H005 Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey

Biologic Environmental Survey

Report to Main Roads Western Australia

July 2022

Document Status				
Revision No.	Author	Review / Approved for Issue	Approved for Issue to	
			Name	Date
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EXECUTIVE SUMMARY

Biologic Environmental Survey was commissioned by Main Roads Western Australia to undertake a single season Detailed flora and vegetation survey, a Basic vertebrate fauna survey, and a targeted black cockatoo habitat assessment for the H005 Great Eastern Highway (GEH) Coates Gully project. The project is located along a 12.7-kilometre (km) length of GEH between SLK 56.4 and 67.8, covering an area of 75.03 hectares (ha). A portion of the project area has previously been surveyed for both flora and vegetation (in 2015 and 2019) and fauna (in 2015) (herein referred to as "the previous survey area"). Additional survey effort is required due to modification of the design; the portion of the project to be surveyed by Biologic is herein referred to as "the current survey area", while the previous and current survey areas are herein collectively known as "the survey area".

The flora survey was completed over three days on the 21st and 23rd of October, and the 20th of November 2020, whilst the fauna survey was completed over two days on the 24th and 30th of November 2020.

Rainfall in the preceding winter months to the surveys was well below average, however this is not considered to be a constraint of the flora portion of the survey. It is considered that the work is of a sufficient level to meet EPA requirements and the objectives of the survey.

Flora and Vegetation

A total of 7 sites were sampled across the current survey area (5 quadrats and 2 relevés) to characterise the vegetation types and condition. Sites were spatially distributed to ensure appropriate representation of the flora and vegetation present. The remainder of the vegetation occurring in the current survey area was traversed on foot to record and describe the vegetation types and condition, and to search for conservation significant, introduced and additional opportunistic flora taxa. Approximately, 0.86 sites were sampled per hectare of native vegetation in the current survey area, which is the highest level of survey adequacy of all surveys in the 25 km vicinity. Approximately 0.54 sites per hectare were sampled collectively across the survey area.

The current field survey recorded 138 discrete vascular flora taxa, comprising 89 native taxa and 49 non-native taxa, representing 52 families and 103 genera. The combined total taxa recorded across the survey area totalled 223 flora taxa from 55 families and 149 genera.

A small number of taxa (20, or 8.9 % of total) observed and collected from the field were difficult to confidently identify to species or infraspecies level. This was mainly due to the specimens lacking suitable flowering and fruiting material for confident taxonomic identification. Of these 20 taxa, six were tentatively identified to species or infraspecies level, while fourteen were only identified to genus level. None of the taxa that couldn't be identified with certainty are considered analogous with any listed conservation significant taxa.

The previous survey conducted by 360 Environmental recorded two conservation significant flora taxa and one planted priority listed taxon (the latter of which was not considered in the overall desktop assessment):

- *Lechenaultia hortii* (P2) – approximately 22 individuals from four point locations;
- *Tetratheca pilifera* (P3) – three individuals from three point locations (also recorded by Terratree (2015)); and
- Planted *Grevillea olivacea* (P4) – two planted individuals from one point location.

The remaining 16 taxa identified from the desktop assessment were considered Possible, while 30 were considered Unlikely or Highly Unlikely to occur in the survey area pre-survey.

One flora taxon of conservation significance was recorded in the current survey area during the current survey, *Tetratheca pilifera* (P3) – 19 individuals from ten point locations. Of the records of this taxon recorded during the current survey; one individual from one point location was a previously known location from the previous survey (checked for familiarity); four individuals from four point locations represent new records within the previous survey area; eleven individuals from three point locations represent new records within the current survey area; and three individuals from two point locations represent new records occurring outside both survey areas.

No new locations of *Lechenaultia hortii* (P2) were recorded during the current survey. Upon review of the previous survey timing (October – too early for the flowering time of this taxon), the database searches (not present within the database searches - the closest record is 25 km south-southeast of the survey area), the lack of taxonomic identification confirmation by the Western Australian Herbarium, and the potential for misidentification due to weaknesses in the literature; It is considered that all of the previous 360 Environmental (2019) records of *Lechenaultia hortii* (P2) recorded during the previous survey represent the taxon *Lechenaultia biloba*, which is not a taxon of conservation significance.

A total of 49 non-native taxa were recorded from the current survey area, bringing the combined total number of introduced taxa recorded to 60 across the survey area. Of these 60 taxa, four are listed as Declared Pests (**Gomphocarpus fruticosus*, **Moraea flaccida, *Zantedeschia aethiopica* and **Echium plantagineum*), one is recognised as a Weed of National Significance (**Genista linifolia* – ten individuals from one point location) and one, **Asparagus asparagoides,* is listed as both (39 individuals from 10 point locations).

Thirty-two vegetation types were described and delineated within the current survey area, including five new vegetation types from the current survey:

- Bsq (0.22 ha / 0.3 %) – represented by a previously scraped gravel pit area now void of trees and dominated by *Banksia squarrosa*;
- EwAla (0.45 ha / 0.6 %) – Relatively open *Eucalyptus wandoo* woodland;
- *MaArc (0.15 ha / 0.2 %) – Planted Cape Lilac (**Melia azedarach*) trees over roadside weeds;
- MvTl (0.55 ha / 0.7 %) – Saline flat area next to a minor drainage line containing *Melaleuca viminea* shrubs over *Tecticornia lepidosperma* samphire shrubland; and
- Pasture (2.18 ha / 2.9 %) – Low mixed weedy grasses and herbs.

None of the vegetation types mapped within the current survey area are considered to be conservation significance.

Vegetation types EwBsq and EwCc are considered to be of local significance due to the presence of the priority flora taxon *Tetratheca pilifera* (P3). Vegetation types ErMv*Ja, MvTl and Tsp*Ja are associated with the minor ephemeral drainage system, Coates Gully. The vegetation types within this system were noted as supporting riparian and riverine vegetation, as well as supporting drainage line, drainage areas, saline flat and small wetland landforms all supporting intermittent ephemeral water-pooling. However, the condition of these vegetation types were noted as saline-affected and Degraded, with high covers of invasive weeds and dead trees.

The condition of the vegetation within the current survey area ranged from Excellent to Completely Degraded, with the majority of the vegetation mapped as Excellent (10.76 ha, 14.3 %). The main disturbances observed in the survey area were mainly associated with Great Eastern Highway, included clearing, weeds and rubbish. A large portion of the survey area was mapped as cleared (34.0 ha, 45.3 %), mainly associated with roads, tracks and parking areas (Figure 4.8).

Terrestrial Vertebrate Fauna

Six broad fauna habitats were recorded and mapped across the survey area from the current and previous field surveys, including cleared areas. These fauna habitats comprised; *Eucalyptus wandoo* Woodland over *Banksia* (25.36 ha, 33.8%), *Corymbia* and *Eucalyptus marginata* Woodland (4.44 ha, 5.9%), *Melaleuca* Shrubland (3.05 ha, 4.1%), Isolated Trees (7.03 ha, 9.4%), and Sedgeland (0.79 ha, 1.1%). The habitats of greatest significance within the survey area are the two woodland fauna habitat types, *Eucalyptus wandoo* Woodland over *Banksia*, and the *Corymbia* and *Eucalyptus marginata* Woodland. Eucalypt woodlands are regionally important for black cockatoos, with wandoo *Eucalyptus wandoo*, marri *Corymbia calophylla*, and jarrah *Eucalyptus marginata* recognised as nesting trees for all three cockatoo species. These habitats also potentially support other conservation significant species such as quenda *Isoodon fusciventer*, western brush wallaby *Notamacropus irma*, chuditch *Dasyurus geoffroii*, south-western brush-tailed phascogale *Phascogale tapoatafa wambenger*, and reptile species such as *Ctenotus delli*. The survey area is overlapped and in close proximity to two Regional Ecological Linkages, and these habitats may provide some level of connectivity to other habitats within the wider vicinity.

The remaining habitats present in the survey area, such as the grassy patches under trees and shrublands, may assist with facilitating fauna movements through the landscape relative to the cleared areas common in the surrounding area; however, they are not uncommon or restricted to the survey area and provide little direct habitat for species of conservation significance.

Overall, a total of 51 vertebrate fauna species were recorded across the survey area, comprising of eight mammals, 39 birds, and four reptiles. Four introduced mammal species were recorded within the survey area. A total of 33 conservation listed fauna species were identified as potentially occurring with the survey area during the desktop assessment. Of these, four species were recorded during the previous and current surveys: Carnaby's cockatoo *Calyptorhynchus latirostris*, Baudin's cockatoo *Calyptorhynchus baudinii*, forest red-tailed black cockatoo *Calyptorhynchus banksii naso*, and quenda. An additional five species are considered Possible to occur in the survey area; chuditch *Dasyurus geoffroii*, south-western brush-tailed phascogale *Phascogale tapoatafa wambenger*, western brush

wallaby *Notamacropus irma*, peregrine falcon *Falco peregrinus*, and fork-tailed swift *Apus pacificus*. However, the core home ranges for each of these species is likely to occur in the adjacent patches of remnant bush and the survey area is not a crucial contributing factor to their presence.

Black cockatoos from all three species were identified during the field surveys via both direct observation and foraging evidence. In total, 5.9% (4.44 ha) of the survey area represented High Quality foraging habitat and 33.8% (25.36 ha) Medium Quality foraging habitat for black cockatoos within the two woodland fauna habitat types. Overall, the foraging habitat in the survey area is valued not only on a local level to support roosting and breeding sites, but also on a minor regional level as a "stepping-stone" between seasonal grounds. Potential night roosting habitat was identified within these same woodland habitat types, as well as within the Isolated Trees habitat (36.82 ha, 49.1% of the survey area in total). A night roost on Mairinger Way, approximately 500-meter west of the survey area, was identified during the previous field survey, as well as three additional night roosts within five km of the survey area. As such, the foraging habitat available within the survey area, although of small quantity in a regional context, is considered significant in its potential to support black cockatoo night roosting.

Following consolidation with the previous field survey, 963 potential black cockatoo breeding trees of suitable diameter breast height (DBH) have been identified. Within the 106 trees containing hollows, 88 hollows were considered to have some potential to support black cockatoo breeding in the future, following consideration of attributes such as angle, tree species, presence of competitors, and potential depth. These hollow-bearing trees were concentrated in the Eucalypt-based habitat types; *Eucalyptus wandoo* woodland over *Banksia*, *Corymbia* and *Eucalyptus marginata* woodland, and Isolated Trees. Although no current breeding was identified within the survey area, there are two recent confirmed Carnaby's cockatoo breeding records within dead stags at Wundowie Reserve, located less than five km from the survey area. As such, the survey area and local region is significant not only in relation to supporting breeding through providing suitable hollows, but also providing supporting foraging resources for breeding pairs.

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1 INTRODUCTION

1.1 Background

Main Roads Western Australia (Main Roads) is proposing to upgrade and widen a section of the H005 Great Eastern Highway (GEH) in Coates Gully, in the Shire of Northam (Figure 1.1). The GEH Coates Gully Project (the survey area) is located along a 12.7-kilometre (km) section of GEH between SLK 56.4 and 67.8, between the town of Wooroloo and Bakers Hill within the Shire of Mundaring and Shire of Northam, in the Wheatbelt region of Western Australia.

This section of GEH has a poor safety record due to its poor geometry and sightlines. Stage 1 of the project is currently underway and involves the replacement of the four bridges (Bridges 604, 605, 606 and 607), which are past their functional usage and capacity levels. Stage 1 has previously been surveyed for both flora and vegetation (360 Environmental, 2019; Terratree, 2015) and fauna (Bamford Consulting, 2015). However, the design for Stage 2 of this project has been modified and it now extents slightly beyond the boundary of the area previously surveyed. Stage 2 of the project will include road upgrades and realignment between the four bridges, including widening of the road to a 12/12 formation and will include a one metre median, turning pockets where warranted, and overtaking lanes in both directions.

Biologic Environmental Survey (Biologic) was commissioned by Main Roads to undertake a desktop assessment, single season Detailed flora and vegetation survey, targeted flora, Basic terrestrial vertebrate fauna survey and Targeted black cockatoo habitat assessment of Stage 2 of the project (16.1 ha) i.e., areas previously unsurveyed during Stage 1. The portion previously surveyed is herein referred to as “the previous survey area”, the current survey area surveyed by Biologic is herein referred to as “the current survey area”, and the combined survey areas are herein referred to as “the survey area”.

The biological survey is required for the project to determine if the native vegetation clearing activities are likely to be at variance with one or more of the clearing principles. The results collated during the biological surveys may support State or Federal environmental approvals.

1.2 Objectives

The overarching objective of this assessment was to broadly document the flora, vegetation, fauna and surface water (wetlands) values of the survey area, specifically, any significant values (conservation significant flora, vegetation, fauna and habitat trees) that may occur. The results presented are a consolidation of the field surveys undertaken within the previous survey area (360 Environmental, 2019; Bamford Consulting, 2015) and the current survey area (Biologic, 2021) of the project. The key objectives of the assessment are:

- complete a desktop assessment of the survey area prior to the field survey to identify all biological features and constraints which may be in, or nearby the survey area;
- undertake a Detailed flora and vegetation field survey to verify the desktop study, assess and delineate the extent of the vegetation communities and their condition within the survey area;

- undertake a targeted flora survey for conservation significant species identified in the desktop assessment;
- undertake a Basic terrestrial vertebrate fauna field survey to verify the desktop study, delineate the extent of fauna habitat, and to determine the occurrence of conservation significant fauna species within the survey area;
- undertake a Targeted black cockatoo habitat assessment, consolidating and reviewing the results of the Bamford Consulting (2015) survey report; and
- preparation of a consolidated biological survey report documenting results of the desktop assessment, field survey and the previous survey work completed in 2015 (Bamford Consulting, 2015; Terratree, 2015) and 2019 (360 Environmental, 2019), and the field surveys undertaken in 2020 (Biologic, 2021).

Legend

- Current Survey Area
- Previous Survey Area
- Study Area
- Context Area
- Shire of Mundaring
- Shire of Northam

IBRA Subregion

- Dandaragan Plateau
- Katanning
- Northern Jarrah Forest
- Perth

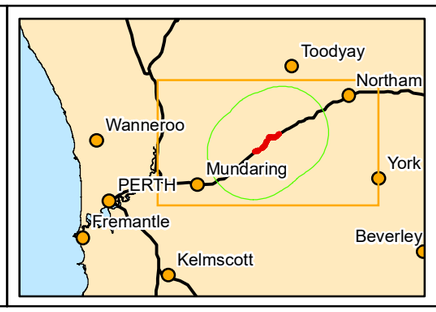
N

biologic Environmental Survey

Scale: 1:180,000

0 5 10 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/04/2021



MAIN ROADS WA

Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey

Figure 1.1: Study Area, Survey Area and regional location

1.3 Background to Protection of Flora, Vegetation and Fauna

Within Western Australia, native flora and fauna are protected under the *Biodiversity Conservation Act 2016* (BC Act) and at a national level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action that has the potential to impact on native fauna or flora needs to be approved by relevant state and/or federal departments as dictated by the state *Environmental Protection Act 1986* (EP Act).

Some species of flora and fauna that are determined to be at risk of extinction or decline are afforded extra protection under these Acts. For the purposes of this report, these species are deemed to be of conservation significance. A summary of applicable legislation and status codes is provided in Table 1.1 and additional information on status codes is provided in Appendix A. A number of migratory bird species are also prioritised for conservation under international agreements and therefore protected under the EPBC Act and BC Act as Migratory.

The EPBC Act identifies TECs as ecological communities at risk of extinction. The BC Act provides for the statutory listing of TECs by the WA Minister for Environment (the Minister). The Minister has endorsed 69 ecological communities as Threatened under Critically Endangered (20 communities), Endangered (17 communities), Vulnerable (28 communities) and Presumed Totally Destroyed (four communities).

For some species and ecological communities, there is insufficient information to determine their status. These species are generally considered by the Environmental Protection Authority (EPA) and the Department of Biodiversity, Conservation and Attractions (DBCA) as being of conservation significance for all development related approvals and are listed on a Priority List that is regularly reviewed and maintained by the DBCA (Table 1.1). TECs that do not meet the criteria for statutory listing by the Minister for Environment are added to DBCA's PECs list under Priorities 1, 2, 3, 4 (Near Threatened) or 5 (Conservation Dependent).

Table 1.1: Definitions and terms for species and communities of conservation significance

Agreement, Act or List	Status Codes
Federal	
***Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)** The Department of Agriculture, Water and the Environment (DAWE) lists Threatened flora and fauna, which are determined by the Threatened Species Scientific Committee (TSSC) per criteria set out in the Act. The Act lists flora and fauna that are considered to be of conservation significance under one of eight categories (listed under 'Status Codes'). Threatened Ecological Communities (TECs) are those that are at risk of extinction.	• Extinct (EX) • Extinct in the Wild (EW) • Critically Endangered (CR) • Endangered (EN) • Vulnerable (VU) • Conservation Dependent (CD) • Migratory (MI) • Critically Endangered (CR) • Endangered (EN) • Vulnerable (VU)
State	
***Biodiversity Conservation Act 2016* (BC Act)** At a state level, native flora and fauna and TECs are protected under the BC Act. Species in need of conservation are given a ranking ranging from Critically Endangered to Vulnerable. TECs are given a ranking ranging from Vulnerable to Presumed Totally Destroyed.	Species • Extinct (EX) • Extinct in the Wild (EW) • Critically Endangered (CR) • Endangered (EN) • Vulnerable (VU) • Migratory (MI) • Conservation Dependent Fauna (CD) • Other specially protected species (OS) TECs • Presumed Totally Destroyed (PD) • Critically Endangered (CR) • Endangered (EN) • Vulnerable (VU)
DBCA Priority List DBCA produces a list of Priority species and ecological communities that have not been assigned statutory protection under the BC Act. This system gives a ranking from Priority 1 to Priority 4.	• Priority 1 (Poorly-known species/ ecological communities) (P1) • Priority 2 (Poorly-known species/ ecological communities) (P2) • Priority 3 (Poorly-known species/ ecological communities) (P3) • Priority 4 (Rare, Near Threatened, and other species/ecological communities in need of monitoring) (P4)

1.4 Introduced Flora Taxa

1.4.1 Weeds of National Significance

The Commonwealth of Australia, in collaboration with the states and territories, has identified 32 Weeds of National Significance (WoNS) based on an assessment process that prioritises these weeds according to their invasiveness, potential for spread and environmental, social and economic impacts. A list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012.

Landowners and land managers at all levels are responsible for managing WoNS. State and territory governments are responsible for legislation, regulation and administration of weeds. The WoNS were selected as they require coordination among all levels of government, organisations and individuals with weed management responsibilities.

1.4.2 Declared Pests

To protect Western Australian agriculture the Department of Primary Industries and Regional Development (DPIRD) regulates harmful plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Plants that are prevented entry into the state or have control or keeping requirements within the state are known as declared pests. The main purposes of the BAM Act and its regulations related to Declared Pests (DP) are to prevent new plant pests from entering Western Australia, manage the impact and spread of those pests already present in the state and safely manage the use of agricultural chemicals.

The BAM Act has categorised the weeds of Western Australia into four main classifications:

- Declared Pests (under Section 22 of the Act);
- Permitted (under Section 11 of the Act);
- Prohibited (under Section 12 of the Act); and
- Permitted requiring a permit (Section 73, BAM Regulations 2013).

Under the BAM Act all DPs are placed in one of three categories:

- C1 (Exclusion) — Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State;
- C2 (Eradication) — Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still feasible; and
- C3 (Management) — Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

1.4.3 Weed Prioritisation

DBCA (formerly Parks and Wildlife) developed and implemented the Weed Prioritisation Process (DBCA, 2013), an integrated approach to weed management on Parks and Wildlife-managed lands in WA. Weeds were prioritised in each region, based on their:

- invasiveness;
- ecological impact;
- potential and current distribution; and
- feasibility of control.

The resulting priorities focus on weeds considered to be high impact, rapidly invasive and still at a population size that can feasibly be eradicated or contained to a manageable size. This means that weed species that are already widespread may not be ranked as a high priority. The weed prioritisation for the Southern Jarrah Forest bioregion has recently been revised. The key priorities are now centred on ‘priority alert’ weeds and weeds that receive a rating for ‘ecological impact’ and ‘invasiveness’.

2 ENVIRONMENT

2.1 Biogeography

The survey area is located approximately 50 km north-east of Perth in the Shire of Northam, within the Jarrah Forest bioregion, as described by the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway & Cresswell, 1995). This bioregion is described as duricrusted plateau of the Yilgarn Craton and is characterised by jarrah (*Eucalyptus marginata*) – marri (*Corymbia calophylla*) forest on laterite gravels and, in eastern parts, by wandoo (*Eucalyptus wandoo*) – marri woodlands on clayey soils. Eluvial and alluvial deposits support *Agonis* shrublands, and in areas of Mesozoic sediments, jarrah forests occur in a mosaic with a variety of species rich shrublands (Williams & Mitchell, 2001).

The Jarrah Forest bioregion is classified into subregions, Northern Jarrah Forest (JAF01), of which the survey area is located, and Southern Jarrah Forest (JAF02) (Figure 1.1). The Northern Jarrah Forest subregion is characterised by jarrah – marri forest on laterite gravels in the west, with bullich (*Eucalyptus megacarpa*) and blackbutt (*Eucalyptus patens*) in the valleys, grading to wandoo – marri woodlands on clayey soils in the east, with powder bark (*Eucalyptus accedens*) on breakaways (Williams & Mitchell, 2001). There are extensive, but localised, sand sheets with *Banksia* low woodlands, and heath is found on granite rocks and as a common understory of forests and woodlands in the north and east (Williams & Mitchell, 2001). Most of the diversity in the communities occurs on lower slopes or near granite soils where there are rapid changes in site conditions (Williams & Mitchell, 2001).

2.2 Climate

The climate of the region is characterised by cool wet winters, and warm, relatively dry summers. Average annual rainfall for the Northern Jarrah Forest ranges from 1,300 millimetres (mm) on the scarp, to approximately 700 mm in the east and north (Williams & Mitchell, 2001). The weather station most likely to accurately document the long-term average weather and climate, and rainfall, for the survey area is the Bureau of Meteorology's (BoM) Northam weather station (station number 10111), located approximately 25 km north-east of the survey area (BoM, 2021).

The highest average daily maximum temperature for Northam occurs in January (34.2 °C), while the lowest average minimum temperature experienced is in July (5.6 °C) (length of record 1902-2020; BoM, 2021). The average annual rainfall for the Northam station is 425.7 mm (length of record 1877-2020; BoM, 2021), with average monthly rainfall peaking from late autumn to early spring (May–August). The highest average monthly rainfall occurs in July (81.5 mm), with the lowest occurring in December (9.2 mm) (BoM, 2021).

