

Report

20 May 2025

То	Main Roads WA	Contact No.	+61 8 6222 8222
From	GHD Pty Ltd	Project No.	12652780
Project Name	Anketell Road Upgrade		
Subject	Black Cockatoo Foraging Habitat Quality		

1. Introduction

1.1 Background

Main Roads Western Australia (Main Roads) is proposing to upgrade Anketell Road between Leath Road, within the Kwinana Industrial Area (KIA), and Kwinana Freeway (the Proposal). The Proposal also includes the upgrade of a short section of Anketell Road east of the Kwinana Freeway (to Treeby Road) to connect the Proposal to the existing Anketell Road. The Proposal was referred to the Western Australia (WA) Environmental Protection Authority (EPA) under s.38 of the *Environmental Protection Act 1986* (EP Act) in February 2024. On 2 April 2024, the EPA determined the Proposal required further assessment based on referral information with additional information required under s.40(2)(a) of the EP Act. The Notice Requiring Information for Assessment (24 June 2024) included comments from the WA Department of Biodiversity, Conservation and Attractions (DBCA) and the EPA regarding the assessment of Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo (FRTBC) foraging habitat. The comments related to the method used to calculate black cockatoo foraging habitat quality (the Habitat Scoring System for WA black cockatoo foraging, HQS), its limitations and consideration/use of other assessment methods.

The HQS system was developed by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) with input from WA specialists to calculate the value of offsets for black cockatoo species. The system is intended to rate the quality of habitat to be used for the purposes of offsetting residual impacts from development proposals. The HQS system was provided informally by DCCEEW to Main Roads. It was used in conjunction with the results of desktop and field surveys conducted by Biota (2025) to determine the value of foraging habitat for black cockatoos across the survey area for the Proposal.

Considering comments from DBCA and the EPA, and of other assessment methods post-referral, Main Roads have determined the Bamford Consulting Ecologists (BCE) foraging habitat scoring system (BCE 2020) is more appropriate for use for the Proposal. The BCE system calculates a numerical foraging value score reflects the significance of vegetation as foraging habitat for Black Cockatoos. The numerical value is designed to provide the information needed by regulators to assess impact significance and offset requirements (BCE 2020).

1.2 Scope of work and purpose of this report

The scope of work was to calculate the value of Carnaby's Cockatoo and FRTBC foraging habitat throughout the Proposal's Development Envelope (DE) using the BCE system. The assessment contained in this report has been revised to incorporate a review by Mike Bamford on 9 May 2025, with respect to the application of the BCE habitat scoring system (BCE 2020).

This report presents the methods and results of the above scope of works. This report should be read with reference to:

- Anketell Road Upgrade (Leath Road to Kwinana Freeway) EPA Environmental Review Document Revised Referral Supporting Document (Main Roads 2025)
- Anketell Road Upgrade (Leath Road to Kwinana Freeway) Consolidated Biological Report (Biota 2025).

1.3 Limitations and assumptions

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GHD has prepared this report on the basis of information provided by Main Roads and others (e.g. Biota 2025) who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information reviewed and assumptions made by GHD at the date of preparation of the report and those outlined in Biota (2025). GHD disclaims liability arising from any of the assumptions being incorrect and has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

2. Methodology

The BCE system has three components: site condition, site context and species density (stocking rate) to calculate an overall score out of 10 and a fourth moderation component (Table 1). The purpose of the moderation component is to prevent vegetation of little or no foraging value receiving an excessive score out of ten (BCE 2020). BCE system descriptions for site condition, site context, species density (stocking rate) and moderation scoring for Carnaby's Cockatoo and FRTBC are provided in Tables 2 to 5. Further details on the BCE system are provided in BCE (2020).

The quality of Carnaby's Cockatoo and FRTBC foraging habitat within the DE was calculated using the BCE system based on biological data collected by Biota (2025). Scores for each component of the BCE system was determined as outlined below:

- Site condition A score for each vegetation unit was determined based on the Biota (2025) vegetation descriptions and corresponding quadrat data.
- Site context The nearest known black cockatoo breeding sites to the DE are approximately 13.5 km north in Bibra Lake and 15 km south in Baldivis with the species not provided (BirdLife Australia data, Biota 2025); a score of 1 was applied for both Carnaby's Cockatoo and FRTBC.
- Species density (stocking rate) A score was determined using fauna habitat descriptors in Biota (2025) which included vegetation unit, and likely fauna for each habitat type.
- Moderation A conservative approach has been applied, with foraging habitat with a site condition score of 'low' (2) being attributed a context and species density score as there is habitat within the DE with at least 'low to moderate' quality foraging habitat (≥3). Areas with a site condition score of 'negligible to low' (1) and 'no foraging value' (0) were assigned a context and species density score of zero.

