



# Carnaby's Cockatoo Habitat Assessment – Shires of Perenjori and Morawa

15 August 2024

## 1. Introduction

### 1.1 Background

Western Ecological (WE) was commissioned in August 2024 by Greenfield Technical Services (GTS) to undertake an assessment of 48 trees that require removal to facilitate road widening, and reduce the safety hazard for vehicles along several roads in the Shire of Perenjori and Morawa. The total length of the road widening project (survey area) is approximately 30 km long and includes sections of Boundary Road, Hill Road and Morawa South Road (Figure 1).

The clearing of these 48 trees could result in the loss of hollows that might potentially be suitable for nesting, particularly by threatened species such as Carnaby's Black Cockatoo (Carnaby's Cockatoo) (*Zanda latirostris*). Carnaby's Cockatoo is one of three threatened Black Cockatoo species that occurs in the south west of WA, however, it is the only Black Cockatoo species that occurs in the northern wheatbelt. Carnaby's Cockatoo is a threatened species listed as Endangered under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Western Australian Biodiversity Conservation Act 2016* (BC Act). Consequently, the trees were assessed to determine if they were potential Carnaby's Cockatoo habitat.

### 1.2 Objectives and Scope

The scope of work (SoW) to be undertaken was as follows:

- Undertake a Carnaby's Cockatoo habitat assessment of 48 trees along three sections of road
- Document the above in a letter report.

### 1.3 Legislative context

Fauna in Western Australia is protected formally and informally by various legislative and non-legislative measures, which are as follows:

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

Non-legislative measures:

- WA Department of Biodiversity, Conservation and Attractions (DBCA) Priority lists for flora, ecological communities and fauna.

A short description of each is given below. Other definitions, including species conservation categories, are provided in Appendix 1.

#### EPBC Act

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) aims to protect matters of national environmental significance, which are detailed in Appendix 1. Under the EPBC Act, the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) lists protected species and Threatened Ecological Communities (TECs) by criteria set out in the Act. Species are conservation significant if they are listed as Threatened (i.e., Critically Endangered [CrEn], Endangered [En] and Vulnerable [Vu]) or Migratory. Bird species protected as Migratory under the EPBC Act include those listed under international migratory bird agreements relating to the protection of birds, which migrate between Australia and other countries, for which Australia has agreed. This includes the Japan-Australia Migratory Bird



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

Some marine fauna or terrestrial fauna that use marine habitats are listed as Marine under the EPBC Act. These species are only considered conservation significant when a proposed development occurs in a Commonwealth marine area (i.e., any Commonwealth Waters or Commonwealth Marine Protected Area). Outside of such areas, the EPBC Act does not consider these species to be matters of national environmental significance, so are not protected under the Act.

### **BC Act**

The *Biodiversity Conservation Act 2016* (BC Act) replaced both the *Wildlife Conservation Act 1950* and the *Sandalwood Act 1929* and came into effect on 1 January 2019. The aim of the new Act is to conserve and protect biodiversity and to promote the ecologically sustainable use of biodiversity components in the State, and will bring more activities within the scope of biodiversity laws.

Taxa listed as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1a, 1b, and 1c), or is a rediscovered species to be regarded as threatened species under section 26(2) of the BC Act. Other categories include extinct or extinct in the wild and they are listed under section 23 (1) of the BC Act (Appendix 1).

If species meet one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection, they are covered under section 13(1) of the BC Act and are called specially protected species. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act can't also be listed as Specially Protected species (see Appendix 1 for a more detailed description of each threat category).

Threatened Ecological Communities (TECs) are also covered under the BC Act and are placed into three categories of critically endangered, endangered or vulnerable under section 27(1a, 1b, and 1c) of the BC Act depending on their threat status.

### **DBCA Priority Species and Communities**

DBCA lists species that are possibly threatened but that do not meet criteria for listing under the BC Act, or are otherwise data deficient, and adds them to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Consideration of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations (Appendix 1 for more detail of the priority codes).

The DBCA also has a list of Priority Ecological Communities (PECs) that have scant information available to be considered a TEC, or which are rare but not currently threatened. Ecological communities that do not meet survey criteria or that are not sufficiently defined are added to the PEC list under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as a TEC. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened list, are placed in priority 4. These ecological communities require regular monitoring.

### **Informal Recognition of Threatened Fauna**

Certain populations or communities of fauna may be of local significance or interest because of their patterns of distribution and abundance. For example, fauna may be locally significant because they are range extensions to the previously known distribution or are newly discovered species (and have the potential to be of conservation significance). In addition, many species are in decline as a result of threatening processes (land clearing, grazing, and changed fire regimes) and relict populations of such species assume local importance for DBCA. It is not uncommon for DBCA to make comment on these species of interest.



Figure 1: Project Location



Legend  
■ Survey Area



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## 2. Methods

### 2.1 Survey Guidance

The Carnaby's Cockatoo habitat assessment was completed in accordance with the following EPA and DCCEEW requirements for the environmental surveying and reporting of fauna surveys in WA, where relevant and practical, and as documented in:

- Commonwealth Department of Agriculture, Water and the Environment (DAWE [now DCCEEW] referral guideline for 3 WA threatened Black Cockatoo species (2022)
- EPA Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020).

### 2.2 Carnaby's Cockatoo Habitat Assessment

The field assessment was undertaken on the 8<sup>th</sup> August 2024 by one qualified and experienced Zoologist (Dr Ron Firth). Just to reiterate, there are three species of Black Cockatoos in the south west of WA that are listed under the EPBC Act, however, the survey area (three road sections) are only in the known distributional range of Carnaby's Cockatoo (Appendix 2 - Black Cockatoo distribution maps [DAWE 2022]). The habitat assessment consisted of the following components when applicable, with the primary focus being the 48 trees that were proposed to be removed.

