GOVERNMENT OF
WESTERN AUSTRALIA

CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

PERMIT DETAILS

Area Permit Number: CPS 9403/1

File Number: DWERVT8497

Duration of Permit: From 29 February 2024 to 28 February 2030

PERMIT HOLDER

Shire of Corrigin

LAND ON WHICH CLEARING IS TO BE DONE

Rabbit Proof Fence Road Reserve (PINs 11577073, 1156935 and 1156936), Bullaring

AUTHORISED ACTIVITY

The permit holder must not clear more than 12 native trees within the area cross-hatched yellow in Figures 1a-1d and Table 1 of Schedule 1.

CONDITIONS

1. Period during which clearing is authorised

The permit holder must not clear any *native vegetation* after 28 February 2026.

2. 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.

3. Weed 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*:

(a) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;

(b) ensure that no known *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.

4. Directional clearing

The permit holder shall conduct clearing in a slow progressive manner in a single direction towards adjacent *native vegetation* to allow fauna to move into adjacent *native vegetation* ahead of the clearing activity.

5. Fauna management – black cockatoos

(a) Prior to undertaking any clearing authorised under this permit within the combined areas cross-hatched yellow in Figures 1a-1d of Schedule 1, the permit holder must engage a *fauna specialist* to conduct an inspection of the permit area to identify *black cockatoo habitat tree/s* being utilised by *Zanda lateriosis* (Carnaby's black cockatoo).

(b) Where *black cockatoo habitat tree/s* are identified under condition 5(a), the permit holder must engage a *fauna specialist* to map *black cockatoo habitat tree/s* within the permit area.

(c) Each *black cockatoo habitat tree* identified must be inspected by a *fauna specialist* for evidence of current or past breeding use by *black cockatoo species*.

(d) Where a *black cockatoo habitat tree* with no evidence of current or past use by *black cockatoo species* is identified in accordance with condition 5(a), that tree must only be cleared immediately after the inspection.

(e) Where a *black cockatoo habitat tree* is identified within the combined areas cross-hatched yellow in Figures 1a-1d of Schedule 1 and that tree shows evidence of current or past breeding use by *black cockatoo species* under condition 5(c), 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 season.

(f) Any *black cockatoo breeding 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 5(e).

(g) For each *black cockatoo breeding tree* with evidence of current or past breeding use by *black cockatoo species* identified that cannot be avoided, the permit holder must install an artificial black cockatoo nest hollow.

(h) Each artificial black cockatoo nesting hollow required by condition 5(g) must be installed prior to commencement of the next *black cockatoo breeding season* following clearing of the related *black cockatoo breeding trees*.

(i) The artificial black cockatoo nest hollow(s) required by condition 5(g) of this permit must:

(i) be installed within the area cross-hatched red on Figures 2a to 2e of Schedule 2;

(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.

(j) Within two months of clearing authorised under this permit within the combined areas cross-hatched yellow in Figures 1a-1d of Schedule 1, the permit holder must provide the results of the *fauna survey* in a report to the CEO.

(k) The *fauna survey* report must include the following;

(i) the time(s) and date(s) of inspection(s) by the *fauna specialist*

(ii) a description of the *fauna specialist* inspection methods used

(iii) the location of the *black cockatoo habitat tree(s)* recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 2020 (GDA2020), expressing the geographical coordinates in Eastings and Northings or decimal degrees

(iv) the location of any Carnaby's black cockatoos if identified, recorded using a GPS unit set to GDA2020, expressing the geographical coordinates in Eastings and Northings or decimal degrees

(v) the amount of any Carnaby's black cockatoos identified

(vi) whether the *black cockatoo habitat tree/s* identified show current use by Carnaby's black cockatoos

(vii) a photo of the *black cockatoo habitat tree(s)* identified;

(viii) a description of the *black cockatoo habitat tree(s)* identified, including the:

(A) species of *black cockatoo habitat tree(s)*; and

(B) condition of the *black cockatoo habitat tree(s)*.

(ix) the time and date each black cockatoo habitat tree with evidence of current of past breeding use was cleared.

6. Revegetation and rehabilitation

(a) The permit holder shall plant and maintain a minimum total of 21 trees comprising a mixture of York gum (*Eucalyptus loxophleba subsp. loxophleba*) and Salmon gum (*Eucalyptus salmonophloia*) within Rabbit Proof Fence Road Reserve (PINs 11577073, 1156935 and 1156936), Bullaring in Figures 2a-2e of Schedule 2 with the following conditions:

(i) ensuring only *local provenance* seeds and propagating material are used to revegetate and *rehabilitate;*

(ii) ensure planting is undertaken at the *optimal time;*

(iii) undertake *weed* control of *plantings* for at least two years post-*planting;*

(iv) the revegetation is to commence within 12 months of undertaking clearing authorised under this permit and no later than 28 February 2027.

(b) Within 12 months of undertaking *revegetation* in accordance with condition 6(a) of this permit, the permit holder must;

(i) engage an *environmental specialist* to make a determination on whether the planted York gum (*Eucalyptus loxophleba subsp. loxophleba*) and Salmon gum (*Eucalyptus salmonophloia*) trees will survive;

(ii) where, in the opinion of an *environmental specialist* the planted York gum (*Eucalyptus loxophleba subsp. loxophleba*) and Salmon gum (*Eucalyptus salmonophloia*) trees will not survive, the permit holder must undertake additional planting of York gum (*Eucalyptus loxophleba subsp. loxophleba*) and Salmon gum (*Eucalyptus salmonophloia*) to ensure the minimal survival of 21 trees is achieved; and

(iii) where additional planting of York gum (*Eucalyptus loxophleba subsp. loxophleba*) and Salmon gum (*Eucalyptus salmonophloia*) trees is undertaken in accordance with condition 6(b)(ii), the permit holder must repeat the activities required by conditions 6(a)(i-iii) and 6(b)(i-ii) of this permit.

7. 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	(a) the species composition, structure, and density of the cleared area; (b) the location where the clearing occurred,

No.	Relevant matter	Specifications
		recorded using a Global Positioning System (GPS) unit set to GDA2020, expressing the geographical coordinates in Eastings and Northings; (c) the date that the area was cleared; (d) the size of the area cleared (in trees); (e) actions taken to avoid, minimise, and reduce the impacts and extent of clearing in accordance with condition 2; and (f) actions taken to minimise the risk of the introduction and spread of *weeds* in accordance with condition 3.
2.	In relation to black cockatoo management pursuant to condition 5	(a) the time(s) and date(s) of inspection(s) of the suitable *black cockatoo habitat tree* by the *fauna specialist*; (b) a description of the inspection methodology employed by the *fauna specialist*; (c) where the suitable *black cockatoo habitat tree* is determined by the *fauna specialist* to be occupied by black cockatoo species: (i) the time and date that it was determined to be no longer occupied; (ii) description of the evidence by which it was determined to be no longer occupied; and (iii) the time and date that the suitable *black cockatoo habitat tree* was cleared.
8.	In relation to the required revegetation activities in accordance with condition 6	(a) the location where the York gum (*Eucalyptus loxophleba subsp. loxophleba*) and Salmon gum (*Eucalyptus salmonophloia*) trees were planted, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 2020 (GDA20), expressing the geographical coordinates in Eastings and Northings; (b) the date that the area was planted; (c) the number of York gum (*Eucalyptus loxophleba subsp. loxophleba*) and

No.	Relevant matter	Specifications
		Salmon gum (*Eucalyptus salmonophloia*) trees planted; (d) the size (in mm) of the York gum (*Eucalyptus loxophleba subsp. loxophleba*) and Salmon gum (*Eucalyptus salmonophloia*) trees planted; (e) dates of the weed actions undertaken in accordance with condition 6(a)(iii); (f) a copy of the environmental specialist's report; (g) a description of the revegetation activities undertaken; and (h) any remedial actions required to be undertaken.

8. 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 7; 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) Prior to 28 November 2029, the permit holder must provide to the CEO a written report of records required under condition 7, where these records have not already been provided under condition 8(a).

DEFINITIONS

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

Table 2: Definitions

Term	Definition
black cockatoo breeding trees	means *black cockatoo habitat trees* that exhibit *evidence* of current or past breeding use by black cockatoo species
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 *Eucalyptus salmonophloia* or *Eucalyptus wandoo*) that contain hollows suitable for breeding by Carnaby's black cockatoo.
CEO	Chief Executive Officer of the department responsible for the administration of the clearing provisions under the *Environmental Protection Act 1986*.
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.
department	means the department established under section 35 of the *Public Sector Management Act 1994* (WA) and designated as responsible for the administration of the EP Act, which includes Part V Division 3.
environmental specialist	means a person who holds a tertiary qualification specialising in environmental science or equivalent, and has a minimum of 2 years work experience relevant to the type of environmental advice that an environmental specialist is required to provide under the permit, or who is approved by the *CEO* as a suitable *environmental specialist.*
EP Act	*Environmental Protection Act 1986* (WA)
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 specialist	means a person who holds a tertiary qualification specialising in environmental science or equivalent, and has a minimum of 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 150 kilometres and the same 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.
optimum time	means the period from May to June for undertaking planting or seeding
planting/s	means the re-establishment of vegetation by creating favourable soil conditions and planting seedlings of the desired species
rehabilitate	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.
revegetate/ion	means actively managing an area containing native vegetation in order to improve the ecological function of the area.

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

END OF CONDITIONS

Digitally signed by Ryan Mincham
Date: 2024.02.06 14:59:38 +08'00'

Ryan Mincham
MANAGER
NATIVE VEGETATION REGULATION

Officer delegated under Section 20 of the Environmental Protection Act 1986

6 February 2024

SCHEDULE 1: PLANS 9403/1

The boundary of the areas authorised to be cleared is shown in the maps below (Figure 1a, Figure 1b, Figure 1c and Figure 1d).

Figure 1a: Map of the boundary of the area within which clearing may occur

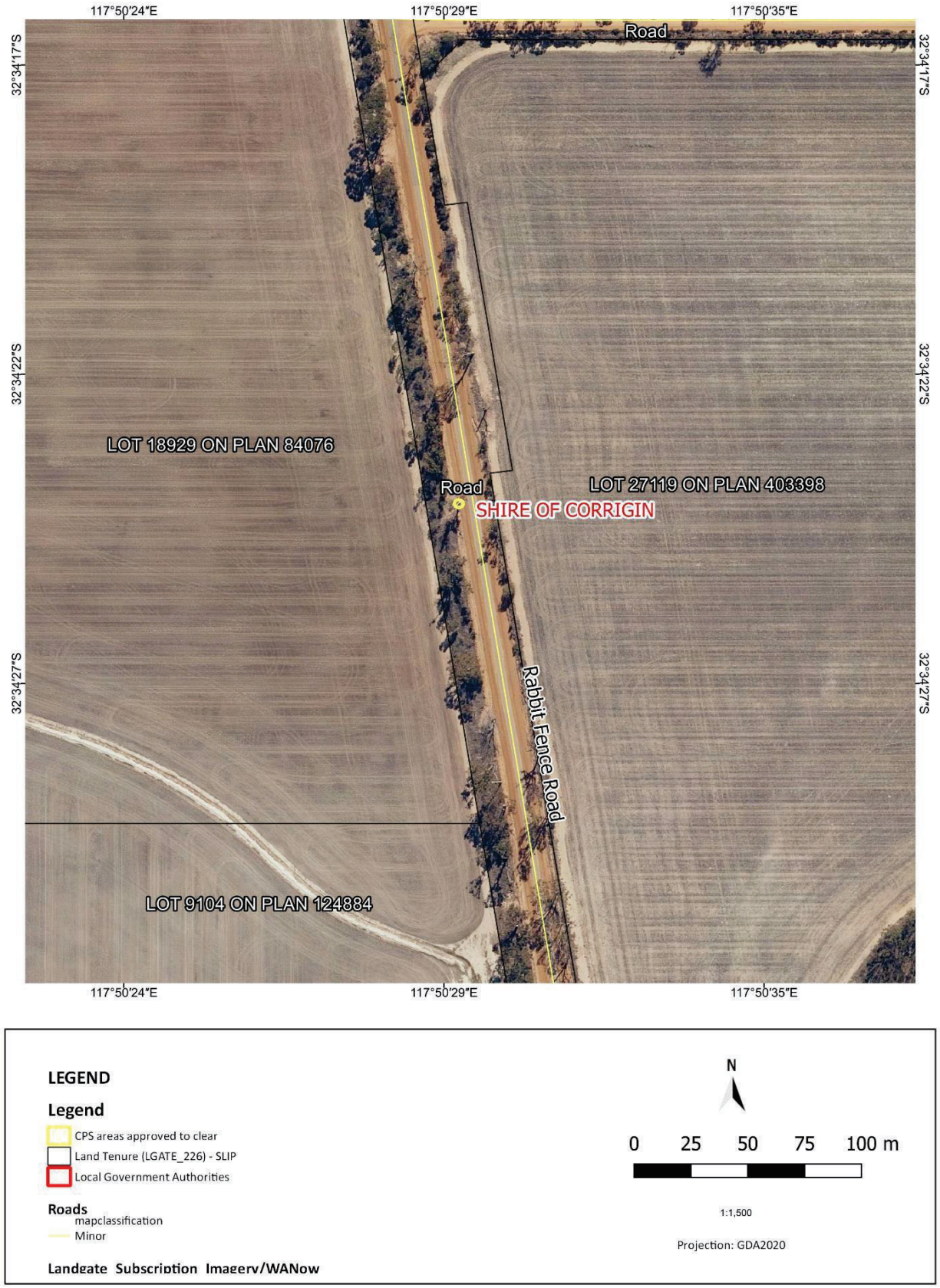


Figure 1b: Map of the boundary of the area within which clearing may occur

Figure 1c: Map of the boundary of the area within which clearing may occur

Figure 1d: Map of the boundary of the area within which clearing may occur

Table 1: Coordinates of trees within area of clearing

Tree	Latitude	Longitude
1	-32.54533691	117.8368298
2	-32.54614731	117.836949
3	-32.54665671	117.8370402
4	-32.57340724	117.8415704
5	-32.57825523	117.8423882
6	-32.57849663	117.8424128
7	-32.57902243	117.8425138
8	-32.57975203	117.8427666
9	-32.57993023	117.8428024
10	-32.58000863	117.8428058
11	-32.58607921	117.8437192
12	-32.58062943	117.8427898

SCHEDULE 2

The boundaries of the areas within which planting is to occur is shown cross-hatched red in the maps below (Figure 2a, Figure 2b, Figure 2c, Figure 2d and Figure 2e).