Table 1 Summary of the BCE system

Component	BCE system
Site condition	Out of 6
Site context	Out of 3
Species density (stocking rate)	Out of 1
Total score	Out of 10
Moderation of score	-/+
Final score	Out of 10

Table 2 Site condition

Table 2	Site cond	ntion	
Site condition	Score	Description (Carnaby's Cockatoo)	Description (FRTBC)
High	6	 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). 	 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).
Moderate to high	5	 Banksia Low Forest (of key species <i>B. attenuata</i> and <i>B. menziesii</i>) with 40-60% projected foliage cover; Banksia Low Forest (of key species <i>B. attenuata</i> and <i>B. menziesii</i>) 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) 	 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 death; Sheoak Forest with > 60% projected foliage cover
Moderate	4	 Woodland/low forest with tree banksias (of key species <i>B. attenuata</i> and <i>B. menziesii</i>) 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 20-60% projected foliage cover. 	 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.
Low to moderate	3	 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 Marris <10% projected foliage cover. 	 Eucalypt Woodland with known food plants (especially Marri and Jarrah) 5- 20% projected foliage cover; Parkland-cleared Eucalypt Woodland/Forest with known food plants such as Marri 10-40% projected foliage cover but badly-degraded understorey (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).

Site condition	Score	Description (Carnaby's Cockatoo)	Description (FRTBC)
Low	2	 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; Eucalypt woodland/mallee of small-fruited species; Paddocks that are densely vegetated with melons or other known food-source weeds (e.g. <i>Erodium</i> spp.) that represent a short-term and/or seasonal food source 	 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, <i>Eucalyptus caesia</i> and <i>E. erythrocorys</i>. Paddocks with <i>Erodium</i> spp. and other weeds.
Negligible to low	1	 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 foodsource weeds (e.g. <i>Erodium</i> spp.) that represent a short-term and/or seasonal food source; Blue Gum plantations (foraging by Carnaby's Cockatoos has been reported but appears to be unusual). 	Scattered specimens of known food plants but projected foliage cover of these < 1%. Could include urban areas with scattered foraging trees.
No foraging value	0	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 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

Table 3 Site context

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

Table 4 Species density (stocking rate)

	Score	Description
Presence/ absence of	1	Species is reported regularly and/or there is abundant foraging evidence (seen at intervals of every few days or weeks for at least several months of the year).
species	0	Species is recorded or reported very infrequently and there is little or no foraging evidence.

 $^{^{\}rm 1}$ "Local" area is defined as within a 15 km radius of the centre point of the study site.

Table 5 Moderation of scores

	Score	Context score	Species density score
Moderation of site context	3-6 (low/moderate to high value)	Assessed as per Table 3	Assessed as per Table 4
and species density scores for site condition ²	0-2 (no to low value)	0	0

3. Results

3.1 Carnaby's Cockatoo

Carnaby's Cockatoo foraging habitat scores calculated using the BCE system are presented in Table 6. Majority of the DE (74.7%) was rated as having an overall score of 1/10 or lower. These areas were scored 0 (No foraging value) or 1 (negligible to low foraging value) for site condition as they lacked potential source foods or had <2% cover of known food plants for Carnaby's Cockatoo. These areas were not considered forging habitat for Carnaby's Cockatoo.

Nine vegetation units had an overall score of 4/10 to 7/10. These included *Banksia* dominated communities or where *Banksia* species were present in the mid-storey with *Eucalyptus* species present in the overstorey. One vegetation unit, EB1 (7.57 ha) had an overall score of 7/10. This unit scored 5 (High foraging value) for site condition as it was dominated by *Eucalyptus marginata* subsp. *marginata*, *Banksia menziesii* and *B. attenuata* and was mostly in Good or Very Good condition.

The average Carnaby's Cockatoo foraging habitat score for the DE is calculated to be 4.69 (Table 7).

3.2 FRTBC

FRTBC foraging habitat scores calculated using the BCE system are presented in Table 8. Majority of the DE (82.9%) was rated as having an overall score of 1/10 or lower. These areas were scored 0 (No foraging value) or 1 (negligible to low foraging value) for site condition as they lacked potential source foods or had <1% cover of known food plants for FRTBC. These areas were not considered forging habitat for FRTBC.

Two vegetation units had overall scores of 4/10 and 7/10. This included E1 that contained occasional *Eucalyptus* marginata subsp. marginata in the overstory and EB1 that was dominated by *Eucalyptus* marginata subsp. marginata in the overstorey.

The average FRTBC Cockatoo foraging habitat score for the DE is calculated to be 4.59 (Table 9).

² Note 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.