#### Breeding Tree Assessment

Carnaby's Cockatoos nest in large hollow-bearing trees, generally in woodlands or forests, but can do in other situations. The size of the tree can be a useful indication of the hollow-bearing potential of the tree. During the survey the 48 trees were assessed for their nesting suitability based on the following criteria:

- Native trees (e.g., Marri [*Corymbia calophylla*], Jarrah [*Eucalyptus marginata*], Wandoo [*Eucalyptus wandoo*], Salmon Gum [*Eucalyptus salmonophloia*], Tuart [*Eucalyptus gomphocephala*], York Gum [*Eucalyptus loxophleba*] and Flooded Gum [*Eucalyptus rudis*)
- Diameter at breast height (DBH – 1.3 m)  $\geq$  500 mm (300 mm for Wandoo and Salmon Gum)
- GPS co-ordinates were recorded using a hand held GPS
- Suitable Black Cockatoo breeding hollows were assessed (from the ground) if present and based on the following:
  - Approx.  $\geq$  120 mm diameter at the entrance
  - location of hollow (i.e., situated on main trunk)
  - direction of hollow
  - height of hollow
  - depth of hollow (where possible to assess from the ground)
  - evidence of nesting activity (beak marks around hollow entrance, feathers and bespatter below hollow or on ground).

#### Foraging Assessment

The Carnaby's Cockatoo habitat assessment involved assessing the 48 trees to determine if they were important dietary items for Carnaby's Cockatoo e.g., Marri and other Eucalypts and included looking for the following (if present):

- Marri and other Eucalyptus species known to be food
- Evidence of feeding (chewed cones, seed and nut material)
- Opportunistic observations of Carnaby's Cockatoos in the survey area and in adjacent nearby areas.

Foraging habitat quality criteria (semi quantitative) based on preferred known food items has been developed, their extent in an area being assessed and the condition of the habitat. Please note that we have attempted to keep this criterion simple, practicable and repeatable across habitats and regions so that assessments are consistent as is practicable (see Table 1 below).



**Table 1: Foraging habitat quality and the criteria it is assessed against.**

Please note that the primary and secondary food sources have been identified in the literature and these will be cited in the results section (should they be present in the survey areas).

Foraging Habitat Quality	Criteria
High Quality	<ul style="list-style-type: none"> <li>• Primary food sources present and dominant (high relative abundance) in an area greater than 1 ha</li> <li>• Secondary food sources also present in medium to high relative abundance in an area greater than 1 ha</li> <li>• No recent extensive fire (&gt;1 year) and limited to no signs of disease such as <i>Phytophthora cinnamomi</i> and or Marri canker</li> </ul>
Medium Quality	<ul style="list-style-type: none"> <li>• Primary food sources present but not dominant (medium relative abundance) in an area greater than 1 ha, and or</li> <li>• Secondary food sources also present in medium to high relative abundance in an area greater than 1 ha</li> <li>• No recent extensive fire (&gt;1 year) and limited signs of disease such as <i>Phytophthora cinnamomi</i> and or Marri canker.</li> </ul>
Low Quality	<ul style="list-style-type: none"> <li>• Very limited to no primary food sources present in an area, and or</li> <li>• Secondary food sources also present in low to medium relative abundance</li> <li>• Recent fire (&lt;1 year) and or signs of disease such as <i>Phytophthora cinnamomi</i> and or Marri canker</li> </ul>
Nil	<ul style="list-style-type: none"> <li>• Self-explanatory.</li> </ul>

### Night Roosting Assessment

Night roosting sites are often situated to access local food and water sources, as well as providing a protected place to roost. Roost sites are typically used sequentially for periods of 4–6 weeks, and may be a traditional roost used over many years.

Surveying for roosting habitat was carried out in the survey area, with a focus on the 48 tree species to be removed. Signs of roosting were looked for and included looking for large numbers of feathers and bespatter under trees.

## 3. Results

### 3.1 Potential Carnaby's Cockatoo Habitat

While undertaking the assessment no Carnaby's Cockatoos were seen or heard in the survey area, and none were seen or heard flying nearby.

#### Potential Carnaby's Cockatoo Breeding Habitat

During the Carnaby's Cockatoo habitat assessment of the 48 trees, 26 trees were identified as Salmon Gums and 22 were not able to be identified to the species level and are referred to as *Eucalyptus* sp. (Figure 2 & Appendix 3). For this assessment it is not important as none of these 22 trees were large enough (i.e., all were too short, and only seven had a DBH >300 mm) to be considered potential nesting trees and further to this none had hollows of a suitable size to be used as nests for Carnaby's Cockatoos (see Plates 3, 7 & 8 for examples & Appendix 3). Superficially these 22 trees were identified as Blackbutt York Gum (*Eucalyptus loxophleba* subsp. *supralaevis*), however, this is now considered unlikely, particularly for all 22 trees.

Only one of the 26 Salmon Gums (Tree 10) had a hollow opening considered large enough and in the main trunk for a Carnaby's Cockatoo to enter when viewed from the ground (see Plate 1). However, the main trunk was not vertical and so this tree is deemed unsuitable for nesting. Further to this there were no signs to indicate it had been recently used for nesting by Carnaby's Cockatoo or any other hollow nesting bird. Of these 26 Salmon Gums, 23 had a DBH >300 mm which according to the Black Cockatoo referral guideline could develop suitable hollows in the future and are therefore considered a potential breeding tree (Appendix 3, DAWE 2022).

