



## CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

<b>Purpose Permit number:</b>	CPS 8327/1
<b>Permit Holder:</b>	Mr Jim Zheng
<b>Duration of Permit:</b>	From 6 July 2024 to 6 July 2044

### ADVICE NOTE

#### Allocation of offset site

In relation to condition 10 of this Permit, it is noted that:

- 2.4 hectares of Lot 2 on Diagram 65861, Crooked Brook, will be attributed to the offset for this project and contains high quality foraging and breeding habitat for *black cockatoo species*, to be conserved in perpetuity.
- 37.2 hectares of Lot 2148 on Deposited Plan 125383, Ferguson, will be attributed to the offset for this project and contains high quality foraging and breeding habitat for *black cockatoo species*, to be conserved in perpetuity.

#### Revegetation and rehabilitation offset

In relation to condition 11 of this permit, it is noted that:

- 1.76 hectares of Lot 2 on Diagram 65861, Crooked Brook, is to be *revegetated* and *rehabilitated* to provide suitable foraging habitat for *black cockatoo species*.
- 2.1 hectares of Lot 2148 on Deposited Plan 125383, Ferguson, is to be *revegetated* and *rehabilitated* to provide suitable foraging habitat for *black cockatoo species*.

The permit holder is authorised to clear *native vegetation* subject to the following conditions of this permit.

### **PART I – CLEARING AUTHORISED**

#### **1. Clearing authorised (purpose)**

The permit holder is authorised to clear *native vegetation* for the purpose of sand and gravel extraction.

#### **2. Land on which clearing is to be done**

LOT 2 ON DIAGRAM 65861, Crooked Brook

#### **3. Clearing authorised**

The permit holder must not clear more than 6.27 hectares of *native vegetation* within the area cross-hatched yellow in Figure 1 of Schedule 1.

#### **4. Period during which clearing is authorised**

The permit holder must not clear any *native vegetation* after 6 July 2029.

## **PART II – MANAGEMENT CONDITIONS**

### **5. Avoid, minimise, and reduce impacts and extent of clearing**

In determining the *native vegetation* authorised to be cleared under this permit, the permit holder must apply the following principles, set out in descending order of preference:

- (a) avoid the clearing of *native vegetation*;
- (b) minimise the amount of *native vegetation* to be cleared; and
- (c) reduce the impact of clearing on any environmental value.

### **6. Weed and dieback management**

When undertaking any clearing authorised under this permit, the permit holder must take the following measures to minimise the risk of introduction and spread of *weeds* and *dieback*:

- (a) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;
- (b) ensure that no known dieback or weed-affected soil, *mulch*, fill, or other material is brought into the area to be cleared; and
- (c) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

### **7. Directional clearing**

The permit holder must:

- (a) conduct clearing activities in a slow, progressive manner towards adjacent *native vegetation*; and
- (b) allow a reasonable time for fauna present within the area being cleared to move into adjacent *native vegetation* ahead of the clearing activity.

### **8. Wind erosion management**

The permit holder must commence extraction activities no later than three (3) months after undertaking the clearing authorised under this permit, to reduce the potential for wind erosion.

### **9. Fauna management – black cockatoo habitat trees**

- (a) Within 72 hours prior to undertaking any clearing authorised under this permit within the area cross-hatched yellow in Figure 1 of Schedule 1, the permit holder must engage a *fauna specialist* to inspect the *black cockatoo habitat tree/s* identified in the *fauna assessment* (Harewood, 2021) for *evidence* of current or past breeding use by *black cockatoo species*.
- (b) The permit holder must not clear more than two (2) *black cockatoo habitat trees* unless approved by the CEO in writing.
- (c) Where *black cockatoo habitat tree/s* with no *evidence* of current or past use by *black cockatoo species* is identified, in accordance with condition 9(a), that tree must be cleared within 72 hours after the inspection.
- (d) Where *black cockatoo habitat tree/s* is identified within the area cross-hatched yellow on Figure 1 of Schedule 1 and that tree shows *evidence* of current or past breeding use by *black cockatoo species*, and clearing of that tree cannot be avoided, that tree must be monitored by a *fauna specialist* to determine when it is no longer in use for that breeding session.

- (e) Any *black cockatoo habitat tree* with evidence of current breeding use by *black cockatoo species* must not be cleared whilst it is in use for that breeding season as determined by the *fauna specialist* under condition 9(d).
- (f) Where a *black cockatoo habitat tree* is cleared, the permit holder must install one artificial black cockatoo nest hollow for every *suitable hollow* identified in a *black cockatoo habitat tree* cleared.
- (g) Each artificial black cockatoo nesting hollow required by condition 9(f) must be installed prior to the commencement of the next breeding season for *black cockatoo species* following clearing of the related *black cockatoo habitat tree/s*.
- (h) The artificial black cockatoo nest hollow/s required by condition 9(f) of this permit, must:
  - (i) be installed within the areas cross-hatched red in:
    1. Figure 3 of Schedule 1 (Lot 2148 on Deposited Plan 125383); OR
    2. Figure 2 of Schedule 1 (Lot 2 on Deposited Plan 403943);
  - (ii) be designed and placed in accordance with the specifications detailed in Schedule 3; and
  - (iii) be monitored and maintained in accordance with the specifications detailed in Schedule 3, for a period of at least ten years.
- (i) The permit holder must provide details and locations of any artificial black cockatoo nesting hollow(s) installed in accordance with condition 9(h) to the *CEO* within six (6) months of installation.
- (j) Within two (2) months of clearing authorised under this permit within the area cross-hatched yellow in Figure 1 of Schedule 1, the permit holder must provide the results of the *black cockatoo habitat tree* inspection, in a report to the *CEO*.
- (k) The report must include the following;
  - (i) the location of the *black cockatoo habitat tree/s* inspected, recorded using a GPS unit set to GDA2020, expressing the geographical coordinates in Eastings and Northings or decimal degrees;
  - (ii) description and a photograph of the *evidence* found, if any, of current or past used by *black cockatoo species*;
  - (iii) the methodology, used to inspect the *black cockatoo habitat trees* within the permit area; and
  - (iv) the date of the inspection.

#### 10. Offset – Conservation covenant

Within 24 months of the commencement of clearing authorised under this permit and no later than 6 July 2026, the permit holder must provide to the *CEO* a copy of the executed conservation covenant under section 30B of the *Soil and Land Conservation Act 1945* over:

- (a) the areas cross-hatched red and orange in Figure 2 of Schedule 1 (Lot 2 on Deposited Plan 403943); and
- (b) the areas cross-hatched red and orange in Figure 3 of Schedule 1 (Lot 2148 on Deposited Plan 125383).

## 11. Offset – Revegetation and rehabilitation

Within 12 months of the commencement of clearing authorised under this permit, and no later than 6 July 2025, for the areas cross-hatched orange in Figure 2 and Figure 3 of Schedule 1, the permit holder must implement and adhere to the *Offset Management Plan*, including but not limited to the following actions:

- (a) commence *revegetation* and *rehabilitation* by;
  - (i) deliberately *planting* and/or *direct seeding native vegetation*, of species which will result in suitable foraging habitat for *black cockatoo species*; and
  - (ii) ensuring only *local provenance* seeds and propagating material are used to *revegetate* and *rehabilitate* the areas.
- (b) undertake *weed* control activities prior to *planting*, and annually thereafter until completion criteria have been met;
- (c) rip the offset sites prior to *planting* to remove any areas of compaction or other obstruction that could prevent root penetration of seedlings.
- (d) establish a minimum of two 10 x 10 metre quadrat monitoring sites across each of the areas cross-hatched orange in Figure 2 and Figure 3 of Schedule 1.
- (e) undertake annual monitoring of the *revegetated* and *rehabilitated* areas by an *environmental specialist*, until the completion criteria specified in Table 1 of Schedule 2 are met.
- (f) achieve the completion criteria specified in Table 1 of Schedule 2 of this permit, after a five- year monitoring period for areas *revegetated* and *rehabilitated* under this permit.
- (g) undertake *remedial actions* for areas *revegetated* and *rehabilitated*, where monitoring indicates that *revegetation* and *rehabilitation* has not met the completion criteria outlined in Table 1 of Schedule 2 of this permit, including;
  - (i) *revegetate/rehabilitate* the area by deliberately *planting* and/or *direct seeding native vegetation* that will result in the minimum target set out in the completion criteria detailed in Table 1 of Schedule 2 and ensuring only *local provenance* seeds and propagating material are used;
  - (ii) additional *weed* control activities;
  - (iii) annual monitoring of the *revegetated* and *rehabilitated* areas by an *environmental specialist*, until the *completion criteria*, specified in Table 1 of Schedule 2 are met; and
  - (iv) where an *environmental specialist* has determined that the completion criteria, outlined in Table 1 of Schedule 2 has been met, that report is to be provided to the *CEO*.

## 12. Vegetation management - fencing

- (a) Within 12 months of commencing clearing authorised under this permit, and no later than 6 July 2025, the permit holder must construct a fence enclosing;
  - (i) the areas cross-hatched red and orange in Figure 2 of Schedule 1 (Lot 2 on Deposited Plan 403943); and
  - (ii) the areas cross-hatched red and orange in Figure 3 of Schedule 1 (Lot 2148 on Deposited Plan 125383).
- (b) The fence must allow for the movement of wildlife by being raised 15 centimetres from the ground.
- (c) The permit holder must notify the *CEO* within three months of the completion of the fence constructed under 12(a).

### 13. Vegetation management – weed management

Within 12 months of undertaking clearing authorised under this permit, and no later than 6 July 2025, the permit holder must undertake annual *weed* control activities within the area cross-hatched red in Figure 2 of Schedule 1 (Lot 2 on Deposited Plan 403943) for the term of the permit.

## **PART III - RECORD KEEPING AND REPORTING**

### 14. Records that must be kept

The permit holder must maintain records relating to the listed relevant matters in accordance with the specifications detailed in Table 1.

**Table 1: Records that must be kept**

No.	Relevant matter	Specifications
1.	In relation to the authorised clearing activities generally	<ul style="list-style-type: none"> <li>(a) the species composition, structure, and density of the cleared area;</li> <li>(b) the location where the clearing occurred, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 2020 (GDA2020), expressing the geographical coordinates in Eastings and Northings;</li> <li>(c) the date that the area was cleared;</li> <li>(d) the size of the area cleared (in hectares);</li> <li>(e) actions taken to avoid, minimise, and reduce the impacts and extent of clearing in accordance with condition 5;</li> <li>(f) actions taken to minimise the risk of the introduction and spread of <i>weeds</i> and <i>dieback</i> in accordance with condition 6;</li> <li>(g) actions taken to mitigate impacts of the proposed clearing on fauna in accordance with condition 7;</li> <li>(h) actions taken to mitigate wind erosion risk in accordance with condition 8; and</li> <li>(i) the actions taken in accordance with condition 9 of this permit.</li> </ul>
2.	In relation to the revegetation and rehabilitation of areas pursuant to condition 11	<ul style="list-style-type: none"> <li>(a) a description of the <i>revegetation</i> and <i>rehabilitation</i> activities undertaken;</li> <li>(b) the size of the area <i>revegetated</i> and <i>rehabilitated</i>;</li> <li>(c) the date/s on which the <i>revegetation</i> and <i>rehabilitation</i> was undertaken;</li> <li>(d) the boundaries of the area <i>revegetated</i> and <i>rehabilitated</i>, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 2020 (GDA2020), expressing the geographical coordinates in Eastings and Northings;</li> <li>(e) results of annual monitoring against the completion criteria</li> <li>(f) the date completion criteria are considered to have been met; and</li> <li>(g) any other actions taken in accordance with condition 11.</li> </ul>

No.	Relevant matter	Specifications
3.	In relation to offset management, pursuant to conditions 10, 12 and 13	<p>(a) A copy of the relevant conservation covenant under section 30B of the <i>Soil and Land Conservation Act 1945</i> in accordance with condition 10;</p> <p>(b) actions undertaken in accordance with condition 12; and</p> <p>(c) a description of the <i>weed</i> control activities undertaken in accordance with condition 13.</p>

## 15. Reporting

- (a) The permit holder must provide to the *CEO*, on or before 30 June of each calendar year, a written report containing:
- (i) the records required to be kept under condition 14; and
  - (ii) records of activities done by the permit holder under this permit between 1 January and 31 December of the preceding calendar year.
- (b) If no clearing authorised under this permit has been undertaken, a written report confirming that no clearing under this permit has been undertaken, must be provided to the *CEO* on or before 30 June of each calendar year.
- (c) The permit holder must provide to the *CEO*, no later than 90 calendar days prior to the expiry date of the permit, a written report of records required under condition 14, where these records have not already been provided under condition 15(a).

## DEFINITIONS

In this permit, the terms in Table 2 have the meanings defined.

**Table 2: Definitions**

Term	Definition
black cockatoo species	means one or more of the following species: (a) <i>Zanda latirostris</i> (Carnaby's cockatoo); (b) <i>Zanda baudinii</i> (Baudin's cockatoo); and/or (c) <i>Calyptorhynchus banksii naso</i> (forest red-tailed black cockatoo).
remedial actions	means any activity that is required to ensure successful reestablishment of vegetation to its pre-clearing composition, structure and density, and may include a combination of soil treatments and <i>revegetation</i> .
black cockatoo habitat trees	means trees that have a diameter, measured at 130 centimetres from the base of the tree, of 50 centimetres or greater (or 30 centimetres or greater for <i>Eucalyptus salmonophloia</i> or <i>Eucalyptus wandoo</i> ) that contain hollows suitable for breeding by black cockatoos.
CEO	Chief Executive Officer of the department responsible for the administration of the clearing provisions under the <i>Environmental Protection Act 1986</i> .
clearing	has the meaning given under section 3(1) of the EP Act.
condition	a condition to which this clearing permit is subject under section 51H of the EP Act.
dieback	means the effect of <i>Phytophthora</i> species on native vegetation.
department	means the department established under section 35 of the <i>Public Sector Management Act 1994</i> (WA) and designated as responsible

Term	Definition
	for the administration of the EP Act, which includes Part V Division 3.
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
environmental specialist	means a person who holds a tertiary qualification in environmental science or equivalent and has experience relevant to the type of environmental advice that an environmental specialist is required to provide under this Permit, or who is approved by the CEO as a suitable environmental specialist.
evidence	means showing chew marks or scratchings on the habitat tree representative of the species being surveyed, the presence of the species entering or leaving the habitat tree, and/or the presence of chicks/young
fauna assessment	means the document 'Fauna Assessment. Lot 2 Banksia Road Dardanup. Greg Harewood'. Provided on August 2022 (DWER reference A2014023)
fauna specialist	means a person who holds a tertiary qualification specialising in environmental science or equivalent, and has a minimum of two (2) years work experience in fauna identification and surveys of fauna native to the region being inspected or surveyed, or who is approved by the CEO as a suitable fauna specialist for the bioregion, and who holds a valid fauna licence issued under the Biodiversity Conservation Act 2016.
fill	means material used to increase the ground level, or to fill a depression.
local provenance	means native vegetation seeds and propagating material from natural sources within 50 kilometres and the same Interim Biogeographic Regionalisation for Australia (IBRA) subregion of the area cleared.
mulch	means the use of organic matter, wood chips or rocks to slow the movement of water across the soil surface and to reduce evaporation.
native vegetation	has the meaning given under section 3(1) and section 51A of the EP Act.
Offset Management Plan	means the document 'Offset Management Plan' prepared by Accendo, provided on 29 April 2024 (DWER reference: DWERDT940388), approved by the CEO
planting(s)/plant	means the re-establishment of vegetation by creating favorable soil conditions and planting seedlings of the desired species.
rehabilitation	means actively managing an area containing native vegetation in order to improve the ecological function of that area using methods such as natural regeneration, direct seeding and/or planting, so that the species composition, structure and density is similar to pre-clearing vegetation types in that area.
revegetation	means the re-establishment of a cover of local provenance native vegetation in an area using methods such as natural regeneration, direct seeding and/or planting, so that the species composition, structure and density is similar to pre-clearing vegetation types in that area.
suitable hollow	means a hollow deemed by a <i>fauna specialist</i> to be suitable for breeding by black cockatoos.

weeds	<p>means any plant –</p> <p>(a) that is a declared pest under section 22 of the <i>Biosecurity and Agriculture Management Act 2007</i>; or</p> <p>(b) published in a Department of Biodiversity, Conservation and Attractions species-led ecological impact and invasiveness ranking summary, regardless of ranking; or</p> <p>(c) not indigenous to the area concerned.</p>
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**END OF CONDITIONS**


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 Jessica Burton  
 A/MANAGER  
 NATIVE VEGETATION REGULATION

*Officer delegated under section 20  
 of the Environmental Protection Act 1986*

12 June 2024



# Schedule 1

The boundary of the area authorised to be cleared is shown in the map below (Figure 1).



**Figure 1: Map of the boundary of the area within which clearing may occur (cross hatched yellow)**



Figure 2: Map of the boundary of the areas within which conditions apply (cross hatched red and orange)

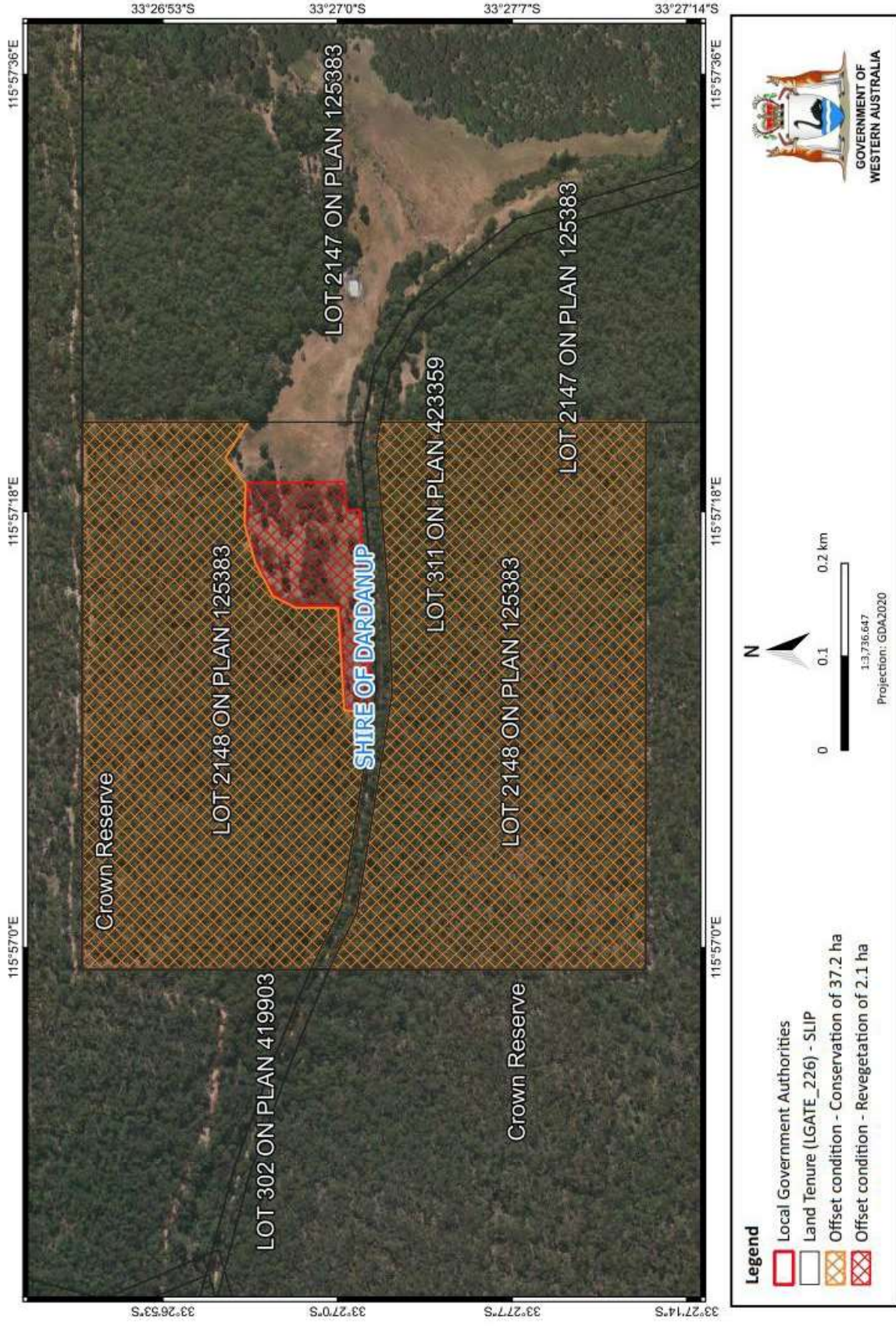


Figure 3: Map of the boundary of the areas within which conditions apply (cross-hatched red and orange)

## Schedule 2

Table 1. Completion criteria for the revegetation within the areas cross-hatched red and orange in Figure 2 and Figure 3 of Schedule 1

Aspect	Completion targets	Completion criteria	Monitoring
Fence	Erection of a suitable perimeter fence to be installed and provide an effective barrier to prevent or reduce impacts to revegetation area	Fence is maintained with no authorised entry	Annual by inspection
Species density/composition	Revegetation area to be comprised of suitable foraging and breeding habitat species for <i>black cockatoos</i> species (see Table 2 of Schedule 2).	<p>Within 5 years, revegetation areas to be comprised of suitable foraging and breeding habitat species for <i>black cockatoo</i> species (see Table 2 of Schedule 2) at a density of:</p> <ul style="list-style-type: none"> <li>Trees – one (1) plant per five (5) square meter,</li> <li>Shrubs – one (1) plant per two (2) square meter, and</li> <li>Groundcovers – four (4) plants per square meter.</li> </ul>	<p>Monitoring via quadrats,</p> <p>Monitoring to occur annually during Spring and Autumn for 5 years or until completion criteria are met</p>
Black cockatoo foraging habitat	A minimum of 50 per cent of the foliage cover is comprised of suitable foraging species for <i>black cockatoos</i> species.	<p>Within 5 years, a minimum of 50 per cent of the foliage cover is comprised of suitable foraging species for <i>black cockatoos</i> species.</p>	
Weeds	Reduce weed cover to less than 5 per cent throughout the revegetation areas.	Reduce weed cover to less than 5 per cent throughout the revegetation areas within 5 years.	
Plants used in rehabilitation to be of local provenance.	All revegetation stock will be sourced from (preferably) local nurseries with NIASA accreditation	All revegetation stock will be sourced from (preferably) local nurseries with NIASA accreditation	Audit of rehabilitation records for sources of plant materials used in revegetation.