Table 6 Carnaby's Cockatoo foraging habitat scores

Vegetation unit	Area (ha)	Condition (out of 6)	Context (out of 3)	Density (out of 1)	Foraging Score (out of 10)
A1: Acacia rostellifera over Xanthorrhoea and Hibbertia on limestone	8.93	1	0	0	1
A2: Acacia rostellifera with isolated Banksia and Eucalyptus marginata over Xanthorrhoea with Hibbertia on limestone	5.39	1	0	0	1
A3: Acacia rostellifera shrublands shallow pale sands	2.40	1	0	0	1
A4: Acacia saligna tall shrubland	6.28	1	0	0	1
T1: Gaudium over mixed Acacia open shrubland	4.98	1	0	0	1
B2: Banksia menziesii (B. attenuata) over Xanthorrhoea spp. with Hibbertia and Conostylis	6.83	4	1	1	6
B3: Banksia menziesii, B. ilicifolia (B. attenuata) over Kunzea with occasional Xanthorrhoea spp. and Scholtzia	0.53	4	1	1	6
B4: Banksia attenuata over Hibbertia and Allocasuarina humilis on limestone	4.22	2	1	1	4
B5: Banksia sessilis shrubland on limestone	3.79	2	1	1	4
B6: Banksia sessilis with mixed Acacia	1.23	2	1	1	4
E1: Eucalyptus gomphocephala with occasional E. marginata, Banksia spp. over Acacia rostellifera over Xanthorrhoea	30.78	2	1	1	4
E5: Eucalyptus decipiens over Banksia sessilis over Melaleuca systena and mixed Acacia with Hardenbergia comptoniana	0.39	2	1	1	4
E6: Eucalyptus gomphocephala over Acacia rostellifera over occasional Xanthorrhoea	1.30	1	0	0	1
E7: Eucalyptus foecunda over Spyridium globulosum and Acacia rostellifera with Hibbertia	0.24	1	0	0	1
EB1: Eucalyptus marginata (Banksia spp.) over Kunzea and Acacia with Xanthorrhoea spp. over Hibbertia	7.57	5	1	1	7
M1: Melaleuca preissiana low woodland over Astartea	0.00	1	0	0	1
M2: Melaleuca lanceolata low woodland	1.81	1	0	0	1
K1: Kunzea tall shrubland to tall open scrub	0.92	1	0	0	1
M4: Mixed Melaleuca (Melaleuca systena) over Xanthorrhoea with mixed Fabaceae/Proteaceae/Rhamnaceae and Hibbertia	2.50	1	0	0	1
M5: Melaleuca huegelii over Spyridium globulosum and Acacia rostellifera on limestone	0.54	1	0	0	1
M6: Melaleuca systena and Acacia saligna over Templetonia retusa, Spyridium globulosum and Acacia lasiocarpa	1.60	1	0	0	1
R2: Modified/Planted Callistemon and Calothamnus on roadsides	5.66	1	0	0	1
R3: Modified/Revegetation/Planted Mosaic of B1 and B2 vegetation	1.65	3	1	1	5
IP: Isolated Trees over Previously Cleared or Pasture	6.92	1	0	0	1
ML: Commercial/Residential Mixed Land Use	27.23	1	0	0	1
D: Mosaic of highly modified degraded areas	8.90	1	0	0	1
CL: Cleared areas	46.02	0	0	0	0
RR: Roads, Rail	36.24	0	0	0	0

Table 7 Average Carnaby's Cockatoo foraging habitat score for DE

Vegetation unit	Area(ha)	Foraging Score	Area x Score
B2: Banksia menziesii (B. attenuata) over Xanthorrhoea spp. with Hibbertia and Conostylis	6.83	6	41.00
B3: Banksia menziesii, B. ilicifolia (B. attenuata) over Kunzea with occasional Xanthorrhoea spp. and Scholtzia	0.53	6	3.16
B4: Banksia attenuata over Hibbertia and Allocasuarina humilis on limestone	4.22	4	16.89
B5: Banksia sessilis shrubland on limestone	3.79	4	15.16
36: Banksia sessilis with mixed Acacia	1.23	4	4.91
E1: Eucalyptus gomphocephala with occasional E. marginata, Banksia spp. over Acacia rostellifera over Xanthorrhoea	30.78	4	123.10
E5: Eucalyptus decipiens over Banksia sessilis over Melaleuca systena and mixed Acacia with Hardenbergia comptoniana	0.39	4	1.55
EB1: Eucalyptus marginata (Banksia spp.) over Kunzea and Acacia with Xanthorrhoea spp. over Hibbertia	7.57	7	52.99
R3: Modified/Revegetation/Planted Mosaic of B1 and B2 vegetation	1.65	5	8.23
Total	56.98		266.99
Average FHQS			4.69