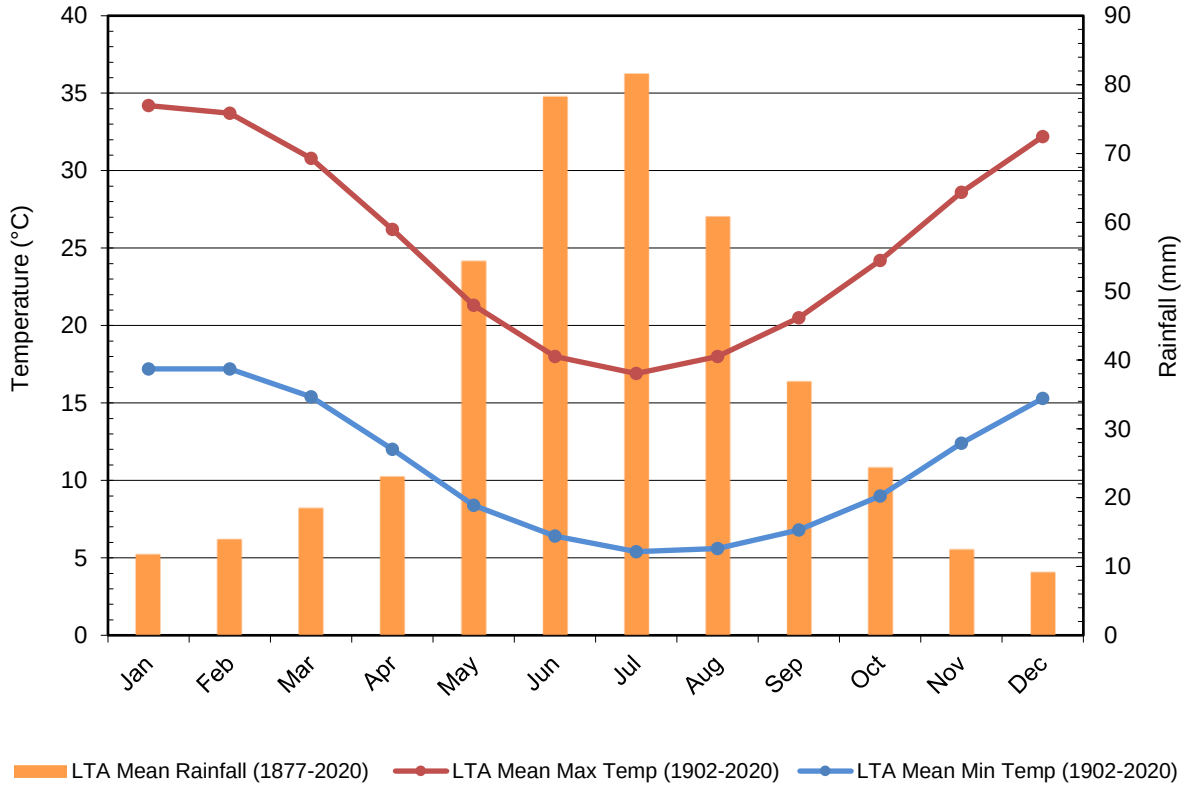


Figure 2.1: Long term average (LTA) climate data for Northam (weather station number 10111) (1877-2020) (BoM, 2021).

2.1 Soil Landscapes and Landforms

The Atlas of Australian Soils (Northcote *et al.*, 1960-1968) was compiled by the Commonwealth Scientific and Industrial Research organisation (CSIRO) in the 1960s to provide a consistent national description of Australia's soils. It comprises of a series of ten maps and associated explanatory notes and is published at a scale of 1:2,000,000; however, the original compilation was at scales from 1:250,000 to 1:500,000. The survey area is located within two broad soil landscape units, Tf3 (73.38 ha, 97.78%) and JZ2 (1.67 ha, 2.23%) (Northcote *et al.*, 1960-1968) (Figure 2.2).

Unit Tf3 consists of low hilly terrain that occupies a zone flanking unit JZ2, comprised of valleys that are frequently narrow and have short fairly steep pediments. This unit possesses soils with predominantly chemical limitations and are naturally low in nutrients (Northcote *et al.*, 1960-1968). Unit JZ2, however, is described as a dissected plateau, having a gentle to moderately undulating relief, consisting of shallow soils with predominantly physical limitations (Northcote *et al.*, 1960-1968).

Soil landscapes and land system mapping of Western Australia describes the broad soil and landscape characteristics from regional and local scales, and has been captured at scales ranging from 1:20,000 to 1:250,000 (DAFWA, 2018). The survey area is located on the Darling Plateau and occurs within two soil landscape systems, the Boyagin System (253By) and the Murray Valleys System (255Mv) (DAFWA, 2018) (Figure 2.3). The Boyagin system is described as large duricrust remnants surrounded by stripped terrain of rock outcrops and fresh soils in the Eastern Darling Range Zone. Gravels have jarrah-marri-parrotbush (*Eucalyptus marginata-Corymbia calophylla-Banksia sessilis*) forests. Loams

and duplexes with york and wandoo (*Eucalyptus loxophleba* and *Eucalyptus wandoo*), with mallet and powderbark (*Eucalyptus astringens* and *Eucalyptus accedens*) on the scarp (DAFWA, 2018). The Murray Valleys system is described as the Western Darling Range from the Avon Valley to Harvey in the south. Valleys are deeply incised with red earthy loams, shallow duplexes and rock outcrop, and jarrah-marri-wandoo (*Eucalyptus marginata-Corymbia calophylla-Eucalyptus wandoo*) forests and woodlands with mixed shrubland (DAFWA, 2018).

2.2 Geology

The survey area is situated within the Northern Jarrah Forest subregion, which occupies the northern portion of the Darling Plateau to the east of the Darling Scarp and overlies Archaean granite and metamorphic rocks (Beard, 1990). The plateau is an ancient erosion surface capped by an extensive lateritic duricrust, which has been dissected by later drainage and broken by occasional granite hills (Williams & Mitchell, 2001). The plateau is dissected by streams rising locally and by rivers originating in the interior which cut across it from east to west, these rivers are comprised of the Swan-Avon System and the Murray River (Beard, 1990). In the east, the plateau becomes more and more deeply dissected and is eventually broken up into isolated remnants (Beard, 1990).

Using GSWA (2016), the bedrock geology of the survey area is mapped as (Figure 2.4):

- A-xmno-mni-YSW (South West Terrane greenstones) - Granulite and migmatite (64.97 ha, 86.57%);
- A-mb-YSW (South West Terrane greenstones) – Metamafic rock; metabasalt with minor bands of metasedimentary rock (6.41 ha, 8.54%), and
- A-g-Y: Yilgarn Craton granites - Granitic rock, undivided; metamorphosed (3.67 ha, 4.89%).

440000
445000
450000
6485000
6480000
Great Eastern Hwy

Legend

- Current Survey Area
- Previous Survey Area

Soil Unit

- JZ2
- Tf3

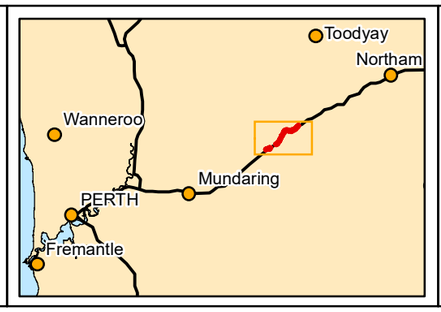
N

biologic Environmental Survey

Scale: 1:35,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/04/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 2.2: Soils of the Survey Area

440000 445000 450000

6485000

6480000

Great Eastern Hwy

Legend

Current Survey Area

Previous Survey Area

Land System

Boyagin System, 253By

Clackline System, 253Cc

Darling Plateau System, 255Dp

Murray Valleys System, 255Mv

Wundowie System, 253Wn

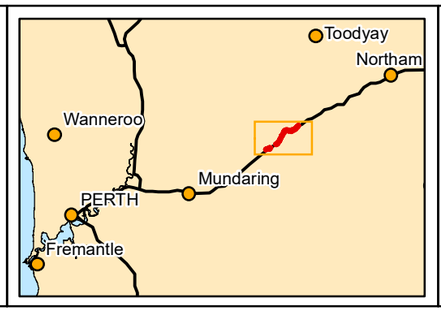
N

biologic Environmental Survey

Scale: 1:35,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/04/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 2.3: Land systems of the Survey Area

440000
445000
450000
6485000
6480000
Great Eastern Hwy

Legend

Current Survey Area

Previous Survey Area

Bedrock Geology

A-g-Y; Yilgarn Craton granites

A-mb-YSW; South West Terrane greenstones

A-mi-YSW; South West Terrane greenstones

A-xmno-mni-YSW; South West Terrane greenstones

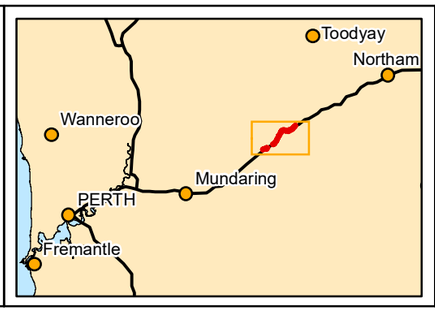
N

biologic Environmental Survey

Scale: 1:35,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/04/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 2.4: Broad geology of the Survey Area

2.3 Hydrology and Hydrogeology

Rivers are the only wetlands of subregional significance within the Northern Jarrah Forest (Williams & Mitchell, 2001). The water courses of the subregion are dominated by the creation of water storage structures (dams and reservoirs) within the forested catchment, primarily to provide potable water to the metropolitan area of Perth and irrigation, horticulture and agriculture (Williams & Mitchell, 2001). The survey area is located within the Wooroloo Brook sub-catchment within the Swan-River Lower Swan Catchment of the Swan Coastal Basin (Figure 2.5).

The survey area periodically intersects Coates Gully, a minor water course that follows the Great Eastern Highway for the majority of the survey area. Coates Gully is fed by numerous other water courses surrounding the survey area, before flowing into an unnamed major perennial water course then into Wooroloo Brook, eventually discharging into the Swan River (Figure 2.5).

440000
445000
450000
6485000
6480000
Great Eastern Hwy
COATES GULLY
WOOROLOO BROOK
CHINGANNING GULLY
MURRAYINE GULLY
BLACKBOY GULLY

Legend

- Current Survey Area
- Previous Survey Area

Surface Hydrology

- Minor
- Major

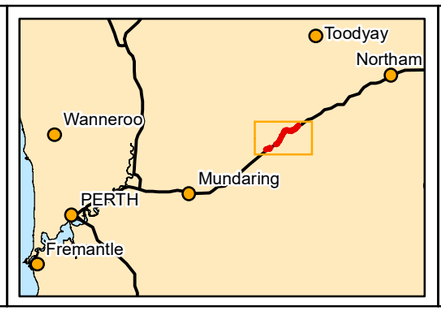
N

biologic Environmental Survey

Scale: 1:35,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/04/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 2.5: Hydrology of the Survey Area

2.4 Vegetation Associations

The survey area is located within the Dale Botanical Subdistrict, which is part of the South-West Botanical Province. It is characterised by jarrah forest on ironstone gravels, and marri–wandoo woodlands on loamy soils with sclerophyll understoreys (Beard, 1990). The vegetation associations of the survey area were mapped by Beard (1975b), in which he classified the following vegetation associations:

- 1006: Jarrah, marri and wandoo woodlands; and
- 3003: Mainly jarrah and marri forests.

Shepherd *et al.* (2002) reinterpreted and updated the vegetation association mapping to reflect the National Vegetation Information System (NVIS Technical Working Group) standards (ESCAVI, 2003). The update also accounts for extensive clearing since the Beard (1975a) mapping. Shepherd *et al.* (2002) created a series of 'systems' to assist in removing mosaic vegetation associations originally mapped by Beard (1975a); however, some mosaics still occur. The survey area is located within the East Darling and Bannister systems, and under Shepherd *et al.* (2002) comprises:

- 1006.1 – Medium woodlands of jarrah, wandoo and powderbark (*Eucalyptus accedens*); and
- 3003.1 – Medium forests of jarrah and marri on laterite with wandoo in valleys, sandy swamps with teatree and *Banksia* sp.

The current extent remaining of the vegetation system associations exceeds 40% for system 1006.1, and 50% for system 3003.1, across the four regional scales (Government of Western Australia, 2019b) (Table 2.1). Currently, both vegetation associations are well represented within the National Reserve System, having greater than 10% (system 1006.1) and 13% (system 3003.1) of their current bioregional and subregional extent within reserves (Government of Western Australia, 2019b) (Table 2.1).

Table 2.1: Regional and local extent of vegetation associations within the survey area

Code	Scale	Pre-European extent (ha)	Current extent (ha /%)	Current extent remaining within reserves (ha /%)
1006.1	State	35,903	19,119 / 53.25	1,953 / 10.22
	Jarrah Forest	35,903	19,119 / 53.25	1,953 / 10.22
	Northern Jarrah Forest	35,903	19,119 / 53.25	1,953 / 10.22
	Shire of Northam	13,907	5,963 / 42.88	1,462 / 24.51
3003.1	State	66,452	39,062 / 58.78	5,190 / 13.29
	Jarrah Forest	66,452	39,062 / 58.78	5,190 / 13.29
	Northern Jarrah Forest	66,452	39,062 / 58.8	5,190 / 13.29
	Shire of Northam	16,259	8,710 / 53.57	2,547 / 29.25

2.5 Vegetation Complexes & Regional Forest Agreement

Mattiske and Havel (1998) mapped vegetation complexes across the south-west forest region at a scale of 1:50,000 as part of the Regional Forest Agreement (RFA). More recently, this dataset has been reviewed (see Webb *et al.*, 2016) to correct errors while mapping along the Whicher Scarp and has been updated to ensure continuation of complexes defined by Mattiske and Havel (1998).

The survey area coincides with the following five vegetation complexes (Webb *et al.*, 2016) (Figure 2.6):

- **Coolakin Complex**: Woodland of *Eucalyptus wandoo* with mixtures of *Eucalyptus patens*, *Eucalyptus marginata* subsp. *thalassica* and *Corymbia calophylla* on the valley slopes in arid and peri-arid zones.
- **Murray (My2) Complex**: Open forest of *Eucalyptus marginata* subsp. *thalassica* – *Corymbia calophylla* – *Eucalyptus patens* and woodland of *Eucalyptus wandoo* with some *Eucalyptus accedens* on the valley slopes to woodlands of *Eucalyptus rudis* – *Melaleuca rhaphiophylla* on the valley floors in semi-arid and arid zones.
- **Pindalup Complex**: Open forest of *Eucalyptus marginata* subsp. *thalassica* – *Corymbia calophylla* on the slopes and open woodland of *Eucalyptus wandoo* with some *Eucalyptus patens* on the lower slopes in semiarid and arid zones.
- **Yalanbee (Y5) Complex**: Mixture of open forest of *Eucalyptus marginata* subsp. *thalassica* – *Corymbia calophylla* and woodland of *Eucalyptus wandoo* on lateritic uplands in semiarid to perarid zones.
- **Yalanbee (Y6) Complex**: Woodland of *Eucalyptus wandoo* – *Eucalyptus accedens*, less consistently open forest of *Eucalyptus marginata* subsp. *thalassica* – *Corymbia calophylla* on lateritic uplands and breakaway landscapes in arid and perarid zones.

The Government of Western Australia reports annually on the statistics of the pre-European and current extent for the vegetation complexes of the south-west of Western Australia (Government of Western Australia, 2019a). The updated statistics provide details on the progress towards achieving a conservation reserve system that is comprehensive, adequate, and representative (CAR Reserve) and provides the statistics for each local government area (LGA; Shire of Northam).

Four of the five vegetation complexes occur extensively across the Darling Plateau, mostly in the Northern Jarrah Forest subregion, covering over 120,000 ha (Ck, Pn, Y5 and Y6), while the fifth vegetation complex (My2) covers 59,317 ha (Government of Western Australia, 2019a) (Table 2.2). This represents 39.2% (Ck), 69% (My2), 76.8% (Pn), 66.2% (Y5) and 46.5% (Y6) of the pre-European extent for all vegetation complexes (Table 2.2), while between 3% and 16% of the current extent of all vegetation complexes is located within IUCN Class I-IV protected lands for conservation (Government of Western Australia, 2019a) (Table 2.2).

Table 2.2: Extent of vegetation complexes that occur within the survey area.

Vegetation Complex and Code	Scale	Pre-European Extent (ha)	Current extent remaining (ha /%)	Current extent protected (ha /%)
Coolakin (Ck)	Subregion	163,992	64,205 / 39.2	6,384 / 3.9
	LGA	8,538	2,188 / 25.6	N/A
Murray (My2)	Subregion	59,317	40,952 / 69	9,427 / 15.9
	LGA	1,408	329 / 23.3	N/A
Pindalup (Pn)	Subregion	167,151	128,358 / 76.8	23,935 / 14.3
	LGA	10,563	6,037 / 57.2	N/A
Yalanbee (Y5)	Subregion	126,610	83,829 / 66.2	7,695 / 6.1
	LGA	10,386	5,393 / 51.9	N/A
Yalanbee (Y6)	Subregion	197,849	92,081 / 46.5	22,731 / 11.5
	LGA	16,466	7,518 / 45.7	N/A

440000 445000 450000

6485000

6480000

Great Eastern Hwy

Legend

Current Survey Area

Vegetation Complex

- Cooke, Ce
- Coolakin, Ck
- Murray 2, My2
- Pindalup, Pn
- Yalanbee, Y5
- Yalanbee, Y6

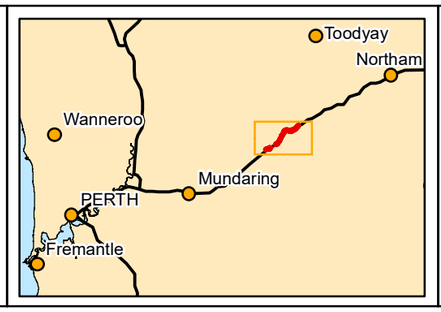
N

biologic Environmental Survey

Scale: 1:35,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/04/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 2.6: Vegetation complexes of the Survey Area

2.6 Bioregional Significance and Conservation Areas

Under the Convention of Biological Diversity, Australia has worked towards a target of 17% of the continent to be protected as part of the National Reserve System (NRS). In building the NRS, priority is given to under-represented bioregions that have less than 10% of their remaining area protected in reserves (NRSTG, 2009). The Jarrah Forest bioregion is currently adequately represented under the NRS, with greater than 10% of its total area protected in reserves. The Northern Jarrah Forest subregion is also adequately represented, with more than 10% of the subregional area protected in reserves.

A number of regional parks and nature reserves occur immediately adjacent or in the local vicinity of the survey area, with Kwolyinine and Woondowing Nature Reserves overlapping the boundary of the survey area (Table 2.3, Figure 2.7). Karakamia Wildlife Sanctuary is located approximately 8.8 km west of the southern portion of the survey area. This sanctuary supports many translocated threatened species not commonly found in the local area or are outside their current extant distribution, such as woylie, tammar wallaby, and quokka (Mawson, 2004).

The value of road verge habitats is well known, providing a wide range of ecological services, including biodiversity provision, regulating services, and cultural services (e.g. aesthetic benefits) (Phillips *et al.*, 2020). Often roadsides are the only remaining example of vegetation communities within agricultural landscapes, where almost 98% of vegetation in some areas has been cleared, and can provide shelter, food, and nesting sites for vertebrate fauna (Jackson, 2002). The southern portion of the survey area is within an area deemed a Regional Ecological Linkage (ID “122”), and is also surrounded by Linkage “98” (Perth Biodiversity Project, 2003) (Table 2.3,Figure 2.7). These linkages are defined as a series of continuous and non-continuous patches of native vegetation which, by virtue of their proximity to each other, act as stepping stones of habitat which facilitate the maintenance of ecological processes and the movement of organisms within, and across, a landscape (Del Marco *et al.*, 2004; Molloy *et al.*, 2009). Although the remnant vegetation patch areas of the Shire of Northam are generally part of an existing relatively large network of protected and unprotected natural areas, the largest patches of vegetation are part of smaller networks than those recorded in other parts of the Jarrah Forest where vegetation forms very large networks (Zelinova, 2015).

Table 2.3: Conservation areas and ecological linkages within the vicinity of the survey area

Name	Distance to survey area
Regional Parks and Nature Reserves	
Wooroloo Regional Park	Adjacent to survey area
Woondowing Nature Reserve	Within survey area
Kwolyinine Nature Reserve	Within survey area
Keaginine Nature Reserve	Directly adjacent to survey area
Inkpen Road Nature Reserve	3.9 km south-east
Clackline Nature Reserve	10.6 km north-east
Mokine Nature Reserve	16.5 km east
St Ronan's Nature Reserve	20.6 km south-east
Wambyn Nature Reserve	23.3 km south-east
Throssell Nature Reserve	42.8 km north-east
Meenaar Nature Reserve	44 km north-east
Wildlife Sanctuaries	
Karakamia Wildlife Sanctuary	8.8 km west
Regional Ecological Linkages	
ID 98	~ 200 metres west and south
ID 122	Within survey area

435000 440000 445000 450000

6485000

6480000

Woondowing Nature Reserve

Kwolyinine Nature Reserve

Great Eastern Hwy

Needham Nature Reserve

Keaginine Nature Reserve

Inkpen Road Nature Reserve

118 116 117 120 98 122 121 99

Legend

- Current Survey Area
- Previous Survey Area
- Nature Reserves
- Wooroloo Regional Park
- Regional Ecological Linkages

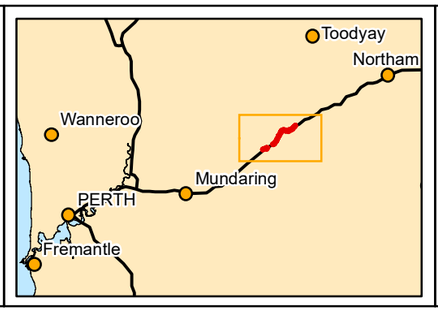
N

biologic Environmental Survey

Scale: 1:50,000

0 1 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 04/05/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 2.7: Conservation areas of the Survey Area

3 METHODOLOGY

3.1 Compliance

The survey was carried out in a manner consistent with documents developed by the Western Australian EPA, Department of Biodiversity, Conservation and Attractions (DBCA) and the Department of Agriculture, Water and the Environment (DAWE) (formally the DoEE, DSEWPaC, and the DoE) for the environmental surveying and reporting of flora, vegetation and fauna. The relevant government guidelines are outlined below in Table 3.1.

Table 3.1: Guidelines, technical guidelines and procedures for the field survey

Survey component	Guidance documents
General / EIA	EPA (2020a) *Statement of environmental principles, factors and objectives*
	DoE (2013) *Significant impact guidelines*
Detailed and Targeted flora survey	EPA (2016b) *Technical guidance: Flora and vegetation surveys for environmental impact assessment*
	EPA (2016a) *Environmental factor guideline: flora and vegetation*
Basic vertebrate fauna survey	EPA (2020b) *Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment*
	DEWHA (2010) *Survey guidelines for Australia's threatened birds*
	DSEWPaC (2011a) *Survey guidelines for Australia's threatened mammals*
	DSEWPaC (2011b) *Survey guidelines for Australia's threatened reptiles*
Black cockatoo habitat assessment	*DSEWPaC (2012)EPBC Act referral guidelines for three species of black cockatoo species: Carnaby's cockatoo (endangered) Calyptorhynchus latirostris; Baudin's cockatoo (vulnerable) Calyptorhynchus baudinii; Forest red-tailed black cockatoo Calyptorhynchus banksii naso*

3.2 Desktop Assessment

3.2.1 Literature Review

A review of available literature relevant to the desktop survey area (25 km radius of the survey area – increased from 15 km for greater contextual knowledge) was undertaken, using, but not limited to, the Index of Biodiversity Surveys for Assessment (IBSA) search portal (Table 3.2). A total of twelve reports were reviewed, comprising three combined flora and fauna surveys, one detailed and one basic flora and vegetation survey undertaken within the survey area, one reconnaissance and two detailed flora and vegetation surveys, two basic vertebrate fauna surveys (including one undertaken within the survey area), and two detailed vertebrate fauna surveys. This literature review was undertaken to compile a list of conservation significant flora and fauna species that may occur in the survey area.