**Table 2. Suitable species for revegetation**

<b>Species</b>	<b>Form</b>
<i>Eucalyptus marginata</i>	Tree
<i>Eucalyptus haematoxylon</i>	Tree
<i>Corymbia calophylla</i>	Tree
<i>Acacia lasiocarpa</i> var <i>lasiocarpa</i>	Shrub
<i>Acacia pulchella</i>	Shrub
<i>Acacia saligna</i>	Shrub
<i>Allocasuarina fraseriana</i>	Tree
<i>Austrodanthonia</i> spp.	Grass
<i>Austrostipa compressa</i>	Grass
<i>Austrostipa sembarbata</i>	Grass
<i>Banksia grandis</i>	Tree
<i>Banksia littoralis</i>	Tree
<i>Eucalyptus decipiens</i>	Tree
<i>Eucalyptus drummondii</i>	Tree
<i>Eucalyptus megacarpa</i>	Tree
<i>Eucalyptus patens</i>	Tree
<i>Ficinia nodosa</i>	Rush
<i>Hakea cyclocarpa</i>	Shrub
<i>Hakea ruscifolia</i>	Shrub
<i>Hakea undulata</i>	Shrub
<i>Hibbertia hypericoides</i>	Shrub
<i>Hibbertia subvaginata</i>	Shrub
<i>Kunzea glabrescens</i>	Shrub
<i>Kunzea micrantha</i>	Shrub
<i>Leucopogon glabellus</i>	Shrub
<i>Lomandra sericea</i>	Rush
<i>Mesomelaena tetragona</i>	Sedge
<i>Microalaena stipoides</i> var <i>stipoides</i>	Grass
<i>Patersonia occidentalis</i>	Herb

## **Schedule 3**

### **Fauna Note - Artificial hollows for Black Cockatoo**

## Artificial Hollows for Black Cockatoos

There are three species of threatened black cockatoos in the southwest of Western Australia (WA): Baudin's cockatoo *Zanda baudinii* (previously *Calyptorhynchus baudinii*), Carnaby's cockatoo *Zanda latirostris* (previously *Calyptorhynchus latirostris*) and forest red-tailed black cockatoo *Calyptorhynchus banksii naso*. Some of the main threats to the three species include nest hollow shortages due to ongoing and extensive habitat loss and degradation, lack of recruitment of new hollow bearing trees, and competition with galahs, corellas, and feral European honey bees.

Artificial hollows can be used to help conserve these threatened black cockatoos by enabling them to breed in areas where natural hollows are limited. This Fauna Note provides advice on how to select an appropriate site, guidelines on how to design and place artificial hollows, and advice on how to maintain and monitor artificial hollows. The information presented here is based on experience with Carnaby's cockatoo which have many examples of successful use of artificial hollows and forest red-tailed black cockatoo which have a few known examples of use. However, to date there are no records of Baudin's cockatoo using artificial nest hollows.

Sometimes a site may not be suitable for artificial hollows. This Fauna Note includes options for alternative conservation actions that are important to the conservation of black cockatoos and can also be used to complement the placement of artificial hollows.

It is important to remember that the retention of both old and dead trees (stags) that have suitable hollows for black cockatoos is crucial for breeding, and natural replacement of hollow bearing trees for future breeding is vital for the long-term survival of the species. The installation of artificial hollows should not be used to justify the removal of natural hollow-bearing trees.

It is important to remember that the retention of both old and dead trees (stags) that have suitable hollows for black cockatoos is crucial for breeding, and natural replacement of hollow bearing trees for future breeding is vital for the long-term survival of the species. The installation of artificial hollows should not be used to justify the removal of natural hollow-bearing trees.

### When to Use Artificial Hollows

Artificial hollows may be useful at sites where natural hollows are a limiting resource. However, cockatoos may not always use artificial hollows, for example if provided in non-traditional nesting areas. Artificial hollows that are installed within 2 km of current breeding sites are regularly taken up. There are ways to select sites for artificial hollows that will increase the chance that they will be used and that birds will be able to successfully raise chicks.

### Where do black cockatoos nest?

Black cockatoos nest in the hollows of mature trees in uncleared or remnant Eucalypt woodland or forest, as well as in remnant paddock trees. Trees may take more than 120 years to develop hollows that are a suitable size, and cockatoos use hollows in both living and dead trees. Refer to the maps at the end of this document for the known breeding range of the three species of black cockatoo.

Carnaby's cockatoos generally breed in Wandoo and Salmon Gum in the Wheatbelt, Marri in forested areas, and Tuart along the Swan Coastal Plain. They are also known to nest in Jarrah, Flooded Gum, York Gum, Gimlet, Powderbark Wandoo, and Karri.

Baudin's cockatoos generally nest in Jarrah, Marri, and Karri in densely forested areas. They are also known to nest in hollows in Wandoo and Tuart.



Carnaby's cockatoo nestlings in an artificial hollow. Note this chewing post will require replacement following breeding.

Photo: Rick Dawson

## FAUNA NOTES – Artificial Hollows for Black Cockatoos

The breeding habitat for forest red-tailed black cockatoos is in uncleared forest or remnant patches of old Marri. They are also known to nest in Karri, Wandoo, Bullich, Blackbutt, Tuart, and Jarrah.

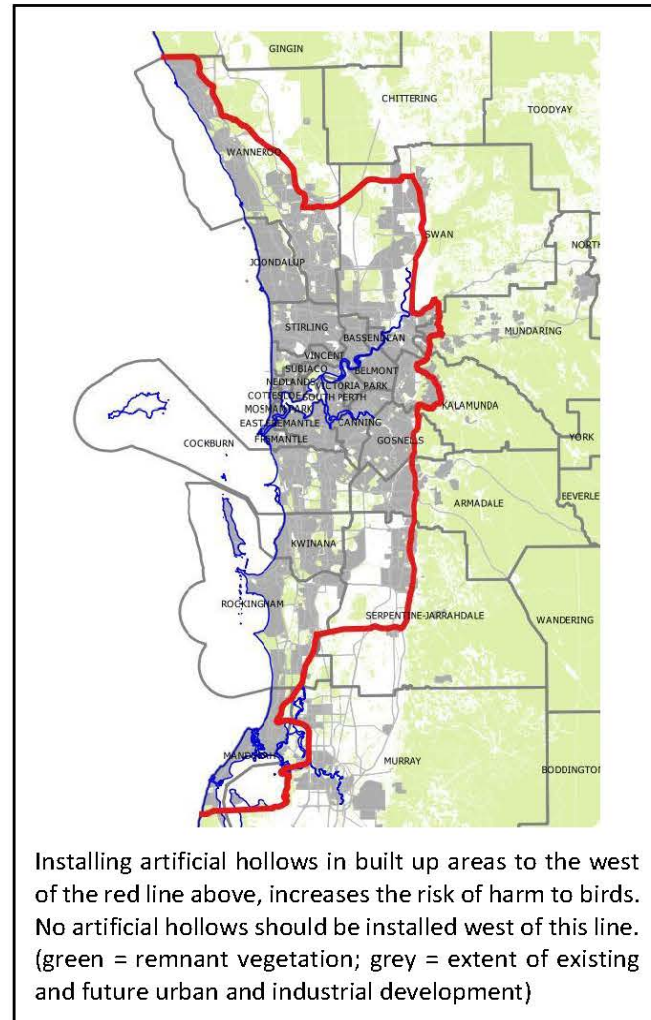
### Is my site suitable for artificial hollows?

It is recommended that artificial hollows be used in known nesting areas where there has been a decrease in the availability of natural nesting hollows. Trials have shown that Carnaby's cockatoo and forest red-tailed black cockatoos will nest in artificial hollows if installed in suitable areas and are of a satisfactory design. However, putting up artificial hollows may not be the best way to help black cockatoos in your area.

Indeed, attracting birds to attempt to breed in unsuitable areas may result in increased risk of harm to adult birds or their chicks. The installation of artificial hollows in built up and urbanized areas of the metropolitan Perth and Peel regions, and other urban centres in the southwest is not recommended and should not be undertaken. This is due to the increased risk in this area, including car strike to young inexperienced birds, attack by predators such as Australian ravens and pets, and in highly urbanised and cleared areas there may not be sufficient food resource for the adults to successfully raise chicks).

To decide if your site is suitable for artificial hollows you need to consider five essential criteria (Table 1). If your site does not match all criteria, you may wish to consider alternative conservation actions including:

- protecting habitat by fencing and/or rabbit and stock control to encourage regeneration of native vegetation;
- controlling competitive species such as galahs, corellas and feral bees that may occupy hollows;
- repairing old and damaged natural nesting hollows;
- providing access to fresh water;
- revegetating with preferred food species and nesting trees; and/or
- creating linkages of vegetation between nesting and feeding areas.



**Table 1: Essential criteria for a site to be considered suitable for installation of artificial hollows, with alternative conservation actions suggested for each criterion that is not met.**

1.	<b>The site is Eucalypt woodland or forest within the known breeding range of the species</b>	
	<i>Important consideration</i>	Carnaby's cockatoos tend to nest in Wandoo and Salmon Gum in the Wheatbelt, Marri in forested area and Tuart along the Swan Coastal Plain. Baudin's cockatoos generally nest in Jarrah, Marri, and Karri and forest red-tailed black cockatoos usually nest in Marri.
	<i>Alternative conservation actions</i>	If the site is not within the known current breeding range of black cockatoos, then it is unlikely that the installation of artificial hollows will attract the birds to the site.  However, black cockatoos are highly mobile species that also require habitat for feeding and roosting which means that it is important to protect and manage habitat visited by the cockatoos by fencing, and carrying out other management, such as rabbit and stock control, to retain existing habitat, and to encourage regeneration of native vegetation. It is also important to revegetate areas within the breeding and non-breeding areas with preferred food species, and to create linkages of vegetation to assist the movement of the birds through the landscape.
2.	<b>Breeding by Black cockatoos is known or suspected at the site. There must also be evidence that a lack of suitable available tree hollows is preventing breeding that would otherwise occur in the area.</b>	



## FAUNA NOTES – Artificial Hollows for Black Cockatoos

	<i>Important consideration</i>	If the lack of available hollows is due to nest competitors such as galahs, western long-billed corellas or feral bees then any attempt to install artificial hollows must be accompanied by efforts to deter or control these competitors. Alternatively, successful control of competitors may mean that artificial hollows are not needed.
	<i>Alternative conservation actions</i>	<p>If sufficient suitable natural hollows are available in an area, then there is no need to install artificial hollows. This overcomes the need for ongoing maintenance of unnecessary artificial hollows.</p> <p>If breeding is already occurring at the site and there are plenty of available hollows, efforts can be redirected towards caring for existing or future nesting hollows. This may involve repairing old or damaged nesting hollows by covering cracks, removing debris blocking access to hollows or replacing rotted wood in the hollow so that the depth of the nest floor is manageable for the birds. Future hollows can be protected by preventing compaction of ground around trees, fencing and/or rabbit and stock control to encourage regeneration to produce future nesting trees, fire management, and the strategic pruning of limbs to prevent limbs breaking and tearing open hollows. Efforts can also be aimed at enhancing the success of existing breeding by revegetating with preferred food and nesting species, as well as creating linkages of suitable vegetation and fresh water between nesting and feeding areas.</p> <p>If breeding is not occurring at the site despite hollows being available, then there may be a range of factors making the site unsuitable for breeding. These factors must be identified and addressed before breeding can resume in the area (if at all possible). Lack of sufficient food could be the cause, and this can be addressed by revegetating with preferred food species and increasing connectivity in the landscape.</p> <p>To compile a list of plant species suitable for revegetation at your site, refer to the document <a href="#">Plants Used by Carnaby's Black Cockatoo</a> available on the Department of Biodiversity, Conservation and Attractions (DBCA) <a href="#">black cockatoo webpage</a>.</p>
3.	<b>The artificial hollows can be located in close proximity to adequate feeding areas – within a 12 km radius.</b>	
	<i>Important consideration</i>	Feeding areas commonly contain proteaceous species such as banksias (including dryandras) and hakeas. A list of food plants can be obtained by use of the document <a href="#">Plants Used by Carnaby's Black Cockatoo</a> .
	<i>Alternative conservation actions</i>	If the site is not close to adequate food, then the black cockatoos will not be able to successfully raise young. Cockatoos require sufficient food close to nesting areas in order to be able to forage during the day and return to feed nestlings. Existing feeding habitat close (within 12km) to breeding areas can be protected by fencing and/or undertaking rabbit and stock control to encourage regeneration of native vegetation. The amount of feeding habitat in an area can be increased by planting or revegetating with preferred food species.
4.	<b>The hollows are placed in secure locations and the owner/manager of these areas is supportive and willing to provide the necessary long-term security and annual maintenance for the entire time that the artificial hollow will be in place.</b>	
	<i>Important consideration</i>	For advice on the monitoring and maintenance requirements, please refer to the section on how to monitor and maintain artificial hollows.
	<i>Alternative conservation actions</i>	Artificial hollows can be subject to nest robbing and vandalism. It is highly recommended that artificial hollows are not put in exposed or easily accessible areas such as road verges unless they are above 8m and placed on the side of trees away from roads. If the site is considered at high risk of nest robbing or vandalism then alternative actions to assist the conservation of the species are recommended including: revegetation, fencing, repairing old or damaged natural nesting hollows and planting vegetation linkages to connect nesting and feeding areas.
5.	<b>A suitable artificial hollow design is used.</b>	
	<i>Important consideration</i>	For greatest chance of success, please refer to the sections below on how to design and place artificial hollows.
	<i>Alternative conservation actions</i>	If an alternative design is proposed, it is recommended that Department of Biodiversity, Conservation and Attractions, BirdLife Australia, or WA Museum are contacted to discuss and approve design.

## How to Design and Place Artificial Hollows

A wide variety of artificial hollow designs have been previously used with mixed success. Evidence suggests that, while artificial hollows must meet some basic requirements, other factors such as proximity to existing breeding areas may be more important in determining the success of artificial hollows.

Successful artificial hollows have been constructed from sections of salvaged natural hollows, or black and white industrial pipe. Research results show that the most effective artificial hollows are made of plastic culvert pipe which is readily available, durable, light, cheap, and easy to install and maintain (see right picture below). When using non-natural materials care must be taken to ensure there are no toxic residues, and that the materials are safe to ingest.

Below are three examples of successful artificial hollows that have been used by black cockatoos for nesting:

- natural log with cut side entrance (left);
- white industrial pipe with top entrance (centre); and
- DBCA recommended polypropylene pipe design (right)



Photo: Christine Groom (left), Rick Dawson (centre and right)

The notes below provides general guidance on design and construction of artificial hollows for black cockatoos. Additional specifications are provided at the end of this Fauna Note which outline current best practice and may be considered recommendations for minimum requirements.

### Walls, size, base, and entrance design

The walls of the artificial hollow need to be constructed from a material that is:

- durable enough to withstand exposure to elements for at least 20 years; and
- able to simulate the thermal properties of a natural tree hollow.

Artificial hollows should be:

- not less than 375 mm in internal diameter; and
- preferably 1200 mm deep overall with 200 mm of substrate/nesting material covering the base.

The base of the artificial hollow must be:

- securely fixed to the walls and able to support the weight of an adult and nestling(s);
- durable enough to last the life of the nest, and survive chewing by cockatoos;
- free draining;

## FAUNA NOTES – *Artificial Hollows for Black Cockatoos*

- at least 375 mm in diameter; and
- covered with 200 mm of sterile, dry, free draining substrate/nesting material such as charcoal, hardwood woodchips or wood debris. Do not use saw dust or fibre products that will retain moisture.

Example materials that could be used for artificial hollow bases include heavy duty stainless steel, galvanised or treated metal (e.g. Zinalume®), thick hard plastic, thick hardwood timber slab or marine ply (not chipboard or MDF). The base material must be cut to fit internally with sharp or rough edges ground away or curled inwards, be fixed securely to the walls and have small drainage holes.

The entrance of the artificial hollow:

- must have a diameter of at least 375 mm; and
- preferably be top entry which will minimise use by non-target species.

Top entry hollows are less attractive to nest competitors such as feral bees, galahs and corellas. Side entry hollows have been successful in areas where feral bees, galahs and corellas are not competitors.

### Adding ladders and sacrificial chewing posts

For artificial hollows made of non-natural materials, or of processed boards, it is necessary to provide a ladder to enable the birds access to the hollow, and sacrificial chewing posts so that birds can chew material, and so that non-target species can exit the hollow. The post can also assist in providing further material to the substrate, however research has shown that not all posts are heavily chewed.

The ladder must be:

- securely mounted to the inside of the hollow;
- made from an open heavy wire mesh with a mesh size of 30 - 50 mm (such as WeldMesh™); or heavy chain; and
- reach to, or below the level of substrate/nesting material.

If using mesh for the ladder, the width will depend on the curvature of the nest walls. A minimum width of about 60 - 100 mm is recommended.

Do not use material for ladders that the birds can chew, including galvanised metal because the birds may grip or chew the ladder, and ingest harmful compounds.

The sacrificial chewing posts must be:

- made of untreated hardwood such as Jarrah, Marri or Wandoo;
- thick enough to satisfy the birds' needs between maintenance visits;
- extended beyond the top of the hollow as an aid to see whether the nest is being used and reach to the floor of the hollow;
- placed on the inside of the hollow; and
- attached in such a way that they are easy to replace (e.g. a hook over the top of hollow or can slide in/out of a pair of U-bolts fitted to the side of the hollow).

It is recommended that at least one chewing post is provided. Posts 70 x 50 mm have been used but require monitoring at least every second breeding season when the nest is active and replacing when found to be no longer reaching the nesting material or otherwise significantly chewed. Birds do vary in their chewing habits, and therefore the frequency at which the chewing posts require replacement will also vary.

### Mounting and placement

It is important that artificial hollows are placed where they will be accessible for future monitoring and maintenance, but preferably not conspicuous to the general public.

The height at which artificial hollows should be placed is variable, between 4 - 8m for Carnaby's cockatoo, and the average height of natural hollows in dominant tree species in the area is a good guide. If located in an area that the general public cannot access, such as a private property, the hollows can be placed as low as 4 m from the ground so that they are easily accessible by ladder. If located in an area where the general public are allowed access, hollows should be placed at least 8 m high (i.e. higher than most ladders) and on the side of the tree away from public view to reduce the chance of interference or poaching.

## FAUNA NOTES – Artificial Hollows for Black Cockatoos

Black cockatoos show no preference for aspect of natural hollows. However, it may still be beneficial to place artificial hollows facing away from prevailing weather and where they receive the most shade and protection.

Artificial hollows to be placed in trees require:

- accessibility of the tree for a vehicle, elevated work platform or cherry picker;
- a section of trunk 2 - 3 m long suitable for attaching the hollow; and
- fitted on the side where the most shade can be obtained.

Artificial hollows must be mounted such that:

- the fixings used will last the duration of the nest e.g. galvanized bracket or chain and fixed with galvanized coach screws;
- it is secured by more than one anchor for security and stability;
- it is positioned vertically or near vertically; and
- where possible living trees are to be used to provide shade.

Artificial hollows should not be placed in the open on poles, as this may result in excessive exposure to sun during very hot weather.