Although 23 of the Salmon Gums had a DBH that measured  $\geq 300$  mm, many of the main trunks of these trees split into multiple trunks or branches at a height of approximately between 1.5 - 5 m, or split at ground level into two main trunks or other forms that make them unsuitable for nesting by Carnaby's Cockatoo. These trees are unlikely to form hollows suitable for nesting in the main trunk in the near future and possibly some will never, despite them meeting the Black Cockatoo referral guidelines for potential breeding trees (Figure 2 and Appendix 3). Some examples of trees from the survey area that are unlikely to be suitable nesting trees in the future can be seen below (see Plates 1-8).



**Plate 1.** Salmon Gum (Tree 10). One hollow with a suitable sized opening (when viewed from the ground), however, the main trunk is far from vertical and the hollow opening is at about 5 m above the ground



**Plate 2.** Salmon Gum (Tree 15). Main trunk divides at multiple points, beginning at about 4 m into smaller branches and there are no hollows.



**Plate 3.** *Eucalyptus* sp. (Tree 16). Tree is too short, there are no hollows and DBH <300 mm.



**Plate 4.** Salmon Gum (Tree 28). The main trunk has snapped off at about 4 m and there are no hollows.



**Plate 5.** Salmon Gum (Tree 29). The main trunk splits at about 1.5 m into multiple branches and there are no hollows.





**Plate 6.** Salmon Gum (Tree 34). Main trunk divides at about 2.5 m into 2 trunks and there are no hollows.



**Plate 7.** *Eucalyptus* sp. (Tree 39). Tree is too short, there are no hollows and DBH <300 mm.



**Plate 8.** *Eucalyptus* sp. (Tree 44). Tree is too short and there are no hollows.

#### **Potential Carnaby's Cockatoo Foraging Habitat**

The survey area has little to no foraging habitat for Carnaby's Cockatoo. The road edge consists mostly of weedy grasses, there is little to no midstorey (no shrub layer) and is adjacent to wheatfields and paddocks (see plates 1 - 8 above). Salmon Gum is recognised as a food item for Carnaby's Cockatoo, however, it is not a preferred item and as such would be considered low quality foraging habitat at best. No signs of foraging were recorded.

#### **Night Roosting Assessment**

No evidence of roosting in the 48 trees was recorded in the survey area during the assessment, particularly as many were too short (especially the *Eucalyptus* sp.) and the others were isolated trees.

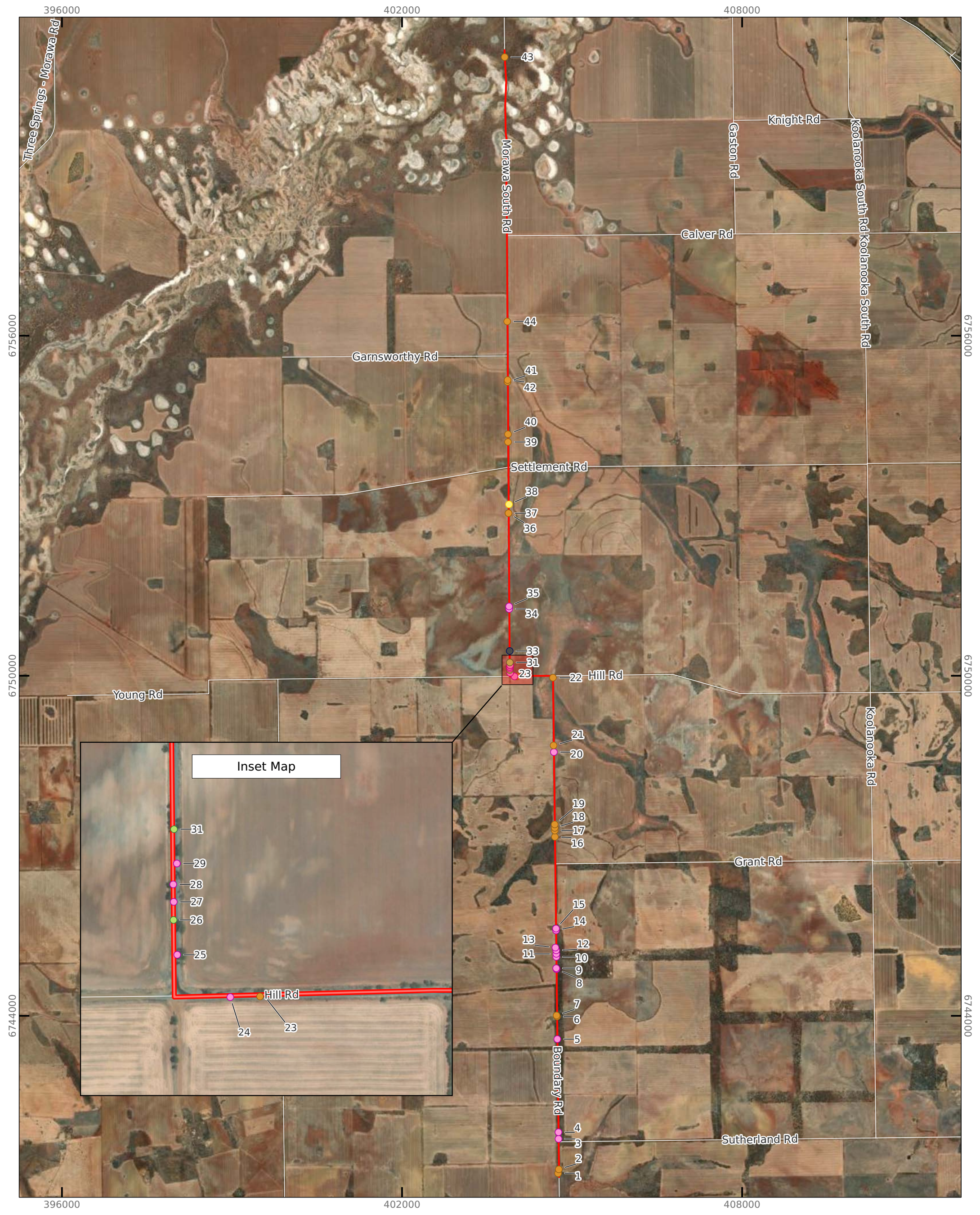
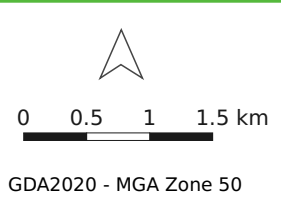