Table 3.2: Reports used in the literature review from the vicinity of the survey area

Survey Title	Reference	Survey Type	Distance from survey area
Flora & Fauna combined			
Wundowie Level 2 Flora, Vegetation and Fauna Assessment Report	360 Environmental (2014)	Detailed Flora, Vegetation and Fauna Assessment Report	3.2 km west
Lot 48 Stoneville Road and Lot 1 Roland Road, Stoneville – Flora, Vegetation and Fauna Survey	Strategen (2020)	Detailed flora and vegetation survey, basic vertebrate fauna survey and black cockatoo/ chuditch habitat assessment	18.7 km west-southwest
Report for Gidgegannup granite quarry: flora and fauna	GHD (2009)	Unknown (original report not available)	24.0 km west-southwest
Flora			
Great Eastern Highway Coates Gully (Stage 1) Project	360 Environmental (2019)	Detailed Flora and Vegetation Survey	Immediately adjacent the current Biologic (2021) survey area
Great Eastern Highway SLK 55.8 to SLK 68.5	Terratree (2015)	Level 1 (Basic) flora, vegetation, and Phytophthora dieback assessment	Overlapping the survey area
Reconnaissance flora and vegetation survey – Lot 500 Coothallie Road Chidlow	Del Botanics (2020)	Reconnaissance flora and vegetation survey	8.1 km southwest
Flora and vegetation assessment, Mt Helena	Del Botanics (2012)	Detailed flora and vegetation survey	14.7 km southwest
Flora and vegetation – Reserve 2145 and Percy Cullen Oval, Gidgegannup	Bennett Environmental (2006)	Detailed flora and vegetation survey	15.3 km west
Fauna			
Great Eastern Highway SLK 55.8 – 68.5 Fauna and Black-Cockatoo Habitat Assessment	Bamford Consulting (2015)	Basic vertebrate fauna survey and black cockatoo habitat assessment	Includes areas within the survey area not surveyed by Biologic (2021)
Karakamia Wildlife Sanctuary Species List.	AWC (2015)	Detailed vertebrate fauna surveys	~ 9.5 km west
Fauna Assessment of the Somerville Ecovillage Coothallie Road, Chidlow	Kabay Consultants (2007)	Basic vertebrate fauna survey	~ 16 km southwest

Survey Title	Reference	Survey Type	Distance from survey area
Nature Reserves of the Shires of York and Northam Management Plan 1987 – 1997 • Clackline Reserve • St Ronan's Reserve • Wambyn Reserve • Mokine Reserve • Throssell Reserve • Meenar Reserve	CALM (1987)	Detailed vertebrate fauna surveys	11 – 48 km east

3.2.2 Database Searches

Database searches were undertaken to generate a comprehensive list of vascular flora and vertebrate fauna taxa previously recorded within the desktop survey area, including introduced species and taxa of conservation significance. The database searches also identified ecological communities/ vegetation types of conservation significance that occur, or may occur, within and near the survey area. Conservation codes for flora, fauna and vegetation of conservation significance are provided in Appendix A.

In total, nine databases were searched to gather information on species and communities previously recorded within or near the survey area (Table 3.3). Searches were either conducted with a 15 km buffer of the survey area or, for DBCA databases, search results were provided to Biologic by Main Roads. For consistency, the same location parameters were applied to the provided DBCA search results.

Table 3.3: Details of database searches conducted

Provider	Reference	Database	Parameters
Flora and Vegetation			
Atlas of Living Australia (ALA)	ALA (2020)	Occurrence Search	A 15 km buffer of the Coates Gully survey area
Department of Agriculture, Water and the Environment (DAWE)	DAWE (2020)	Protected Matters Search Tool	A 15 km buffer of the Coates Gully survey area
Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA (2020a)	NatureMap	A 15 km buffer of the Coates Gully survey area
	DBCA (2020c)	Threatened and Priority Ecological Communities (supplied by Main Roads Western Australia)	A 15 km buffer of the Coates Gully survey area shapefile
	DBCA (2020e)	Threatened and Priority Flora (supplied by Main Roads Western Australia)	A 15 km buffer of the Coates Gully survey area shapefile
Department of Primary Industries and Regional Development (DPIRD)	DPIRD (2020)	Declared Plants Database Western Australian Organism List (WAOL)	Search of the Shire of Northam local government area
Fauna			
Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA (2020d)	Threatened and Priority Fauna (supplied by Main Roads Western Australia)	A 15 km buffer of the Coates Gully survey area shapefile
	DBCA (2020a)	NatureMap	A 15 km buffer of the Coates Gully survey area
Department of Agriculture, Water and the Environment (DAWE)	DAWE (2020)	Protected Matters Search Tool	A 15 km buffer of the Coates Gully survey area
Birdlife Australia (Birdlife)	BirdLife Australia (2020a)	Birdata	A 15 km buffer of the Coates Gully survey area
	BirdLife Australia (2020b)	Custom black cockatoo roost database	A 12 km buffer of the Coates Gully survey area

3.3 Field Survey Methodology

3.3.1 Survey Personnel, Timing and Weather

A single-phase Detailed and targeted flora and vegetation survey was undertaken on the 21st and 23rd of October, and the 20th of November 2020 by Mr Samuel Coultas, a Senior Botanist with over six years' experience completing flora surveys in Western Australia. Sam was supported by Graduate Botanist Kaylin Geelhoed. Both Sam and Kaylin hold flora collecting permits (FB62000017 and FB62000238) pursuant to the BC Act (Regulation 61). Sam also holds a "Permit to Take Declared Rare Flora" for identification purposes (TFL 60-1819), issued under the BC Act, Section 40. The flora sampling for this survey, particularly as sampling occurred within and adjacent to Nature Reserves (see section 2.6), was also conducted under a DBCA Regulation 4 Authority – 8(1) "To authorise a person to take flora in CALM Act lands/waters that would, but for such a notice, be unlawful under the *Conservation and Land Management Regulations 2002*" issued to Sam. The timing of the flora field survey fell within the

recommended timing for flora surveys in the region (Spring) (EPA, 2016b), while the follow up survey (November – late Spring) was specifically timed to capture the flowering time of the conservation significant flora taxon *Lechenaultia hortii* (P2) (Sage, 2006a).

A Basic terrestrial vertebrate fauna survey and black cockatoo habitat assessment was undertaken on the 24th and 30th of November 2020 by Senior Zoologists Claire Brooks (24th and 30th of November) and Andrew Hide (30th November), and Zoologist Brighton Downing (24th and 30th of November). Collectively, the field personnel have a combined total of over 25 years' experience completing fauna surveys. The fauna sampling for this survey was conducted under a DBCA Regulation 27 "Fauna Taking (Biological Assessment) License" (BA27000350) issued to Chris Knuckey. In accordance with Section 40 of the BC Act, threatened species sampling was completed under a DBCA "Authorisation to Take or Disturbed Threatened Species" (authorisation number TFA 2020-0161) issued to C. Knuckey. The timing of the Basic terrestrial vertebrate fauna field survey fell within the recommended timing for the target groups; September to December for the breeding season of bush birds, October to December for reptiles, and during higher periods of activity for mammals (spring) (DEWHA, 2010; DSEWPaC, 2011b; EPA, 2020b). The fauna survey undertaken within the previous survey area by Bamford Consulting (2015) was conducted during October 2015, which is also consistent with the recommended primary survey timings for each faunal group.

Observed weather conditions prior to and during the surveys are shown in Figure 3.1, alongside long-term climatic data for Northam (weather station 10111), located 25 km north-east of the survey area (BoM, 2021). Overall, above average temperatures were recorded in the 12 months prior to the surveys, and rainfall was well below the long-term average (284 mm compared to 425.3 mm) (Figure 3.1). Long-term average temperatures for October and November ranged from 10.5 °C to 27.3 °C and 12 °C to 27.1°C, respectively. Similar temperatures were recorded during the survey, however, November 24th recorded 41 °C during the survey and was the hottest day of November. Although the hot conditions may have contributed to a reduced level of opportunistic fauna activity, it did not influence the ability to assess the likelihood of occurrence for flora and fauna, or to determine the flora and fauna habitats present.

Well below average rainfall was received in the six months leading up to the field survey (184.7 mm for April to September compared to the long term average of 334.9 mm for the same period). No rainfall was observed on any of the field survey dates. Only 1.1 mm was recorded for the month of October which is 23.3 mm below the long term average (24.4 mm), while 44.7 mm was recorded for the month of November which is 32.2 mm above the long term average (12.5 mm) (Figure 3.1). However, below average rainfall is not considered to be a constraint on the flora survey (see Section 3.5).

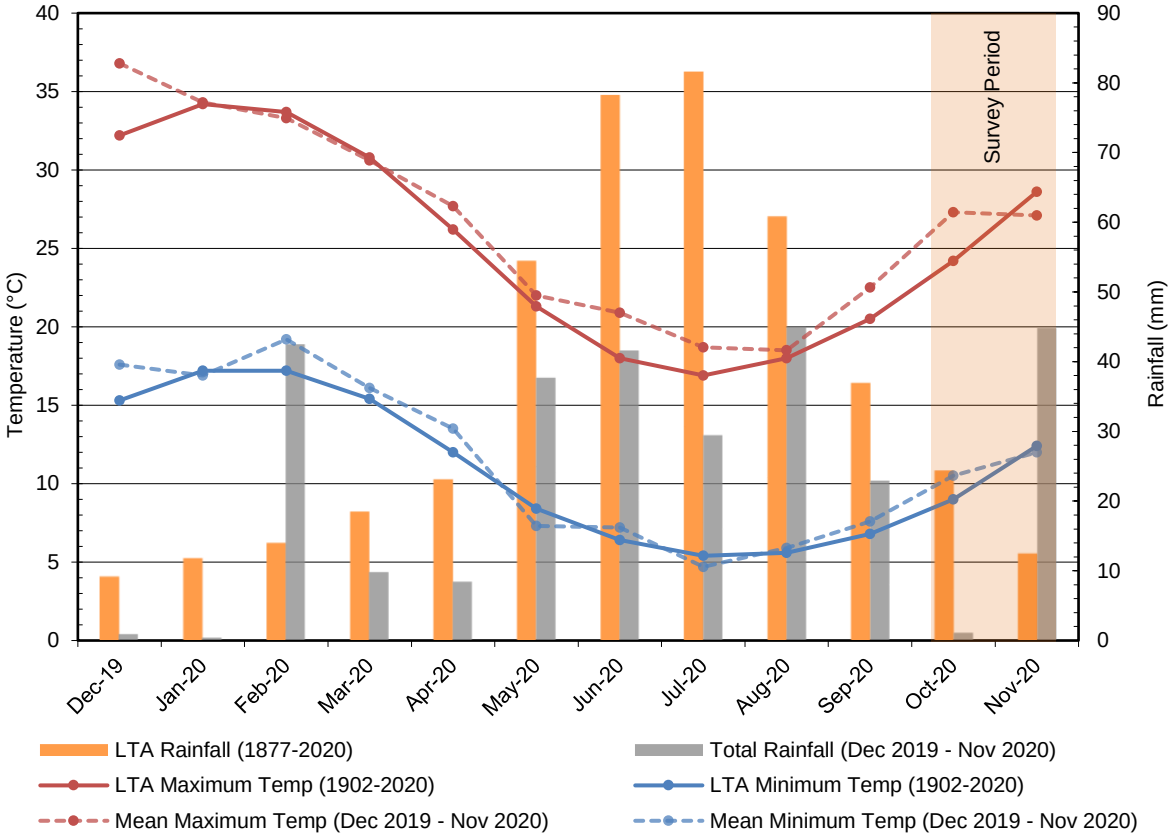


Figure 3.1: Long-term climate data relevant to the survey area (sourced from Northam weather station number 10111, 1877-2020) compared to monthly rainfall and mean maximum and minimum monthly temperatures received in the 12 months prior to the survey (BoM, 2021).

3.3.2 Flora and Vegetation Survey

Prior to the field survey, aerial photography of the survey area via Google Earth Pro©, were reviewed, along with previous regional vegetation mapping (Beard, 1975c; Shepherd *et al.*, 2002) and soil landscape mapping (Northcote *et al.*, 1960-1968), to determine broad preliminary vegetation type boundaries. Furthermore, detailed vegetation mapping produced by 360 Environmental (2019) in the previous survey area was intensively reviewed prior to the survey. Following the review of the aerial imagery and contextual information, a survey plan was designed to ensure the current survey area was appropriately traversed, sampled and targeted to capture the data required for a single season Detailed flora and vegetation survey and to complement the previous survey completed by 360 Environmental (2019). All vegetation types and units present in the current survey area were adequately traversed and sampled by this survey. One floristic site was established in each vegetation type as a minimum, which for the small size of the survey area (16.1 ha) is considered adequate. However, as sites have already been completed in adjacent vegetation by 360 Environmental (2019), it is likely that multiple sites per vegetation type have been completed.

All vascular flora taxa within each quadrat (including overhang from plants rooted outside the boundary of quadrats) were recorded, with their corresponding height and cover. A brief summary of the

vegetation assemblage at each site was also recorded to aid in producing vegetation type descriptions (NVIS Technical Working Group, 2017) (Appendix C). In addition, the following information was recorded at each quadrat:

- unique quadrat number;
- date of survey;
- personnel;
- GPS coordinate of northwest corner (GDA 94);
- site photograph – taken from the north-west corner, facing south-east;
- soil characteristics (texture and colour);
- geology (type, size and nature of any rocks, stones, gravel, or outcropping);
- topography (landform type and aspect);
- vegetation condition (based on EPA (2016b)) (Appendix B);
- disturbance (if present); and
- approximate time since last fire.

Five quadrats (10 metre (m) x 10 m) and two relevés were sampled during this survey, along with a number of mapping notes across the survey area (Figure 3.2 and Appendix G). Quadrats were not permanently marked (i.e., posts) in the field; they were orientated north west, north east, south west and south east (any deviation from this was recorded in the site data) to assist with any future re-sampling. Mapping notes were recorded in vegetation that was already adequately represented by floristic sites or showed signs of disturbance (i.e., weeds, grazing etc.) that hindered an accurate determination of the typical vegetation structure and diversity. The mapping notes also assisted with delineation of vegetation type boundaries.

Conservation Significant Flora Targeted Searches

Prior to the field survey, a list of conservation significant flora known to, with the likelihood to, or the potential to occur within the survey area was compiled (Section 3.2). Field personnel familiarised themselves with photographs, reference samples, and descriptions of these taxa before conducting the field survey. Targeted searching was undertaken for flora of conservation significance identified during the desktop assessment, with taxa that were confirmed or considered Highly likely, Likely, or Possible to occur within the survey area targeted. The active targeted searches while traversing the survey area focussed on habitat and locations considered likely to support conservation significant flora.

If a conservation significant taxon was identified, a GPS coordinate of the individual was taken when occurring in isolation, or a central GPS coordinate was taken for a small population (central coordinate with an approximate 20 m radius). Information collected at each location comprised:

- Number of individuals, for a small population;
- Condition and reproductive status of the plants in each population;
- Photographs and description of vegetation habitat; and
- Broad information on vegetation type and condition.

Threatened and Priority Flora Report Forms will be provided to the Parks and Wildlife Division (Parks and Wildlife) of DBCA, as required under the flora collecting permits. Conservation significant flora specimens will be vouchered with the Western Australian Herbarium (WAH), where required and appropriate.

Introduced Taxa

Where significant environmental weeds, WoNS, and DPs listed under Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) were identified in the field, searches were conducted within a minimum radius of 20 m from the given specimen to document the number of individual plants and map the spatial extent of the infestation. The methodology and information collected for significant environmental weeds was consistent with the methodology and information collected for the conservation significant flora.

Vegetation Type Mapping

Broad vegetation mapping was conducted in the field, with vegetation boundaries delineated over aerial photography. Following the completion of the quadrat sampling and taxonomic identifications, the broad vegetation type boundaries were refined based on the review of the floristic data collected from the sites (and mapping notes). The vegetation type mapping was then digitised using geographic information system (GIS) software.

The vegetation structure information collected from the sites and mapping notes was reviewed to describe the vegetation units based on the dominant taxa, foliar cover and height of the three traditional strata (upper, mid and lower/ ground). This method of vegetation unit determination is consistent with EPA (2016b).

The vegetation types were described to Level 5 (Vegetation Association) in the NVIS hierarchical structure (NVIS Technical Working Group, 2017). The vegetation type descriptions were developed according to standard practice, leading with the dominant taxon in the upper stratum. The mapping reliability is considered to be high across the survey area, with the majority of the survey area traversed.

Vegetation mapping of the current survey area and the previous survey area mapping were both used to extrapolate the vegetation types to a 500 m buffer around the survey area.

Vegetation Condition Mapping

Vegetation condition was defined within the survey area using the vegetation condition scale in EPA (2016b), which has been adapted from (Keighery, 1994) (Appendix B). The vegetation condition was determined based on the level of disturbance observed in an area. Condition was recorded at each quadrat, while additional notes were taken while traversing the survey area to broadly map vegetation condition boundaries. The vegetation condition mapping was then digitised using GIS software.

Assessment of potential conservation significant Ecological Communities against diagnostic criteria

Areas of mapped vegetation within the survey area that were considered to potentially align with conservation significant ecological communities (i.e., PECs and TECs) were assessed in the field against the key diagnostic characteristics and condition thresholds, as per the approved conservation advice (see Section 1.3). These assessments were only applied to patches occurring within the survey area; patches situated outside of the survey area were not assessed.

Identification of Flora Specimens

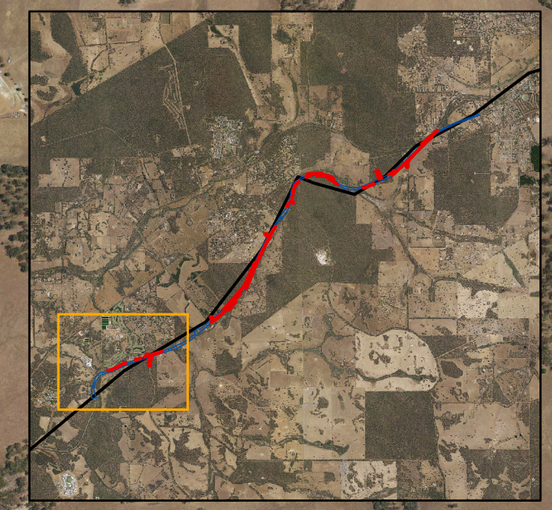
Plant taxa that could not be identified during the field survey were collected, assigned a unique number for tracking purposes, and pressed for subsequent identification. Identifications were carried out by Biologic's taxonomists, Dr Rachel Meissner and Mr Samuel Coultas, utilising the WAH reference collection, taxonomic keys and reference material. All taxa were checked against Florabase© (version 2.9.31; WAH, 1998-) to ensure their currency and validity. Any conservation significant flora taxa, including potential Threatened and Priority species, range extensions, and potential new taxa will be verified and vouchered (if appropriate) at the WAH.

437000 438000 439000 440000 441000

6481000

6480000

Great Eastern Hwy



Legend

Current Survey Area

Previous Survey Area

Current Survey sample sites

Quadrat

Relevé

Traverse

Previous Survey sample sites

Quadrat

Relevé

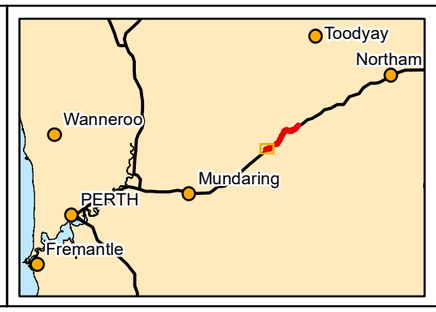
N

biologic Environmental Survey

Scale: 1:11,000

0 250 500 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 04/05/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 3.2a: Flora sample sites and traverses

441000 442000 443000 444000

6483000

6482000

Great Eastern Hwy

Legend

Current Survey Area

Previous Survey Area

Current Survey sample sites

Quadrat

Relevé

Traverse

Previous Survey sample sites

Quadrat

Relevé

N

biologic Environmental Survey

Scale: 1:11,000

0 250 500 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 04/05/2021

Toodyay
Northam
Wanneroo
Mundaring
PERTH
Fremantle

MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

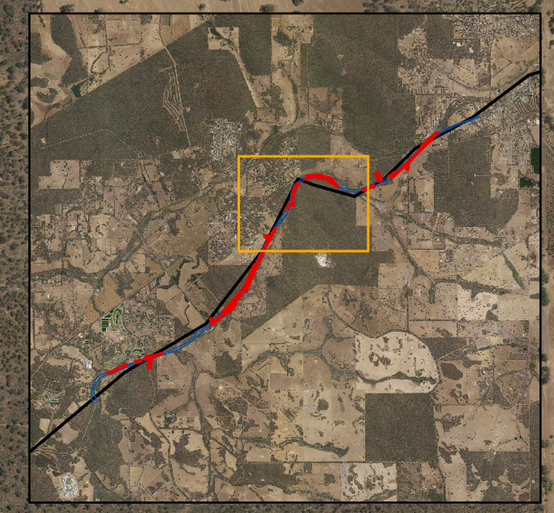
Figure 3.2b: Flora sample sites and traverses

442000 443000 444000 445000

6485000

6484000

Great Eastern Hwy



Legend

Current Survey Area

Previous Survey Area

Current Survey sample sites

Quadrat

Traverse

Previous Survey sample sites

Quadrat

Relevé

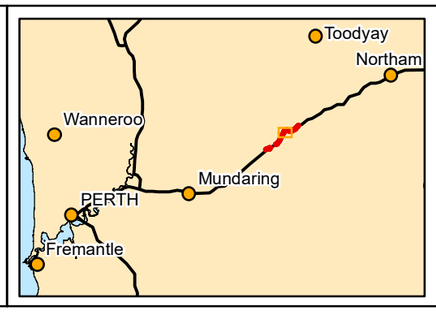
N

biologic Environmental Survey

Scale: 1:11,000

0 250 500 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 04/05/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 3.2c: Flora sample sites and traverses

445000 446000 447000 448000

6487000 6486000 6485000

Great Eastern Hwy

Legend

Current Survey Area
Previous Survey Area

Current Survey sample sites
Quadrat
Traverse

Previous Survey sample sites
Quadrat
Relevé

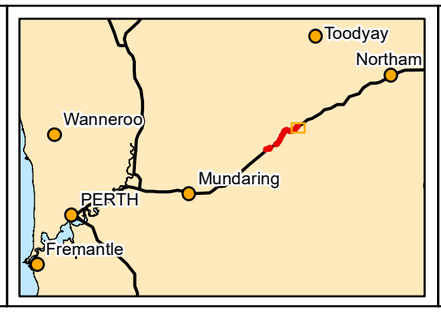
N

biologic Environmental Survey

Scale: 1:11,000

0 250 500 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 04/05/2021



MAIN ROADS WA
Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 3.2d: Flora sample sites and traverses

3.3.3 Terrestrial Fauna Assessment

Fauna Habitat Assessments and Mapping

Fauna habitat assessments were undertaken in the field to characterise and define habitats and their significance to vertebrate fauna. Habitat assessments were undertaken at 35 locations across the survey area, including at all sampling sites (Figure 3.3).