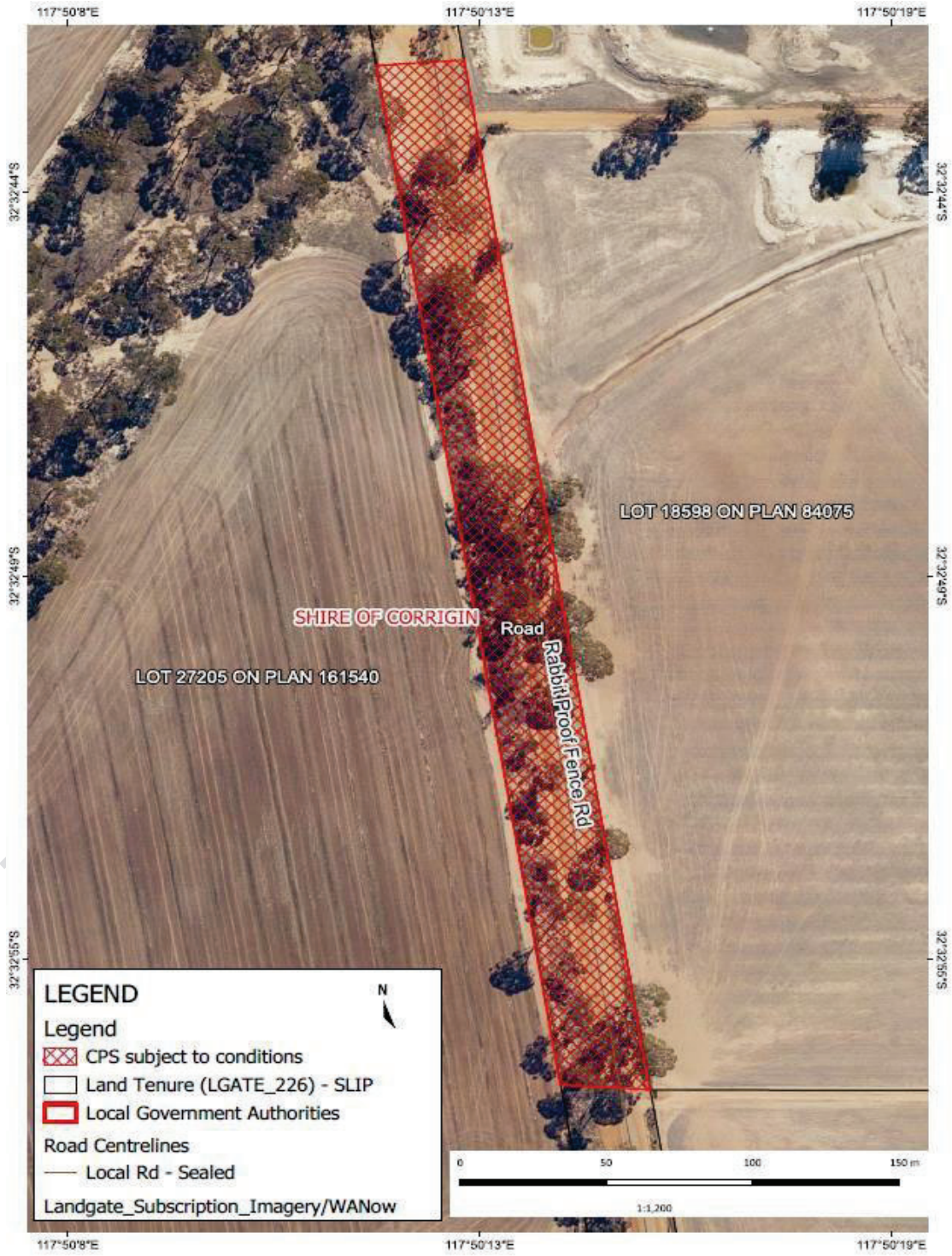


Figure 2a: Map of the boundary of the areas within which planting and nest box installation must occur

Figure 2b: Map of the boundary of the areas within which planting and nest box installation must occur

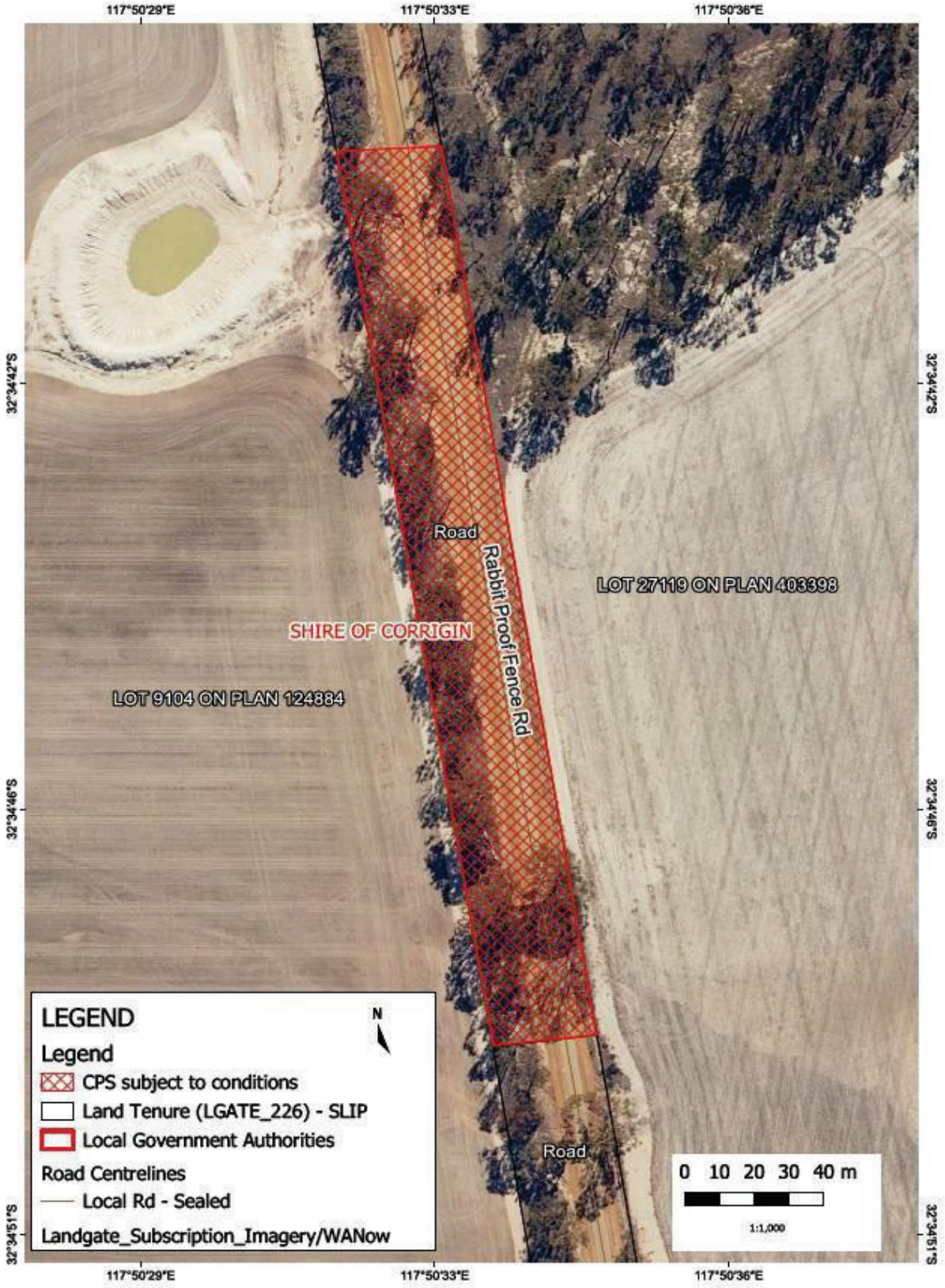


Figure 2c: Map of the boundary of the areas within which planting and nest box installation must occur

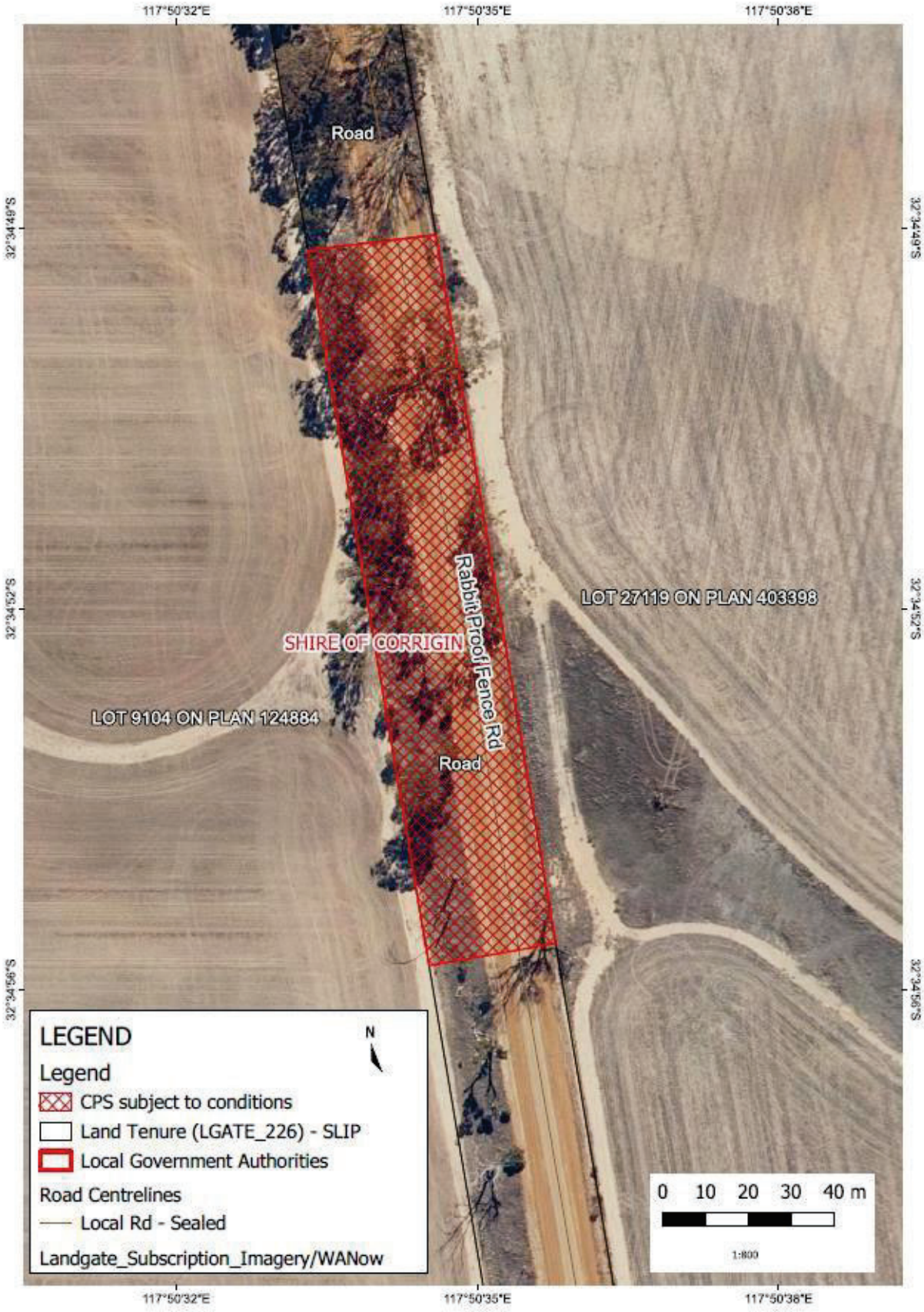


Figure 2d: Map of the boundary of the areas within which planting and nest box installation must occur

