



WESTERN
ENVIRONMENTAL

Lot 600, Old Yanchep Road and Orchid Road Neerabup

Basic Fauna and Targeted Black Cockatoo
Habitat Assessment

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Basic Fauna and Targeted Black Cockatoo Habitat Assessment

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Executive Summary

Western Environmental Pty Ltd was commissioned by the City of Wanneroo to undertake a Basic Fauna Survey and Targeted Black Cockatoo Habitat Survey of Lot 600, Old Yanchep Road and Orchid Road, Neerabup. The Survey Area is a 23.42 ha in size.

Fauna

The Desktop likelihood of occurrence for conservation listed fauna species found that:

- One conservation listed fauna species *Zanda latirostris* (Carnaby's black cockatoo) Endangered (EN) was recorded as present.
- Three species had a high likelihood of occurrence.
- Two species had a medium likelihood of occurrence.
- Twenty-five species had a low likelihood of occurrence.

The three species were assessed as having a high likelihood of occurrence:

- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) (EN)
- *Isodon fusciventer* (Quenda, southwestern brown bandicoot) Priority 4 (P4)
- *Neelaps calonotos* (Black-striped snake, black-striped burrowing snake) Priority 3 (P3)

The two species were assessed as having a medium likelihood of occurrence:

- *Falco peregrinus* (Peregrine falcon) Other Specially Protected
- *Synemon gratiosa* (Graceful sun-moth) P4

Five fauna habitat types were identified within the Survey Area. These habitats are not considered to provide core habitat services for any of the conservation significant species identified as present or having a high likelihood of occurrence. Supporting habitat is provided for six conservation significant species.

Black Cockatoos

The Survey Area is within the modelled distribution for Carnaby's black cockatoo, and forest red-tailed black cockatoo. The Survey Area is outside of modelled breeding distribution for Baudin's black cockatoo and (DCCEEW, 2022).

Black Cockatoo Breeding Habitat Assessment

No Potential or Known nesting trees were recorded within the Survey Area.

Fifty-nine Potential nesting trees were recorded within the Survey Area. Forty-four Potential future nesting trees were recorded within the Survey Area.

Black Cockatoo Foraging Habitat Assessment

Foraging habitat quality was primarily rated using the Commonwealth Habitat Quality Scoring Tool (DCCEEW, n.d.). As per the Habitat Quality Scoring Tool areas with a site condition score of 2 or lower (low, negligible or none value) are "extremely unlikely to be considered as suitable habitat". These areas are therefore classified as not comprising suitable foraging habitat in this assessment. Foraging habitat was considered for Carnaby's black cockatoo, and forest red-tailed black cockatoo.

The Survey Area was assessed as containing 0.06 ha of suitable foraging habitat for Carnaby's black cockatoo and 0.02 ha of suitable foraging habitat for forest red-tailed black cockatoo. Foraging habitat quality extents within the Survey Area out of ten are:

- Carnaby's black cockatoo: 0.06 ha (8/10), 1.93 ha (6/10), 1.5 ha (2/10), 0.48 ha (1/10), 21.36 ha (0/10). Total of 0.06 ha of suitable foraging habitat and 23.34 ha of unsuitable foraging habitat.
- Forest red-tailed black cockatoo: 0.02 ha (7/10), 1.5 ha (2/10), 0.52 ha (1/10), 21.36 ha (0/10). Total of 0.02 ha of suitable foraging habitat and 23.4 ha of unsuitable foraging habitat.

Carnaby's black cockatoo foraging evidence (chewed banksia cones) was observed within the Survey Area.

Black Cockatoo Roosting Habitat Assessment

No evidence of roosting was recorded. Habitat types FHT-01 contain stands of tall trees which may provide suitable roosting habitat. Access to water is present (in the nearby lake Joondalup and Lake Mariginiup).

Acronyms and Abbreviations

Abbreviation	Full Title
BC Act	<i>Biodiversity Conservation Act 2016</i>
BoM	Bureau of Meteorology
°C	Degree Celsius
cm	Centimetres
CR	Critically Endangered
DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter at Breast Height
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEWHA	Department of the Environment Water Heritage and the Arts
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
EIA	Environmental Impact Assessment
EN	Endangered
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection Biodiversity and Conservation Act 1999</i>
ESA	Environmentally Sensitive Area
GIS	Geographic Information System
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
IBSA	Index of Biodiversity Surveys for Assessments
km	Kilometres
m	Metres
mm	Millimetres
MA	Marine
MI	Migratory
MNES	Matters of National Environmental Significance
OS	Other Specially Protected
P	Priority
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
RAAF	Royal Australian Air Force
SCP	Swan Coastal Plain

Abbreviation	Full Title
T	Threatened
TEC	Threatened Ecological Community
VU	Vulnerable
WA	Western Australia
WC Act	<i>Wildlife Conservation Act 1950</i>
WEPL	Western Environmental Pty Ltd

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1. Introduction

1.1 Project Background

The City of Wanneroo (the 'City') received clearing permits from the Department of Water and Environmental Regulation (DWER) (CPS 6359/3) and approvals from the Department of Climate Change, Energy, the Environment and Water (DCCEEW) (EPBC 2007/3479) in 2015 for the development of part of the Lot 600, Old Yanchep Road and Orchid Road Neerabup.

The City intends to apply for a clearing permit for another portion of Lot 600, facilitating its development for a resource recovery centre.

To support the clearing permit in addition to the ecological baseline information provided by Ecoscape (2020), the City commissioned Western Environmental Pty Ltd (WEPL) to undertake a Basic Fauna Survey and Targeted Black Cockatoo Habitat Survey of the additional portion of lot 600 Neerabup (hereby referred to as the 'Survey Area').

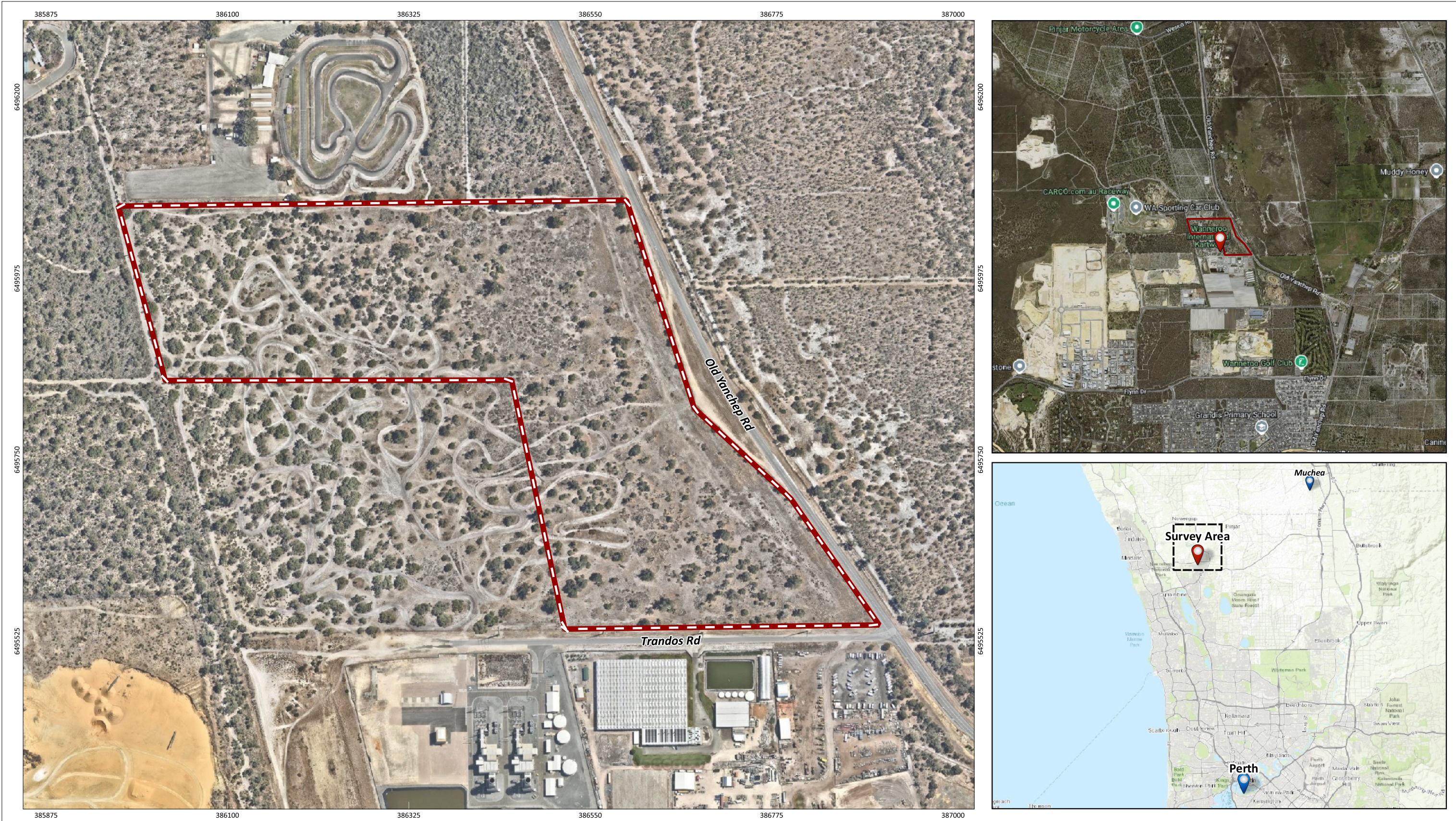
1.2 Location

Lot 600 Neerabup (the 'Survey Area') is located approximately 40 kilometres (km) north of the Perth CBD within the Local Government Area of the City of Wanneroo. The Survey Area consists of a 23.42 hectare (ha) portion of Lot 600 and is presented below in Figure 1.

1.3 Objectives and Scope of Work

Specifically, the scope of works included:

- A desktop assessment of the survey with a 10km buffer including:
 - Review of existing biological information.
 - Database searches.
 - Assessment of the likelihood of occurrence of conservation significant fauna species and communities.
- Basic Fauna Survey.
- Black Cockatoo Habitat Assessment.
- Preparation of a technical report detailing the findings of the desktop assessment and field survey.
- Preparation of a geospatial data package prepared in accordance with Index of Biodiversity Surveys for Assessments (IBSA) requirements.



1.4 Relevant Legislation and Guidance

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- *Western Australian Environmental Protection Act 1986* (EP Act).
- *Western Australian Biodiversity Conservation Act 2016* (BC Act).
- *Western Australian Biodiversity Conservation Regulations 2018*.
- Department of the Environment (DotE) (2013). *Matters of National Environmental Significance. Significant Impact Guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999*.
- Department of the Environment Water Heritage and the Arts (DEWHA) (2010). *Survey Guidelines for Australia's Threatened Birds*.
- Department of Climate Change, Energy, Environment and Water (DCCEEW) (2022). *Referral Guidelines for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed black cockatoo*.
- DCCEEW (2023- unpublished resource). *Habitat Scoring System for WA black cockatoo foraging habitat'* (the Habitat Quality Scoring Tool)

As well as those listed above, the assessment complied with Environmental Protection Authority (EPA) requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA. (2020). Technical Guidance – *Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*. Known herein as the 'Fauna Survey Technical Guidance'.

A short description of key legislation is provided in Appendix A. Other definitions, including species and ecological community conservation categories, are provided in Appendix B.

1.5 Survey Limitations and Constraints

Limitations and constraints of the Basic Fauna Survey and Black Cockatoo Habitat Assessment as outlined in the Fauna Survey Technical Guidance are detailed below in Table 1.

Table 1: Limitations and Constraints of the Fauna Survey

Possible Limitation	Degree of Limitation (Significant, Moderate or Negligible)	Potential Constraints on Survey Outcomes
Survey Level/ Scope	Negligible	The Basic Fauna Survey and Targeted Black Cockatoo Habitat Assessment is considered suitable based on species expected to be present and the extent and condition of vegetation/habitat present within the Survey Area. The level of information collected is suitable to provide information required to inform and support approvals and referrals.
Availability of contextual information at a regional and local scale	Negligible	All data required to complete the scope of works including regional and local contextual information was available. Department of Biodiversity Conservation and Attractions (DBCA) data was requested as part of the desktop assessment.
Site Access	Negligible	The Survey Area was readily accessed by vehicle and on foot.
Survey Intensity and Extent	Negligible	Suitable survey effort by an experienced ecologist was applied. Survey effort include four person days of sampling of fauna and black cockatoo habitat. All planned Survey Areas were adequately sampled in line with the project scope of works. Survey effort for the Black Cockatoo Habitat Survey included every tree with a suitable DBH for support black cockatoo breeding as well as all areas of potential foraging and roosting habitat within the Survey Area boundary. All planned Survey Areas were adequately sampled in line with the project scope of works.
Experience	Negligible	The ecologist leading the Targeted Black Cockatoo Habitat Assessment; Jack Rogers has been conducting Basic Fauna Survey and Black Cockatoo Targeted Assessments in Western Australia for over a year. Jack Rogers is an experienced Ecologist from the UK who has over 3 years' experience in targeted fauna and ornithological surveys. Surveying Ecologist Renae Makin has over five years' experience in environmental consultancy and in undertaking fauna assessments. Technical support was provided by Andrew Fry who has been conducting fauna habitat assessments and black cockatoo targeted assessments in Western Australia for over 10 years including experience in the Swan Coastal Plain bioregion.
Timing, weather, season	Negligible	The Targeted Black Cockatoo Habitat Assessment was undertaken within the recommended timing for both foraging and breeding habitat for forest red-tailed black cockatoo (year-round) but outside of the recommended timing for breeding habitat survey for Carnaby's black cockatoo (July to December) (DCCEEW, 2022). Baudin's black cockatoo are not expected to occur within the Survey Area. Targeted searches were undertaken for secondary evidence of the species presence (i.e. foraging evidence which can be identified at any time of year) and to evaluate the potential suitability of the habitat. The temperatures and weather experienced during both field surveys were not considered to be a limitation to the survey and did not affect the ability to record fauna or habitats.

