, including experience in the bioregion survey | Not a limitation | Survey activities were undertaken by experienced environmental scientists who have extensive experience undertaking detailed flora surveys and black cockatoo habitat assessments within the Swan Coastal Plain, Jarrah Forest and Avon Wheatbelt bioregions. |
| Survey effort and extent | Minor | A detailed flora, vegetation, and black cockatoo habitat assessment survey was undertaken over a period of one day. All flora and vegetation types were adequately surveyed. A total of three quadrats were established.<br><br>The black cockatoo habitat assessment portion of the survey occurred during the day and assessments were made from the ground, capturing the required level of information for this survey. As this was a targeted search for this species, other faunal groups which may have been present within the site have not been recorded. The black cockatoo hollow assessment was conducted from the ground and is therefore limited to those hollows visible from ground-level. As such, not all hollows may have been observed as new growth, dense foliage and position in the landscape can hide hollows from vision. Additionally, internal hollow inspections would be required to confirm hollow characteristics such as internal hollow depth and structure and therefore to confirm their suitability to support nesting by black cockatoos. |
| Survey timing (weather/season) | Not a limitation | The flora and vegetation survey was conducted within spring, the optimal time to survey flora in the Avon Wheatbelt Region. Of the eight conservation significant flora species identified in the desktop survey as being likely to occur within the survey area, five species have flowering periods outside of the survey period. All five species are perennial shrub or herb species for which identification would have been possible outside of their flowering periods due to distinct morphological characteristics including growth habit and leaf structure. |

| Potential Limitation | Degree of Limitation | Comments |
|---|---|---|
| | | The black cockatoo assessment was conducted within the main breeding season for black cockatoos. Weather and season were not a limitation for habitat assessment. |
| Proportion of flora recorded/collected, any identification issues | Minor | A total of 47 flora species (taxa) were recorded from 15 families during the spring field survey. The total comprised of 28 introduced (weed) species and 17 native species. Of these, two species (4.26%) were unable to be identified to species level due to a lack of diagnostic characteristics present at the time of surveys. These being one species of *Eucalyptus* and one species of *Austrostipa* genera were not able to be confirmed in the field. These individuals were not flowering at the time of the survey and no other diagnostic features were present to enable identification. It is likely these species are not of conservation significance as they do not match any flora in the potential significant flora list (Appendix 2). |
| Disturbance that may have affected results, e.g., fire, flood | Not a limitation | No recent large-scale disturbance was noted at the time of the survey. |
| Adequacy of the survey intensity and proportion of survey achieved, e.g. the extent to which the area was surveyed | Minor | All trees within the survey area with a DBH ≥ 300 mm were surveyed with the exception of two trees that were on private property but still within the provided site boundary. These two trees had their DBH estimated, however their status as potential habitat trees are not ambiguous as they were estimated well over the 500 mm DBH threshold. |
| Access restrictions | Minor | There were no access issues to the site except to physically measure two trees located on private property. These trees were visually assessed instead. |

# 4.0 Flora Survey Results

## 4.1 Desktop Survey

A desktop survey of online databases indicated the potential for a total of 19 conservation significant species to occur within 10 km of the survey area (Table 5). NatureMap indicated two conservation significant flora species listed under the *BC Act* or by the Western Australian Herbarium (1998-), as potentially occurring within 10 km radius of the site (DBCA, 2024a). A review of the Protected Matters Search Tool (PMST) (DCCEEW, 2024) indicated 17 significant flora species listed under the *EPBC Act* as potentially occurring within a 10 km radius of the site (Appendix 1).

A review of the DBCA (2018b) threatened and priority flora database indicated conservation significant species have been recorded within 10 km of the site. Of the conservation significant species potentially found in the area, it was determined that the site conditions (soil type, drainage, location) may be suitable for eight (highlighted green) of these species (Table 5). Conservation code descriptions are provided in Appendix 3.

**Table 5:** Threatened and Priority flora species listed by NatureMap, PMST and DBCA

| Species Name | Cons Code | NatureMap | PMST | DBCA |
|---|---|---|---|---|
| *Acacia ataxiphylla* subsp. *magna* | T | | X | |
| *Acacia cochlocarpa* subsp. *velutinosa* | T | | X | |
| *Andersonia gracilis* | T | | X | |
| *Asterolasia grandiflora* | P4 | | X | |
| *Caladenia huegelii* | T | | X | |
| *Chorizema humile* | T | | X | |
| *Conospermum densiflorum* subsp. *unicephalatum* | T | | X | |
| *Dasymalla axillaris* | T | | X | |
| *Daviesia euphorbioides* | T | | X | |
| *Eleocharis keigheryi* | T | | X | |
| *Eucalyptus* x *carnabyi* | P4 | X | | X |
| *Gastrolobium hamulosum* | T | | X | |
| *Grevillea flexuosa* | T | | X | |
| *Hemiandra gardneri* | T | | X | |
| *Melaleuca sciotostyla* | T | | X | |
| *Roycea pycnophylloides* | T | | X | |
| *Thelymitra stellata* | T | | X | |
| *Thysanotus tenuis* | P3 | X | | X |
| *Verticordia staminosa* subsp. *staminosa* | T | | X | |

### 4.1.1 Threatened and Priority Ecological Communities

A review of the PMST report and DBCA's Threatened Communities database identified one listed Threatened Ecological Community (TEC) that could potentially occur within 10 km of the site, *Eucalypt Woodlands of the Western Australian Wheatbelt* (DBCA, 2024b; DCCEEW, 2024).

## 4.2 Flora Survey Results

### 4.2.1 Vegetation Types

One vegetation type was recorded across the survey area: *Eucalyptus loxophleba* Open Woodland. This vegetation type is described as an open woodland of *Eucalyptus loxophleba* (York Gum) over an understorey of invasive and native herbs and grasses (Figure 4).

**Figure 4:** Example of *Eucalyptus loxophleba* Open Woodland vegetation type on site

### 4.2.2 Vegetation Condition

Vegetation condition across the entire site (2.06 ha) was completely degraded. The upper story structure remains intact, however there is a clear lack of middle and lower native vegetation with a majority of the survey area comprised of bare ground covered with leaf litter and introduced species (Appendix 4).

### 4.2.3 Flora

A total of 47 flora species (taxa) were recorded from 15 families during the field survey, comprised of 28 introduced (weeds), 17 native species and two species (*Eucalyptus* sp. and *Austrostipa* sp.) of an unknown status due to an inability to be identified to a species level. Examples of native flora species are shown in Figure 5 and weed species in Figure 6. A complete flora species list is provided in Appendix 5. No declared pests or Weeds of National Significance (WoNS) were identified within the survey site. No threatened and priority species were recorded during the 2023 spring survey event.

*Atriplex semibaccata* (Berry Saltbush) | *Solanum hoplopetalum* (Thorny Solanum) | *Amyema preissii* (Wireleaf Mistletoe)

**Figure 5**: Examples of native flora species recorded

Prickly Lettuce (**Lactuca serriola*) | Toad Rush (**Juncus bufonius*) | Spiny Rush (**Juncus acutus*)

**Figure 6**: Examples of introduced flora species recorded

### 4.2.4 Threatened Ecological Communities

The desktop analysis indicated the potential for one TEC to occur within the survey boundary: *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC (DBCA, 2024b; DCCEEW, 2024).