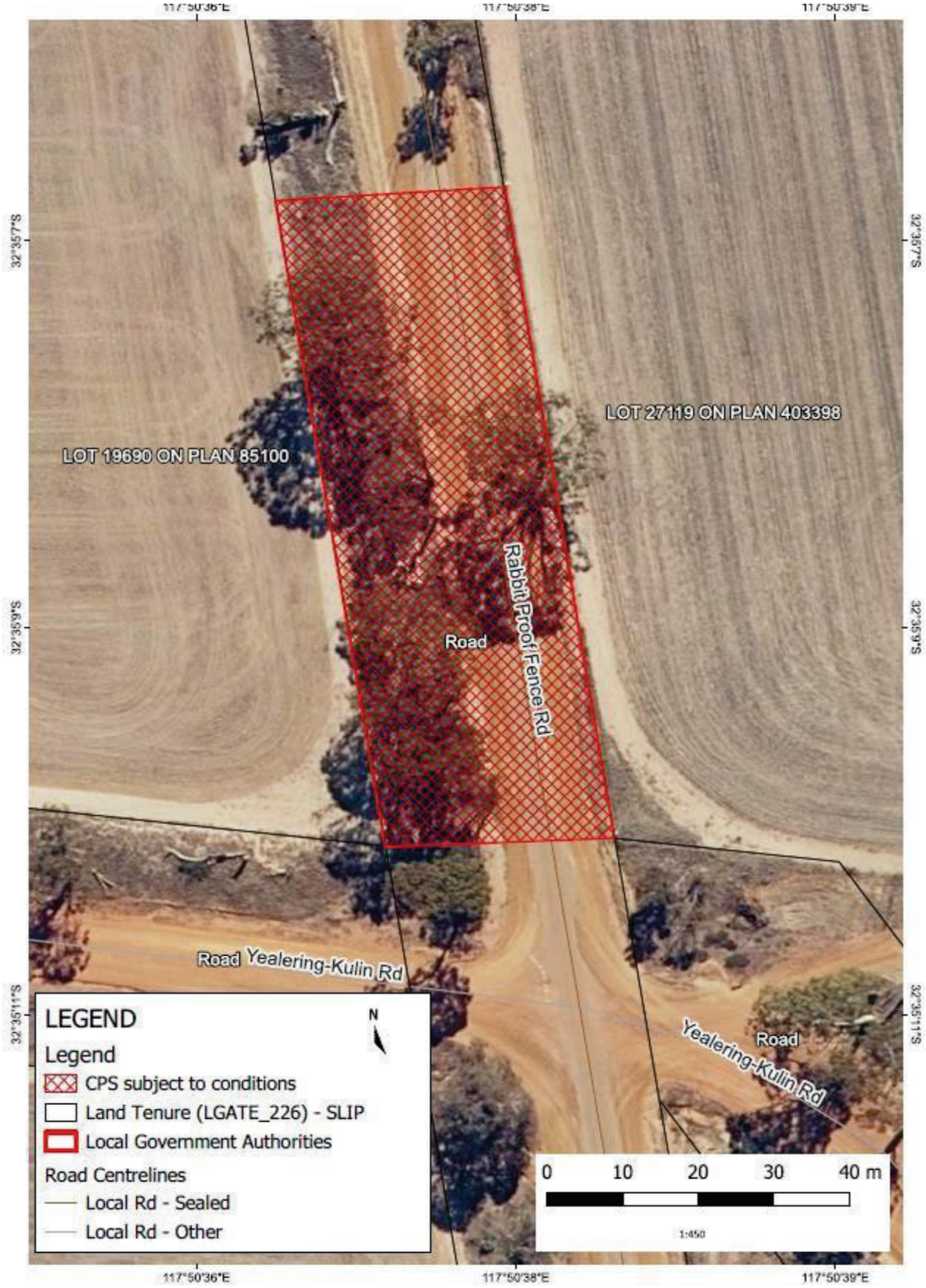


Figure 2e: Map of the boundary of the areas within which planting and nest box installation must occur

SCHEDULE 3

How to design, monitor and maintain artificial hollows for Black cockatoo species

Department of Biodiversity, Conservation and Attractions
GOVERNMENT OF WESTERN AUSTRALIA

FAUNA NOTES

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.

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

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.

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.

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.

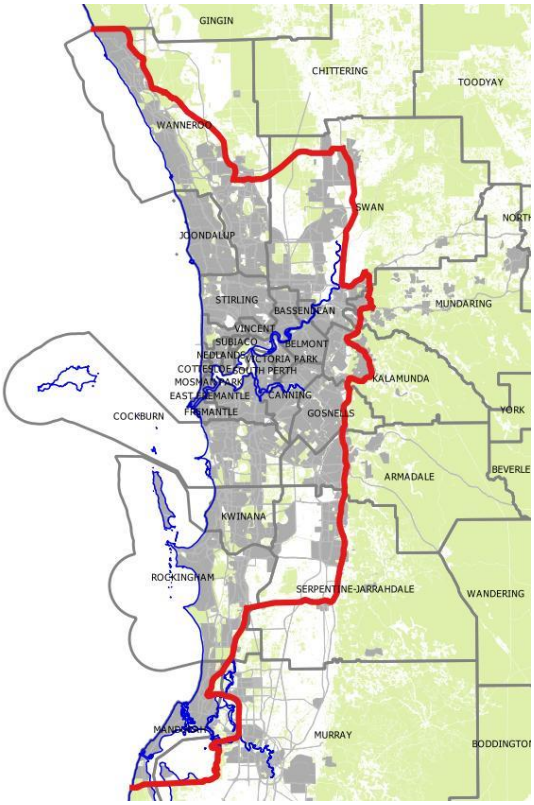
Is my site suitable for artificial hollows?

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.



Installing artificial hollows in built up areas to the west of the red line above, increases the risk of harm to birds. No artificial hollows should be installed west of this line. (green = remnant vegetation; grey = extent of existing and future urban and industrial development)

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.	**The site is Eucalypt woodland or forest within the known breeding range of the species**	
	Important consideration	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.
	Alternative conservation actions	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.	**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.**	

	Important consideration	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.
	Alternative conservation actions	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. 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. 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. To compile a list of plant species suitable for revegetation at your site, refer to the document *Plants Used by Carnaby's Black Cockatoo* available on the Department of Biodiversity, Conservation and Attractions (DBCA) black cockatoo webpage.
3.	**The artificial hollows can be located in close proximity to adequate feeding areas – within a 12 km radius.**	
	Important consideration	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 *Plants Used by Carnaby's Black Cockatoo*.
	Alternative conservation actions	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.	**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.**	
	Important consideration	For advice on the monitoring and maintenance requirements, please refer to the section on how to monitor and maintain artificial hollows.
	Alternative conservation actions	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.	**A suitable artificial hollow design is used.**	
	Important consideration	For greatest chance of success, please refer to the sections below on how to design and place artificial hollows.
	Alternative conservation actions	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)

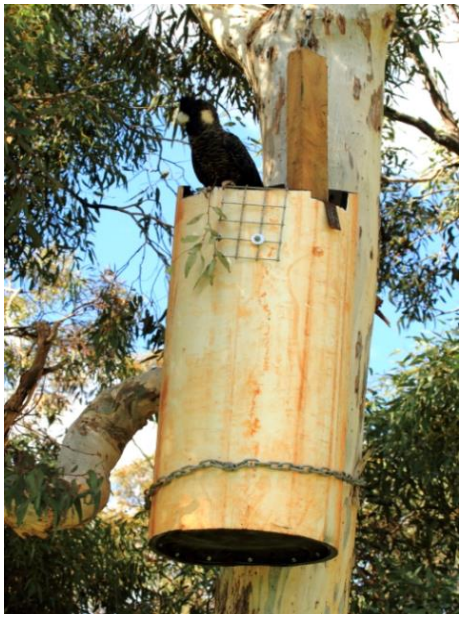




Photo: Christine Groom (left), Rick Dawson (centre and right)

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;

- 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. Zincalume®), 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.

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

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. Records should be submitted to the Department by emailing 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

<table>
<tr><th>Technique</th><th>Description of Technique</th></tr>
<tr><td>Looking for signs of use</td><td>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.</td></tr>
<tr><td>Observing parent behaviour around a hollow</td><td>The behaviour of parent birds around a hollow can indicate an approximate age of young in the nest.
<table>
<tr><th>Parent Behaviour</th><th>Approximate Stage and Age of Young</th></tr>
<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 (< 3 - 4 weeks)</td></tr>
<tr><td>Both parents seen entering/exiting the hollow</td><td>Nestling(s) has hatched (> 3 - 4 weeks)</td></tr>
</table></td></tr>
<tr><td>Observing feeding flocks</td><td>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).</td></tr>
<tr><td>Tapping to flush female</td><td>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.
Tapping or scraping is best undertaken between 10 am - 3 pm when females will most likely to be sitting.</td></tr>
<tr><td>Observing insect activity around a nest</td><td>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.</td></tr>
<tr><td>Listening for nestling</td><td>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.</td></tr>
<tr><td>Looking inside a nest</td><td>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.</td></tr>
</table>

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,

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.	• Looking for signs of use (evidence of chewing) • Observing behaviour of adults around a hollow • Tapping or scraping to flush female • Listening for nestlings • Looking inside nest
To confirm use by black cockatoos	At least two visits during peak breeding season.	• Looking for signs of use (evidence of chewing) • Observing behaviour of adults around a hollow • Tapping or scraping to flush female • Listening for nestlings • Looking inside a nest Observing breeding evidence from at least two of the techniques confirms use by black cockatoos.
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.	• Observing insect activity around a nest • Listening for nestlings • Looking inside a nest The presence of eggs or nestlings inside a nest will help to determine nesting success.
To determine use by any species	As often as possible.	As a minimum, inspection from the ground: • Looking for signs of use To confirm: • Looking inside a nest
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.

Artificial hollow base needing repair.
Photo by Christine Groom

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.

Maps of Black Cockatoo Breeding Range

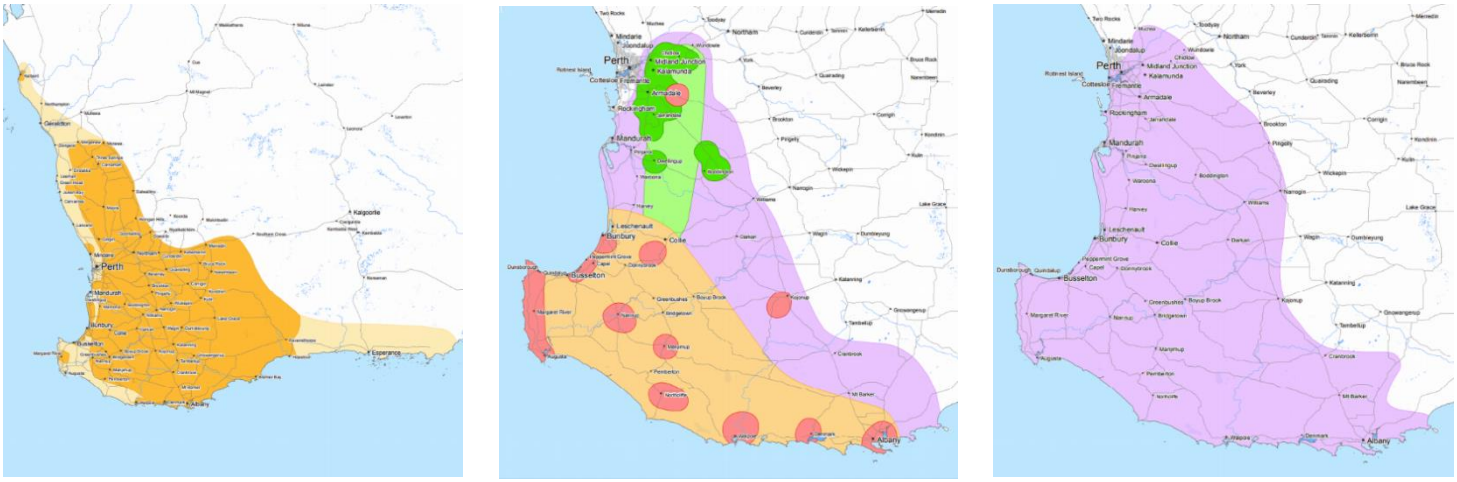


Image: Commonwealth of Australia, 2011

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.

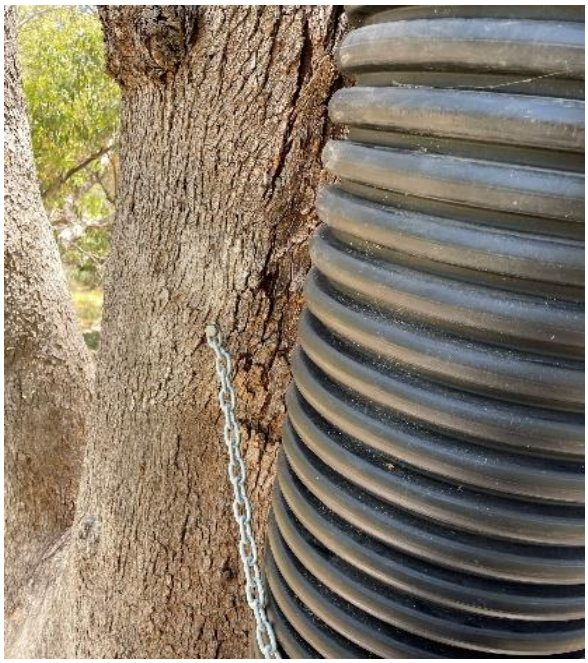
Artificial Hollows – best current design and installation specifications

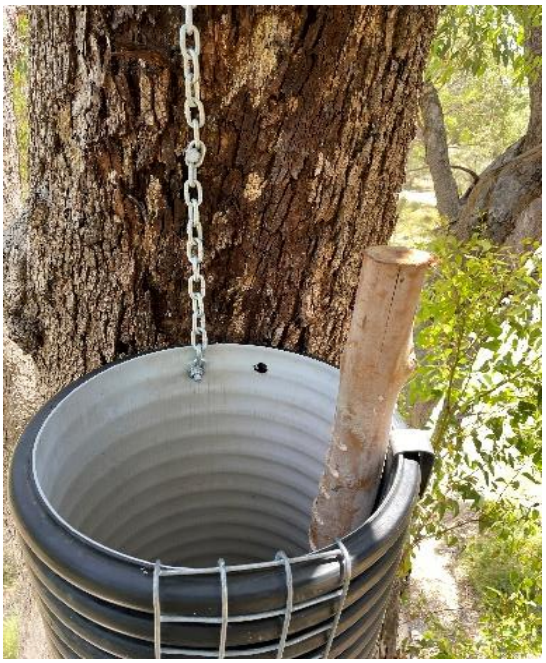
The specifications below outline the most recent detailed specifications for artificial hollow construction installation and maintenance. These would provide for a well-constructed and installed artificial hollow that is most likely to have an adequate lifespan (minimum 50-years). To ensure longevity, 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.