Figure 2: Proposed Tree Removal



Legend		
<span style="color: red;">■</span>	Survey Area	
<span style="color: orange;">●</span>	Tree Location	
<span style="color: yellow;">●</span>	Eucalyptus sp.	
<span style="color: yellow;">●</span>	Eucalyptus sp. x 3	
<span style="color: pink;">●</span>	Salmon Gum	
<span style="color: darkblue;">●</span>	Salmon Gum (dead)	
<span style="color: lightgreen;">●</span>	Salmon Gum x 2	



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## 4. Discussion

Carnaby's Cockatoo is endemic to south-west WA, and is distributed from the Murchison River to Esperance and inland to Coorow, Kellerberrin and Lake Cronin (Cale 2003). The species was once common, but the population has declined significantly in the last half century, and is now locally extinct in some areas (Johnstone & Storr 1998; Shah 2006). In the last 45 years (prior to Cale 2003) the species has suffered a 50% reduction in its abundance (Cale 2003). More recent information suggests this decline has continued. This reduction is due to the clearing of core breeding habitat in the wheatbelt, the deterioration of nesting hollows, and clearing of food resources on the Swan Coastal Plain (SCP) (Cale 2003). The total population of Carnaby's Cockatoo was estimated to be 40,000 in 2008 (Johnstone & Kirkby 2008). Since then, trend analyses of the seven Great Cocky Counts 2010 – 2017 identified strong indications that the population of Carnaby's -Cockatoo inhabiting the Perth-Peel Coastal Plain continues to decline.

Carnaby's Cockatoos feed on seeds, nuts and flowers of a variety of native and exotic plants. Food plants include a variety of Eucalyptus species, such as Marri, Jarrah, Swan River Blackbutt (*Eucalyptus patens*), Coastal Blackbutt (*Eucalyptus tottiana*), Caesia (*Eucalyptus caesia*) and Salmon Gum, as well as Pine trees (*Pinus* sp.), Grevillea, Allocasuarina, and Hakea species (Shah 2006). The seeds from a variety of Banksia species and the cones of Pine trees provide the highest energetic yield (Cooper et al. 2002).

Breeding has been recorded from early July to mid-December, and primarily occurs in the wheatbelt in the semi-arid and subhumid interior (Johnstone & Storr 1998). However, this species is currently expanding its breeding range westward and south into the Jarrah-Marri forests of the Darling Scarp (e.g., Wungong Dam Catchment) and into the Tuart forests of the SCP including Yanchep, Baldy, Lake Clifton and near Bunbury (Johnstone et al. 2011).

Carnaby's Cockatoo display strong pair bonds and mate for life. They nest in hollows of smooth-barked eucalypts particularly Salmon Gum and Wandoo but nests have also been found in other Eucalypt species including York Gum (*Eucalyptus loxophleba*), Flooded Gum (*Eucalyptus rudis*), the rough-barked Marri and Tuart (Johnstone et al. 2011). They nest in large hollow bearing trees that most commonly have a vertical aspect, an entrance of about 270 mm, a depth of 1.2 m, and a floor diameter of approximately 400 mm (Saunders & Dawson 2018). In most nests in Tuart, eggs are laid on a mat of wood chips at the bottom of a large hollow (mostly top entry hollows) ranging from a few cm's to 5 m deep (Johnstone et al. 2011). Clutch size is 1–2 eggs, more typically two; only one young is reared (Saunders et al. 1986). Incubation lasts for 29 days and only the female incubates and broods. The nestling is brooded by the female during which time both rely on food from the male. Once brooding is complete, the female then leaves the nest each day at dawn, sometimes returning mid-morning (with the male) to feed the chick (Johnstone et al. 2011). After approximately three weeks she ceases to brood and the chick is fed by one or both parents in the morning and in the late evening (Johnstone et al. 2011).

Approximately 87% (525,732 ha) of potential Carnaby's Cockatoo habitat (i.e., areas of vegetation that contain flora species and vegetation types that could support the species' breeding, feeding and night roosting activities) has been cleared in the wheatbelt since European settlement. The south-west region is now a severely fragmented landscape and the further loss of foraging habitat, the lack of suitable breeding sites, climate change, alterations in the landscape, changing forest structure with almost every part of the Jarrah-Marri forest logged in the past and with most trees too young to form hollows, and competition with exotic species, exacerbate the future conservation of Carnaby's Cockatoo (Johnstone et al. 2011).

There was little to no foraging habitat, and what is present is of low quality (Salmon Gum trees). There is potential breeding habitat present in the survey area, however, many of those trees that meet the criteria for potential breeding trees have a growth form that is unlikely to produce hollows of a suitable size and at a suitable position in the tree for nesting i.e., high enough of the ground and in a main trunk (vertical hollow). Only one of the 26 Salmon Gums (Tree 10) had a hollow opening considered large enough and in the main trunk for a Carnaby's Cockatoo to enter when viewed from the ground. However, the main trunk was not vertical and so this tree is deemed unsuitable for nesting. Further to this the depth of the hollow is unknown. While undertaking the assessment no Carnaby's Cockatoos were seen or heard in the survey area, and none were seen or heard flying nearby.