Possible Limitation	Degree of Limitation (Significant, Moderate or Negligible)	Potential Constraints on Survey Outcomes
		A Basic fauna survey aims to identify core and support habitat for a wide assemblages of fauna species, The timing and weather were not considered a significant limitations to the survey as specific species were not surveyed for, while habitat classification was possible throughout year and in a range of climatic conditions.
Proportion of the flora and fauna recorded and/or collected, and any identification issues	Negligible	Species sampling was in line with the technical guidance for Basic Fauna survey and Targeted Black Cockatoo Habitat Assessment
Mapping Reliability	Negligible	The majority of the Survey Areas was traversed by foot and mapping reliability is considered high.
Disturbances (fire, flood etc.)	Negligible	No recent fire evidence was observed within the Survey Area, Survey Area disturbance was at a level expected for a degraded, mixed-use lot.

2. Existing Environment

2.1 Climate and Pre-Survey Rainfall

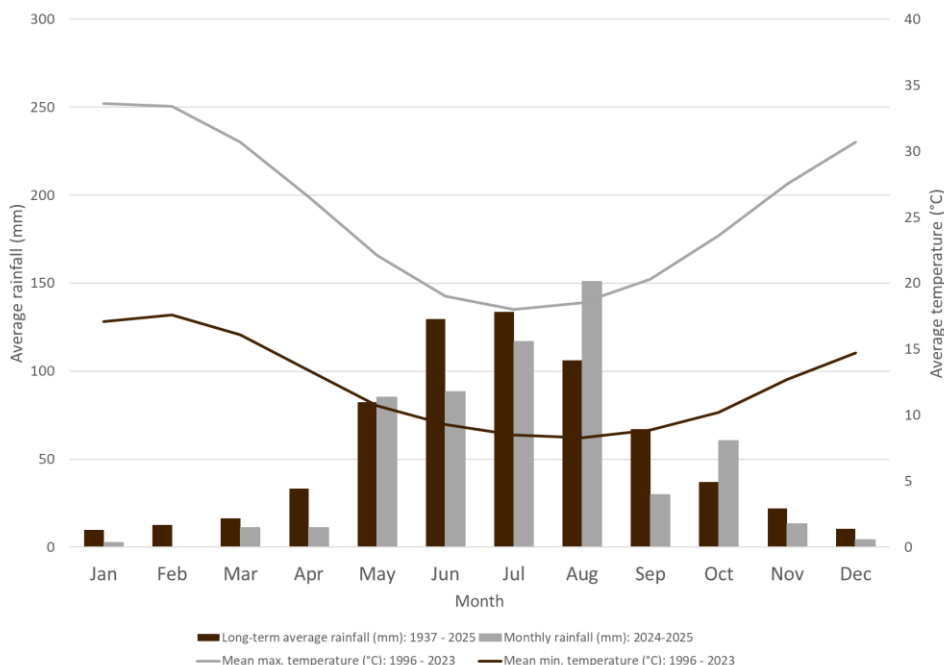
The Survey Area is located within the Swan Coastal Plain (SCP). In 1990, J. S. Beard (Beard, 1990) described the climate of the area as warm Mediterranean, with cool wet winters (May to September) and warm dry summers.

Climate results are presented using the closest long-term Bureau of Meteorology (BoM) weather station with a complete dataset. The station utilised for the Survey Area was the Pearce Royal Australian Air Force (RAAF) weather station (Station 009053).

Climate statistics were calculated utilising data from the most current climate normal, which is defined as a 30-year interval (BoM, 2007), where possible. A climate normal is a period long enough to include year-to-year variations while avoiding the influence of longer-term changes in climate.

The long-term (1940-2025) mean minimum temperature was 8.3°C (August) to 17.6 °C (February) and the long-term mean maximum temperature ranges from 17.9 C (July) to 33.6°C (January) as presented below in Graph 1 (BoM, 2024).

The Pearce RAAF WA weather station recorded 574 millimetres (mm) of rainfall in the 12 months prior to the survey (February 2024 to March 2025), which is 87 mm below the long-term average of 660 mm (BoM 2025).



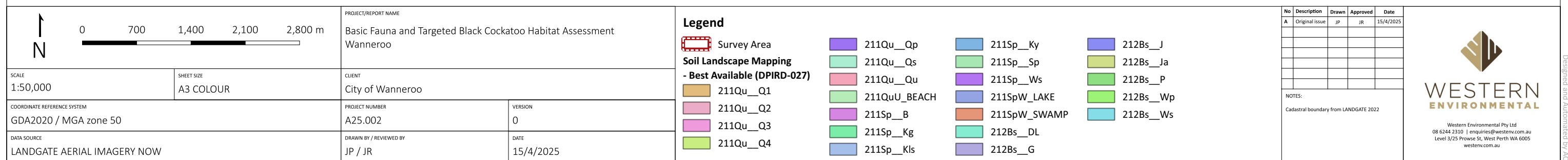
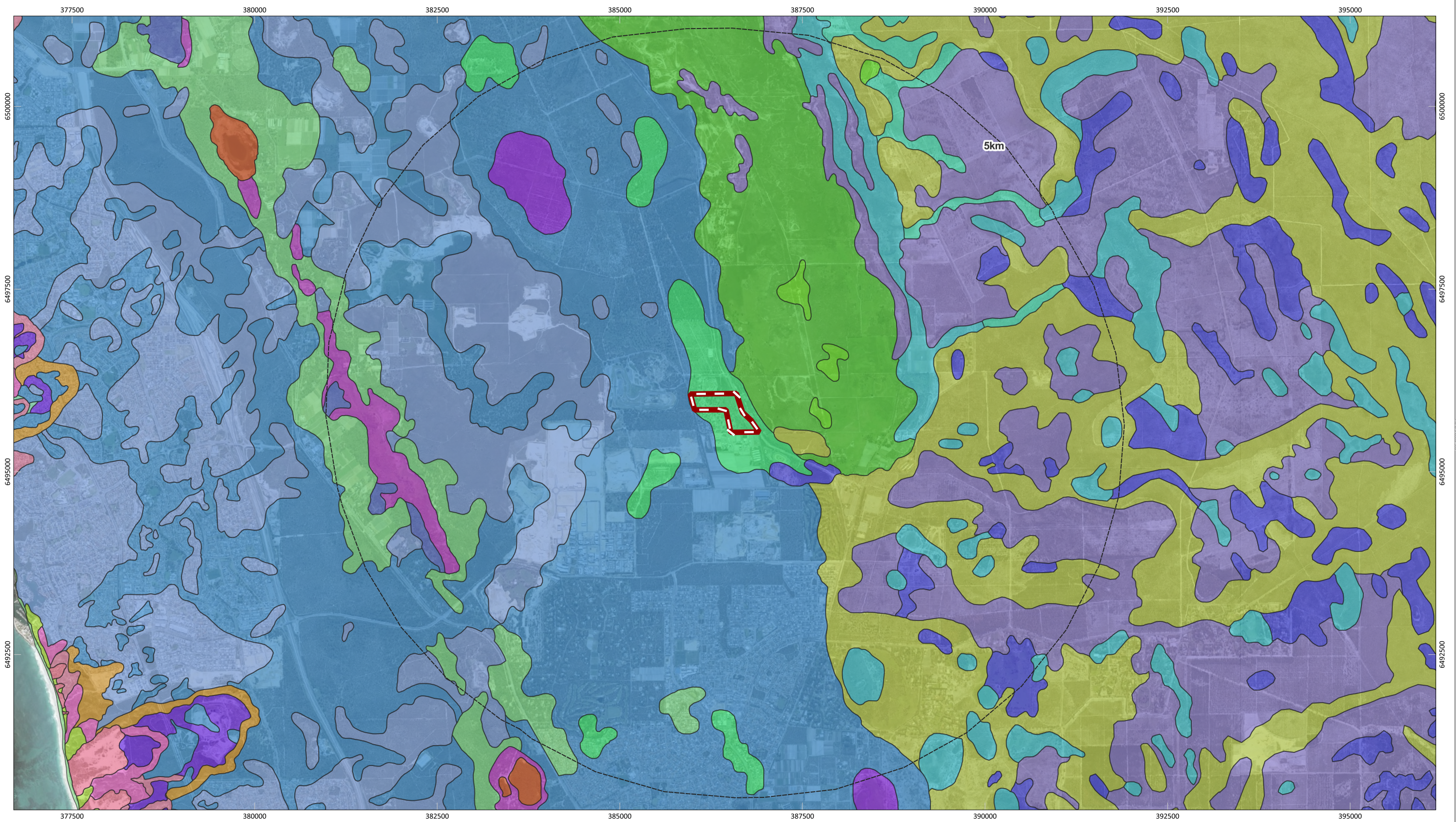
Graph 1: Long Term and Monthly Total Rainfall, Maximum and Minimum Temperatures for Pearce RAAF (Station 0092053) (BoM, 2024)

2.2 Interim Biogeographic Regionalisation for Australia

The Interim Biogeographic Regionalisation of Australia (IBRA) divides Australia into 89 bioregions based on major biological, geographical, and geological attributes. These bioregions are subdivided into 419 subregions as part of a refinement of the IBRA framework (Commonwealth of Australia, 2012). The Survey Area is situated within the Swan Coastal Plain bioregion and the Swan Coastal Plain Perth (SWA02) subregion.

2.3 Geology and Soils

The geology units (DPIRD-027) intersecting the Survey Area as shown in Figure 2. The Survey Area is entirely within the Karrakatta Sand Grey Phase Mapping Unit (211Sp__Kg). The Karrakatta Sand Grey Phase Mapping Unit is described as low hilly to gently undulating terrain with iron podzols. Vegetation associated with the mapping unit is *Banksia spp* woodland with *E. tottiana* and depauperate *E. marginata* with a dense shrub layer.



2.4 Pre-European Vegetation Types

2.4.1 Vegetation Association Mapping

During the 1970s, John Beard and associates conducted a systematic survey of native vegetation, describing the vegetation systems in Western Australia. Beard (1981) mapped the vegetation of the SCP at 1:1,000,00 scale. This mapping described one broad vegetation unit; Spearwood Woodland for the Survey Area.

Beard's mapping attempted to depict the native vegetation as it was presumed to be at the time of settlement and is known as the pre-European vegetation type and extent. Beard's vegetation maps are maintained in digital form by DPIRD (2019). Extents are updated periodically by Department of Biodiversity, Conservation and Attractions (DBCA) (Government of Western Australia [GoWa], 2018).

2.4.2 Vegetation Complex Mapping

The vegetation complexes of the SCP were mapped by Heddle et al. (1980) at a scale of 1:250,000. According to this data, the Survey Area is primarily representative of two vegetation complex (see Figure 3):

- Karrakatta Complex-Central and South: Predominantly open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri) and woodland of *Eucalyptus marginata* (Jarrah) - *Banksia* species. *Agonis flexuosa* (Peppermint) is co-dominant south of the Capel River.
- Pinjar Complex; Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) - *Banksia* species to a fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca preissiana* (Moonah) and sedgelands.

2.5 Environmentally Sensitive Areas, Conservation Estate and Bush Forever

Environmentally Sensitive Areas (ESAs) are declared by DWER to prevent the degradation of important environmental values such as Threatened Flora, Threatened Ecological Communities (TECs) or significant wetlands.

Conservation Estate are declared by DBCA to manage and protect important conservation values.

Bushland Policy for the Perth Metropolitan Region aims to provide a policy and implementation framework that ensures bushland protection and management issues throughout the Perth Metropolitan Region are adequately addressed and integrated with broader land use planning and decision-making (WAPC 2021). The policy predominantly deals with two distinct subjects, Bush Forever areas and local bushland areas.

The Survey Area intersects one ESA (DWER-046). This ESA is the 50 metre (m) buffer of a conservation listed wetland (DBCA-019) (see Figure 4 below).

The Survey Area does not intersect any Bush Forever Areas (DPLH-019) or other sites in the Conservation Estate, however the Survey Area is immediately adjacent to two Bush Forever Areas (see Table 2).

Table 2 Bush Forever Areas adjacent to the Survey Area

Bush Forever ID	Bush Forever Name
428	State Forest 65 - Pinjar Plantation South Bushland (10) Nowergup/ Yanchep/Neerabup
382	Lake Pinjar and Adjacent Bushland, Pinjar

2.6 Wetlands and Hydrology

The Survey Area intersects the very edge of a Conservation listed Sumpland Lake Pinjar (UID 13373) on its eastern edge (DBCA-019), as shown in Figure 5.

