Prepared for
Public Transport Authority
ABN: 61 850 109 576

AECOM

Matilda Bay Black Cockatoo Habitat Assessment

11-Aug-2025
Matilda Bay Black Cockatoo Assessment

Art by
Hayley Thompson Farmer

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Matilda Bay Black Cockatoo Habitat Assessment

Client: Public Transport Authority

ABN: 61 850 109 576

Prepared by

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Executive Summary

The Public Transport Authority of Western Australia (PTA) is expanding its existing ferry service, which currently operates between Elizabeth Quay and South Perth. To support this expansion, AECOM Australia Pty Ltd (AECOM) was engaged by the PTA to undertake a Black Cockatoo habitat assessment in accordance with the Department of Agriculture, Water and the Environment (DAWE) black cockatoo referral guideline at the Matilda Bay site (the survey area). The purpose of the assessment was to identify and assess habitat values for three Black Cockatoo species, focusing on the presence and quality of foraging, breeding and night roosting habitats.

A summary of the results is presented below:

- The survey area is within the modelled distribution of the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (EPBC Act and BC Act Vulnerable) and Carnaby's Cockatoo (*Zanda latirostris*) (EPBC Act and BC Act Endangered). It is outside the modelled distribution of the Baudin's Cockatoo (*Zanda baudinii*) (EPBC Act and BC Act Endangered) however records suggest they may occur.
- The vegetation within the survey area is high quality foraging habitat for the Forest Red-tailed Black Cockatoo due to the presence of favoured foraging species using the federal scoring guideline. It is not considered foraging habitat for the Carnaby's or the Baudin's Cockatoo.
- The refined foraging tool from Bamford suggests that 2.08 ha of Revegetation, Replanting and Parkland areas habitat has a Low and Negligible value for Carnaby's and Baudin's respectively, and Low to Moderate foraging value for Forest Red-tailed Black Cockatoo.
- Foraging evidence of the Forest Red-tailed Black Cockatoo was recorded during the survey.
- The survey area contains 29 potential nesting trees with a diameter at breast height (DBH) greater than 300 mm (noting trees suitable to develop a nest hollow in the future are 300-500 mm DBH (DAWE, 2022)). All trees represent planted mature Eucalypt species in a highly urban environment which is unlikely to be utilised for breeding, described as occurring in 'woodlands and forests' in the DAWE referral guideline.
- No tree hollows of a suitable size, orientation or height above ground level were observed during the assessment.

The Black Cockatoo assessment was completed successfully with no limitations that may influence the ability to assess habitat quality.

1.0 Introduction

1.1 Background

The Public Transport Authority of Western Australia (PTA) is expanding its ferry service, which currently operates between Elizabeth Quay and South Perth. To support this initiative, PTA engaged AECOM Australia Pty Ltd (AECOM) to undertake a Black Cockatoo habitat assessment within the proposal Development Envelope (DE) at the Matilda Bay site (the survey area).

The assessment aimed to identify and evaluate habitat values for the three threatened Black Cockatoo species, with a focus on determining the presence and quality of foraging, breeding, and night roosting habitats within the survey area. The results of this assessment will inform the Environment Protection Authority (EPA) referral documentation and determine whether a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is required. The assessment will be undertaken in accordance with the Commonwealth *Referral guideline for 3 WA threatened black cockatoo species* (DAWE, 2022) and refined using the widely implemented Bamford Consulting Ecologists 2023 tool.

1.2 Location

The DE is 7.17 ha located along Hackett Drive in Matilda Bay, approximately 3 km south of Perth along the Derbal Yerrigan (Swan River), shown in Figure 1.

1.3 Objectives

The objective of the assessment was to define and map Black Cockatoo habitat values present within the survey area. The scope included:

- Review of existing information from previous surveys.
- Undertake a targeted Black Cockatoo habitat assessment.
- Prepare a technical report accompanied by a comprehensive data package.

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LEGEND

Survey Area

Survey Area

PUBLIC TRANSPORT AUTHORITY

MATILDA BAY BLACK COCKATOO ASSESSMENT

Figure 1

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2.0 Methodology

A field survey was undertaken on 17 July 2025 by Hannah Spanswick and Jasmin Swoboda. Hannah Spanswick has more than 5 years' experience as a zoologist undertaking similar scopes across the Swan Coastal Plain. She holds a Masters of Biological Science (Zoology) and Bachelor of Science (Zoology) and is trained in the refined Black Cockatoo Breeding Methodology by Tony Kirkby and Mike Bamford. Jasmin Swoboda has three years' experience in fauna surveys across WA as part of the fauna technical team at DBCA.