### Safety

Care needs to be taken when placing artificial hollows to ensure human safety is paramount.

## Monitoring and Maintaining Artificial Hollows

It is important to monitor and maintain artificial hollows after they have been erected to ensure their effectiveness and so that problems with pest species or maintenance requirements can be identified and resolved. This will ensure the artificial hollow continues to provide opportunities to be used and that birds will be able to successfully raise chicks

Without regular maintenance, artificial hollows are likely to fail to achieve their objective to provide safe nesting opportunities for threatened black cockatoos. Therefore, it is important to continue a regime of regular maintenance for however long the artificial hollow is required. It may be several (to many) decades until a natural replacement hollow is available. Artificial hollows erected as a condition of development to offset the loss of natural hollows may be required to be available and maintained for the life of the development approval.

### How do I monitor artificial hollows?

Before undertaking monitoring of artificial hollows for black cockatoos, it is recommended that you seek advice from the Department of Biodiversity, Conservation and Attractions, BirdLife Australia, or the WA Museum. It is also important to contact the Department's Wildlife Licensing Section, to determine if a lawful authority required (<https://www.dbca.wa.gov.au/licences-permits>).

Monitoring artificial hollows requires keen observation, and naturalist skills. It is often not possible to observe direct evidence of breeding (i.e. nestlings or eggs) and therefore inferences must be made based on other observations. It is also important to limit disturbance to breeding birds. There are many techniques available to monitor artificial hollows, and a combination of several is likely to achieve the best results (**Table 2**).

Monitoring of artificial hollows should consider and record:

- the condition of the tree, hollow fixings and general hollow condition;
- condition and connection of sacrificial chewing posts, ladder and substrate/nesting material inside hollow;
- any use by black cockatoos and nature of activity (adult birds, chewing, eggs, chicks etc.)
- details of use by non-target species (native or pest);
- identify any problems with pest species or maintenance requirements; and
- maintenance actions undertaken to resolve any problems.

The information collected from monitoring should be written down and reported. There are standard fauna report forms available on the Department's website (<https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals>) that can be used to record the details of your sighting. Alternatively, if you are

## FAUNA NOTES – Artificial Hollows for Black Cockatoos

frequently monitoring a larger number of artificial hollows, you can put the details into a spreadsheet or use the black cockatoo monitoring forms available on the [DBCA website](http://www.dbca.wa.gov.au). Records should be submitted to the Department by emailing [fauna.data@dbca.wa.gov.au](mailto:fauna.data@dbca.wa.gov.au). The Department will put the records into the Threatened and Priority Fauna Database, and it will be used to inform conservation and management decisions. Any other opportunistic sightings of Threatened and Priority species can also be reported via the same email.

**Table 2: Techniques for monitoring artificial hollows**

Technique	Description of Technique								
<b>Looking for signs of use</b>	Cobwebs covering the entrance to the hollow will indicate that the hollow has not been used recently. This would also apply to other light debris that may have fallen to cover the opening partially. Signs of recent use or interest in the hollow include evidence of chewing.								
<b>Observing parent behaviour around a hollow</b>	<p>The behaviour of parent birds around a hollow can indicate an approximate age of young in the nest.</p> <table border="1"> <thead> <tr> <th>Parent Behaviour</th> <th>Approximate Stage and Age of Young</th> </tr> </thead> <tbody> <tr> <td>Prospecting for hollow</td> <td>Unborn</td> </tr> <tr> <td>Male only seen out of hollow</td> <td>Egg or very young nestling (&lt; 3 - 4 weeks)</td> </tr> <tr> <td>Both parents seen entering/exiting the hollow</td> <td>Nestling(s) has hatched (&gt; 3 - 4 weeks)</td> </tr> </tbody> </table>	Parent Behaviour	Approximate Stage and Age of Young	Prospecting for hollow	Unborn	Male only seen out of hollow	Egg or very young nestling (< 3 - 4 weeks)	Both parents seen entering/exiting the hollow	Nestling(s) has hatched (> 3 - 4 weeks)
Parent Behaviour	Approximate Stage and Age of Young								
Prospecting for hollow	Unborn								
Male only seen out of hollow	Egg or very young nestling (< 3 - 4 weeks)								
Both parents seen entering/exiting the hollow	Nestling(s) has hatched (> 3 - 4 weeks)								
<b>Observing feeding flocks</b>	Flocks of all male birds can indicate that females are incubating eggs. When flocks are mixed it suggests the birds have either not laid yet or that the nestlings have hatched and no longer require brooding (approximately 3 - 4 weeks old).								
<b>Tapping to flush female</b>	<p>When females are sitting on eggs they will usually respond to tapping or scraping at the base of their tree by appearing at the entrance or flying from the hollow opening. This is not a guarantee of breeding activity, but an indication that breeding is possibly occurring in the hollow.</p> <p>Tapping or scraping is best undertaken between 10 am - 3 pm when females will most likely to be sitting.</p>								
<b>Observing insect activity around a nest</b>	Faecal matter produced by nestlings attracts insects, especially flies and ants. The type and number of these insects will help to indicate how old any nestlings present may be. Factors such as temperature and humidity will also affect insect activity and so observations of insect activity should only be used as supporting evidence for other indications of age/use. Blowflies around the entrance of a nest usually indicate that a death has occurred.								
<b>Listening for nestling</b>	With experience it is possible to determine if nestlings are present, and a broad estimate of age based on the type and volume of noises they make.								
<b>Looking inside a nest</b>	This can be achieved either with the aid of a telescopic pole and camera or mirror, or with the use of a ladder or other climbing equipment. This method can obtain the most detailed monitoring information for artificial hollows. However, it is also the most time consuming and difficult to organize. Also keep in mind that it is important to limit disturbance to breeding birds. Special equipment is likely to be needed depending on the height and positioning of artificial hollows. There are also safety issues associated with ladder or rope climbing to reach nests to undertake observations.								

### When do I monitor artificial hollows?

The minimum frequency of monitoring, and the techniques used will be determined by the aims of the monitoring, and the resources available. It is important to limit disturbance to breeding birds, and this should be considered when determining the techniques, frequency, and timing of monitoring (Table 3).

Breeding by the three southwest black cockatoos varies, and the timing of monitoring of artificial hollows should accommodate the breeding of the likely target species. The Commonwealth Department of Climate Change, Energy,

## FAUNA NOTES – Artificial Hollows for Black Cockatoos

the Environment and Water (DCCEEW) Species Profile and Threats Database (SPRAT) database records the breeding periods of each of the species as:

- Carnaby's cockatoo - July to November (with peak between August to September)
- Baudin's cockatoo - October to January
- Forest red-tailed black cockatoo - every month, with peaks in April to June and August to October

The age of Carnaby's cockatoo nestlings can be determined by using the following publication:

Saunders, D. A., Dawson, R. and Nicholls, A. O. (2015). Aging nestling Carnaby's cockatoo, *Calyptorhynchus latirostris*, and estimating the timing and length of the breeding season. *Nature Conservation* 12: 27-42  
<http://dx.doi.org/10.3897/natureconservation.12.4863>

This document provides a series of photographs to illustrate changes in size and plumage of nestlings over the 10–11 weeks of the nestling period which can be used to estimate the approximate age of Carnaby's cockatoo nestlings, up to about nine weeks, by comparing appearance with the nestlings illustrated in the photographs.

Any monitoring that involving disturbance or handling of black cockatoos, requires lawful authority (<https://www.dbca.wa.gov.au/licences-permits>). Such activity requires specialist skills and authorisation under the *Biodiversity Conservation Act 2016*.

**Table 3: Recommended frequency for monitoring artificial hollows, as determined by the aim of the monitoring**

Monitoring Aim	Frequency of Visits	Monitoring Techniques
To determine possible use by black cockatoos	At least once during peak breeding season.	<ul style="list-style-type: none"> <li>• Looking for signs of use (evidence of chewing)</li> <li>• Observing behaviour of adults around a hollow</li> <li>• Tapping or scraping to flush female</li> <li>• Listening for nestlings</li> <li>• Looking inside nest</li> </ul>
To confirm use by black cockatoos	At least two visits during peak breeding season.	<ul style="list-style-type: none"> <li>• Looking for signs of use (evidence of chewing)</li> <li>• Observing behaviour of adults around a hollow</li> <li>• Tapping or scraping to flush female</li> <li>• Listening for nestlings</li> <li>• Looking inside a nest</li> </ul> <p>Observing breeding evidence from at least two of the techniques confirms use by black cockatoos.</p>
To determine nesting success by black cockatoos	Preferably fortnightly visits between July and December. As a minimum, at least 3 visits spread throughout breeding season.	<ul style="list-style-type: none"> <li>• Observing insect activity around a nest</li> <li>• Listening for nestlings</li> <li>• Looking inside a nest</li> </ul> <p>The presence of eggs or nestlings inside a nest will help to determine nesting success.</p>
To determine use by any species	As often as possible.	<p>As a minimum, inspection from the ground:</p> <ul style="list-style-type: none"> <li>• Looking for signs of use</li> </ul> <p>To confirm:</p> <ul style="list-style-type: none"> <li>• Looking inside a nest</li> </ul>
To determine maintenance requirements	At least every two years and preferably annually.	A basic maintenance check can be undertaken from the ground. Looking inside the nest using a telescopic pole with camera or mirror enables inspection of the sacrificial chewing posts and level of substrate/nesting material. A ladder or elevated work platform will be required for a comprehensive check, and to replace sacrificial chewing posts and carry out other maintenance.

## How do I maintain artificial hollows?

Natural hollows used by black cockatoos are typically present for many decades and if artificial hollows are expected to provide a similar role, then they will require maintenance to ensure they continue to function as potential nesting locations for black cockatoos for the long term.

In many cases artificial hollows are required as a condition of development to offset loss of natural hollows, in which case State and Commonwealth offset policy expects that the artificial hollows continue to provide that function for the duration of the impact (or alternatively the expected period of time the natural hollow would have persisted, or the life of the environmental approval). As part of establishing artificial hollows the responsibility and regime for long term monitoring and maintenance should also be established.

Periodic maintenance checks should be undertaken at least every two years, preferably annually, for as long as the artificial hollow is required. Maintenance actions should be completed prior to the breeding season.

Any problems identified during monitoring or maintenance checks should be addressed as soon as possible and will require similar specialist skills and equipment as used in installation. If breeding is currently occurring, maintenance may need to be delayed if it is likely to disturb the parents or nestling. Maintenance concerns regarding the security of attachment points or the stability of the tree or pole should be addressed as a priority for safety reasons. Likely maintenance includes:

- replacement of sacrificial chewing posts (frequently);
- top-up or replacement of nesting substrate to ensure it reaches the ladder and chewing posts (occasionally);
- replacement of nest bases (occasionally);
- repair or replacement of attachment points (infrequently); and/or
- repair of any cracks to wooden hollows (infrequently).

For artificial hollows known to be used, spare chewing posts should be taken into the field when undertaking maintenance checks as these are likely to need replacement.

Artificial hollows are likely to need to be completely replaced after many years, and other circumstances may require the relocation of artificial hollows (e.g. if the tree they are in becomes damaged).

## Applying this guidance to forest red-tailed black cockatoo and Baudin's cockatoo

The information presented here is based on experience with Carnaby's cockatoo, for which many examples of successful use of artificial hollows exist, and forest red-tailed black cockatoo for which a few known examples of use exist. However, to date there are no records of Baudin's cockatoo using artificial nest hollows.

A definite reason for this lack of use is not yet known but may relate to the location of artificial hollows installed to date (few or none placed in Baudin's cockatoo breeding sites where breeding is occurring and natural hollows are limiting) or design or installation issues, such as hollows not being installed high enough in tall forest canopy.

Before deciding to install artificial hollows for forest red-tailed black cockatoo or Baudin's cockatoo, it is recommended that you discuss your proposal with, and/or seek advice from, the Department of Biodiversity, Conservation and Attractions, BirdLife Australia, or the WA Museum.



Artificial hollow base needing repair.  
Photo by Christine Groom

## Maps of Black Cockatoo Breeding Range

## FAUNA NOTES – Artificial Hollows for Black Cockatoos

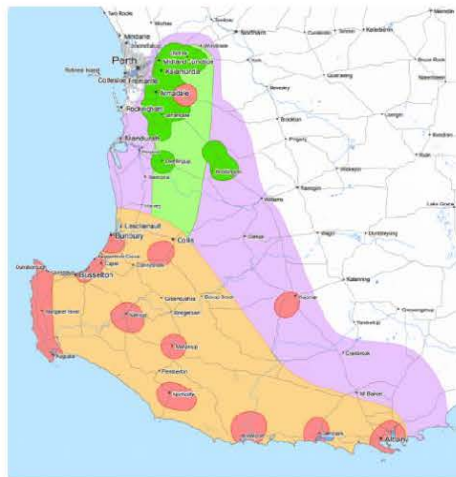


Image: [Commonwealth of Australia, 2011](#)

The maps show the modelled distributions of Carnaby's cockatoo (left), Baudin's cockatoo (centre) and forest red-tailed black cockatoo (right). For Baudin's cockatoo, the breeding range is indicated by the red (known breeding areas) and yellow (predicted breeding range), and for Carnaby's cockatoo, the breeding range is indicated by the orange.

## Artificial Hollows – best current design and installation specifications

The specifications below outline the most recent detailed specifications for artificial hollow construction installation and maintenance. These would provide for a well-constructed and installed artificial hollow that is most likely to have an adequate lifespan (minimum 50-years). To ensure longevity, regular maintenance will be required on the nesting material, sacrificial post, and removal of debris from the hollow.

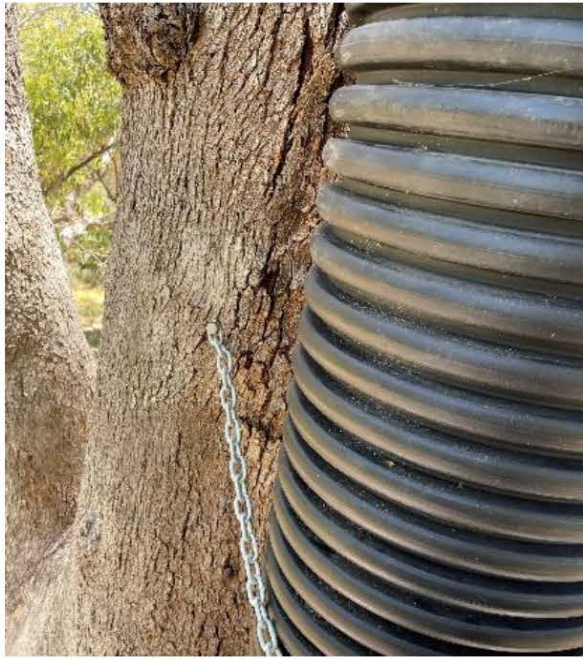
It is highly recommended that any artificial hollows installed as a condition of environmental approval (for example where the artificial hollow is expected to provide benefit for a long period), or installed on DBCA managed lands would meet these specifications as a minimum.

### Artificial Hollow Construction Specifications

- Dimensions: internal diameter 375mm (430 mm external), 1200 mm in height, and installed a minimum of 4 m above ground on private property and 8 m on public land.
- Pipe material: Fifty-year UV rated culvert pipe (polypropylene material used with corrugated outer wall and thin inner sleeve. Recommended brand or similar: The 'Vinidex StormPRO' pipes are twin wall, corrugated, polypropylene pipes for non-pressure stormwater and drainage applications, which meet all the requirements for artificial hollows.
- Chain: 6 mm galvanised (not zinc plated). The hollows will be attached to the tree by chain and fixed by 4 points.
- Fixings: Galvanised M10 coach screws four x 75 mm. Two on the weight bearing chain at the top and one each side of the hollow.
- Ladder: 50 x 50 mm square galvanised weldmesh 4mm thick.
- Chewing posts: Untreated Jarrah, Marri or Wandoo that meet requirements in "Adding ladders and sacrificial chewing posts" above.



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Artificial hollow design, the fixing method, and the sacrificial chewing post extending above the hollow rim. Left image shows the side chains that are to be at a 30-degree upwards angle to allow the hollow to move up the tree as the tree grows. Right image shows the top weight bearing fixing which is to be 100 mm above the hollow to allow upwards movement.



Left image shows the internal view, including substrate material placed on the floor to line the hollow, and the internal weld mesh ladder. Substrate material must be coarse, hard, wood chips at least 200 mm deep.

Centre image shows one hard wood sacrificial post which is to fit and connect to the rim of the hollow by a hook screwed to the post to ensure it does not come loose, block the hollow or injure the occupants.

Right image shows the hard plastic floor which is to be securely fixed with a minimum of 12 small drainage holes. Larger holes may result in the occupants chewing the base.

## Monitoring and Maintaining Artificial Hollows

It is important to continue a regime of regular maintenance for however long the artificial hollow is required. Artificial hollows erected as a condition of development to offset the loss of natural hollows may be required to be available and maintained for the life of the development approval. As part of establishing artificial hollows the responsibility and regime for long term monitoring and maintenance should also be established.

Periodic maintenance checks should be undertaken at least every two years, preferably annually, for as long as the artificial hollow is required. Maintenance actions should be completed prior to the breeding season.

## Further Reading

DBCA webpage and fauna profiles: [Black cockatoos](#)

Department information sheets: [Fauna Note – Corellas and other flocking cockatoos](#)

BirdLife Australia webpage and brochure: [Identify your Black cockatoo](#)

Western Australian Museum webpage and fact sheets: [Cockatoo Care](#)

Saunders DA et al. (2022) Artificial nesting hollows for the conservation of Carnaby's cockatoo *Calyptorhynchus latirostris*: definitely not a case of erect and forget. *Pacific Conservation Biology* [doi:10.1071/PC21061](https://doi.org/10.1071/PC21061)

## Acknowledgements

This Fauna Note is a joint initiative of the Department of Biodiversity, Conservation and Attractions, Birdlife Australia, and the Western Australian Museum. Many individuals have contributed to its preparation, including members of the department's Carnaby's cockatoo and forest black cockatoo recovery teams, with significant contributions from Rick Dawson (DBCA Research Associate), Ron Johnstone (WAM), Alan Elliot (Serpentine-Jarrahdale Landcare Centre), and Denis Saunders (CSIRO). This document was prepared by David Mitchell, Geoff Barrett, Kim Williams, Rebecca Bloomfield, Amie Raycraft, Brooke Richards, Teagan Johnston and Martin Dziminski.

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Last updated: 08 Feb 2023



## Clearing Permit Decision Report

This report has been prepared to fulfil the requirements of an accredited environmental assessment process between the Commonwealth and State governments, pursuant to a bilateral agreement established under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

This report is set out in four parts:

- Part 1: Application, site details and outcome;
- Part 2: Assessment against matters of national environmental significance (pursuant to the EPBC Act);
- Part 3: Assessment against the clearing principles (pursuant to the *Environmental Protection Act 1986* (EP Act)). Appeal rights pursuant to section 101A of the EP Act are relevant to this section of the report;
- Part 4. References and databases.

### Part 1: Application details and outcome

#### 1.1. Permit application details

<b>Permit number:</b>	CPS 8327/1
<b>Permit type:</b>	Purpose permit
<b>Applicant name:</b>	Mr Jim Zheng
<b>Application received:</b>	11 January 2019
<b>Application area:</b>	6.27 hectares (revised) of native vegetation
<b>Purpose of clearing:</b>	Sand and gravel extraction
<b>Method of clearing:</b>	Mechanical
<b>Property:</b>	LOT 2 ON DIAGRAM 65861
<b>Location (LGA area/s):</b>	Shire of Dardanup
<b>Localities (suburb/s):</b>	Crooked Brook

#### 1.2. Description of clearing activities

The vegetation proposed to be cleared consists of 6.27 hectares for the purpose of extractive industry for sand and gravel, to support the ongoing maintenance of the existing Banksia Road landfill site (see Figure 1, Section 1.5).

The application was revised during the assessment process. The changes included:

- a reduction in the application area from 26.4 hectares to 6.27 hectares, see Section 2.4 for further details.
- a revision of the purpose of clearing from extractive industry and landfill cells to extractive industry only.

#### 1.3. Decision on application

<b>Decision:</b>	Granted
<b>Decision date:</b>	12 June 2024
<b>Decision area:</b>	6.27 hectares of native vegetation, as depicted in Section 1.5, below.

#### 1.4. Reasons for decision

This clearing permit application was submitted, accepted, assessed and determined in accordance with sections 51E and 51O of the EP Act. The Department of Water and Environmental Regulation (the department) advertised the application for 21 days and no submissions were received.