The *Eucalyptus Woodlands of the Western Australian Wheatbelt* is listed as Critically Endangered under the *EPBC Act*, and as a Priority 3 under the *BC Act*. Two key species *Eucalyptus loxophleba* (York Gum) and *E. salmonophloia* (Salmon Gum) were recorded within the vegetation type, *Eucalyptus loxophleba* Open Woodland. This vegetation type meets the description and key diagnostic characteristics of the *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC as described in the approved conservation advice (Department of Environment, 2015) (Table 6). Where these criteria are met, the minimum conditions for patches of this TEC apply. These condition thresholds for degraded vegetation patches are summarised in Table 7 (Commonwealth of Australia, 2016).

As this vegetation patch is along a roadside, the width of the patch is used to assess the condition thresholds, rather than the total size of the patch. The width of the native understorey within the road verge varies but ranges between 5 m in some areas to 10 m in other areas and is therefore considered to meet the minimum patch width criteria of 5 m. These patches also meet the criteria for weed cover and number of mature trees. As a result, the patches of vegetation within the *Eucalyptus loxophleba* Open Woodland are considered likely to be part of the *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC.

**Table 6:** Key Diagnostic Criteria for the *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC

| Key Diagnostic Characteristics | Meets/Doesn't Meet | Site Specifics |
|---|---|---|
| Occurs in the Avon Wheatbelt, Western Mallee (MAL02) and eastern Jarrah Forest Bioregions, Western Australia | Meets diagnostic characteristics | Site occurs in the Avon Wheatbelt Bioregion. |
| The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10% | Meets diagnostic characteristics | Site is an open woodland with an average tree canopy cover of 10%. |
| The key species of the tree canopy are species of Eucalyptus as identified in Table 2a, and are dominant or co-dominant | Meets diagnostic characteristics | The key species *Eucalyptus loxophleba* (York Gum) and *Eucalyptus salmonophloia* (Salmon (Gum) were present within the site and are listed in Table 2a of the approved conservation advice. *Eucalyptus loxophleba* was dominant in all three quadrats. |
| A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in section 2.3.2 and in Table A1 of Appendix A | Meets diagnostic characteristics | A native understorey was present in the patch. 11 out of the 17 native species recorded in this vegetation type are listed in table A1 of the conservation advice for this TEC. |

**Table 7:** Minimum condition thresholds for the *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC (Category D: Patches likely to correspond to a condition of degraded to good BUT retains important habitat features)

| Condition threshold | | Meets/Doesn't Meet | Site Specifics |
|---|---|---|---|
| Criteria | Threshold | | |
| Minimum Patch Width | 5 m | Meets condition threshold | The width of the native understorey within the road verge ranged between 5 – 10 m |
| Weed cover | Weeds account for >30-50% of total understorey vegetation cover | Meets condition threshold | Weed cover was >50% |
| Mature trees | 5 mature trees (DBH >300 mm) per 0.5 ha | Meets condition threshold | >5 mature trees were present / 0.5 ha |

# 5.0 Black Cockatoo Habitat Assessment Results

## 5.1 Desktop Survey

A desktop search of the DBCA fauna database (DBCA, 2024c), NatureMap database (DBCA, 2024a), and the Protected Matters Search Tool (DCCEEW, 2024) indicated the potential for Baudin's Cockatoo (Zanda baudinii), Carnaby's Cockatoo (*Zanda latirostris*), and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) to occur within the survey area (Table 8). The DBCA fauna database search listed 25 black cockatoo breeding hollows and one black cockatoo roost site within a 20 km search buffer of the survey boundary (DBCA, 2024c).

**Table 8:** Black cockatoo species listed by DBCA, NatureMap and PMST

| Species Name | Cons Code | Nature Map | PMST | DBCA | Presence |
|---|---|---|---|---|---|
| *Calyptorhynchus banksii naso* | VU | | X | X | Species or species habitat may occur within area |
| *Zanda baudinii* | EN | | | X | Species and species habitat not likely to occur within area as it is out of usual distribution |
| *Zanda latirostris* | EN | X | X | X | Species or species habitat known to occur within area |

## 5.2 Field Survey

### 5.2.1 Breeding Habitat

A total of 70 trees with a DBH greater than 300 mm were recorded within the survey area. These trees therefore fit the commonwealth guidelines for potential black cockatoo nesting trees (DAWE, 2022). All trees recorded were alive and observed to be from three species. The most common species was *Eucalyptus loxophleba* (York Gum) with 55 individuals, followed by *Eucalyptus salmonophloia* (Salmon Gum) with 14 individuals and one tree of eucalyptus genus that was not able to be definitively identified due to a lack of diagnostic features present at the time of survey.

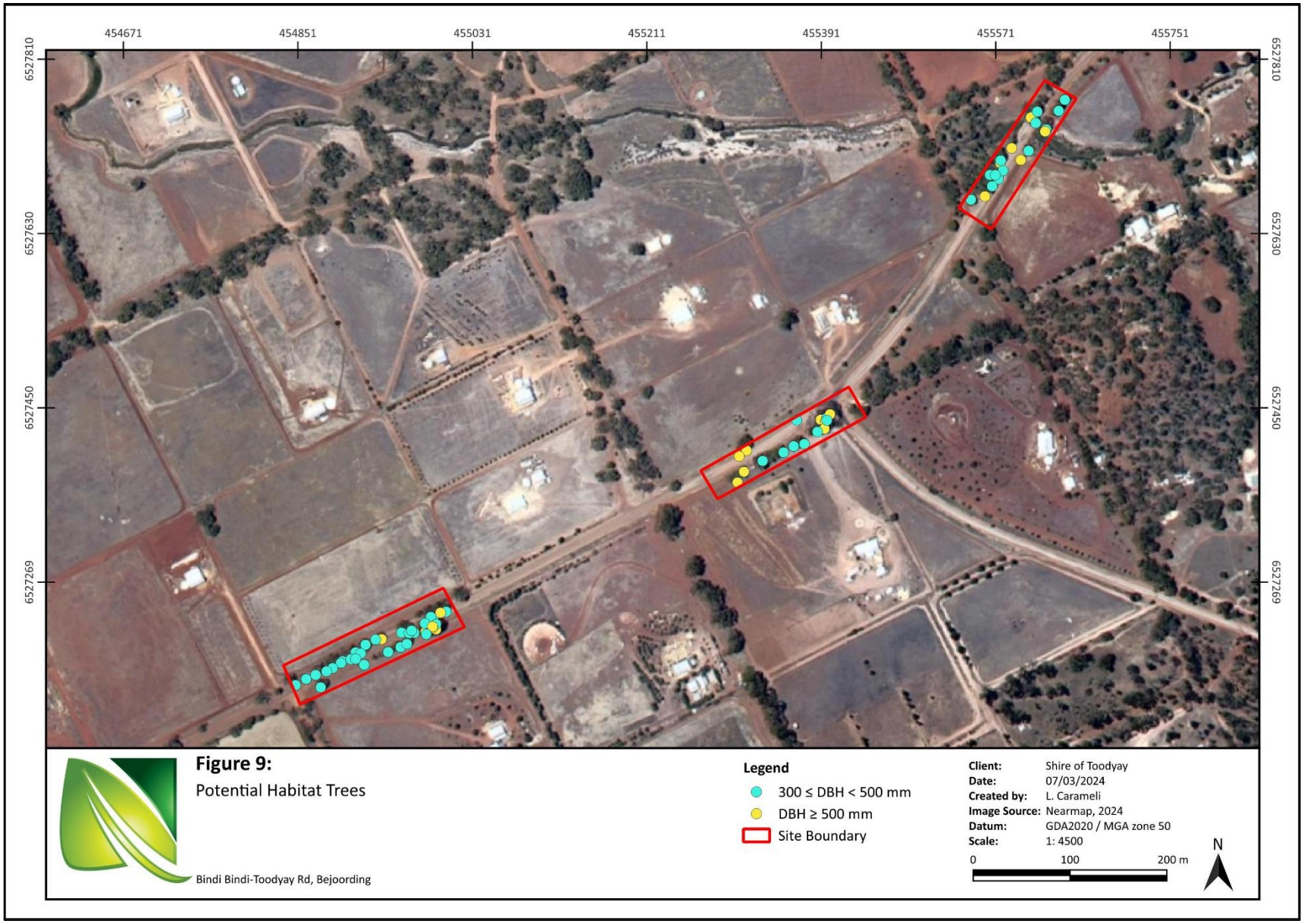
Of the trees recorded, 20 (28.6%) were identified to be over the threshold of ≥ 500 mm DBH. DBH of these trees ranged from 514 mm to 1106 mm and included all three eucalyptus species present. Five (25%) of these trees were observed to have hollows. However, all hollows observed had an approximate entrance diameter below 100 mm, which is below the size required for black cockatoos to nest (Cherriman, 2022). No signs of usage by black cockatoos were identified in any of the hollows.