Table 8 FRTBC foraging habitat scores

Vegetation unit	Area (ha)	Condition (out of 6)	Context (out of 3)	Density (out of 1)	Foraging Score (out of 10)
A1: Acacia rostellifera over Xanthorrhoea and Hibbertia on limestone	8.93	1	0	0	1
A2: Acacia rostellifera with isolated Banksia and Eucalyptus marginata over Xanthorrhoea with Hibbertia on limestone	5.39	1	0	0	1
A3: Acacia rostellifera shrublands shallow pale sands	2.40	1	0	0	1
A4: Acacia saligna tall shrubland	6.28	1	0	0	1
T1: Gaudium over mixed Acacia open shrubland	4.98	1	0	0	1
B2: Banksia menziesii (B. attenuata) over Xanthorrhoea spp. with Hibbertia and Conostylis	6.83	1	0	0	1
B3: Banksia menziesii, B. ilicifolia (B. attenuata) over Kunzea with occasional Xanthorrhoea spp. and Scholtzia	0.53	1	0	0	1
B4: Banksia attenuata over Hibbertia and Allocasuarina humilis on limestone	4.22	1	0	0	1
B5: Banksia sessilis shrubland on limestone	3.79	1	0	0	1
B6: Banksia sessilis with mixed Acacia	1.23	1	0	0	1
E1: Eucalyptus gomphocephala with occasional E. marginata, Banksia spp. over Acacia rostellifera over Xanthorrhoea	30.78	2	1	1	4
E5: Eucalyptus decipiens over Banksia sessilis over Melaleuca systena and mixed Acacia with Hardenbergia comptoniana	0.39	1	0	0	1
E6: Eucalyptus gomphocephala over Acacia rostellifera over occasional Xanthorrhoea	1.30	1	0	0	1
E7: Eucalyptus foecunda over Spyridium globulosum and Acacia rostellifera with Hibbertia	0.24	1	0	0	1
EB1: Eucalyptus marginata (Banksia spp.) over Kunzea and Acacia with Xanthorrhoea spp. over Hibbertia	7.57	5	1	1	7
M1: Melaleuca preissiana low woodland over Astartea	0.00	1	0	0	1
M2: Melaleuca lanceolata low woodland	1.81	1	0	0	1
K1: Kunzea tall shrubland to tall open scrub	0.92	1	0	0	1
M4: Mixed Melaleuca (Melaleuca systena) over Xanthorrhoea with mixed Fabaceae/Proteaceae/Rhamnaceae and Hibbertia	2.50	0	0	0	0
M5: Melaleuca huegelii over Spyridium globulosum and Acacia rostellifera on limestone	0.54	0	0	0	0
M6: Melaleuca systena and Acacia saligna over Templetonia retusa, Spyridium globulosum and Acacia lasiocarpa	1.60	0	0	0	0
R2: Modified/Planted Callistemon and Calothamnus on roadsides	5.66	1	0	0	1
R3: Modified/Revegetation/Planted Mosaic of B1 and B2 vegetation	1.65	1	0	0	1
IP: Isolated Trees over Previously Cleared or Pasture	6.92	1	0	0	1
ML: Commercial/Residential Mixed Land Use	27.23	1	0	0	1
D: Mosaic of highly modified degraded areas	8.90	1	0	0	1
CL: Cleared areas	46.02	0	0	0	0
RR: Roads, Rail	36.24	0	0	0	0

Table 9 Average FRTBC foraging habitat score for DE

Vegetation unit	Area(ha)	Foraging Score	Area x Score
E1: Eucalyptus gomphocephala with occasional E. marginata, Banksia spp. over Acacia rostellifera over Xanthorrhoea	30.78	4	123.10
EB1: Eucalyptus marginata (Banksia spp.) over Kunzea and Acacia with Xanthorrhoea spp. over Hibbertia	7.57	7	52.99
Total	38.34		176.09
Average FHQS			4.59

4. References

BCE (2020). Scoring system for the assessment of foraging value of vegetation for Black-Cockatoos. Available online from: https://ecologists.bamford.id.au/ecological-consulting/black-cockatoos.

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Project na	ame	Anketell Road Upgrade						
Documen	t title	Report Black Cock	atoo Foraging H	labitat Quality				
Project n	umber	12652780						
File name	;	12652780-REP_Bla	ack Cockatoo Fo	raging Habitat Qu	uality.docx			
Status	Revision	Author	Reviewer		Approved for issue			
Code			Name	Signature	Name	Signature	Date	
S4	0	GHD Pty Ltd	GHD	On file	GHD	On file	18/3/2025	
S4	1	GHD Pty Ltd	GHD	On file	GHD	On file	20/5/2025	

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