Finally, the survey area is on the very edge of Carnaby's Cockatoos distribution (Saunders & Dawson 2018, Appendix 3), there is little to no foraging habitat, and the survey area is surrounded by wheatfields and paddocks, consequently, this bird is unlikely to occur in the survey area.



## 5. References

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## **Appendix 1: Conservation Categories**



### Categories of Threatened Fauna Species under the EPBC Act

Conservation Code	Description
Ex	Extinct Taxa which at a particular time if, at the time, there is no reasonable doubt that the last member of the species has died.
ExW	Extinct in the Wild Taxa which are known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	Critically Endangered Taxa which at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
En	Endangered Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Vu	Vulnerable Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Source: Environment Protection and Biodiversity Conservation Act 1999.



# CONSERVATION CODES

## For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora<sup>1</sup> are species<sup>2</sup> which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

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

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

### **T**     **Threatened species**

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

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

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

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

### **CR**     **Critically endangered species**

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

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

### **EN**     **Endangered species**

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

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

### **VU**     **Vulnerable species**

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

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



## **Extinct species**

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

### **EX Extinct species**

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

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

### **EW Extinct in the wild species**

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

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

## **Specially protected species**

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

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

### **MI Migratory species**

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

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

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

### **CD Species of special conservation interest (conservation dependent fauna)**

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

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

### **OS Other specially protected species**

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

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

**P** **Priority species**

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

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

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

**1** **Priority 1: Poorly-known species**

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

**2** **Priority 2: Poorly-known species**

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

**3** **Priority 3: Poorly-known species**

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

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

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

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

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

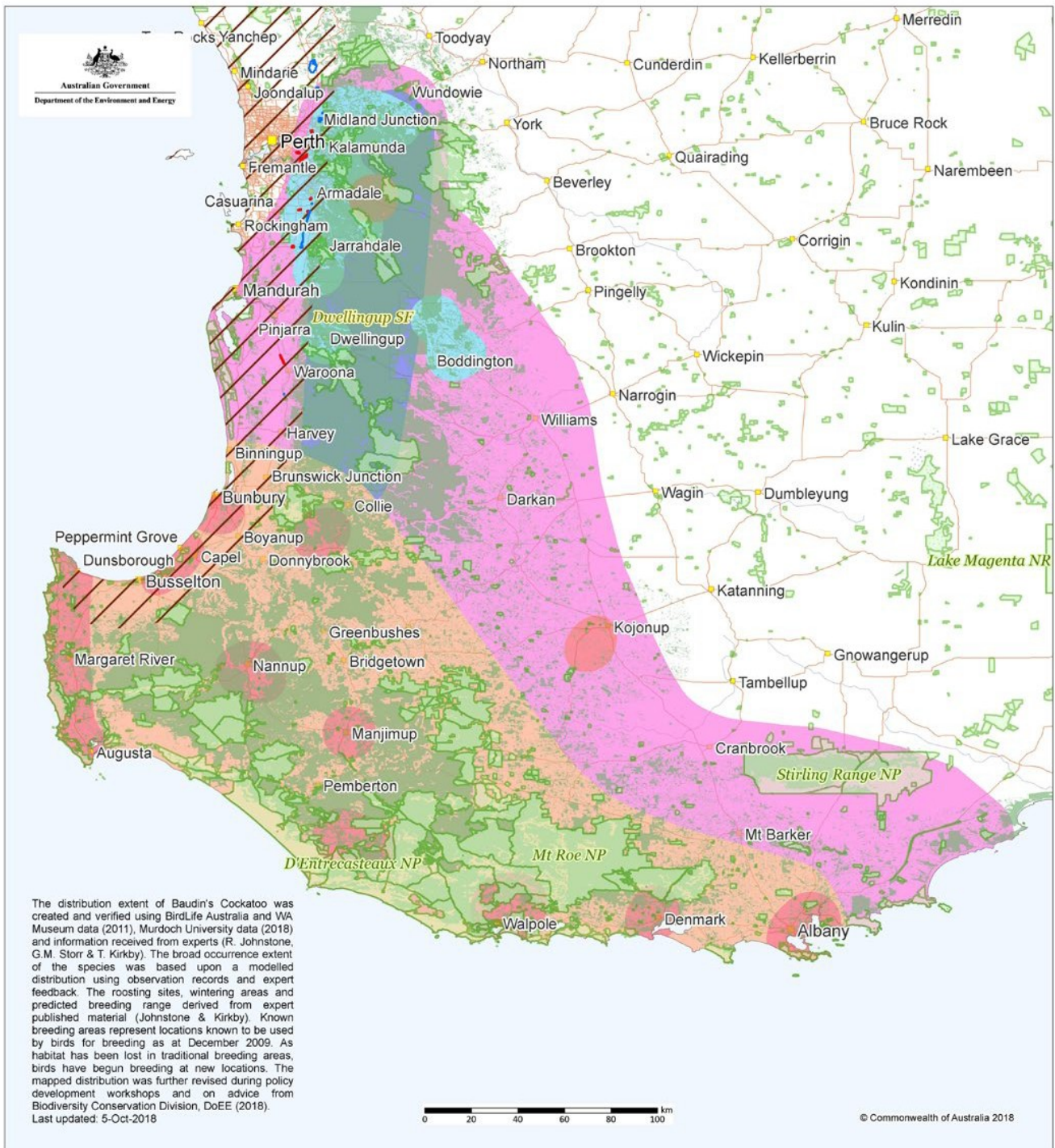
<sup>1</sup> The definition of flora includes algae, fungi and lichens