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 course, 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

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.

Citation

Department of Biodiversity, Conservation and Attractions. (2023). *Fauna Notes – Artificial hollows for black cockatoos*. Retrieved from http://www.dbca.wa.gov.au/

Disclaimer

Last updated: 08 Feb 2023

Government of Western Australia
Department of Water and Environmental Regulation

Clearing Permit Decision Report

1 Application details and outcome

Permit application details

Permit number:	CPS 9403/1
Permit type:	Area permit
Applicant name:	Shire of Corrigin
Application received:	23 August 2021
Application area:	12 native trees
Purpose of clearing:	Road widening
Method of clearing:	Mechanical Removal
Property:	Rabbit Proof Fence Road Reserve (PINs 11577073, 1156935 and 1156936)
Location (LGA area):	Shire of Corrigin
Localities (suburb):	Bullaring

1.1. Description of clearing activities

The vegetation proposed to be cleared is distributed across the Rabbit Proof Fence Road Reserve (PINs 11577073, 1156935 and 1156936) (see Figure 1, Section 1.4).

The size and location of application area was revised during the assessment process by the Shire of Corrigin (the applicant), to be within a different section of the Rabbit Proof Fence Road Reserve (PIN 11569829), with the amount of clearing reduced from 2.35 hectares to 12 individual trees. See Figure 2, Appendix E (3.3.2), for details of the original application area.

1.2. Decision on application

Decision:	Granted
Decision date:	6 February 2024
Decision area:	12 native trees, as depicted in Section 1.5, below.

1.3. Reasons for decision

This clearing permit application was submitted, accepted, assessed and determined in accordance with sections 51E and 51O of the *Environmental Protection Act 1986* (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 Appendix B), relevant datasets (see Appendix 0), the findings of a flora and vegetation survey and a site inspection undertaken by Rapallo Environmental (see Appendix E), the clearing principles set out in Schedule 5 of the EP Act (see Appendix C), relevant planning instruments and any other matters considered relevant to the assessment (see Section 3.3).

The Delegated Officer also took into consideration that the road upgrade is part of a statewide Wheatbelt Secondary Freight Network project to provide safer roads for the movement of major grain, livestock, hay and general freight from farms to markets.

The assessment identified that the proposed clearing will result in:

- the loss of 12 trees representing foraging habitat for the endangered Carnaby's black cockatoo;
- the loss of trees that may contain potentially suitable breeding hollows for Carnaby's black cockatoo;
- the loss of native vegetation that is significant as a remnant of native vegetation in an area that has been extensively cleared; and
- the potential introduction and spread of weeds into adjacent vegetation, which could impact on the quality of the adjacent vegetation and its habitat values.

After consideration of the available information, as well as the applicant's minimisation and mitigation measures (see Section 3.1), the Delegated Officer determined the proposed clearing is unlikely to lead to unacceptable impacts to the environment.

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;
- undertake slow, progressive one directional clearing to allow terrestrial fauna to move into adjacent habitat ahead of the clearing activity;
- engage a fauna specialist to inspect habitat trees for the presence of Carnaby's black cockatoo prior to clearing, to ensure individuals are not impacted during the clearing process. The clearing of trees where these species have been identified is not permitted, until the fauna specialist has verified that the hollow/s are no longer being utilised for nesting;
- install, at a rate of 1:1 for each suitable hollow(s) proposed to be cleared, artificial black cockatoo nesting hollows within land managed by the Shire, to mitigate impacts associated with the loss of trees containing suitably sized hollows for breeding by Carnaby's black cockatoos, and
- deliberate planting of at least 21 trees comprising a combination of York gum (*Eucalyptus loxophleba* subsp. *loxophleba*) and Salmon gum (*Eucalyptus salmonophloia*) will be required to be planted and maintained within the road reserve, as a mitigation measure for the clearing of 12 native trees that provide fauna habitat value, within an extensively cleared landscape.

1.4. Site maps

Figure 1a - Map of the application area

The areas cross-hatched yellow indicate the areas authorised to be cleared under the granted clearing permit.

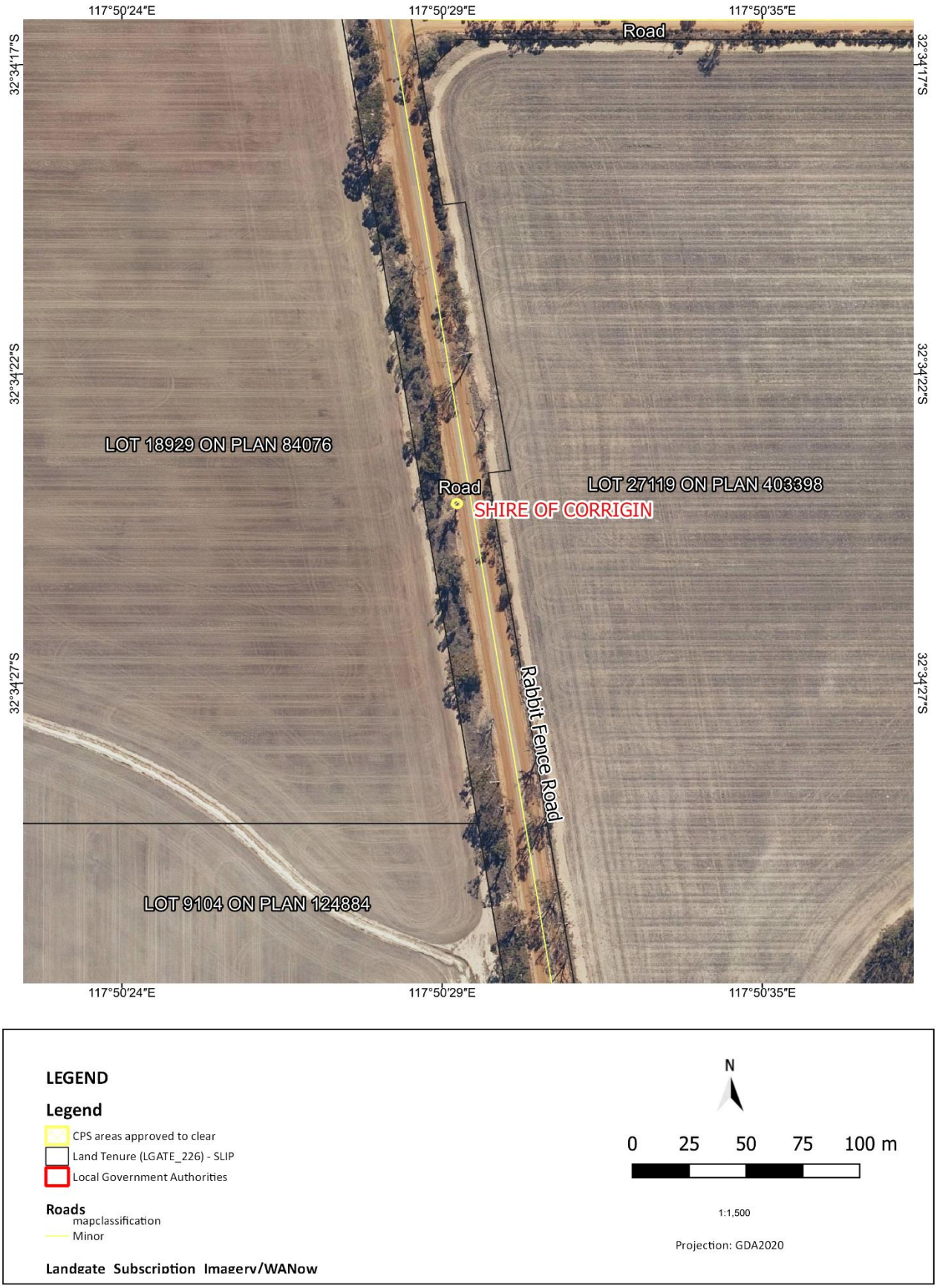


Figure 1b - Map of the application area

The areas cross-hatched yellow indicate the areas authorised to be cleared under the granted clearing permit.

Figure 1c - Map of the application area

The areas cross-hatched yellow indicate the areas authorised to be cleared under the granted clearing permit.

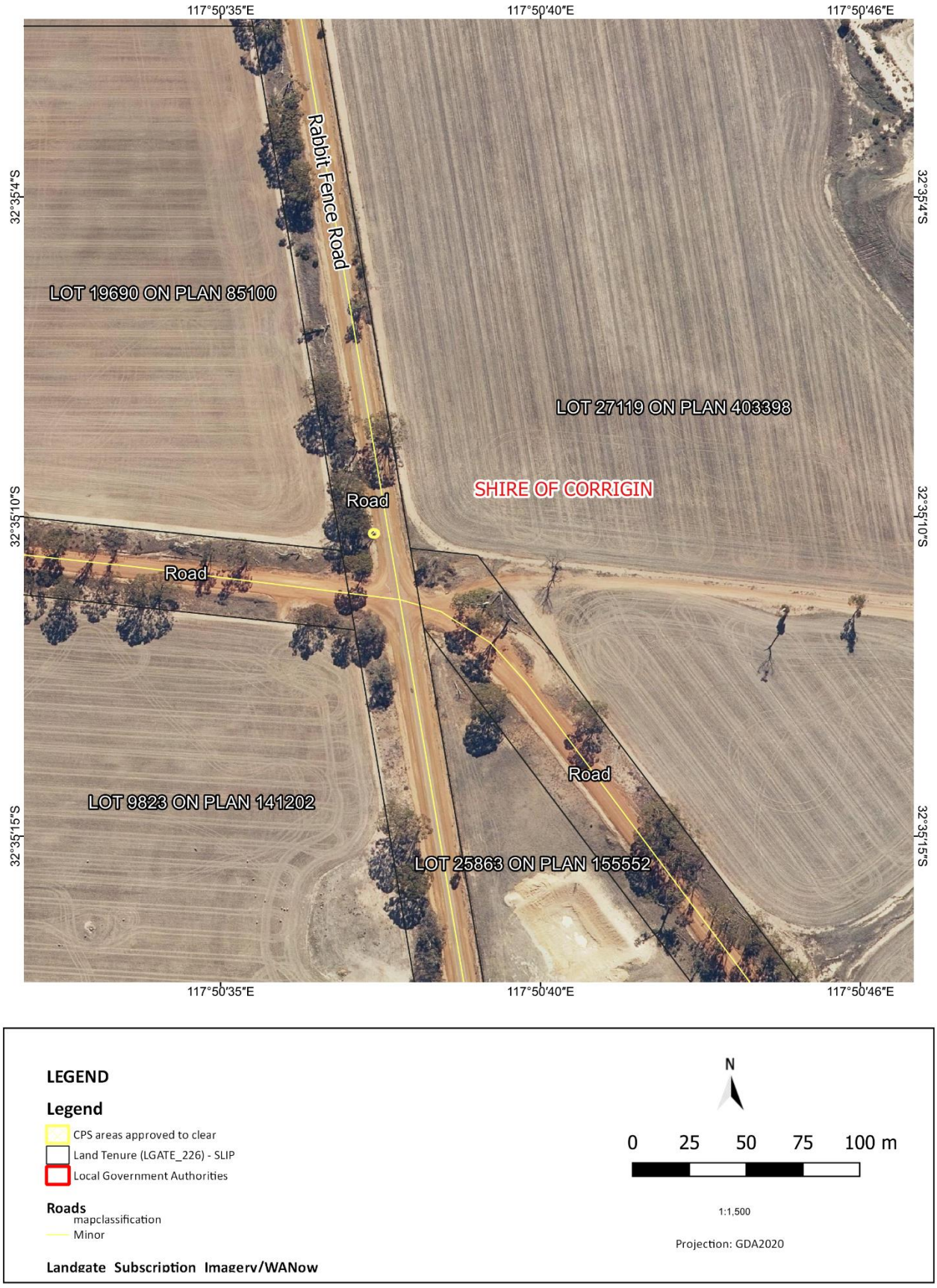


Figure 1d - Map of the application area

The areas cross-hatched yellow indicate the areas authorised to be cleared under the granted clearing permit.

2 Legislative context

The clearing of native vegetation in Western Australia is regulated under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations).

In addition to the matters considered in accordance with section 51O of the EP Act (see Section 1.4), the Delegated Officer has also had regard to the objects and principles under section 4A of the EP Act, particularly:

- the precautionary principle
- the principle of intergenerational equity
- the principle of the conservation of biological diversity and ecological integrity.

