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Belisama Conventional Gas Project
Review of black-cockatoo assessment (Phoenix 2025)
Prepared for Hancock Energy

BACKGROUND

Hancock Energy is proposing to develop a conventional gas project in the mid-west region of Western Australia between Mingenew and Dongara, and is considering options for the development of this project. These options are to progress with the already approved Lockyer Conventional Gas Project (LCGP), subject to some minor changes, or to develop a substantially new project, the Belisama Conventional Gas Project (BCGP). The relationship between these two approaches is illustrated on Figure 1.

The original fauna assessment of the LCGP was undertaken by Phoenix (2023 a & b), and this was reviewed by Bamford (2024) with a particular focus on values for Carnaby's Black-Cockatoo (Carnaby's) *Zanda latirostris*, determined by Phoenix to be the key species of conservation significance likely to be present in the LCGP area. With the proposed changes in the project layout, Phoenix (2025) undertook an assessment of the BCGP areas, consisting of a level 1 ('Basic') assessment, involving a desktop review and targeted assessments and surveys for species of conservation significance, with a focus on Carnaby's and on short range endemic (SRE) invertebrates.

In preparation for using the Phoenix (2025) report in the approvals process, Hancock commissioned Bamford Consulting Ecologists (BCE) to carry out a review of this new report, requesting a 'technical expert review and providing a report outlining the efficacy and completeness of the Black-Cockatoo assessments against regulatory guidelines and industry standards'. This review has been prepared as a stand-alone report but is effectively an addendum to Bamford (2024) which reviewed the Phoenix (2023 a & b) reports in broadly the same manner.

