MEMORANDUM

Date	4 December 2020	**Title**	Black-cockatoo Foraging Habitat Assessment
Ref.	COT20003_MEM02_RevC	**Distribution**	Kristen Watts - Coterra Environment
Author	Kellie Bauer-Simpson Principal Ecologist	**Authorised by**	Kellie Bauer-Simpson Principal Ecologist

Background and Scope of Work

Coterra Environment (Coterra) is assisting a client with the proposed development of Lot 9103 Warton Road (the study area), Piara Waters. The study area is proposed to be developed as a school. An application for a native vegetation clearing permit (NVCP) is currently under assessment by the Department of Water and Environmental Regulation (DWER). As part of the application assessment, DWER have considered the Carnaby's Black-cockatoo foraging habitat quality of the proposed clearing footprint and provided this to the applicant. In order to respond to the suggested quality scores, Coterra has sought advice from Focused Vision Consulting Pty Ltd (FVC) to consider the foraging habitat quality in more detail across the range of habitat present at the site. This report presents the findings of the analysis, which is based on the recent flora and vegetation assessment results, also carried out by FVC.

The study area is located approximately 20 kilometres (km) south of Perth in the suburb of Piara Waters (**Figure 1**). The study area occupies approximately 12.7 ha.

0 25 50 75 100 m

GDA 94 / MGA Zone 50

Legend

Study Area

Figure 1 - Study Area

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COT20003 07 April 2020

Methodology

The foraging habitat quality assessment has been caried out using a combination of the methodologies and results of an assessment carried out by DWER and methodologies typically utilised by FVC, which are in accordance with those developed by FVC's specialist sub-consultants, Bamford Consulting Ecologists (BCE). The BCE methodology has been developed by Dr Mike Bamford and the BCE team, in consultation with representatives from the Commonwealth Department of Agriculture, Water and the Environment (DAWE) and is summarised below.

Foraging Habitat Assessment

Foraging habitat for Black-cockatoos is given a score out of ten to indicate the quality of that foraging habitat. The scoring system used (developed by BCE, in consultation with DAWE) is comprised of the following three scores (which are described in more detail below):

- a score out of six for vegetation composition, condition and structure, in accordance with **Table 1**
- a score out of three for site context, in accordance with **Table 2**
- a score out of one for stocking rate (Black-cockatoo species density).

The vegetation composition score is based on the presence, density/abundance, condition and proportions of food source plants for the relevant species of Black-cockatoo, as well as the preference that the species has for that food source. A selection of key examples applicable to Carnaby's Black-cockatoo is presented in **Table 1**.

Table 1 - Scoring System for the Assessment of Foraging Value of Vegetation for Carnaby's Black-Cockatoos

Site Score	Description of Vegetation
0	No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples would be salt lakes and bare ground.
1	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these <2%. Could include urban areas with scattered foraging trees. Blue Gum plantations are considered to have a score of 1 as foraging by Black-Cockatoos has been reported but appears to be unusual.
2	Low foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, with <10% projected foliage cover. • Open eucalypt woodland/mallee of small-fruited species. • Paddocks with melons or other weeds (a short-term, seasonal food source).
3	Low to moderate foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, with 10-20% projected foliage cover. • Woodland with tree banksias 2-10% projected foliage cover. • Eucalypt woodland/mallee of small-fruited species; Marri, if present, <10% project foliage cover.
4	Moderate foraging value. Examples: • Woodland with tree banksias 20-40% projected foliage cover. • Eucalypt woodland/forest with Marri 20-40% projected foliage cover.
5	Moderate to high foraging value. Example: • Banksia woodlands with tree banksias >40%. Vegetation condition moderate due to weed invasion and some tree deaths.
6	High foraging value. Example: Banksia woodlands of key species (e.g. *B. attenuata, B. menziesii*) with projected foliage cover >60%. Vegetation condition good with low weed invasion and low tree death to indicate it is robust and unlikely to decline in the medium term.

Proteaceous plants include species such as *Banksia, Hakea* and *Grevillea*

The site context score depends upon factors such as the vegetation extent at the site and in the local context, and the presence of breeding birds. Specific scores for site context are guided by **Table 2**, noting that 'local area' is defined as within a 15 km radius of the centre point of the project area. To assign a score for site context, a maximum score of three is applied where foraging habitat is known or found to support breeding birds (regardless of the proportion of the extent of vegetation), or it can also be applied in fragmented landscapes where there is little foraging habitat remaining and thus what is left has a high contextual value.