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



## **Appendix 2: Black Cockatoo Distribution Maps**

## Map 2 Modelled distribution for Baudin's Cockatoo (*Zanda baudinii*)



INDICATIVE MAP ONLY: For the latest departmental information, please refer to the Protected Matters Search Tool and the Species Profiles & Threats Database at

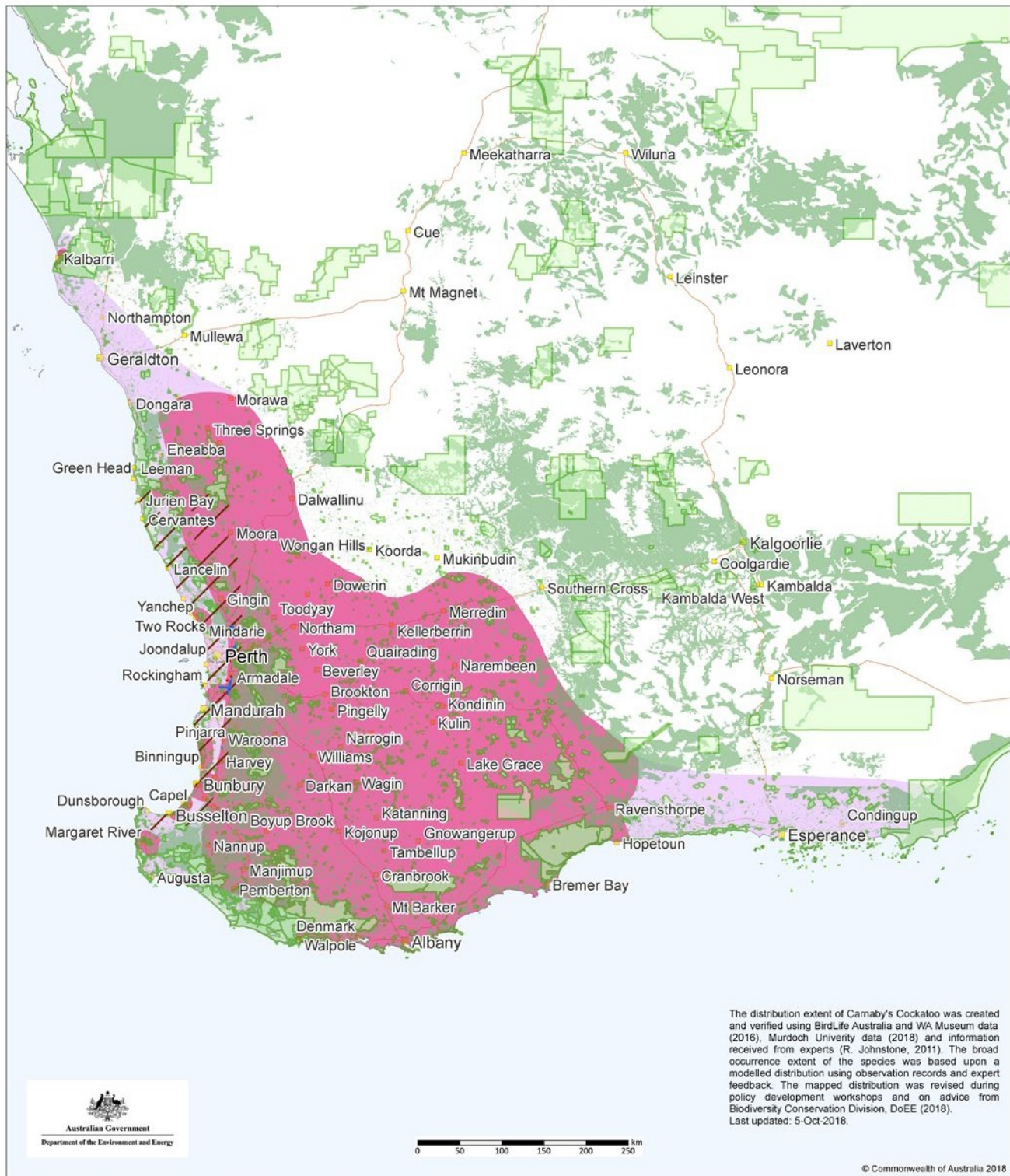
Produced by:  
Environmental Resources Information Network 2018

Contextual data source:  
National Vegetation Information System (NVIS 5.1) 2018  
Interim Biogeographic Regionalisation for Australia (IBRA) version 7 2012  
Collaborative Australian Protected Area Database (CAPAD) 2016  
Geoscience Australia GEODATA TOPO 250K Topographic Data Series 3 2006

Projection: Geographic  
Datum: GDA94

- Conservation Areas
- Jarrah, Karri and Manri
- Species**
- Known Breeding Areas
- Predicted Breeding Range
- Known Foraging Areas
- Main Wintering Area
- Species Likely to Occur
- Ecological Communities**
- Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain
- Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain
- Banksia Woodlands of the Swan Coastal Plain
- Cities & Towns
- Roads (sealed)
- Roads (unsealed)
- State Border
- Major Rivers
- Lakes/Reservoirs
- Non-perennial Lakes

**Map 3** Modelled distribution for Carnaby's Cockatoo (*Zanda latirostris*)



**INDICATIVE MAP ONLY:** For the latest departmental information, please refer to the Protected Matters Search Tool and the Species Profiles & Threats Database at <http://www.environment.gov.au/biodiversity/threatened/index.html>