In making this decision, the Delegated Officer had regard for:

- the site characteristics (see section 3.5 of this report)
- relevant datasets (see Appendix E.1)
- the findings of flora, flora and vegetation surveys (Astron, 2014; Harewood, 2021) (see Appendix B)
- the findings of the department's site inspection (see Appendix C)
- a revegetation plan prepared in accordance with the department's *Guide to preparing revegetation plans for clearing permits* to support offset revegetation activities
- specialist advice received from the Department of Biodiversity, Conservation and Attractions (DBCA) (DBCA, 2019a; 2019b; 2020 and 2021)
- the applicant's actions to avoid and minimise the need for native vegetation clearing and measures to minimise the environmental impacts (see section 2.4)
- the clearing principles set out in Schedule 5 of the EP Act (see section 3)
- other relevant considerations (see section 2.6)
- the relevant planning instruments and any other matters considered relevant to the assessment (see section 3.11). In particular, the Delegated Officer took into consideration the following:
  - The proposed clearing will support the ongoing maintenance of Banksia Road Putrescible landfill site, which is one of two Class III landfill operations, servicing the Perth Metropolitan area and the only one located in the south-west of Western Australia.
  - The Shire of Dardanup have indicated support for the proposed extractive industry application and the applicant holds an Extractive Industry Licence for Lot 2.

Taking into account the avoidance and minimisation measures proposed by the applicant, including the reduction in the clearing area from 26.4 hectares to 6.27 hectares, the Delegated Officer considered that the following significant residual impacts remain and need to be offset:

- 6.27 hectares of high-quality foraging habitat for black cockatoo species; and
- 55 potential nesting trees, including two with a suitable hollows for black cockatoo species.

Consistent with the Commonwealth offset assessment guide (Commonwealth Offsets Calculator) and the Western Australian Government's Offset Policy (WA Offset Policy), the Delegated Officer determined that an offset was required to address the above significant residual impacts to black cockatoo habitat (see Section 4). The Delegated Officer took into consideration the proposed offsets and determined that the following offsets are appropriate:

- Conservation of 2.4 hectares of native vegetation within Lot 2 on Diagram 65861 as detailed below:
  - conservation of native vegetation in very good to degraded condition that contains high quality black cockatoo foraging habitat and potential breeding habitat.
- Revegetation and conservation of 1.76 hectares within Lot 2 on Diagram 65861 as detailed below:
  - revegetation with jarrah and marri species providing high quality black cockatoo foraging habitat and potential future breeding habitat.
- Conservation of 37.2 hectares of native vegetation within Lot 2148 on Plan 125383 as detailed below:
  - that provides high value foraging habitat and consists of jarrah and marri woodland in very good to excellent condition and potential breeding habitat, and
- Revegetation and conservation of 2.1 hectares of completely degraded vegetation within Lot 2148 on Plan 125383 as detailed below:
  - revegetation with jarrah and marri species providing high quality black cockatoo foraging habitat and potential future breeding habitat.

The Delegated Officer decided to grant a clearing permit subject to conditions to:

- avoid, minimise to reduce the impacts and extent of clearing
- take hygiene steps to minimise the risk of the introduction and spread of weeds
- staged clearing to minimise wind erosion
- undertake slow, progressive one directional clearing to allow terrestrial fauna to move into adjacent habitat ahead of the clearing activity
- black cockatoo pre-clearance surveys
- provision of an offset (see section 4).

Given the above and noting that the offset provided (see Section 4) counterbalances the significant residual impacts, the Delegated Officer determined that the proposed clearing is unlikely to lead to an unacceptable risk to the environment.

## 1.5. Site Characteristics

Characteristic	Details
Local context	<p>The area proposed to be cleared is part of an expansive patch of vegetation adjoining the Dardanup Conservation Park.</p> <p>Spatial data indicates that the local area (10-kilometre radius from the application area) retains approximately 34.1 per cent of the pre-European extent of native vegetation cover.</p>
Vegetation description	<p>The application area has been mapped regionally as South West vegetation complexes described by Mattiske and Havel (1998) as updated by Webb et al. (2016):</p> <ul style="list-style-type: none"> <li>• SWF ID 290 (Whicher Scarp, WC): Open forest of <i>Eucalyptus marginata</i> subsp. <i>Marginata</i> - <i>Corymbia calophylla</i> on escarpment with some <i>Corymbia haematoxylon</i>, <i>Banksia attenuata</i> and <i>Xylomelum occidentale</i> in the humid zone.</li> <li>• SWF ID 291 (Whicher Scarp, WCv): Open forest of <i>Eucalyptus marginata</i> subsp. <i>marginata</i> - <i>Corymbia calophylla</i> with some <i>Xylomelum occidentale</i> on valleys dissecting escarpment in the humid zone.</li> </ul> <p>A flora and vegetation survey was conducted across the application area by Astron in 2014 (Astron, 2014).</p> <p>The vegetation within the application area was described and mapped by Astron (2014) (Appendix D) as:</p> <ul style="list-style-type: none"> <li>• low woodland of <i>Eucalyptus marginata</i> subsp. <i>marginata</i>, <i>Corymbia calophylla</i> over a <i>Kingia australis</i> tall open shrubland over a <i>Hakea lissocarpha</i> and <i>Hypocalymma angustifolia</i> low open shrubland over a <i>Tetraria capillaris</i>, <i>Patersonia umbrosa</i> var. <i>xanthina</i> and *<i>Briza maxima</i> very open sedge/ grassland on dark brown loam (0.27 ha), and</li> <li>• low open woodland of <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Corymbia calophylla</i> over a <i>Xanthorrhoea preissii</i>, <i>Hakea lissocarpha</i> open shrubland over <i>Hibbertia hypericoides</i> low shrubland over a <i>Desmocladius flexuosus</i>, <i>Tetraria capillaris</i>, <i>Desmocladius fasciculatus</i> and <i>Patersonia umbrosa</i> var. <i>xantha</i> open sedgeland on lateritic loam (4.5 ha).</li> </ul> <p>A site inspection was conducted by the department on 9 July 2020 (DWER, 2020) identifying marri and jarrah woodland in very good (Keighery, 1994) condition.</p> <p>Site visits were also undertaken by officers of the Department of Biodiversity, Conservation and Attractions (DBCA) with relevant advice received (DBCA 2019a; DBCA 2019b; DBCA 2020; DBCA 2021).</p>
Vegetation condition	<p>The vegetation across the application area was assessed by Astron (2014) as ranging from completely degraded to very good-excellent condition (Keighery 1994):</p> <ul style="list-style-type: none"> <li>• 2.70 hectares in completely degraded to degraded condition,</li> <li>• 2.47 hectares in good to very good condition,</li> <li>• 1.10 hectares in very good to excellent condition.</li> </ul> <p>A site inspection conducted by the Department (DWER, 2020) identified the vegetation to be in degraded to very good (Keighery, 1994) condition.</p> <p>The full Keighery (1994) condition rating scale is provided in Appendix A. Representative photos and descriptions are available in Appendix B and Appendix C</p>
Soil description	<p>Soils within the application area have been mapped as:</p> <ul style="list-style-type: none"> <li>• Whicher valleys phase subsystem, and</li> <li>• Whicher gentle slopes phase subsystem.</li> </ul>

### 1.6. Site map



Figure 1 Map of the application area. The area crosshatched yellow indicates the area authorised to be cleared under the granted clearing permit.

## Part 2: Assessment against matters of national environmental significance

### 2.1 Description of controlling actions

The proposed action was referred to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) (the then Department of the Environment and Energy) on 21 December 2018 for an assessment under the EPBC Act and was determined to be a controlled action. This assessment was referred to the department on 11 January 2019 concurrently with the Native Vegetation Clearing Permit application under the bilateral agreement provision between the Commonwealth and Western Australian governments.

The original application was for 26.4 hectares across three areas (Area A, B and C) (Zheng, 2019) (see Figure 4). During the assessment process the applicant reduced the proposed clearing to 6.27 hectares by removing areas A and B (Harley Dykstra, 2023) (see section 2.4).

Based on the information in the referral, the proposed action is likely to have a significant impact on the following species listed under the EPBC Act:

- Carnaby's cockatoo (*Zanda latirostris*) listed as endangered,
- Baudin's cockatoo (*Zanda baudinii*) listed as vulnerable, and
- Forest red-tailed black cockatoo (*Calyptorhynchus banksii* subsp. *naso*) listed as vulnerable.

#### Carnaby's cockatoo

Carnaby's cockatoos are endemic to the southwest of Western Australia. Breeding takes place between late July and December and occurs mostly in the inland wheatbelt region of its distribution, in areas receiving between 300 and 750 millimetres of annual average rainfall (Saunders, 1974). During the non-breeding season (January to July) the majority of the birds move to the higher rainfall coastal regions of their range including the midwest coast, Swan Coastal Plain and south coast (Saunders, 1980; Saunders, 1990; Berry, 2008; Johnstone et al., 2011). There has been an apparent expansion in the breeding range to include areas further west and south since the middle of last century with a more rapid increase into the jarrah and marri forests of the southwest (Johnstone and Storr, 1998; Johnstone et al., 2011). This expansion in breeding range is due to threatening processes such as clearing of breeding habitat and competition for suitable breeding hollows.

Carnaby's cockatoo preferred habitat is remnant native eucalypt woodlands, especially those of salmon gum (*Eucalyptus salmonophloia*) and wandoo (*Eucalyptus wandoo*), and in shrubland or kwongan heathland dominated by plants of the Proteaceae family. It also occurs in forests containing marri, jarrah, karri (*Eucalyptus diversicolor*) and tuart (*Eucalyptus gomphocephala*) (Department of Agriculture, Water and the Environment (DAWE), 2022; Parks and Wildlife, 2013).

Foraging resources for Carnaby's cockatoo include the seeds, flowers and nectar of native proteaceous plant species (e.g. *Banksia*, *Hakea* and *Grevillea* species), Eucalypts and Callistemon species. The species also forages on seeds of introduced species (e.g. *Pinus* and *Erodium* species, canola and almonds), insects and insect larvae. Carnaby's cockatoo generally forages within six kilometres of a night roost site and, while nesting, within a 12 kilometres radius of their nest site (DAWE, 2022).

Carnaby's cockatoo nests in large hollows in tall, living or dead eucalypts. It nests most commonly in smooth-barked wandoo and salmon gum, but has also been recorded breeding in red morrel (*Eucalyptus longicornis*), York gum (*Eucalyptus loxophleba*), tuart, flooded gum (*Eucalyptus rudis*), swamp yate (*Eucalyptus occidentalis*), gimlet (*Eucalyptus salubris*) and marri, and are said to nest in any species of eucalypt with a suitable hollow (DAWE, 2022; Parks and Wildlife, 2013).

Currently, the overall population trend for Carnaby's cockatoo is one of decline due to the loss and fragmentation of habitat as a result of the clearing of native vegetation (Saunders, 1990; Johnstone and Storr, 1998; Saunders and Ingram, 1998; Garnett et al., 2011).

The Carnaby's cockatoo recovery plan summarises habitat critical to the survival of Carnaby's cockatoos as:

- the eucalypt woodlands that provide nest hollows used for breeding, together with nearby vegetation that provides feeding, roosting and watering habitat that supports successful breeding;
- woodland sites known to have supported breeding in the past and which could be used in the future, provided adequate nearby food and/or water resources are available or are re-established; and
- in the non-breeding season the vegetation that provides food resources as well as the sites for nearby watering and night roosting that enable the cockatoos to effectively utilise the available food resources (Parks and Wildlife, 2013).

The recovery plan also states that success in breeding is dependent on the quality and proximity of feeding habitat within 12 kilometres of nesting sites. Along with the trees that provide nest hollows, the protection, management and increase of this feeding habitat that supports the breeding of Carnaby's cockatoo is a critical requirement for the conservation of the species (Parks and Wildlife, 2013).

The Carnaby's cockatoo is also listed as endangered under the Western Australia's *Biodiversity Conservation Act 2016* (BC Act).

### **Baudin's cockatoo**

Baudin's cockatoo is endemic to a 2,000 kilometre area of the humid and sub-humid zones of southwest Western Australia and is generally contained within the 750 millimetre isohyet of average annual rainfall. This species is locally resident, but at the end of the breeding season (January), the birds move away from the breeding area and form flocks that move in response to changing food resources (DEC, 2008). The range of this species has declined by more than 50 per cent over the past 50 years (Garnett and Crowley, 2000). The principal cause of the decline in range was clearing of the eastern margins of the forests for agriculture and the current primary threat to the population is illegal shooting, habitat loss through land clearing, nest hollow shortage and competition from other species (DEC, 2008).

Baudin's cockatoo feeds primarily on 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) (DAWE, 2022).

Suitable breeding habitat includes trees (live or dead trees) with hollows. Many eucalypt species may provide suitable hollows, particularly Karri, Marri, Jarrah, Wandoo, Bullich (*Eucalyptus megacarpa*) and Tuart. Roosting habitat includes any tall trees, but particularly Jarrah, Flooded Gum, Blackbutt, Tuart and introduced eucalypts (Blue Gum (*Eucalyptus globulus*) and Lemon Scented Gum (*Corymbia citriodora*)).

Baudin's cockatoo is also listed as endangered under the BC Act.

### **Forest red-tailed black cockatoo**

The forest red-tailed black cockatoo is endemic to the southwest humid and sub-humid zones of southwest Western Australia and inhabits jarrah, karri and marri forests receiving more than 600 millimetres of annual average rainfall (DEC, 2008). The forest red-tailed black cockatoo occurs in one population of approximately 15,000 individuals and is known to nest in the large hollows of marri, jarrah and karri (Johnstone and Kirkby, 1999). The main identified threats to the forest red-tailed black cockatoo are illegal shooting, habitat loss through land clearing, nest hollow shortage and competition from other species (DEC, 2008; DEWHA, 2009).

Forest red-tailed black cockatoos forage primarily on seeds of Jarrah and Marri in woodlands and forest, and edges of Karri forests, including Wandoo and Blackbutt. They will also forage on Allocasuarina cones, fruits of Snottygobble (*Persoonia longifolia*) and Mountain Marri (*Corymbia haematoxylon*). Other less important foods include Blackbutt, Bullich, *Allocasuarina fraseriana*, *Hakea* spp., Tuart, Redheart Moit (*Eucalyptus decipiens*) and Bushy Yate (*E. lehmanni*).

Breeding habitat for this species primarily includes trees with hollows, mainly eucalypt species, particularly Marri, Karri, Wandoo, Bullich, Blackbutt (*Eucalyptus patens*), Tuart and Jarrah. Night roosting habitat consists of tall Jarrah, Marri, Blackbutt, Tuart and introduced eucalypt trees or large trees on the edges of forests.

According to the recovery plan, habitat critical for survival for both Baudin's and forest red-tailed black cockatoos comprises of habitat that is:

- currently occupied by the cockatoos
- not currently occupied by the cockatoos due to recent fire but capable of supporting cockatoo populations when sufficiently recovered
- of natural vegetation in which the cockatoos nest, feed and roost
- of natural vegetation through which the cockatoos can move from one occupied area to another; and
- of suitable vegetation within the recorded range in which undiscovered cockatoo populations may exist (DEC, 2008).

Given the above, habitat critical to survival for these species include all Marri (*Corymbia calophylla*), Karri (*Eucalyptus diversicolour*) and Jarrah (*Eucalyptus marginata*) forests, woodlands and remnants in the south-west of Western Australia receiving more than 600 mm of annual average rainfall (DEC, 2008).

Forest red-tailed black cockatoo is also listed as vulnerable under the BC Act.



## 2.2 Summary of impacts

### **Carnaby's cockatoo, Baudin's cockatoo and Forest red-tailed black cockatoo**

The proposed clearing area occurs within the Jarrah Forest Interim Biogeographic Regionalisation of Australia (IBRA) region. According to the Commonwealth of Australia's EPBC Act referral guidelines for Western Australia's three threatened black cockatoo species (referral guideline), the proposed clearing area is located within the known breeding range for Carnaby's cockatoo, Baudin's Cockatoo and the forest red-tailed black cockatoo (DAWE, 2022). The Jarrah forest is especially important for Baudin's cockatoo and the forest red-tailed black cockatoo as it is the main breeding region. Baudin's cockatoo are also known to have important foraging and wintering areas in this region (DAWE, 2022).

Black cockatoos generally forage within 20 kilometres of a night roost site and, while nesting, within a 12-kilometre radius of their nest site (DAWE, 2022). According to current DBCA databases, 27 confirmed black cockatoo roosting sites occur within a 20 kilometre radius, the closest is two kilometres east of the application area. One (1) known breeding site occurs within a 12.6 kilometres of the application area.

Black cockatoos rely on the availability of night roosting habitat in proximity to foraging resources, and rely on access to watering points in selecting night roost sites, with roost sites usually within two kilometres of a watering point (DAWE, 2022). According to available databases, there is one water source within two kilometres of the application area and several more within close proximity (six kilometres) of the application area (see Figure 3 below).

In accordance with the referral guidelines for the three species of black cockatoo, nesting habitat is defined as trees of species known to support nesting within the range of the species, which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow (DAWE, 2022). For jarrah and marri trees, DBH is 50 centimetres (cm) or above (DAWE, 2022).

A black cockatoo habitat assessment (Harewood, 2015) identified jarrah and marri/mountain marri as the dominant tree species within the application area, both of which are known food source for all three black cockatoo species (Harewood, 2015, 2021). Evidence of Baudin's cockatoo and forest red-tailed black cockatoos foraging onsite was observed during the habitat surveys (Harewood, 2015, 2021).

A fauna assessment (Astron, 2014, Harewood, 2021) identified all three species of black cockatoo as occurring within the application area. A total of 55 trees with a DBH greater than 50 cm were recorded within the application area. Of these 55 trees, two contained hollows potentially suitable for black cockatoos (Astron, 2014, Harewood, 2021) (see Figure 2). In total, the proposed clearing will result in the loss of 6.27 hectares of high-quality foraging habitat supporting suitable breeding habitat.



Figure 2. Locations of potentially suitable black cockatoo breeding trees (DBH > 50 cm) recorded by Harewood (2021).

The Carnaby's Cockatoo Recovery Plan notes that there are multiple reasons for the decline of Carnaby's cockatoo, however the decline to-date has primarily been brought about by the extensive clearing of nesting and feeding habitat (Parks and Wildlife, 2013). Loss of nesting habitat, together with foraging areas and watering sites within foraging distance of breeding sites is one of the key threatening processes contributing towards the decline of the species. A further significant threat is the clearing, fragmentation and degradation of foraging and night roosting habitat in the non-breeding parts of Carnaby's cockatoo range in the southwest of Western Australia and particularly on the Swan Coastal Plain (Parks and Wildlife, 2013). The long-term survival of Carnaby's cockatoo depends on the availability of suitable breeding habitat and foraging habitat capable of providing enough food to sustain the population (Parks and Wildlife, 2013).

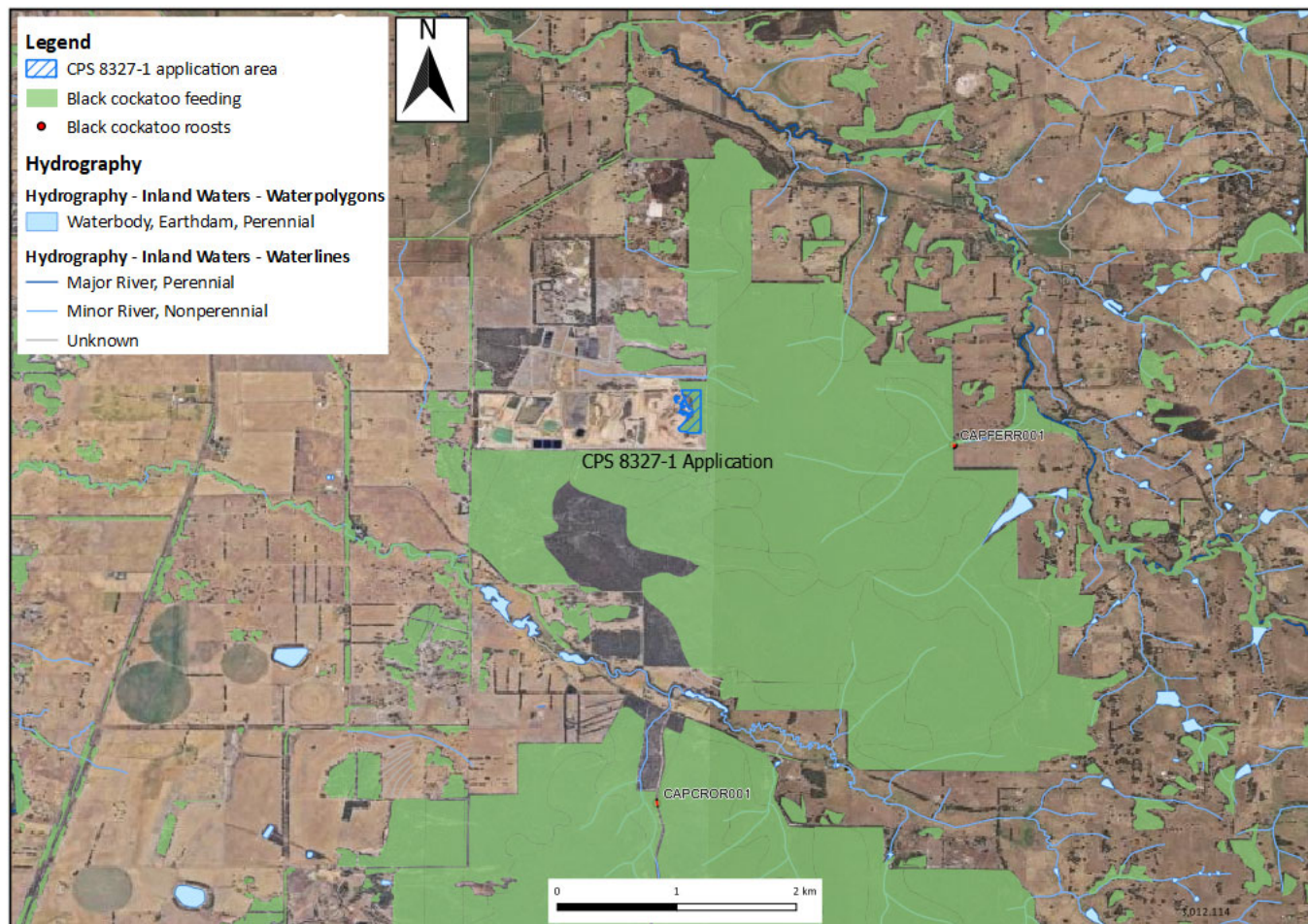


Figure 3. Mapped black cockatoo feeding areas, roost sites and water sources within close proximity (6km) from the application area.