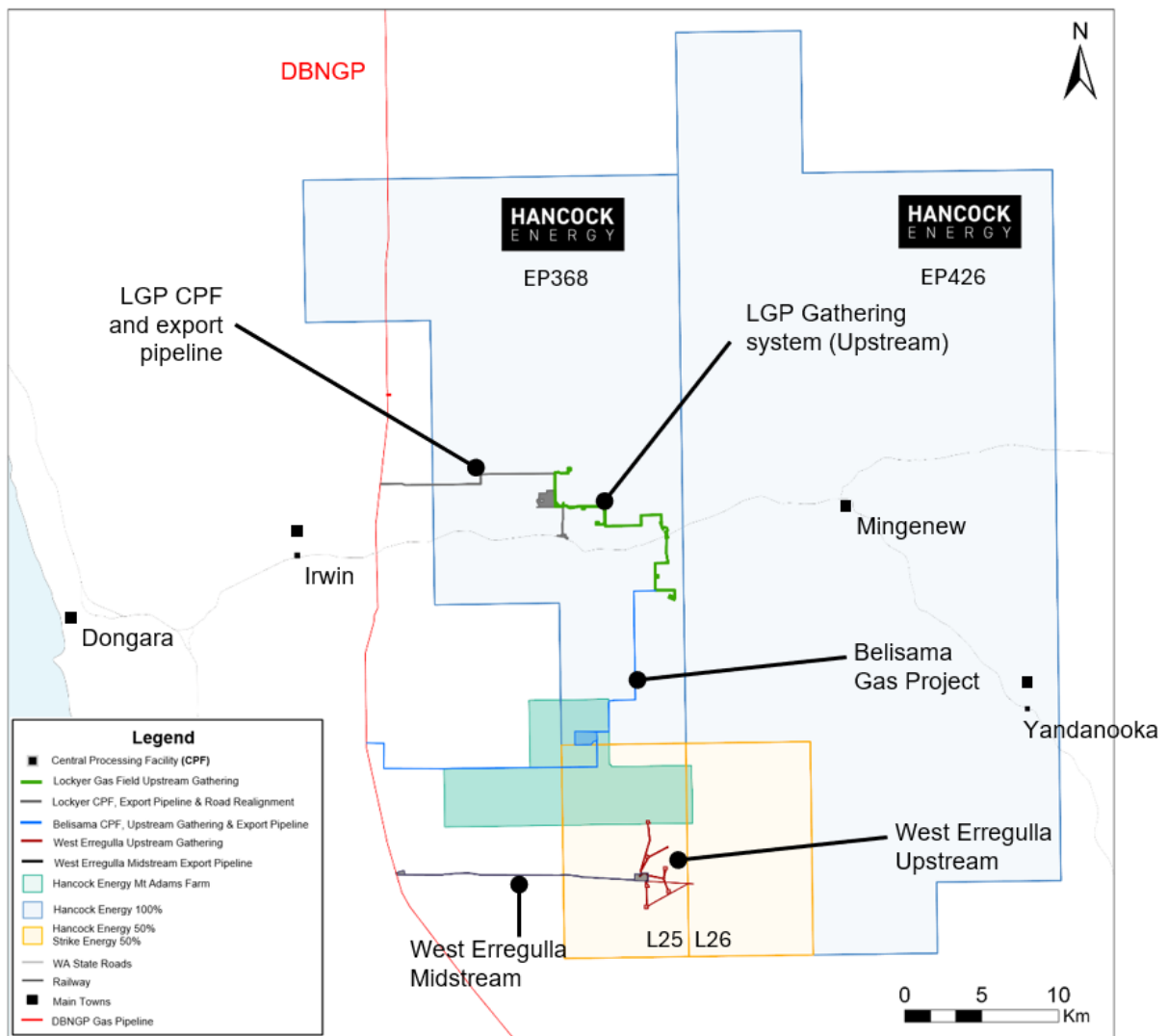


Figure 1. Locations of the Lockyer and Belisama project areas.

APPROACH TO REVIEW

This review was carried out by Dr Mike Bamford of BCE as a desktop only. A site inspection was considered to be unnecessary given the familiarity of BCE personnel with the project area. In addition to the site inspection of the LCGP area carried out in January 2024 as part of the review of Phoenix (2023 a & b), BCE has undertaken multiple surveys within and adjacent to the BCGP area over the period 2008 to 2023. This has included level 1 ('Basic'), level 2 (detailed) and targeted surveys for Tronox Joint Venture, Beharra Silica, Beach Energy and VRX Silica at sites along Mt Adams Road. Mt Adams Road lies about 5km south of Yandanooka Road along which much of the new BCGP area is located.

Advice on the status and habitat values of the project area for Carnaby's Black-Cockatoo is based upon methods developed by BCE for assessing the value of trees as potential nest trees ([Error! Reference source not found.](#)) and for assigning a foraging value to vegetation ([Error! Reference source not found.](#)).

Advice on the significance of impacts is also drawn from the referral guidelines (DAWE 2022) with the most relevant table reproduced in Appendix 1.

The following sections combine the review of the Phoenix reports, and advice on the status and habitats of Carnaby's Black-Cockatoo in the project area under key headings related to the biology of the species. Comments and additional information on some other species of conservation significance is also provided.

BLACK-COCKATOO

Black-cockatoos in the project area

The report notes that the project area is within the modelled distribution of Carnaby's but not of Baudin's (*Zanda baudinii*) or the Forest Red-tailed (*Calyptrorhynchus banksii naso*) Black-Cockatoos. It concludes that records of 'white-tailed black-cockatoos' in databases can be assumed to represent Carnaby's as the area is out of range for Baudin's, but it seems to accept a single record of the Forest Red-tail, despite noting that this is way out of range. This record is much more likely to be an error and to be of the western inland subspecies *C. banksia escondidus*.

The likelihood of occurrence assessment for Carnaby's (presented in Table 5.8) concludes that the species is likely to be present, and that it is likely to occur as an irregular visitor. This is consistent with the LCGP area (Phoenix 2023 a & b; Bamford 2025). 'Irregular visitor' is not actually defined, and this conclusion could be combined with information presented elsewhere in the report to clarify. For example, there is information on usage of nearby roost sites (section 5.1.1.1 notes most recent record use of a roost site 1.4km from the project area in 2018), and it is reported that no observations of the species were made during field investigations of the BCGP area. However, both Phoenix (2023b) and Bamford (2024) found foraging signs on banksias in the LCGP area, with Bamford suggesting the foraging sign could be dated to Autumn 2023. Bamford also noted that project staff have reported occasional flocks of Carnaby's. There are two known roosts close to the western end of the BCGP area, and it is possible that Carnaby's may be a more regular visitor in this area than along the bulk of the project area and in the LCGP area. BCE has seen the species regularly in the vicinity of the Yardanogo Nature Reserve that lies just south of the western extent of the BCGP area.