Table 2 – Key to Black-cockatoo Site Context Score for Foraging Habitat Quality

Site Context Score	% of 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%	0.1 - 5%
0	< 0.1%	< 0.1%

The score for stocking rate/species density (0 or 1), is based upon the relevant Black-cockatoo species being either abundant or not abundant, and is species-specific. A score of 1 is applied where the species is seen or reported regularly or quite regularly and/or there is abundant foraging evidence. 'Regularly' is considered to be 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 applied when the species is recorded or reported very infrequently and there is little or no foraging evidence.

DWER Foraging Habitat Assessment

The foraging habitat assessment and results provided by DWER are provided in **Table 3**.

Table 3 –Black-cockatoo Foraging Habitat Quality Methodology and Assessment Results of DWER

Value	Foraging habitat for Carnaby's Black Cockatoo	Comments	Score
Starting Score			
10 (Very high quality)	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a sore of ≥10	-	-
7 (High quality)	Native shrubland, kwongan heathland and 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, including along roadsides. Does not include orchards, canola, or areas under a RFA	Vegetation types BaEtLW (-B), EmBaLW and EmBaLW (-B) (together comprising 1.16 ha) are considered to be "native eucalypt woodland that contains foraging species", namely *Eucalyptus marginata, E. todtiana, Banksia attenuata, B. menziesii* and *Allocasuarina fraseriana* (see table from Valentine and Stock (2008) below), which are present to varying degrees. Vegetation type BaEtLW (comprising 0.01 ha) is considered to be "woodland dominated by proteaceous plant species". As such vegetation is broadly considered to fit into this category, however, given the considerations in Section 6.2.2.2 of Harewood (2018) and the density of *Banksia* vegetation, this has been revised to a score of 5.	5
5 (Quality)	Pine plantation or introduced Eucalypts	-	-
1 (Low quality)	Individual foraging plants or small stand of foraging plants	While the plants present form small patches, they are considered significant noting the extensively cleared landscape within the local area (approximately 18% vegetation remaining in the local area).	-
Additions			
+3	Is within the Swan Coastal Plain (important foraging area)	Yes	+3
+3	Contains trees with suitable nest hollows	No	-
+2	Primarily contains marri	No	-
+2	Contains trees with potential to be used for breeding (DBH ≥ 500 mm or ≥ 300 mm DBH for salmon gum and wandoo)	Yes	+2
+1	Is known to be a roosting site	No	-

Value	Foraging habitat for Carnaby's Black Cockatoo	Comments	Score
Subtractions			
-2	No clear evidence of feeding debris	Although the fauna survey (Harewood, 2018) noted that within the survey area "some foraging evidence which could possibly be attributed to this species was found during field survey (chewed blackbutt fruits) but this could not be distinguished from the forest red-tailed black cockatoo which also feeds on the same fruits and leaves similar traces" it was not established whether this was actually within the application area, and was not confirmed to be Carnaby's foraging, so this is not considered "clear evidence".	-2
-2	No other foraging habitat within 6 km	Foraging habitat is present within 6 km	-
-1	Is >12 km from a known breeding Location	Potential breeding locations known within 12 km, but none confirmed	-1
-1	Is > 12 km from a known roosting Location	A known roost site occurs within 1.2 km northeast of the application area	-
-1	Is >2 km from a watering point	Permanent waterbodies within 2 km include lakes at Newhaven Park (1.1 km) Baystone Park (1.4 km) and Warbler Park (1.7 km).	-
-1	Disease present (e.g. *Phytophthora cinnamomic* or marri canker)	Possible dieback was identified during the flora and vegetation survey (FVC, 2020)	-1
		Total	**6**

Results and Discussion

Determination of the study area's foraging habitat quality score for Carnaby's Black-cockatoo was carried out using the BCE methodology applied separately to each of the vegetation types present at the site. Total scores are comprised of the results of the analysis as described above for:

- vegetation (as providing food source plants)
- context
- stocking rate.

Vegetation

Scores out of six have been applied to each native remnant vegetation unit based on the species composition (species as food source plants their density) and the overall condition of the vegetation, as presented in **Appendix A**. These scores were found to range from zero in the *Melaleuca* woodland and *Adenanthos* shrubland, to five and six in the Banksia woodlands.