Given the application area contains 6.27 hectares of foraging habitat and 55 potential breeding trees, including two with suitable hollows, it is considered that the application contains critical habitat for Carnaby's cockatoo.

In relation to Baudin's cockatoo and the forest red-tailed black cockatoo, the Recovery Plan for these species identify habitat critical to the species survival as Marri and Jarrah forest (DEC, 2008). Therefore, it is considered that the proposed clearing contains critical habitat for the Baudin's cockatoo and forest red-tailed black cockatoo.

### 2.3 Public consultation

The applicant advised that initial consultation has been undertaken with the Shire of Dardanup who have indicated support for the proposed extractive industry application. No further public consultation has been undertaken (Zheng, 2019).

The clearing application was advertised for public comment on DWER's website on 18 April 2019. The public comment period ended on 16 May 2019. No public submissions were received during this comment period.

### 2.4 Avoidance and mitigation

The applicant has advised that the following measures have been considered to avoid and mitigate the impact of the proposed clearing (Accendo, 2024).

#### Avoidance and consideration of alternatives

The proponent had originally applied to clear 26.4 hectares across three sites (Sites A, B and C), see Figure 4 below (Zheng, 2019). During the assessment process, the applicant reduced the proposed clearing area to 14.99 hectares by removing area A (Accendo, 2023). The proposed clearing area was further reduced to 6.27 hectares by removing area B (Harley Dykstra, 2023). This reduced the proposed clearing to 6.27 hectares, consequently reducing the significant residual impacts to black cockatoo habitat. In addition, the reduced clearing area resulted in the avoidance of impacts to the priority 1 flora species *Orianthera wendyae*.

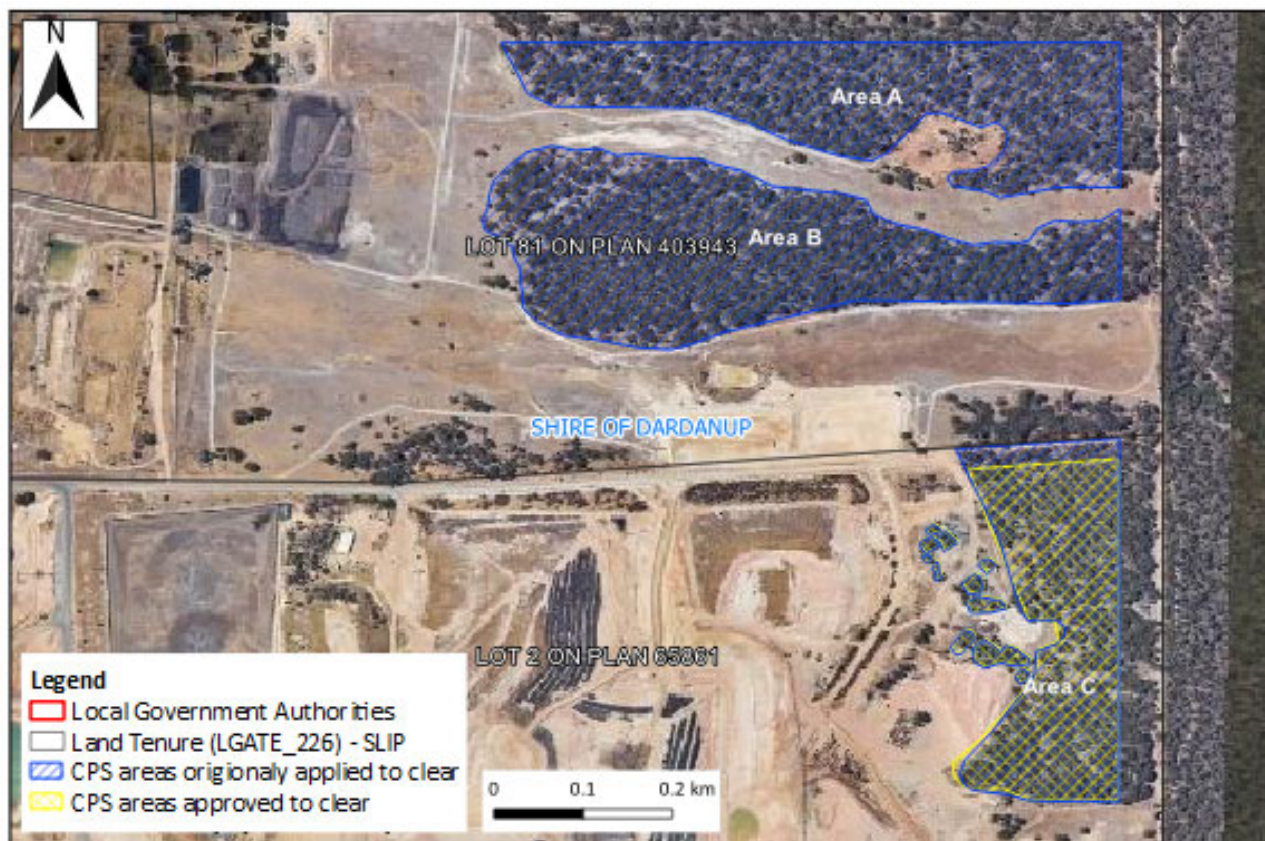


Figure 4 Map of original and revised application area.

Regarding the remaining 6.27 hectares proposed to be cleared within Site C, the applicant has considered alternative locations for the proposed action within Lot 2. However, the topographic relief in certain areas, and proximity to groundwater in the western portions of the Lot render the proposed clearing footprint as the only feasible location for obtaining the required materials.

### Mitigation

Historically, there have been some impacts to the Dardanup Conservation Park associated with the existing land use within Lot 2 (landfill). This has included wind-blown litter and inadequate stormwater management.

Over the last three years, the following has been implemented to address this (Accendo, 2018):

- The installation of a three metre high cyclone fencing around the periphery of waste cells and two metre high fencing around the property boundary to prevent wind-blown litter (see figure 5 below); and
- Significant upgrades to stormwater infrastructure have been implemented to ensure that there is no direct discharge of stormwater into the Dardanup Conservation Park.



Plate 1. Cyclone fencing on southern property boundary and upgraded stormwater infrastructure.



Plate 2. Cyclone fencing on the periphery of a waste cell.

**Figure 5. Photos of cyclone fencing (Accendo, 20124).**

To mitigate potential impacts to the adjacent Dardanup Conservation Park from the proposed action, the applicant has proposed to protect a 50-metre buffer of vegetation adjacent to the proposed clearing area within Lot 2 (see section 2.5 below). This will involve the application of a conservation covenant over the vegetation to enable protection in perpetuity. This will also ensure that the tree containing a black cockatoo hollow with evidence of historical use (Harewood 2021a) within Lot 2 is retained.

In addition to the above, a series of management plans will be implemented as described below.

#### Flora and Vegetation Management

The management objectives for vegetation and flora are:

- Restrict vegetation clearing to a practical minimum;
- Prevent unauthorised clearing of native vegetation outside of the clearing footprint; and
- Minimise disturbance to remaining vegetation to retain health and integrity. Management actions to minimise disturbance to vegetation include:
  - Peg/flag areas to be cleared to avoid any unnecessary disturbance to adjacent vegetation;
  - Create strategic firebreaks where necessary; and
  - Restrict vehicle movement to designated access tracks, to prevent vegetation damage and erosion.

#### Fauna Management

The proposed management actions to mitigate potential impacts to fauna include:

- Plan clearing such that it does not result in the creation of isolated remnants of native vegetation that have no ecological corridors to allow fauna movement to adjacent areas;
- Restrict all vehicle use to designated roads and access tracks;
- Enforce compliance with onsite speed limits at all times;

- General housekeeping procedures such as litter removal at the perimeter of the Lots will be maintained to discourage fauna from entering the site from the adjacent Dardanup Conservation Park;
- Investigate methods for removing European honey bee hives from the clearing footprint;
- During clearing, a qualified fauna expert will be present to direct clearing operators, particularly when clearing trees that are occupied by fauna, to ensure that these are cleared in a way that allows the animals to safely mobilise to adjacent areas. In addition, they will supervise any animal handling and the rescue of injured animals should this be required;
- No stockpiling of topsoil or other material is to occur outside of the clearing boundary for the duration of the clearing period;
- If clearing during black cockatoo breeding season (i.e. August to May), check potential habitat trees (i.e. DBH in excess of 50 cm) for nesting hollows;
- If active black cockatoo nests are located in the clearing footprint, do not clear until fledglings have left the nest; and
- Clearing will commence in a west to east direction, which will enable fauna to naturally disperse into the adjoining Dardanup Conservation Park.

#### Weed and pathogen management

The proposed management actions to mitigate potential impacts associated with weeds and pathogens include:

- All earthmoving and ground engaging equipment will be inspected and cleaned of vegetation, mud and soil prior to entry and exit of the impact area.

## 2.5 Offsets

Through the detailed assessment outlined in Section 3.1 below, the Delegated Officer determined that the proposed clearing will result in the following significant residual impacts after consideration of the above avoidance and mitigation measures:

- 6.27 hectares of high-quality foraging habitat for black cockatoo species; and
- 55 potential nesting trees, including two (2) with suitable hollows for black cockatoo species.

To address the above impacts and applying the Commonwealth offset assessment guide (Commonwealth Offsets Calculator) and the Western Australian Government's Offset Policy (WA Offset Policy), the Delegated Officer took into consideration the offsets proposed (Accendo 2018) and determined that the following are appropriate:

- Conservation of 2.4 hectares of native vegetation within **Lot 2 on Diagram 65861** (Figure 6 and Figure 7) as detailed below:
  - conservation of native vegetation in very good to degraded condition that contains high quality black cockatoo foraging habitat and potential breeding habitat.
- Revegetation and conservation of 1.76 hectares within **Lot 2 on Diagram 65861** (Figure 6 and Figure 7) as detailed below:
  - revegetation with jarrah and marri species providing high quality black cockatoo foraging habitat and potential future breeding habitat.
- Conservation of 37.2 hectares of native vegetation within **Lot 2148 on Plan 125383** (Figure 6 and Figure 8) as detailed below:
  - that provides high value foraging habitat and consists of jarrah and marri woodland in very good to excellent condition and potential breeding habitat.
- Revegetation and conservation of 2.1 hectares of completely degraded vegetation within **Lot 2148 on Plan 125383** (Figure 6 and Figure 8) as detailed below:
  - revegetation with jarrah and marri species providing high quality black cockatoo foraging habitat and potential future breeding habitat.

The Delegated Officer determined that the above offset was sufficient to counterbalance the significant residual impacts associated with the proposed clearing. Further information on the suitability of the offsets provided are summarised in Appendix D.

In support of the above offset, the applicant has provided an Offset Management Plan, detailing the revegetation and/or management activities to be undertaken within each site (Accendo, 2024).



Figure 6. Proposed offsets within Lot 2 and Lot 2148 in relation to the approved clearing area.



Figure 7. Proposed offsets within Lot 2

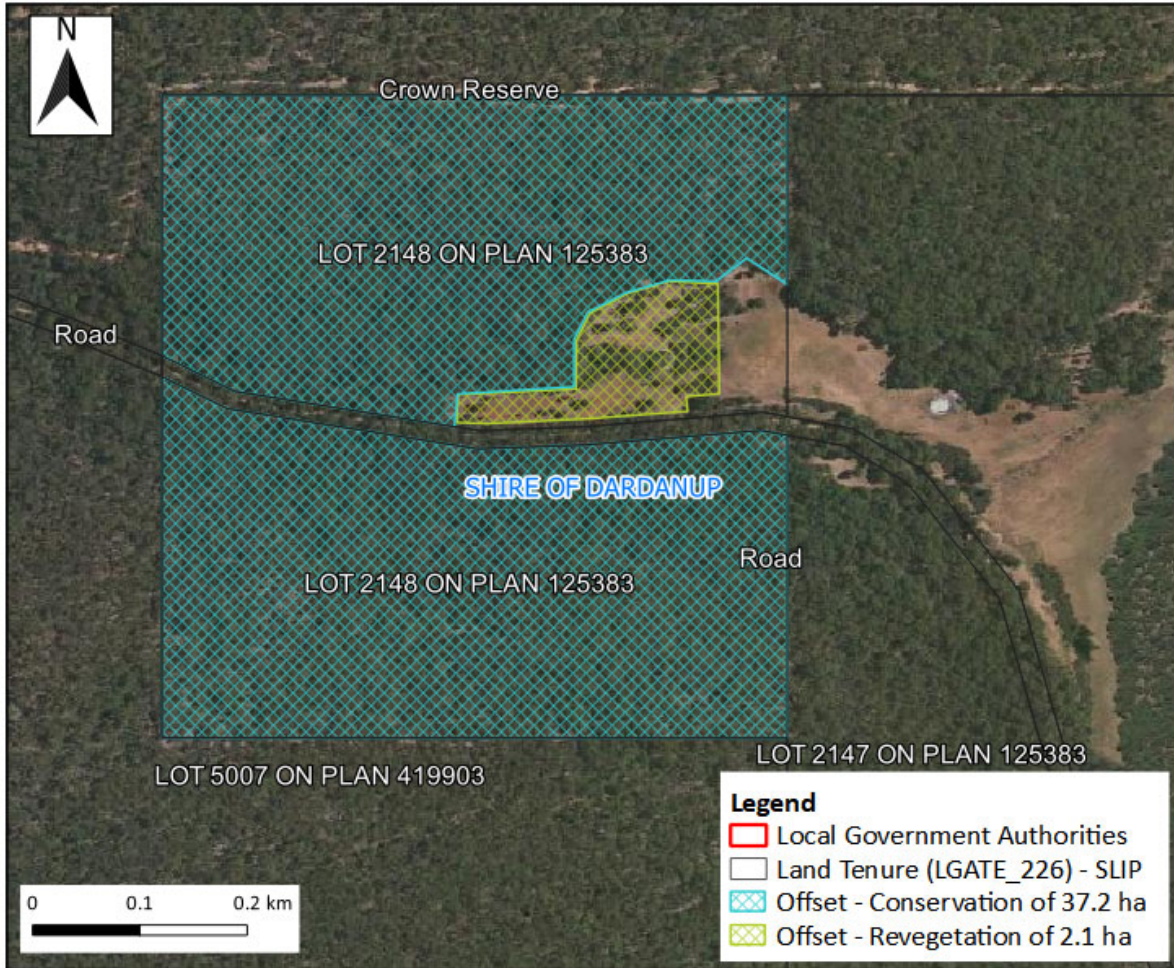


Figure 8. Proposed offsets within Lot 2148





## Clearing Permit Decision Report

Table 1. Summary of the proposed offset site characteristics and proposed actions (Accendo, 2024)

Lot 2 on Diagram 65861			
	Offset site 1	Offset site 4	Offset site 5
Size	2.4 hectares	0.76 hectares	1.0 hectare
Vegetation type	<ul style="list-style-type: none"> <li>Low woodland of jarrah and marri over a <i>Kingia australis</i> tall open shrubland over a <i>Hakea lissocarpa</i> and <i>Hypocalymma angustifolia</i> low open shrubland over a <i>Tetraria capillaris</i>, <i>Patersonia umbrosa</i> var. <i>xanthina</i> and <i>*Briza maxima</i> very open sedge/grassland (0.46 ha).</li> <li>Low open woodland of jarrah and marri over a <i>Xanthorrhoea preissii</i>, <i>Hakea lissocarpa</i> open shrubland over <i>Hibbertia hypericoides</i> low shrubland over <i>Desmocladius flexuosus</i> (1.64 ha) (see Appendix B).</li> </ul>	This area has historically been cleared of all native vegetation and is currently comprised of pasture grasses only (see Appendix B).	This area is largely devoid of native vegetation, comprising of a stand of blue gum trees ( <i>Eucalyptus globulus</i> ) (see Appendix B).
Vegetation condition	Vegetation in 'good to degraded' to 'very good to excellent' condition (see Appendix B).	Completely degraded (see Appendix B).	Completely degraded (see Appendix B).
Habitat values for black cockatoos	<ul style="list-style-type: none"> <li>Within the mapped distribution of all three species of black cockatoos.</li> <li>Several roosting records occur within the local area. The nearest roosting and breeding records are 2 km and 13 km respectively.</li> <li>A variety of primary foraging species are present, providing high quality black cockatoo foraging habitat.</li> <li>Several trees with suitable sized DBH (&gt;50cm), considered potential future breeding habitat and a potential breeding tree (containing a hollow with historical use).</li> <li>Evidence of Baudin's cockatoo and forest red-tailed black cockatoos foraging was observed within the surrounding vegetation.</li> </ul>	<ul style="list-style-type: none"> <li>Within the mapped distribution of all three species of black cockatoos.</li> <li>Several roosting records occur within the local area. The nearest roosting record is 2 km and breeding record is 11.1 km.</li> <li>Evidence of Baudin's cockatoo and forest red-tailed black cockatoos foraging was observed within the surrounding vegetation.</li> </ul>	<ul style="list-style-type: none"> <li>Within the mapped distribution of all three species of black cockatoos.</li> <li>Several roosting records occur within the local area. The nearest roosting record is 2 km and breeding record is 13 km.</li> <li>Evidence of Baudin's cockatoo and forest red-tailed black cockatoos foraging was observed within the surrounding vegetation.</li> </ul>
Current vesting	Zoned 'Rural' under the Greater Bunbury Region Scheme and 'General Farming' under TPS No. 3. Zoned 'Waste Disposal/Processing' under the Local Planning Strategy.		

Proposed actions	To protect this vegetation, the area will be placed into a conservation covenant. This will also ensure that the identified tree containing a hollow with evidence of historical use within Lot 2 will be retained.	Revegetation of 0.76 hectares will improve onsite habitat connectivity and increase black cockatoo habitat. To protect this vegetation, the area will be placed into a conservation covenant.	Revegetation of one hectare will improve onsite habitat connectivity and increase black cockatoo habitat. To protect this vegetation, the area will be placed into a conservation covenant.
<b>Lot 2148 on Plan 125383</b>			
	<b>Offset site 2</b>	<b>Offset site 3</b>	
Size	2.1 hectares	37.2 hectares	
Vegetation type	Isolated trees (species unknown)	Medium forest consisting of jarrah, marri and blackbutt	
Vegetation condition	Degraded	Very good to excellent condition (DWER, 2019)	
Habitat values for black cockatoos	<ul style="list-style-type: none"> <li>• Within the mapped distribution of all three species of black cockatoos.</li> <li>• This site occurs within 9 km of a known roosting record and 26 km of a known breeding record.</li> <li>• Low foraging value (isolated trees).</li> <li>• Foraging evidence was observed at several locations within the surrounding vegetation.</li> </ul>	<ul style="list-style-type: none"> <li>• Within the mapped distribution of all three species of black cockatoos.</li> <li>• This site occurs within 9 km of a known roosting record and 26 km of a known breeding record.</li> <li>• A variety of primary foraging species are present at high density providing high quality black cockatoo foraging habitat,</li> <li>• Approximately 1,286 trees with suitable sized DBH (&gt;50cm) occur within the site, considered to provide potential future breeding habitat (see Figure 15).</li> <li>• Foraging evidence was observed at several locations across the site (see Appendix B).</li> </ul>	
Current vesting	Zoned "Rural" under the Greater Bunbury Region Scheme and "General Farming" pursuant to the Town Planning Scheme.		
Proposed actions	2.1 ha will be revegetated to improve onsite habitat connectivity and increase black cockatoo habitat. To protect this vegetation, the area will be placed into a conservation covenant.	To protect the 37.2 ha of vegetation, the proponent will cede the property to the Department of Biodiversity, Conservation and Attractions (DBCA) for the long term management and protection of this vegetation.	