Potential nest trees

Phoenix (2025) follows guidance from DAWE (2022) and recorded only 12 trees as potential nest trees (DBH >500mm), but noted none had suitable hollows. Only six of these trees were in the actual project area (the report actually notes that the remaining four trees were within 300m of the project area, which leaves two trees unaccounted for). Note that Table 5-6 states that trees of potential nest tree size are located in plantations, but based on the mapping of habitat types (Figure 5.4) and of potential nest trees (Figure 5.5), it is not clear if any such trees are located in plantation areas.

No observations were made on trees in the smaller size range of DBH 300-500mm, which DAWE (2022) does suggest may be of interest, but is unclear on what should be reported. Trees in this size range do represent potential future nesting habitat and from the photographs of habitat types, such trees are probably restricted to plantations.

Foraging habitat

Phoenix assessed different habitat types using the foraging scoring tool developed by BCE (**Error! Reference source not found.**). Methods proposed by regulators have not been used. While the BCE method is widely accepted, regulators may expect alternative methods to be used in addition.

There is some inconsistency in the descriptions of habitat types in the Phoenix report. Four main habitat groups are recognised (section 5.2.1.1) but these account for only about 10% of the landscape; the remaining nearly 90% being cleared (agricultural) land. These four main habitat groups are used in Table 5.8 to identify habitats used by significant species, but this overlooks the possible value of farmland. This possible value is recognised where foraging habitat value is assessed for Carnaby's, and the foraging value assessment addresses habitats at a finer scale (Table 5-9). This assessment broadly concludes that foraging values are low to low/moderate.

While the foraging assessment is based upon the Bamford method, there are some subtle differences in how this can be carried out, and the habitat types are reassessed below (Table 1). While most of the foraging values are considered the same, there are some key differences as outlined below. A species presence/abundance score of 0/1 is used throughout to reflect the status of Carnaby's as an irregular visitor.

- Farmland (cleared) is better assigned a vegetation score of at least 1/6 rather than the 0/6 used by Phoenix. Crops, pasture and agricultural weeds are foraging habitat for Carnaby's, and BCE has some recent observations suggesting that in agricultural areas, weeds and crops may be a key food source. The greatest value may be along verges where cropping and grazing do not occur. This habitat is very extensive and therefore has a low context value.
- Open banksia woodland. If the vegetation score of 3/6 suggested by Phoenix is accepted, this habitat should have a context score of at least 1/3, as this is a very limited habitat type. This gives it a total HQS of 4/10. That this area was recently burnt does not affect its foraging value in the long term.
- Low to mid shrubland/grassland, remnant woodland/shrubland over paddock, sheoak and acacia shrubland and shrubland on lateritic breakaway were all assigned a vegetation score of 1/6 by Phoenix and a total HQS of 1/10, but in an extensively cleared landscape even these poor examples of habitat can be assigned a context value of 1/3 to distinguish them from even lower value habitat types. They are also more likely to provide a food source in the form of wood-boring insect larvae. This gives them a slightly elevated HQS of 2/10. Note that descriptions of the vegetation in these habitats is limited.

- Tall closed shrubland was given an overall HQS of zero by Phoenix but with no explanation. As a rare patch of native vegetation, it can be treated the same as other rare patches of native vegetation and thus gets a HQS of 2/20.

Even with these slight changes in foraging value assessment, the project area remains of low foraging value with the exception of the small patch of banksia open woodland. Overall, the landscape provides limited foraging value for Carnaby's Black-Cockatoo which might explain the infrequency of records of the species in the area.