No Ramsar Site intersects the Survey Area. The Survey Area does not intersect with any wetlands listed under the Directory of Important Wetlands in Australia (DBCA-045) or any drainage lines (DWER-031).

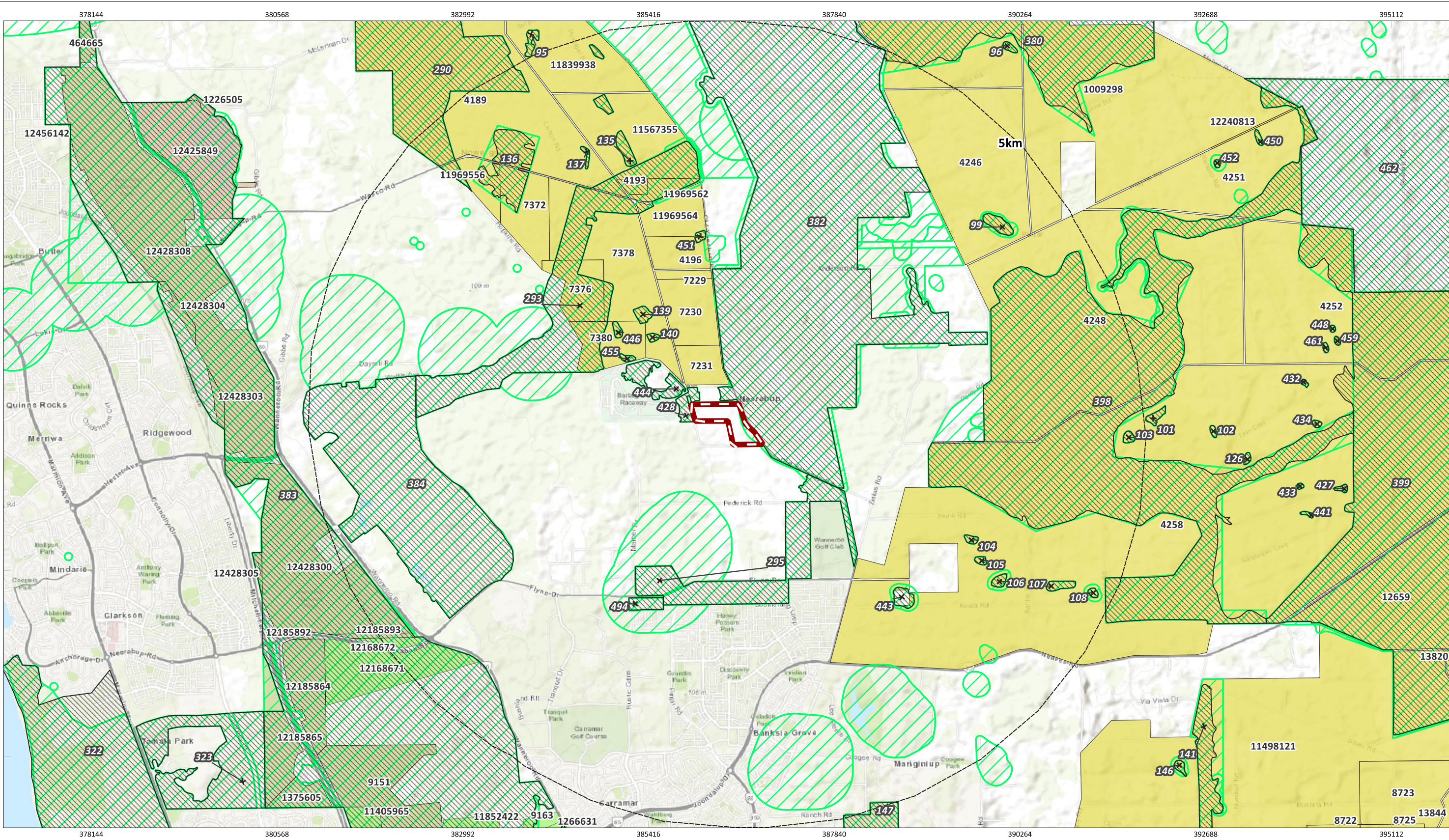


Figure 4: Environmentally Sensitive Areas, Conservation Estate and Bush Forever

0700140021002800

SCALE

1:48,475

SHEET SIZE

A3 COLOUR

COORDINATE REFERENCE SYSTEM

GDA2020 / MGA zone 50

DATA SOURCE

LANDGATE AERIAL IMAGERY NOW

PROJECT/REPORT NAME

Basic Fauna and Targeted Black Cockatoo Habitat Assessment Wanneroo

CLIENT

City of Wanneroo

PROJECT NUMBER

A25.002

VERSION

0

DRAWN BY / REVIEWED BY

JP/JR

DATE

15/4/2025

Legend

Survey Area

Bush Forever Areas - 2000 (DPLH-019)

Clearing Regulations - Environmentally Sensitive Areas (DWER-046)

DBCA - Legislated Lands and Waters (DBCA-011)

National Park

Nature Reserve

State Forest

Crown Freehold - Dept Managed

No	Description	Drawn	Approved	Date
A	Original Issue	JP	JR	15/4/2025

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

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3. Methodology

3.1 Desktop Assessment

3.1.1 Database Searches

Database searches of DBCA records were undertaken to compile a list of potential conservation significant fauna previously recorded within or surrounding the Survey Areas (see Table 3). In addition, an EPBC Protected Matters Search Tool (PMST) search was undertaken to identify the potential for Matters of National Environmental Significance (MNES) to occur within or surrounding the Survey Areas (DCCEEW, 2024).

Table 3: Database Searches of the Survey Areas

Database Name	Date Received and Reference Number	Search Type	Search Area
DBCA Threatened and Priority Fauna database search (DBCA, 2025)	13/02/2025 11-0225FA.	Threatened and Priority Fauna	10 km buffer around the Survey Areas
Protected Matters Search Tool (DCCEEW, 2025)	13/03/2025 .	Commonwealth listed Threatened Flora and fauna and TECs	10 km buffer around the Survey Areas

3.1.2 Likelihood of Occurrence

Conservation listed fauna identified from the desktop assessment were assessed to determine their likelihood of their occurrence within the Survey Area. The assessment was completed based on the likelihood of occurrence criteria presented in Table 4.

Only species either recorded within the Survey Area or considered as having a high or medium likelihood of occurrence in post field survey assessment will be discussed in detail. Species classified as having a low likelihood of occurrence will not be discussed unless a justification for this classification is required.

Species listed as Marine (MA) only under the EPBC Act (e.g. sharks, whales, turtles) and pelagic seabirds have been excluded from the likelihood of occurrence list as there is no marine habitat present within the Survey Area.

Table 4: Likelihood of Occurrence Criteria

Likelihood	Criteria
Recorded	Recorded in the Survey Area from database searches, previous survey by others or by current survey.
High	Records of fauna species <10 km from the Survey Area. With record <20 years old; or

Likelihood	Criteria
	For species with well understood and specific habitat preference/ requirements, when specific habitat is present in the Survey Area, and records present <10 km from the Survey Area. Species with general habitat preference, which is present in the Survey Area, and records present <5 km from the Survey Area.
Medium	There are records <10 km from the Survey Area, however: The species is strongly linked to a specific habitat, which is marginally suitable or small in extent in the Survey Area; or Species has a general habitat preference, but small extent of suitable habitat is present. There is suitable habitat in the Survey Area, but records are >10 km from Survey Area.
Low	Records are historical only or are pre mapping procedures (e.g. records assigned to towns or place names). The species has a well understood and specific habitat preference/ requirements, which is absent from the Survey Area; or Suitable habitat is present, however there are no existing records of the species from the region despite reasonable previous search effort; or There is some suitable habitat in the Survey Area, however the species is very infrequently recorded in the locality (e.g. migratory bird species).

3.2 Basic Fauna Survey

The basic fauna survey incorporated a number of survey techniques as per the *Fauna Survey Technical Guidance* (EPA, 2020). A basic survey is a low-intensity survey, conducted at the local scale to gather broad fauna and habitat information. The primary objectives are to verify the overall adequacy of the desktop study, and to map and describe habitats, with a focus on habitat for conservation listed fauna.

Fauna species were identified by active searches, secondary evidence such as scats, tracks, calls, remains, diggings and other signs. A fauna inventory was not compiled as part of this survey (not required under basic level survey) however observations are used to inform the fauna habitat type assessment. Potential habitats for conservation listed species were identified and evaluated and their likelihood of occurrence assessed.

The fauna survey was undertaken over two consecutive days: the 19th and 20th of March 2025. Details of the field survey team are presented below in Table 5.

Table 5: Survey Team

Name	Position and years of Experience
Jack Rogers	Environmental Scientist, 3 years
Renaë Makin	Environmental Scientist, 5 years

3.2.1 Fauna Habitat Type Assessment

The fauna habitat types present within the Survey Area were defined considering landform, vegetation, structure such as rockpiles and logs and fauna assemblage occupying the area.

The following information was used to define and map all fauna habitat types within the Survey Area at specific fauna habitat assessment points and during traverses of the Survey Area.

- Land systems and landform.
- Vegetation type and condition mapping.
- Soil characteristics.
- Structure such as rockpiles and logs.
- Fauna assemblage information from desktop assessment and field observations.
- Aerial imagery and historic imagery.

3.2.2 Fauna Taxonomy

Terrestrial vertebrate fauna taxa were identified in the field by an experienced ecologist.

Taxonomy and nomenclature follow the WA Museum checklist 2024 (Western Australian Museum, 2024). Conservation status follows the DBCA Threatened and Priority fauna list (DBCA, 2024). Where required verification of identification of secondary evidence (tracks, scats, diggings) may be undertaken by a relevant species group expert.

3.3 Black cockatoo Habitat Assessment

The Survey Area falls within the modelled distribution and breeding range of the Carnaby's black cockatoo (*Zanda latirostris*) and forest red-tailed black cockatoo (*Calyptorhynchus banksii*) and outside the modelled distribution of the Baudin's black cockatoo (*Zanda baudinii*) (DCCEEW, 2022). As the Survey Area falls outside of the modelled breeding and foraging distribution for Baudin's black cockatoo, they have not been considered further within this assessment.

The SPC is used by Carnaby's black cockatoos for foraging, with some patches of breeding habitat. Vegetation used by Carnaby's is dominated by *Banksia* spp. and Tuart (*Eucalyptus gomphocephala*) woodlands, as well as Marri (*Corymbia calophylla*), with Jarrah (*E. marginata*) in the east. (DCCEEW, 2022).

In the SCP, Carnaby's are present at any time of year, most commonly from January through to July, some individuals being present all year round. The timing of the survey in November provided good opportunity to record foraging individuals and nesting for Carnaby's black cockatoo. If no individuals are present, searching

for foraging evidence is a reliable alternative as it will generally persist in the landscape (particularly chewed marri nut) (DCCEEW, 2022).

The black cockatoo habitat field survey followed the Commonwealth referral guidelines for Threatened black cockatoos (DCCEEW, 2022) for identifying breeding, foraging and roosting habitat.

3.3.1 Breeding Habitat Assessment

The Commonwealth defines breeding habitat as that which contains known, suitable or potential nesting trees, and which occurs within the range of the species. Terminology used in this report for breeding habitat trees follows that defined in glossary of DCCEEW (2022) as shown in Table 6

Table 6: Breeding Habitat Terminology

Breeding Habitat Term	Definition (DCCEEW, 2022)
Known nesting trees	Trees (live or dead but still standing) which contains a hollow where black cockatoo breeding has been recorded or which demonstrates evidence of breeding (i.e. showing evidence of use through scratches, chew marks or feathers).
Suitable nesting trees	Trees with suitable nesting hollows present, although no evidence of use.
Suitable nesting hollows	Any hollow with dimensions suitable for use for nesting by black cockatoos.
Potential nesting trees	Trees that have a suitable Diameter at Breast Height (DBH) to develop a nest hollow, but do not currently have hollows. For most species of trees, suitable nest hollows are only found in live trees with a DBH of at least 500 mm.
Potential future nesting trees	Trees suitable to develop a nest hollow in the future are 300-500 mm DBH.

In addition to Commonwealth guidelines for assessing breeding habitat trees, a scoring system based on that developed by Dr Mike Bamford (referred to as Bamford Class) was applied to class breeding habitat trees. This system and the Bamford Class alignment with DCCEEW (2022) breeding habitat terminology are shown in Table 7.

Table 7: Black cockatoo Breeding Habitat Trees- Bamford Class

Bamford Class	Description of Tree and Hollows/Activity	Alignment with DAWE (2022) Breeding Habitat Terminology
1	Active nest observed; adult (or immature) bird seen entering or emerging from hollow, eggs present.	Known nesting tree
2	Hollow of suitable size and angle visible with chew marks attributed to black cockatoo nesting activity around entrance.	Known nesting tree

Bamford Class	Description of Tree and Hollows/Activity	Alignment with DAWE (2022) Breeding Habitat Terminology
3	Potentially suitable hollow visible but no chew marks present; or potentially suitable hollow present if from ground-based assessment only (as suggested by structure of tree, such as large, vertical trunk broken off at a height of >10 m with thin rim).	Suitable nesting tree
4	Tree with hollows or broken branches that might or do contain hollows, but hollows or potential hollows are not of a suitable size, or are aligned or obstructed so as to prevent access	Potential nesting tree
5	Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.	Potential nesting tree
No Class	No description. Potential future nesting trees were not considered in the Bamford Class scale.	Potential future nesting trees

All breeding habitat trees were recorded using a mobile GIS field data collector platform. The following was recorded for each tree:

- Species.
- DBH (approximately 1.3 m from the ground).
- Coordinates.
- Presence of hollows (as observable from the ground).
- Bamford Class (see below).