Four trees also contained bird nests (Figure 7), with a total of five nests present. One of the hollows was also observed to have a Boobook Owl (*Ninox boobook*) inhabiting it (Figure 7).

Examples of habitat trees and hollows observed are shown in Figure 8 and the locations of all potential habitat trees are shown in Figure 9. Data for each tree is provided in Appendix 6. No evidence of black cockatoo foraging or secondary evidence was observed surrounding the identified habitat trees.


**Figure 7**: Use of trees by bird species other than black cockatoo. (a: hollow occupied by a Boobook Owl (*Ninox Boobook*), b: example of nest in tree)

**Figure 8**: Examples of potential habitat trees in the Bindi Bindi-Toodyay Rd survey area


454671
454851
455031
455211
455391
455571
455751
6527810
6527630
6527450
6527269
Figure 9:
Potential Habitat Trees
Bindi Bindi-Toodyay Rd, Bejoording
Legend
300 ≤ DBH < 500 mm
DBH ≥ 500 mm
Site Boundary
Client: Shire of Toodyay
Date: 07/03/2024
Created by: L. Carameli
Image Source: Nearmap, 2024
Datum: GDA2020 / MGA zone 50
Scale: 1: 4500
0
100
200 m
N

### 5.2.2 Roosting habitat

*Eucalyptus loxophleba* (York Gum) and *E. salmonophloia* (Salmon Gum) are considered suitable for roosting by black cockatoos (Department of Environment and Conservation (DEC), 2011). No evidence of roosting in the form of scats or feathers was observed throughout the survey area. Evening surveys were not conducted as part of this assessment, so potential roosting sites cannot be confirmed.

### 5.2.3 Foraging habitat

*Eucalyptus loxophleba* (York Gum) and *E. salmonophloia* (Salmon Gum) are considered suitable food sources for black cockatoos (DEC, 2011). At the time of the survey, no evidence of foraging was observed throughout the survey area.

The black cockatoo foraging quality scoring tool (DAWE, 2022) was applied to the survey area and a score of eight was assigned for Carnaby's Cockatoo (*Zanda latirostris*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (Table 9). These scores represent areas that are considered to have high-quality native foraging habitat for black cockatoos. A score for Baudin's Cockatoo (*Zanda baudinii*) was not generated as the survey site is considered outside of this species distribution (DAWE, 2022).

**Table 9**: Foraging quality score for Bindi Bindi-Toodyay Rd survey area

| | **Baudin's Cockatoo** | **Carnaby's Cockatoo** | **Forest Red-tailed Black-Cockatoo** | **Appraisal** |
|---|---|---|---|---|
| **Starting score** | NA | 10 | 10 | |
| Foraging potential | - | 8 | 8 | No evidence of feeding debris was observed on site |
| Connectivity | - | 8 | 8 | Foraging habitat is present within 12 km of survey site |
| Proximity to breeding | - | 8 | 8 | Survey site is within 12 km of a known breeding area |
| Proximity to roosting | - | 8 | 8 | Survey site is within 20 km of a known roost area |
| Impact from significant plant disease | - | 8 | 8 | No evidence of disease observed |
| **Total Score** | **NA** | **8** | **8** | |

# 6.0 Implications of Results

## 6.1 Flora and Vegetation

One vegetation type was recorded during the survey: *Eucalyptus loxophleba* Open Woodland. Vegetation condition throughout the survey area was completely degraded, which is reflected in the higher ratio of introduced flora species. A total of 47 flora species (taxa) were recorded from 15 families during the field survey, comprised of 28 (59.6%) introduced, 17 (36.2%) native and two species (4.2%) (*Eucalyptus* sp. and *Austrostipa* sp.) of an unknown status due to an inability to be identified to a species level. The two unidentified species are not considered to be conservation significant flora, declared pests or WoNS following comparison with desktop data.

## 6.2 Significant Flora

No significant flora species were identified during the survey event. The two species that were unable to be identified to a species level (*Eucalyptus* sp. and *Austrostipa* sp.) are not likely to be significant flora species.

Of the eight significant flora species identified in the desktop survey as being likely to occur within the survey boundary, five had flowering periods outside the survey period. All five species are perennials and are therefore expected to be present within the site year-round. Four of these species; *Acacia ataxiphylla* subsp. *magna*, *Chorizema humile*, *Daviesia euphorbioides*, and *Grevillea flexuosa* are perennial shrubs species, while *Thysanotus tenuis* is a perennial herb. Identification would have been possible outside of the flowering periods of these species due to distinct morphological characteristics including growth habit and leaf structure (WA Herbarium, 1998-).

## 6.3 Threatened Ecological Communities

The desktop analysis indicated the potential for one TEC to occur within the survey boundary: *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC (DBCA, 2024b).

As the *Eucalyptus loxophleba* Open Woodland vegetation type met the key diagnostic criteria and condition thresholds it is considered to be part of the *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC.

## 6.4 Black Cockatoo Habitat

There is the potential for Carnaby's Cockatoo (*Zanda latirostris*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) and their habitat to occur on site.

A total of 70 trees with a DBH ≥ 300 mm were recorded within the survey area, therefore meeting the Commonwealth guidelines for potential nesting tree. Of the trees recorded, 50 were between 300 and 500 mm DBH, while 20 were identified to be over the threshold of ≥ 500 mm DBH. Ten hollows from five trees were observed within the potential nesting trees but deemed too small for black cockatoo habitation. Two trees within the survey area boundary provided were located on private property and as such had their DBH approximated. No evidence of chew marks outside of the hollows was observed. Other species of birds were observed using the trees for nesting.

No signs of usage by black cockatoos were identified in any of the hollows and are unlikely to be in use by black cockatoos during the survey. However, internal hollow inspections would be required to confirm hollow characteristics such as internal hollow depth and structure and therefore to confirm their suitability to support potential nesting by black cockatoos.

## 6.5 Assessment Against Clearing Principles

An assessment of information obtained during the 2023 survey has been made against the Western Australian 10 clearing principles. It is suggested that the clearing application may be at variance with four (A, B, D, and E) of the ten clearing principles (Table 10).