Table 1. Reassessment of foraging value of habitat types based on the Bamford method (Error! Reference source not found.).

Habitat type	Vegetation score (/6)	Context score (/3)	Abundance score (/1)	Total HQS (/10)
Farmland (cleared)	1	0	0	1
Creepline	1	0	0	1
Low to mid shrubland/grassland	1	1	0	2
Eucalypt open woodland	1	1	0	2
Plantation	1	0	0	1
Remnant woodland/shrubland over paddock	1	1	0	2
Open banksia woodland	3	1	0	4
Sheoak and acacia shrubland	1	1	0	2
Shrubland on lateritic breakaway	1	1	0	2
Tall closed shrubland	1	1	0	2

NB. Where vegetation score is 0-2, context and abundance scores are set to zero except where they can be used to recognise subtle differences in value. A context score of 1 has been used for several habitat types which have a low vegetation score but are very restricted in the landscape. The subtle use of context scores in this way represent a recent refinement in the Bamford method.

Roosting habitat

There is no discussion on roosting habitat in the Phoenix (2025) report, but the habitat descriptions suggest that very few if any large trees are present. The desktop review carried out by Phoenix reported only one known roost site close to the BCGP area, presumably found in the DBCA threatened fauna database with the most recent report of bird present from 2018. This is located about 1.4km north of the western end of the BCGP area (Figure 5-2). The source of roost data in this database is the Great Cocky Count, which will contain information on whether or not the roost site has been revisited since 2018, which is important in determining if the roost site has been resurveyed since 2018 and birds have not been present, or if it has not been resurveyed since 2018. Bamford (2025) provided information on three additional roost sites:

- 15/06/2016. 300+ Carnaby's at 317663mE 6723633mS on 15/06/2016, along the Arrowsmith River).
- 1/04/2015. 500+ Carnaby's at 316325mE 6752399mS, on the north-eastern boundary of Yandanogo Nature Reserve.
- 6/12/21. About 60 Carnaby's at 310350mE, 6735200mS

The roost in Yandanogo Nature Reserve is within 5km of the western extent of the BCGP area. These observations suggest that Carnaby's may be present regularly at least around the western extent of the BCGP area.

CONCLUSIONS

The BCGP area lies within the range of Carnaby's Black-Cockatoo, and the species may be an irregular visitor across most of the project area but regular (probably annual in winter) in the west. It can thus be described as a regular to irregular non-breeding visitor for the following reasons:

- Within the project area, there are few records of either birds or foraging signs despite multiple visits by experienced scientists. However, there are regular records and two known roosts in the vicinity of the western end of the project area, around Yandanogo Nature Reserve. This reserve provides extensive foraging habitat in the form of proteaceous Kwongan heaths and shrublands; this sort of habitat is not represented in the project area.
- There is little foraging habitat and only a small area of foraging habitat of moderate quality. This is partly due to the nature of the landscape but also due to extensive clearing for agriculture. Remnant areas of Banksia low woodland are only of low/moderate foraging value as they are badly degraded, with such decline in condition likely to continue unless management actions are taken. This banksia woodland would formerly have been more extensive, but much of the original native vegetation in the area consisted of eucalypt woodlands and shrubland that would only have been of low (3/10), or possibly low-moderate (4/10) foraging value. Note that road verges in agricultural areas may be of more foraging value than is currently recognised, but this habitat is not limited in extent.
- There is effectively no breeding habitat within or close to the project area. Large trees along the Irwin River (visited as part of investigations for the LCGP but well outside the BCGP area) almost certainly have hollows of suitable dimensions to support breeding by Carnaby's Black-Cockatoo. However, while this potential breeding habitat is present, the limited extent and poor quality of foraging habitat is very unlikely to support breeding.