Habitat assessments were conducted using methodology and terminology modified from the *Australian Soil and Land Survey Field Handbook* (National Committee on Soil and Terrain, 2009). The characteristics recorded during the habitat assessments were:

- site information, photo and location;
- landform: slope, relative inclination of slope, morphological type and landform type;
- vegetation: leaf litter%, wood litter, hollow bearing trees, broad floristic formation, vegetation structure (tall, mid and low), and dominant species;
- land surface: micro relief, sheet erosion, rill erosion, gully erosion, gully depth, abundance and size of coarse fragments, rock outcropping, water bodies, comments on nests, burrows, roosts and diggings;
- soil: texture, colour;
- substrate: bare ground, rock size, rock type, rock outcropping; and
- disturbance: time since last fire, evidence of weeds, grazing, or human disturbances.

The mapping and nomenclature of broad fauna habitats undertaken across the entirety of the survey area was finalised from the completed habitat assessments, high-resolution aerial imagery, vegetation mapping from the concurrent flora and vegetation survey, and results of the surveys undertaken within the previous survey area (360 Environmental, 2019; Bamford Consulting, 2015).

Camera Trap Deployments

Targeted sampling using motion cameras was conducted to verify the presence of conservation significant vertebrate species identified during the desktop assessment (i.e. chuditch *Dasyurus geoffroii*, quenda *Isoodon fusciventer*, and south-western brush-tailed phascogale *Phascogale tapoatafa wambenger*), as recommended for many medium-sized mammals such as these (DSEWPaC, 2011a; EPA, 2020b). This sampling was undertaken during both the Biologic (2021) and Bamford Consulting (2015) field surveys. During the current field survey, five baited cameras were deployed opportunistically in suitable habitat throughout the survey area over six consecutive nights, from the 24th to the 30th of November (Figure 3.3). This resulted in a total of 30 camera trap nights over the duration of the survey. Each camera was set to record 5 continuous seconds of video footage when triggered during their deployment. An example of a motion camera deployment is shown below in Plate 3.1. Camera traps were baited with a universal bait mix, a mixture of oats, sardines, and peanut butter.

During the field surveys undertaken by Bamford Consulting (2015), five baited cameras were also deployed opportunistically in suitable habitat throughout the survey area over seven consecutive nights, from the 28th of October to the 4th of November. This resulted in a total of 35 camera trap nights over the duration of the survey. The location of the camera traps deployed by Bamford Consulting (2015) are shown on Figure 3.3.

Plate 3.1: Example of a camera trap deployment in the survey area

Opportunistic Vertebrate Fauna Records

At all times while surveying, all records pertaining to species not previously recorded during the survey, rare species, species of conservation significance, or other fauna of interest were documented. These records include those from primary (i.e., direct observation of species) or secondary (e.g., burrows, scratching's, diggings, and scats) evidence. Efforts were made to target likely microhabitats by turning rocks, logs, and anthropogenic debris where present.

Taxonomy and Nomenclature

The latest checklist of mammal, reptile and amphibian names published by the WAM (2020) was used as a guide to the current taxonomy and nomenclature of these groups. For birds, the current checklist of Australian birds maintained by the Australian Faunal Directory (ABRS, 2021) was used in conjunction with the WAM (2020) species list. While compiling a list of fauna potentially occurring in the survey area, all records were checked to ensure the latest taxonomy, using recent papers and lists.

Black Cockatoo Assessment

The survey area is located in the "Jarrah Forest" region which is utilised by all three species (DoEE, 2017). The most current distributional information (DSEWPaC, 2012) for each species of black cockatoo in relation to the survey area is summarised as follows:

- Carnaby's cockatoo: survey area occurs within the modelled breeding distribution for the species;
- Baudin's cockatoo: survey area occurs inside key foraging and wintering areas for Baudin's cockatoo within the modelled likely occurrence range; however, it is outside the breeding range of the species; and
- Forest red-tailed black cockatoo: survey area occurs inside the modelled likely occurrence and breeding range for the species.

Potential foraging habitat

Habitat assessments are the primary method used to identify any habitat used for foraging, breeding or roosting by black cockatoos (DSEWPaC, 2012). The foraging ecology for all three black cockatoo species is well documented (Cooper *et al.*, 2002a; Groom, 2011; Johnstone & Kirkby, 2008; Saunders, 1980; Valentine & Stock, 2008). Suitable foraging resources were identified during the targeted black cockatoo assessment and from sampling undertaken during the concurrent flora and vegetation field surveys. In addition to the classification of habitats, searches were undertaken for evidence of occurrence from feeding debris, such as 'chewed' *Banksia*, pinecones, or marri nuts, as well as broken or scattered flowers. Bite patterns were used to determine species (where possible) using available guides (Fleming, 2011). Searches were also undertaken for other sighting records such as droppings and feathers.

Foraging habitat quality was assessed post-survey throughout the survey area using the habitat scoring tool provided in Table 3.4. The tool is based on known foraging attributes and preferences for each of the three species, to give value habitat as high, medium, low, or nil. The primary attribute of consideration is the presence and overall canopy cover of primary food resources (as defined in Table 3.5). Black cockatoos are recorded to preferentially forage in a canopy compared to the ground within *Banksia*-habitats and pine habitats, where canopy shade may be a significant factor in reducing sun exposure (Finn & Valentine, 2009). The presence of secondary food resources (Table 3.5) and vegetation health are also considerations.

Where post-survey considerations may determine that the foraging habitat quality deviates from the scoring criteria, detailed justification for any variation will be presented. These considerations may include (where applicable);

- ***Local considerations:***
  - Presence and degree of foraging evidence recorded during the field survey DSEWPaC (2012).
  - Area (size) of the habitat type. DSEWPaC (2012) states that clearing of more than 1 ha of quality foraging habitat is a high risk of significant impact to black cockatoos. Around 82% of remaining *Banksia* Woodland patches are under 10 ha, with the median patch size 1.6 ha (TSSC, 2016); patches over the median size may be considered of high quality.
  - The proximity of known roosts or breeding sites. Black cockatoos favour night roost sites within 1 - 6 km of quality foraging resources, and will forage up to 12 km from breeding

hollows during the breeding season (DSEWPaC, 2012). Saunders (1980) reported that black cockatoos will forage 1.4 km from the nest where food is abundant (7.1 km maximum; Coomaloo Creek) and 2.5 km from the nest where food is scarce (12.1 km maximum; Manmanning).

- Context of threat sources at the site e.g., roadside verges compared to a protected regional park. Vehicle collision accounts for a high percentage of black cockatoo deaths (EPA, 2019; Johnstone *et al.*, 2017; Johnstone & Kirkby, 2017), increasing through birds flying to the ground to drink from water pools, feed on dropped seeds and nuts on roadsides, or when flying across roads between areas of foraging habitat.
- Connectivity to other foraging resources on a local scale. Large areas of foraging habitat are required to support black cockatoo populations, and as such the quantity and quality of habitat in local proximity should be considered (< 10 km; DSEWPaC, 2012)
- Proximity to water resources (Glossop *et al.*, 2011; Le Roux, 2017).

- ***Regional considerations:***
  - Region context. Each of the four regions identified as part of the black cockatoo distribution (Swan Coastal Plain, Wheatbelt, Jarrah Forest, and South Coast) provides different key functions across seasons (DSEWPaC, 2012).
  - Connectivity to other areas of foraging resources on a regional scale (DSEWPaC, 2012), in consideration of whether foraging resources maintain vegetation connectivity in the landscape across the migratory routes between breeding and non-breeding grounds (Rycken *et al.*, 2020).

Bamford Consulting (2015) also used foraging score categories based on the condition of vegetation types present within the survey area, assigning scores between 0 (no foraging value) to 6 (High foraging value). Searching for foraging evidence (i.e., chewed nuts) was also conducted during the survey.

Table 3.4: Black cockatoo foraging habitat quality criteria

Foraging habitat quality	Criteria	Example

High	• High abundance of primary food resources in very good condition (i.e., minimal dieback, low tree death), with a projected canopy cover of
	  • > 50% for Eucalypt- or pine-dominated habitats, or
	  • > 30% for *Banksia*- dominated habitats. The percentage canopy cover for *Banksia* Woodlands is recorded as more than 2% and typically less than 50% on the Swan Coastal Plain (TSSC, 2016).
	• Secondary food resources (e.g., Proteaceae shrubs) may also be present in low – high abundance across both the middle and upper storey.
		• Dense *Banksia attenuata or B. menzesii* woodland
		• Closed eucalypt woodland, with a high proportion of mature marri or jarrah
		• Pine plantations

Medium	• Moderate abundance of primary and secondary food resources in good condition (i.e., minimal dieback, low tree death), with a projected canopy cover of
	  • 30 – 50% for Eucalypt-dominated habitats and
	  • 10 - 30% for *Banksia*- dominated habitats (i.e., middle to upper canopy is a mix of common food resources and other flora species).
		• Open eucalypt woodlands of key primary foraging species (marri, jarrah)
		• Orchards (especially those of apple and pear)

Low	• Low overall abundance of primary and secondary food resources, with a projected canopy cover of
	  • up to 30% for Eucalypt-dominated habitats (i.e., scattered specimens across the habitat, with common food resources comprising the minority of species) and
	  • up to 10% for *Banksia*- dominated habitats.
		• Verge trees in an urban environment (e.g., cape lilac)
		• Isolated shrubs in a grassland or paddock.
		• Open Proteaceae shrubland

Nil	• No known food resources present	• Roads • Infrastructure

Table 3.5: Examples of primary and secondary food resources for each black cockatoo species

Foraging resource quality	Carnaby's cockatoo	Baudin's cockatoo	Forest red-tailed black cockatoo
Primary	• Marri *Corymbia calophylla* (Cale, 2003; Groom, 2015; Shah, 2006) • Jarrah *Eucalyptus marginata (*Higgins, 1999; Shah, 2006; Valentine & Stock, 2008) • *Banksia* sp. (especially *B. attenuata, B. menziesii, B. grandis, B. sessilis, B. prionotes*) (Shah, 2006) • Pine *Pinus* sp. (Finn & Valentine, 2009; Stock *et al.*, 2013)	• Marri Chapman (2007); DSEWPaC (2012); (Johnstone & Kirkby, 2017; Weerheim, 2008)	• Marri and jarrah, comprising 90% of the diet (Johnstone et al., 2017)
Secondary	• Other *Banksia* species (e.g., *B. ilicifolia*) (Johnston *et al.*, 2016) • Wandoo *(E. wandoo)* • *Xanthorrhoea preissii* • *Allocasuarina* (sheoak) • *Hakea sp. (*e.g., *H. lissocarpha, H. prostrata)* • *Grevillea sp. (*e.g., *G. bipinnatifida, G*. hookeriana) • *Callistemon* sp. (bottlebrush) • *Erodium* sp. (corkscrew grass) • Canola *Brassica campestris* • Almonds and Pecan nuts • Insects and insect larvae Reference: (DSEWPaC, 2012; Saunders, 1980)	• Jarrah (Saunders, 1974) • *Banksia* sp. (e.g., *B. grandis, B. littoralis, B. ilicifolia, B. sessilis, B. squarrosa*) (Chapman, 2007) • *Hakea* sp. (*H. undulata, H. prostrata, H. trifurcata)*(Johnstone & Storr, 1998) • Insects and insect larvae DSEWPaC (2012) • Pith of kangaroo paw DSEWPaC (2012) • Fruit; apples, pears, persimmons DSEWPaC (2012) • Pine tips DSEWPaC (2012) • *Xanthorrhoea preissii* DSEWPaC (2012); (Weerheim, 2008)	• *Allocasuarina fraseriana* (sheoak) cones • Cape lilac *Melia azedarach* • Blackbutt *E. patens* • Snottygobble (*Persoonia longifolia*) • Silver princess *E. caesia* • *E. erythocorys* • River red gum *E. camaldulensis* • Flooded gum *E. grandis* Reference: (Cooper *et al.*, 2002a; DSEWPaC, 2012; Johnstone *et al.*, 2017; Johnstone & Kirkby, 1999)

Potential night roosting

Bamford Consulting (2015) undertook roosting surveys within the survey area at sunset on the evening of the 5th, 6th, and 8th October 2015 at three different sites (Figure 3.3, Appendix K). These sites were selected during the daylight survey work to identify the most optimal location to view birds flying into potential roost trees. Additionally, a Birdlife Australia black cockatoo search was conducted within 20 km of the survey area to identify the presence of any other known roosting locations (refer to Section 4.2.2). The potential for night roosting to occur within the survey area was interpreted and extrapolated from the identification of potential breeding trees, mapping of potential breeding habitat, proximity to suitable watering spots, and knowledge of any known roosting sites within the vicinity of the survey area.

Any evidence of possible roosting activity (i.e., clipped leaves and branches or droppings under suitable trees) recorded during the field survey was documented.

Potential breeding tree

Breeding habitat for black cockatoos is defined as "trees of species 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" (DoEE, 2017) (Table 3.6). For most tree species, suitable DBH is 500 mm, while for salmon gum and wandoo, suitable DBH is 300 mm (DSEWPaC, 2012). Breeding habitat for all three black cockatoo species generally consists of woodland or forest; however, breeding is also known to occur in former woodland or forest now comprising of isolated or small patches of trees (DSEWPaC, 2012).

Table 3.6: Known breeding trees for black cockatoo species

Species[1]	DBH (mm)
Corymbia calophylla (marri) *Eucalyptus marginata* (jarrah) *Eucalyptus rudis* (flooded gum) *Eucalyptus camaldulensis* (river gum) *Eucalyptus diversicolor* (karri) *Eucalyptus gomphocephala* (tuart) *Eucalyptus patens* (Swan River blackbutt) *Eucalyptus megacarpa* (bullich) *Eucalyptus accedens* (powderbark wandoo)	500
Eucalyptus salmonophloia (salmon gum) *Eucalyptus wandoo* (wandoo)	300

[1] List excludes species for which survey area occurs outside the known distribution of the species, as provided in Florabase (WAH, 1998-)

The location and attributes of all potential black cockatoo habitat trees (as defined by DAWE) were recorded within the survey area during the field survey. Attributes recorded included tree species (where discernible), approximate height, DBH, condition (i.e., living or dead), presence of hollows, and dimensions of hollows (where discernible).

Where suitably sized hollows were recorded, further inspections were undertaken with binoculars to identify the presence/absence of any known breeding signs, i.e. hollows showing evidence of wear and chew marks around the hollow entrance that may be attributed to black cockatoos. Where possible,

hollow usage by fauna was also recorded, including use by introduced honeybees *Apis mellifera* or rainbow lorikeets *Trichoglossus moluccanus*. Potentially suitable nest hollows were considered to be hollows that appeared to be deep enough with an opening diameter large enough to be used by black cockatoos (>100 mm diameter), of both natural and artificial origin, as determined by the criteria shown below in Table 3.7.

Table 3.7: Hollow suitability criteria for potential use by black cockatoo species

Overall hollow suitability	Hollow present?	Suitable diameter? (> 100 mm and unobstructed)	Suitable depth? (> 250 mm)	Evidence of chewing around hollow rim?	Other factors to alter suitability?
Active (Currently in use)	Yes	Yes	Yes	Yes	**Orientation (vertical is preferred)** Diameter at base (>30 cm) **Evidence of bees** Common breeding tree species Height above ground (> 2m)
Suitable (No evidence of use)	Yes	Yes	Yes	No	
Possible (Potential to support black cockatoo but cannot confirm)	Yes	Yes	Potential	No	
Not suitable	Yes	No	No	No	

The black cockatoo survey undertaken within the previous survey area (Bamford Consulting, 2015) recorded most of these similar attributes; however, detailed information on hollow characteristics (e.g. diameter) was not provided. Instead, Bamford Consulting (2015) applies a tree status class (Class 1 – 5) to assess the potential of trees for black cockatoo breeding based on characteristics such as height of the hollow, orientation, and presence of chew marks, whereby Classes 1, 2, and 3 are considered potentially suitable. The descriptions of the tree classes used by Bamford Consulting (2015) are provided below in Table 3.8.

Due to the overlap in areas of tree surveying between the current field survey and the boundary surveyed by Bamford Consulting (2015) and potential discrepancies in GPS precision, tree records made by Bamford Consulting (2015) that fell within the current survey area were removed as duplicates from the current data set if they showed attributes similar to that recorded by Biologic (2021). The previous breeding tree records that fell outside the overall survey boundary were removed.

Table 3.8: Grading system for the assessment of potential nest trees for black cockatoos used by Bamford Consulting (2015)

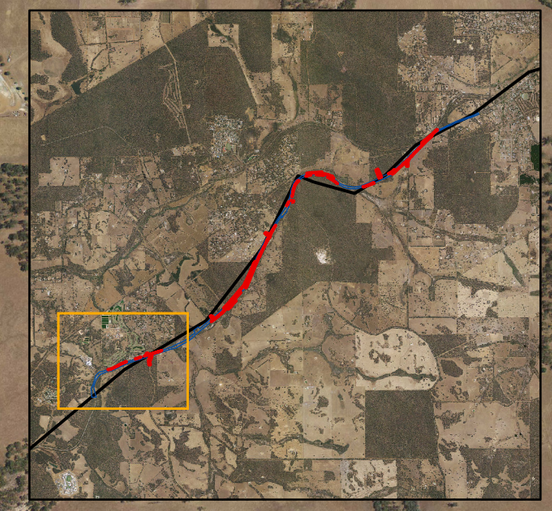
Class	Description of tree and hollows/activity
1	Active nest observed; adult (or immature) bird seen entering or emerging from hollow.
2	Hollow of suitable size and angle (i.e., near-vertical) visible with chew marks around entrance.
3	Potentially suitable hollow visible but no chew marks present; or potentially suitable hollow present (as suggested by structure of tree, such as large, vertical trunk broken off at a height of >10m).
4	Tree with large hollows or broken branches that might contain large hollows, but hollows or potential hollows are not vertical or near-vertical; thus a tree with or likely to have hollows of sufficient size but not to have hollows of the angle preferred by black cockatoos.
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.

437000 438000 439000 440000 441000

6481000

6480000

Great Eastern Hwy



Legend

- Current Survey Area
- Previous Survey Area

Current Survey Sample Sites

- Camera trap
- Habitat assessment
- Traverse

Sample Sites - Bamford (2015)

- Camera trap

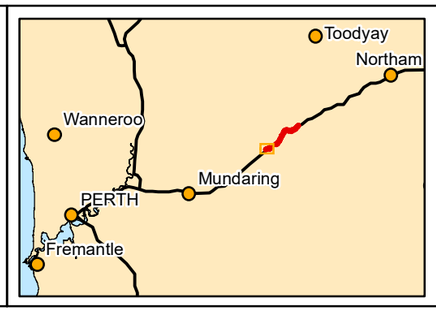
N

biologic Environmental Survey

Scale: 1:11,000

0 250 500 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 04/05/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 3.3a: Fauna sample sites and traverses

441000 442000 443000 444000

6483000

6482000

Great Eastern Hwy

Legend

- Current Survey Area
- Previous Survey Area

Current Survey Sample Sites

- Cockatoo sampling site
- Habitat assessment
- Traverse

Sample Sites - Bamford (2015)

- Roost survey

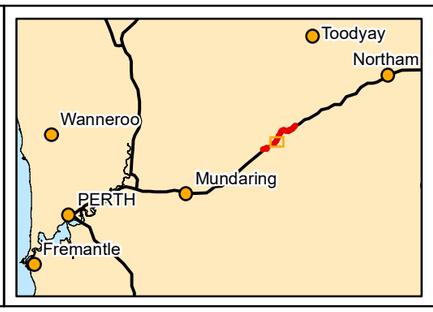
N

biologic Environmental Survey

Scale: 1:11,000

0 250 500 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 04/05/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 3.3b: Fauna sample sites and traverses

442000 443000 444000 445000

6485000

6484000

Great Eastern Hwy

Legend

Current Survey Area

Previous Survey Area

Current Survey Sample Sites

Camera trap

Habitat assessment

Traverse

Sample Sites - Bamford (2015)

Camera trap

Roost survey

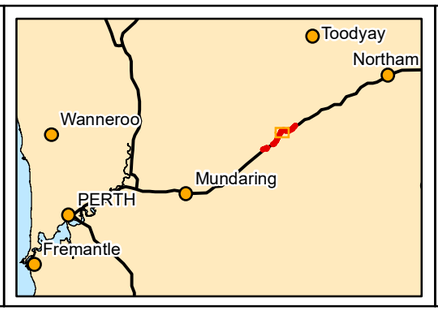
N

biologic Environmental Survey

Scale: 1:11,000

0 250 500 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 04/05/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 3.3c: Fauna sample sites and traverses

445000 446000 447000 448000

6487000 6486000 6485000

Great Eastern Hwy

Legend

- Current Survey Area
- Previous Survey Area

Current Survey Sample Sites

- Camera trap
- Cockatoo sampling site
- Habitat assessment
- Traverse

Sample Sites - Bamford (2015)

- Camera trap

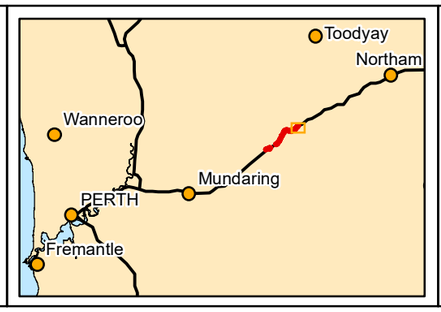
N

biologic Environmental Survey

Scale: 1:11,000

0 250 500 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 04/05/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 3.3d: Fauna sample sites and traverses

3.4 Assessment of Occurrence

3.4.1 Flora

Conservation significant flora species recorded from the database searches and previous reports were assessed for their likelihood of occurrence in the survey area using a decision matrix (Table 3.9). The decision matrix considers the suitability of habitat within the survey area and the proximity of previous records. The decision matrix is intended to be an indicative guide only, and the way in which it is interpreted may vary among species. It is also recognised that a lack of records near the survey area may indicate a limited sampling effort rather than species' absence. Additionally, previous records may include historic or presumed erroneous information which may misrepresent a species' current distribution. Where the determination of a species' likelihood of occurrence within the survey area deviates from the decision matrix, detailed justification for any variation will be presented. Based on this decision matrix, each species was assigned to one of six categories of likelihood: Confirmed, Highly Likely, Likely, Possible, Unlikely, or Highly Unlikely.

Table 3.9: Flora species likelihood of occurrence decision matrix

		Habitat categories (within the survey area)			
		Core/ critical habitat present	**Suitable habitat present/ within known distribution**	**Marginal habitat present/ adjacent to known distribution**	**No suitable habitat present/ outside of known distribution**
Species Records / Occurrence Categories	**Recorded in the survey area**	Confirmed	Confirmed	Confirmed	Confirmed
	Recorded within <4 km	Highly Likely	Likely	Possible	Possible
	Recorded within 4-10 km	Likely	Possible	Possible	Unlikely
	Recorded within 10 -25 km	Possible	Possible	Unlikely	Unlikely
	Recorded >25 km	Possible	Unlikely	Unlikely	Highly Unlikely
	Species considered locally/ regionally extinct	Unlikely	Unlikely	Highly Unlikely	Highly Unlikely

3.4.2 Fauna

Species of conservation significance identified by the desktop assessment were assessed for their likelihood of occurrence within the survey area using a decision matrix which considers the suitability of habitat within the survey area and the proximity of previous records (Table 3.10). Based on this decision matrix, each species was assigned to one of six categories of likelihood: Confirmed, Highly Likely, Likely, Possible, Unlikely, or Highly Unlikely.