Context

Scores out of three have been applied for the site as a whole, based on whether or not local breeding of the species is known (not confirmed for either species) and the proportion of existing vegetation within the local area that the study area represents. An analysis of the remaining native vegetation in the local context was carried out using a data set containing vegetation extent polygons from the mapping of remnant vegetation in Western Australia (Department of Primary Industries and Regional Development 2017). The analysis found that mapped remnant vegetation within the study area represents 1.15 ha, which is 0.007% of the 15,409.40 ha mapped as remaining within a 15 km buffer of the study area. Accordingly, the score for site context as per **Table 2** is 0.

Stocking Rate

A score for species stocking rate/density of 0 was determined to be applicable to the site, given that Carnaby's Black-cockatoo is not known to occur/utilise the site and is therefore not considered abundant at the site. That is, Carnaby's Black-cockatoo is not seen or reported regularly or quite regularly and there was no conclusive foraging evidence.

The resulting foraging habitat quality score combining the above elements is summarised in **Table 4**, which is also presented spatially in **Figure 2** for all areas mapped as native remnant vegetation.

Table 4 - Summary of Carnaby's Black-cockatoo Foraging Habitat Quality within the Study Area (BCE Methodology)

Habitat	Habitat Quality Scores				Area (ha)	% of Project Area*
	Vegetation Characteristics	Context	Stocking Rate/ Species Density	Total Score		
EmBaLW Jarrah-Banksia-Sheoak Woodland	5	0	0	**5**	0.404	3.164
BaEtLW Jarrah-Coastal Blackbutt-Banksia-Sheoak Woodland	6	0	0	**6**	0.225	1.770
EmBaLW(-B) Jarrah-Sheoak Woodland	3	0	0	**3**	0.832	6.549
BaEtLW(-B) Jarrah-Coastal Blackbutt-Sheoak Woodland	3	0	0	**3**	0.597	4.699
MpOLW Melaleuca Woodland	0	0	0	**0**	0.045	0.354
AcOS Adenanthos Shrubland	0	0	0	**0**	0.138	1.086

Based on planted and cleared areas comprising 10.464 ha (82.361%)
Foraging Habitat Quality (Total) Scores:
0 = none/negligible; 1 = negligible to low; 2 = low; 3 = low to moderate; 4 = moderate; 5 = moderate to high; 6 = high; 7+ = very high

Where the adjustors of the DWER results are applied in lieu of the adjustors for context and stocking rate (as per the BCE methodology) in addition to vegetation scores resulting from application of the BCE methodology (for the respective vegetation types), foraging habitat quality scores are as per **Table 5**.

Table 5 - Summary of Carnaby's Black-cockatoo Foraging Habitat Quality within the Project Area (Combined BCE/DWER Methodology)

Habitat	Habitat Quality Scores			Area (ha)	% of Project Area
	Vegetation Characteristics	DWER Nett Adjustment	Total Score		
EmBaLW Jarrah-Banksia-Sheoak Woodland	5	1	**6**	0.404	3.164
BaEtLW Jarrah-Coastal Blackbutt- Banksia-Sheoak Woodland	6	1	**7**	0.225	1.770
EmBaLW(-B) Jarrah-Sheoak Woodland	3	1	**4**	0.832	6.549
BaEtLW(-B) Jarrah-Coastal Blackbutt- Sheoak Woodland	3	1	**4**	0.597	4.699
MpOLW Melaleuca Woodland	0	1	**1**	0.045	0.354
AcOS Adenanthos Shrubland	0	1	**1**	0.138	1.086

Foraging Habitat Quality (Total) Scores:
0 = none/negligible; 1 = negligible to low; 2 = low; 3 = low to moderate; 4 = moderate; 5 = moderate to high; 6 = high; 7+ = very high

Regardless of method applied, the results of the foraging habitat quality assessment determine that four of the six recorded vegetation types comprising 2.241 ha (17.622% of the total study area) represent Black-cockatoo foraging habitat of 'moderate to high' or better quality.

0 25 50 75 100 m

GDA 94 / MGA Zone 50

Legend

Study Area

Foraging Habitat Quality Score

0
3
5
6

Figure 2 - Carnaby's Black-cockatoo Foraging Habitat Quality

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Closing

Should you require further information or clarification regarding the information provided in this report, please do not hesitate to contact the undersigned.