REFERENCES

- Bamford (2025). Energy Resources Limited Lockyer Project. Assessment for Carnaby's Black-Cockatoo. Unpubl. Report to Energy Resources Ltd (Mineral Resources) by Bamford Consulting Ecologists, Kingsley.
- DAWE (2022). Referral guideline for 3 WA threatened black-cockatoo species: Carnaby's Black-Cockatoo, Baudin's Black-Cockatoo and the Forest Red-tailed Black-Cockatoo, Department of Agriculture, Water and the Environment, Canberra, February.
- Phoenix Environmental Sciences (2023a). Targeted fauna survey for the Lockyer Development Project. June 2023.
- Phoenix Environmental Sciences (2023b). Targeted fauna survey for the Lockyer Development Project. Prepared for Energy Resources Limited. December 2023.
- Phoenix Environmental Sciences (2025). Basic and targeted terrestrial fauna survey of the Belisama Conventional Gas Project. Prepared for Hancock Energy (PBN) Pty Ltd.

Bamford Consulting Ecologists

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. This score out of 10 is the Foraging Habitat Quality Score (foraging HQS). 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 HQS 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 HQS 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. It can also be influenced by the abundance of the species (referred to as species stocking rate) at the site. 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 (<https://www.agriculture.gov.au/sites/default/files/documents/offsets-how-use.pdf>), 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 vegetation characteristics (termed condition by DAWE). 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 vegetation characteristics 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.

A. Site vegetation characteristics: 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	<p>No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples:</p> <ul style="list-style-type: none"> • 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 	<p>No foraging value. No eucalypts or other potential sources of food. Examples:</p> <ul style="list-style-type: none"> • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits). 	<p>No foraging value. No eucalypts or other potential sources of food. Examples:</p> <ul style="list-style-type: none"> • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).
1	<p>Negligible to low foraging value. Examples:</p> <ul style="list-style-type: none"> • 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. <i>Erodium</i> 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). 	<p>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.</p>	<p>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.</p>

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	Baudin's Black-Cockatoo	Forest Red-tailed Black-Cockatoo
2	<p>Low foraging value. Examples:</p> <ul style="list-style-type: none"> • 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. 	<p>Low foraging value. Examples:</p> <ul style="list-style-type: none"> • Woodland with scattered specimens of known food plants (e.g. Marri and Jarrah) 1-5% projected foliage cover; • Urban areas with scattered foraging trees. • Paddocks with <i>Erodium</i> spp. and other weeds. 	<p>Low foraging value. Examples:</p> <ul style="list-style-type: none"> • 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.

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	Baudin's Black-Cockatoo	Forest Red-tailed Black-Cockatoo
3	<p>Low to Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> • 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 with Marri 5- 10% projected foliage cover. • 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); 	<p>Low to Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> • Eucalypt Woodland with known food plants (especially Marri) 5-10% projected foliage cover; • 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); • Managed revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability). • Paddocks with <i>Erodium</i> spp. and other weeds at a high density or close to high value forest. 	<p>Low to Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> • 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); • Managed revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	Baudin's Black-Cockatoo	Forest Red-tailed Black-Cockatoo
4	<p>Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> 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. Depending on understorey condition (and thus long-term viability) and Marri density, may downgrade to 3 or upgrade to 5 (see below). 	<p>Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> 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). 	<p>Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> 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	<p>Moderate to High foraging value. Examples:</p> <ul style="list-style-type: none"> 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; Eucalypt Woodland/Forest with Marri >60% projected foliage cover and good understorey condition (and thus long-term viability). Pine plantations with trees more than 10 years old (but see pine note below in moderation section). 	<p>Moderate to High foraging value. Examples:</p> <ul style="list-style-type: none"> 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. 	<p>Moderate to High foraging value. Examples:</p> <ul style="list-style-type: none"> 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	<p>High foraging value. Example:</p> <ul style="list-style-type: none"> Banksia Low Forest (of key species <i>B. attenuata</i> and <i>B. menziesii</i>) 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). 	<p>High foraging value. Example:</p> <ul style="list-style-type: none"> 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). 	<p>High foraging value. Example:</p> <ul style="list-style-type: none"> 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).

B. 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, but this may simply be because the trees potentially provide food.

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 assignment 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.