The decision matrix is intended to be an indicative guide only, and the way in which it is interpreted may vary between species, depending on a given species' habitat preferences and ability to disperse, as well as the reliability and availability of contextual information. For example, considering species which have been previously recorded close to the survey area, a species with a limited dispersal capability

will have a reduced likelihood of occurring in the survey area compared with a species with greater dispersal capability. It is also recognised that a lack of records in the vicinity of the survey area may indicate limited sampling effort rather than species' absence, and that previous records may include historic or presumed erroneous information which may misrepresent a species' current distribution. Where the determination of a species' likelihood of occurrence within the survey area deviates from the decision matrix, detailed justification for any variation will be presented.

Table 3.10: Vertebrate fauna species likelihood of occurrence decision matrix

		Habitat suitability of survey area			
		Core habitat[2] present	**Foraging and dispersal habitat present**	**Marginally suitable habitat[3] present**	**No suitable habitat present**
Species Records[1]	**Recorded in survey area**	Confirmed	Confirmed	Confirmed	Confirmed
	Recorded within 2 km of survey area	Highly Likely	Likely	Possible	Possible
	Recorded within 2-5 km of survey area	Likely	Possible	Possible	Unlikely
	Recorded within 5-20 km of survey area	Possible	Possible	Unlikely	Unlikely
	Recorded >20 km of survey area	Possible	Unlikely	Unlikely	Highly Unlikely
	Species considered locally/regionally extinct	Unlikely	Unlikely	Highly Unlikely	Highly Unlikely

[1]Only records within the previous 50 years are considered

[2]Core habitat is habitat which contains elements (e.g. nest sites, roost sites, breeding season foraging locations) which are critical for the survival and reproduction of a species (Bingham & Noon, 1997), or habitat which is otherwise defined as critical habitat within relevant species recovery plans and guidelines.

[3]Marginally suitable habitat is habitat which is possibly used by a species for roosting or nesting, or during foraging and dispersal activities, but is unlikely to be depended upon; for example, it may be of low quality or only sporadically present

3.5 Potential Limitation and Constraints

The (EPA, 2016b, 2020b) outlines several potential limitations and constraints which have the potential to affect results of flora and vegetation and terrestrial vertebrate fauna surveys. These aspects are assessed and discussed in Table 3.11. The sampling techniques used during the survey was not constrained by any significant limitations.

Table 3.11: Survey limitations and constraints

Potential limitation or constraint	Limitation	Applicability to this survey
Availability of data and information	Partial	**Flora and Vegetation:** Although a previous detailed flora and vegetation survey has been undertaken immediately adjacent the survey area (360 Environmental, 2019), fairly limited survey work has been undertaken within the local vicinity (see Section 3.2.1). However, this is not considered to be a limitation to the flora survey. **Fauna:** Although a previous Basic terrestrial vertebrate fauna survey has been undertaken within the survey area (Bamford Consulting, 2015), limited survey work has been undertaken within the local vicinity. Subsequently species lists (from nature reserves or wildlife sanctuaries) were incorporated into the literature review. These reports were reviewed to assist in the development of the survey and the preparation of the report. Black cockatoo survey work has been undertaken in the wider local area and the surrounding region, including annual black cockatoo monitoring for the past decade, and these survey results were available for review. The Birdlife, DBCA, and DAWE database searches provided additional sources of recent information.
Competency/ experience of the survey team, including experience in the bioregion surveyed	No	**Flora and Vegetation:** The botanists who undertook the survey have extensive survey experience (>8 years collectively) in the region. **Fauna:** The zoologists who undertook the survey have extensive survey experience within the region. DSEWPaC (2012) advises that black cockatoo surveys should be done by a suitably qualified person with at least three years' experience in surveys of black cockatoo habitat. Claire Brooks and Andrew Hide have the required experience and have completed numerous black cockatoo habitat assessments.
Scope (groups sampled and whether any constraints affect this)	No	**Flora and Vegetation:** The survey was conducted over two days, one in the middle of spring and one at the end of the spring season. This ensured both early and late flowering conservation significant flora taxa (e.g., *Lechenaultia hortii*, P2) were adequately sampled for. In combination with the adjacent survey area's taxon list (360 Environmental, 2019), the resulting flora species list was therefore as comprehensive and representative as possible, given the timing of the survey (mid-Spring and late-Spring). From the combined 360 and Biologic survey, there were 20 species identified to genus level and one species that was tentatively identified to species level. None of the taxa that have had difficulty with identification are considered analogous with any listed conservation significant taxa. **Fauna:** The survey was undertaken over two days, potentially reducing the ability to record a comprehensive list of species present. However the survey was completed in line with the scope of a Basic terrestrial vertebrate fauna survey (EPA, 2020b), and thus it was not necessary to record all species present. The assemblages present could be interpreted based on the habitats mapped. Limited targeted searching was undertaken by the field personnel, reducing the ability to record species of conservation significance. However, the motion cameras deployed (for a total of 30 camera nights from the current field survey) are a preferred method for sampling medium sized mammals (chuditch, quenda, and south-western brush-tailed phascogale), and increased the likelihood of recording such species.

Potential limitation or constraint	Limitation	Applicability to this survey
Timing, weather and season	No	**Flora and Vegetation:** The survey was conducted over two days, one in the middle of spring (21st October) and one at the end of the spring (20th November), the former of which is the recommended optimal survey period for flora in south west Western Australia (EPA, 2016b), while the latter is recommended for the seasonal capture of specific conservation significant flora taxon previously known from in the area (e.g. *Lechenaultia hortii.* P2). However, the six months prior to the survey (April to September) recorded a total of 150.2 mm below the long term average collectively, while the whole month of October recorded just 1.1 mm (compared to the long term average of 24.4 mm). Although monthly rainfall for Northam weather station was well below average prior and during the field survey, conditions observed on site during the survey were considered to be adequate, particularly during October, with many annual taxa observed along with perennial taxa bearing reproductive material. Therefore survey timing is not considered to have constrained this survey. **Fauna:** The field survey was conducted in spring which is the recommended optimal survey period for the main faunal groups sampled (birds, mammals, reptiles) (EPA, 2020b). The survey timing fell within the recommended timing for one of the targeted black cockatoo species (year-round for forest red-tailed black cockatoo) (DoEE, 2017). Although the timing was outside of that recommended for Carnaby's cockatoo (January to July; DoEE, 2017) and Baudin's cockatoo (March to September); targeted searches were undertaken for secondary evidence of the species presence (i.e. foraging evidence) and to evaluate the potential suitability of the habitat. The temperatures and weather experienced were not considered a limitation to the survey.
Disturbance that may have affected results, e.g. fire, flood	No	**Flora and Vegetation:** No on-ground disturbance during the field survey affected overall survey in any way. Weeds, tracks/ firebreaks, fence lines, proximity to major roads and development, rubbish and minor trampling were the main general disturbances recorded within the survey area. These disturbances are common in areas of bushland along major roads, with the majority of the vegetation considered to be in Completely Degraded condition. However, most of the intact vegetation was in excellent condition with little in the way of observable disturbances. **Fauna:** The main disturbance to the survey was the presence of Great Eastern Highway bisecting the survey area, providing noise, vibration, and risk of vehicle collision. However, the disturbance was not considered to constrain the survey methods and has been present for a long period of time. The survey area does not appear to have been burned during the February 2021 Wooroloo fires as shown on Landgate (2021); however, some areas of the immediate region experienced habitat loss from the fires. The assessment and description of fauna habitats within this report are described from field surveys undertaken pre-fire events, and as such do not take potential fire damage into consideration as the impacts are unknown.

Potential limitation or constraint	Limitation	Applicability to this survey
Proportion of flora and fauna identified, recorded, or collected	No	**Flora and Vegetation:** From the combined 360 and Biologic survey, there were 20 species identified to genus level and one species that was tentatively identified to species level. Of these 20 taxa, six were tentatively identified to species or infraspecies level, while fourteen have only been identified to genus level. None of the taxa that have had difficulty with identification are considered analogous with any listed conservation significant taxa. Overall, the majority of species were easily identifiable, and this is not considered to be a constraint on the proportion of flora recorded. **Fauna:** All observed fauna were identified at the point of observation. All fauna captured on motion camera were identified post-survey with no limitations on identification.
Adequacy of the survey intensity and proportion of survey achieved	No	**Flora and Vegetation:** A Detailed flora and vegetation survey with targeted searching was undertaken across the survey area. This level of survey is the required intensity given the previous survey undertaken adjacent to the current survey area, the size of the survey area, and the significance which a potential development may have. All vegetation types were surveyed and all areas were traversed extensively. **Fauna:** A Basic terrestrial vertebrate fauna survey and targeted black cockatoo habitat assessment was undertaken across the survey area. This level of survey is the required intensity given the previous survey undertaken within the survey area, the size of the survey area, and the significance which a potential development may have. The entire survey area was traversed on foot, with all tasks achieved within the allotted field time.
Access problems	No	**Flora and Vegetation:** The survey area was easily accessible from adjacent and adjoining roads, namely Great Eastern Highway, allowing for the entire area to be traversed on foot. **Fauna:** The entire survey area was traversed on foot, with a vehicle used between patches, thus remoteness or access was not considered a limitation.
Problems with data and analysis, including sampling biases	No	**Flora and Vegetation:** No issues with data or analysis were experienced. Previous flora results (360 Environmental, 2019) were consolidated with the current field survey. The small size and thin, linear nature of the survey area did not allow for the replication of detailed floristic site (quadrat) vegetation type sampling for statistical analysis. **Fauna:** No issues with data or analysis were experienced. Previous fauna results (Bamford Consulting, 2015) were consolidated with the current field survey. Potential black cockatoo nesting trees from the previous field surveys were removed where deemed replications from the current survey (where GPS accuracy and DBH were presumed more accurate).

4 RESULTS AND DISCUSSION

4.1 Flora Desktop Assessment

4.1.1 Literature Review

The results and outcomes of the review of eight flora and vegetation reports are presented in Table 4.1. The literature review identified three conservation significant flora taxa previously recorded within the previous survey area, *Tetratheca pilifera* (P3), *Lechenaultia hortii* (P2) and *Grevillea olivacea* (P4). However, the survey report completed by 360 Environmental (2019) concluded that the *Grevillea olivacea* (P4) was planted, and therefore does not have any significance in relation to the survey area and will not be considered further in this survey report.

Only one taxon, *Tetratheca pilifera* (P3), was identified from both the literature review and the databases searched (Table 4.1; Appendix D). The two remaining taxa, *Lechenaultia hortii* (P2) and *Grevillea olivacea* (P4), were only identified from the literature review (360 Environmental, 2019). The literature review did not identify any conservation significant ecological communities previously occurring within or near the survey area (Table 4.1).

Table 4.1: Key findings from the flora literature review

Study Details	Methods	Results	Significant Findings	Limitations

360 Environmental (2019)
Client: Main Roads Western Australia
Type: Detailed Flora and Vegetation Survey
Location: Great Eastern Hwy Coates Gully (survey area)
Timing: October 2019
	• Seven Quadrats
	• Five releves
	• Mapping notes
		• 161 flora taxa from 119 genera from 45 families
		• Vegetation condition was Excellent to Completely Degraded
		• 26 vegetation types
		• 38 introduced species recorded
			• No TECs or PECs
			• No Threatened flora recorded
			• 3 Priority flora species recorded:
			  ○ *Lechenaultia hortii* (P2)
			  ○ *Tetratheca pilifera* (P3)
			  ○ *Grevillea olivacea* (P4) – concluded to be planted (not considered further)
				• No substantial limitations

Terratree (2015) **Client:** Main Roads Western Australia **Type:** Level 1 Flora, Vegetation and *Phytophthora* Dieback Assessment **Location:** Great Eastern Hwy (survey area) **Timing:** 2015	• Traversed site on foot • Quadrats • Dieback assessment	• 146 flora taxa recorded • Seven vegetation communities • 20 introduced weed species	• No TECs or PECs • No Threatened flora recorded • One Priority floraspecies recorded ○ *Tetratheca pilifera* (P3)	• No substantial limitations
360 Environmental (2014) **Client:** Water Corporation **Type:** Level 1 Flora, Vegetation and Level 1 (basic) fauna assessment (including black cockatoo) **Location:** Wundowie, 3.22 km from the survey area **Timing:** 2014	• Not available	• 49 flora taxa	• No TECs or PECs • No conservation significant flora recorded	• Original report not publicly available
Del Botanics (2020) **Client:** Strategen **Type:** Reconnaissance flora and vegetation survey & targeted flora survey **Location:** Lot 500 Coothallie Road Chidlow (8.1 km SW) **Timing:** October 2019	• Eight releves • Transverse parallel sweeps (targeted searching)	• 68 flora taxa from 51 genera and 24 families • Three introduced weed taxa • Three vegetation communities • Vegetation condition ranged from Very Good to Completely Degraded	• No TECs or PECs • No conservation significant flora recorded • Habitat trees	• No substantial limitations
Del Botanics (2012) **Client:** Land Insights **Type:** Detailed flora and vegetation survey **Location:** multiple private properties in Mt Helena (14.7 km SW) **Timing:** October 2012	• 11 quadrats	• 98 flora taxa from 70 genera and 28 families • 23 introduced weed taxa • Three vegetation communities • Vegetation condition ranged from Very Good to Completely Degraded	• No TECs or PECs • No conservation significant flora recorded	• No substantial limitations

Bennett Environmental (2006)
Client: City of Swan
Type: Detailed flora and vegetation survey
Location: Reserve 2145 and Percy Cullen Oval, Gidgegannup (15.3 km W)
Timing: September 2006
	• 9 permanent quadrats	• 174 flora taxa from 110 genera and 42 families
		• Eight introduced weed taxa
		• Five vegetation communities
		• Vegetation condition ranged from Excellent to Good
			• Three Priority flora species recorded
			  ○ *Tetratheca pilifera* (P3
			  ○ *Templetonia drummondii* (P4) – no longer considered a Priority
			  ○ *Hibbertia montana* (P4) – no longer considered conservation significant
			• No TECs or PECs
			• Two wetlands (floodplain and creek)
				• No substantial limitations

Strategen (2020) **Client:** Satterley Property Group **Type:** Detailed flora and vegetation survey **Location:** Lot 48 Stoneville Rd & Lot 1 Roland Rd Stoneville (18.7 km WSW) **Timing:** Nov 2016 & Nov 2017	• 29 quadrats • Foot traverses	• 89 flora taxa from 67 genera and 30 families • Nine introduced weed taxa • Five vegetation communities • Vegetation condition ranged from Excellent to Completely Degraded	• No conservation significant flora recorded • DP **Zantedeschia aethiopica* • No TECs or PECs	• No substantial limitations
GHD (2009) **Client:** Boral Resources **Type:** Unknown **Location:** Gidgegannup granite quarry (24.0 km WSW) **Timing:** Unknown	• Not specified	• 32 introduced weed taxa • Three vegetation communities	• One Priority flora species recorded ○ *Calothamnus rupestris* (P4) – no longer considered conservation significant • DP **Echium plantagineum* • No TECs or PECs	• Original report not publicly available

4.1.2 Database Review

Flora of Conservation Significance

A total of 47 conservation significant flora taxa (those listed under the EPBC Act, BC Act, or DBCA's Priority List) were identified from the database searches (Figure 4.1; Appendix D). Of the 47 taxa, 11 are listed as Threatened flora (EPBC Act and BC Act), while the remaining 36 are Priority taxa (one P1, seven P2, fifteen P3 and fourteen P4).

The 48 taxa identified from the desktop assessment (literature review and database searches) were then assessed and ranked on the likelihood of occurring within the survey area (Appendix F) (please note that **Grevillea olivacea* (P4) has not been included in the overall desktop assessment). This assessment takes into consideration the post-survey likelihood assessment completed by 360 Environmental (2019) which is included in the combined survey area. This consideration significantly reduces the pre-survey likelihood of all unconfirmed taxa, as many of the taxa considered Highly Likely or Likely in the pre-survey likelihood completed by 360 Environmental (2019) were all downgraded to Unlikely or below.

Two taxa have been previously recorded from the survey area pre-survey (confirmed) (see section 3.3.2 above), while 16 were considered Possible to occur in the survey area pre-survey (Table 4.2). The remaining 30 taxa were considered Unlikely or Highly Unlikely to occur (Appendix F).

Table 4.2: Likelihood of conservation significant flora occurrence to the survey area

Taxon	Description (WAH, 1998-)	Location
Confirmed		
Lechenaultia hortii (P2)	Erect to spreading perennial, herb or shrub (subshrub), to 0.4 m high. White-cream sandy soils. Low slopes and flats, road verges.	Within
Tetratheca pilifera (P3)	Spreading shrub, 0.1-0.3 m high. Fl. purple, Aug to Oct. Gravelly soils	Within
Possible		
Drosera albonotata (P2)	Upright orange flower with black/yellow centre. Basal rosette. Open woodland/heath. Allocasuarina campestris, *Banksia* armata and Ericomyrtus serpyllifolia.	7.7 km SE
Grevillea candolleana (P2)	Spreading shrub, 0.2-0.8 m high. Fl. white-cream, Aug to Sep. Laterite, lateritic loam. Hillsides.	6.8 km NE
Acacia campylophylla (P3)	Dense, rigid, spreading shrub, 0.1-0.6 m high. Fl. yellow, Jul to Aug. Lateritic gravelly soils.	6.5 km E
Adenanthos cygnorum subsp. *chamaephyton* (P3)	Prostrate, mat-forming, non-lignotuberous shrub, to 0.3 m high. Fl. white-cream-pink-green/green, Jul or Sep to Dec or Jan. Grey sand, lateritic gravel	3 km WSW
Asteridea gracilis (P3)	Annual, herb, 0.15-0.35 m high. Fl. white-pink, Sep to Dec. Sand, clay, gravelly soils	6.7 km NNW
Synaphea diabolica (P3)	Clumped, sprawling shrub (subshrub), 0.2-0.6 m high. Dry, yellow-brown laterite soil with laterite gravel. In undulating areas.	7.2 km SE
Thysanotus cymosus (P3)	Caespitose perennial, herb (with fibrous roots with ellipsoidal tubers), to 0.3 m high. Fl. purple, Sep to Oct. Clay, granitic or lateritic sand.	0.4 km N
Verticordia serrata var. linearis (P3)	Shrub, to 1 m high, differs from other varieties in the linear acuminate leaves 6-20 mm long; cilia to 1.2 mm long. Fl. other, Sep to Oct. White sand, gravel. Open woodland	7.8 km NNE
Anigozanthos humilis subsp. *chrysanthus* (P4)	Rhizomatous, perennial, herb, 0.2-0.4(-0.8) m high. Fl. yellow, Jul to Oct. Grey or yellow sand.	7 km NE

Taxon	Description (WAH, 1998-)	Location
Asterolasia grandiflora (P4)	Slender open shrub, 0.2-0.6(-0.8) m high. Fl. pink/white, Jul to Oct. Lateritic soils, clay over granite. Breakaways, hills.	1 km NNE
Caladenia integra (P4)	Tuberous, perennial, herb, 0.2-0.5 m high. Fl. green & red, Sep to Oct. Clayey loam. Granite outcrops, rocky slopes	9.9 km NE
Cyanicula ixioides subsp. ixioides (P4)	Tuberous, perennial, herb, 0.05-0.15 m high. Fl. yellow, Aug to Oct. Laterite, gravel	0.7 km SSE
Daviesia oxylobium (P4)	Glaucous shrub, 0.5-1 m high. Fl. yellow & red & pink, Jul to Aug. Sandy lateritic soils. Undulating plains	4 km WNW
Sowerbaea multicaulis (P4)	Tufted perennial, herb, 0.075-0.25 m high. Fl. purple-violet, Oct to Dec or Jan. Yellow-brown sand	8.7 km N
Stylidium leptocalyx (P4)	Rosetted perennial, herb, 0.08-0.4 m high, Leaves tufted, linear, 3.5-16 cm long, 1.1-2.2 mm wide, apex acute, margin involute, scabrous. Membraneous scale leaves present at base of mature leaves. Scape glandular throughout, pilose at base. Inflorescence racemose. Fl. pink, Oct to Nov. Laterite soils. Upland, breakaways. Eucalypt woodland or shrubland.	9.4 km ESE
Stylidium striatum (P4)	Rosetted perennial, herb, 0.15-0.55 m high, Leaves erect, oblanceolate to spathulate, 1.5-4 cm long, 1.5-6 mm wide, apex acute to acuminate, margin entire, glabrous, striate. Scape sparingly glandular on inflorescence axis, glabrous below. Inflorescence racemose. Fl. yellow, Oct to Nov. Brown clay loam over laterite. Hillslopes. Jarrah/Marri forest, Wandoo woodland.	0.4 km N

420000 440000 460000

6500000 6480000

Great Eastern Hwy

Taxon

T,VU

- *Acacia aphylla*

P1

- *Senecio gilbertii*

P2

- *Amperea micrantha*
- *Banksia nivea* subsp. Morangup (M. Pieroni 94/2)
- *Cyanicula ixioides* subsp. *candida*
- *Drosera albonotata*
- *Grevillea candolleana*
- *Lasiopetalum trichanthera*
- *Verticordia citrella*

P3

- *Acacia campylophylla*
- *Adenanthos cygnorum* subsp. *chamaephyton*
- *Asteridea gracilis*
- *Beaufortia purpurea*
- *Daviesia nudiflora* subsp. *drummondii*
- *Juncus meianthus*
- *Meionectes tenuifolia*
- *Stylidium asteroideum*
- *Stylidium exappendiculatum*
- *Synaphea diabolica*
- *Stylidium periscelianthum*
- *Tetratheca pilifera*
- *Thysanotus cymosus*
- *Verticordia huegelii* var. *tridens*
- *Verticordia serrata* var. *linearis*

P4

- *Anigozanthos humilis* subsp. *chrysanthus*
- *Asterolasia grandiflora*
- *Caladenia integra*
- *Chordifex chaunocoleus*
- *Cyanicula ixioides subsp. ixioides*
- *Daviesia oxylobium*
- *Eremaea blackwelliana*
- *Eucalyptus loxophleba x wandoo*
- *Grevillea pimeleoides*
- *Hemigenia platyphylla*
- *Sowerbaea multicaulis*
- *Stylidium striatum*

Legend

- Current Survey Area
- Previous Survey Area
- Study Area

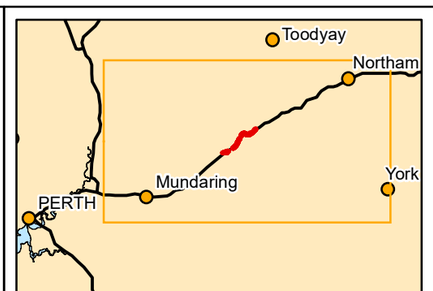
N

biologic Environmental Survey

Scale: 1:175,000

0 5 10 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/04/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.1: Conservation significant flora database search results

Vegetation of Conservation Significance

The database searches identified 83 patches of a single conservation significant ecological community in proximity to the survey area; Eucalypt woodlands of the Western Australian Wheatbelt (EPBC Critically Endangered, synonymous with DBCA-listed P3 PEC) (DBCA, 2020c) (Table 4.3, Figure 4.2). The most proximate of these patches is approximately 7.7 km east of the survey area. The community can occur in outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt, that are off the Darling Range (DBCA, 2020b).