Trees identified as potentially having suitable hollows present were inspected using a pole camera to determine the hollows internal dimensions. Hollow information recorded included:

- Size of entry.
- Estimated depth.
- Hollow type (knot, fissure, spout, vertical/chimney).
- Suitability for use.
- Evidence of use.
- Presence of other birds or bees.

3.3.2 Foraging Habitat Assessment

The Commonwealth defines foraging habitat as areas including plants of species known to support foraging within the range of each black cockatoo species. Marri and jarrah woodlands are particularly important to forest red-tailed black cockatoo, while proteaceous heaths (shrublands dominated by *Banksia*, *Hakea* and *Grevillea* species) are also utilised by Carnaby's black cockatoo (DCCEEW, 2022).

The potential of the habitat within the Survey Area to support foraging was described, and any evidence was recorded, along with opportunistic sightings of any individual black cockatoos.

Habitat mapping of the Survey Area was used in conjunction with the site assessment to determine the foraging quality using the Foraging Habitat Scoring Tool (DCCEEW, 2022). The Foraging Habitat Scoring Tool (DCCEEW, 2022) is applied once only for an entire site. A secondary assessment was undertaken using the 'Habitat Scoring System for WA black cockatoo foraging habitat' (the Habitat Quality Scoring Tool) provided by DCCEEW in 2023 as an unpublished source. The Habitat Quality Scoring Tool produces a score of 0-7 for site condition and may be applied to each identified fauna habitat type. An overall site context score of 0-3 is then added. See Appendix E for detailed scoring tool methodologies.

As per the Habitat Quality Scoring Tool areas with a site condition score of 2 or lower (foraging condition low, negligible or none) are "extremely unlikely to be considered as suitable habitat". These areas are therefore classified as not comprising suitable foraging habitat in this assessment.

3.3.3 Roosting Habitat Assessment

Roosting habitat was assessed based on observation of roosting or roosting evidence recorded during survey and based on habitat suitability (generally tall trees in the landscape in proximity to a water source). During the field survey, searches were conducted for evidence of roosting (e.g. piles of scats, feeding debris or chewed trees).

4. Results

4.1 Literature Review

A literature review was undertaken of previous terrestrial fauna studies considered relevant to the current Survey Area, to inform the targeted Black Cockatoo assessment and Basic Fauna Survey. A summary of the key findings relevant to the survey is provided below in Table 8.

Table 8: Review of Previous Studies

Source- Title	Key Findings
Ecoscape (2021) Neerabup Industrial Area - Environmental Assessment Report (Fauna)	The basic fauna survey undertaken in October 2020 of the area adjacent to the Survey Area recorded the following: • two fauna habitat types - Woodlands and Degraded Grasslands • 28 species detected during the basic survey • 226 previously recorded fauna species including 12 threatened and priority fauna species • three conservation listed species were recorded during the field survey, Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>), Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>), and Quenda (<i>Isoodon fusciventer</i>).
ATA Environmental (2007) Neerabup Industrial Area Flora Vegetation And Vertebrate Fauna Assessment	Flora Vegetation and Vertebrate Fauna (Basi Fauna) Survey of the adjacent Neerabup Industrial Area (NIA) Two species (Carnaby's cockatoo and peregrine falcon) of conservation concern that are listed under the EPBC Act 1999 or the Wildlife Conservation Act 1950 were recorded during the survey. In addition, four other species of conservation concern (western brush wallaby, southern brush-tailed phascogale, black-striped snake, and southern brown bandicoot) have been recorded in the region in previous surveys. A ninth species (Chuditch) was known from the region but had not been recorded by ATA Environmental during this survey or previous surveys in similar habitat in the region.

4.2 Fauna Desktop Assessment

The database searches identified 31 conservation listed fauna species that potentially occur, or habitat likely occurs within the Survey Area, comprising:

- Twenty-three bird species.
- Five mammal species.
- One reptile species.
- Two invertebrate species.

The results of the DBCA Threatened and Priority Fauna database search are shown in Figure 6. Database searches results and desktop likelihood of occurrence assessment are summarised in Appendix C.

4.2.1 Fauna Likelihood of Occurrence

The likelihood of occurrence for conservation listed fauna species found that:

- One conservation listed fauna species; *Zanda latirostris* (Carnaby's black cockatoo) Endangered (EN) was recorded as present.
- Three species had a high likelihood of occurrence.
- Two species had a medium likelihood of occurrence.
- Twenty-five species had a low likelihood of occurrence.

The results of the likelihood of occurrence assessment are presented in Appendix C.

The three species were assessed as having a high likelihood of occurrence:

- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) EN
- *Isodon fusciventer* (Quenda, southwestern brown bandicoot) Priority 4 (P4)
- *Neelaps calonotos* (Black-striped snake, black-striped burrowing snake) Priority 3 (P3)

The two species were assessed as having a medium likelihood of occurrence:

- *Falco peregrinus* (Peregrine falcon) Other Specially Protected (OS)
- *Synemon gratiosa* (Graceful sun-moth) P4

The species assessed as low likelihood of occurrence are species that are locally extinct, have no recent records or for which no suitable habitat is present (e.g. wading birds). Species recorded or assessed as having a high or medium likelihood of occurrence are discussed in detail in Section 4.3.3.

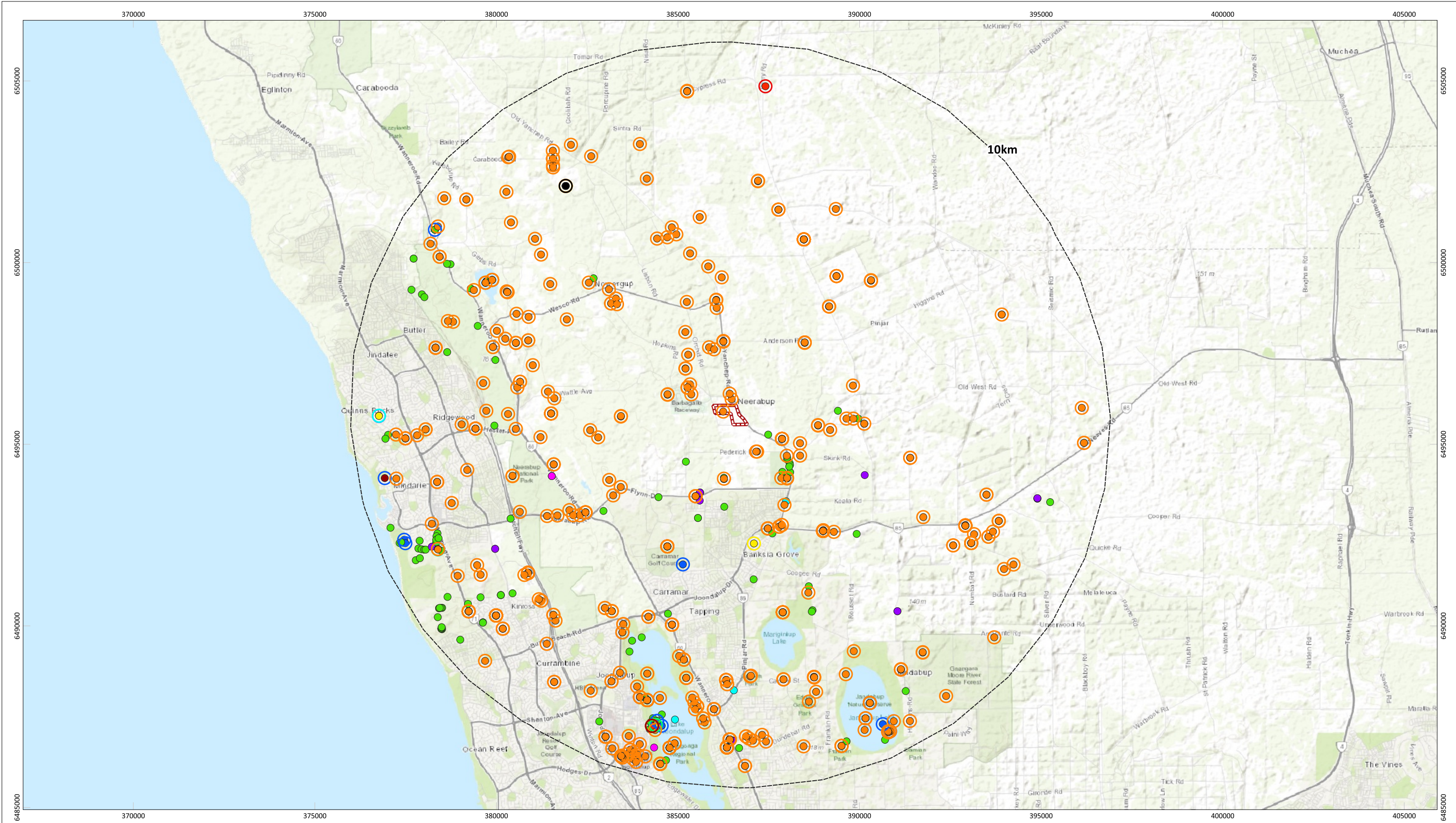


Figure 6: DBCA Database Search Results Fauna

0

1,500

3,000

4,500

6,000 m

N

SCALE

1:100,000

SHEET SIZE

A3 COLOUR

PROJECT/REPORT NAME

Basic Fauna and Targeted Black Cockatoo Habitat Assessment Wanneroo

CLIENT

City of Wanneroo

PROJECT NUMBER

A25.002

VERSION

0

DATA SOURCE

LANDGATE AERIAL IMAGERY NOW

DRAWN BY / REVIEWED BY

JP/JR

DATE

22/4/2025

Legend

Survey Area

DBCA Threatened and Priority Fauna (WA Status)

●

Extinct species

●

Conservation dependent and migratory species

●

Critically endangered species

●

Endangered species

●

Vulnerable species

●

Priority 2

●

Priority 3

●

Priority 4

●

Migratory species

●

Other specially protected species

DBCA Threatened and Priority Fauna (EPBC Status)

○

Extinct species

○

Critically endangered species

○

Critically endangered and migratory species

○

Endangered species

○

Endangered and migratory species

○

Vulnerable species

○

Vulnerable and migratory species

○

Migratory species

No

Description

Drawn

Approved

Date

A

Original issue

JP

JR

22/4/2025

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

WESTERN ENVIRONMENTAL

Western Environmental Pty Ltd

08 6244 2310 | enquiries@western.com.au

Level 3/25 Prowse St, West Perth WA 6005

western.com.au

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4.3 Basic Fauna Field Survey

4.3.1 Fauna Assemblage

As per the scope of a basic fauna survey under the Technical Guidance the primary objectives are to verify the overall adequacy of the desktop study, and to map and describe habitats, with a focus on habitat for conservation listed fauna.

4.3.2 Fauna Habitat Types

Seven habitat types were described. The fauna habitat types are described below in Table 9 and shown in Figure 7.

For possibly occurring conservation listed fauna species, habitat types are assessed as either core, supporting or non-significant habitat. As per Commonwealth MNES – Significant Impact Guidelines 1.1 “core” habitat is defined as that critical to the survival of the species and considered to contain denning/ breeding sites, primary foraging areas and refuge from drought, fire and other stresses (DotE, 2013). “Supporting” habitat is defined as that which is likely used for foraging and dispersing/ connective purposes but is not essential habitat for the continuation of a local population. “Non-significant” habitat is that which would be used only very infrequently for foraging or dispersing. Discussion of habitat type suitability for species identified as having a high or medium likelihood of occurrence is provided in Table 9 and discussed in Section 4.2.3.