## Clearing Permit Decision Report

### 2.6 Other relevant considerations

#### Economic and Social Matters

The applicant advised that the proposed clearing is to support the ongoing maintenance of Banksia Road Putrescible landfill site, which is one of two Class III landfill operations, services the Perth Metropolitan area and the only one located in the south-west of Western Australia. The landfill accepts 300,000 tonnes per year (Accendo, 2024).

#### Applicant's Environmental History

The applicant applied for a portion of the proposed clearing three times prior to the current application (CPS 7062/1, CPS 7098/1 and 7197/1), but withdrew CPS 7062/1 and 7098/1 to allow the clearing to be assessed under the bilateral agreement. CPS 7197/1 was withdrawn by the applicant to allow them time to investigate potential offsets.

The applicant has had no prior approvals under the EPBC Act. The applicant states that they have no history of breaching any environmental approval conditions or environmental legislation.

Cleanaway Solid Waste Pty Ltd (the Licence Holder) hold *Environmental Protection Act 1986* licence number L8904/2015/1 for a Category 64: Class III landfill and Category 61: Liquid waste facility operations at the Banksia Road Landfill located on Lot 2.

Numerous public complaints regarding litter and stormwater management along the southern border of the landfill on Lot 2 and the adjoining conservation reserve has been received through DWER's Pollution Watch Hotline. In addition, in October 2020 a petition with 2644 signatures was submitted to Parliament opposing the continuation of landfilling and any expansion to operating hours, waste classification, height, footprint and capacity. The petition requested legislation and planning guidelines for the siting design and management of waste disposal sites and the development of a three year exit plan for the landfill.

The applicant has liaised with DBCA and made recent efforts to manage long standing issues relating to windblown waste and stormwater impacts to the adjoining DBCA management conservation reserve.

The applicant submitted a proposal to the EPA to assess the expansion works of the landfill site on Lot 2 to include additional landfill cells. This proposal was formally assessed and approved (Ministerial Statement 1213) under section 38 of the EP Act by the Western Australian Environmental Protection Authority (EPA). This proposal does not include clearing of native vegetation and occurs outside of the application areas that are subject to this clearing application.

### Part 3: Assessment against clearing principles (in accordance with EP Act)

#### 3.1 (a) Native vegetation should not be cleared if it comprises a high level of biodiversity

##### Proposed clearing is at variance with this Principle

The vegetation within the application area is predominantly in very good condition (Keighery, 1994), includes significant habitat for black cockatoos, is representative of the naturally restricted and poorly reserved Whicher Scarp vegetation complexes, supports vegetation adjacent to and buffering a Priority Ecological Community (PEC) and provides habitat for priority listed flora. Given this, the proposed clearing is at variance to this principle.

#### Assessment

##### Vegetation complexes

The application area comprises of jarrah and marri forest in a predominantly very good condition (Keighery, 1994).

Two vegetation types were described and mapped across the application area by Astron (2014):

- low woodland of *Eucalyptus marginata* subsp. *marginata*, *Corymbia calophylla* over a *Kingia australis* tall open shrubland over a *Hakea lissocarpa* and *Hypocalymma angustifolia* low open shrubland over a *Tetraria capillaris*, *Patersonia umbrosa* var. *xanthina* and *\*Briza maxima* very open sedge/ grassland on dark brown loam, and

- low open woodland of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over a *Xanthorrhoea preissii*, *Hakea lissocarpa* open shrubland over *Hibbertia hypericoides* low shrubland over a *Desmocladius flexuosus*, *Tetraria capillaris*, *Desmocladius fasciculatus* and *Patersonia umbrosa* var. *xantha* open sedgeland on lateritic loam.

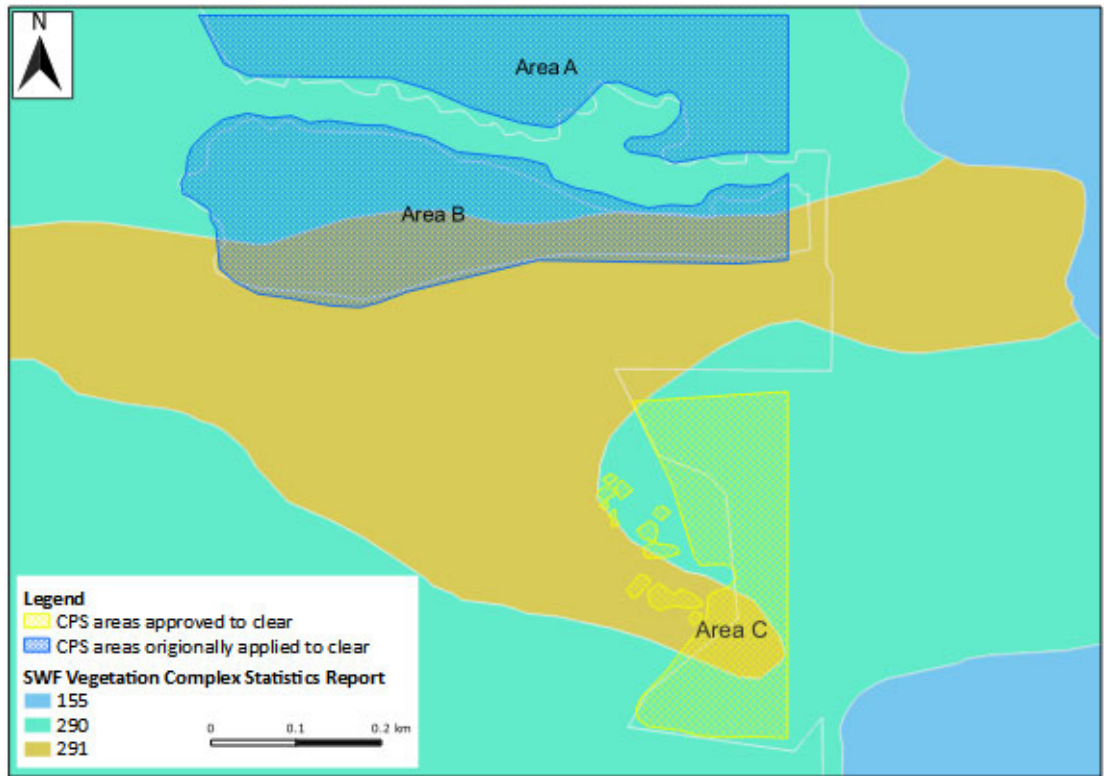
The local area retains approximately 34.1 per cent of the pre-European vegetation extent, a large portion of which is contained within the Dardanup Conservation Park and Boyanup State Forest. The application area forms a part of large contiguous remnant of native vegetation which includes the Dardanup Conservation Park, located approximately 50 metres east of the application area.

The application area is located within the Whicher Scarp landform and of the Whicher Scarp vegetation complexes WC and WCv. The scarp landform is described as a poorly-reserved forest ecosystem (Conservation Commission 2012) and is a naturally restricted landform. The vegetation complexes proposed to be cleared, in particular the WCv complex, are naturally restricted and poorly reserved. The WCv complex has less than the Molloy et al. (2007) recommended 1,500 hectare level of retention (DBCA, 2019b) (see Table 1).

Based on available mapping, it is estimated that within the application area, one hectare is mapped as WCv vegetation complex (291) and 4.99 hectares are mapped as WC vegetation complex (290) (see Figure 9). The clearing of one hectare of vegetation representative of the poorly reserved vegetation complex, WCv, is considered significant.

**Table 1 Pre-European vegetation statistics for Whicher scarp complexes**

Complex	SWF ID	Pre-European Extent (ha)	Current Extent (ha)	% Remaining	Pre-European extent in all DBCA managed land* (ha)	Current extent in all DBCA managed land* (ha)	Current percentage remaining within all DBCA managed land* (%)	#Area within formal IUCN categories I-IV
Whicher Scarp, WC	290	4,510 ha	3,129 ha	69.4 %	2,625 ha	2,417 ha	53.6 %	444 ha (<10%)
Whicher Scarp, WCv	291	799 ha	574 ha	71.8 %	461 ha	446 ha	55.8 %	94 ha (<20%)



**Figure 9. Mapped southwest forest vegetation complexes (2018) within application area.**

### Priority ecological communities

A PEC has been recorded within 80 metres of the application area, the Priority 1 Dardanup jarrah and Mountain Marri woodland on laterite (Whicher Scarp woodlands of coloured sands and laterites floristic community C5) community (Whicher Scarp C5 PEC).

The vegetation within the application area contains low woodland/open woodland of *Eucalyptus marginata* subsp. *marginata* (jarrah) and *Corymbia calophylla* (marri) (Astron, 2014). The C5 Whicher Scarp PEC indicator species *Banksia armata* var. *armata* was recorded at one location within the application area during Astron's survey in 2014 (Astron, 2014).

In April 2019 staff from DBCA conducted a site visit of the application area and surrounding vegetation. Advice received from DBCA noted that the vegetation was in excellent to very good condition, and that towards the eastern extent of the remnant a stand of vegetation dominated by *Xanthorhoea acanthostachya* and *Banksia armata* was noted. Given both these species are significant taxa for the Whicher Scarp landform (Keighery et.al 2008) and key indicators of the Whicher Scarp C5 PEC, DBCA concluded that it was likely that this area supports the PEC.

A site visit was undertaken by DWER staff with botanist qualifications to assess the application area for the presence of flora species characteristic of the PEC (DWER 2020). A thorough search for *Banksia armata* var. *armata* was undertaken but the species was not recorded, nor any other species characteristic of the PEC. Based upon the results of Astron (2014), DBCA advice (DBCA, 2020) and the DWER (2020) site visit, it is unlikely that the vegetation within the application area is representative of the Whicher Scarp C5 PEC.

### Conservation significant flora

According to current DBCA databases, five Threatened and 19 priority flora species have been recorded in the local area. In determining the likelihood of conservation significant flora occurring within the proposed clearing area, consideration was given to the results of the preferred habitat types, proximity of records to the application area, and the type and condition of the vegetation within the application area. The likelihood assessment determined that the application area is likely to provide suitable habitat for priority flora species endemic to the Whicher Scarp landform including *Stylidium perplexum* (P1), *Orianthera wendyae* (P1), *Lomandra whicherensis* (P3), *Chamelaucium* sp. Yoongarillup (P4), *Gastrolobium whicherense* (P2) and *Synaphea polypodioides* (P3). Of these species *S. perplexum* is of particular conservation interest as it is only known from three small populations, all within Dardanup Conservation Park which is immediately adjacent to the application area. Any proposed clearing of *S. perplexum* and its habitat is considered significant to the conservation of the species, given it has a very restricted distribution (known from a single location) and a small number of plants (DBCA, 2019a; DBCA, 2019b).

The vegetation and flora survey undertaken during the flowering periods of the priority flora listed above, did not identify any Threatened or priority flora (Astron 2014).

### Conservation significant fauna

The application area is considered to consist of significant foraging and potential breeding habitat for threatened fauna species, the Carnaby's cockatoo, Baudin's cockatoo and the forest red-tailed black cockatoo (Harewood, 2015).

### Weeds and dieback

The majority of the application area contains a low level of weed invasion, with weed cover increasing slightly within the edges adjacent to previously cleared areas (Astron, 2014; DWER, 2019; DBCA 2019b). Mechanical clearing has the potential to facilitate weed spread, which can decrease the biodiversity value of an area as weeds out-compete native vegetation for available resources, contribute to land degradation and increase the frequency and intensity of fires (DEC, 2011). Potential impacts to biodiversity within and nearby the application area as a result of the proposed clearing may be minimised by the implementation of weed and dieback management practices.

## **3.2 (b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna**

### **Proposed clearing is at variance to this Principle.**

The impacts of the proposed clearing constitute a significant residual impact to black cockatoo species given the occurrence of high-quality foraging habitat and suitable breeding habitat.

Based on the below assessment, the proposed clearing will result in:

- clearing of 6.27 hectares of high-quality foraging habitat for black cockatoo species;

- clearing of 55 potential future breeding trees for black cockatoo species (including two with suitably sized hollows); and
- indirect impact through spread of weeds and dieback into adjacent fauna habitat.

## Assessment

According to available databases, a total of six threatened, one priority, two migratory and one other specially protected fauna species have been recorded within the local area (DBCA, 2007-), including the western ringtail possum (*Pseudocheirus occidentalis*) (Vulnerable under the EPBC Act), Carnaby's cockatoo, Baudin's black cockatoo and the forest red-tailed black cockatoo.

Three fauna surveys have been undertaken within the application area (Astron, 2014; Harewood, 2015, Harewood, 2021). Both of the Harewood surveys included daytime survey, nighttime survey and habitat assessment for western ringtail possums and for all three black cockatoo species.

The majority of vegetation within the application area is in very good (Keighery, 1994) condition (Astron, 2014; DWER, 2020). One fauna habitat type was recorded within the application area (Astron, 2014; Harewood, 2015; Harewood, 2021), comprising:

- jarrah (*Eucalyptus marginata*) marri (*Corymbia calophylla*) and mountain marri (*Corymbia haematoxylon*) woodland with associated sparse midstorey species such as bull banksia (*Banksia grandis*), snottygobble (*Persoonia longifolia*), Christmas tree (*Nuytsia foribunda*) and woody pear (*Xylomelum occidentale*) (Harewood 2015; Harewood, 2021).

### Black cockatoo species

The proposed clearing area occurs within the known distribution range of Baudin's black cockatoo, Carnaby's cockatoo and the forest red-tailed black cockatoo. Habitat requirements for black cockatoos can be categorised as foraging habitat, breeding habitat and night roosting habitat. Habitat loss, habitat modification, climate change and fire are increasingly causing the scarcity of foraging resources which are critical at all stages of life for these species (DAWE, 2022).

Jarrah and marri/mountain marri are the dominant tree species within the application area, both of which are a known food source for all three black cockatoo species (Harewood, 2021a). Other known food sources that have been recorded within the application areas include, *Banksia grandis*, *Persoonia longifolia*, *Banksia dallanneyi*, *Hakea lissocarpha*, *Kingia australis* and *Agonis flexuosa* (Harewood, 2021a). Evidence of Baudin's cockatoo and forest red-tailed black cockatoos foraging onsite was observed within the application area and surrounding vegetation (Harewood, 2021a).

According to the commonwealth's foraging habitat quality scoring tool for black cockatoos (DAWE, 2022), the vegetation within the application areas consists of high-quality foraging habitat for all three black cockatoo species, on the balance of the following:

- six confirmed roost sites occur within 10 km of the application area
- trees providing breeding habitat are present within adjacent vegetation, and one confirmed breeding tree have been recorded within 12 kilometres of the application area
- water sources are likely to be present within the adjacent areas
- foraging habitat is comprised mainly of marri, which is one of the preferred foraging species for Carnaby's cockatoo, forest red-tail cockatoo and Baudin's cockatoo; and
- evidence of foraging has been observed within the application areas.

Food resources within the range of breeding sites and roost sites are important to sustain populations, and foraging resources are therefore viewed in the context of known breeding and night roosting sites, particularly within 12 kilometres of an impact area (DAWE, 2022).

Suitable black cockatoo roost habitat is generally in or near riparian environments or other permanent water sources. According to available databases, several watercourses occur within close proximity to the application area with the closest two kilometers away (see Figure 3). A review of available desktop data revealed six known roost sites within 12 kilometers of the application area. No evidence of black cockatoos roosting within the application area was observed during the survey (Harewood, 2015, 2021). It is considered that the application provides foraging resources for nearby roosting black cockatoos.

In accordance with the referral guidelines for the three species of black cockatoo, breeding habitat is defined as trees of species known to support nesting within the range of the species, which either have a suitable nest hollow or are of a suitable depth at breast height (DBH) to develop a nest hollow (DAWE, 2022). For jarrah and marri trees, DBH is 500 millimetres or above (DAWE, 2022). According to available databases, one confirmed white-tailed black

cockatoo (either Baudin's or Carnaby's) breeding record occurs within 12.5 kilometers of the application area.

A black cockatoo assessment was conducted across the application area identified 55 trees within the application area and are considered potential future breeding habitat for all three black cockatoo species (Harewood, 2021a). In addition, two trees were identified as having at least one hollow of a size large enough for a black cockatoo to use for breeding. No evidence of any hollows being used by black cockatoos for breeding (current or previously) was observed within the application area during the fauna survey (Harewood, 2021a). One tree with evidence of use for breeding by black cockatoo species was recorded 25 meters east of the application area (Harewood, 2021a). The applicant has proposed to retain this tree within an area that will be protected by a conservation covenant (Accendo, 2021).

Given that the proposed clearing will impact on 55 potential breeding trees of which two contain a suitable hollow for black cockatoo breeding, it is considered for the application areas to contain critical habitat for the survival of all three black cockatoo species.

It is considered that the clearing of 6.27 hectares of high-quality foraging habitat for black cockatoo species that is likely to support nearby roosting and nesting habitat, is likely to have a significant impact on critical habitat for black cockatoos.

#### Western Ringtail Possum

Based on available datasets, there are 278 records of western ringtail possum (WRP) within the local area, none of which occur within the application area. The application area is within the Swan Coastal Management Zone as described within the 'Western Ringtail Possum Recovery Plan' (DPaW, 2017). The management plan outlines strategies to slow the decline in population size, extent and area of occupancy through managing major threatening processes affecting the subpopulations and their habitats and allowing the persistence of the species in each of the identified key management zones: Swan Coastal Plain, Southern Forests and South Coast (DPaW, 2017). According to the mapped Western Ringtail Possum Habitat Suitability (DBCA-049), the vegetation within the application area is considered to be of low to very low suitability.

Vegetation communities critical to the species includes long unburnt mature remnants of peppermint (*Agonis flexuosa*) woodlands with high canopy continuity and high foliage nutrients; jarrah (*Eucalyptus marginata*)/marri (*Corymbia calophylla*) forests and woodlands with limited anthropogenic disturbance (unlogged or lightly logged, and a low intensity and low frequency fire history), that are intensively fox-baited and have low indices of fragmentation (DPaW, 2017).

A fauna survey (Harewood, 2021a) conducted over the application area included a daytime search for secondary evidence and suitable habitat and a nighttime target search for individuals. The survey did not identify any evidence in the form of dreys, scats or individuals during the daytime surveys and no individuals were observed during the nighttime surveys. The survey recorded two common brush tailed possums within the application area (Harewood, 2021a).

The application area is comprised of a jarrah/marri woodland which shows a distinct lack of associated midstory vegetation such as peppermint. Western ringtail possums show a preference for relatively dense midstory vegetation and therefore the application area is not considered to represent critical habitat for the species. Given western ringtail possums are known from nearby surrounding areas where better quality habitat exists and therefore it is possible that individuals of the species may occur on occasions, within the application areas, despite the lack of preferred habitat (Harewood, 2021a).

#### Other species

Numerous common bush bird species, one frog species, three reptile species, five bat species and the Western Grey Kangaroo (*Macropus fuliginosus*) were observed within the application area and surrounding vegetation, during the fauna surveys (Astron, 2014; Harewood, 2021). In addition to these common species, three other species of conservation significance were also observed, they being the south-western brush tailed phascogale (schedule 6, BC Act), western false pipistrelle (priority 4 – DBCA priority species) and the Rainbow-bee eater (Priority 4, DBCA priority species).

The south-western brush-tailed phascogale was recorded at several locations during a camera trap survey within the application area and is considered to use hollow bearing trees that occur within the application areas for daytime refuge (Harewood, 2021a).

Calls of the western false pipistrelle were recorded during a bat survey within the application area (along with five other common bat species including Gould's wattled bat, chocolate wattled bat, lesser long-eared bat and the

southern forest bat) (Harewood, 2021a). The application area represent potential foraging habitat for this species and any hollow bearing trees represent possible day time roost sites.

Astron (2014) and Harewood (2021) recorded the rainbow bee-eater within the application area. This species is likely to use habitat within the application areas as part of a larger range and is not likely to be significantly impacted by the proposed clearing.

Given the above, there is the potential for the direct mortality of any individuals of the above species occurring within the application area during the time of clearing. Although the application area contains suitable habitat for the above species, the proposed clearing is not likely to result in significant impacts to habitat for these species, noting the following:

- The abundance of native vegetation to the east of the application area within lands managed by DBCA for conservation, which is likely to be in better condition than vegetation within the application area and therefore more likely to provide better quality habitat;
- These species are mobile and likely to be able to find new habitat in adjacent vegetation, should they currently be inhabiting vegetation within the clearing area.