Best regards,

Kellie Bauer-Simpson
Director & Principal Ecologist/Environmental Manager
Focused Vision Consulting Pty Ltd

Appendix A – Inferred Vegetation Foraging Scores Based on Species Composition

Vegetation Unit	Relevé		Species	Food Source Plants for CBC*	Ht (m)	% cover
EmBaLW	PR02		*Dasypogon bromeliifolius*		0.5	1
			Hibbertia hypericoides		0.5	2
			Xanthorrhoea gracilis	1	1	5
			Xanthorrhoea preissii		2	5
			Banksia menziesii	3	5	10
			Allocasuarina fraseriana	1	6	10
			Eucalyptus marginata	2	8	10
			Acacia pulchella			
			Adenanthos cygnorum			
			Bossiaea eriocarpa			
		*	*Briza maxima*			
			Burchardia congesta			
			Dampiera linearis			
		*	*Ehrharta calycina*			
		*	*Gladiolus caryophyllaceus*			
			Gompholobium tomentosum			
			Gonocarpus pithyoides			
			Hypocalymma robustum			
			Jacksonia ?gracillima			
			Jacksonia furcellata	1		
			Kennedia prostrata			
			Lomandra sp.			
			Loxocarya cinerea			
			Macrozamia riedlei			
			Melaleuca preissiana			
			Platysace compressa			
			Inferred Quality	**5**		
BaEtLW	PR03		*Lomandra ?caespitosa*		0.4	2
			Dasypogon bromeliifolius		0.6	2
			Hibbertia hypericoides		0.6	5
			Kunzea glabrescens		3	10
			Banksia attenuata	3	5	25
			Banksia menziesii	3	7	20
			Eucalyptus todtiana	3	7	30
			Acacia pulchella			
			Banksia ilicifolia	2		
			Bossiaea eriocarpa			
			Burchardia congesta			
			Calytrix sp.			
			Conostephium sp.			
			Dampiera linearis			
		*	*Ehrharta calycina*			
		*	*Gladiolus caryophyllaceus*			
			Gompholobium tomentosum			
			Hovea trisperma			
			Jacksonia furcellata	1		
			Lechenaultia floribunda			
			Lepidosperma squamatum			
		*	*Leptospermum laevigatum*			
			Lomandra sericea			

			Loxocarya cinerea			
			Lyginia imberbis			
			Melaleuca thymoides			
			Patersonia occidentalis			
			Petrophile linearis			
			Schoenus curvifolius			
			Stirlingia latifolia			
			Stylidium repens			
			Styphelia xerophylla			
			Inferred Quality	**6**		
EmBaLW(-B)	PR01		*Dasypogon bromeliifolius*		0.5	3
			Melaleuca seriata		1	20
			Kunzea glabrescens		3	60
			Melaleuca preissiana		6	5
			Acacia pulchella			
		*	*Avena barbata*			
			Banksia attenuata	1		
			Banksia menziesii	1		
			Bossiaea eriocarpa			
			Burchardia congesta			
		*	*Ehrharta calycina*			
		*	*Gladiolus caryophyllaceus*			
			Gompholobium tomentosum			
			Jacksonia furcellata	1		
			Loxocarya cinerea			
			Melaleuca thymoides			
			Schoenus curvifolius			
			Xanthorrhoea gracilis			
			Inferred Quality	**3**		
BaEtLW(-B)	PR05		*Lyginia imberbis*		0.6	5
			Dasypogon bromeliifolius		0.6	25
			Xanthorrhoea preissii	2	1.2	3
			Adenanthos cygnorum		1.8	5
			Kunzea glabrescens		4	25
			Eucalyptus todtiana	3	6	5
			Acacia pulchella			
			Allocasuarina fraseriana	1		
		*	*Ehrharta calycina*			
		*	*Gladiolus caryophyllaceus*			
			Hemiandra pungens			
			Jacksonia furcellata	1		
			Loxocarya cinerea			
			Schoenus sp.			
			Inferred Quality	**3**		
AcOS	PR04		*Stirlingia latifolia*		0.6	1
			Hibbertia hypericoides		0.7	3
			Adenanthos cygnorum		1.8	20
			Acacia pulchella			
			Acacia stenoptera			
			Boronia ramosa			
		*	*Ehrharta calycina*			
		*	*Gladiolus caryophyllaceus*			
			Gompholobium tomentosum			
			Hemiandra pungens			

			Laxmannia squarrosa			
			Lechenaultia floribunda			
			Leucopogon conostephioides			
			Lyginia imberbis			
			Scaevola repens			
			Scholtzia involucrata			
			Styphelia xerophylla			
		*	*Ursinia anthemoides*			
			Inferred Quality	**0**		

*Based on being preferred (3), somewhat preferred (2) and marginal (1) food sources