**Table 10**: Assessment against the clearing principles

| Clearing Principle | | Comment |
|---|---|---|
| A | Native vegetation should not be cleared if it comprises a high level of biological diversity. | The proposed area to be cleared may be at variance with this principle:<br>▪ A total of 47 flora species (taxa) were recorded from 15 families during the field survey, comprised of 28 (59.6%) introduced, 17 (36.2%) native and two species (4.2%) (*Eucalyptus* sp. and *Austrostipa* sp.) of an unknown status.<br>▪ No threatened or priority flora species were recorded within the site during the 2023 survey.<br>▪ One vegetation type was identified within the site: Eucalyptus loxophleba Open Woodland.<br>▪ The vegetation condition across site was completely degraded. |
| B | Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia. | The proposed area to be cleared may be at variance with this principle:<br>▪ a total of 70 potential habitat trees (DBH ≥ 300 mm) were recorded within the survey area<br>▪ no Black Cockatoo individuals or evidence of feeding or roosting were observed during survey activities<br>▪ no signs of usage by black cockatoos were identified in any of the hollows<br>▪ a total of five trees were identified to contain hollows, however not suitable for black cockatoo breeding<br>▪ use of trees by other bird species including a hollow currently being used by Boobook Owl (*Ninox Boobook*) and five recorded bird nests. |
| C | Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora. | The proposed area to be cleared is not likely to be at variance with this principle:<br>▪ no threatened or priority flora species were recorded within the site<br>▪ Of the eight conservation significant flora species identified in the desktop survey as being likely to occur within the survey area, five species have flowering periods outside of the survey period. All of these species are perennial shrub or herb species for which identification would have been possible outside of their flowering periods due to distinct morphological characteristics including growth habit and leaf structure. |
| D | Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a | The proposed area to be cleared may be at variance with this principle:<br>▪ the desktop analysis indicated the potential for one TEC to occur within the survey boundary: *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC (DBCA, 2024b) |

| Clearing Principle | | Comment |
|---|---|---|
| | threatened ecological community. | ▪ the recorded vegetation type *Eucalyptus loxophleba* Open Woodland meets the description and key diagnostic characteristics of the Eucalyptus Woodlands of the Western Australian Wheatbelt TEC as described in the approved conservation advice (Department of Environment, 2015). |
| E | Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared. | The proposed area to be cleared may be at variance with this principle:<br>▪ the proposed clearing occurs within the Wheatbelt which has been extensively cleared historically for farming practices<br>▪ The site is located within the pre-European vegetation complex: York_352. Within Western Australia, there is 19.61% of York_352 remaining and 13.83% remaining within the Shire of Toodyay. |
| F | Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland. | The proposed area to be cleared is not likely to be at variance with this principle:<br>▪ there are no RAMSAR or important wetlands<br>▪ no watercourses or wetlands were identified within the site. |
| G | Native Vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation. | The proposed area to be cleared is not likely to be at variance with this principle:<br>▪ the vegetation throughout the site was observed to be in a completely degraded condition<br>▪ the proposed clearing is not expected to cause further land degradation as the site occurs along an existing roadway and is surrounded by land which is used for farming practices. |
| H | Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area. | The proposed area to be cleared is not likely to be at variance with this principle:<br>▪ the proposed clearing is not expected to impact adjacent or nearby conservation areas as the site is not located in close proximity to any conservation areas and is predominantly bordered by agricultural land-uses. |
| I | Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water. | The proposed site to be cleared is not likely to be at variance with this clearing principle:<br>▪ the proposed clearing is not expected to cause deterioration in the quality of surface or underground water as the site occurs along an existing road within the road reserve<br>▪ there is the potential for clearing of the site to impact water quality through road run-off and machinery spills/contamination, the development of a management plan and strategy is recommended to aid with the mitigation. |
| J | Native vegetation should not be cleared if clearing | The proposed site is not likely to be at variance with this principle: |

| Clearing Principle | Comment |
|---|---|
| the vegetation is likely to cause, or exacerbate, the incidence of flooding. | ▪ the proposed clearing is not expected to cause, or exacerbate, the incidence of flooding as the site is occurring along an existing road within the road reserve and the design of the proposed upgraded road should allow for water management/ development of a management plan<br>▪ there is a potential for water run-off to increase as a result of the loss of large, established trees during clearing, however this is not expected to have a significant impact or result in an increased risk of flooding. |

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# Appendix 1: PMST Report 10 km

# EPBC Act Protected Matters Report

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

Report created: 26-Feb-2024

# Summary

## Matters of National Environment Significance

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

| | |
|---|---|
| World Heritage Properties: | None |
| National Heritage Places: | None |
| Wetlands of International Importance (Ramsar | None |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | None |
| Listed Threatened Ecological Communities: | 1 |
| Listed Threatened Species: | 31 |
| Listed Migratory Species: | 6 |

## 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 https://www.dcceew.gov.au/parks-heritage/heritage

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

| | |
|---|---|
| Commonwealth Lands: | None |
| Commonwealth Heritage Places: | None |
| Listed Marine Species: | 11 |
| Whales and Other Cetaceans: | None |
| Critical Habitats: | None |
| Commonwealth Reserves Terrestrial: | None |
| Australian Marine Parks: | None |
| Habitat Critical to the Survival of Marine Turtles: | None |

## Extra Information

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

| | |
|---|---|
| State and Territory Reserves: | 2 |
| Regional Forest Agreements: | 1 |
| Nationally Important Wetlands: | None |
| EPBC Act Referrals: | 2 |
| Key Ecological Features (Marine): | None |
| Biologically Important Areas: | None |
| Bioregional Assessments: | None |
| Geological and Bioregional Assessments: | None |

# Details

## Matters of National Environmental Significance

### Listed Threatened 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.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

| Community Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Eucalypt Woodlands of the Western Australian Wheatbelt | Critically Endangered | Community likely to occur within area | In feature area |

### Listed Threatened Species [ Resource Information ]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| BIRD | | | |
| Aphelocephala leucopsis<br>Southern Whiteface [529] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| Calyptorhynchus banksii naso<br>Forest Red-tailed Black-Cockatoo, Karrak [67034] | Vulnerable | Species or species habitat may occur within area | In buffer area only |
| Falco hypoleucos<br>Grey Falcon [929] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Leipoa ocellata<br>Malleefowl [934] | Vulnerable | Species or species habitat likely to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| [Rostratula australis](#) | | | |
| Australian Painted Snipe [77037] | Endangered | Species or species habitat likely to occur within area | In feature area |
| [Zanda latirostris listed as Calyptorhynchus latirostris](#) | | | |
| Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737] | Endangered | Species or species habitat known to occur within area | In feature area |
| MAMMAL | | | |
| [Bettongia penicillata ogilbyi](#) | | | |
| Woylie [66844] | Endangered | Species or species habitat may occur within area | In buffer area only |
| [Dasyurus geoffroii](#) | | | |
| Chuditch, Western Quoll [330] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| [Myrmecobius fasciatus](#) | | | |
| Numbat [294] | Endangered | Species or species habitat may occur within area | In buffer area only |
| [Phascogale calura](#) | | | |
| Red-tailed Phascogale, Red-tailed Wambenger, Kenngoor [316] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| PLANT | | | |
| [Acacia ataxiphylla subsp. magna](#) | | | |
| Large-fruited Tammin Wattle [64823] | Endangered | Species or species habitat likely to occur within area | In feature area |
| [Acacia cochlocarpa subsp. cochlocarpa](#) | | | |
| Spiral-fruited Wattle [23877] | Endangered | Species or species habitat may occur within area | In feature area |
| [Acacia cochlocarpa subsp. velutinosa](#) | | | |
| Velvety Spiral Pod Wattle [65112] | Critically Endangered | Species or species habitat may occur within area | In buffer area only |
| [Andersonia gracilis](#) | | | |
| Slender Andersonia [14470] | Endangered | Species or species habitat may occur within area | In feature area |
| [Asterolasia nivea](#) | | | |
| Bindoon Starbush [8225] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Caladenia huegelii<br>King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309] | Endangered | Species or species habitat may occur within area | In feature area |
| Chorizema humile<br>Prostrate Flame Pea [32573] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Conospermum densiflorum subsp. unicephalatum<br>One-headed Smokebush [64871] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Dasymalla axillaris<br>Native Foxglove [38829] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| Daviesia euphorbioides<br>Wongan Cactus [3477] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Eleocharis keigheryi<br>Keighery's Eleocharis [64893] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |
| Gastrolobium hamulosum<br>Hook-point Poison [9212] | Endangered | Species or species habitat likely to occur within area | In feature area |
| Grevillea flexuosa<br>Zig Zag Grevillea [2957] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Hemiandra gardneri<br>Red Snakebush [7945] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Melaleuca sciotostyla<br>Wongan Melaleuca [24324] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Roycea pycnophylloides<br>Saltmat [21161] | Endangered | Species or species habitat likely to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Thelymitra stellata<br>Star Sun-orchid [7060] | Endangered | Species or species habitat may occur within area | In buffer area only |
| Verticordia staminosa subsp. staminosa<br>Wongan Featherflower [55825] | Endangered | Species or species habitat may occur within area | In feature area |
| **SPIDER** | | | |
| Idiosoma nigrum<br>Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798] | Vulnerable | Species or species habitat likely to occur within area | In feature area |