Other legislation of relevance for this assessment include:

- *Biodiversity Conservation Act 2016* (WA) (BC Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)

The key guidance documents which inform this assessment are:

- *A guide to the assessment of applications to clear native vegetation* (DER, December 2013)
- *Procedure: Native vegetation clearing permits* (DWER, October 2019)
- Technical guidance – *Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016)

3 Detailed assessment of application

3.1. Avoidance and mitigation measures

Evidence was submitted by the applicant (Shire of Corrigin, 2021; 2023b), demonstrating that the Shire has explored a number of engineering designs to reduce the proposed clearing, however, given the proximity of trees to the edge of the road, there is a risk to motorists.

The applicant has committed to the following avoidance and minimisation measures which will be implemented:

- the road construction widening has been done in a way to retain the existing corridor of native vegetation;
- minimising disturbance to remnant vegetation when maintaining the road, with the applicant committing to only clearing within a two-metre circumference of the trees to be cleared. The individual trees in the clear zone of the road reserve will be removed with minimal or no impact on to be wider landscape;
- weed control to assist with establishment of new seedlings, with controlling weeds on road verges to reduce competition and ensure native species can thrive;
- the planting of 21 trees from local provenance seeds and protecting the rehabilitation sites from fire by requiring fire breaks (Shire of Corrigin, 2023b).

The applicant advised that the road upgrade was part of a statewide Wheatbelt Secondary Freight Network project to provide safer roads for the movement of major grain, livestock, hay and general freight from farms to markets (Shire of Corrigin, 2023b). The applicant advised that this road is high priority for the Shire to upgrade, given the speeds travelled along this stretch of road by motorists and that the removal of 12 individual trees will be done with care to preserve the remaining vegetation in the road reserve to ensure there is suitable and adequate corridors for native fauna (Shire of Corrigin, 2023b).

After consideration of avoidance and mitigation measures, it was determined that further avoidance and/or mitigation measures were required to counterbalance the impacts to native vegetation within a highly cleared landscape. Upon request from the Department, the Shire has committed to the planting of 21 native trees within the Rabbit Proof Fence Road reserve to mitigate the loss of 12 trees.

The Delegated Officer was satisfied that the applicant has undertaken reasonable measures to avoid and minimise potential impacts of the proposed clearing on environmental values.

3.2. Assessment of impacts on environmental values

In assessing the application, the Delegated Officer has had regard for the site characteristics (see Appendix B) and the extent to which the impacts of the proposed clearing present a risk to biological, conservation, or land and water resource values.

The assessment against the clearing principles (see Appendix C) identified that the impacts of the proposed clearing present a risk to black cockatoo habitat and significant remnant vegetation. The consideration of these impacts, and the extent to which they can be managed through conditions applied in line with sections 51H and 51I of the EP Act, is set out below.

3.2.1. Biological values (biodiversity or flora) - Clearing Principles (a) and (c)

Assessment:

The application area is located within the Avon Wheatbelt IBRA region. Photographs supplied by the applicant and the flora and vegetation survey (Rapallo Environmental, 2023a and 2023b) indicate the vegetation within the proposed clearing area is largely consistent with the mapped vegetation type for the application area, which is Beard vegetation association 1023, described as Wheatbelt woodland (other); York gum, salmon gum etc. *Eucalyptus loxophleba, E. salmonophloia,* Goldfields; gimlet, redwood etc. *E. salubris, E. oleosa*. Riverine; rivergum *E. camaldulensis*.

A targeted flora and vegetation survey was completed by Rapallo Environmental (2023a) on 6 and 7 December 2022. As per the Environmental Protection Authority's (EPA) *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (December 2016) (EPA, 2016a), it is noted that Rapallo completed the survey out of the recommended flowering season (September to November) for the some of the flora species. Rapallo advised that the survey intersected with the flowering time of three target taxa: *Lechenaultia pulvinaris (*October-December), *Microcorys cephalantha (*October-December), and *Oxymyrrhine cordata* (December-January), while *Grevillea scapigera* being at the end of its flowering period (February or October - November) might still be detected during the targeted flora survey (Rapallo Environmental, 2023a).

Upon review of Rapallo's targeted flora and vegetation survey, the Department requested further information from the applicant to provide adequate demonstration that the nine conservation significant flora species identified as potentially occurring within the area proposed to be cleared had a low likelihood of being present.

In response to the above request, Rapallo undertook a follow-up site inspection on 24 October 2023, within the recommended flowering period, to further identify if the nine conservation significant flora species had the potential to occur within the proposed clearing area (Rapallo, 2023b). For each tree within the proposed clearing area, an area within two metres surrounding the base of the tree was carefully inspected. None of the target taxa were recorded, nor were any plants recorded that resembled the target taxa, or which belonged to the same genus as the target taxa (Table 2, Appendix E (section 3.3)). All non-target taxa were recorded and identified in the field to genus level or as a minimum family level (Rapallo, 2023b).

Photographs were taken of all the trees proposed to be cleared, including up to two-metres surrounding each tree (see Appendix E (section 3.3)). The coordinates for each of the trees were recorded by hand-held GPS units. All trees grew close to the edge of the road, and the ground surrounding the trees comprised between 30-70 percent bare soil, gravel, or bitumen, which is expected for verge trees. The vegetated area surrounding the trees was generally dense. Between five and ten different understorey taxa were recorded per tree, however, none of these comprised the target taxa, or belonged to the same family as the target taxa.

Based on Rapallo's revised analysis, the site inspection found no evidence of any of the nine target flora taxa (nor plants resembling these taxa) within two metres of the trees proposed to be cleared, within the application area (see photographs in Appendix E (section 3.3).

No Threatened Ecological Communities (TECs) listed under the *Biodiversity Conservation Act 2016* or *Environment Protection and Biodiversity Conservation Act 1999*, or Priority Ecological Communities (PECs), have been mapped or identified within the application area.

While several sections of the application area are adjacent to patches of Eucalyptus Woodland of the Western Australian Wheatbelt (Eucalyptus Woodland), which is classified as a TEC, based on the representative photographs provided and surveys conducted, the application area would not meet the criteria for the Eucalyptus Woodlands TEC. The vegetation within the immediate vicinity of the trees to be cleared largely comprises exotic species and is in a completely degraded to degraded (Keighery, 1994) condition, on which basis it would not meet the condition thresholds to be representative of the Eucalyptus Woodland TEC (see photographs in Appendix E (section 3.3)).

Conclusion:

The Department has determined that the application area is unlikely to comprise of a high level of biodiversity, noting that it is 12 individual trees to be cleared, with no or little understorey and within a completely degraded (Keighery, 1994) to degraded condition. A weed management condition will be placed on the permit, to minimise impacts to surrounding native vegetation.

Conditions:
To address the above impacts, the following management measures will be required as conditions on the clearing permit:

- avoidance and minimisation; and
- weed management measures will be required as a condition on the clearing permit to mitigate impacts to adjacent vegetation.

3.2.2. Biological values (fauna) - Clearing Principles (b)

Assessment:

According to available databases, a total of two conservation significant fauna species have been recorded within the local area (10-kilometre radius of the application area); the Peregrine falcon *(Falco peregrinus*) and Tammar wallaby (*Notamacropus eugenii derbianus*). Given that the application area comprises of 12 individual trees, with no or little understorey within the road reserve, the Department has identified that it is unlikely to provide significant habitat for the Peregrine falcon (Australian Museum, 2019), or ground dwelling fauna such as the Tammar wallaby), however, may contribute to ecological linkage function between remnants of native vegetation.

Black cockatoos

While no records of any of the black cockatoo species were recorded within the 10-kilometre local area, the application area is located within the mapped breeding distribution of Carnaby's black cockatoo (*Zanda latirostris*, EN). Black cockatoo species are noted to forage on a range of plant species, with the primary foraging resources varying between species (Commonwealth of Australia, 2012). Carnaby's cockatoos forage on the seeds, nuts, and flowers of a variety of plants, including Proteaceous species (*Banksia spp., Hakea spp., and Grevillea spp*.), as well as *Allocasuarina* and *Eucalyptus* species, marri, and a range of introduced species (Valentine and Stock, 2008). The seasonal movements of black cockatoos mean they require large areas of habitat for breeding, night roosting and foraging, as well as connectivity between these habitats to assist their movement through the landscape (Commonwealth of Australia, 2012). The assessment has considered the potential impacts of the proposed clearing on all types of black cockatoo habitat.

The decline of Carnaby's cockatoo has been due primarily to the loss and fragmentation of habitat, as a result of clearing of native vegetation, since the middle of the 20th century (Saunders 1979b, 1980, 1986, 1990; Saunders and Ingram 1987, 1995). Approximately 87 per cent (525,732 hectares) of potential Carnaby's cockatoo habitat (i.e. areas of vegetation that contain flora species and vegetation types that could support the species' breeding, feeding and night roosting activities) has been cleared in the Wheatbelt since European settlement (DEC unpublished data, 2010). As a result of historical and current threats, Carnaby's cockatoo has undergone a major decline in range, particularly in drier areas and the central wheatbelt (Saunders 1990; Johnstone and Storr 1998).

In the short-term (decades), the loss or degradation of feeding habitat adjacent (i.e. less than 12-kilometres) to breeding sites is considered to pose the greatest risk to Carnaby's cockatoos (Saunders and Ingram 1998). The clearance of foraging resources around breeding sites and the removal of corridors of native vegetation that connect breeding and foraging sites in the Wheatbelt region of Western Australia reduces the amount of food available for breeding birds, which will lead to a reduction in productivity and survival of young (Saunders 1977, 1980, 1982, 1986; Saunders *et al*., 1985; Saunders and Ingram 1987, 1998).

The flora and vegetation survey found the following tree species within the application area; York gum (*Eucalyptus loxophleba* subsp*. loxophleba*) and Salmon gum (*Eucalyptus salmonophloia*) (Rapallo Environmental, 2023a), which are utilised by Carnaby's black cockatoo (Bamford, 2013). The Salmon gum is noted to be a primary foraging species and a more commonly used species for nesting by the Carnaby's cockatoo, while the York gum is noted to be a secondary foraging species and a less commonly used species for nesting by the Carnaby's cockatoo (DoEE 2017, DSEWPaC 2012, Groom 2011, Johnstone et al 2010).

Significant habitat refers to the resources (breeding, resting and feeding) connectivity or habitat for a species or community that is critical for its survival. Food resources within the range of roost sites are important to sustain populations of black cockatoos, and foraging resources should therefore be viewed in the context of the proximity to the known night roosting sites to the application area. Black cockatoos will generally forage up to 12 kilometres from an active breeding site. Following breeding, they will flock in search of food, usually within six kilometres of a night roost, but may range up to 20 kilometres (DAWE, 2022).

Suitable breeding habitat for these species includes trees which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow. Suitable DBH for nest hollows is 500 millimetres for most tree species, however, is reduced to 300 millimetres for Wandoo and Salmon gum (Commonwealth of Australia, 2012). Carnaby's cockatoo typically nests in Eucalypt woodlands, primarily in the hollows of wandoo, salmon gum and marri in hollows that are 2.5 to 12 metres above the ground and have an entrance of 23 to 30 centimetres with a depth of 1 to 2.5 metres (Groom, 2010).

A black cockatoo habitat assessment has not been undertaken by the applicant and based on representative photographs provided (Shire of Corrigin, 2023c; Rapallo, 2023b), it appears that there are some trees within the application area, which may contain suitable breeding hollows for Carnaby's cockatoo. The loss of breeding hollows and reduced nest availability through land clearing and destruction of habitat has been identified as one of the key threats to Carnaby's cockatoo, contributing to increased competition for hollows and reduced breeding rates and reproductive success (DPAW, 2013). Studies have shown that it may also take up to 200 years for a Eucalypt to develop suitable nest hollows for black cockatoo species (Saunders et al., 1982; Rose, 1993; Whitford and Williams, 2002), which represents a significant time lag between the loss and replacement of breeding habitat (EPA, 2019). Given the above, the loss of suitable breeding hollows is considered to represent a significant impact to Carnaby's cockatoo. As a black cockatoo habitat assessment has not been completed by the applicant, a pre-clearance survey condition will be placed on the permit, to be undertaken prior to the time of the clearing to identify any suitable black cockatoo hollows within the trees proposed to be cleared.

Roosting habitat is defined as a suitable tree (generally the tallest) or group of tall trees, native or introduced, usually close to an important water source, within an area of quality foraging habitat within the range of each black cockatoo species which provide black cockatoos with shelter during the heat of the day and safe resting places at night (Department of the Environment and Energy, 2017). Individual night roosting sites need suitable foraging habitat and water within six kilometres (EPA, 2019). Overlapping foraging ranges within 12-kilometres also support roosting sites and maintain habitat connectivity and movement across the landscape (EPA, 2019).

There are no recorded roost sites within the local area, with the assessment determining that the application area does not likely provide significant roosting habitat for Carnaby's black cockatoo. However, there is one confirmed breeding site located approximately 8.18 kilometres south-east from the application area, and it possible that the foraging habitat within the application area may support breeding by black cockatoos given the low vegetation extent within the local area.

Ecological linkage

The application area forms part of roadside vegetation, which has connectivity to other vegetation within the road reserve. The applicant is not clearing all of the native vegetation within the road reserve, and has only selected 12 trees which border the road itself. The purpose of this application is to provide a safe and efficient road to motorists travelling along the Rabbit Proof Fence Road. The small scale of clearing proposed is unlikely to significantly impact ecological linkage function at a landscape level, noting that native vegetation will remain within the road reserve. The proposed clearing is not likely to have a significant impact on the ability of Carnaby's black cockatoo to move across the landscape.