**Produced by:**  
Environmental Resources Information Network 2018

**Contextual data source:**  
National Vegetation Information System (NVIS 5.1) 2018  
Interim Biogeographic Regionalisation for Australia (IBRA) version 7 2012  
Collaborative Australian Protected Area Database (CAPAD) 2016  
Geoscience Australia GEODATA TOPO 250K Topographic Data Series 3 2006

**Projection:** Geographic  
**Datum:** GDA94

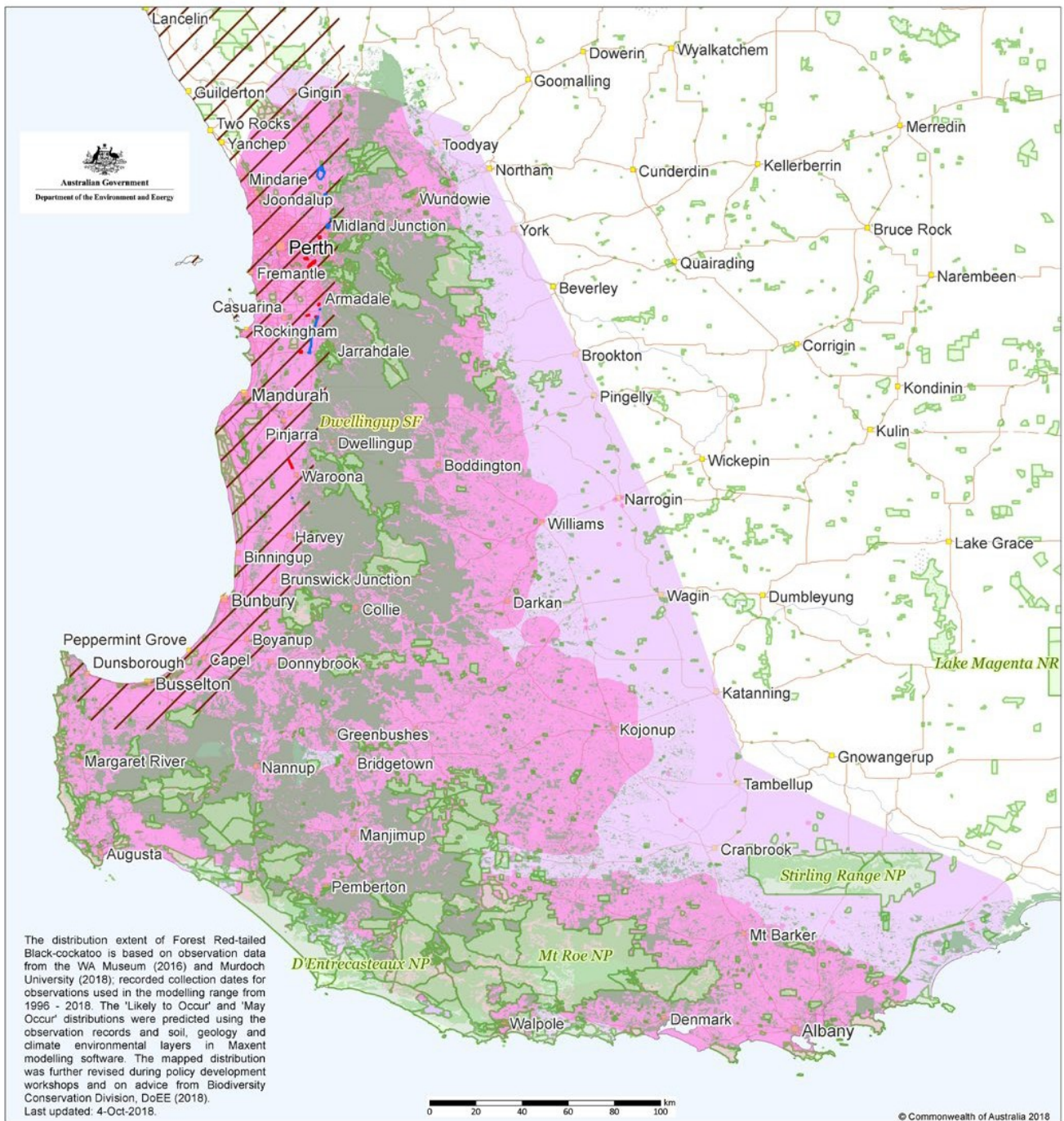
**Conservation Areas**  
Jamrah, Karri, Mann, Salmon Gum, Wandoo, Banksia, Grevillea, Dryandra and Hakea

**Species**  
Breeding Range  
Non-breeding Range

**Ecological Communities**  
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain  
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain  
Banksia Woodlands of the Swan Coastal Plain

Cities & Towns  
Roads (sealed)  
Roads (unsealed)  
State Border

**Map 4** Modelled distribution for Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)

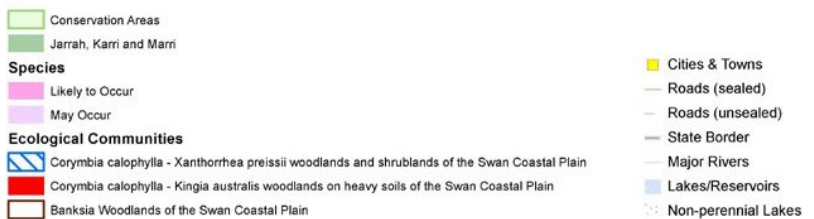


INDICATIVE MAP ONLY: For the latest departmental information, please refer to the Protected Matters Search Tool and the Species Profiles & Threats Database at <http://www.environment.gov.au/biodiversity/threatened/index.html>