This community was not identified as present within the survey area by the previous survey (360 Environmental, 2019) or by surveys within close proximity (360 Environmental, 2014). 360 Environmental (2019) identified two vegetation types (EwCc and EwBsq) that were of similar characteristics to the TEC/PEC; however, the survey area falls outside the average rainfall isohyet of <600 mm required for its occurrence (DoE, 2015) and therefore cannot contain vegetation representing this conservation significant ecological community.

Table 4.3: Conservation significant ecological communities identified from the desktop assessment (DBCA, 2020c; DoE, 2015)

Community ID	Community Name and Description	Location
Eucalypt woodlands of the Western Australian Wheatbelt	**Western Australia: Priority 3** **EPBC Act: Critically Endangered** The ecological community defined and assessed in this conservation advice is composed of eucalypt woodlands that formerly were the most common type of vegetation across the wheatbelt landscape of south-western Western Australia (WA), i.e., inland between the Darling Range and western edge of the goldfields. The woodlands are dominated by a complex mosaic of eucalypt species with a tree or mallet1 form over an understorey that is highly variable in structure and composition. Woodlands dominated by mallee forms or vegetation with a very sparse eucalypt tree canopy are not part of the ecological community. **Threats**: • Clearance of native vegetation. • loss of habitat for key native species. • fragmentation into smaller, disconnected patches. • Weed invasion. • Impacts from pest animals. • Inappropriate application of chemicals. • Grazing pressure. • Increased salinity and waterlogging of the landscape largely due to modification of the landscape and hydrology. • Soil acidification. • Altered fire regimes, notably altered fire frequency. • Potential impact of plant diseases such as *Phytophthora sp.* • Potential impacts of climate change.	Beginning ~ 7.7 km east of the survey area

420000
440000
460000
6500000
6480000
Great Eastern Hwy

Legend

- Current Survey Area
- Previous Survey Area
- Study Area
- Wheatbelt Woodlands (WA P3; EPBC T,CR)

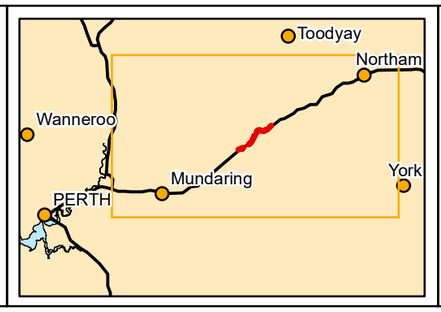
N

biologic Environmental Survey

Scale: 1:175,000

0 5 10 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/04/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.2: Conservation significant ecological communities database search results

Introduced Flora Taxa

The NatureMap (DBCA, 2020a), Protected Matters (DAWE, 2020), ALA (ALA, 2020) and The Western Australian Organism List (WAOL) (DAFWA, 2015) database searches identified a list of 106 introduced taxa that may potentially occur within the survey area (Appendix D).

Of the list of introduced taxa identified during the desktop assessment, 10 are listed as WoNS (Appendix E). The 10 WoNS were identified from the WAOL database search for the entire Shire of Northam and either, occur or may potentially occur, within the Shires boundaries. The desktop assessment identified 51 DPs (including numerous cacti species), previously recorded or potentially located within the Shire of Northam (Appendix E).

4.2 Vertebrate Fauna Desktop Assessment

4.2.1 Literature Review

The desktop assessment identified that limited survey work has been undertaken in the immediate vicinity of the survey area (< 20 km). The previous (Bamford Consulting, 2015) Basic terrestrial vertebrate fauna survey was the first vertebrate fauna survey undertaken within the survey area. The Karakamia Wildlife Sanctuary list (AWC, 2015), incorporating the results of multiple years of fauna surveys and research, was publicly available; however, the species present within the sanctuary may represent translocations of threatened species (Mawson, 2004) and as such are not naturally occurring local populations or connected to habitat in the local vicinity. Additional sources of information were provided by the management plan for the Shire of Northam nature reserves; Clackline, St Ronan's, Wambyn, Mokine, Throssell, and Meenaar reserve (CALM, 1987). These reserves are located between 11 km and 48 km of the survey area. Kabay Consultants (2007) undertook a Basic and targeted vertebrate fauna survey in Chidlow, 16 km southwest of the survey area in 2007. The results of the Basic vertebrate fauna survey undertaken by 360 Environmental (2014), located 3.22 km from the survey area, was not available for review.

Black cockatoo species have been recorded from most of the reviewed literature sources, in particular the two white-tailed species (Carnaby's and Baudin's cockatoo), recorded from the nearby nature reserves and sanctuaries (AWC, 2015; CALM, 1987), and the previous field survey (Bamford Consulting, 2015). Mammalian species such as the chuditch (AWC, 2015; Kabay Consultants, 2007; unconfirmed), quenda (AWC, 2015; Kabay Consultants, 2007; unconfirmed), and western brush wallaby (AWC, 2015; CALM, 1987) have also been recorded from the local regions from previous surveys. Despite their presence in database searches, no migratory bird species (e.g., greenshanks, curlews, sandpipers) have been recorded in the local area by other fauna surveys.

In total, 14 vertebrate species of conservation significance were identified from the literature sources as occurring from the vicinity of the survey area. The results and outcomes of the review of the fauna reports identified from the literature review are presented in Table 4.4.

4.2.2 Database Review

General Results

A total of 288 species of vertebrate fauna were identified (Appendix M) from the database searches and literature review as having previously been recorded with or have the potential to occur within the Survey Area based on habitats present. This comprised of 40 mammals (11 introduced, 29 native), 189 birds (10 introduced, 179 native), 48 reptiles (one introduced, 47 native), and eleven amphibians.

Vertebrate Fauna of Conservation Significance

Based on the database searches, a total of 33 terrestrial vertebrate fauna species of conservation significance have previously been recorded or have the potential to occur within 15 km of the survey area (Table 4.4, Figure 4.3). This comprises 14 mammals, 18 birds (including migratory species, and excluding the *Calyptorhynchus sp. 'white-tailed black cockatoo'*), and one reptile. Invertebrate fauna was not considered as part of this vertebrate fauna survey and were excluded from consideration. Of these species, 20 are listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependent, or Specially Protected under the EPBC Act and/or BC Act. A further eight are listed as Migratory under the EPBC Act and/or BC Act, including some species also listed in the Threatened categories above. Seven species are listed as Priority by the DBCA. For some conservation significant vertebrate species, such as numbat *Myrmecobius fasciatus*, western ringtail possum *Pseudocheirus occidentalis*, and bilby *Macrotis lagotis*, the database records included historic or presumed erroneous information which do not represent the species' current distribution.

Due to the size of the database search area, the number of species identified as potentially occurring within the survey area is likely to be an overestimate due to the search area containing habitats that do not occur within the survey area, such as large water bodies. Additionally, many species tend to be patchily distributed even where appropriate habitats are present, and many species of birds can occur as regular migrants, occasional visitors, or vagrants. The only previous species of conservation significant vertebrate fauna identified in the desktop review that had previously been recorded with the survey area, are those recorded by Bamford Consulting (2015); however, this is likely due to the lack of survey effort within the immediate vicinity.

Table 4.4: Conservation significant fauna database search results

Scientific Name	Common name	Conservation status				Database searches					Literature sources									
		EPBC	BC	DBCA	IUCN	NatureMap (15 km)	EPBC (15km)	DBCA Priority and Threatened Database (15km)	ALA (15 km)	Birdlife (15km)	Great Eastern Highway SLK 55.8 – 68.5 Fauna and Black-Cockatoo Habitat Assessment. Bamford Consulting Ecologists (2015).	Karakamia Wildlife Sanctuary Species List. Australian Wildlife Conservancy (AWC) (2013)	Kabay (2007)	Nature Reserves of the Shires of York and Northam: Clackline Nature Reserve (CALM, 1985)	Nature Reserves of the Shires of York and Northam: St Ronans (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Wambyn (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Mokine (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Throssell (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Meenaar (CALM, 1987)	Current field survey (Biologic, 2021)
DASYURIDAE																				
Dasyurus geoffroii	Chuditch	VU	VU			●	●	●	●			●	?							
Phascogale calura	Red-tailed phascogale	VU	CD				●													
Phascogale tapoatafa wambenger	Wambenger, brush-tailed phascogale		CD					●					?							
MACROPODIDAE																				
Notamacropus eugenii derbianus	Tammar			P4				●				●								
Notamacropus irma	Western brush wallaby			P4		●		●				●	●	●	●	●	●			
Petrogale lateralis lateralis	Black-footed rock-wallaby, moororong	EN	EN		NT			●												
Setonix brachyurus	Quokka	VU	VU				●	●				●								
MURIDAE																				
Hydromys chrysogaster	Water-rat			P4		●		●	●											
MYRMECOBIIDAE																				
Myrmecobius fasciatus	Numbat	EN	EN					●												
PERAMELIDAE																				
Isoodon fusciventer	Quenda			P4				●			●	●	?							●
POTOROIDAE																				
Bettongia penicillata	Woylie	EN	CR			●	●		●			●								
PSEUDOCHEIRIDAE																				
Pseudocheirus occidentalis	Western ringtail possum, ngwayir	CR	CR					●				●								
THYLACOMYIDAE																				
Macrotis lagotis	Bilby	VU	VU		VU	●		●	●											
VESPERTILIONIDAE																				
Falsistrellus mackenziei	Western false pipistrelle			P4				●												
PANDIONIDAE																				
Pandion haliaetus	Osprey	MI	MI				●													
ANATIDAE																				
Oxyura australis	Blue-billed duck			P4	NT							●								
APODIDAE																				
Apus pacificus	Fork-tailed swift	MI	MI				●	●	●			●								
CACATUIDAE																				
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	VU	VU			●	●	●			●	●								●
Calyptorhynchus baudinii	Baudin's cockatoo	EN	EN			●	●	●	●		●	●		●	●	●	●			●
Calyptorhynchus latirostris	Carnaby's cockatoo	EN	EN			●	●	●	●		●	●	●							●

Scientific Name	Common name	Conservation status				Database searches					Literature sources									
		EPBC	BC	DBCA	IUCN	NatureMap (15 km)	EPBC (15km)	DBCA Priority and Threatened Database (15km)	ALA (15 km)	Birdlife (15km)	Great Eastern Highway SLK 55.8 – 68.5 Fauna and Black-Cockatoo Habitat Assessment. Bamford Consulting Ecologists (2015).	Karakamia Wildlife Sanctuary Species List. Australian Wildlife Conservancy (AWC) (2013)	Kabay (2007)	Nature Reserves of the Shires of York and Northam: Clackline Nature Reserve (CALM, 1985)	Nature Reserves of the Shires of York and Northam: St Ronans (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Wambyn (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Mokine (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Throssell (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Meenaar (CALM, 1987)	Current field survey (Biologic, 2021)
Calyptorhynchus sp. 'white-tailed black cockatoo'	White-tailed black cockatoo	EN	EN			•		•												
FALCONIDAE																				
Falco hypoleucos	Grey falcon		VU		VU		•													
Falco peregrinus	Peregrine falcon		OS			•		•	•	•		•								
MEGAPODIIDAE																				
Leipoa ocellata	Malleefowl	VU	VU			•	•	•												
MOTACILLIDAE																				
Motacilla cinerea	Grey wagtail	MI	MI				•													
PROCELLARIIDAE																				
Pterodroma mollis	Soft-plumaged petrel	VU				•			•											
ROSTRATULIDAE																				
Rostratula benghalensis australis	Australian painted snipe	EN	EN		EN		•													
SCOLOPACIDAE																				
Calidris acuminata	Sharp-tailed sandpiper	MI	MI				•													
Calidris ferruginea	Curlew sandpiper	CR/MI	CR/MI		NT		•													
Calidris melanotos	Pectoral sandpiper	MI	MI				•													
Numenius madagascariensis	Eastern curlew	CR/MI	CR/MI		EN		•													
Tringa hypoleucos	Common sandpiper	MI	MI				•													
Tringa nebularia	Common greenshank	MI	MI				•													
SCINCIDAE																				
Ctenotus delli	Dell's skink			P4				•												

420000 440000 460000

6500000 6480000

Great Eastern Hwy

Bird

- Malleefowl - T,VU
- Peregrine falcon - OS
- Fork-tailed swift - MI

Mammal

- Western ringtail possum - T,CR
- Woylie - T,CR
- Black-flanked rock-wallaby, black-footed rock-wallaby, mooroorong - T,EN
- Numbat - T,EN
- Bilby, dalgyte, ninu - T,VU
- Chuditch - T,VU
- Quokka - T,VU
- Quenda - P4
- Tammar wallaby - P4
- Water rat - P4
- Western brush wallaby - P4
- Western false pipistrelle - P4
- South-western brush-tailed phascogale - CD

Reptile

- Dell's skink - P4

Legend

- Current Survey Area
- Previous Survey Area
- Study Area

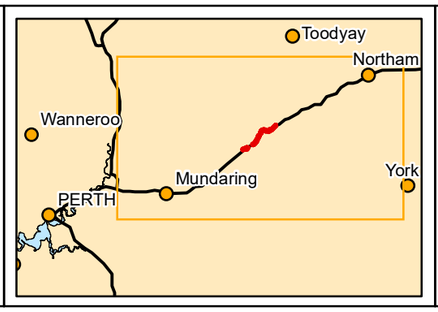
N

biologic Environmental Survey

Scale: 1:175,000

0 5 10 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/04/2021



MAIN ROADS WA

Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey

Figure 5.1: Threatened fauna database search results (excluding black cockatoo)

Black cockatoo database results

Roosting habitat is defined as a suitable tree (generally the tallest) or group of tall trees, native or introduced, usually close to an important water source, and within an area of quality foraging habitat within the range of the black cockatoo species (DSEWPaC, 2012). There are three confirmed white-tailed black cockatoo (Carnaby's and/ or Baudin's black cockatoo) roosts, three forest-red tailed black cockatoo roosts, and three joint roost sites within 20 km of the survey area (nine total; BirdLife Australia, 2021). Three of these roosts are in close proximity to the survey area; NORWUNR001 (joint roost), located 500 m west, NORBAKR001 (white-tailed black cockatoo roost), located 1.2 north-east, and MUNWOOR001 (forest red-tailed black cockatoo roost), located 5.1 km west (BirdLife Australia, 2021) (Figure 4.4). Roost NORWUNR001 is located 1.1 km north-east of the Mairinger Way roost site recorded by Bamford Consulting (2015), and as such, these two sites may be used together by flocks as a single roost. In 2019, roost NORBAKR001 recorded a high number of birds (*n* = 160) roosting during the Great Cocky Count (Peck *et al.*, 2019). A summary of the recent usage for the roosts of the local region is provided in Table 4.5.

All three black cockatoo species are known to breed in the Jarrah Forest bioregion (DoEE, 2017). Wheatbelt Natural Resource Management (2021) recorded two active Carnaby's cockatoo nests in Wundowie Reserve during their breeding surveys in November and December 2020. At one tree, the female was found nesting in a dead stag with a DBH less than 300 mm (less than the estimated DBH recognised by DSEWPaC (2012)), and when flushed, the individual climbed over three metres internally to reach the hollow entrance. Records from surveys between 2009 and 2013 found eight confirmed breeding records for Carnaby's cockatoo between 12 - 20 km of the survey area, all within natural hollows (BirdLife Australia, 2021). There are no confirmed breeding records in artificial hollows within that radius. These records were made from 2009 to 2013 (BirdLife Australia, 2021).

Table 4.5: Summary of roost usage by black cockatoo within 20 km of the survey area (BirdLife Australia, 2021)

Site	Distance from survey area	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
White-tailed black cockatoo											
NORWUNR001	0.5 km west	125	.	8	0	.	0	0	0	.	15
NORBAKR001	1.2 km north-east	217	.	.	.	.	.	94	52	.	160
MUNWOOR001	5.2 km west	0	.	.	0	0	.	.	.	0	.
MUNCHIR002	9.4 km west	.	.	.	.	0	.	0	0	0	0
NORWOOR002	11.8 k south	.	.	.	.	.	.	.	.	8	0
SWAGIDR003	12.4 km west	.	.	3	.	.	.	0	0	0	.
TOOMORR003	12.9 km north-west	.	.	.	.	.	.	.	55	32	36
TOOMORR001	17.1 km north-west	.	.	183	29	56	12	140	44	99	58
TOOMORR002	18 km north-west	.	.	.	.	.	.	.	0	0	0
Forest red-tailed black cockatoo											
NORWUNR001	0.5 km west	.	.	.	.	.	6	0	8	.	0
NORBAKR001	1.2 km north-east	.	.	.	.	.	.	0	0	.	0
MUNWOOR001	5.2 km west	.	.	.	.	17	.	.	.	0	.
MUNCHIR002	9.4 km west	.	.	.	.	12	.	49	65	0	0
MUNCHIR003	10.8 km south-west	.	.	.	.	.	.	4	4	0	.
NORWOOR002	11.8 k south	.	.	.	.	.	.	.	.	0	0
SWAGIDR003	12.4 km west	.	.	.	.	.	.	0	0	0	.
TOOMORR003	12.9 km north-west	.	.	.	.	.	.	.	23	23	23
TOOMORR001	17.1 km north-west	.	.	.	.	0	5	0	0	0	0
TOOMORR002	18 km north-west	.	.	.	.	.	.	.	36	11	35

420000 440000 460000

6500000 6480000

Great Eastern Hwy

Legend

- Current Survey Area
- Previous Survey Area
- Study Area

Species Record (DBCA, 2020)

- Baudin's cockatoo - EN
- Carnaby's cockatoo - EN
- Forest red-tailed black cockatoo - VU
- White-tailed black cockatoo - EN

Roost (Birdlife, 2021)

- Forest red-tailed cockatoo
- White-tailed cockatoo
- Joint Forest red-tailed and White-tailed cockatoo

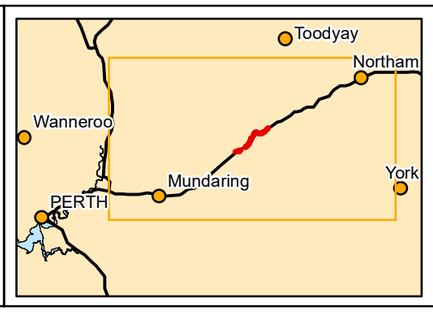
N

biologic Environmental Survey

Scale: 1:175,000

0 5 10 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/04/2021



MAIN ROADS WA

Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey

Figure 4.4: Black cockatoo database search results

4.3 Flora and Vegetation Field Results

4.3.1 Flora Composition

The current field survey conducted by Biologic recorded a total of 138 discrete vascular flora taxa (Appendix H). This number included 89 native taxa and 49 non-native taxa. The 138 flora taxa represent 52 families and 103 genera, with 22 genera represented by two or more taxa (Appendix H). The combined total taxa recorded during both the previous (360 Environmental, 2019) and current (2021) field surveys came to a total of 223 discrete vascular flora taxa from 55 families and 149 genera.

Results from the overall survey area showed that the dominant families equate to 46.1 % of the total taxa recorded, comprising of Fabaceae (36 taxa), Poaceae (16 taxa), Cyperaceae (14 taxa), Proteaceae (14 taxa), Asteraceae (13 taxa), and Myrtaceae (10 taxa). Of the 55 families recorded, 24 were represented by one taxon, which equates to 10.7 % of the total taxa recorded. The dominant genera equate to 12.1 % of the total taxa recorded and comprised *Acacia* (12 taxa), *Hakea* (5 taxa), *Hibbertia* (5 taxa) and *Lepidosperma* (5 taxa). Of the 149 genera recorded, 107 were represented by only one taxon, which equates to 47.9 % of the total taxa recorded.

A small number of taxa (20, or 8.9 % of total) observed and collected from the field across the survey area, were difficult to confidently identify to species or infraspecies level (Appendix H). This was mainly due to the specimens lacking suitable flowering and fruiting material required for confident taxonomic identification. Of these 20 taxa, six were tentatively identified to species or infraspecies level, while fourteen were only identified to genus level. None of the taxa that couldn't be identified with certainty are considered analogous with any listed conservation significant taxa.

4.3.2 Survey Adequacy

A total of 7 sites were sampled across the current survey area (5 quadrats and 2 relevés), equating to 0.86 sites sampled per hectare of native vegetation. The EPA (2016b) suggests that a minimum of three quadrats are to be sampled in each vegetation type where possible, however long, thin and linear survey areas of this nature may not allow for this to occur and thus a sites per hectare comparison is better suited.

The sampling intensity is consistent with the flora and vegetation surveys reviewed in the desktop assessment, ranging from 0.1 to 0.86 sites per hectare (Table 4.6). Not all the reports reviewed in the desktop assessment are included due to survey type and missing information in the reports (i.e. size of the survey).

Table 4.6: Comparison of survey intensity and effort

Survey	Survey area (ha)	Taxa recorded	No. of sampling sites	Sites / ha
Biologic (2021) (current survey)	16.1 (8.1 remnant bushland)	138	7	0.86
Biologic (2021) and 360 Environmental (2019) combined	75 (35.24 remnant bushland)	223	19	0.54
360 Environmental (2019) (previous survey)	58.9 (27.14 remnant bushland)	161	12	0.44
Strategen (2020)	555 (304.9 remnant bushland)	89	29	0.10
Terratree (2015)	not available	146	not available	n/a
Del Botanics (2012)	not specified	98	11	n/a
Bennett Environmental (2006)	not specified	174	9	n/a
GHD (2009)	42	not available	not available	n/a
Del Botanics (2020)	not specified	68	8	n/a
360 Environmental (2014)	not available	49	not available	n/a

4.3.3 Flora of Conservation Significance

Previous field survey (360 Environmental, 2019)

The field survey conducted by 360 Environmental recorded three conservation significant flora taxa:

- *Lechenaultia hortii* (P2) – approximately 22 individuals from four point locations;
- *Tetratheca pilifera* (P3) – three individuals from three point locations; and
- *Grevillea olivacea* (P4) – two planted individuals from one point location.

Current field survey (this survey) (Biologic, 2021)

The field survey conducted by Biologic recorded one conservation significant flora taxon:

- *Tetratheca pilifera* (P3) – 19 individuals from ten point locations.

One individual from one point location was a previously known location from the previous survey area (check for familiarity), four individuals from four point locations are new locations within the previous survey area, three individuals from two point locations are new locations occurring outside the overall survey area, and eleven individuals from three point locations are new locations recorded within the current survey area (Figure 4.5, Appendix J).

Tetratheca pilifera (P3)

Tetratheca pilifera (P3) is a spreading shrub that grows 0.1-0.3 m high and produces purple flowers between August and October (WAH, 1998-) (Plate 4.1). The WAH currently holds 34 specimens of this species, distributed mainly in the Northern Jarrah Forest IBRA subregion (WAH, 1998-). It is known to occur in *Eucalyptus wandoo* or *Eucalyptus accedens* woodland on slopes, breakaways, or gullies in gravelly soils. It was observed in the survey areas growing in *Eucalyptus wandoo* woodland on lateritic slopes and gullies, with lateritic pebbles and boulders at the surface. *Tetratheca pilifera* (P3) has previously been found in the survey area by Terratree (2015) and 360 Environmental (2019), while

known records occur in adjacent remnant vegetation, including Woondowing Nature Reserve (DBCA, 2021). It is likely that more records occur in adjacent remnant vegetation and Nature Reserves (including Kwolyinine, Keaginine and Inkpen Road Nature Reserves).