The survey targeted all three threatened Western Australian Black Cockatoo species which are Carnaby's Cockatoo (*Zanda latirostris*), Baudin's Cockatoo (*Zanda baudinii*), and the Forest-Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*).

Breeding, foraging and night roosting habitat values were recorded using methodology outlined in the Referral Guidelines for Three Threatened Black Cockatoo Species and the 'Survey guidelines for Australia's threatened birds' (DAWE, 2022; DCCEEW, 2010).

A refined foraging assessment was completed using data collected during the survey based on the Bamford Consulting Ecologists (2020) scoring system which assists in identifying areas of higher quality habitat to assist in impact avoidance.

2.1 Breeding Habitat

Breeding habitat was assessed by quantifying the number of trees that have the potential to form hollows suitable for nesting by Black Cockatoo species. Breeding habitat is defined by DAWE (2022) and includes potential nesting trees (DBH >300 mm), suitable nesting trees (trees with hollows present), and known nesting trees (breeding confirmed). Trees could be part of remnant native vegetation woodland or forests or isolated remnant trees.

All trees with a DBH >300 mm were recorded using hand-held Samsung Tablet devices including the tree location, species, and hollow presence and any additional details relevant to inform the breeding habitat assessment.

Hollows were assessed from the ground.

2.2 Night Roosting Habitat

Night roost habitat was assessed by assessing the presence of known roosting trees and potential roosting trees. Known roosting trees are defined as any tall tree but particularly:

- Baudin's Cockatoo - Jarrah, Flooded Gum, Blackbutt, Tuart and introduced eucalypts Blue Gum (*E. globulus*), Lemon Scented Gum (*Corymbia citriodora*).
- Carnaby's Cockatoo - Flat-topped Yate (*E. occidentalis*), Salmon Gum, Wandoo, Marri, Karri, Blackbutt, Tuart, introduced eucalypts and introduced pines.
- Forest Red-tailed Black Cockatoo - tall Jarrah, Marri, Blackbutt, Tuart and introduced eucalypt trees or large trees on the edges of forests.

Water sources are essential to support night roosting habitat.

2.3 Foraging Habitat

Foraging habitat was assessed using a combination of field observations and contextual information from publicly available databases for roosting and breeding sites (Birdlife Australia, 2018). This dataset is five years' old and does not replace the updated DBCA dataset.

2.3.1 DAWE Foraging Tool

Foraging for the three species is characterised as:

- Baudin's - Primarily seeds of Marri, rarely Jarrah, in woodlands and forest, and seeds of native proteaceous plant species (for example, *Banksia* spp. (includes *Dryandra* spp.) and *Hakea* spp.). During the breeding season feed primarily on native vegetation, particularly Marri (seeds, flowers, nectar and grubs). Also insects and insect larvae; pith of Kangaroo Paw (*Anigozanthos flavidus*);

tips of *Pinus* spp.; *Macadamia* spp., almonds and pecans; seeds of apples and pears; and persimmons.

- Carnaby's – Native shrubland, kwongan heathland and woodland on seeds, flowers and nectar of native proteaceous plant species (Banksia spp., *Hakea* spp. and *Grevillea* spp.), as well as Callistemon spp. and Marri. Also seeds of introduced species including *Pinus* spp., *Erodium* spp., wild radish, canola, almonds, macadamia and pecan nuts; insects and insect larvae; occasionally apples and persimmons; and liquidambar.
- Forest Red-tailed Black Cockatoo – Primarily seeds of Jarrah and Marri in woodlands and forest, and edges of Karri forests, including Wandoo and Blackbutt. Forages on Allocasuarina cones, fruits of Snottygobble (*Persoonia longifolia*) and Mountain Marri (*C. haematoxylon*). Other less important foods include Blackbutt, Bullich, *Allocasuarina fraseriana*, *Hakea* spp., Tuart, Redheart Moit (*E. decipiens*) and Bushy Yate (*E. lehmanni*). Also some introduced eucalypts such as River Red Gum (*E. camaldulensis*) and Rose Gum (E. grandis). On the Swan Coastal Plain, often feeds on introduced Cape Lilac (Melia *azedarach*), *E. caesia, E. erythrocorys*, Lemon-scented Gum and Kaffir Plum (*Harpephyllum caffrum*).