Table 9: Fauna Habitat Type Descriptions within the Survey Area

Fauna Habitat Type	Habitat Description	Total Area (ha), Proportion of the Survey Area (%)	Representative Photo
FHT-01 - Stands of small-fruited eucalyptus	Native SCP species including <i>E. rudis</i> and <i>E. tottiana</i> . non-native planted Eucalyptus, over open paddock of short grassland offering minimal habitat values.		
	Not core habitat for listed species.		
	Supporting habitat for: Carnaby's black cockatoo Forest red-tailed black cockatoo Quenda Peregrine falcon	1.52 6.53 %	
	Non-significant habitat for: Peregrine falcon Black-striped snake Graceful sun-moth		

Fauna Habitat Type	Habitat Description	Total Area (ha), Proportion of the Survey Area (%)	Representative Photo
FHT-02- Individual Banksia	Sparse <i>Banksia spp.</i> over weeds.		
	Not core habitat for listed species.		
	Supporting habitat for: Carnaby's black cockatoo	0.06	
	Quenda		
	Black-striped snake	0.26 %	
	Graceful sun-moth		
	Non-significant habitat for: Forest red-tailed black cockatoo		
	Peregrine falcon		
FHT-03- Nuytsia grove	Shrubland of native species (<i>Jacksonia spp</i>) and weeds, dominated by <i>Nuytsia floribunda</i> over weeds.	0.46	Not photographed
	Not core habitat for listed species.	1.96 %	
	Supporting habitat for: Quenda		

Fauna Habitat Type	Habitat Description	Total Area (ha), Proportion of the Survey Area (%)	Representative Photo
	Black-striped snake Graceful sun-moth Non-significant habitat for: Carnaby's black cockatoo Forest red-tailed black cockatoo Peregrine falcon		
FHT-04 - Sheoak grove	Individual <i>Allocasuarina fraseriana</i> over small native shrubs and weeds Not core habitat for listed species. Supporting habitat for: Forest red-tailed black cockatoo Non-significant habitat for: Carnaby's black cockatoo Peregrine falcon Quenda Graceful sun-moth Black-striped snake	0.02 0.04 %	

Fauna Habitat Type	Habitat Description	Total Area (ha), Proportion of the Survey Area (%)	Representative Photo
FHT-05 - individual Jarrah	Individual <i>Eucalyptus marginata</i> with a DBH greater than 30cm, over small native shrubs and weeds. Not core habitat for listed species. Supporting habitat for: Carnaby's black cockatoo Forest red-tailed black cockatoo Non-significant habitat for: Peregrine falcon Quenda Graceful sun-moth Black-striped snake	Negligible	Not photographed

Fauna Habitat Type	Habitat Description	Total Area (ha), Proportion of the Survey Area (%)	Representative Photo
BG-01- Bare ground, sand with sparse weeds.	Bare sandy ground and unvegetated sand, sparsely vegetated sand with occasional large <i>Melaleuca preissiana</i> , ground dominated by weeds.		
	Not core habitat for listed species.		
	Supporting habitat for: Black striped burrowing snake	21.36	
	Non-significant habitat for: Carnaby's black cockatoo Forest red-tailed black cockatoo Peregrine falcon Quenda Graceful sun-moth	91.20 %	
Total		23.42	

4.3.3 Threatened and Priority Fauna

Fauna species of conservation significance which were recorded as present or assessed as having a high or medium likelihood of occurrence (excluding black cockatoo species) are discussed in detail below.

Black cockatoo species were subject to a specific targeted habitat assessments which is presented in Section 4.3 below.

Black-striped snake, black-striped burrowing snake - P3

Black-striped snake (*Neelaps calonotos*) is listed as a Priority 3 species by DBCA. The species inhabits coastal dunes and sandplains that support heath or banksia woodland.

As a subterranean sand dwelling nocturnal species, the majority of the Survey Area consists of supporting habitat for this species.

There is one DBCA records of this species within the 10 km buffer of the Survey Area within the last 20 years. This species is likely infrequently recorded due to its nocturnal and subterranean habit.

Peregrine falcon - OS

Peregrine falcon (*Falco peregrinus*) is listed as a species in need of Other Specially Protected (OS), a cosmopolitan species that predates other bird species, it can be found in an extremely wide range of habitats. Habitats within the Survey Area have the potential to support a number of potential prey species, as well as perches that the Peregrine Falcon could use to prepare their prey. There is no breeding habitat present within the Survey Area for the Peregrine falcon, which require steep cliffs or built structures that serve as bio-mimics of their preferred cliffside nesting habitat.

There are six DBCA records of Peregrine falcons within 10 km of the Survey Area within the last 20 years. The species is likely to be only infrequently present, FHT-01 provides the only supporting habitat and other habitat types are considered non-significant habitat for the species.

Quenda, southwestern brown bandicoot - P4

Quenda (*Isoodon fusciventer*) is listed as a Priority 4 species by DBCA. Preferred habitat for the species is dense understory such as around swamps or in banksia and jarrah woodlands. The DBCA database search returned 72 records of quenda within a radius of 10 km from the Survey Area within the last 20 years, FHT-01, 02 and 03 provide supporting habitat for this species.

Graceful sun-moth - P4

Graceful sun-moth (*Synemon gratiosa*) is listed as is listed as a Priority 4 species by DBCA. Graceful sun-moth is associated with coastal heath land, dense and numerous vegetation and banksia woodland. The DBCA database search returned 20 records of graceful sun-moth within a radius of 10 km from the Survey Area within the last 20 years, FHT-02 and 03 provide supporting habitat for this species.

Graceful sun-moth require the host plant *Lomandra hermaphrodita* to complete their life cycle. *L. hermaphrodita* was not specifically surveyed for, however is common in banksia woodlands in the Wanneroo area; it was therefore assumed to be likely present. Graceful sun-moth has been given a precautionary Medium likelihood of occurrence

4.4 Black Cockatoo Habitat Assessment

4.4.1 Observations and Previous Records

The Survey Area falls within the modelled distribution and breeding range for Carnaby's black cockatoo and forest red-tailed black cockatoo and outside the modelled breeding and foraging range of Baudin's black cockatoo (DCCEEW, 2022). Carnaby's black cockatoo foraging evidence (chewed banksia cones) was identified as present within the Survey Area. Small flocks of Carnaby's cockatoos were observed commuting over the Survey Area on both days of the survey. No foraging evidence of forest red-tailed-Black cockatoo was observed within the Survey Area. There were no opportunistic sightings of forest red-tailed black cockatoo within the Survey Area.

There is a confirmed Carnaby's black cockatoo breeding location 7.5 km southwest of the Survey Area in the Edith Cowan University Campus at Lake Joondalup (DBCA database search). There are also two confirmed Carnaby's black cockatoo breeding locations approximately 20 km northwest and northeast respectively (DBCA-054) The Survey Area does not overlap with the (12 km) key foraging area buffer of these confirmed breeding locations. Seven mapped black cockatoo roosting sites are present within 6 km of the Survey Area (DBCA-064). All are confirmed Carnaby's black cockatoo roost sites (DBCA-064). See Figure 8.

4.4.2 Breeding Habitat Assessment

Breeding habitat is defined as that which contains known, suitable or potential nesting trees (DCCEEW, 2022). Breeding typically occurs in native eucalypt species particularly marri, karri, wandoo and tuart however many species of eucalypt including non-endemic species may develop suitable nesting hollows (DCCEEW, 2022). A summary of understood suitable nesting hollow characteristics for the three species is provided below in Table 10.

Table 10: Black cockatoo Nesting Hollow Characteristics

	Carnaby's black cockatoo	Forest red-tailed black cockatoo
Tree species and hollow characteristic	Nesting mainly in salmon gum, wandoo, tuart, jarrah, flooded gum, karri and marri.	Nesting mainly in jarrah, marri, karri, wandoo, bullich, blackbutt and tuart
	Utilise hollows from 10-65 cm diameter (average 26 cm) and >1 m deep	Utilise hollow from 12-150 cm diameter (average 34 cm) and >1 m depth
		DCCEEW, 2022, Johnstone et al., 2013.

	Carnaby's black cockatoo	Forest red-tailed black cockatoo
	DCCEEW, 2022, Saunders et al., 2014a, Saunders et al., 2014b.	

Known and Suitable Nesting Trees

None of the 103 trees recorded within the Survey Area were identified as Known or Suitable nesting trees.

Potential Nesting Trees

A total of 59 Potential breeding trees were recorded. See Figure 9 for tree locations and Appendix D for summary of tree locations, species and DBH. Trees within the Survey Area either showed no signs of potential nesting hollow development (Bamford class 5), or were Trees with hollows or broken branches that might or do contain hollows, but hollows or potential hollows are not of a suitable size or are aligned or obstructed so as to prevent access (Bamford class 4). A breakdown of tree results is presented in Table 11.

Table 11 Summary of Black Cockatoo breeding Habitat Trees

Bamford Class	Class 1	Class 2	Class 3	Class 4 or 5		
DAWE, 2022 Terminology	Known Nesting Tree	Suitable Nesting Tree	Potential Nesting Tree	Potential future nesting trees	Totals (Trees)	
Tree Species						
Coastal Blackbutt (<i>Eucalyptus tottiana</i>)	-	-	-	10	18	28
Small fruited Eucalypt (<i>E. rudis</i> and <i>E. camaldulensis</i>)	-	-	-	45	25	70
Dead	-	-	-	4	0	4
Jarrah	-	-	-		1	1
Total (Bamford Class	0	0	0	59	44	103

Potential Future Nesting Trees

A total of 44 trees had a DBH less than 50 cm and greater than 30 cm and were therefore classified as Potential future nesting trees.

4.4.3 Foraging Habitat Assessment

The habitat within the survey area primarily comprised of large areas of open sand with sparse weeds and occasional native species and occasional large trees.

The eastern half of the Survey Area contains a number of large, poor condition or dead eucalypts which do not comprise important foraging resources for either species of black cockatoo, and large moonah trees (*Melaleuca preissiana*) which is not a foraging species for black cockatoo. Moonah were mapped under BG- 01 and are not represented separately in Figure 7. The western half of the Survey Area mostly comprised sparse groves of coastal blackbutt (*E. tottiana*) and Western Australian Christmas tree (*N. floribunda*), which also do not constitute important foraging resources for black cockatoo. Occasional stands of banksia (*B. attenuata* and *B. ilicifolia*) are present within the Survey Area and constitute good foraging habitat for Carnaby's black cockatoo, which was evidenced by instances of foraged banksia cones. The Survey Area contained occasional small groves of sheoak (*A. fraseriana*) which is a high value foraging species for forest red-tailed black cockatoo.

The Commonwealth referral guideline provides a foraging quality scoring tool to guide referral information (DCCEEW, 2022). The tool advises that if the Survey Area contains native vegetation used for foraging at any time by a black cockatoo species and is >1 ha in size, that it is considered at face value to be of very high quality and assigned a starting score of 10. The tool then allows for subtractions if attributes are present which reduce the functionality of the foraging habitat. The Commonwealth referral guidelines specify that the tool is to be applied once to the entire impact area even if there is more than one type of foraging habitat present. The calculated foraging habitat quality score is shown below in Table 12. Scores of 5-10 are identified as representing high value foraging habitat.

Table 12: Foraging Quality Scoring Tool (DCCEEW, 2022)

Attribute	Carnaby's black cockatoo	Forest red-tailed black cockatoo
Starting score	10 - Foraging habitat more than 1 ha	10 - Foraging habitat more than 1 ha
Foraging potential (-2 if no foraging evidence)	Foraging evidence present	-2 No foraging evidence present
Connectivity (-2 if no other foraging habitat in 12 km)	No change, other foraging habitat <12 km away	No change, other foraging habitat <12 km away
Proximity to breeding habitat (-2 if no breeding habitat in 12 km)	No change, recorded breeding habitat within 12 km	No change, recorded breeding habitat within 12 km
Proximity to roosting (-1 if >20 km from known night roost)	No change, known roosting site <20 km distant	No change, known roosting site <20 km distant
Impact from significant plant disease (-1 if >50% impact)	No change, impact from plant disease affecting <50% of foraging plants	No change, impact from plant disease affecting <50% of foraging plants
Total score	10	8

The Commonwealth referral guidance allows for the inclusion of additional information for foraging habitat which may be considered during an assessment, such as the extent and density of recognised foraging plants within a Survey Area. As an additional source of information, WEPL provides an assessment of foraging habitat quality using a more detailed scoring tool developed by DCCEEW (n.d.) referred to as the Habitat Quality Scoring Tool to produce a numerical foraging habitat score. The Habitat Quality Scoring Tool allows for a score of 0 (none) to 7 (very high) for Site Condition. This is assessed based on density of known foraging species and health of vegetation. The 0-7 Site Condition score is applied to each mapped polygon of fauna habitat. The Habitat Quality Scoring Tool then applies a Site Context score out of three, this is applied only once to the whole Survey Area.

The Site Condition habitat quality score for each species, and the total area of that score present within the Survey Area are listed in Table 13 below and shown in Figure 10 and Figure 11 The score was calculated as per the criteria listed in Appendix E.

Table 13: Habitat Quality Scoring Tool- Site Condition Extent

Site Condition	Carnaby's black cockatoo (ha)	Forest red-tailed black cockatoo (ha)
7- Very High	-	--
6- High	-	--
5-Moderate-High	0.06	-
4-Moderate	-	0.02
3-Low-Moderate	-	-
2-Low	1.5	1.5
1-Negligable to Low	0.48	0.52
0-None	21.36	21.36
Total	23.42	23.42

* shaded cells are classified as not comprising suitable foraging habitat.

The Habitat Quality Scoring Tool then requires the application of a Site Context score out of three (see Table 14) which is added to the Site Condition score for a final x/10 score. See Table 15 for final Habitat Quality Scoring Tool score. Note that habitat with a Site Condition starting score of 2 or less are extremely unlikely to be suitable habitat and do not have a Site Context score added.

Table 14: Habitat Quality Scoring Tool-Site Context

Site Context					
Proximity of the site in relation to other habitat	3	Site is within 6 km of known breeding site.	or	Site is within 12 km of other foraging resources with site condition of at least 3.	3
	2	Site is within 12 km of known breeding site.		Site is within 15 km of other foraging resources with site condition of at least 4.	2
	1	Site is within 15 km of known breeding site.		Site is between 15 km and 20 km of other foraging resources with site condition of at least 5.	1
	0	Site is further than 15 km from known breeding site.		Site is further than 20 km from other foraging resources.	0
Totals					3

Table 15: Final Habitat Quality Scoring Tool Score

Site Condition	Carnaby's black cockatoo (ha)	Forest red-tailed black cockatoo (ha)
10	-	-
9	-	-
8	0.06	-
7	-	0.02
6	-	-
5	-	-
4	-	-
3	-	-
2	1.5	1.5
1	0.48	0.52
0	21.36	21.36
Total	23.42	23.42

* shaded cells are classified as not comprising suitable foraging habitat.