Plate 4.1:*Tetratheca pilifera* (P3), observed within the survey area (top) and typical habitat for that taxon (bottom) (Biologic photos)

Lechenaultia hortii (P2) and *Lechenaultia biloba*

Lechenaultia hortii (P2) is an erect to spreading perennial, herb or shrub that grows to 0.4 m high, and displays white-blue flowers from November through to January (WAH, 1998-). It is closely related to *Lechenaultia biloba* but was formally described as its own distinct species in 2006 (Sage, 2006b). *L*. *biloba* is a common Jarrah Forest shrub growing between 0.15 – 1 m high and flowering between July to December (WAH, 1998-). The two *Lechenaultia* species are differentiated by their stems, corolla (petals) and flowering peak (Table 4.7).

Table 4.7: Comparison of two closely related species *Lechenaultia hortii* (P4) and *Lechenaultia biloba* (adapted from Sage, 2006b; WAH, 1998-)

Species	Stems	Corolla	Flowering peak	Distribution
Lechenaultia hortii (P4)	Fleshy	Thick and artificial in appearance	Late spring / early summer	Restricted distribution on eastern edge of Mundaring State Forest
Lechenaultia biloba	Mostly woody	Thin	Later winter / early spring	Widespread across Northern Jarrah Forest

The field survey conducted by 360 Environmental (2019) recorded approximately 22 individuals of *Lechenaultia hortii* (P2) from four locations within the previous survey area. Upon commencement of current survey, Biologic revisited these locations and were unable to identify and locate these individuals. The current field survey commenced in October and was visited a second time in November (flowering period for *L*. *hortii* is November to January (WAH, 1998-)). Biologic observed hundreds of individuals of *L*. *biloba* from various locations across the survey areas, many of which were located at previous records of *L*. *hortii* recorded during the previous survey. Numerous *Lechenaultia* specimens were collected during the current survey and sent to the WA Herbarium for confirmation by an expert taxonomist, four of which were collected from the four previous locations of *L*. *hortii*. These specimens were confirmed as *Lechenaultia biloba* based on the current understanding of the differences between the two species.

It is therefore likely that all previously recorded *Lechenaultia hortii* (P2) individuals by 360 Environmental within the survey represent that of *Lechenaultia biloba*, based on the following:

- None of the *L*. *hortii* specimens were taxonomically confirmed by the Western Australian Herbarium;
- There are no known records of *L*. *hortii* in close proximity to the survey area prior to 360 Environmental's survey. The closest record of *Lechenaultia hortii* is 25 km south-southeast of the survey area and was not even present in any of the database searches (Appendix D);
- 360 Environmental's survey was completed in October which is outside of the known flowering time for *L*. *hortii* (November to December).

It should be noted that misidentifications could easily occur between the two *Lechenaultia* species in question, as the differentiating characters documented by the author (Sage, 2006b) separating *L*. *hortii*

made at the time of publication were fairly weak and the putative differences are much in need of clarification (M. Hislop, Western Australian Herbarium, *pers. comms.*, 08/03/2021).

It is therefore considered in this report that all of the previous 360 Environmental (2019) records of *Lechenaultia hortii* (P2) represent the taxon *Lechenaultia biloba*, which is not a taxon of conservation significance[1].

[1] Note that in Figure 4.5 the previous records of Lechenaultia hortii (P2) recorded in the survey by 360 Environmental (2019) have been changed to *Lechenaultia* ?*hortii* for context

436000 438000 440000 442000 444000 446000 448000

6486000 6484000 6482000 6480000

Great Eastern Hwy

Great Eastern Hwy

Great Eastern Hwy

Legend

Current Survey Area

Previous Survey Area

Current Survey Records

- *Tetratheca pilifera* - P4

Previous Survey Records

- *Lechenaultia ?hortii* - P2
- *Tetratheca pilifera* - P2
- *Grevillea olivacea* - P4

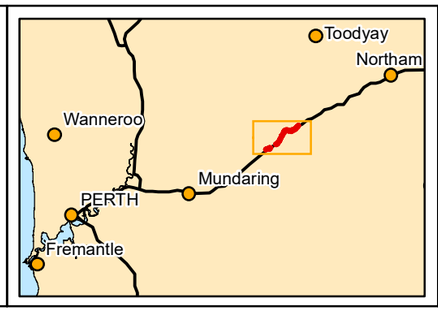
N

biologic Environmental Survey

Scale: 1:35,000

0 0.5 1 1.5 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 30/04/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.5: Flora of conservation significance recorded in the Survey Area

4.3.4 Review of Conservation Significant Flora Likelihood of Occurrence

Of the two taxa previously confirmed pre-survey within the previous survey area (see section above, Table 4.8), one taxon, *Tetratheca pilifera* (P3), was also confirmed within the current survey area post-survey. The remaining taxon, *Lechenaultia hortii* (P2), was not confirmed in either survey area post survey and as such, is considered unlikely to occur in the survey area post survey (see Section 3.4.1 for reasoning).

All of the 16 taxa considered possible to occur in the survey areas pre-survey are now considered unlikely to occur post-survey, with justification for the change in likelihood of occurrence summarised below (Table 4.8).

Table 4.8: Post-survey likelihood of occurrence for conservation significant flora

Taxon	Post-survey likelihood	Reason for change in likelihood
Pre-survey likelihood – Confirmed		
Leschenaultia hortii (P2)	Unlikely	Previous records likely represent that of the *Lechenaultia biloba*, which is not of conservation significance
Tetratheca pilifera (P3)	Confirmed	No change. Confirmed within the survey area
Pre-survey likelihood – Possible		
Drosera albonotata (P2)	Unlikely	Limited suitable habitat observed within survey area, intensive searching within the survey area during both surveys
Grevillea candolleana (P2)	Unlikely	
Acacia campylophylla (P3)	Unlikely	
Adenanthos cygnorum subsp. *chamaephyton* (P3)	Unlikely	
Asteridea gracilis (P3)	Unlikely	
Synaphea diabolica (P3)	Unlikely	
Thysanotus cymosus (P3)	Unlikely	
Verticordia serrata var. linearis (P3)	Unlikely	
Anigozanthos humilis subsp. *chrysanthus* (P4)	Unlikely	
Asterolasia grandiflora (P4)	Unlikely	
Caladenia integra (P4)	Unlikely	
Cyanicula ixioides subsp. ixioides (P4)	Unlikely	
Daviesia oxylobium (P4)	Unlikely	
Sowerbaea multicaulis (P4)	Unlikely	
Stylidium leptocalyx (P4)	Unlikely	
Stylidium striatum (P4)	Unlikely	

4.3.5 Flora of "Other" Significance

The EPA (2016b) advises that flora species, subspecies, varieties, hybrids, and ecotypes may be considered significant for reasons other than listing as a Threatened or Priority Flora taxa. This may include, but is not limited to, range extensions, keystone species, relic status, local endemism, and anomalous features.

The record of *Callistachys lanceolata* recorded during the current survey represents a range extension. The closest record of this taxon is on the Swan Coastal Plain approximately 38.5 km south west of the survey area. Its current distribution is mostly much further south in the southern jarrah forest and warren IBRA subregions, while the few records that exist in the northern jarrah forest IBRA subregion are all over 140 km away from the survey area (DBCA, 2021).

Additionally, five taxa recorded during the surveys fill gaps in their current known distributions (DBCA, 2021):

- *Bolboschoenus caldwellii;*
- *Triglochin striata;*
- *Tecticornia lepidosperma;*
- *Stackhousia monogyna* (not collected*);* and
- *Juncus kraussii* (not collected).

4.3.6 Introduced Flora

A total of 49 non-native taxa were recorded from the current survey area (Figure 4.6), bringing the combined total number of introduced taxa recorded from both survey areas to 60. Of these 60 taxa, two are WoNS and five are DPs (of which **Asparagus asparagoides* is both) (Table 4.9). No 'Priority Weeds' listed by the DBCA were found within the survey area.

Table 4.9: Significant weeds recorded in the survey area

Taxon	WoNS	DP	Previous Survey	Current Survey
**Asparagus asparagoides*	Yes	Yes	•	•
**Genista linifolia*	Yes	No		•
**Echium plantagineum*	No	Yes		•
**Gomphocarpus fruticosus*	No	Yes		•
**Moraea flaccida*	No	Yes	•	•
**Zantedeschia aethiopica*	No	Yes	•	•

The most abundant large woody weeds included **Acacia iteaphylla*, **Acacia podalyriifolia*, and **Chamaecytisus palmensis* (counts of eight, five and 78 individuals respectively) which were most abundant immediately adjacent Great Eastern Highway. The most abundant grassy and herbaceous weeds included **Avena barbata*, **Echium plantagineum*, **Ehrharta calycina*, **Eragrostis curvula*, **Hypochaeris glabra*, **Lupinus angustifolius* and **Trifolium arvense*, which all had counts between 100 and 1,000 individuals. Grassy and herbaceous weeds were generally confined to road verges and edges and parkland cleared pastoral areas.

Declared Pests

The five DPs recorded are adapted to a wide range of soils, form dense monocultures, and produce large amounts of seed that can germinate at any time throughout the year and remain dormant in the soil for years (WAH, 1998-). **Moraea flaccida, *Zantedeschia aethiopica,* and **Gomphocarpus fruticosus* are classed as having a high ecological impact and rapid invasiveness (DBCA, 2013), while

Echium plantagineum is classed as having a high ecological impact, with a relatively moderate invasiveness (DBCA, 2013). **Asparagus asparagoides* is discussed separately below. All these taxa have the potential to cause disruption to ecological process if left unmanaged (DBCA, 2013).

Weeds of National Significance

Asparagus asparagoides

**Asparagus asparagoides* (bridal creeper) is considered a serious environmental weed that is rhizomatous and tuberous, with the ability to climb and smother native vegetation (Plate 4.2). **A. asparagoides* has been rated by DBCA as having a high ecological impact and rapid invasiveness (DBCA, 2013). This taxon has the potential to cause acute disruption to ecological processes, and dominate and/or significantly alter vegetation structure, composition and function of ecosystems (DBCA, 2013). During the current field survey, 39 individuals from 10 point locations of this taxon were opportunistically recorded within Parkland cleared and ErErc vegetation associations (Figure 4.6, Appendix I).

Plate 4.2: *Aparagus asparagoides located within the survey area (Biologic photo)

Genista linifolia

**Genista linifolia* (flaxleaf broom) is listed as a Weed of National Significance. It is considered to be a serious environmental weed, that grows 0.45 – 3 m high and produces yellow flowers from August to November (WAH, 1998-). It is common in lateritic soils and is predominantly found along roadsides (WAH, 1998-) (Figure 4.6, Plate 4.3). **Genista linifolia* has been rated by DBCA as having a high ecological impact and moderate invasiveness (DBCA, 2013). Similar to above, this taxon has the potential to cause acute disruption to ecological processes, dominate and/or significantly alter vegetation structure, composition and function of ecosystems (DBCA, 2013). During the current field survey, ten individuals from one point location of this taxon were recorded opportunistically within the Cleared vegetation association (Appendix I). The species was not recorded during the previous field survey (360 Environmental, 2019)

Plate 4.3: **Genista linifolia* located within the survey area (Biologic photo)

436000 438000 440000 442000 444000 446000 448000

6486000 6484000 6482000 6480000

Current Survey Records

- **Acacia dealbata*
- **Acacia iteaphylla*
- **Acacia podalyriifolia*
- **Acacia pycnantha*
- **Aira cupaniana*
- **Arctotheca calendula*
- **Asparagus asparagoides*
- **Avena barbata*
- **Briza maxima*
- **Bromus diandrus*
- **Chamaecytisus palmensis*
- **Cotula coronopifolia*
- **Cotula turbinata*
- **Cynodon dactylon*
- **Disa bracteata*
- **Echium plantagineum*
- **Ehrharta calycina*
- **Eragrostis curvula*
- **Erigeron bonariensis*
- **Euphorbia peplus*
- **Freesia alba × leichtlinii*
- **Fumaria capreolata*
- **Genista linifolia*
- **Gomphocarpus fruticosus*
- **Hypochaeris glabra*
- **Juncus acutus*
- **Lavandula stoechas*
- **Lotus angustissimus*
- **Lupinus angustifolius*
- **Lupinus cosentinii*
- **Lysimachia arvensis*
- **Melia azedarach*
- **Moraea flaccida*
- **Olea europaea*
- **Orobanche minor*
- **Osteospermum ecklonis*
- **Oxalis pes-caprae*
- **Oxalis* sp.
- **Pinus pinaster*
- **Pinus* sp.
- **Pyrus* sp.
- **Raphanus raphanistrum*
- **Romulea rosea*
- **Solanum nigrum*
- **Trifolium arvense*
- **Ursinia anthemoides*
- **Wahlenbergia capensis*
- **Watsonia meriana*

Great Eastern Hwy

Legend

- Current Survey Area
- Previous Survey Area

Previous Survey Records

- **Asparagus asparagoides*
- **Avena barbata*
- **Briza maxima*
- **Bromus diandrus*
- **Cotula coronopifolia*
- **Ehrharta calycina*
- **Eragrostis curvula*
- **Freesia* sp.
- **Gladiolus caryophyllaceus*
- **Hypochaeris glabra*
- **Juncus microcephalus*
- **Lysimachia arvensis*
- **Oxalis pes-caprae*
- **Ursinia anthemoides*
- **Watsonia merianavar. bulbillifera*

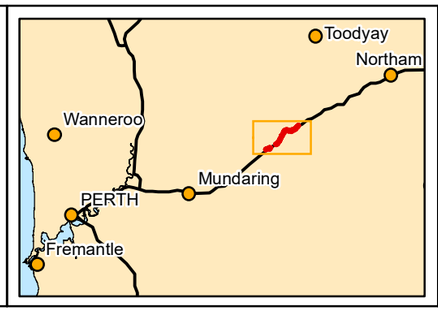
N

biologic Environmental Survey

Scale: 1:35,000

0 0.5 1 1.5 2 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 29/04/2021



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.6: Introduced flora recorded in the Survey Area

4.3.7 Vegetation Types

Thirty-two vegetation types were described and delineated within the survey area (Figure 4.7 and Table 4.10).

The vegetation type covering the greatest proportion of the survey areas was EwCc (8.63 ha / 11.5 %) closely followed by EwBsq (8.46 ha / 11.3 %); both of which are *Eucalyptus wandoo* dominated.

A total of five new vegetation types were described and delineated during the current survey (which weren't mapped in the previous survey by 360 (Table 4.10):

- Bsq (0.22 ha / 0.3 %) – represented by a previously scraped gravel pit area now void of trees and dominated by *Banksia squarrosa*;
- EwAla (0.45 ha / 0.6 %) – Relatively open *Eucalyptus wandoo* woodland;
- *MaArc (0.15 ha / 0.2 %) – Planted Cape Lilac (**Melia azedarach*) trees over roadside weeds;
- MvTl (0.55 ha / 0.7 %) – Saline flat area next to a minor drainage line containing *Melaleuca viminea* shrubs over *Tecticornia lepidosperma* samphire shrubland; and
- Pasture (2.18 ha / 2.9 %) – Low mixed weedy grasses and herbs.

One additional unit was mapped in the survey area, "Cleared", consisted of the areas lacking any vegetation (roads and road edges, tracks, parking areas etc.).

All of the vegetation types and mapping units were extrapolated out to the overall 500 m buffer of the study area.

Table 4.10: Vegetation unit descriptions

Code	Description	Author	Previous Sample Sites	Current Sample Sites	Extent ha / % of survey area	Photo
AhEw	Mid Open forest of *Allocasuarina huegeliana* with either *Eucalyptus wandoo, Corymbia calophylla* and *Eucalyptus marginata* over Tall sparse shrubland of *Banksia sessilis*, *Banksia squarrosa* over Mid open shrubland of *Hakea lissocarpha, Hibbertia hypericoides, Hibbertia commutata* over Low sparse sedgeland of *Tetraria octandra, Lepidosperma* aff. *costatale* on rocky lateritic undulating hills and hill slopes	360 Environmental	Q3, Q7	Mapping notes (aligned with 360)	Biologic: 0.35 / 0.5 360: 3.18 / 4.2 **Total: 3.53 / 4.7**	
Bsq	Tall *Banksia squarrosa* shrubland over mid sparse shrubland of *Xanthorrhoea preissii*, *Macrozamia riedlei* and *Dianella revoluta* with occasional scattered low *Eucalyptus wandoo* saplings (regrowth from gravel extraction pit) on rocky lateritic undulating hills and hill slopes	Biologic Environmental Survey		Mapping Notes (gravel pit areas)	Biologic: 0.22 / 0.3 360: 0 **Total: 0.22 / 0.3**	
Cc	Isolated *Corymbia calophylla* on roadsides	360 Environmental	-	Mapping Notes (too degraded for floristic sites)	Biologic: 2.02 / 2.7 % 360: 0.88 / 1.2 % **Total: 2.89 / 3.9 %**	

Code	Description	Author	Previous Sample Sites	Current Sample Sites	Extent ha / % of survey area	Photo
Cleared	Cleared	360 Environmental, Biologic Environmental Survey	-	Mapping Notes (too degraded for floristic sites)	Biologic: 2.20 / 2.9 360: 31.80 / 42.4 **Total: 34.0 / 45.3**	
Em	Isolated *Eucalyptus marginata* on roadsides	360 Environmental	-	-	Biologic: 0 360: 0.04 / <0.1 **Total: 0.04 / <0.1**	-
EmA?a	Mid Woodland of *Eucalyptus marginata* over *Acacia ?acuminata* on roadsides	360 Environmental	-	-	Biologic: 0 360: 0.06 / 0.1 **Total: 0.06 / 0.1**	-
EmCc	Mid Woodland of *Eucalyptus marginata* and *Corymbia calophylla* over Mid sparse shrubland of *Xanthorrhoea preissii, Phyllanthus calycinus, Bossiaea eriocarpa, Gastrolobium spinosum* over Low sparse sedgeland of *Tetraria octandra* on sandy undulating plains, hillslopes and roadsides	360 Environmental	GEHR01	-	Biologic: 0 360: 0.84 / 1.1 % **Total: 0.84 / 1.1**	

Code	Description	Author	Previous Sample Sites	Current Sample Sites	Extent ha / % of survey area	Photo
EmHp	Mid Woodland of *Eucalyptus marginata* over Mid open shrubland of *Hakea prostrata, Xanthorrhoea preissii*, *Billardiera fusiformis* and *Mesomelaena tetragona* on sandy undulating plains, hillslopes and roadsides	360 Environmental	-	-	Biologic: 0 360: 0.16 / 0.2 **Total: 0.16 / 0.2**	-
EpEw	Mid Woodland of *Eucalyptus patens* and *Eucalyptus wandoo* over Mid sparse shrubland of *Xanthorrhoea preissii*, *Hakea prostrata, Billardiera fusiformis* and *Mesomelaena tetragona* on rocky lateritic gullies and lower slopes	360 Environmental, Biologic Environmental Survey	-	Mapping outside of current survey area	Biologic: 0 360: 0.99 / 1.3 **Total: 0.99 / 1.3**	
Er	Stand of *Eucalyptus rudis* on roadsides	360 Environmental	-	Mapping Notes (too degraded for floristic sites)	Biologic: 2.71 / 3.6 360: 0.21 / 0.3 **Total: 2.91 / 3.9**	

Code	Description	Author	Previous Sample Sites	Current Sample Sites	Extent ha / % of survey area	Photo
ErAh	Mid Woodland of *Eucalyptus rudis* and *Allocasuarina huegeliana* over weeds on roadsides	360 Environmental	-	Mapping Notes (too degraded for floristic sites)	Biologic: 0.47 / 0.6 360: 0.44 / 0.6 **Total: 0.90 / 1.2**	
ErBs	Mid Woodland of *Eucalyptus rudis* over Tall open shrubland of *Banksia sessilis*, *Hakea prostrata, Acacia pulchella* and *Billardiera fusiformis* on roadsides	360 Environmental	-	-	Biologic: 0 360: 0.09 / 0.1 **Total: 0.09 / 0.1**	
ErErc	Mid woodland of *Eucalyptus rudis* over tall open shrubland of *Hakea prostrata* over tall weedy grassland of **Eragrostis curvula*, **Ehrharta calycina* and **Avena barbata* with scattered dense patches of **Watsonia meriana* on sandy clay on roadsides	Biologic Environmental Survey	-	Mapping Notes (too degraded for floristic sites)	Biologic: 0.37 / 0.5 360: 0.11 / 0.1 **Total: 0.48 / 0.6**	
ErLc	Isolated clumps of trees of *Eucalyptus rudis* over tall open shrubland of *Acacia saligna* over Low sedgeland of *Leptocarpus coangustata*, **Juncus acutus* and *Lepidosperma* sp. on sandy clay drainage areas and roadsides	360 Environmental	-	-	Biologic: 0 360: 0.51 / 0.7 **Total: 0.51 / 0.7**	

Code	Description	Author	Previous Sample Sites	Current Sample Sites	Extent ha / % of survey area	Photo
ErMv*Ja	Isolated clumps of trees of *Eucalyptus rudis* over Tall open shrubland of *Melaleuca viminea* over Low sedgeland of **Juncus acutus* over Low grasses of **Cynodon dactylon, *Pennisetum clandestinum* and **Watsonia meriana var. bulbillifera* on clay saline drainage areas and minor drainage lines	360 Environmental	-	Mapping outside of current survey area	Biologic: 0 360: 0.97 / 1.3 **Total: 0.97 / 1.3**	
ErSg	Mid Woodland of *Eucalyptus rudis* over Tall open shrubland of *Melaleuca viminea* over Low scattered Forbs of *Stypandra glauca, Dianella revoluta, Sowerbaea laxiflora* and *Kennedia prostrata* on sandy clay drainage areas	360 Environmental	GEHR05	Mapping outside of current survey area	Biologic: 0 360: 0.31 / 0.4 **Total: 0.31 / 0.4**	
ErSs	Mid Woodland of *Eucalyptus rudis* and *Eucalyptus wandoo* over Low sparse sedgeland of *Schoenus subfascicularis* and grass weeds on sandy clay drainage areas	360 Environmental	-	-	Biologic: 0 360: 0.38 / 0.5 **Total: 0.38 / 0.5**	-

Code	Description	Author	Previous Sample Sites	Current Sample Sites	Extent ha / % of survey area	Photo
EwAla	Mid woodland of *Eucalyptus wandoo* over low open shrubland of *Acacia lasiocarpa*, *Gastrolobium hookeri* and *Hakea lissocarpha* over scattered low shrubs and grasses on rocky lateritic hill slopes and roadsides	Biologic Environmental Survey	-	MCG-08	Biologic: 0.45 / 0.6 360: 0 **Total: 0.45 / 0.6**	
Ew	Stand of *Eucalyptus wandoo* on roadsides	360 Environmental	-	Mapping Notes (too degraded for floristic site)	Biologic: 0.14 / 0.2 360: 1.80 / 2.4 **Total: 1.94 / 2.6**	
EwBsq	Mid Open Forest of *Eucalyptus wandoo* over Tall sparse shrubland of *Banksia squarrosa, Banksia sessilis* and *Gastrolobium spinosum* over Low open shrubland of *Hibbertia hypericoides*, *Dampiera lavandulacea* over Low sparse sedgeland of *Lepidosperma aff. apricola* and *Lepidosperma* aff. *costale* on rocky lateritic undulating hills, hillslopes and roadsides	360 Environmental, Biologic Environmental Survey	Q4, Q5	MCG-02, MCG-06, MCG-09	Biologic: 2.24 / 3.0 360: 6.22 / 8.3 **Total: 8.46 / 11.3**	