The foraging quality scoring tool developed by DAWE (2022) incorporates site condition, site context and species stocking rate, and applies a single score to a defined survey area provided it is larger than 1 ha. The DAWE (2022) foraging tool was applicable for the survey area which is 3.94 ha. The scoring tool is defined in Table A1 of the DAWE (2022) guideline.

2.3.2 Bamford Refined Foraging Tool

The Bamford Consulting Ecologists (2020) scoring system (Table 3) was applied to further inform quality foraging habitat mapping. This method assists in defining areas of high/medium/low quality based on specific fauna habitat features present rather than applying a single score to a survey area. This assessment is limited to the 2018 Birdlife Australia dataset to inform site context and species density. The details are in Appendix A.

3.0 Results

3.1 Breeding Habitat

Twenty-nine potential nesting trees with an appropriate DBH > 300mm were recorded within the survey area (Table 1). Trees included six Lemon-scented Gums, one Powderbark Wandoo, one Flooded Gum and 21 planted Eucalypt trees.

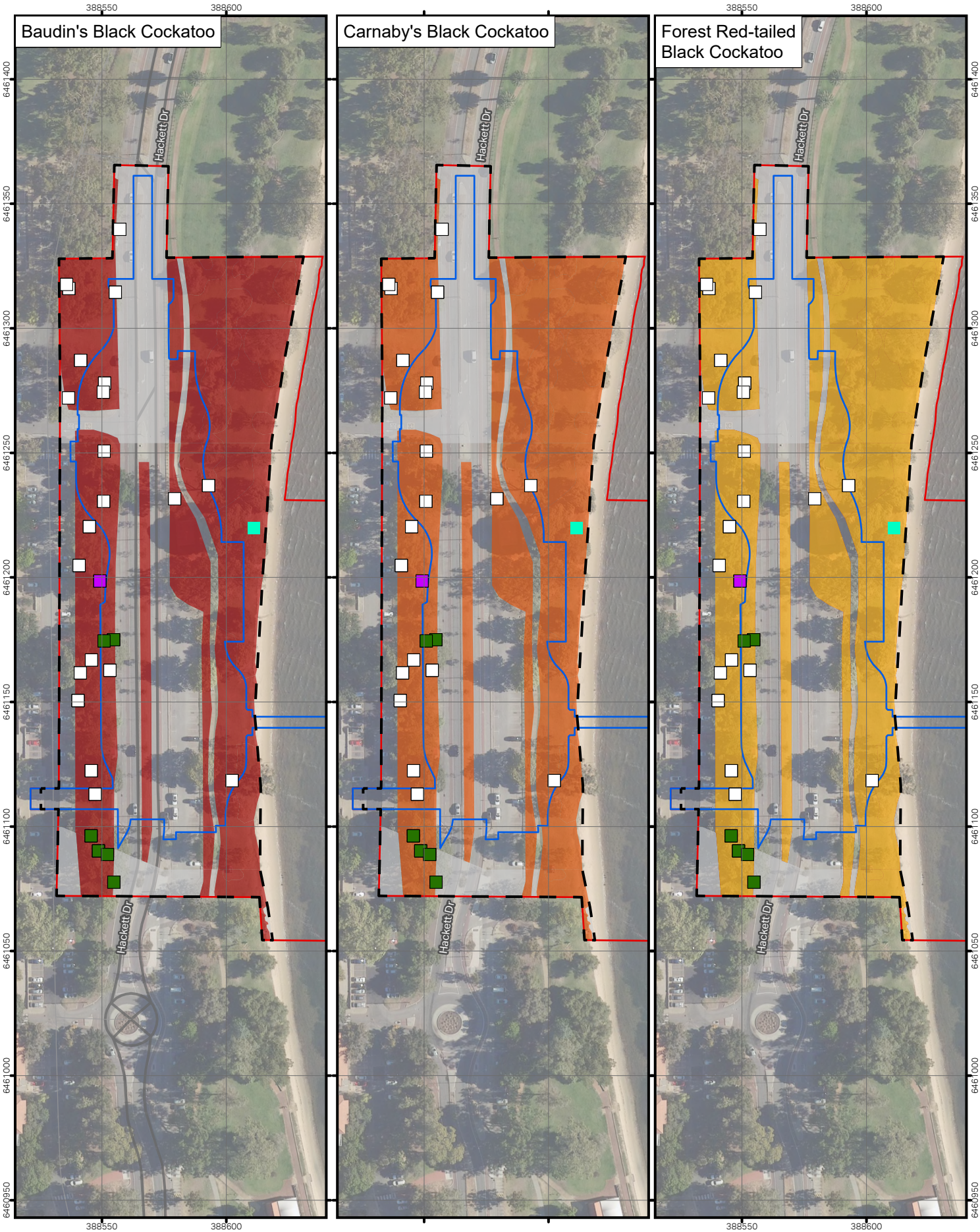
No suitable hollows were observed during the survey therefore no suitable breeding trees were recorded. Trees are mapped in Figure 2.