#### Adjacent fauna habitat

As stated in principle (a), the local area retains approximately 34 per cent pre-European vegetation extent, a large portion of which is contained within the adjacent Dardanup Conservation Park and Boyanup State Forest. The application area is likely to provide a buffer between the existing landfill operation and the Dardanup Conservation Park. Given the proximity to the Dardanup Conservation Park and Boyanup State Forest, and noting the condition of native vegetation within the application area and the presence of foraging and nesting habitat for black cockatoos, the application area is considered to provide significant habitat for fauna. The proposed clearing has the potential to increase edge effects within the large contiguous remnant that the application area is part of, which is likely to affect the quality and availability of fauna habitat in the local area. Given this, the application area may also be necessary for the maintenance of fauna habitat within adjacent vegetation.

#### **Conclusion**

For the reasons set out above, the impacts of the proposed clearing constitute a significant residual impact to black cockatoo habitat as the proposed clearing will impact two trees with suitable hollows for breeding and high-quality foraging habitat. To counterbalance this impact, an offset is required (see Section 2.4 above).

#### **3.3 (c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, threatened flora**

##### **Proposed clearing is not likely to be at variance to this Principle**

Current DBCA databases have recorded five Threatened flora species within the local area. As stated in Section 2, the application area comprises of jarrah and marri forest over sandy soils in a predominantly very good (Keighery, 1994) condition (DWER, 2019).

Three of the Threatened flora species recorded within the local area occur within wetland habitats and the other two species prefer soil and habitat types not found within the application area (Western Australian Herbarium, 1998-). In addition, the flora survey did not find any Threatened flora species within the application areas (Astron, 2014). Given this, it is not considered for the Threatened flora species to occur within the application area.

The proposed clearing is not likely to be at variance to this principle.

#### **3.4 (d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community**

##### **Proposed clearing is not likely to be at variance to this Principle**

One threatened ecological community (TEC) has been recorded within the local area. This TEC is the 'Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region' and has been mapped 1.2 kilometres west of the application area.

This TEC is dominated by Banksia species (TSSC, 2016). As the application area consists of jarrah and marri forest (DWER, 2019; DBCA 2019b; Astron 2014), it is not considered for the application area to represent this TEC.



The proposed clearing is not likely to be at variance to this principle.

### 3.5 (e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared

#### Proposed clearing is not likely to be at variance to this Principle

The application area is considered a significant remnant of native vegetation as it contains high biodiversity, and significant fauna habitat. However, given the local area contains over 30 per cent of the pre-European vegetation extent, the application area is not considered to be within an extensively cleared landscape, and therefore, the proposed clearing is not likely to be at variance to this principle.

#### Assessment

The application area is located within the Jarrah Forrest IBRA bioregion, near the boundary to the Swan Coastal Plain IBRA bioregion that occurs to the west. The Jarrah Forrest bioregion has approximately 53 per cent of its pre-European extent remaining (Government of Western Australia, 2018). The local area retains approximately 34.1 per cent (approximately 11,159 hectares) pre-European vegetation extent, a large portion of which is contained within the Dardanup Conservation Park and Boyanup State Forest.

The national objectives and targets for biodiversity conservation in Australia has a target to prevent clearance of ecological communities with an extent below 30 per cent of that present pre-1750, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Australia, 2001). None of the vegetation extents are below the 30 per cent threshold (Government of Western Australia, 2018). On this basis the application area is not located within an extensively cleared landscape.

Table 2: Vegetation extent remaining statistics

	Pre-European extent (ha)	Current extent (ha)	Extent remaining (%)	Current extent in all DBCA managed land (ha)	Current proportion (%) of pre-European extent in all DBCA managed land
IBRA bioregion*					
Jarrah Forest	4,506,660	2,399,838	53.25	1,673,614	37.1
Vegetation complex					
Sw vegetation complex Whicher Scarp, WC	4,510	3,129	69.4	2,417	53.6
SW vegetation complex Whicher Scarp, WCv	799	574	71.8	446	55.8
Local area					
10km radius	32,717	11,159	34.1	-	-

\*Government of Western Australia (2019a)

### 3.6 (f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland

#### Proposed clearing is not likely to be at variance to this Principle

According to available databases, the nearest waterbody is located approximately 1.2 kilometres from the application area and there are no watercourses or wetlands mapped within the application area.

No wetlands, watercourses or riparian vegetation were observed during the site inspection (DWER, 2020) or flora surveys (Astron, 2014). Given this the proposed clearing is not at variance to this principle.

The proposed clearing is not likely to be at variance to this principle.

### 3.7 (g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation

#### Proposed clearing may be at variance to this Principle

The land subsystems mapped within the application area are not associated with a high risk of land degradation via water erosion, waterlogging, flooding or eutrophication. However, the application area contains sandy soils prone to land degradation through wind erosion. Staged clearing will assist in mitigating this risk.

#### Assessment

The application area has been mapped as the following land Unit – land subsystem:

- Whicher valleys phase: minor valleys on laterite over Perth basin sediments in the northern margin of the Donnybrook Sunkland (along the Whicher Scarp from Burekup to Chapman Hill). Duplex sandy gravels; and
- Whicher gentle slopes phase: gentle, smooth lateritic slopes on laterite over Perth Basin sediments in the northern margin of the Donnybrook Sunkland (along the Whicher Scarp from Burekup to Chapman Hill). Duplex sandy gravels, shallow gravels and deep sandy gravels.

The Department of Primary Industry and Regional Development (DPIRD) developed land degradation risk potentials for mapped subsystems, as shown within the below table:

Table 3: Land degradation risks for mapped soil units (DPIRD, 2019)

Risk categories	<i>Both Land Units have</i>
Wind erosion	10-30% has a high to extreme wind erosion risk
Water erosion	3-10 % high to extreme water erosion risk
Salinity	30-50 % of map moderate to high salinity risk or is presently saline
Flood risk	<3% of map has moderate to high flood risk
Water logging	< 3% of map has moderate to very high waterlogging risk
Phosphorus export risk	10-30% of map has high to extreme risk

### 3.8 (h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area

#### Proposed clearing may be at variance to this Principle

Given the potential for weeds and dieback to spread into the nearby Dardanup Conservation Park, the proposed clearing is at variance to this principle. Weed and dieback management and a maintenance and protection of an appropriate buffer will assist in mitigating this risk.

#### Assessment

The Dardanup Conservation Park is located approximately 50 metres east of the application area. Native vegetation within the application area and surrounds is separated from the Dardanup Conservation Park by an access track along the eastern property boundary.

The Dardanup Conservation Park contains vegetation in very good to excellent (Keighery, 1994) condition and contains populations of priority flora. The Dardanup Conservation Park is also likely to provide suitable foraging and nesting habitat for Carnaby's cockatoo, Baudin's cockatoo and the forest red-tailed black cockatoo.

The Dardanup Conservation Park is a very significant North Whicher Scarp conservation area which supports diversity of the flora of the North Whicher Scarp and a large number of significant taxa including at least 11 at the end of their range and a series of Whicher Scarp endemics including *Gastrolobium whicherense*, *Stylidium* sp. *Dardanup* (G.S. McCutcheon 1066), *Lomandra whicherensis* and *Logania wendyae* (Keighery et al. 2008).

Soil disturbance and removal of native vegetation increases the risk of weeds, which may spread into adjacent vegetation. Weeds can decrease the biodiversity value of an area as they out-compete native vegetation for available resources, contribute to land degradation and increase the frequency and intensity of fires (DEC, 2011).

The vegetation within the application area is likely to provide a buffer between the existing landfill facility to the west of the application area and vegetation within Dardanup Conservation Park. During the site inspection, it was noted that rubbish had migrated from the landfill across to the eastern boundary of the application area (DWER, 2020; DBCA, 2019b). Given that rubbish was observed throughout the application area, it is likely that the reduction in buffer vegetation is likely to lead to rubbish encroachment into the Dardanup Conservation Park.

The 50 metre wide separation between the application area and the boundary of the conservation park includes a strip of native vegetation approximately 30 metres wide adjacent to the application area and a cleared access track. The proposed clearing will reduce the overall buffer between the existing landfill facility and the Dardanup Conservation Park from its current width of 100 metres to approximately 30 metres.

### **3.9 (i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water**

#### **Proposed clearing is not likely to be at variance to this Principle**

Given the existing level of groundwater salinity and the size of the application area, the proposed clearing is not likely to cause any further deterioration in the quality of groundwater in the local area. Given the above, the proposed clearing is not likely to be at variance to this Principle.

#### **Assessment**

There are no watercourses or wetlands within the application area. The nearest waterbody is a Multiple Use Dampland wetland, which is located approximately 1.2 kilometres from the application area. Given this, the proposed clearing is not likely to cause deterioration in the quality of surface water.

Groundwater salinity in the application area is mapped as 3,000 to 7,000 milligrams per litre total dissolved solids, which is considered moderately saline to saline. The proposed clearing will cause the removal of deep rooted vegetation, which may cause only a minor increase in groundwater discharge in the local area.

The proposed clearing is not likely to be at variance to this principle.

### **3.10 (j) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding**

#### **Proposed clearing is not likely to be at variance to this Principle**

The proposed clearing is not considered likely to cause or exacerbate flooding and is not likely to be at variance to this Principle.

The application area occurs on a mild slope, with runoff likely to drain in a south-east to north-west direction and into previously cleared areas associated with the adjacent waste facility. Both mapped land subsystems within the application area consist of deep sandy soils and have a very low risk of waterlogging and flooding.

The proposed clearing is not likely to be at variance to this principle.

### **3.11 Relevant planning instruments and other matters**

Lot 2 is zoned "Rural" under the Greater Bunbury Region Scheme (GBRS) and "General Farming" pursuant to the Town Planning Scheme (TPS) No. 3. In accordance with the Shire of Dardanup's Local Planning Strategy, Lot 2 is zoned 'Waste Disposal/Processing'. Currently, Lot 2 is operated as a waste facility to meet the waste needs of the southwest region.

Under the GBRS Strategic Minerals and Basic Raw Materials Resource Policy (WAPC, 2018) the application areas are mapped as a 'Strategic resources – Titanium-zircon mineralization'. Strategic resources are classed under this policy as either significant geological supplies of basic raw materials (sand, clay, hard rock, limestone, lime, gravel, gypsum and other construction and road building materials) or mineral resources, which have been identified by the Geological Survey of Western Australia, Department of Mines, Industry Regulation and Safety (WAPC, 2018).

Therefore, the application area falls within an area that contains a significant geological supply (due to either the size and scarcity) of a mineral resource for titanium and zircon. These minerals are used in a variety of industrial and manufacturing purposes. The application area is not mapped as containing a significant geological supply for basic raw materials for such as sand and gravel under this policy.

Under the GBRS Strategic Minerals and Basic Raw Materials Resource Policy, the identification of strategic resources does not presume that extraction would be environmentally acceptable and that environmental regulation of proposals that are mapped as significant geological resource may require the vegetation retention and /or protection of other environmental assets (WAPC, 2018).

Under the State Planning Policy 2.4 Planning for Basic Raw Materials (WAPC, 2021) the areas under application are not mapped as containing a significant geological supply (based on size, scarcity, demand and location to growth/transport areas) of basic raw materials (sand, gravel, clay etc).

The applicant has advised that within Lot 2, the clearing is required to utilise in-situ sand for daily cover and internal roads during the winter months, and gravel material for the construction of internal drains and stormwater infrastructure and to improve the operations of the existing landfill use. The extracted materials will be used in different manners, dependent on their composition. sand will be used on the landfill face as an all-weather trafficable surface and gravel will be used for off landfill roading, on the internal road networks and on larger gravel to be used in stormwater drains for erosion control and mitigation.

Currently, the applicant holds an Extractive Industry Licence for the western portion of Lot 2 (Harley Dykstra, 2023). It is understood that this approval includes the extraction of up to 73,000 m<sup>3</sup> of material over a 5–10-year period. The applicant has advised that it is anticipated that the volume of material proposed to be extracted on Lot 2 represents around 5.5 years' worth of sand supply at the current rate of use. This application proposes to exhaust the store of gravel and sand material over the period of 5 years and stockpiling the excess to benefit the landfill use in following 18 months.

The proposed extractive industry activities have the potential for impact on the environment and water resource values and management. The proposed extraction is to be implemented in accordance with the department's Water Quality Protection Note (WQPN) No. 15 'Basic raw materials extraction', where appropriate to the site situation, to ensure environmental risks are appropriately mitigated.

No Aboriginal sites of significance have been mapped within the application area. It is the applicant's responsibility to ensure that they adhere to the *Aboriginal Heritage Act 1972*

**End**

## Appendix A. Vegetation condition rating scale

Vegetation condition is a rating given to a defined area of vegetation to categorise and rank disturbance related to human activities. The rating refers to the degree of change in the vegetation structure, density and species present in relation to undisturbed vegetation of the same type. The degree of disturbance impacts upon the vegetation's ability to regenerate. Disturbance at a site can be a cumulative effect from a number of interacting disturbance types.

Considering its location, the scale below was used to measure the condition of the vegetation proposed to be cleared. This scale has been extracted from Keighery, B.J. (1994) *Bushland Plant Survey: A Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc). Nedlands, Western Australia.

### Measuring vegetation condition for the South West and Interzone Botanical Province (Keighery, 1994)

Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, with disturbance affecting individual species; weeds are non-aggressive species.
Very good	Vegetation structure altered, with obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and/or grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and/or grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and/or grazing.
Completely degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

**Appendix B. Biological survey exerts of the application area (Astron, 2014; Harewood, 2021)**

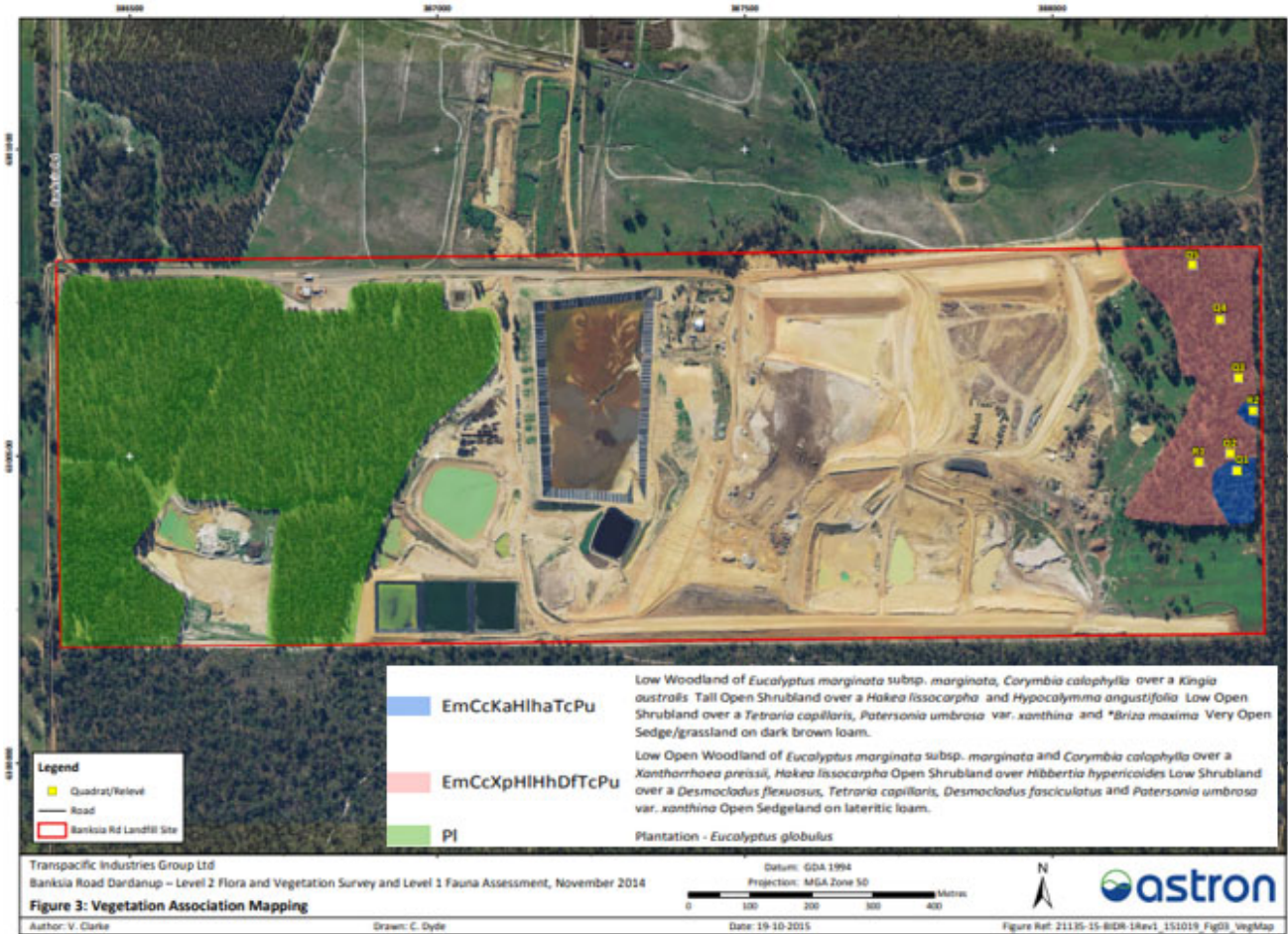


Figure 10 Vegetation types across the survey area (Astron, 2014)



Figure 11 Vegetation condition across the survey area (Astron, 2014)

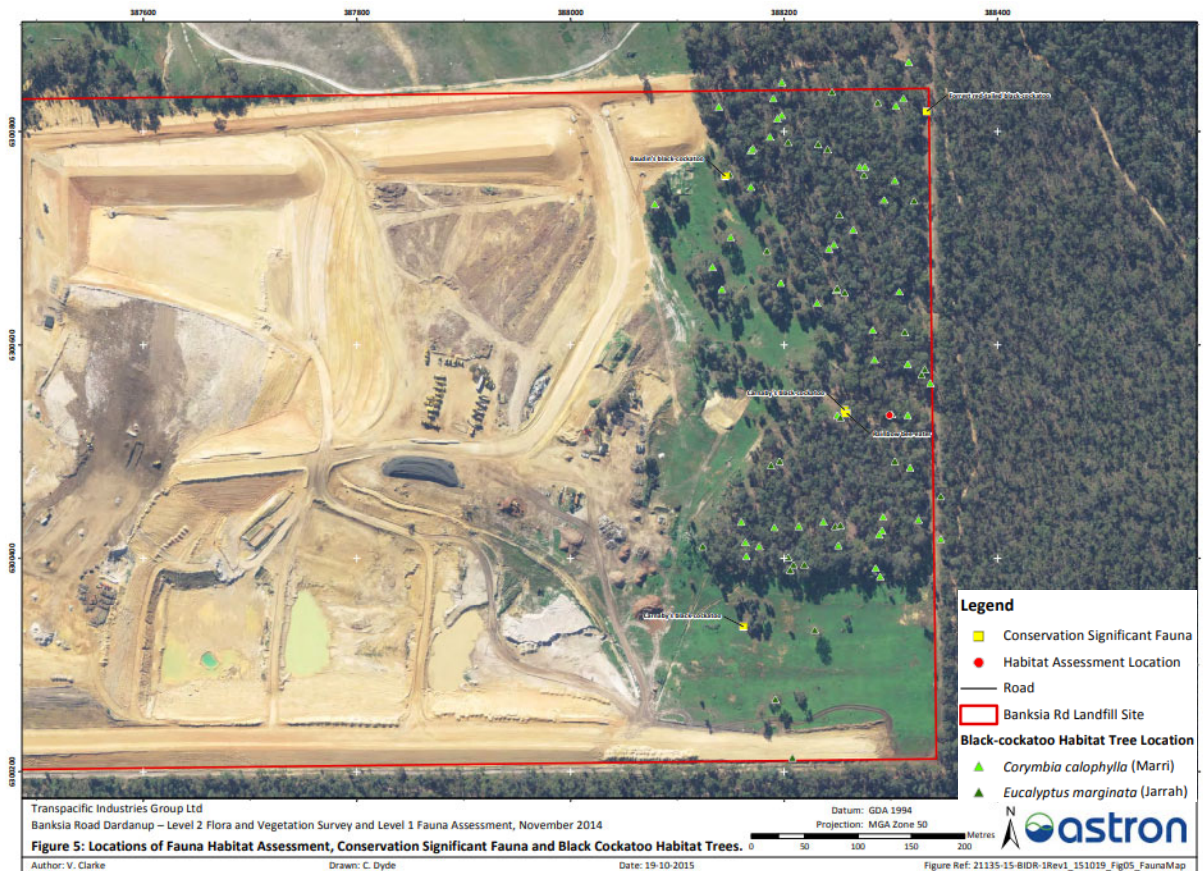


Figure 12 Locations of conservation significant fauna and black cockatoo habitat trees (Astron, 2014)