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%

It should be stressed that the above table is a guide and the percentages should not be treated as strict criteria. Broadly speaking, context is high close to breeding and especially when foraging habitat is limited, medium when close to breeding but habitat is not limited, or when not close to breeding but foraging habitat is limited, and low when not close to breeding and foraging habitat is not limited. And then it is effectively nil if vegetation characteristics score is low. However, a low context score can be given if a patch of vegetation is the only foraging habitat left and birds are in the area. 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 (eg 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. Adjustments to context score are further discussed below (moderation of scores).

C. 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. Assignment 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.

D. 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:

vegetation composition, condition and structure score (out of 6)	context score	Species density score
3-6 (low/moderate to high value)	Assessed as per B above	Assessed as per C 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. It could also get an elevated context score if it is the only foraging habitat in an area and birds are present, and also if it is immediately alongside at least moderately good foraging habitat, on the basis that birds are more likely to utilise it if they are nearby. Species density score might also be raised if there is a high likelihood of the birds actually being present. Context score can also be used to give a fine adjustment to the total score, such as if there are two vegetation types with the same vegetation composition score, but one may be slightly better foraging habitat and covers a larger area. Moderation is a means by which fairly subtle differences in overarching foraging value can be recognised.

Pine plantations

Pine plantations are an important foraging resource for Carnaby's Black-Cockatoo (only) but are not directly comparable with native vegetation. In comparing native vegetation with pine plantations for the purpose of calculating offsets, the following should be noted:

- Pine plantations are a commercial crop established with the intention of being harvested and thus have short-term availability (30-50 years), whereas native vegetation is available indefinitely if protected. Due to the temporary nature of pines as a food source, site condition and context differs between pines and native vegetation.
- Although pines provide a high abundance of food in the form of seeds, they are a limited food resource compared with native vegetation which provides seeds, insect larvae, flowers and nectar. The value of insect larvae in the diet of Carnaby's Black-Cockatoo has not been quantified, but in the vicinity of Perth, the birds forage very heavily on insect larvae in young cones of *Banksia attenuata* in winter, ignoring the seeds in these cones and seeds in older cones on the same trees (Scott and Black 1981; M. Bamford pers. obs.). This suggests that insect larvae are of high nutritional importance immediately prior to the breeding season.
- Pine plantations have very little biodiversity value other than their importance as a food source for Carnaby's Black-Cockatoos. They inhibit growth of other flora. While this is not a factor for direct consideration with respect to Carnaby's Black-Cockatoo, it is a factor in regional conservation planning of which offsets for the cockatoos are a part.

Taking the above points into consideration, it is possible to assign pine plantations a foraging value as follows:

- Site condition. The actual foraging value of pines is high. Stock *et al.* (2013) report that it takes nearly twice as many seeds of *Pinus pinaster* to meet the daily energy requirements for Carnaby's Black-Cockatoo compared with Marri, and three times as many *P. pinaster* seeds compared with Slender Banksia. However, pines are planted at a high density so the food supply per hectare can be high. Taking account of the lack of variety of food from pines, this suggests a site condition score of 4 or 5 out of 6 (5 is used in Section A above). As a source of food, pines are thus comparable to the best banksia woodland. This site condition score then needs to be adjusted to take account of the short-term nature of the food supply (for pine plantations to be harvested. Where pines are 'ornamental, such as in some urban contexts, they can be treated as with other trees in urban landscapes). The foraging value of a site after pines are harvested will effectively be 0, or possibly 1 if there is some retention. It is proposed that this should approximately halve the site condition score; young pine plantations could be redacted slightly less than old plantations on the basis that a young plantation provides a slightly longer term food supply. If a maximum site condition score of 5 is given, then a young plantation (>10 but <30 years old) could be assigned a score of 3, and an old plantation (>30 years old) could be assigned a score of 2. Plantations <10 years old and thus not producing large quantities of cones could also get a score of 2, but recognising they may increase in value.