As per the Habitat Quality Scoring Tool areas with a site condition score of 2 or lower (shaded cells) are "extremely unlikely to be considered as suitable habitat". These areas are therefore classified as not comprising suitable foraging habitat in this assessment.

Regional Foraging Habitat Assessment

Analysis of estimated foraging habitat extent within the local area was also undertaken to provide further context. The estimated extent of foraging habitat is calculated for a buffer of 12 km around and including the

Survey Area. This buffer is selected as recommended in the Commonwealth referral guidelines due to black cockatoos mainly foraging within 12 km of their nest site during the breeding season and their reliance on this proximity of foraging resources to successfully raise chicks (DCCEEW, 2022).

Analysis considers Remnant Native Vegetation Extent mapping (DPIRD-005) and Vegetation Complexes-Swan Coastal Plain and Southwest Forest region (DBCA-046 and DBCA-047). See summary of regional vegetation complexes and extents in Table 16 and displayed in Figure 12.

Analysis indicates there is 19450.5 ha of remnant native vegetation mapped within a 12 km buffer of the Survey Area. It is expected that the majority of this vegetation would contain suitable foraging species at the same or greater rate than that present within the Survey Area. Much of this regional remnant native vegetation occurs within the Gnaragar State Forest and the Walyunga National Park.

Within the Survey Area there is 2.06 ha of foraging habitat scoring between 1 (negligible to low) and 7 (very high high) on the Habitat Quality Scoring Tool -Site Condition scale. This represents 0.01 % of the estimated regional habitat extent. The habitat quality within the Survey Area is considered likely to be of similar quality than much of the regional foraging habitat, which includes the jarrah and marri forests of the Darling Scarp.

Table 16: Regional Foraging Habitat Extent

Vegetation Complex	Remnant Extent (ha)
Bassendean Complex-Central and South	19.37
Bassendean Complex-Central and South Transition	547.93
Bassendean Complex-North	7931.45
Bassendean Complex-North Transition	852.44
Cottesloe Complex-Central and South	4583.74
Herdsmen Complex	569.57
Karrakatta Complex-Central and South	1041.55
Karrakatta Complex-North	480.30
Karrakatta Complex-North Transition	1044.15
Pinjar Complex	1751.82
Quindalup Complex	628.18
Bassendean Complex-Central and South	19.37
Bassendean Complex-Central and South Transition	547.93
Bassendean Complex-North	7931.45
Total	19450.5

4.4.4 Roosting Habitat Assessment

Three known roost sites are present <1 km from the Survey Areas (DBCA-064). No evidence of roosting within the Survey Area was recorded. There is a confirmed Carnaby's black cockatoo roosting Site on a residential property immediately south of the Survey Area, eight birds were recorded using the roosting area in 2017.

Night roosting locations are typically in proximity to foraging habitat (black cockatoos mainly foraging within 20 km of night roosts) and with access to water points <2 km from roosting location (DCCEEW, 2022). Any groups of tall trees, particularly large native eucalypts in proximity to water sources may provide night roosting habitat (DCCEEW, 2022). FHT-02 is considered to provide the most suitable roosting habitat. Throughout the Survey Area, isolated stands of tall (> 10 m) *Eucalyptus* are scattered which may provide suitable roosting habitat. Access to permanent water was present from Mariginiup Lake within 3 km.

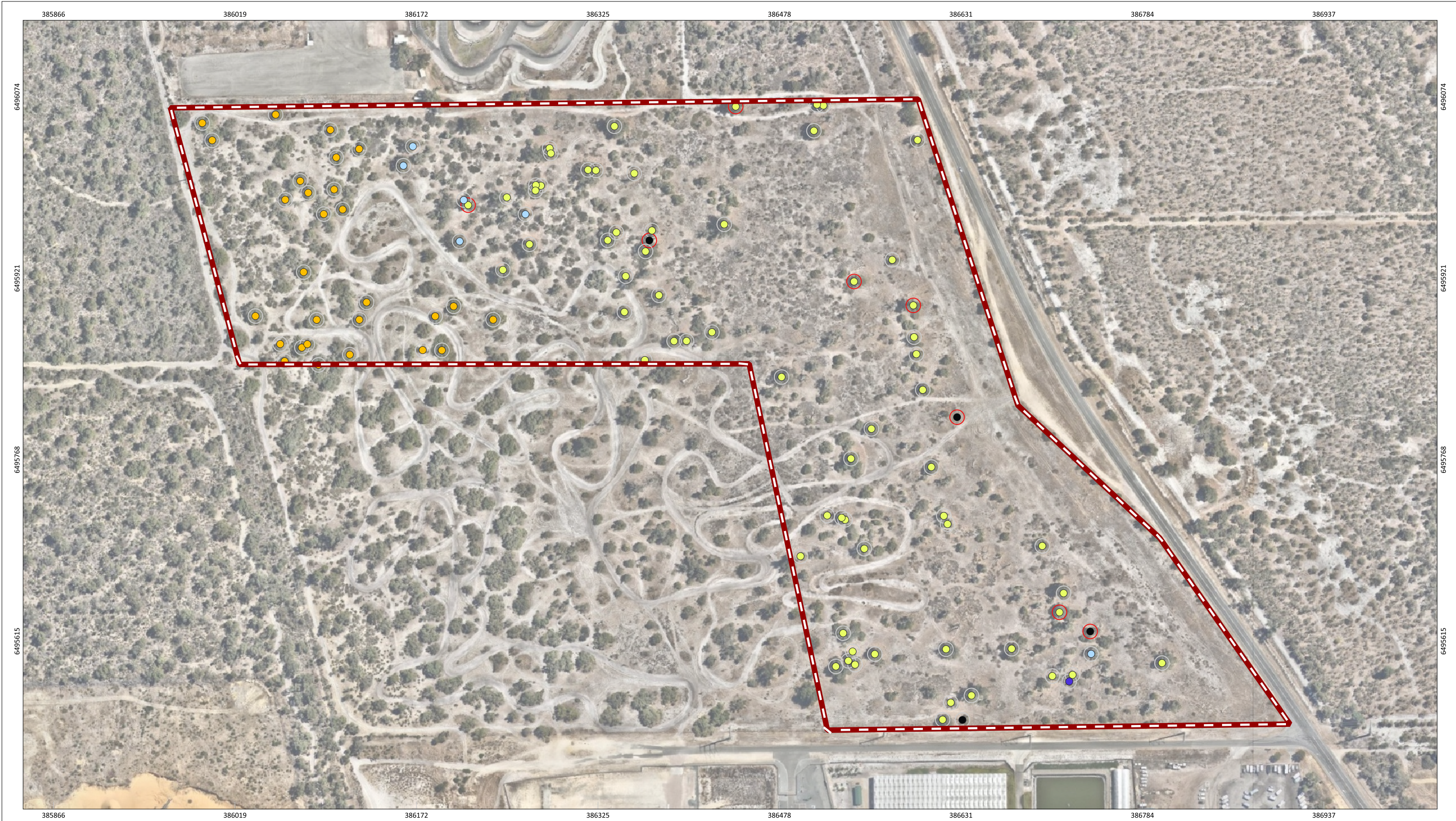


Figure 9: Black Cockatoo Potential Breeding Habitat

N

0

40

80

120

160 m

SCALE

1:3,061

SHEET SIZE

A3 COLOUR

PROJECT/REPORT NAME

Basic Fauna and Targeted Black Cockatoo Habitat Assessment Wanneroo

CLIENT

City of Wanneroo

PROJECT NUMBER

A25.002

VERSION

0

DRAWN BY / REVIEWED BY

JP/JR

DATE

15/4/2025

Legend

Survey Area

4

5

Bamford Tree Class

Tree Species

Blackbutt

Dead

Flooded Gum

Jarrah

River Red Gum

No	Description	Drawn	Approved	Date
A	Original Issue	JP	JR	15/4/2025

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

WESTERN ENVIRONMENTAL

Western Environmental Pty Ltd

08 6244 2310 | enquiries@western.com.au

Level 3/25 Prowse St, West Perth WA 6005

western.com.au

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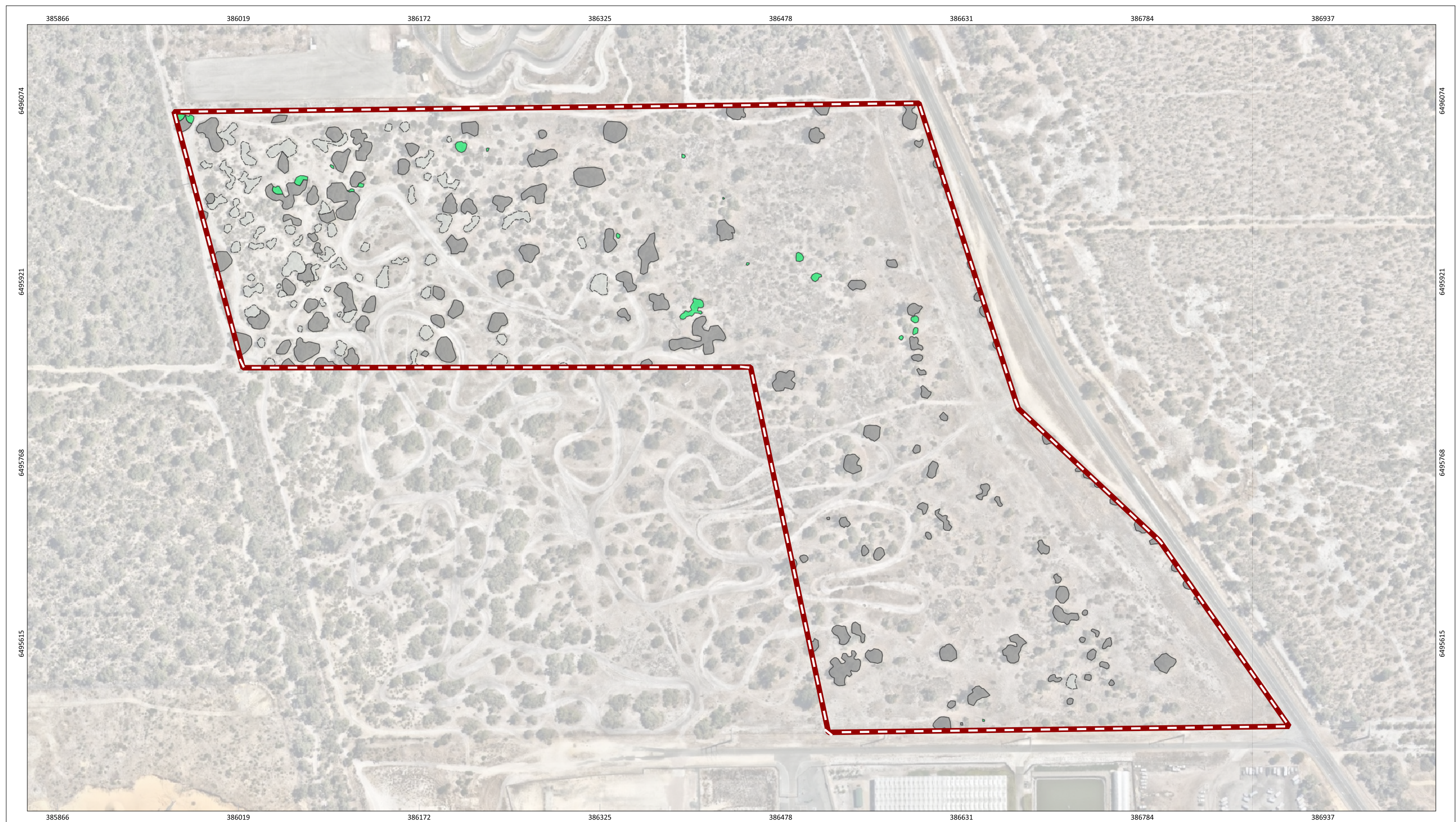


Figure 10: Carnaby's Black Cockatoo Foraging Habitat

N 0 40 80 120 160 m		PROJECT/REPORT NAME Basic Fauna and Targeted Black Cockatoo Habitat Assessment Wanneroo	
SCALE 1:3,061		CLIENT City of Wanneroo	
COORDINATE REFERENCE SYSTEM GDA2020 / MGA zone 50		VERSION A25.002	
DATA SOURCE LANDGATE AERIAL IMAGERY NOW		DATE 22/4/2025	

Legend

Survey Area

Site Condition Score (Habitat Quality Score Tool)

0

1

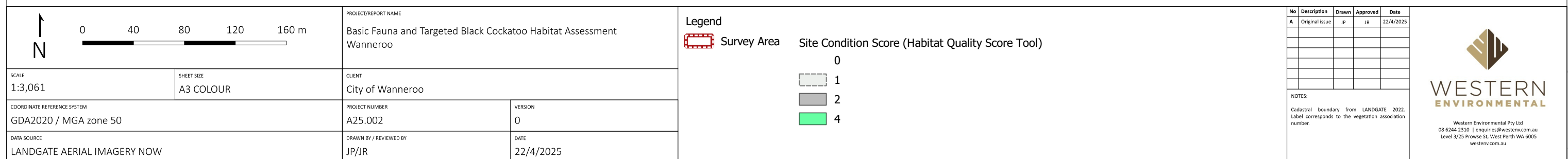
2

5

No	Description	Drawn	Approved	Date
A	Original Issue	JP	JR	22/4/2025
NOTES:				
Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.				