Table 1 Potential nesting trees with a DBH (>300 mm) within the DE

Species	Tree Height (m)	DBH (cm)
Lemon-scented gum (*Corymbia citriodora*)	15-20m	70
Lemon-scented gum (*Corymbia citriodora*)	15-20m	49
Lemon-scented gum (*Corymbia citriodora*)	15-20m	57
Lemon-scented gum (*Corymbia citriodora*)	15-20m	95
Lemon-scented gum (*Corymbia citriodora*)	10-15m	33
Lemon-scented gum (*Corymbia citriodora*)	15-20m	47
Non-native planted tree	15-20m	69
Non-native planted tree	5-10m	123
Non-native planted tree	15-20m	61
Non-native planted tree	10-15m	49
Non-native planted tree	15-20m	140
Non-native planted tree	15-20m	62
Non-native planted tree	15-20m	93
Non-native planted tree	10-15m	43
Flooded Gum (*Eucalyptus rudis*)	15-20m	128
Non-native planted tree	15-20m	65
Non-native planted tree	15-20m	81
Non-native planted tree	10-15m	115
Non-native planted tree	15-20m	66
Non-native planted tree	15-20m	57
Non-native planted tree	10-15m	70
Non-native planted tree	15-20m	55
Non-native planted tree	15-20m	51
Non-native planted tree	15-20m	63
Non-native planted tree	15-20m	79
Non-native planted tree	20-25m	97
Non-native planted tree	20-25m	93
Non-native planted tree	5-10m	30
Powderbark Wandoo (*Eucalyptus accedens*)	10-15m	45

3.2 Night Roosting Habitat

No evidence of night roosting was observed in the survey area. There are known roosting sites within 2 km of the survey area. There were seven trees recorded as more than 20 m tall that could be classified as “tall trees”.



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DATA SOURCES Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010)
Service Layer Credits: Main Roads: World Imagery Source: Esri, Maxar, Earthstar Geographics, and the GIS User CommunityOthers: *Minor Roads: Freeways & Highways: Townsites (LGATE-248) (small scale)* DEF QUERY: WMS

LEGEND

- Development Envelope
- Indicative Disturbance Footprint
- Survey Area (AECOM, 2025)

Black Cockatoo Breeding Trees

- Powderbark Wandoo (Eucalyptus accedens)
- Lemon-scented gum (Corymbia citriodora)
- Flooded Gum (Eucalyptus rudis)
- Other

Black Cockatoo Foraging Quality

- None
- Negligible
- Low
- Low to Moderate
- Moderate
- Moderate to High
- High

Black Cockatoo Foraging and Breeding Habitat

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Figure 2

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3.3 DAWE Foraging Habitat

The survey area has been assessed as providing no foraging quality habitat for Baudin's and Carnaby's Cockatoo. The survey area lacks any 'native vegetation including roadsides and parkland cleared'. The scattered mature trees present in the survey area do not represent native vegetation that has been historically cleared but planted native and introduced species for landscaping. The scattered trees include two "native" individuals which were likely planted (one Flooded Gum and one Powderbark Wandoo). These trees are not listed in Table 1 of the DAWE (2022) referral guidelines as preferred foraging species.

The survey area is considered High quality foraging quality for the Forest Red-tailed Black Cockatoo. There are eight suitable foraging tree species present; the Lemon-Scented Gum, Wandoo and Flooded Gum, all listed in Table 1 of the DAWE (2022) guideline. Evidence of Forest Red-tailed Black Cockatoo foraging was recorded at two locations directly adjacent to the survey area. This included foraging on an isolated Marri tree less than 5 m north of the survey area (Plate 1). No foraging evidence for Baudin's or Carnaby's Cockatoo was observed.

The DAWE (2022) foraging score tool results are presented in Table 2.