**Produced by:**  
Environmental Resources Information Network 2018

**Contextual data source:**  
National Vegetation Information System (NVIS 5.1) 2018  
Interim Biogeographic Regionalisation for Australia (IBRA) version 7 2012  
Collaborative Australian Protected Area Database (CAPAD) 2016  
Geoscience Australia GEODATA TOPO 250K Topographic Data Series 3 2006

**Projection:** Geographic  
**Datum:** GDA94





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## **Appendix 3: Tree Data**

Road Name	SLK (Straight Line Kilometre)	Side of Road	Distance from Existing Edge of Seal (m)	Tree Number	Species (Common Name)	DBH (mm)	Number of Suitable Hollows	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
<b>Boundary Road</b>	6.77	RHS	3	1	<i>Eucalyptus</i> sp.	400	0	-29.454836	116.077944
	6.85	LHS	1.9	2	<i>Eucalyptus</i> sp.	380	0	-29.454208	116.017925
	7.38	LHS	3	3	Salmon Gum	535	0	-29.449362	116.017926
	7.5	RHS	2.1	4	Salmon Gum	590	0	-29.448301	116.017922
	9.13	LHS	1.7	5	Salmon Gum	560	0	-29.433468	116.017859
	9.52	LHS	2.8	6	<i>Eucalyptus</i> sp.	<300	0	-29.429868	116.017832
	9.55	RHS	2.8	7	<i>Eucalyptus</i> sp.	<300	0	-29.429700	116.017753
	10.37	LHS	2.6	8	Salmon Gum	550	0	-29.422317	116.017816
	10.38	LHS	2.6	9	Salmon Gum	400	0	-29.422178	116.017768
	10.57	RHS	2.8	10	Salmon Gum	830	1	-29.420376	116.017795
	10.64	RHS	1.8	11	Salmon Gum	690	0	-29.419892	116.017806
	10.7	RHS	1.7	12	Salmon Gum	740	0	-29.419336	116.017792
	10.72	LHS	2.8	13	Salmon Gum	500	0	-29.418891	116.017652
	11.03	RHS	1.2	14	Salmon Gum	660	0	-29.416158	116.017790
	11.07	LHS	2.4	15	Salmon Gum	670	0	-29.415862	116.017788
	12.71	RHS	2.7	16	<i>Eucalyptus</i> sp.	<300	0	-29.401257	116.017727
	12.82	RHS	2.8	17	<i>Eucalyptus</i> sp.	<300	0	-29.400254	116.017716
	12.86	RHS	2.7	18	<i>Eucalyptus</i> sp.	<300	0	-29.399825	116.017722
	12.94	LHS	3	19	<i>Eucalyptus</i> sp.	<300	0	-29.399278	116.017711
	14.24	LHS	2.4	20	Salmon Gum	550	0	-29.387756	116.017675
	14.34	LHS	2.6	21	<i>Eucalyptus</i> sp.	520	0	-29.386700	116.017620
	15.57	RHS	2.5	22	<i>Eucalyptus</i> sp.	<300	0	-29.375906	116.017615
<b>Hill Road</b>	20.72	RHS	2.6	23	<i>Eucalyptus</i> sp.	<300	0	-29.375649	116.011085
	20.77	RHS	1.4	24	Salmon Gum	760	0	-29.375654	116.010634
<b>Morawa South Rd (Perenjori)</b>	0.06	RHS	2.6	25	Salmon Gum	770	0	-29.375086	116.009836
	0.11	RHS	2.4	26	Salmon Gum x 2	620 & 510	0	-29.374624	116.009784
	0.14	RHS	1.8	27	Salmon Gum	640	0	-29.374384	116.009790
	0.16	RHS	2.1	28	Salmon Gum	630	0	-29.374152	116.009784
	0.19	RHS	1.8	29	Salmon Gum	750	0	-29.373875	116.009842
	0.19	RHS	2.7	30	Salmon Gum	400	0	-29.373875	116.009842
	0.24	RHS	2.8 & 2.9	31	Salmon Gum x 2	<300 x 2	0	-29.373420	116.009803
	0.38	RHS	1.3	32	Salmon Gum	500	0	-29.372199	119.009766



Road	SLK (Straight Line Kilometre)	Side of Road	Distance from Existing Edge of Seal (m)	Tree Number	Species (Common Name)	DBH (mm)	Number of Suitable Hollows	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
	0.44	LHS	2.3	33	Salmon Gum (dead)	630	0	-29.371601	116.009796
	1.18	RHS	2.2	34	Salmon Gum	630	0	-29.364897	116.009763
	1.22	LHS	2.2	35	Salmon Gum	<300	0	-29.364504	116.009752
	2.85	LHS	2.6	36	<i>Eucalyptus</i> sp.	320	0	-29.349653	116.009794
	2.85	RHS	2.2	37	<i>Eucalyptus</i> sp.	470	0	-29.349653	116.009794
	2.9	RHS	2.8	38	<i>Eucalyptus</i> sp. x 3	<300 x 3	0	-29.348252	116.009889
	4.11	LHS	2.7	39	<i>Eucalyptus</i> sp.	<300	0	-29.338313	116.009810
	4.25	LHS	2.4	40	<i>Eucalyptus</i> sp.	<300	0	-29.337078	116.009820
	5.17	LHS	2	41	<i>Eucalyptus</i> sp.	<300	0	-29.32875	116.00981
	5.23	LHS	2.2	42	<i>Eucalyptus</i> sp.	<300	0	-29.328447	116.009836
<b>Morawa South Rd (Morawa)</b>	2.28	LHS	2.8	43	<i>Eucalyptus</i> sp.	400	0	-29.277014	116.009790
	6.95	LHS	2.3	44	<i>Eucalyptus</i> sp.	430	0	-29.319120	116.009850