The Shire will mitigate the loss of 12 trees by planting at least 21 trees within the Rabbit Proof Fence Road reserve (PINs 11569835, 11569836 and 11577073), Bullaring (Shire of Corrigin, 2023c). The Department has assessed the suitability of this mitigation measure. The mitigation planting proposed was input into the WA Environmental Offsets Metric Calculator to determine the ratio required to mitigate the loss of 12 trees. Based on this calculation, 21 trees were determined to be a suitable mitigation measure. A significant residual impact does not remain following the mitigation planting. The Department considers that the mitigation planting aligns with the *WA Environmental Offset Policy* (2011) and *WA Environmental Offsets Guideline* (2014).

Conclusion:

Based on the above assessment, the proposed clearing may impact on black cockatoo breeding and foraging habitat The proposed clearing and associated clearing activities have the potential to introduce weeds into the surrounding vegetation which may lead to further loss in quality of vegetation. A weed management condition will be required to assist in mitigating impacts to surrounding vegetation. In addition, the permit will condition slow, directional clearing to mitigate potential impacts on any conservation significant fauna species that may be utilising the trees within the application area at the time of clearing.

Outcome:
To mitigate the loss of 12 trees, the Shire has proposed to plant at least 21 trees within the Rabbit Proof Fence Road reserve (PINs 11569835, 11569836 and 11577073), Bullaring (Shire of Corrigin, 2023c), to ensure the clearing will not contribute to the decline of black cockatoo foraging habitat within the local area.

Conditions:
To address the above impacts, the following management measures will be required as conditions on the clearing permit:

- weed management;
- undertake slow, progressive one directional clearing to allow terrestrial fauna to move into adjacent habitat ahead of the clearing activity;
- pre-clearance inspection - a fauna specialist to inspect habitat trees prior to clearing for past or current breeding use by black cockatoo species. Artificial hollows must be installed at a rate of 1:1 where the clearing of black cockatoo breeding trees cannot be avoided;
- undertake planting of at least 21 trees within the Rabbit Proof Fence Road Reserve (PINs 11577073, 1156935 and 1156936).

3.2.3. Significant remnant vegetation - Clearing Principle (e)

Assessment:

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 (i.e. pre-European settlement) (Commonwealth of Australia, 2001). This is the threshold level below which species loss appears to accelerate exponentially at an ecosystem level.

The application area falls within the Avon-Wheatbelt IBRA region and the Beard vegetation association 1023, that retain 18.51 and 10.84 per cent of their pre-European extent, respectively. Additionally, a review of available databases determined that the local area retains approximately 9.33 per cent of its pre-European native vegetation extent. As such, all three groups are inconsistent with the national objectives (Commonwealth of Australia, 2001). Due to the highly fragmented nature of the vegetation within the local area, the proposed clearing area is considered significant as a remnant in an extensively cleared landscape.

Conclusion:

Noting the extent of native vegetation remaining within the IBRA bioregion and local area and given the mapped vegetation association retain less than 30 per cent of their pre-European vegetation extent, the application area is considered to be within an extensively cleared area.

The proposed clearing and associated clearing activities have the potential to introduce and/or spread weeds into the surrounding vegetation which may lead to further loss in quality of vegetation.

To mitigate the loss of 12 trees, the Shire has proposed to plant at least 21 trees within the Rabbit Proof Fence Road Reserve (PINs 11577073, 1156935 and 1156936), to ensure the clearing will not contribute to the decline of vegetation within the local area.

Conditions:

To address the above impacts, the following management measures will be required as conditions on the clearing permit:

- weed management measures to mitigate impacts to adjacent vegetation;
- undertake planting of at least 21 trees within the Rabbit Proof Fence Road Reserve (PINs 11577073, 1156935 and 1156936).

3.3. Relevant planning instruments and other matters

Aboriginal Heritage

The application area is mapped within the South West Settlement Native Title area (Tribunal No. WCD2021/010).

Several Aboriginal sites of significance have been mapped within the local area, however none occur within the application area. It is the permit holder's responsibility to comply with the *Aboriginal Heritage Act 1972* (WA) and ensure that no Aboriginal Sites of Significance are damaged through the clearing process.

End

Appendix A. Additional information provided by applicant

Reference	Description of information (in timeline order)
Shire of Corrigin (2023a)	*Applicant requests revision of Clearing permit application CPS 9403/1, from 2.35 hectares to 12 individual trees,* received 15 May 2023 (DWER Ref: DWERDT778654).
Shire of Corrigin (2023b)	*Applicant provides further avoidance and mitigation measures and consideration of revegetation planting,* received 29 August 2023 (DWER Ref: DWERDT836892).
Rapallo Environmental (2023a)	*Targeted flora and vegetation survey of the Rabbit Proof Fence Road SLK 22.00 – 29.40*. Undertaken on 6 and 7 December 2022. Prepared for: Greenfield Technical Services on behalf of the Shire of Corrigin, received 23 August 2023 (DWER Ref: A2199688).
Rapallo Environmental (2023b)	*Follow-up site inspection and memo conducted by Rapallo on 24 October 2023,* received 7 November 2023 (DWER Ref: DWERDT863250).

Appendix B. Site characteristics

The information provided below describes the key characteristics of the area proposed to be cleared and is based on the best information available to DWER at the time of this assessment. This information was used to inform the assessment of the clearing against the Clearing Principles, contained in Appendix B.

B.1 Site characteristics

Characteristic	Details
Local context	The area proposed to be cleared, comprises of 12 individual trees, within the Rabbit Proof Fence Road reserve (PINs 11569835, 11569836 and 11577073), Bullaring (SLK 23.01 to SLK 27.52), located approximately 24 kilometres south of the town of Corrigin. The application area is contained within the Avon Wheatbelt IBRA region, in the intensive land use zone of Western Australia (WA). The proposed clearing area is within a highly cleared landscape and contributes to an important informal ecological linkage. Aerial imagery and spatial data indicates the local area (10-kilometre radius from the centre of the area proposed to be cleared) retains approximately 9.33 per cent of the original native vegetation cover.
Ecological linkage	No formal ecological linkages are mapped within the application area, nor do any exist within the ten-kilometre local area. However, the application area may contribute to ecological linkage function between areas of remnant vegetation in an extensively cleared landscape.
Conservation areas	The closest DBCA Legislated Tenure is an unnamed Nature Reserve, located approximately 990 metres north from the application area.
Vegetation description	Photographs supplied by the applicant and the flora and vegetation survey (Rapallo Environmental, 2023a and 2023b) indicate the vegetation within the proposed clearing area is largely consistent with the mapped vegetation type for the application area: • Beard vegetation association 1023, described as Wheatbelt woodland (other); York gum, salmon gum etc. *Eucalyptus loxophleba*, *E. salmonophloia*.

<table>
<tr><th>Characteristic</th><th>Details</th></tr>
<tr><td></td><td>Goldfields; gimlet, redwood etc. E. salubris, E. oleosa. Riverine; rivergum E. camaldulensis. Tropical; messmate, woolyb

Representative photographs and the survey excerpts (descriptions and maps) are available in Appendix E (3.3.3).</td></tr>
<tr><td>Vegetation condition</td><td>Photographs supplied by the applicant and the flora and vegetation survey (Rapallo Environmental, 2023a and 2023b) indicate the vegetation within the road reserve and proposed clearing area is within a completely degraded (Keighery, 1994) to degraded condition, described as:
• 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
To
• 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.

The full Keighery (1994) condition rating scale is provided in Appendix D.

Representative photographs and the survey excerpts (descriptions and maps) are available in Appendix E (3.3.3).</td></tr>
<tr><td>Climate and landform</td><td>According to BOM (2023), Corrigin shows a mean annual rainfall of 382.8 millimetres. Mean monthly rainfall is highest in August at 95.0 millimetres, and lowest in September at 0.0 millimetres. The hottest month is January with a mean maximum temperature of 32.6 degrees Celsius (°C) and a mean minimum temperature of 15.8 °C.

Landforms of this region consist of undulating plateaux, yellow sandplains with ironstone gravels, loam soils on slopes, bottomlands and disorganised drainages (Beard 1990).</td></tr>
<tr><td>Soil description</td><td>
<table>
<tr><th>Individual tree number/ reference</th><th>Soil best available mapping</th></tr>
<tr><td>1</td><td>259Kk_3u</td></tr>
<tr><td>2</td><td>259Kk_3u</td></tr>
<tr><td>3</td><td>259Kk_3u</td></tr>
<tr><td>4</td><td>259Kk_3u</td></tr>
<tr><td>5</td><td>259Cb_2</td></tr>
<tr><td>6</td><td>259Cb_2</td></tr>
<tr><td>7</td><td>259Cb_2</td></tr>
<tr><td>8</td><td>259Cb_2</td></tr>
<tr><td>9</td><td>259Kk_3u</td></tr>
<tr><td>10</td><td>259Kk_3u</td></tr>
<tr><td>11</td><td>259Kk_3u</td></tr>
<tr><td>12</td><td>259Kk_3u</td></tr>
</table>
67 per cent of application area (8 trees) reside on the soil type Kukerin 3 undifferentiated Phase (259Kk_3u), described as irregularly undulating rises with silicified saprolite and minor granite forming grey sandy duplex soils, often with alkaline subsoils.

33 per cent of application area (4 trees) reside on the soil type Coblinine 2 Subsystem (259Cb_2), described as Broad valley floors and alluvial plains with significant areas of saline wet soils (30-40 per cent) as well as alkaline grey shallow sandy duplex soils and grey deep sandy duplex soils.</td></tr>
</table>

Characteristic	Details
Land degradation risk	The Department of Primary Industries and Regional Development (DPIRD), provides a series of soil degradation risk mapping at the systems level. The land degradation table B.4. below summaries the soil degradation risks within the application area.
Waterbodies	The desktop assessment and aerial imagery indicated that four, minor non-perennial tributaries of Avon River are recorded adjacent to the application area. No wetlands in or adjacent to application area.
Hydrogeography	The application area does not occur within a Public Drinking Water Source Area or a groundwater area under the *Rights in Water and Irrigation Act 1914* (RIWI Act) nor does it occur within an area subject to the *Country Areas Water Supply Act* 1947 (DWER-034). The application area is, however, within a surface water area protected under the *RIWI Act* 1914. Groundwater salinity level (Total Dissolved Solids) is mapped as 14000-35000 milligrams per litre (Saline) (DWER-026).
Flora	A total of 13 conservation significant flora species were recorded within the local area, with the nearest being the threatened *Stylidium applanatum,* which has been recorded 120 metres from the application area. Two other species categorised as threatened were recorded within the local area. See the flora analysis table (B.3) below significant taxa identified.
Ecological communities	A few sections of the application area are adjacent to the Eucalyptus woodland of the Western Australian wheatbelt which is classified as a threatened ecological community. Patches of Eucalyptus woodland TEC is mapped in a number of locations within the local area.
Fauna	There are two conservation significant fauna records within local area, with the nearest being *Notamacropus eugenii derbianus* (Tammar wallaby) which has been recorded 3.18 kilometres from application area.

B.2 Vegetation extent

	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*					
Avon Wheatbelt	9,517,109.95	1,761,187.42	18.51	174,980.68	9.94
Vegetation complex					
Beard vegetation association 1023*	1,522,680.4	165,123.60	10.84	17,277.64	10.46
Local area calculation					
10km radius	40,494.83	3,777.71	9.33	-	-

*Government of Western Australia (2019a)

B.3 Flora analysis table

With consideration for the site characteristics set out above, relevant datasets (see Appendix 0), and biological survey information (Rapallo, 2023a and 2023b), impacts to the following conservation significant flora required further consideration.