Plate 1 Forest Red-tailed Black Cockatoo foraging evidence

Table 2 Black Cockatoo foraging habitat quality scores for the survey area in accordance with DAWE (2022)

Starting Score		Baudin's Cockatoo (*Zanda baudinii)*		Carnaby's Cockatoo (*Zanda latirostris)*		Forest Red-Tailed Black Cockatoo *(Calyptorhynchus banksii naso)*	
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. No suitable foraging species present.		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. No suitable foraging species present.		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. Arguably according to Table 1 of the Referral Guideline, Lemon Scented-Gum represents foraging habitat. Survey area supports 13 suitable foraging trees and foraging evidence recorded.	
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.	☐

Starting Score		Baudin's Cockatoo (*Zanda baudinii*)		Carnaby's Cockatoo (*Zanda latirostris*)		Forest Red-Tailed Black Cockatoo *(Calyptorhynchus banksii naso)*	
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		**-2**		**-2**		**10**	

3.4 Bamford Foraging Habitat

The refined Bamford Consulting Ecologists (2020) foraging habitat assessment considered known breeding and roosting sites and characteristics of each fauna habitat type. The following key factors influenced the results:

- Site condition for Carnaby's and Baudins' was considered '1' representing "scattered specimens of known food plants but projected foliage cover of these is <2%".
- Site context is 0 for all three species as existing vegetation represents <1% of available habitat within 12 km and local breeding is unlikely.
- Confirmed roosting sites for Forest-Red tailed Black Cockatoo and Carnaby's Cockatoo exist in Kings Park and within two kilometres of the survey area. Foraging evidence was recorded for Forest Red-tailed Black Cockatoo. Stocking rate has therefore been scored as '1' for these species. Baudin's is unlikely to occur therefore stocking rate is '0'.
- Kings Park provides suitable foraging habitat for all three Black Cockatoo species.

Based on the assumptions above, the Revegetation, Replanting and Parkland areas (mapped for 2.08 ha) were rated as Low and Negligible for Carnaby's Cockatoo and Baudin's Cockatoo respectively. This habitat was scored Low to Moderate for Forest Red-tailed Black Cockatoos influenced largely by the presence of suitable foraging species (Lemon-scented Gum, Powerbark Wandoo and Flooded Gum).

Foraging scores are shown in Table 3 and mapped in Figure 2.

Table 3 Matilda Bay survey area refined foraging habitat assessment (Bamford Consulting Ecologists, 2020).

Fauna Habitat	Forest Red-tailed Black Cockatoo				Baudin's Cockatoo				Carnaby's Cockatoo			
	Site Condition	Site Context	Stocking Rate	**Total Score**	Site Condition	Site Context	Stocking Rate	**Total Score**	Site Condition	Site Context	Stocking Rate	**Total Score**
Cleared	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Wetland Shoreline	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Revegetation, Replanting and Parkland	2	0	1	**3**	1	0	0	**1**	1	0	1	**2**

4.0 Discussion

4.1 Black Cockatoo Known Distribution

The survey area is on the Swan Coastal Plain region and lies within the modelled distribution of the Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo (DAWE, 2022). Carnaby's Cockatoos are known to forage across the Swan Coastal Plain region, with localised breeding potentially occurring between July and December. Forest Red-tailed Black Cockatoos are known to both breed and forage within the Swan Coastal Plain, including the Perth Metropolitan Area. In contrast, Baudin's Cockatoos are less commonly recorded in the western portion of the Swan Coastal Plain, and their presence in the survey area is considered unlikely based on current distribution modelling (DAWE, 2022).

4.2 Breeding Habitat

Twenty-nine potential nesting trees were identified, none supporting hollows suitable for potential breeding. The survey area supports scattered native species including a Flooded Gum and a Wandoo tree amongst planted Eucalyptus and Lemon-scented Gums. Despite many trees exceeding the 300 mm DBH threshold outlined in DAWE (2022) guidelines, the absence of hollows suggests limited breeding habitat value, and future hollow development is considered unlikely.

Black Cockatoos are known to breed in woodland or forest, partially cleared areas and isolated trees. For this reason the breeding value cannot be entirely discounted. However, isolated trees are likely to refer to trees in paddocks in proximity to woodlands and forests rather than landscaped corridors in a heavily urban environment.

4.3 Foraging Habitat

The survey area has no foraging quality for Baudin's or Carnaby's using the DAWE (2022) guidelines. The area is considered 'high quality' for Forest Red-tailed Black Cockatoos based on the presence of suitable foraging trees and foraging evidence present.

Similarly, the Bamford scoring tool determined that the "Revegetation, Replanting and Parkland" fauna habitat provides low or negligible foraging quality for Baudin's and Carnaby's Cockatoo respectively, and Low to Moderate quality foraging for Forest Red-tailed Black Cockatoos. This again was influenced by the lack of suitable foraging species for the former two Cockatoo species, while evidence of use was recorded for Forest Red-tailed Black Cockatoo.