WESTERN ENVIRONMENTAL

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5. Discussion

5.1 Basic Fauna Survey

Five fauna habitat types were described. The majority of the Survey Area consisted of sparsely vegetated sand. Occasional stands of *Eucalyptus*, *Banksia* and native shrubland were present within the Survey Area.

One species of Threatened or Priority fauna was recorded as present within the Survey Area was:

- *Zanda latirostris* (Carnaby's black cockatoo) EN

The three species were assessed as having a high likelihood of occurrence:

- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) EN
- *Isodon fusciventer* (Quenda, southwestern brown bandicoot) P4
- *Neelaps calonotos* (Black-striped snake, black-striped burrowing snake) P3

The two species were assessed as having a medium likelihood of occurrence:

- *Falco peregrinus* (Peregrine falcon) OS
- *Synemon gratiosa* (Graceful sun-moth) P4

Extent of core and supporting habitat present within the Survey Area by species is summarised in Table 17.

Table 17: Summary of Habitat Values

Species	Extent Core Habitat (ha)	Extent Supporting Habitat (ha)
<i>Zanda latirostris</i> (Carnaby's black cockatoo)	0	1.58
<i>Calyptorhynchus banksii</i> (forest red-tailed black cockatoo)	0	1.54
<i>Isodon fusciventer</i> (quenda)	0	2.04
<i>Neelaps calonotos</i> (black-striped snake, black-striped burrowing snake)	0	21.88
<i>Falco peregrinus</i> (Peregrine falcon)	0	1.52
<i>Synemon gratiosa</i> (graceful sun-moth)	0	0.52

5.2 Black Cockatoo Habitat Assessment

The Survey Area is within the modelled distribution for Carnaby's black cockatoo, and forest red-tailed black cockatoo. The Survey Area is outside of modelled breeding distribution for Baudin's black cockatoo and (DCCEEW, 2022).

No Potential or Known nesting trees were recorded within the Survey Area.

Fifty-nine Potential nesting trees were recorded within the Survey Area. Forty-four Potential future nesting trees were recorded within the Survey Area.

Foraging habitat quality was primarily rated using the Commonwealth Habitat Quality Scoring Tool (DCCEEW, n.d.). As per the Habitat Quality Scoring Tool areas with a site condition score of 2 or lower (low, negligible or none value) are "extremely unlikely to be considered as suitable habitat". These areas are therefore classified as not comprising suitable foraging habitat in this assessment. Foraging habitat was considered for Carnaby's black cockatoo, and forest red-tailed black cockatoo foraging habitat quality extents within the Survey Area out of ten are:

The Survey Area was assessed as containing 0.06 ha of suitable foraging habitat for Carnaby's black cockatoo and 0.02 ha of suitable foraging habitat for forest red-tailed black cockatoo.

Foraging habitat quality was primarily rated using the Commonwealth Habitat Quality Scoring Tool (DCCEEW, n.d.). Foraging habitat quality extents within the Survey Area out of ten are:

- Carnaby's black cockatoo: 0.06 ha (8/10), 1.93 ha (6/10), 1.5 ha (2/10), 0.48 ha (1/10), 21.36 ha (0/10). Total of 0.06 ha of suitable foraging habitat and 23.34 ha of unsuitable foraging habitat.
- Forest red-tailed black cockatoo: 0.02 ha (7/10), 1.5 ha (2/10), 0.52 ha (1/10), 21.36 ha (0/10). Total of 0.02 ha of suitable foraging habitat and 23.4 ha of unsuitable foraging habitat.

No evidence of roosting was recorded. Habitat types FHT-01 contains stands of tall trees which may provide suitable roosting habitat. Access to water is present in the nearby lake Joondalup and Lake Mariginiup.

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Appendix A

Legislation

Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act aims to protect matters of national environmental significance (MNES). Under the EPBC Act, the Commonwealth Department of Climate Change, Energy and the Environment lists Threatened species and communities in categories determined by criteria set out in the EPBC Act.

Projects likely to cause a significant impact on MNES should be referred to the DCCEEW for assessment under the EPBC Act.

Biodiversity Conservation Act 2016

The Biodiversity Conservation Act 2016 aims to conserve and protect biodiversity and biodiversity components within the State and to promote ecologically sustainable use of biodiversity components in the State.

Environmental Protection Act 1986

Declared Rare Flora (DRF) and Threatened Ecological Communities (TECs) are given special consideration in environmental impact assessments and have special status as Environmentally Sensitive Areas (ESAs) under the EP Act and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. Exemptions for a clearing permit do not apply in an ESA. In addition, habitat necessary for the maintenance of indigenous fauna is considered in the clearing principles and assessed during consideration of applications for a clearing permit.

Department of Biodiversity, Conservation and Attractions Priority Lists

DBCA lists 'Priority' flora and fauna that have not been assigned statutory protection as "Threatened" under the BC Act and are under consideration for declaration as Threatened. Flora and fauna assessed as Priority 1-3 are considered to be in urgent need of further survey. Priority 4 flora requires monitoring every 5 -10 years.

DBCA maintains a list of Priority Ecological Communities (PECs) which identifies plant communities that require further investigation before possible nomination for TEC status. Once listed, a community becomes a PEC and, when endorsed by the WA Minister for Environment, becomes a TEC and protected as an ESA under Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

Informal Recognition of Flora and Fauna

Certain populations or communities of flora and/or fauna may be of local significance or interest because of their patterns of distribution and abundance. For example, specific locations of flora and may be locally significant because they are range extensions to the previously known distribution, or are newly discovered taxa (and have the potential to be of more than local significance). In addition, many species are in decline as a result of threatening processes (land clearing, grazing, and changed fire regimes) and relict populations of such species assume local importance for DBCA. It is not uncommon for DBCA to make comment on these species of interest.

Appendix B

Definitions and Criteria

EPBC Act Categories for Flora, Fauna and Ecological Communities

Category	Threatened Species	Threatened Ecological Communities
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.	N/A.
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.	N/A.
Critically Endangered (CE)	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied:	N/A.

Category	Threatened Species	Threatened Ecological Communities
	(i) the species is a species of fish. (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised. (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory. (iv) cessation of the plan of management would adversely affect the conservation status of the species.	

Conservation Codes for Western Australian Flora and Fauna (DBCA)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora which have been adequately searched for and are deemed to be, in the wild, Threatened, extinct or in need of special protection, and have been gazetted as such. The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the Biodiversity Conservation Act 2016. Categories of Threatened, Extinct and Specially Protected fauna and flora are:	
T	Threatened species Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as Threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act). Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna. Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using International Union for Conservation of Nature (IUCN) Red List categories and criteria as detailed below.
CR	Critically endangered species Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	Endangered species Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines".

Conservation Codes for Western Australian Flora and Fauna

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.

VU	Vulnerable species Threatened species considered to be “facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines”. Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
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Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

EX	Extinct species Species where “there is no reasonable doubt that the last member of the species has died”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.
----	---

EW	Extinct in the wild species Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no Threatened fauna or Threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
----	---

Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as Threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.
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Conservation Codes for Western Australian Flora and Fauna

Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as Threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
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OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
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P	Priority species Possibly Threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of Priority for survey and evaluation of conservation status so that consideration can be given to their declaration as Threatened fauna or flora. Species that are adequately known, are rare but not Threatened, or meet criteria for near Threatened, or that have been recently removed from the Threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
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1	Priority 1: Poorly-known species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
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2	Priority 2: Poorly-known species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
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3	Priority 3: Poorly-known species Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey
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Conservation Codes for Western Australian Flora and Fauna

requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

4

Priority 4: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently Threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of Threatened species during the past five years for reasons other than taxonomy.

Appendix C

Desktop Assessment Results and Likelihood of Occurrence Assessment

Fauna Database Search Results (DBCA Database Search using 20 Km Buffer, PMST 20 km buffer), Likelihood and Fauna Survey Records

Scientific Name	Common Name	Conservation Status		Database Source		Likelihood of Occurrence	Justification
		WA	EPBC	DBCA	PMST		
Aves							
<i>Apus pacificus</i>	fork-tailed swift	MI	MI	X	X	Low	Migratory species, no breeding or roosting habitat within Survey Area
<i>Botaurus poiciloptilus</i>	Australasian Bittern	EN	EN	X	X	Low	Wetland species, no suitable habitat within Survey Area
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	MI	VU & MI	X	X	Low	Migratory shorebird, unlikely to occur within Survey Area
<i>Calidris canutus</i>	Red Knot, Knot	EN	VU & MI	X	X	Low	Migratory shorebird, unlikely to occur within Survey Area
<i>Calidris ferruginea</i>	Curlew Sandpiper	CR	CR & MI	X	X	Low	Migratory shorebird, unlikely to occur within Survey Area
<i>Calidris ruficollis</i>	red-necked stint	MI	MI	X	X	Low	Migratory shorebird, unlikely to occur within Survey Area
<i>Calyptorhynchus banksii naso</i>	forest red-tailed black cockatoo	VU	VU	X	X	High	Potential foraging habitat within and adjacent to Survey Area. 2 records within 10 km within 20 years.
<i>Charadrius leschenaultii</i>	greater sand plover, large sand plover	VU	VU & MI	X	X	Low	Migratory shorebird, unlikely to occur within Survey Area
<i>Falco peregrinus</i>	peregrine falcon	OS		X		Medium	Flyover species, may alight in tall trees to consume avian prey.
<i>Leipoa ocellata</i>	Malleefowl	VU	VU	X	X	Low	Locally extinct

Scientific Name	Common Name	Conservation Status		Database Source		Likelihood of Occurrence	Justification
		WA	EPBC	DBCA	PMST		
<i>Limosa lapponica menzbieri</i>	Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit	CR	EN	X	X	Low	Migratory shorebird, unlikely to occur within Survey Area
<i>Limosa limosa</i>	black-tailed godwit	MI	MI	X	X	Low	Migratory shorebird, unlikely to occur within Survey Area
<i>Numenius madagascariensis</i>	Eastern Curlew, Far Eastern Curlew	CR	CR & MI	X	X	Low	Migratory shorebird, unlikely to occur within Survey Area
<i>Oxyura australis</i>	blue-billed duck	P4		X		Low	Wetland species, no suitable habitat within Survey Area
<i>Pandion haliaetus</i>	osprey	MI	MI	X	X	Low	Coastal species, no suitable habitat within Survey Area
<i>Plegadis falcinellus</i>	glossy ibis	MI	MI	X	X	Low	Wetland species, no suitable habitat within Survey Area
<i>Rostratula australis</i>	Australian Painted Snipe	EN	EN	X	X	Low	Wetland species, no suitable habitat within Survey Area
<i>Sternula albifrons</i>	Little Tern	MI	MI	X	X	Low	Coastal and wetland species, no suitable habitat within Survey Area
<i>Sternula nereis nereis</i>	Australian Fairy Tern	VU	VU	X	X	Low	Coastal and wetland species, no suitable habitat within Survey Area
<i>Thalasseus bergii</i>	crested tern	MI	MI	X	X	Low	Coastal and wetland species, no suitable habitat within Survey Area
<i>Tringa nebularia</i>	common greenshank	MI	MI	X	X	Low	Wetland species, no suitable habitat within Survey Area

Scientific Name	Common Name	Conservation Status		Database Source		Likelihood of Occurrence	Justification
		WA	EPBC	DBCA	PMST		
Zanda baudinii	Baudin's cockatoo	EN	EN	X	X	Low	Outside of expected presence range for species
Zanda latirostris	Carnaby's cockatoo	EN	EN	X	X	Recorded	Observed flying over Survey Area, Recorded in DBCA data. 413 DBCA records within 10 km within 20 years.
Mammals							
Dasyurus geoffroii	Chuditch, Western Quoll	VU				Low	Locally extinct
Hydromys chrysogaster	water-rat, rakali	P4		X		Low	Wetland species, no suitable habitat within or near Survey Area.
Isoodon fusciventer	quenda, southwestern brown bandicoot	P4		X		High	Suitable vegetated habitats within the Survey Area. 72 records within 10 km within 20 years.
Macroderma gigas	Ghost Bat		VU	X	X	Low	PMST record, very far outside of expected range.
Notamacropus irma	western brush wallaby	P4		X		Low	Primary habitat for species not present within Survey Area. 2 records within 10 km within 20 years
Reptiles and Amphibians							
Neelaps calonotos	black-striped snake, black-striped burrowing snake	P3		X		High	Subterranean sandplain species, which is likely under recorded, one record within 10 km in 20 years. Entire Site constitutes Core habitat
Invertebrates							

Scientific Name	Common Name	Conservation Status		Database Source		Likelihood of Occurrence	Justification
		WA	EPBC	DBCA	PMST		
Synemon gratiosa	graceful sun-moth	P4		X		Medium	20 records within 10 km within 20 years. Host species <i>Lomandra hermaphrodita</i> not surveyed for but may be present within Survey Area
Hesperocolletes douglasi	Douglas's broad-headed bee	CR	CR	X		Low	Single record of species from Pinjar area in 2015, very unlikely to occur within Survey Area.