## Listed Migratory Species [ Resource Information ]

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| **Migratory Marine Birds** | | | |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area | In feature area |
| **Migratory Terrestrial Species** | | | |
| Motacilla cinerea<br>Grey Wagtail [642] | | Species or species habitat may occur within area | In feature area |
| **Migratory Wetlands Species** | | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat may occur within area | In feature area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area | In feature area |

## Other Matters Protected by the EPBC Act

| Listed Marine Species | | | [ Resource Information ] |
|---|---|---|---|
| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| Bird | | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat may occur within area | In feature area |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area overfly marine area | In feature area |
| Bubulcus ibis as Ardea ibis<br>Cattle Egret [66521] | | Species or species habitat may occur within area overfly marine area | In feature area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area overfly marine area | In feature area |
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area overfly marine area | In feature area |
| Chalcites osculans as Chrysococcyx osculans<br>Black-eared Cuckoo [83425] | | Species or species habitat likely to occur within area overfly marine area | In feature area |
| Haliaeetus leucogaster<br>White-bellied Sea-Eagle [943] | | Species or species habitat may occur within area | In feature area |
| Merops ornatus<br>Rainbow Bee-eater [670] | | Species or species habitat may occur within area overfly marine area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Motacilla cinerea | | | |
| Grey Wagtail [642] | | Species or species habitat may occur within area overfly marine area | In feature area |
| Rostratula australis as Rostratula benghalensis (sensu lato) | | | |
| Australian Painted Snipe [77037] | Endangered | Species or species habitat likely to occur within area overfly marine area | In feature area |

## Extra Information

### State and Territory Reserves [ Resource Information ]

| Protected Area Name | Reserve Type | State | Buffer Status |
|---|---|---|---|
| Flat Rock Gully | Nature Reserve | WA | In buffer area only |
| Wattening | Nature Reserve | WA | In buffer area only |

### Regional Forest Agreements [ Resource Information ]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

| RFA Name | State | Buffer Status |
|---|---|---|
| South West WA RFA | Western Australia | In buffer area only |

### EPBC Act Referrals [ Resource Information ]

| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
|---|---|---|---|---|
| Not controlled action | | | | |
| Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia | 2015/7522 | Not Controlled Action | Completed | In feature area |
| Referral decision | | | | |
| Road Reserve Maintenance and Road Widening Works | 2007/3438 | Referral Decision | Completed | In feature area |

# Caveat

## 1 PURPOSE

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

The report contains the mapped locations of:

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

## 2 DISCLAIMER

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

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

## 3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

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

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

## 4 LIMITATIONS

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

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

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

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

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

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

# Acknowledgements

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

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

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

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


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# Appendix 2: Significant Species

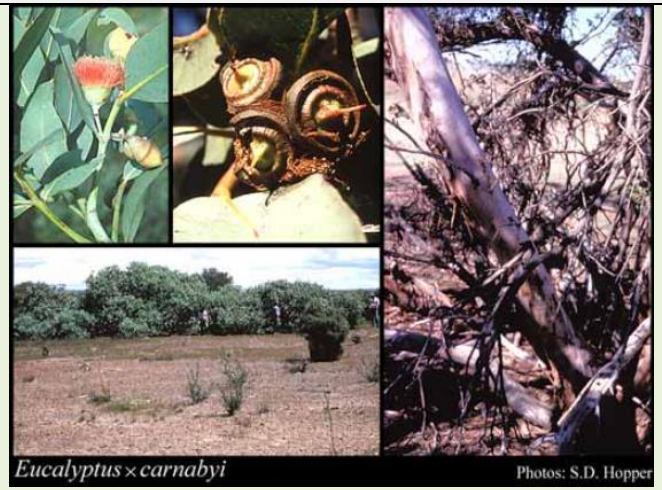
| Species Name | Common Name | Description | Flowering Period | Habitat Type | Cons code | Likelihood (Y/N) | Comment |
|---|---|---|---|---|---|---|---|
|  | | Spreading to ascending shrub, 0.3-0.6 m high. Fl. Yellow. | Jun to Jul | Sandy soils. Lateritic ironstone rises, flats. | T | Y | Habitat suitable |
|  | | Velutinous, sprawling shrub, 0.3-0.7(-1.5) m high. Fl. Yellow. | May to Aug | Sandy clay or laterite. Hard white clay. | T | Y | Habitat not suitable. |

| Species Name | Common Name | Description | Flowering Period | Habitat Type | Cons code | Likelihood (Y/N) | Comment |
|---|---|---|---|---|---|---|---|
|  | | Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple. | Sep to Nov | White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps. | T | N | Unlikely as habitat is unsuitable |
|  | | Slender open shrub, 0.2-0.6(-0.8) m high. Fl. pink/white. | Jul to Oct | Lateritic soils, clay over granite. Breakaways, hills. | P4 | N | Habitat unsuitable |

| Species Name | Common Name | Description | Flowering Period | Habitat Type | Cons code | Likelihood (Y/N) | Comment |
|---|---|---|---|---|---|---|---|
|  | Grand Spider Orchid | Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red. | Sep to Oct | Grey or brown sand, clay loam. | T | N | Unlikely due to habitat requirements |
|  | | Sprawling, prostrate or decumbent shrub. Fl. yellow & red/brown. | Jul to Sep | Sandy clay or loam. Plains. | T | Y | Habitat suitable |

| Species Name | Common Name | Description | Flowering Period | Habitat Type | Cons code | Likelihood (Y/N) | Comment |
|---|---|---|---|---|---|---|---|
|  | | Erect, much-branched shrub, 0.3-0.6 m high, inflorescence a spike. Fl. cream/white & blue. | Sep to Nov | Clay soils. Low-lying areas. | T | Y | Habitat suitable |
| *Dasymalla axillaris* | Native Foxglove | Low, diffuse shrub that can grow to 0.3 m high. The flowers are red to yellowish-scarlet, vivid in appearance. | July to December | Sandy soils | T | Y | Habitat suitable |