The survey area represents a narrow corridor of planted native and introduced mature tree species. It is not anticipated that Cockatoos would utilise this as significant foraging habitat taking into account the prevalence of preferred foraging species in Kings Park remnant native vegetation.

The presence of feeding debris from Forest Red-tailed Black Cockatoo supports their use of the area, while the absence of evidence for the other species may reflect habitat limitations or seasonal variability.

4.4 Night Roosting Habitat

Roosting potential within the survey area and surrounding area is supported by the presence of suitable tree species (e.g. *Corymbia citriodora)*, proximity to water and confirmed roosting sites within 1.5 km of the survey area. However, at a landscape scale, the removal of these trees is unlikely to significantly impact black cockatoo populations, given the presence of 36 known roosting sites within a 20 km radius (DBCA, 2019a). This broader context suggests that while the survey area may offer some roosting value, its contribution to regional habitat availability is relatively minor.

5.0 Conclusion

Habitat loss, particularly the loss of breeding habitat, is widely recognised as the most significant threat to the recovery of all three threatened black cockatoo species (DEC, 2008). This is largely due to the scarcity of mature native trees capable of forming suitable nesting hollows, compounded by ongoing clearing of remnant habitat. Current guidance from (DAWE, 2022) strongly recommends avoiding the removal of potential breeding habitat and protecting foraging resources, particularly in proximity to any nesting habitat.

According to DAWE (2022) guidelines, the Swan Coastal Plain provides critical foraging habitat and the focus is to maintain viable foraging resources to ensure the survival of the species. Foraging values were low to negligible for Carnaby's and Baudins and Low to Moderate for Forest Red-tailed Black Cockatoo. This reflects the limited ecological value of scattered trees compared to intact bushland. Feeding debris from Forest Red-tailed Black Cockatoos was observed, supporting their use of the area, but no evidence was found for Carnaby's or Baudin's Cockatoos. These Cockatoo may fly over the area but are unlikely to utilise it.

Most trees within the survey area are planted Eucalypt species, and no suitable breeding hollows were identified. Although some trees exceed the DBH threshold for potential nesting habitat, their non-native status and lack of hollows suggest low breeding suitability. A small number of native species (Tuart and Flooded Gum) were observed outside the survey area.

In summary, while the survey area lies within the known distribution range of all three Black Cockatoo species, the habitat within the survey area is unlikely to represent critical breeding or foraging habitat.

6.0 References

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Appendix A

Appendix A Bamford Foraging Score Method

1.0 Bamford Consulting Ecologists (BCE) Black Cockatoo Scoring System

1.1 Introduction

Application of the Offset Assessment Guide (offsets guide) developed by the federal environment department for assessing Black-Cockatoo foraging habitat requires the calculation of a score out of 10. The following system has been developed by Bamford Consulting Ecologists (BCE) with assistance from Quessentia Consulting to provide an objective scoring system that is practical and can be used by trained field zoologists with experience in the environments frequented by the species.

The foraging value score provides a numerical value that reflects the significance of vegetation as foraging habitat for Black-Cockatoos, and this numerical value is designed to provide the information needed by the Federal Department of Agriculture, Water and the Environment (DAWE) to assess impact significance and offset requirements. The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area and can be influenced by the context such as the availability of foraging habitat nearby. The BCE scoring system for value of foraging habitat has three components as detailed above. These three components are drawn from the DAWE offsets guide but the scoring approach was developed by BCE and includes a fourth (moderation) component.

Note that the scoring system can only be applied within the range of the species or at least where the species could reasonably be expected to occur based upon existing information.

Calculating the total score (out of 10) requires the following steps:

a. Site condition. Determining a score out of six for the vegetation composition, condition and structure; plus

b. Site context. Determining a score out of three for the context of the site; plus

c. Species stocking rate. Determining a score out of one for species density.

d. Determining the total score out of 10, which may require moderation for context and species density with respect to the site condition (vegetation) score. Moderation also includes consideration of pine plantations as a special case for foraging value.

The BCE scoring system places the greatest weight on site condition (scale of 0 to 6) because this has the highest influence on the foraging values of a site, which in turn is the fundamental driver in meeting ecological requirements for continued survival.

Site context has a lower weight (scale of 0 to 3) in recognition of the mobility of the species, which means they can access good foraging habitat even in fragmented landscapes, but allowing for recognition of the extent of available habitat in a region and context in relation to activity (such as breeding and roosting). The application of scoring site context is further discussed below.