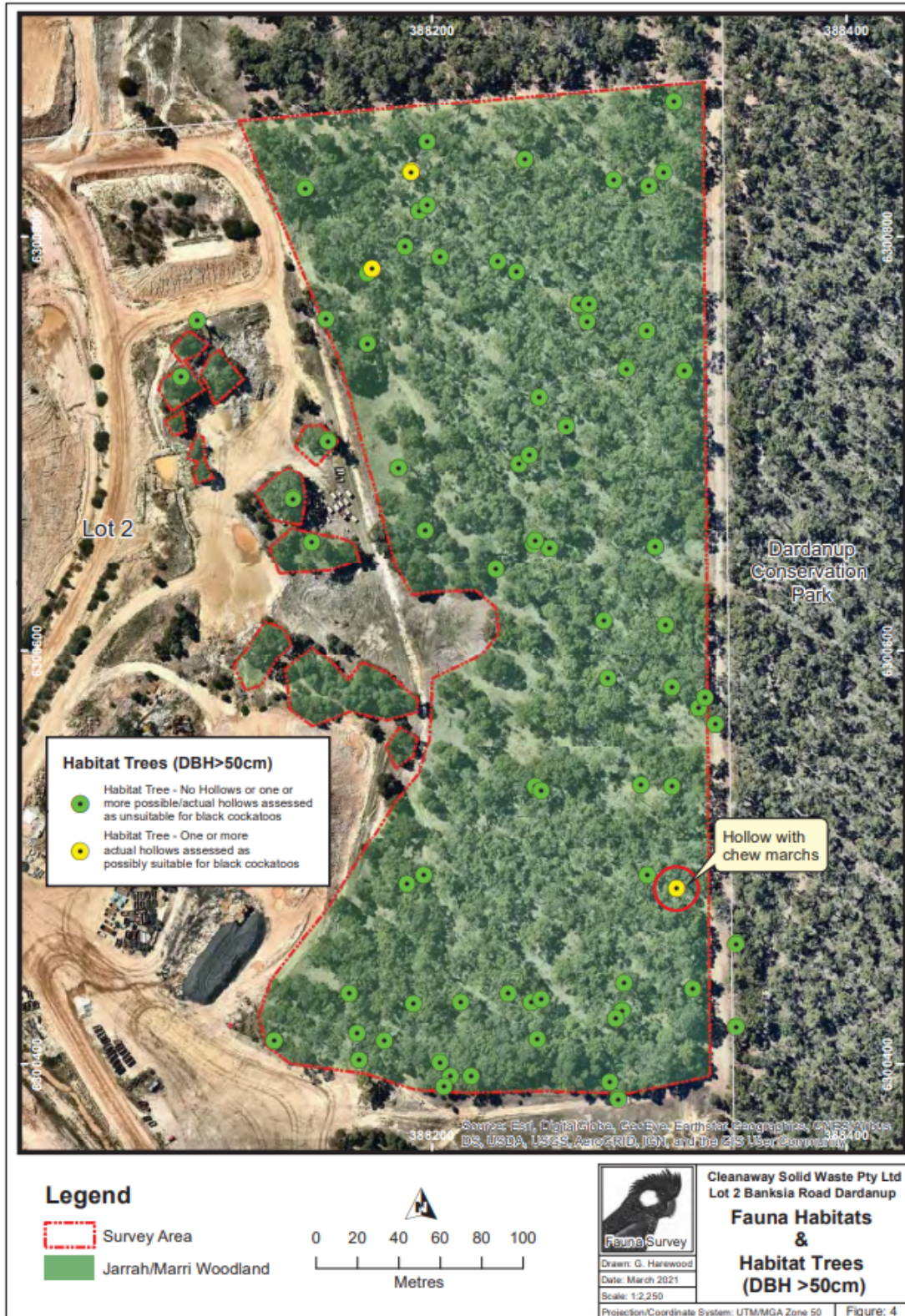


Figure 13 Black cockatoo habitat (Harewood, 2021a)





Plate 4: Recently chewed marri fruit from forest red-tailed black cockatoo or Carnaby's cockatoo.



Plate 5: Recently chewed marri fruit from forest red-tailed black cockatoo or Carnaby's cockatoo.



Plate 6: Recently chewed marri fruit from forest red-tailed black cockatoo or Carnaby's cockatoo.



Plate 7: Recently chewed marri fruit from Baudin's cockatoo.

**Figure 14 Black cockatoo foraging evidence observed during the survey of Lot 2 (Astron, 2014)**

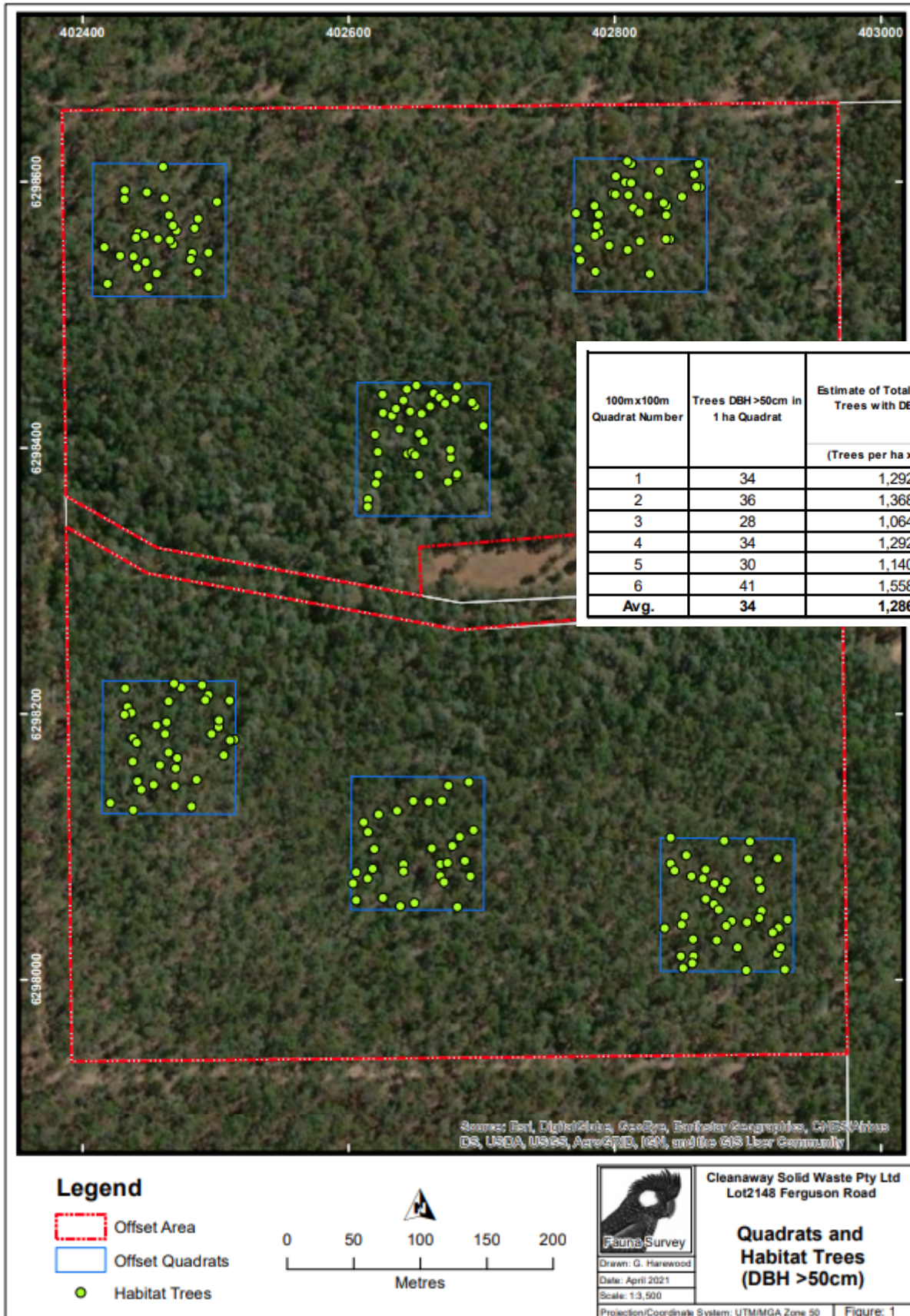


Figure 15 Quadrats and Black cockatoo habitat trees (Accendo, 2024)

**Appendix C. DWER site inspection (DWER, 2019; 2020)**

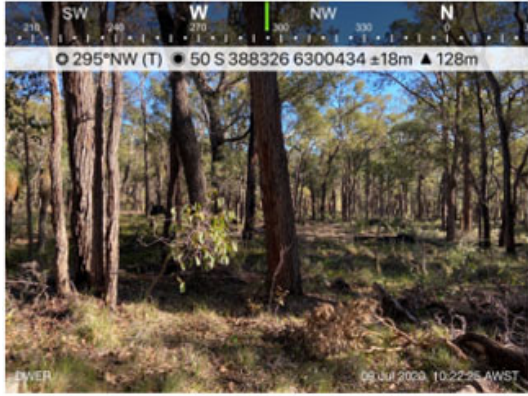


Photo 1



Photo 2



Photo 3



Photo 4



Photo 5

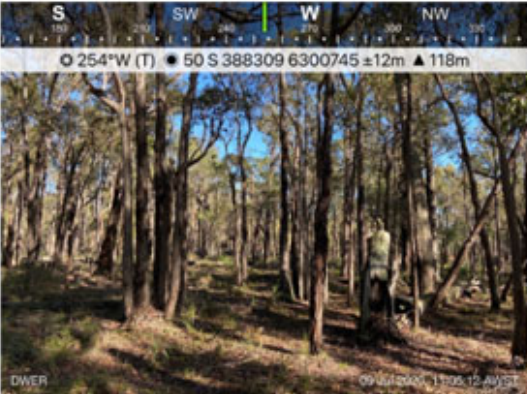


Photo 6



Photo 7



Photo 8

**Figure 16. Photos of the application area taken during the site inspection of LOT 2 (DWER 2020)**



Figure 17. Photos of the proposed offset site Lot 2148 Ferguson Road (DWER, 2019)

## Appendix D. Offset calculator value justification

Calculation	Score (Area)	Rationale
<b>Conservation significance</b>		
Description		Carnaby's cockatoo habitat.
Conservation significance of environmental value	Rare/Threatened Species - Endangered	Carnaby's cockatoo is listed as endangered under the BC Act and EPBC Act
<b>Significant impact</b>		
Significant impact	6.27 hectares	Carnaby's cockatoo habitat.
Quality (scale)	8.00	Clearing area contains high quality foraging and breeding habitat (Harewood, 2021). Clearing of 48 future potential breeding trees (with DBH of 50 cm), two of which contain suitable nesting hollows. Occurs within close proximity to known breeding (12.7 km) and roosting records (2 km).
<b>Offset calculation 1 – Conservation of 2.4 hectares (Lot 2 on Plan 65861)</b>		
Description	Land acquisition	Conservation of 2.4 hectares of native vegetation within Lot 2 on Plan 403943 that provides habitat values for black cockatoos.
Proposed offset (area in hectares)	2.4	2.4 hectares of native vegetation.
Current quality of offset site	8.00	Based on Harewood (2015; 2021a) – high quality black cockatoo foraging and potential breeding habitat (marri and jarrah). The site occurs within close proximity to known roosting (2 km) and breeding (13 km) records.
Future quality WITHOUT offset	7.00	It is assumed that the quality is likely to decline due to land uses adjacent to the vegetation.
Future quality WITH offset	8.00	Conservation and land management (fencing and weed control) of the site will ensure the long term security of the habitat values. Details of management actions are outlined in the Offset Management Plan (Accendo, 2024) provided.
Time until ecological benefit (years)	1.00	It is expected that it will take 1 year for a conservation covenant to be placed over the offset site and for management actions to be implemented.
Confidence in offset result (%) – risk of loss	90%	High level of confidence that offset will mitigate future risks to the site.
Confidence in offset result (%) – change in quality	90%	High level of confidence that the offset site would remain in at its current quality if entered into conservation estate
Duration of offset implementation (maximum 20 years)	20.00	The offset site will be protected in perpetuity.
Time until offset site secured (years)	1.00	It is expected that it will take 1 year for a conservation covenant to be placed over the offset site.
Risk of future loss WITHOUT offset (%)	20.0%	Zoned 'Rural' under the Greater Bunbury Region Scheme and 'General Farming' under TPS No. 3. Zoned 'Waste Disposal/Processing' under the Local Planning Strategy.
Risk of future loss WITH offset (%)	5.0%	A conservation covenant will be placed over the offset site, thus the risk of loss is considered to be low.
% of impact offset	7.47%	7.47% of the significant residual will be offset by the proposed offset
<b>Offset calculation 2 – Conservation and rehabilitation of 1.76 hectares (Lot 2 on Plan 65861)</b>		
Description	0	Rehabilitation of 1.76 hectares of native vegetation within Lot 2 on Plan 403943 that provides habitat values for Carnaby's cockatoos.

Calculation	Score (Area)	Rationale
		The site occurs within close proximity to known roosting (2 km) and breeding (11.1 km) records.
proposed offset (area in hectares)	1.76	1.76 hectares of native vegetation.
Current quality of offset site	1.00	The vegetation is in degraded to completely degraded condition (Keighery, 1994) with little to no habitat values.
Future quality WITHOUT offset	1.00	The quality is considered unlikely to improve or decline beyond its current quality over the next 20 years.
Future quality WITH offset	6.00	Vegetation management and direct planting and seeding of suitable black cockatoo habitat species (marri and jarrah) within the site is expected to increase the habitat values and condition of the vegetation to good condition (Keighery, 1994).  Details of revegetation and management actions are outlined in the Offset Management Plan (Accendo, 2024) provided (see revegetation areas B and C).
Time until ecological benefit (years)	15.00	It is expected that it will take 15 years for the vegetation to mature and provide habitat values for black cockatoo foraging.
Confidence in offset result (%) – risk of loss	90%	Moderately high level of confidence that offset will mitigate future risks to the site.
Confidence in offset result (%) – change in quality	85%	Moderate to high level of confidence that the revegetation/rehabilitation will increase the quality of foraging habitat based on the revegetation plan provided (Accendo, 2024)
Duration of offset implementation (maximum 20 years)	20.00	The offset site will be protected in perpetuity.
Time until offset site secured (years)	1.00	It is expected that it will take 1 year for a conservation covenant to be placed over the offset site.
Risk of future loss WITHOUT offset (%)	20%	Zoned 'Rural' under the Greater Bunbury Region Scheme and 'General Farming' under TPS No. 3. Zoned 'Waste Disposal/Processing' under the Local Planning Strategy
Risk of future loss WITH offset (%)	5%	A conservation covenant will be placed over the offset site, thus the risk of loss is considered to be low.
% of impact offset	12.21	12.21% of the significant residual will be offset by the proposed offset
<b>Offset calculation 3 – Conservation and revegetation of 2.1 hectares (Lot 2148 on Plan 125383)</b>		
Description	0	Revegetation of 2.1 hectares of native vegetation Lot 2148 Ferguson Road that provides habitat values for Carnaby's cockatoos. This site occurs within 9 km of a known roosting record and 26 km of a known breeding record.
proposed offset (area in hectares)	2.1	2.1 hectares of native vegetation.
Current quality of offset site	1.00	The vegetation is in completely degraded condition (Keighery, 1994) with little to no habitat values.
Future quality WITHOUT offset	1.00	The quality is considered unlikely to improve or decline beyond its current quality over the next 20 years.
Future quality WITH offset	6.00	Vegetation management and direct planting and seeding of suitable black cockatoo habitat species (marri and jarrah) within the site is expected to increase the habitat values and condition of the vegetation to good condition (Keighery, 1994). Details of revegetation and management actions are outlined in the Offset Management Plan (Accendo, 2024).
Time until ecological benefit (years)	15.00	It is expected that it will take 15 years for the vegetation to mature and provide habitat values for black cockatoo foraging.
Confidence in offset result (%) – risk of loss	90%	Moderately high level of confidence that offset will mitigate future risks to the site.

Calculation	Score (Area)	Rationale
Confidence in offset result (%) – change in quality	85%	Moderate to high level of confidence that the revegetation/rehabilitation will increase the quality of foraging habitat based on the revegetation plan provided (Accendo, 2024)
Duration of offset implementation (maximum 20 years)	20.00	The offset site will be protected in perpetuity.
Time until offset site secured (years)	1.00	It is expected that it will take 1 year for a conservation covenant to be placed over the offset site.
Risk of future loss WITHOUT offset (%)	20%	Currently zoned 'Rural'.
Risk of future loss WITH offset (%)	5%	A conservation covenant will be placed over the offset site, thus the risk of loss is considered to be low.
% of impact offset	14.57%	14.57% of the significant residual will be offset by the proposed offset
<b>Offset calculation 4 – Conservation and rehabilitation of 37.2 hectares (Lot 2148 on Plan 125383)</b>		
Description	0	Conservation of 37.2 hectares of native vegetation within Lot 2148 Ferguson Road, Ferguson that provides high quality black cockatoo habitat and potential breeding habitat. This site occurs within 9 km of a known roosting record and 26 km of a known breeding record.
proposed offset (area in hectares)	37.2	37.2 hectares of native vegetation
Current quality of offset site	8.00	The site consists of high quality black cockatoo foraging habitat (marri and jarrah), containing an estimated 1,286 habitat trees (trees that are >50 cm DBH) and evidence of foraging by black cockatoos were observed (Harewood, 2021b).
Future quality WITHOUT offset	8.00	Black cockatoo foraging and breeding habitat not expected to decline over time.
Future quality WITH offset	8.00	Conservation of the site will ensure the long term security of the habitat values.
Time until ecological benefit (years)	1.00	It is expected that the benefit and reduced risk will occur when the site is conserved in perpetuity.
Confidence in offset result (%) – risk of loss	95%	High level of confidence that offset will mitigate future risks to the site.
Confidence in offset result (%) – change in quality	95%	High level of confidence that the offset site would remain in at its current quality if entered into conservation estate. It has been confirmed that the offset site contains high value foraging habitat.
Duration of offset implementation (maximum 20 years)	20.00	The offset site will be protected in perpetuity.
Time until offset site secured (years)	1.00	It is expected that it will take 1 year for a conservation covenant to be placed over the offset site.
Risk of future loss WITHOUT offset (%)	20%	Currently zoned 'Rural'.
Risk of future loss WITH offset (%)	5%	A conservation covenant will be placed over the offset site, thus the risk of loss is considered to be low.
% of impact offset	66.6%	66.6% of the significant residual will be offset by the proposed offset

## Appendix E. Sources of information

### E.1. GIS databases

Publicly available GIS Databases used (sourced from [www.data.wa.gov.au](http://www.data.wa.gov.au)):

- 10 Metre Contours (DPIRD-073)
- Aboriginal Heritage Places (DPLH-001)
- Aboriginal Heritage Places (DPLH-001)
- Cadastre (LGATE-218)
- Cadastre Address (LGATE-002)
- Contours (DPIRD-073)
- DBCA – Lands of Interest (DBCA-012)
- DBCA Legislated Lands and Waters (DBCA-011)
- Directory of Important Wetlands in Australia – Western Australia (DBCA-045)
- Environmentally Sensitive Areas (DWER-046)
- Flood Risk (DPIRD-007)
- Groundwater Salinity Statewide (DWER-026)
- Hydrography – Inland Waters – Waterlines
- Hydrological Zones of Western Australia (DPIRD-069)
- IBRA Vegetation Statistics
- Imagery
- Local Planning Scheme – Zones and Reserves (DPLH-071)
- Native Title (ILUA) (LGATE-067)
- Offsets Register – Offsets (DWER-078)
- Pre-European Vegetation Statistics
- Public Drinking Water Source Areas (DWER-033)
- Ramsar Sites (DBCA-010)
- Regional Parks (DBCA-026)
- Remnant Vegetation, All Areas
- RIWI Act, Groundwater Areas (DWER-034)
- RIWI Act, Surface Water Areas and Irrigation Districts (DWER-037)
- Soil Landscape Land Quality – Flood Risk (DPIRD-007)
- Soil Landscape Land Quality – Phosphorus Export Risk (DPIRD-010)
- Soil Landscape Land Quality – Subsurface Acidification Risk (DPIRD-011)
- Soil Landscape Land Quality – Water Erosion Risk (DPIRD-013)
- Soil Landscape Land Quality – Water Repellence Risk (DPIRD-014)
- Soil Landscape Land Quality – Waterlogging Risk (DPIRD-015)
- Soil Landscape Land Quality – Wind Erosion Risk (DPIRD-016)
- Soil Landscape Mapping – Best Available
- Soil Landscape Mapping – Systems
- Wheatbelt Wetlands Stage 1 (DBCA-021)

Restricted GIS Databases used:

- ICMS (Incident Complaints Management System) – Points and Polygons
- Threatened Flora (TPFL)
- Threatened Flora (WAHerb)
- Threatened Fauna
- Threatened Ecological Communities and Priority Ecological Communities
- Threatened Ecological Communities and Priority Ecological Communities (Buffers)

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