| Species Name | Common Name | Description | Flowering Period | Habitat Type | Cons code | Likelihood (Y/N) | Comment |
|---|---|---|---|---|---|---|---|
|  | Wongan Cactus | Shrub, 0.4-0.8 m high. Fl. yellow & red. | Jul to Sep | Clayey sand, sandy gravel. Flats, sandplains. | T | Y | Habitat suitable |
|  | | Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. Green. | Aug to Nov | Clay, sandy loam. Emergent in freshwater: creeks, claypans | T | N | Unlikely based on habitat requirements |

| Species Name | Common Name | Description | Flowering Period | Habitat Type | Cons code | Likelihood (Y/N) | Comment |
|---|---|---|---|---|---|---|---|
|  | | (Mallee), 1.5-6 m high, bark smooth, grey over cream. Fl. pink-cream. | Oct to Nov | Grey sand, sandy loam. Lateritic ridges. | P4 | Y | Habitat suitable |
|  | Hookpoint Poison | Low shrub, 0.2-0.45 m high. Fl. Yellow & orange & red & purple. | Aug to Oct | Pale yellow clay loam with some sand and gravel on clay flats. It also grows in white and grey sand or sandy clay. | T | N | Habitat unsuitable |

| Species Name | Common Name | Description | Flowering Period | Habitat Type | Cons code | Likelihood (Y/N) | Comment |
|---|---|---|---|---|---|---|---|
|  | Tangled Grevillea | Irregular, few-branched, non-lignotuberous shrub, to 2 m high. Fl. creamy-yellow. | Jul to Oct | Red-brown sand with laterite & gravel, sand over granite. Ridgetop plateau & associated breakaways. | T | Y | Based on soil types |
|  | Red Snakebush | Prostrate, pungent shrub, 0.1-0.2 m high, to 1 m wide. Fl. red/pink-red. | Aug to Oct | Grey or yellow sand, clayey sand. Sandplains. | T | N | Habitat unsuitable |

| Species Name | Common Name | Description | Flowering Period | Habitat Type | Cons code | Likelihood (Y/N) | Comment |
|---|---|---|---|---|---|---|---|
|  | Wongan Melaleuca | Spreading shrub, 0.6-1.5 m high. | Aug | Orange clayey sand with lateritic pebbles. Scree slopes. | T | N | Northwest of Wongan Hills |
|  | Saltmat | Perennial, herb, forming densely branched, silvery mats to 1 m wide. | Sep | Sandy soils, clay. Saline flats. | T | | Habitat unsuitable |

| Species Name | Common Name | Description | Flowering Period | Habitat Type | Cons code | Likelihood (Y/N) | Comment |
|---|---|---|---|---|---|---|---|
|  | | Tuberous, perennial, herb, 0.15-0.25 m high. Fl. yellow & brown. | Oct to Nov | Sand, gravel, lateritic loam. | T | Y | Based on habitat requirements and associated vegetation. |
|  | | Perennial, herb (with tuberous roots), to 0.2 m high. Fl. Purple. | Sep to Oct | Clay, sandy clay, sand. | P3 | Y | Based on soil types |

| Species Name | Common Name | Description | Flowering Period | Habitat Type | Cons code | Likelihood (Y/N) | Comment |
|---|---|---|---|---|---|---|---|
|  | | Spreading shrub, 0.15-0.6 m high. Fl. green-yellow/yellow-brown. | Jul to Oct | Soil pockets. Granite outcrops. | T | N | Habitat unsuitable |

# Appendix 3: Conservation Codes

**Western Australia**

| Conservation Code | Name | Description |
|---|---|---|
| T | Threatened | Flora or fauna that is rare or likely to become extinct, ranked according to their level of threat using IUCN Red List criteria (Schedules 1-3 of the Wildlife Conservation (Specially Protected Fauna) Notice or the Wildlife Conservation (Rare Flora) Notice) |
| CR | Critically endangered | Species considered to be facing an extremely high risk of extinction within the wild in the immediate future |
| EN | Endangered | Species considered to be facing a very high risk of extinction in the wild in the near future |
| VU | Vulnerable | Species considered to be facing a high risk of extinction in the wild in the medium-term future |
| EX | Extinct Species | Species where 'there is no reasonable doubt that the last member of the species has died (Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice or the Wildlife Conservation (Rare Flora) Notice) |
| EW | Extinct in the Wild | Species that are known to only survive in cultivation, in captivity, or as a naturalised population well outside its past range; and it has not been recorded in its known or expected habitat at appropriate seasons anywhere in its past range, despite surveys over a timeframe appropriate to its life cycle and form |
| 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 (Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice) |
| CD | Conservation Dependent | Species of special conservation interest (conservation dependent fauna), being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened (Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice) |
| OS | Specially Protected | Fauna otherwise in need of special protection to ensure their conservation (Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice) |
| 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 |

| Conservation Code | Name | Description |
|---|---|---|
| | | 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. |
| P1 | Priority One | 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, such as road verges, urban areas, farmland, active mineral lease and under threat of habitat destruction or degradation. |
| 2 | Priority Two | 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, such as national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves and similar. |
| 3 | Priority Three | 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 |
| 4 | Priority Four | Rare or near threatened and other species in need of monitoring. |

(Source: DBCA, 2020)

**Commonwealth**

| Category | Description |
|---|---|
| **Critically Endangered** | Species facing an extremely high risk of extinction in the wild in the immediate future |
| **Endangered** | Species facing a very high risk of extinction in the wild in the near future |
| **Vulnerable** | Species facing a high risk of extinction in the wild in the medium term |

(Source: DBCA, 2019b)

# Appendix 4: Quadrat Data

| Quadrat No.: | Q1 |
|---|---|
| Survey Date: | 10/11/2023 |
| Personnel: | KG, AC |
| Latitude: | -31.3887 |
| Longitude: | 116.5305 |
| Topography: | Flat |
| Aspect: | NA |
| Slope: | 0% |
| Soil: | Brown-red sandy clay |
| Gravel: | 2% |
| Rock: | 2% |
| Leaf Litter: | 70% |
| Bare Ground: | 5% |
| Drainage: | Well |
| Condition: | Completely Degraded |

Notes: *Eucalyptus loxophleba* Open Woodland

| Species | Cover (%) | Height (m) |
|---|---|---|
| **Avena barbata* | 20 | 0.5 |
| **Ehrharta longiflora* | 2 | 0.3 |
| **Hordeum leporinum* | 40 | 0.2 |
| **Lolium rigidum* | 3 | 0.3 |
| *Atriplex semibaccata* | 3 | 0.2 |
| *Austrostipa* sp. | 1 | 0.5 |
| *Eucalyptus loxophleba* | 90 | 20 |
| *Eucalyptus salmonophloia* | 15 | 30 |
| *Maireana georgei* | 2 | 0.5 |

Note: *denotes introduced species.

| Quadrat No.: | Q2 |
|---|---|
| Survey Date: | 10/11/2023 |
| Personnel: | KG, AC |
| Latitude: | -31.3870 |
| Longitude: | 116.5305 |
| Topography: | Mid |
| Aspect: | South-west |
| Slope: | 2% |
| Soil: | Brown-red sandy clay |
| Gravel: | 5% |
| Rock: | 1% |
| Leaf Litter: | 45% |
| Bare Ground: | 9% |
| Drainage: | Well |
| Condition: | Completely Degraded |