Species stocking rate is given a low weight (0 to 1) as it is a means only of recognising that a species may or may not be abundant at a site, but that abundance is dependent upon site condition and context and is thus not an independent variable. The abundance of a species is also sensitive to sampling effort, and to seasonal and annual variation, and is therefore an unreliable indicator of actual importance of a site to a species.

Calculation of scores and the moderation process are described in detail below.

1.2 Site Condition

Table 1 Site Condition: Vegetation Composition, Condition and Structure Scoring

Site Score	Description of Vegetation Values		
	Carnaby's Black Cockatoo	Baudin's Black Cockatoo	Forest Red-tailed Black Cockatoo
0	No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples: • Water bodies (e.g. salt lakes, dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits) or with vegetation of no food value, such as some suburban landscapes. • Mown grass	No foraging value. No eucalypts or other potential sources of food. Examples: • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).	No foraging value. No eucalypts or other potential sources of food. Examples: • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits)
1	Negligible to low foraging value. Examples: • Scattered specimens of known food plants but projected foliage cover of these is < 2%. This could include urban areas with scattered foraging trees; • Paddocks that are lightly vegetated with melons or other known food-source weeds (e.g. Erodium spp.) that represent a short-term and/or seasonal food source; • Blue Gum plantations (foraging by Carnaby's Black-Cockatoos has been reported but appears to be unusual).	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. This could include urban areas with scattered foraging trees.	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. Could include urban areas with scattered foraging trees.
2	Low foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, have <10% projected foliage cover; • Woodland with tree banksias 2-5% projected foliage cover; • Open eucalypt woodland/mallee of small-	Low foraging value. Examples: • Woodland with scattered specimens of known food plants (e.g. Marri and Jarrah) 1-5% projected foliage cover; • Urban areas with scattered foraging trees.	Low foraging value. Examples: • Woodland with scattered specimens of known food plants (e.g. Marri, Jarrah or Sheoak) 1-5% projected foliage cover; • Urban areas with scattered food plants such as Cape Lilac, *Eucalyptus caesia* and *E. erythrocorys*.

Site Score	Description of Vegetation Values		
	Carnaby's Black Cockatoo	Baudin's Black Cockatoo	Forest Red-tailed Black Cockatoo
	• fruited species; • Paddocks that are densely vegetated with melons or other known food-source weeds (e.g. Erodium spp.) that represent a short-term and/or seasonal food source.		
3	Low to Moderate foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, have 10-20% projected foliage cover; • Woodland with tree banksias 5-20% projected foliage cover; • Eucalypt Woodland/Mallee of small-fruited species; • Eucalypt Woodland with Marri < 10% projected foliage cover	Low to Moderate foraging value. Examples: • Eucalypt Woodland with known food plants (especially Marri) 5-20% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).	Low to Moderate foraging value. Examples: • Eucalypt Woodland with known food plants (especially Marri and Jarrah) 5-20% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).
4	Moderate foraging value. Examples: • Woodland/low forest with tree banksias (of key species B. attenuata and B. menziesii) 20-40% projected foliage cover; • Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have 20-40% projected foliage cover; • Eucalypt Woodland/Forest with Marri 20-40% projected foliage cover.	Moderate foraging value. Examples: • Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. • Eucalypt Woodland/Forest with diverse, healthy understorey and known food trees (especially Marri) 10-20% projected foliage cover. • Orchards with highly desirable food sources (e.g. apples, pears, some stone fruits).	Moderate foraging value. Examples: • Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Sheoak Forest with 40-60% projected foliage cover.

Site Score	Description of Vegetation Values		
	Carnaby's Black Cockatoo	Baudin's Black Cockatoo	Forest Red-tailed Black Cockatoo
5	Moderate to High foraging value. Examples: • Banksia Low Forest (of key species B. attenuata and B. menziesii) with 40-60% projected foliage cover; • Banksia Low Forest (of key species B. attenuata and B. menziesii) with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Pine plantations with trees more than 10 years old (but see pine note below in moderation section).	Moderate to High foraging value. Examples: • Marri-Jarrah Forest with 40-60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths.	Moderate to High foraging value. Examples: • Marri-Jarrah Forest with 40-60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. • Sheoak Forest with > 60% projected foliage cover.
6	High foraging value. Example: • Banksia Low Forest (of key species B. attenuata and B. menziesii) with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).