Appendix D

Black Cockatoo Potential Suitable and Known Breeding Trees

Potential, Suitable and Known Black Cockatoo Nest Trees.

Tree Number	Species	Bamford Class	DBH	Hollow Data	Eastings	Northings
1	Coastal Blackbutt	5	50	None	386053.1985	6496059.007
2	Flooded Gum	5	50	None	386625.265	6495562.238
3	Flooded Gum	5	50	None	386696.4189	6495695.831
4	Flooded Gum	5	50	None	386555.5035	6495794.064
5	Flooded Gum	5	50	None	386316.614	6496012.451
6	Flooded Gum	5	50	None	386338.6113	6495953.229
7	Flooded Gum	5	50	None	386285.4798	6496030.799
8	Coastal Blackbutt	5	55	None	386236.5454	6495886.135
9	Coastal Blackbutt	5	55	None	386087.8146	6495886.052
10	Coastal Blackbutt	5	55	None	386079.9016	6495865.44
11	Coastal Blackbutt	5	55	None	386076.8077	6495926.224
12	Flooded Gum	5	55	None	386544.9257	6495691.51
13	Flooded Gum	5	55	None	386532.944	6495720.388
14	Flooded Gum	5	55	None	386479.7549	6495837.733
15	Flooded Gum	5	55	None	386593.5325	6495872.685
16	Flooded Gum	5	55	None	386383.6509	6495909.134
17	Flooded Gum	5	55	None	386272.2642	6495995.022
18	Flooded Gum	5	55	None	386267.1795	6495949.649
19	Coastal Blackbutt	5	60	None	385991.3382	6496051.911

Tree Number	Species	Bamford Class	DBH	Hollow Data	Eastings	Northings
20	Coastal Blackbutt	5	60	None	385999.6907	6496037.394
21	Coastal Blackbutt	5	60	None	386123.6061	6496030.05
22	Dead	4	60	Small hollows	386627.7088	6495803.882
23	Flooded Gum	5	60	None	386598.758	6495826.929
24	Flooded Gum	5	60	None	386598.1864	6495860.55
25	Flooded Gum	5	60	None	386505.7594	6496047.577
26	Flooded Gum	5	60	None	386370.4546	6495961.323
27	Flooded Gum	5	60	None	386389.0981	6495868.046
28	Flooded Gum	5	60	None	386347.2076	6495892.603
29	Flooded Gum	5	60	None	386287.1959	6496026.271
30	Flooded Gum	5	60	None	386244.7829	6495928.114
31	Flooded Gum	4	60	None	386215.4872	6495982.694
32	Coastal Blackbutt	5	65	None	386075.2795	6495862.567
33	Flooded Gum	5	65	None	386525.5167	6495593.708
34	Flooded Gum	5	65	None	386558.3499	6495604.068
35	Flooded Gum	5	65	None	386673.7356	6495608.625
36	Flooded Gum	5	65	None	386723.1969	6495587.212
37	Flooded Gum	5	65	None	386800.452	6495596.534
38	Flooded Gum	5	65	None	386544.1971	6495771.582
39	Flooded Gum	5	65	None	386345.8913	6496053.25

Tree Number	Species	Bamford Class	DBH	Hollow Data	Eastings	Northings
40	River Red Gum	5	65	None	386208.3243	6495952.2
41	River Red Gum	5	65	None	386168.8827	6496032.194
42	Flooded Gum	5	65	None	386615.5311	6495548.801
43	Flooded Gum	5	70	None	386538.4892	6495620.862
44	Dead	5	70	None	386632.219	6495548.578
45	Flooded Gum	5	70	None	386530.6288	6495722.006
46	Flooded Gum	5	70	None	386431.3527	6495966.474
47	Flooded Gum	5	70	None	386374.5511	6495949.109
48	Flooded Gum	5	70	None	386248.1154	6495989.181
49	Flooded Gum	5	75	None	386637.4779	6495571.296
50	Flooded Gum	5	75	None	386717.5316	6495655.424
51	Coastal Blackbutt	5	80	None	386073.9395	6496003.105
52	Flooded Gum	5	80	None	386353.1052	6495923.446
53	Dead	4	80	Small spout hollow	386744.7494	6495629.386
54	River Red Gum	5	85	None	386740.6515	6495601.279
55	Flooded Gum	5	85	None	386495.7384	6495686.61
56	Dead	4	90	Small knots and some broken branches hollowing not deep enough or large enough	386372.3335	6495959.372
57	Flooded Gum	4	105	Small fissure in branch possibly 10cm deep, side spout on south side branch 6m up, shallow knot hollowing west side 5m up	386540.845	6495918.296

Tree Number	Species	Bamford Class	DBH	Hollow Data	Eastings	Northings
58	Flooded Gum	4	105	Photo #224- fissure/spout hollow on North side too shallow and bee activity, side fissure small and bee activity, small fissure east side with two openings 10cm diameter	386430.326	6496066.083
59	Flooded Gum	4	125	One fissure in lowest branch 10cm opening- bees entering and exiting, two branches hollowing at ends, 5cm diameter	386590.8196	6495898.168
60	Flooded Gum	4	35	One small opening on low hollowed branch 30cm diameter and 15-20cm deep	386716.7337	6495646.105
61	Coastal Blackbutt	5	30	None	386089.3263	6495848
62	Coastal Blackbutt	5	30	None	386060.7892	6495851.064
63	Coastal Blackbutt	5	30	None	386057.0546	6495865.555
64	Coastal Blackbutt	5	30	None	386036.1408	6495889.157
65	Coastal Blackbutt	5	30	None	386061.2683	6495987.278
66	Coastal Blackbutt	5	30	None	386080.6361	6495993.116
67	Coastal Blackbutt	5	30	None	386102.4994	6495995.924
68	Coastal Blackbutt	5	30	None	386109.6958	6495979.052
69	Coastal Blackbutt	5	30	None	386093.7652	6495975.135
70	Coastal Blackbutt	5	30	None	386104.3106	6496022.875
71	Coastal Blackbutt	5	30	None	386099.33	6496046.194
72	Coastal Blackbutt	5	30	None	386203.2641	6495897.386
73	Coastal Blackbutt	5	30	None	386187.7251	6495889.007
74	Coastal Blackbutt	5	30	None	386193.341	6495860.317
75	Coastal Blackbutt	5	30	None	386177.1843	6495860.444

Tree Number	Species	Bamford Class	DBH	Hollow Data	Eastings	Northings
76	Coastal Blackbutt	5	30	None	386123.7507	6495886.042
77	Coastal Blackbutt	5	30	None	386115.6799	6495856.601
78	Coastal Blackbutt	5	30	None	386129.882	6495900.727
79	Flooded Gum	5	40	None	386542.0457	6495597.776
80	Flooded Gum	5	35	None	386539.4053	6495600.289
81	Flooded Gum	5	30	None	386540.3621	6495605.286
82	Flooded Gum	5	40	None	386701.2002	6495582.352
83	Flooded Gum	5	45	None	386621.8153	6495712.779
84	Flooded Gum	5	45	None	386614.6487	6495719.867
85	Flooded Gum	5	40	None	386618.3876	6495608.227
86	Flooded Gum	5	45	None	386521.6327	6495720.378
87	Flooded Gum	5	30	None	386603.8363	6495762.187
88	Flooded Gum	5	30	None	386597.5842	6495930.884
89	Flooded Gum	5	40	None	386590.8901	6496035.893
90	Flooded Gum	5	45	None	386511.7928	6496065.674
91	Flooded Gum	5	45	None	386509.6063	6496067.472
92	Flooded Gum	5	30	None	386355.5649	6496009.444
93	Flooded Gum	5	45	None	386323.1811	6496012.024
94	Flooded Gum	5	45	None	386339.3982	6495962.678
95	Flooded Gum	5	30	None	386398.8249	6495871.609

Tree Number	Species	Bamford Class	DBH	Hollow Data	Eastings	Northings
96	Flooded Gum	5	45	None	386419.3332	6495873.638
97	Flooded Gum	5	30	None	386371.9948	6495858.195
98	Flooded Gum	5	35	None	386279.1754	6495999.119
99	Flooded Gum	5	45	None	386277.9222	6495998.785
100	River Red Gum	5	40	None	386263.7661	6495975.002
101	River Red Gum	5	40	None	386211.8034	6495986.992
102	River Red Gum	5	40	None	386160.9025	6496015.974
103	Jarra	5	30	None	386722.2566	6495581.041

Appendix E

Black Cockatoo Habitat Quality Scoring Tool (DCCEEW, n.d)

Habitat Scoring System for WA black cockatoo foraging habitat

This habitat scoring system describes elements indicative of suitable foraging habitat¹ for the three WA black cockatoo species (Carnaby's Black Cockatoo, Baudin's Black Cockatoo and the Forest Red-tailed Black Cockatoo) in WA. Its use must be supported by survey information and reporting, undertaken by suitably qualified and experienced ecologists.

Appropriate scores will best fit a description. Where all components of the 'detail' column description are not met, this must be specified, and justification provided for that score to be accepted by the Department.

For an offset site to be considered by the Department, the offset site must have a start score of 1 for each indicator (e.g., there must be a species stocking rate score of at least 1).

Indicator	Score	Detail		Impact site	Offset start quality	Without offset	With offset
Site Condition							
		Foraging value	Details				
Vegetation condition and structure. Habitat features	7	Very High	Carnaby’s Black Cockatoo				
			Native kwongan heath and shrubland (>30% projected foliage cover), banksia and eucalypt woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths².				
			Baudin’s Black Cockatoo				
			Marri-Jarrah Forest and woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.				
	6	High	Carnaby’s Black Cockatoo				
			Native kwongan heath and shrubland (>25% projected foliage cover), banksia and eucalypt woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.				
			Baudin’s Black Cockatoo				
			Marri-Jarrah Forest and woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.				

¹ In some cases, an impact or offset site may contain or require both foraging and breeding habitat for one or more black cockatoos. Breeding habitat is species of trees known to support breeding within the range of the species which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most species of trees, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm.

²No tree deaths indicate robustness of habitat, unlikely for the habitat to decline in the medium-term. Tree deaths may be owing to disease, water stress, fire, etc.

Vegetation condition and structure. Habitat features	5	Moderate to high	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland (>20% projected foliage cover), banksia and eucalypt woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
	4	Moderate	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 20-30% projected foliage cover. Moderate percentage of tree deaths (30-40%).				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 20-30% projected foliage cover; OR Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to tree deaths (up to 30-40%).				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with: 20-30% projected foliage cover; OR 40-60% projected foliage cover but veg. condition reduced due to tree deaths (up to 30-40%).				
	3	Low to moderate	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 10-20% projected foliage cover.				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 5-20% projected foliage cover.				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 5-20% projected foliage cover.				
	2	Low	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia and eucalypt woodlands with <10% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksias, marri.				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksia, hakea, dryandra.				

Vegetation condition and structure.			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered food plants such as Cape Lilac, <i>Eucalyptus caesia</i> and <i>E. erythrocorys</i> .				
	1	Negligible to low	All species				
			Scattered specimens of known food plants but projected foliage cover of these is <2%. May include: paddocks or urban areas with scattered foraging trees.				
Habitat features	0	None	All species				
			No Proteaceae, eucalypts or other potential sources of food. May include bare ground or developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).				
			Totals				

Site Context							
Proximity of the site in relation to other habitat.	3	Site is within 6km of known breeding site.	or	Site is within 12km of other foraging resources with site condition of at least 3.			
	2	Site is within 12km of known breeding site.	or	Site is within 15km of other foraging resources with site condition of at least 4.			
	1	Site is within 15km of known breeding site.	or	Site is between 15km and 20km of other foraging resources with site condition of at least 5.			
	0	Site is further than 15km from known breeding site.	or	Site is further than 20km from other foraging resources.			
Totals							

Final Totals								
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Indicator		Species Stocking Rate ³	Impact Site			Offset Site		
			CBC	BBC	FRT	CBC	BBC	FRT
Confirm presence/absence of species.	Yes	Species is seen or reported regularly and/or there is abundant foraging evidence, e.g. chewed nuts can be identified as this species. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year.						
	No	Species is recorded or reported very infrequently and there is little or no foraging evidence.						

³ Species stocking rate is indicated by yes or no to confirm if any of the species is frequently present or not. If yes, the presence must be for the species being impacted by the proposal, not for a species that will not be impacted.

Legend	
	If the site scores between 0-2 (low to no value) for site condition, 0 for the site context score, or is No for species stocking rate, it is extremely unlikely to be considered as suitable habitat. This would not be appropriate to use as an offset site.

The metrics used to determine Site Condition, Site Context, and Species Stocking Rate were developed by the Department of Climate Change, Energy, the Environment, and Water in consultation with species experts in WA.

A standard habitat quality scoring system for a species allocates scores out of 3 for both site condition and site context, and out of 4 for species stocking rate. However, as black cockatoos are very mobile, this HQS uses a score out of 7 for site condition and a score out of 3 for site context. Site condition is considered the key factor in determining the quality of habitat for these black cockatoo species. Species stocking rate is considered only in terms of presence or absence of the species and does not add to the total score. Note that the species, or strong indicators of the species, must be present, consistent with the presence/usage description above, for an offset to be considered suitable.