Notes: *Eucalyptus loxophleba* Open Woodland

| Species | Cover (%) | Height (m) |
|---|---|---|
| **Avena barbata* | 5 | 0.2 |
| **Ehrharta longiflora* | 3 | 0.3 |
| **Hordeum leporinum* | 5 | 0.3 |
| **Lolium rigidum* | 1 | 0.2 |
| **Sonchus oleraceus* | 0.1 | 0.2 |
| *Atriplex semibaccata* | 5 | 0.2 |
| *Austrostipa* sp. | 1 | 0.5 |
| *Eucalyptus loxophleba* | 90 | 15 |
| *Eucalyptus salmonophloia* | 10 | 16 |
| *Maireana trichoptera* | 3 | 0.1 |
| *Maireana georgei* | 5 | 0.6 |

Note: *denotes introduced species.

| **Quadrat No.:** | **Q3** |
|---|---|
| Survey Date: | 10/11/2023 |
| Personnel: | KG, AC |
| Latitude: | -31.3845 |
| Longitude: | 116.5330 |
| Topography: | Flat |
| Aspect: | NA |
| Slope: | 0% |
| Soil: | Brown-red sandy clay |
| Gravel: | 7% |
| Rock: | 1% |
| Leaf Litter: | 25% |
| Bare Ground: | 10% |
| Drainage: | Well |
| Condition: | Completely Degraded |

Notes: *Eucalyptus loxophleba* Open Woodland

| **Species** | **Cover (%)** | **Height (m)** |
|---|---|---|
| **Avena barbata* | 1 | 0.3 |
| **Ehrharta longiflora* | 1 | 0.3 |
| **Erigeron bonariensis* | 0.1 | 0.2 |
| **Hordeum leporinum* | 2 | 0.3 |
| **Lolium rigidum* | 3 | 0.2 |
| **Sonchus oleraceus* | 1 | 0.2 |
| *Eucalyptus loxophleba* | 50 | 15 |

Note: *denotes introduced species

# Appendix 5: Species List

The complete flora list for the site is provided in the table below with flora listed by species. *Denotes introduced species and # denotes species that are native to Western Australia but not to this local region.

| Family | Species Name | Common Name |
|---|---|---|
| Fabaceae | **Acacia iteaphylla* | |
| Chenopodiaceae | **Atriplex prostrata* | Hastate Orache |
| Poaceae | **Avena barbata* | Bearded Oat |
| Brassicaceae | **Brassica tournefortii* | Mediterranean Turnip |
| Brassicaceae | **Brassica × napus* | |
| Poaceae | **Bromus diandrus* | Great Brome |
| Cucurbitaceae | **Citrullus amarus* | |
| Asteraceae | **Cotula turbinata* | Funnel Weed |
| Poaceae | **Cynodon dactylon* | Couch |
| Poaceae | **Ehrharta longiflora* | Annual Veldt Grass |
| Poaceae | **Eragrostis curvula* | African Lovegrass |
| Asteraceae | **Erigeron bonariensis* | |
| Euphorbiaceae | **Euphorbia maculata* | |
| Poaceae | **Hordeum leporinum* | Barley Grass |
| Juncaceae | **Juncus acutus* | Spiny Rush |
| Juncaceae | **Juncus bufonius* | Toad Rush |
| Asteraceae | **Lactuca serriola* | Prickly Lettuce |
| Poaceae | **Lolium rigidum* | Wimmera Ryegrass |
| Malvaceae | **Malva parviflora* | Marshmallow |
| Fabaceae | **Medicago polymorpha* | Burr Medic |
| Poaceae | **Polypogon monspeliensis* | Annual Beardgrass |
| Asteraceae | **Pseudognaphalium luteoalbum* | Jersey Cudweed |
| Polygonaceae | **Rumex acetosella* | Sorrel |
| Anacardiaceae | **Schinus terebinthifolia* | |
| Solanaceae | **Solanum nigrum* | Black Berry Nightshade |
| Asteraceae | **Sonchus oleraceus* | Common Sowthistle |
| Asteraceae | **Symphyotrichum squamatum* | Bushy Starwort |
| Fabaceae | **Trifolium campestre* | Hop Clover |

| Family | Species Name | Common Name |
|---|---|---|
| Fabaceae | *Acacia lasiocalyx* | Silver Wattle |
| Fabaceae | *Acacia acuminata* | Jam |
| Fabaceae | *Acacia saligna* | Orange Wattle |
| Loranthaceae | *Amyema preissii* | Wireleaf Mistletoe |
| Chenopodiaceae | *Atriplex semibaccata* | Berry Saltbush |
| Poaceae | *Austrostipa nitida* | |
| Poaceae | *Austrostipa* sp. | |
| Poaceae | *Austrostipa elegantissima* | |
| Myrtaceae | *Calothamnus quadrifidus* | One-sided Bottlebrush |
| Poaceae | *Chloris truncata* | Windmill Grass |
| Chenopodiaceae | *Enchylaena tomentosa* | Barrier Saltbush |
| Myrtaceae | *Eucalpytus* sp. | |
| Myrtaceae | *Eucalyptus loxophleba* | York Gum |
| Myrtaceae | *Eucalyptus salmonophloia* | Salmon Gum |
| Chenopodiaceae | *Maireana brevifolia* | Small Leaf Bluebush |
| Chenopodiaceae | *Maireana trichoptera* | Downy Bluebush |
| Chenopodiaceae | *Salsola australis* | |
| Solanaceae | *Solanum hoplopetalum* | Thorny Solanum |
| Typhaceae | *Typha domingensis* | Bulrush |

# Appendix 6: Habitat Tree Data

| Tree No | Species | DBH (mm) | Height (m) | Condition | Hollows Present | Comments | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|
| **1** | *Eucalyptus loxophleba* | 464 | 16 | Fair | 2 x Small hollows | | -31.389228 | 116.525102 |
| **2** | *Eucalyptus loxophleba* | 483 | 16 | Good | No | | -31.389170 | 116.525217 |
| **3** | *Eucalyptus loxophleba* | 457 | 15 | Good | No | Leaning into private property | -31.389133 | 116.525320 |
| **4** | *Eucalyptus loxophleba* | 351 | 20 | Good | No | | -31.389249 | 116.525374 |
| **5** | *Eucalyptus loxophleba* | 465 | 15 | Good | No | | -31.389100 | 116.525438 |
| **6** | *Eucalyptus loxophleba* | 481 | 14 | Good | No | | -31.389071 | 116.525505 |
| **7** | *Eucalyptus loxophleba* | 396 | 16 | Good | No | | -31.389023 | 116.525595 |
| **8** | *Eucalyptus loxophleba* | 473 | 16 | Good | No | | -31.389006 | 116.525613 |
| **9** | *Eucalyptus loxophleba* | 414 | 16 | Good | No | | -31.388988 | 116.525703 |
| **10** | *Eucalyptus loxophleba* | 499 | 14 | Good | No | | -31.388986 | 116.525755 |
| **11** | *Eucalyptus loxophleba* | 370 | 16 | Good | No | | -31.388924 | 116.525755 |
| **12** | *Eucalyptus loxophleba* | 396 | 20 | Good | No | | -31.388934 | 116.525811 |
| **13** | *Eucalyptus loxophleba* | 305 | 16 | Good | No | | -31.389040 | 116.525847 |
| **14** | *Eucalyptus loxophleba* | 392 | 17 | Good | No | 1 x nest | -31.388854 | 116.525862 |
| **15** | *Eucalyptus loxophleba* | 380 | 15 | Good | No | | -31.388806 | 116.525972 |
| **16** | *Eucalyptus loxophleba* | 514 | 15 | Good | No | | -31.388803 | 116.526037 |
| **17** | *Eucalyptus loxophleba* | 322 | 15 | Good | No | | -31.388923 | 116.526107 |