Vegetation structural class terminology follows Keighery (1994).

1.3 Site Context

Site Context is a function of site size, availability of nearby habitat and the availability of nearby breeding areas. Site context includes consideration of connectivity, although Black-Cockatoos are very mobile and will fly across paddocks to access foraging sites. Based on BCE observations, Black-Cockatoos are unlikely to regularly go over open ground for a distance of more than a few kilometres and prefer to follow tree-lines.

The maximum score for site context is 3, and because it is effectively a function of presence/absence of nearby breeding and the distribution of foraging habitat across the landscape, the following table, developed by Bamford Consulting in conjunction with DEE, provides a guide to the assignation of site context scores. Note that 'local area' is defined as within a 15 km radius of the centre point of the study site. This is greater than the maximum distance of 12km known to be flown by Carnaby's Black-Cockatoo when feeding chicks in the nest.

Table 2 Site Context Weighting

Site Context Score	Percentage of the existing native vegetation within the 'local' area that the study site represents	
	'Local' breeding known/likely	'Local' breeding unlikely
3	>5%	>10%
2	1-5%	5-10%
1	0.1-1%	1-5%
0	<0.1%	<1%

The table above provides weighting for where nearby breeding is known (or suspected) and for the proportion of foraging habitat within 15km represented by the site being assessed. Some adjustments may be needed based on the judgement of the assessor and in relation to the likely function of the site. For example, a small area of foraging habitat (e.g. 0.5% of such habitat within 15km) could be upgraded to a context of 2 if it formed part of a critical movement corridor. In contrast, the same sized area of habitat, of the same local proportion, could be downgraded if it were so isolated that birds could never access it.

1.4 Species Density (Stocking Rate)

Species stocking rate is described as "the usage and/or density of a species at a particular site" in the offsets guide. The description also implies that a site supports a discrete population, which is unlikely in the case of very mobile black-cockatoos. Assignation of the species density score (0 or 1) is based upon the black-cockatoo species being either abundant or not abundant. A score of 1 is used where the species is seen or reported regularly and/or there is abundant foraging evidence.

Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year. A score of 0 is used when the species is recorded or reported very infrequently and there is little or no foraging evidence. Where information on actual presence of birds is lacking, a species density score can be assigned by interpreting the landscape and the site context. For example, a site with a moderate condition score that is part of a network of such habitat where a black-cockatoo species is known would get a species density score of 1 even without clear presence data, while a species density score of 0 can be assigned to a site where the level of usage can confidently be predicted to be low.

1.5 Moderation of scores for the calculation of a value out of 10

The calculation out of 10 requires the vegetation characteristics (out of 6) to be combined with the scores given for context and species density. It is considered that the context and density scores are not independent of vegetation characteristics, otherwise habitat of absolutely no value for black-

cockatoo foraging (such as concrete or a wetland) could get a foraging score out of 10 as high as 4 if it occurred in an area where the species breed (context score of 3) and are abundant (species density score of 1). Similarly, vegetation of negligible or low characteristics which could not support black-cockatoos could be assigned a score as high as 6 out of 10. In that case, the score of 6 would be more a reflection of nearby vegetation of high characteristics than of the foraging value of the negligible to low scoring vegetation. The Black-Cockatoos would only be present because of vegetation of high characteristics, so applying the context and species density scores to vegetation of low characteristics would not give a true reflection of their foraging value.

For this reason, the context and species density scores need to be moderated for the vegetation characteristic score to prevent vegetation of little or no foraging value receiving an excessive score out of 10. A simple approach is to assign a context and species density score of zero to sites with a Condition score of low (2), negligible (1) or none (0), on the basis that birds will not use such areas unless they are adjacent to at least low-moderate quality foraging habitat (>3). The approach to calculating a score out of 10 can be summarised as follows:

Table 3 Moderation of scores

Vegetation composition, condition and structure score (out of 6)	Context score	Species density score
3-6 (low/moderate to high value)	Assessed as per Section 1.3 above	Assessed as per Section 1.4 above
0-2 (no to low value)	0	0

Note that this moderation approach may require interpretation depending on the context. For example, vegetation with a condition score of 2 could be given a context score of 1 under special circumstances. Such as when very close to a major breeding area or if strategically located along a movement corridor.

Quality scores are described as outlined in Table 4.

Table 4 Scores and descriptions

Description	Overall Score
None	0
Negligible	1
Low	2
Low to Moderate	3
Moderate	4
Moderate	5
Moderate	6
Moderate to High	7
High	8