- Site context. Although a temporary food source, pines can be very important for Carnaby's Black-Cockatoo in some contexts; they could be said to carry populations in areas where there is little native vegetation. The system for assigning a context score as outlined above (Section B) also applies to pines. Thus, a context score of 3 can be given where pines are a significant proportion of foraging habitat (>5% if breeding occurs; >10% if no breeding), but where pines are a small part of the foraging landscape they will receive a context score of less than this.
- Species density. As outlined above (Section C), pines will receive a species density score of 1 where Carnaby's Black-Cockatoo are regular visitors. This is irrespective of an old plantation having a moderated condition score of 2.

Based on the above, pine plantations that represent a substantial part of the foraging landscape, such as in the region immediately north of Perth, would receive a total score (out of 10) of 6; young plantations in this area would receive a score of 7. In contrast, isolated and small plantations in rural landscapes could receive a score of just 2 if they are only a small proportion of foraging habitat and Carnaby's Black-Cockatoos are not regularly present.

DCCEEW (undated). How to use the Offsets Assessment Guide.

(<https://www.agriculture.gov.au/sites/default/files/documents/offsets-how-use.pdf>).

Keighery, B. J. (1994). *Bushland Plant Survey: A guide to plant community survey for the community*. Wildflower Society of Western Australia (Inc.), Nedlands, Western Australia.

Scott, J. K. and Black, R. (1981). Selective Predation by White-Tailed Black Cockatoos on Fruit of *Banksia attenuata* Containing the Seed-Eating Weevil *Alphitopis nivea*. *Australian Wildlife Research* **8(2)**, 421-430.

Stock, W.D., Finn, H., Parker, J. and Dods, K. (2013). Pine as Fast Food. Foraging Ecology of an Endangered Cockatoo in a Forestry Landscape. *PlosOne* 8: issue 4.

Appendix 1.

(Table A2) Types of additional information that might be considered during the assessment and approval stage.

Type of habitat	Types of additional information
Breeding	<ul style="list-style-type: none"> • The number and location (e.g., in or adjacent to breeding habitat; in normal breeding range; away from breeding habitat; or outside of known breeding range.) of known nesting trees, i.e. trees of each species currently or recently used for breeding. • The number and location of suitable nesting trees, i.e. trees of each species with suitable hollows. • An estimated number and location of potential nesting trees. Potential nesting trees have a suitable diameter at breast height (DBH) to develop a nest hollow, but do not have hollows. For most species of trees, suitable nest hollows are only found in live trees with a DBH of at least 500 mm. Trees suitable to develop a nest hollow in the future are 300-500 mm DBH. Note that many species of eucalypt may develop suitable hollows for breeding. • Landscape characteristics around the impact site, including details of foraging habitat in proximity (e.g. up to 12 km) to the breeding habitat and the location and details of watering points that could support the use of the breeding habitat.
Night roosting	<ul style="list-style-type: none"> • The number and location of trees of each species currently or recently used for night roosting (known night roosting site). • The frequency of use of the night roost site (daily, weekly, monthly or annually). • The potential of the site to be used as night roosting despite no evidence of roosting (including the number and size of potential roosting trees). • Landscape characteristics around the impact site, including details of foraging habitat in proximity (e.g. up to 20 km) to the night roosting habitat and the location and details of watering points that could support the use of the night roosting habitat.
Foraging	<ul style="list-style-type: none"> • The presence, extent and density (including foliage cover and flowering density) of all plant species that provide foraging, including non-native food sources used by black cockatoos. • The distribution and size of foraging habitat in proximity (e.g. up to 12 km) to the impact site. • Presence and prevalence of plant disease (such as dieback disease <i>Phytophthora</i> spp., Marri Canker (<i>Quambalaria coyrecup</i>) or any other plant diseases), or impact site degradation (such as cleared, disturbed or degraded areas). • The fire history of the impact site. • Landscape characteristics around the impact site, including details of roosting and breeding habitat in proximity (e.g. up to 20km for roosting and 12km for breeding) and the location and details of watering points that could support the use of the foraging habitat.

Extracted from DAWE 2022, *Referral guideline for 3 WA threatened black-cockatoo species: Carnaby's, Baudin's and the Forest Red-tailed Black- Cockatoos*. Department of Agriculture, Water and the Environment, Canberra, February.