| Tree No | Species | DBH (mm) | Height (m) | Condition | Hollows Present | Comments | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|
| **18** | *Eucalyptus loxophleba* | 339 | 15 | Good | No | 1 x nest | -31.388877 | 116.526242 |
| **19** | *Eucalyptus loxophleba* | 493 | 15 | Fair | 2 x small hollows | | -31.388743 | 116.526254 |
| **20** | *Eucalyptus loxophleba* | 327 | 12 | Good | No | | -31.388848 | 116.526312 |
| **21** | *Eucalyptus loxophleba* | 375 | 12 | Fair | No | | -31.388747 | 116.526339 |
| **22** | *Eucalyptus loxophleba* | 420 | 15 | Fair | 1 x small hollow | | -31.388724 | 116.526364 |
| **23** | *Eucalyptus loxophleba* | 416 | 15 | Fair | No | | -31.388745 | 116.526393 |
| **24** | *Eucalyptus loxophleba* | 334 | 15 | Good | No | | -31.388658 | 116.526509 |
| **25** | *Eucalyptus salmonophloia* | 688 | 25 | Good | 1 x small hollow | 1 x nest | -31.388737 | 116.526514 |
| **26** | *Eucalyptus salmonophloia* | 350 | 20 | Good | No | | -31.388757 | 116.526522 |
| **27** | *Eucalyptus loxophleba* | 425 | 15 | Good | 2 x small hollows | | -31.388597 | 116.526573 |
| **28** | *Eucalyptus salmonophloia* | 521 | 30 | Good | No | | -31.388700 | 116.526588 |
| **29** | *Eucalyptus salmonophloia* | 756 | 30 | Good | No | | -31.388687 | 116.526592 |
| **30** | *Eucalyptus loxophleba* | 437 | 15 | Good | No | | -31.388611 | 116.526598 |
| **31** | *Eucalyptus salmonophloia* | 905 | 30 | Good | No | 2 x nests | -31.388714 | 116.526629 |
| **32** | *Eucalyptus salmonophloia* | 497 | 20 | Good | No | | -31.388665 | 116.526629 |
| **33** | *Eucalyptus loxophleba* | 679 | 15 | Good | No | | -31.388558 | 116.526678 |
| **34** | *Eucalyptus loxophleba* | 444 | 14 | Fair | 2 x small hollows | | -31.388549 | 116.526739 |
| **35** | *Eucalyptus loxophleba* | 750 | 12 | Good | No | DBH estimated. On private property but limbs hanging over site. | -31.387356 | 116.529908 |

| Tree No | Species | DBH (mm) | Height (m) | Condition | Hollows Present | Comments | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|
| **36** | *Eucalyptus loxophleba* | 551 | 15 | Good | No | | -31.387112 | 116.529928 |
| **37** | *Eucalyptus loxophleba* | 860 | 12 | Fair | No | DBH estimated. On private property but limbs hanging over site. | -31.387257 | 116.529979 |
| **38** | *Eucalyptus loxophleba* | 798 | 12 | Good | No | Limbs hanging over private property | -31.387060 | 116.530007 |
| **39** | *Eucalyptus loxophleba* | 447 | 15 | Good | No | | -31.387156 | 116.530182 |
| **40** | *Eucalyptus loxophleba* | 324 | 12 | Good | No | | -31.387078 | 116.530409 |
| **41** | *Eucalyptus salmonophloia* | 317 | 12 | Good | No | | -31.387021 | 116.530519 |
| **42** | *Eucalyptus loxophleba* | 327 | 10 | Fair | No | | -31.386778 | 116.530554 |
| **43** | *Eucalyptus salmonophloia* | 358 | 15 | Good | No | | -31.387000 | 116.530635 |
| **44** | *Eucalyptus salmonophloia* | 412 | 15 | Good | No | | -31.386888 | 116.530778 |
| **45** | *Eucalyptus salmonophloia* | 745 | 20 | Good | 2 x small hollows | Boobook Owl nesting. | -31.386775 | 116.530814 |
| **46** | *Eucalyptus loxophleba* | 653 | 15 | Good | 3 x small hollows | | -31.386860 | 116.530854 |
| **47** | *Eucalyptus salmonophloia* | 769 | 25 | Good | 3 x small hollows | | -31.386791 | 116.530864 |
| **48** | *Eucalyptus salmonophloia* | 327 | 15 | Good | No | | -31.386759 | 116.530880 |
| **49** | *Eucalyptus salmonophloia* | 328 | 15 | Good | No | | -31.386781 | 116.530881 |
| **50** | *Eucalyptus salmonophloia* | 1106 | 20 | Good | 1 x small hollow | Limbs historically cut. | -31.386725 | 116.530915 |
| **51** | *Eucalyptus loxophleba* | 398 | 10 | Fair | No | | -31.384729 | 116.532455 |
| **52** | *Eucalyptus loxophleba* | 562 | 15 | Good | No | | -31.384699 | 116.532608 |
| **53** | *Eucalyptus loxophleba* | 368 | 12 | Fair | No | | -31.384501 | 116.532663 |

| Tree No | Species | DBH (mm) | Height (m) | Condition | Hollows Present | Comments | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|
| **54** | *Eucalyptus loxophleba* | 316 | 10 | Good | No | | -31.384605 | 116.532685 |
| **55** | *Eucalyptus loxophleba* | 458 | 15 | Fair | No | | -31.384501 | 116.532720 |
| **56** | *Eucalyptus loxophleba* | 336 | 12 | Fair | No | | -31.384538 | 116.532754 |
| **57** | *Eucalyptus loxophleba* | 767 | 17 | Good | No | | -31.384389 | 116.532775 |
| **58** | *Eucalyptus loxophleba* | 450 | 15 | Good | No | | -31.384366 | 116.532779 |
| **59** | *Eucalyptus loxophleba* | 306 | 15 | Good | No | | -31.384461 | 116.532804 |
| **60** | *Eucalyptus* sp. | 599 | 15 | Good | No | | -31.384252 | 116.532899 |
| **61** | *Eucalyptus loxophleba* | 549 | 15 | Fair | No | | -31.384363 | 116.532997 |
| **62** | *Eucalyptus loxophleba* | 316 | 15 | Fair | No | | -31.384278 | 116.533083 |
| **63** | *Eucalyptus loxophleba* | 514 | 15 | Good | No | | -31.383967 | 116.533108 |
| **64** | *Eucalyptus loxophleba* | 387 | 15 | Good | No | | -31.383956 | 116.533126 |
| **65** | *Eucalyptus loxophleba* | 373 | 15 | Good | No | | -31.384018 | 116.533162 |
| **66** | *Eucalyptus loxophleba* | 335 | 15 | Good | No | | -31.383912 | 116.533179 |
| **67** | *Eucalyptus loxophleba* | 556 | 15 | Good | No | | -31.384097 | 116.533263 |
| **68** | *Eucalyptus loxophleba* | 404 | 15 | Good | No | | -31.384078 | 116.533275 |
| **69** | *Eucalyptus loxophleba* | 395 | 15 | Good | No | | -31.383905 | 116.533411 |
| **70** | *Eucalyptus loxophleba* | 444 | 15 | Good | No | | -31.383803 | 116.533479 |