Species name	Conservation status	Suitable habitat features? [Y/N]	Distance of closest record to application area (km)	Number of known records (total)	Did surveys find? (Y, N, N/A)
Threatened species					
Grevillea scapigera A.S George	T	Y	8.45	2	N
Guichenotia seorsiflora	T	Y	9.41	4	N
Stylidium applanatum	T	Y	0.12	8	N
Priority species					
Banksia dallanneyi subsp. *agricola*	P2	Y	9.54	4	N
Banksia densa A.R.Mast & K.R.Thiele	P2	Y	5.20	2	N
Banksia rufa subsp. *Obliquiloba* A.S.George) A.R.Mast & K.R.Thiele	P3	Y	9.54	2	
Brachyloma mogin	P3	N	6.23	4	N/A
Calothamnus brevifolius	P4	N	9.44	1	N/A
Grevillea asteriscosa	P4	N	4.88	2	N/A
Lechenaultia pulvinaris C.A.Gardner	P4	Y	5.20	5	N
Leucopogon amplectens Ostenf.	P2	N	6.94	2	N/A
Microcorys cephalantha	P3	Y	9.49	2	N
Oxymyrrhine cordata	P2	Y	9.54	1	N

T: threatened, CR: critically endangered, EN: endangered, VU: vulnerable, P: priority

B.4 Land degradation risk table

Risk categories	259Kk_3u	259Cb_2
Wind erosion	M1	M1
Water erosion	N/A	N/A
Salinity	H1	N/A
Subsurface Acidification	H2	H2
Flood risk	N/A	N/A
Water logging	H2	N/A
Phosphorus export risk	M1	N/A

Note:

L1	<3% of map unit has a high (to extreme) risk
L2	3-10% of map unit has a high (to extreme) risk
M1	10-30% of map unit has a high (to extreme) risk
M2	30-50% of map unit has a high (to extreme) risk
H1	50-70% of map unit has a high (to extreme) risk
H2	>70% of map unit has a high (to extreme) risk

Appendix C. Assessment against the clearing principles

Assessment against the clearing principles	Variance level	Is further consideration required?
Environmental value: biological values		
Principle (a): *"Native vegetation should not be cleared if it comprises a high level of biodiversity."* Assessment: The area proposed to be cleared contains foraging habitat for the Carnaby's black cockatoo species, however, is not likely to contain conservation	Not likely to be at variance	Yes *Refer to Section 3.2.1, above.*

Assessment against the clearing principles	Variance level	Is further consideration required?
significant flora or assemblages of plants (Rapallo Environmental, 2023a; 2023b).		
Principle (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."* Assessment: The area proposed to be cleared contains foraging and potential breeding habitat for the Carnaby's black cockatoo.	At variance	Yes *Refer to Section 3.2.2, above.*
Principle (c): *"Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, threatened flora."* Assessment: Given the proposed clearing is for 12 individual trees, and the lack of understorey across the road verge vegetation, the area proposed to be cleared is unlikely to contain flora species listed as threatened under the BC Act (Rapallo Environmental, 2023a).	Not likely to be at variance	Yes *Refer to Section 3.2.1, above.*
Principle (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."* Assessment: A few sections of the application area are adjacent to patches of *Eucalyptus Woodland of the Western Australian Wheatbelt* (Eucalyptus Woodland), which is classified as a Threatened Ecological Community (TEC). However, the Department has identified, the application area would not meet the criteria for the Eucalyptus Woodlands TEC.	Not likely to be at variance	Yes *Refer to Section 3.2.1, above.*
Environmental value: significant remnant vegetation and conservation areas		
Principle (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."* Assessment: The extent of the mapped vegetation type within the application area is inconsistent with the national objectives and targets for biodiversity conservation in Australia. The vegetation proposed to be cleared may contribute to ecological linkage function for the movement of fauna.	At variance	Yes *Refer to Section 3.2.3, above.*
Principle (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."* Assessment: Given the distance to the nearest conservation area (approximately 990 metres north of application area), the proposed clearing is not likely to have an impact on the environmental values of nearby conservation areas.	Not likely to be at variance	No
Environmental value: land and water resources		
Principle (f): *"Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland."* Assessment: Given no wetlands, and only four minor non-perennial watercourses are mapped within close proximity of the application area, the proposed clearing is	Not likely to be at variance	No

Assessment against the clearing principles	Variance level	Is further consideration required?
unlikely to impact an environment associated with a watercourse or wetland or on- or off-site hydrology and water quality.		
Principle (g): *"Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation."* Assessment: The mapped soils are highly susceptible to land degradation from surface acidification, 259kk_3u is highly susceptible to salinity and waterlogging. However, these land degradation risks are not likely to be risks in consideration of the final land use as a public road. Noting this, and the extent of the application area and the mitigation planting, the proposed clearing is not likely to have an appreciable impact on land degradation.	Not likely to be at variance	No
Principle (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."* Assessment: Given no wetlands, and only four minor non-perennial watercourses are mapped within close proximity of the application area, the proposed clearing of 12 individual trees is unlikely to impact surface or ground water quality.	Not likely to be at variance	No
Principle (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."* Assessment: Noting the mapped soils and topographic contours in the surrounding area and small extent of the proposed clearing, the proposed clearing is not likely to contribute to increased incidence or intensity of flooding or waterlogging.	Not likely to be at variance	No

Appendix D. 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.

Condition	Description
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 E. Further supporting information

3.3.1. DWER

Individual tree number/ reference	Tree location (SLK)	Relevant Parcel Identification Number (PIN) within the Rabbit Proof Fence Road reserve
1	SLK 23.01	PIN 11569835
2	SLK. 23.10	PIN 11569835
3	SLK 23.16	PIN 11569835
4	SLK 26.13	PIN 11569836
5	SLK 26.67	PIN 11569836
6	SLK 26.68	PIN 11569836
7	SLK 26.73	PIN 11569836
8	SLK 26.86	PIN 11569836
9	SLK 26.87	PIN 11569836
10	SLK 26.90	PIN 11577073
11	SLK 26.93	PIN 11577073
12	SLK 27.52	PIN 11577073

Table 1 – Individual tree number/ reference in relation to tree location on SLK, within relevant Parcel Identification Number (PIN) within the Rabbit Proof Fence Road reserves

3.3.2. Shire of Corrigin (2021; 2023a)

Figure 2 – Original application area (Shire of Corrigin, 2021)

Note: Within a different section of the road reserve to the revised application area

Figure 3 – Tree locations within revised application area (Shire of Corrigin, 2023a)

Note: Within a different section of the road reserve to the original application area

Figure 4 - Tree location 1 (SLK 23.01) (Shire of Corrigin, 2023b)

Figure 5 – Tree location 2 (SLK 23.10) (Shire of Corrigin, 2023b)

Figure 6 – Tree location 3 (SLK 23.16) (Shire of Corrigin, 2023b)

Figure 7 – Tree location 4 (SLK 26.13) (Shire of Corrigin, 2023b)

Figure 8 – Tree location 5 (SLK 26.67) (Shire of Corrigin, 2023b)

Figure 9 – Tree location 6 (SLK 26.68) (Shire of Corrigin, 2023b)

Figure 10 – Tree location 7 (SLK 26.73) (Shire of Corrigin, 2023b)

Figure 11 – Tree location 8 (SLK 26.86) (Shire of Corrigin, 2023b)

Figure 12 – Tree location 9 (SLK 26.87) (Shire of Corrigin, 2023b)

Figure 13 – Tree location 10 (SLK 26.90) (Shire of Corrigin, 2023b)

Figure 14 – Tree location 11 (SLK 26.93) (Shire of Corrigin, 2023b)

Figure 15 – Tree location 12 (SLK 27.52) (Shire of Corrigin, 2023b)

3.3.3. Rapallo Environmental (2023a; 2023b)

Biological survey excerpts

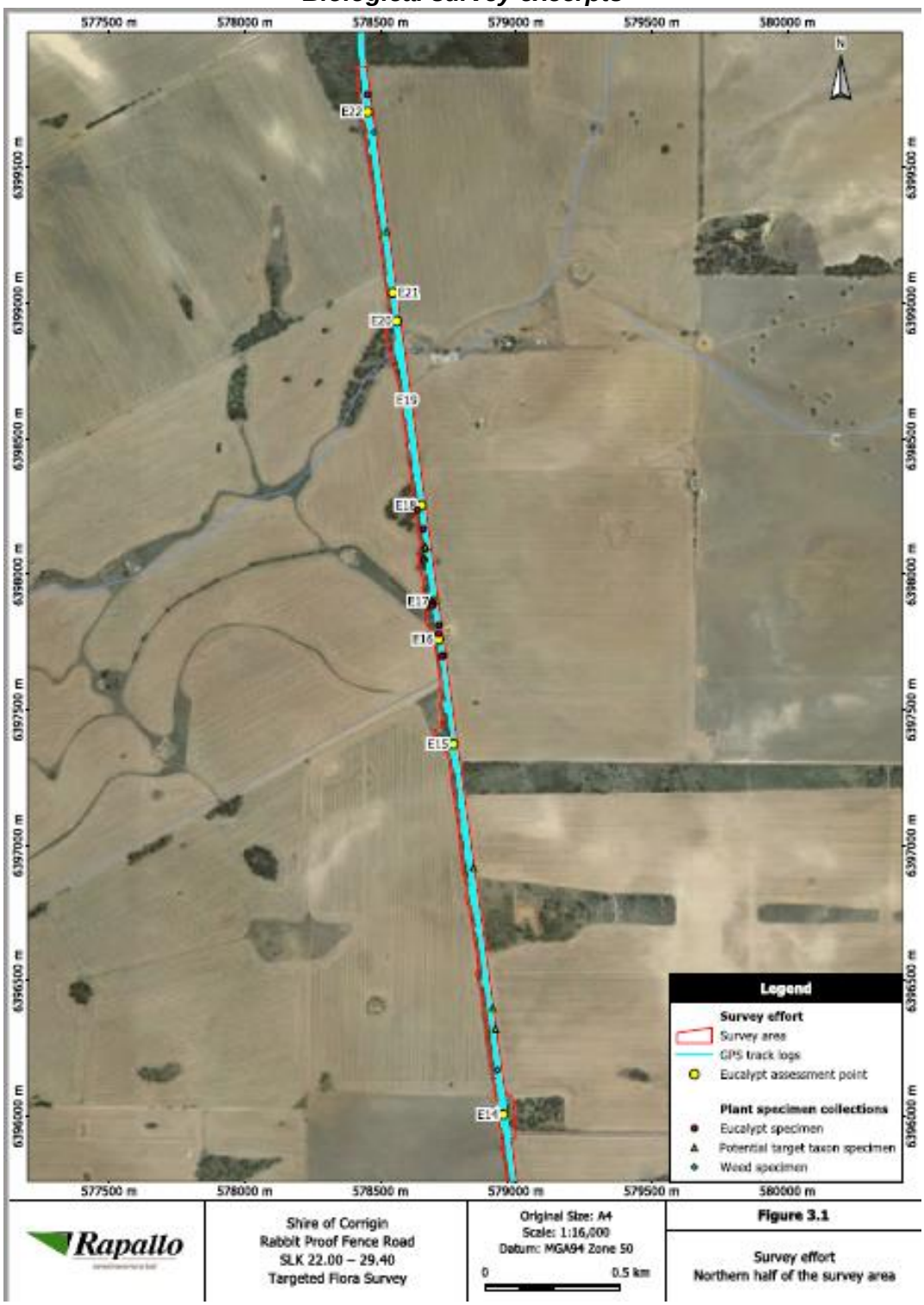


Figure 16 – Northern half of survey area (Rapallo Environmental, 2023a)

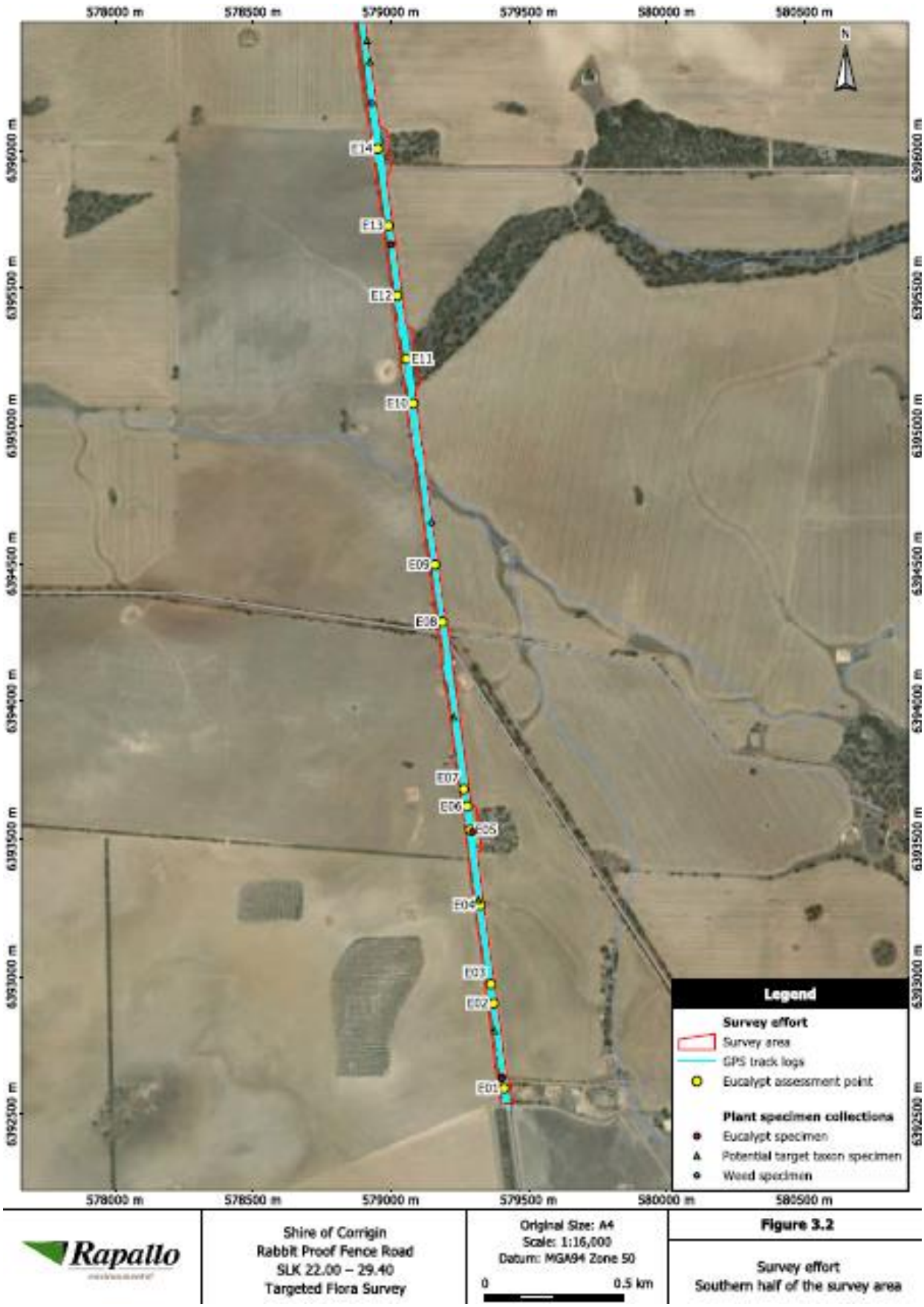


Figure 17 – Southern half of survey area (Rapallo Environmental, 2023a)

***Representative photographs provided by Rapallo Environmental, taken 24 October 2023 on a site inspection* (Rapallo, 2023b)**

Figure 18 – Tree location 1 (SLK 23.01) (Rapallo, 2023b)

Figure 19 – Tree location 2 (SLK 23.10) (Rapallo, 2023b)

Figure 20 – Tree location 3 (SLK 23.16) (Rapallo, 2023b)

Figure 21 – Tree location 4 (SLK 26.13) (Rapallo, 2023b)

Figure 22 – Tree location 5 (SLK 26.67) (Rapallo, 2023b)

Figure 23 – Tree location 6 (SLK 26.68) (Rapallo, 2023b)

Figure 24 – Tree location 7 (SLK 26.73) (Rapallo, 2023b)

Figure 25 – Tree location 8 (SLK 26.86) (Rapallo, 2023b)

Figure 26 – Tree location 9 (SLK 26.87) (Rapallo, 2023b)

Figure 27 – Tree location 10 (SLK 26.90) (Rapallo, 2023b)

Figure 28 – Tree location 11 (SLK 26.93) (Rapallo, 2023b)

Figure 29 – Tree location 12 (SLK 27.52) (Rapallo, 2023b)

Appendix F. Sources of information

F.1 GIS databases

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

- 10 Metre Contours (DPIRD-073)
- 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)
- 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)

Government of Western Australia
Department of Water and Environmental Regulation

Clearing Permit Decision Report

F.2 References

Australian Museum (2019) Peregrine falcon (Falco peregrinus). The Australian Museum, New South Wales. Available from: https://australian.museum/learn/animals/birds/peregrine-falcon/ (accessed September 2023)

Bamford Consulting Ecologists (Bamford) (2013). *Plants known to be used for foraging, roosting and nesting by black cockatoos in south-western Western Australia.* Data compiled from the literature (Davies, 1966; Saunders, 1974, 1979a, b, 1980; Saunders *et al.* 1982; Saunders, 1986; Johnstone and Storr, 1998; Higgins 1999; Johnstone and Kirkby, 1999, 2008; Groom, 2011; Johnstone *et al.* 2011; DSEWPaC, 2012a, b; c, R. Johnstone pers. comm.) in Bamford (2013) Wedgetail Circle, Parkerville Fauna Assessment. Prepared for Coterra Environment. Bamford Consulting Ecologists. Prepared by Jeff Turpin, Simon Cherriman and Mike Bamford. 14th August 2013.

Beard, J.S. (1990) Plant life of Western Australia. Kangaroo Press, Kenthurst, N.S.W.

Bureau of Meterology (BoM) (2023) Climate Data Online for Corrigin Commonwealth of Australia, Canberra, ACT. Available from: http://www.bom.gov.au/climate/data/ (Accessed September 2023).

Commonwealth of Australia (2001) *National Objectives and Targets for Biodiversity Conservation 2001-2005*, Canberra.

Department of Agriculture, Water and the Environment (DAWE) (2022) *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black cockatoo*. Department of Agriculture, Water and the Environment, Canberra, February. Available from: https://www.awe.gov.au/environment/epbc/publications/referral-guideline-3-wa-threatened-black-cockatoo species-2022

Department of the Environment (DotE) (2015) *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt.* Department of the Environment, Canberra. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/128-conservation-advice.pdf

Department of Environment and Conservation (DEC) (2008a) *Forest black cockatoo (Baudin's cockatoo, Calyptorhynchus baudinii, and forest red-tailed black cockatoo, Calyptorhynchus banksii naso) Recovery Plan*. Department of Environment and Conservation, Canberra, ACT.

Department of the Environment and Energy (DoEE) (2017) *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo*, Commonwealth of Australia.

Department of Environment Regulation (DER) (2013). *A guide to the assessment of applications to clear native vegetation*. Perth. Available from: https://www.der.wa.gov.au/images/documents/your-environment/native-vegetation/Guidelines/Guide2_assessment_native_veg.pdf

Department of Parks and Wildlife (DPAW) (2013) *Carnaby's cockatoo (Calyptorhynchus latirostris) Recovery Plan*. Department of Parks and Wildlife, Perth, Western Australia.

Department of Primary Industries and Regional Development (DPIRD) (2019). *NRInfo Digital Mapping. Department of Primary Industries and Regional Development.* Government of Western Australia. Available from: https://maps.agric.wa.gov.au/nrm-info/ (accessed 30 June 2023).

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012) *EPBC Act referral guideline for three threatened black cockatoo species*, Australian Government, Canberra.

Department of Water and Environmental Regulation (DWER) (2019). *Procedure: Native vegetation clearing permits*. Joondalup. Available from: https://dwer.wa.gov.au/sites/default/files/Procedure_Native_vegetation_clearing_permits_v1.PDF.

Environmental Protection Authority (EPA) (2016). *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment*. Available from: http://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/EPA%20Technical%20Guidance%20-%20Flora%20and%20Vegetation%20survey_Dec13.pdf

Groom, C (2011) *Plants used by Carnaby's Black Cockatoo*, Department of Environment and Conservation, Perth.

Government of Western Australia (2011) WA Environmental Offsets Policy. Available from: https://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/WAEnvOffsetsPolicy-270911.pdf

Government of Western Australia (2014) WA Environmental Offsets Guidelines. Available from: https://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/WA%20Environmental%20Offsets%20Guideline%20August%202014.pdf

Government of Western Australia (2019) *2018 South West Vegetation Complex Statistics. Current as of March 2019*. WA Department of Biodiversity, Conservation and Attractions, Perth. Available from: https://catalogue.data.wa.gov.au/dataset/dbca

Government of Western Australia. (2019) *2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of March 2019.* WA Department of Biodiversity, Conservation and Attractions. Available from: https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics

Heddle, E. M., Loneragan, O. W., and Havel, J. J. (1980) *Vegetation Complexes of the Darling System, Western Australia*. In Department of Conservation and Environment, Atlas of Natural Resources, Darling System, Western Australia.

Johnstone, R.E. and Storr, G.M. (1998). *Handbook of Western Australian Birds, Volume I, Non-passerines (Emu to Dollarbird)*. Western Australian Museum, Perth.

Johnstone, R.E., Johnstone, C. and Kirkby, T. (2008). *Carnaby's cockatoo* (Calyptorhynchus latirostris*) on the Northern Swan Coastal Plain (Lancelin-Perth) Western Australia*. Report to Department of the Environment, Water, Heritage and the Arts.

Johnstone, R.E., Johnstone, C. and Kirkby, T. (Johnstone et al) (2010) *Studies on distribution, status, breeding, food, movements and historical changes of the Black Cockatoos on the Swan Coastal Plain (Lancelin-Dunsborough), Western Australia*, Department of Planning, WA.

Keighery, B.J. (1994) *Bushland Plant Survey: A Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc). Nedlands, Western Australia.

Mattiske, E.M. and Havel, J.J. (1998) *Vegetation Complexes of the South-west Forest Region of Western Australia.* Maps and report prepared as part of the Regional Forest Agreement, Western Australia for the Department of Conservation and Land Management and Environment Australia.

Molloy, S., Wood, J., Hall, S., Wallrodt, S. and Whisson, G. (2009) *South West Regional Ecological Linkages Technical Report*, Western Australian Local Government Association and Department of Environment and Conservation, Perth.

Rapallo Environmental (2023a) *Targeted flora and vegetation survey of the Rabbit Proof Fence Road SLK 22.00 – 29.40*. Undertaken on 6 and 7 December 2022. Prepared for: Greenfield Technical Services on behalf of the Shire of Corrigin, received 23 August 2023 (DWER Ref: A2199688).

Rapallo Environmental (2023b) *Follow-up site inspection and memo conducted by Rapallo on 24 October 2023*, received 7 November 2023 (DWER Ref: DWERDT863250).

Rose, P.W. (1993) *Production of habitat hollows by wheatbelt eucalypts: final report, Save the bush research grant 1991/92, project R053*. Report prepared by Rose and Bending Forest and Environmental Consultants for the Department of Conservation and Land Management, Western Australia

Roadside Conservation Committee (RCC) (2005) *Roadside Vegetation and Conservation Values in the Shire of Corrigin*. Department of Biodiversity Conservation and Attractions. Perth, Western Australia.

Schoknecht, N., Tille, P. and Purdie, B. (2004) *Soil-landscape mapping in South-Western Australia – Overview of Methodology and output*s Resource Management Technical Report No. 280. Department of Agriculture.

Saunders, D.A. (1979b). The availability of tree hollows for use as nest sites by White-tailed Black Cockatoos. *Australian Wildlife Research.* 6: 205-216.

Saunders, D.A. (1986). Breeding season, nestling success and nestling growth in Carnaby's cockatoo, *Calyptorhynchus funereus latirostris*, over 16 years at Coomallo Creek, and a method for assessing the viability of populations in other areas. *Australian Wildlife Research.* 13: 261-273.

Saunders, D.A. (1990). Problems of survival in an extensively cultivated landscape: the case of Carnaby's cockatoo *Calyptorhynchus funereus latirostris*. *Biological Conservation*. 54: 277-290.

Saunders, D.A., Dawson, R. and Mawson, P. (2011a). Photographic identification of banded Carnaby's Black Cockatoos. *Corella.* 35: 52-54.

Saunders, D.A. and Ingram, J.A. (1987). Factors affecting survival of breeding populations of Carnaby's cockatoo *Calyptorhynchus funereus latirostris* in remnants of native vegetation. In: *Nature Conservation: The Role of Remnants of Native Vegetation*. (Eds. D.A. Saunders, G.W. Arnold, A.A. Burbidge and A.J.M. Hopkins) Pp. 249-258. Surrey Beatty and Sons, Chipping Norton.

Saunders, D. and Ingram, J. (1995). *Birds of Southwestern Australia: An Atlas of Changes in the Distribution and Abundance of Wheatbelt Avifauna*. Surrey Beatty and Sons, Chipping Norton.

Saunders, D.A. and Ingram, J.A. (1998). Twenty-eight years of monitoring a breeding population of Carnaby's cockatoo. *Pacific Conservation Biology*. 4: 261-270.

Saunders, D.A. (1990). Problems of survival in an extensively cultivated landscape: the case of Carnaby's cockatoo *Calyptorhynchus funereus latirostris*. *Biological Conservation*. 54: 277-290.

Saunders, D.A., Mawson, P. and Dawson, R. (2011b). The impact of two extreme weather events and other causes of death on Carnaby's Black Cockatoo: a promise of things to come for a threatened species? *Pacific Conservation Biology.* 17: 141-148.

Saunders, D.A., Rowley, I. and Smith, G.T. (1985). The effects of clearing for agriculture on the distribution of cockatoos in the southwest of Western Australia. In: *Birds of Eucalypt Forests and Woodlands: Ecology, Conservation, Management*. (Eds. A. Keast, H.F. Recher, H. Ford and D. Saunders) Pp. 309-321. Surrey Beatty & Sons, Chipping Norton.

Saunders, D. A., Smith, G. T., Ingram, J. A. and Forrester, R. I. (2003). Changes in a remnant of salmon gum *Eucalyptus salmonophloia* and York gum *E. loxophleba* woodland, 1978 to 1997. Implications for woodland conservation in the wheat-sheep regions of Australia. *Biological Conservation* 110: 245-256.

Saunders, D. A., Smith, G. T. and Rowley, I. (1982). The availability and dimensions of tree hollows that provide nest sites for cockatoos (Psittaciformes) in Western Australia. *Australian Wildlife Research* 9: 541-56.

Shire of Corrigin (2021) *Clearing permit application CPS 9403/1 and supporting information*, received 23 August 2021 (DWER Ref: DWERDT494100).

Shire of Corrigin (2023a) *Applicant requests revision of Clearing permit application CPS 9403/1, from 2.35 hectares to 12 individual trees,* received 15 May 2023 (DWER Ref: DWERDT778654).

Shire of Corrigin (2023b) *Applicant provides further avoidance and mitigation measures and consideration of revegetation planting,* received 29 August 2023 (DWER Ref: DWERDT836892).

Shah, B. (2006) *Conservation of Carnaby's Black-Cockatoo on the Swan Coastal Plain, Western Australia*. December 2006. Carnaby's Black-Cockatoo Recovery Project. Birds Australia, Western Australia.

Shepherd, D.P., Beeston, G.R. and Hopkins, A.J.M. (2001) *Native Vegetation in Western Australia, Extent, Type and Status*. Resource Management Technical Report 249. Department of Agriculture, Western Australia.

Valentine, L.E. and Stock, W. (2008) *Food Resources of Carnaby's Black Cockatoo (Calyptorhynchus latirostris) in the Gnangara Sustainability Strategy Study Area*. Edith Cowan University and Department of Environment and Conservation. December 2008.

Western Australian Herbarium (1998-). *FloraBase - the Western Australian Flora*. Department of Biodiversity, Conservation and Attractions, Western Australia. https://florabase.dpaw.wa.gov.au/ (Accessed 12 September 2021).

Whiteford, K.R. and Williams, M.R. (2002) *Hollows in jarrah (Eucalyptus marginata) and marri (Corymbia calophylla) trees: II. Selecting trees to retain for hollow dependent fauna*. Forest Ecology and Management, 160, pp. 215-278.