Code	Description	Author	Previous Sample Sites	Current Sample Sites	Extent ha / % of survey area	Photo
EwCc	Mid Woodland of *Eucalyptus wandoo, Eucalyptus marginata, Corymbia calophylla* over Mid shrubland of *Banksia sessilis, Xanthorrhoea preissii, Hakea lissocarpha* and *Hibbertia diamesogenos* over Low sedgeland of L*epidosperma* aff. *apricola, Tetraria octandra* and *Lepidosperma* aff. *costale* on sandy and rocky lateritic undulating hills, hillslopes and roadsides	360 Environmental, Biologic Environmental Survey	Q1, Q2, Q6, GEHR02	MCG-01, MCG-11, Mapping Notes	Biologic: 1.98 / 2.6 360: 6.65 / 8.9 **Total: 8.63 / 11.5**	
EwXp	Mid Woodland of *Eucalyptus wandoo* over Mid open shrubland of *Xanthorrhoea preissii, Macrozamia riedlei* and *Dianella revoluta* (regrowth from gravel extraction pit)	360 Environmental	-	-	Biologic: 0 360: 0.81 / 1.1 **Total: 0.81 / 1.1**	-
GoAb	*Planted *Grevillea olivacea* and **Acacia baileyana* and weeds on roadsides	360 Environmental	-	-	Biologic: 0 360: 0.07 / 0.1 **Total: 0.07 / 0.1**	-
***Ja**	Low sedgeland of **Juncus acutus* on roadsides	360 Environmental	-	-	Biologic: 0 360: 0.38 / 0.5 **Total: 0.38 / 0.5**	-

Code	Description	Author	Previous Sample Sites	Current Sample Sites	Extent ha / % of survey area	Photo
***MaArc**	Planted low scattered trees of *Melia azedarach over low mixed herbland and grassland of *Arctotheca calendula and grassy weeds on roadsides	Biologic Environmental Survey	-	Mapping Notes (too degraded for floristic site)	Biologic: 0.15 / 0.2 360: 0 **Total: 0.15 / 0.2**	
Mv	Stand of *Melaleuca viminea* on roadsides	360 Environmental	-	-	Biologic: 0 360: 0.08 / 0.1 **Total: 0.08 / 0.1**	
MvBa	Tall Closed shrubland of *Melaleuca viminea* over Low closed sedgeland of *Baumea articulata* over Low grassland of **Avena barbata, *Briza maxima* and *Bromus diandrus* on drainage areas	360 Environmental	GEHR04	Mapping outside of current survey area	Biologic: 0 360: 0.06 / 0.1 **Total: 0.06 / 0.1**	
MvEw	Tall closed shrubland of *Melaleuca viminea* with scattered *Eucalyptus wandoo* on roadsides	360 Environmental	-	Mapping Notes (too small and degraded for floristic site)	Biologic: 0.04 / 0.1 360: 0.76 / 1.0 **Total: 0.80 / 1.1**	

Code	Description	Author	Previous Sample Sites	Current Sample Sites	Extent ha / % of survey area	Photo
Mv*Ja	Tall closed shrubland of *Melaleuca viminea* over Low sedgeland of **Juncus acutus* on sandy clay on drainage areas	360 Environmental	-	Mapping notes (aligned with 360)	Biologic: 0.05 / 0.1 360: 0.53 / 0.7 **Total: 0.57 / 0.8**	-
MvTl	Tall, scattered *Melaleuca viminea* shrubs over tall **Juncus acutus* and *Bolboschoenus caldwellii* mixed open sedgeland and rushland over low open *Tecticornia lepidosperma* samphire shrubland over low open **Cynodon dactylon* grassland on clay on salines drainage areas and minor drainage lines	Biologic Environmental Survey	-	MCG-05, Mapping Notes	Biologic: 0.55 / 0.7 % 360: 0 **Total: 0.55 / 0.7**	
NeEm	Woodland of Non-endemic Eucalyptus and *Eucalyptus marginata* over planted *Melaleuca huegelii* on roadsides	360 Environmental	-	-	Biologic: 0 360: 0.18 / 0.2 **Total: 0.18 / 0.2**	-

Code	Description	Author	Previous Sample Sites	Current Sample Sites	Extent ha / % of survey area	Photo
Pasture		Biologic Environmental Survey	-	-	Biologic: 2.18 / 2.9 360: 0 **Total: 2.18 / 2.9**	
Tsp*Ja	Low Forbland of *Tecticornia* sp. with **Juncus acutus, Isolepis cernua *Cotula coronopifolia* with scattered *Eucalyptus rudis* on clay on saline drainage areas	360 Environmental	GEHR03	Mapping outside of current survey area	Biologic: 0 360: 0.41 / 0.6 **Total: 0.41 / 0.6**	
TOTAL					**75.03 / 100 %**	

438000

439000

440000

6480000

6480000

360 (2019) Extrapolated
Vegetation Type
AhEw
Cc
Cleared
EmA?a
EpEw
Er
ErMv*Ja
Ew
EwBsq
EwCc
NeEm

360 (2019)
Vegetation Type
AhEw
Cc
Cleared
Em
EmA?a
EmHp
EpEw
Er
ErBs
ErErc
EwBsq
EwCc
NeEm

Legend

- Current Survey Area
- Previous Survey Area
- Context Area

Current Survey
Vegetation Type
- AhEw
- Cleared
- Er
- ErErc
- EwAla
- MaArc

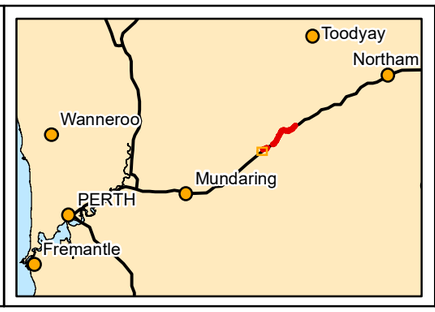
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022

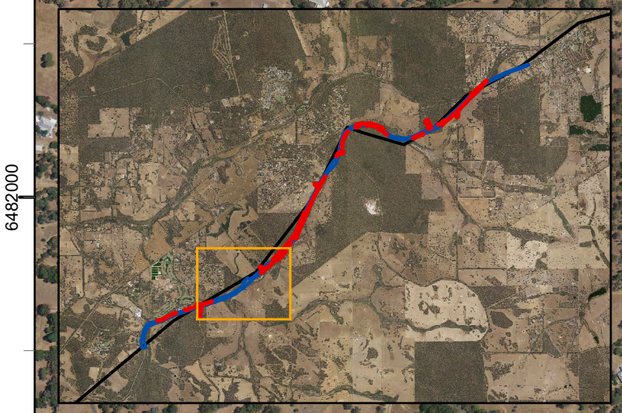


MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.7a: Vegetation types of the Survey Area

440000
441000
442000
6482000
6481000



360 (2019) Extrapolated
Vegetation Type
- *Ja
- AhEw
- Cleared
- EpEw
- Er
- ErLc
- ErMv*Ja
- Ew
- EwBsq
- EwCc
- Ne
- Revegetation

360 (2019)
Vegetation Type
- *Ja
- AhEw
- Cc
- Cleared
- Em
- EmCc
- EpEw
- Er
- ErAh
- ErLc
- ErMv*Ja
- ErSs
- Ew
- EwBsq
- EwCc
- Tsp*Ja

Legend

- Current Survey Area
- Previous Survey Area
- Context Area

Current Survey
Vegetation Type
- AhEw
- Cleared
- Er
- ErErc
- EwAla
- EwBsq
- MaArc
- MvTl

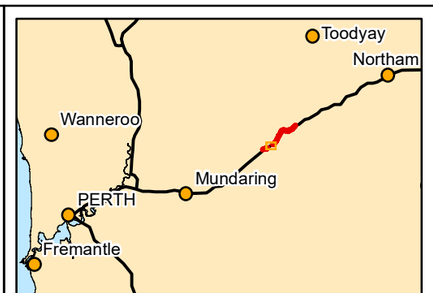
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022

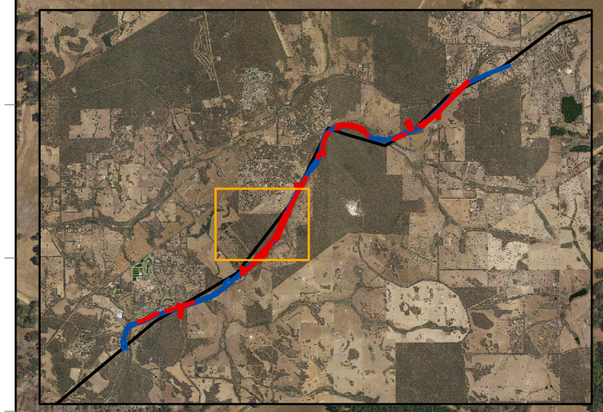


MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.7b: Vegetation types of the Survey Area

441000
442000
443000
6483000
6482000



360 (2019) Extrapolated Vegetation Type
- AhEw
- Cleared
- ErMv*Ja
- Ew
- EwBsq
- MvEw
- Ne
- Revegetation

360 (2019) Vegetation Type
- AhEw
- Cc
- Cleared
- ErAh
- Ew
- EwBsq
- EwXp

Legend
- Current Survey Area
- Previous Survey Area
- Context Area

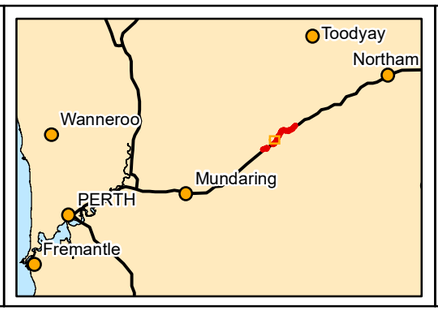
Current Survey Vegetation Type
- AhEw
- Cleared
- Er
- ErAh
- ErErc
- Ew
- EwBsq
- MvTl
- Pasture

N

biologic Environmental Survey

Scale: 1:8,000
0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA
Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.7c: Vegetation types of the Survey Area

442000
443000
444000
445000
6485000
6484000

360 (2019) Extrapolated Vegetation Type
- AhEw
- Cleared
- ErMv*Ja
- Ew
- EwBsq
- EwCc
- Mv*Ja
- MvEw

360 (2019) Vegetation Type
- AhEw
- Cc
- Cleared
- Er
- ErMv*Ja
- ErSg
- Ew
- EwBsq
- EwCc
- Mv
- Mv*Ja
- MvBa
- MvEw

Legend
- Current Survey Area
- Previous Survey Area
- Context Area

Current Survey Vegetation Type
- AhEw
- Bsq
- Cc
- Cleared
- Ew
- EwBsq
- Mv*Ja
- MvEw
- Pasture

N

biologic Environmental Survey

Scale: 1:8,000
0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022

Toodyay
Northam
Wanneroo
Mundaring
PERTH
Fremantle

MAIN ROADS WA
Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.7d: Vegetation types of the Survey Area

445000
446000
447000
6486000
6485000

360 (2019) Extrapolated Vegetation Type
- Cleared
- EmCc
- ErMv*Ja
- EwBsq
- EwCc
- MvEw
- Revegetation

360 (2019) Vegetation Type
- AhEw
- Cc
- Cleared
- EmCc
- Er
- ErMv*Ja
- Ew
- EwBsq
- EwCc
- Mv
- Mv*Ja
- MvEw

Legend
- Current Survey Area
- Previous Survey Area
- Context Area

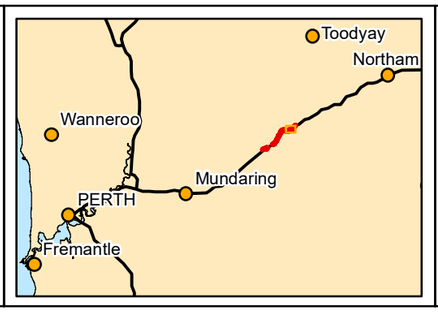
Current Survey Vegetation Type
- AhEw
- Bsq
- Cc
- Cleared
- EwBsq
- EwCc
- Pasture

N

biologic Environmental Survey

Scale: 1:8,000
0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA
Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.7e: Vegetation types of the Survey Area

446000 447000 448000 449000

6487000

6486000

360 (2019) Extrapolated Vegetation Type
- Cc
- Cleared
- EmCc
- EwCc
- MvEw

360 (2019) Vegetation Type
- Cc
- Cleared
- EmCc
- Ew
- EwCc
- GoAb

Legend
- Current Survey Area
- Previous Survey Area
- Context Area

Current Survey Vegetation Type
- Cc
- Cleared
- EwCc
- Pasture

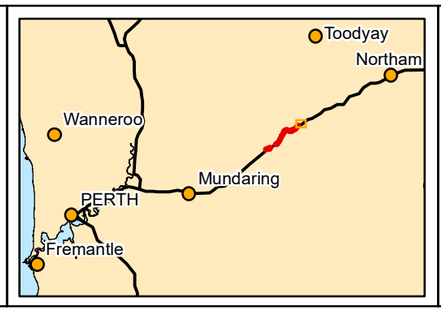
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway Coates Gully (SLK 56.4-67.8) Biological Survey

Figure 4.7f: Vegetation types of the Survey Area

4.3.8 Significant Vegetation

Conservation Significant Ecological Communities

The database searches identified one conservation significant ecological community in proximity to the survey area; Eucalypt woodlands of the Western Australian Wheatbelt (EPBC Critically Endangered, synonymous with DBCA-listed P3 PEC) (DBCA, 2020c).

This community was not identified as present within the survey area by the previous survey (360 Environmental, 2019) or by surveys within close proximity (360 Environmental, 2014). 360 Environmental (2019) identified two vegetation types (EwCc and EwBsq – both of which were mapped in the current survey area) that were of similar characteristics to the TEC/PEC; however, the survey area falls outside the average rainfall isohyet of <600 mm required for its occurrence (DoE, 2015) and therefore cannot contain vegetation representing this conservation significant ecological community.

None of the remaining vegetation occurrences in the survey area are considered to represent any ecological communities of conservation significance.

Vegetation of "Other" Significance

The EPA (2016a) advises that vegetation may be of significance for reasons other than a listing as a TEC or a PEC. This may include, although is not limited to, scarcity, novel combination of species, role as a refuge, restricted distribution and vegetation extent being below a threshold level.

None of the vegetation types within the survey area are considered to have any level of regional significance.

Vegetation types EwBsq and EwCc are potentially considered to have a level local significance due to the presence of the priority flora taxon *Tetratheca pilifera* (P3). Records of this taxon within these vegetation types were generally confined to small breakaways and gullies with large exposed lateritic boulders, all of which were relatively small and localised across the survey areas. However, known locations of this taxon occur in remnant bushland adjacent to the survey area (including Woondowing Nature Reserve, see section 4.3.3), while it is highly likely that additional occurrences of this taxon and supporting vegetation occur in the vegetation surrounding the survey area, particularly in other adjacent remnant bushlands and Nature Reserves (eg. Kwolyinine and Woondowing Nature Reserves). It is therefore considered that the occurrences of this conservation significant taxon, and the vegetation that supports it, within the survey area is not regionally or locally significant.

Vegetation types ErMv*Ja, MvTl and Tsp*Ja are associated with a drainage line (Coates Gully) (see section below). Although this vegetation is considered to have some level of local significance, small drainage line and drainage area landforms and vegetation of this nature are common through the local area and region.

Vegetation and Hydrology

As mentioned above, vegetation types ErMv*Ja, MvTl and Tsp*Ja are associated with Coates Gully. Coates Gully is an ephemeral drainage system that flows following substantial rainfall in the river

catchment. Coates Gully is fed by numerous other water courses surrounding the survey area, before flowing into an unnamed major perennial water course then into Wooroloo Brook, eventually discharging into the Swan River. During the current field survey, numerous pools were observed in association with Coates Gully (Plate 4.4). It is likely that these pools will be present in the survey area after substantial rainfall events, while the longevity of these pools would be determined by the amount, intensity and frequency of the rainfall in the immediate region and within the catchment of the creeks. The pools potentially persists for extended periods due anthropogenic alterations to the hydrology from the nearby Great Eastern Highway and surrounding cleared pastoral areas.

Vegetation types ErMv*Ja, MvTl and Tsp*Ja were noted as supporting riparian and riverine vegetation (collectively 1.94 ha) and supported drainage line, drainage areas, saline flat and small wetland landforms (Plate 4.4). Vegetation generally consisted of scattered *Eucalyptus rudis* (flooded gums) over mid to tall *Melaleuca viminea* shrubs and trees over moderate covers of tall sedges (and sedge-like taxa) (**Juncus acutus and Bolboschoenus caldwellii*) over herbs and grasses, all taxa of which are known to occur in association with wetland habitats or habitats with permanent to intermittent groundwater or surface water presence (WAH, 1998–). However, the condition of these vegetation types were generally noted as Degraded, with high covers of invasive weeds (**Juncus acutus*, **Cynodon dactylon*, **Pennisetum clandestinum* and **Watsonia meriana*), while all were also noted as having a relatively high level of soil salinity (salt precipitation at soil surface, death of flooded gums, presence of saline taxa (*Tecticornia lepidosperma*)).

Plate 4.4: Above surface pools and riparian vegetation observed in Coates Gully (note the effects of salinity in the image at the top-right and dead trees at the bottom), observed within the survey area (Biologic photos)

4.3.9 Vegetation Condition

The condition of the vegetation within the survey area ranged from Excellent to Completely Degraded, with the majority of the vegetation mapped as Excellent (10.76 ha, 14.3 %) (Figure 4.8 and Table 4.11). A large portion of the survey area has been cleared (34.0 ha, 45.3 %), mainly associated with roads, tracks and parking areas (Figure 4.8).

The main disturbances observed in the survey area were mainly associated with Great Eastern Highway. Disturbances included clearing, weeds and rubbish. These disturbances were mainly restricted to vegetation immediately adjacent the highway where edge effects were more evident. Other major disturbances were agriculturally influenced, with nearby cleared pastural areas with high weed loads, fence lines, tracks and salinity in drainage areas.

Table 4.11: Vegetation condition extent in the survey area

Condition	Extent (ha / %)	Comment
Excellent	10.76 / 14.3	Located within the larger areas of remnant bushland and Nature Reserves where vegetation has remained more or less intact. Low weed cover (<1%).
Very Good	3.53 / 4.7	Located closer to areas affected by Great Eastern Highway and pasture areas. More noticeable weed presence (1-5%).
Good	7.81 / 10.4	Located along edges of vegetation where edge effects were more evident. High weed diversity and cover (5-10%) but vegetation structure still intact.
Degraded	8.88 / 11.8	Mainly located in sections directly adjacent to Great Eastern Highway and within Coates Gully "drainage line". Significant weed cover (10-50%) and diversity which has displaced the lower vegetation stratum and significantly reduced native mid shrub layer cover.
Completely Degraded	10.35 / 13.8	Associated with recently and historically disturbed areas including road and track edges, firebreaks, culverts, road shoulders, pasture fields and parkland cleared areas. Generally these areas had no retention of native species and were generally dominated by weedy grasses (**Eragrostis curvula*, **Avena barbata* and **Ehrharta calycina*).
Cleared	34.00 / 45.3	Cleared areas with no vegetation including tracks, firebreaks, roads and parking areas.
TOTAL	**75.03 / 100**	

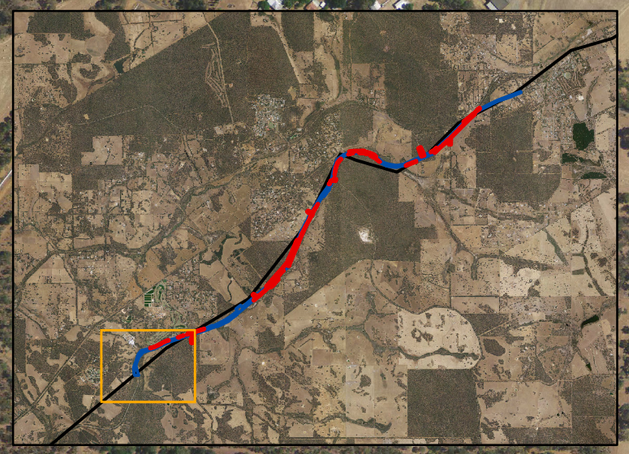
438000

439000

440000

6480000

6480000



Legend

Current Survey Area

Previous Survey Area

Current Survey

Vegetation Condition

Excellent

Degraded

Completely Degraded

Cleared

360 (2019)

Vegetation Condition

Excellent

Very Good

Good

Degraded

Completely Degraded

Cleared

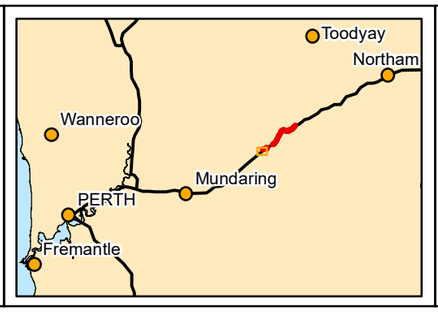
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.8a: Vegetation condition of the Survey Area

440000
441000
442000
6482000
6481000

Legend

- Current Survey Area
- Previous Survey Area

Current Survey
Vegetation Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared

360 (2019)
Vegetation Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared

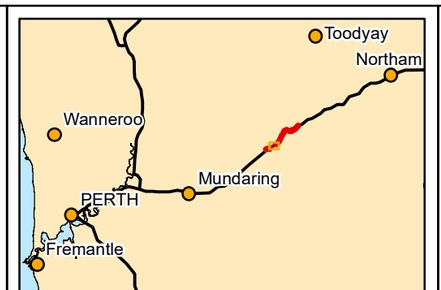
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA
Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.8b: Vegetation condition of the Survey Area

441000
442000
443000
6483000
6482000

Legend

Current Survey Area
Previous Survey Area

Current Survey

Vegetation Condition

Very Good
Good
Degraded
Completely Degraded
Cleared

360 (2019)

Vegetation Condition

Excellent
Very Good
Good
Degraded
Degraded - Completely Degraded
Completely Degraded
Cleared

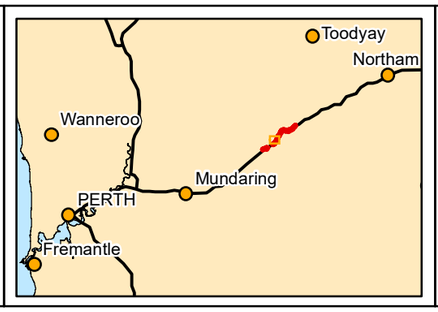
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.8c: Vegetation condition of the Survey Area

442000 443000 444000 445000

6485000

6484000

Legend

Current Survey Area

Previous Survey Area

Current Survey

Vegetation Condition

Excellent

Good

Degraded

Completely Degraded

Cleared

360 (2019)

Vegetation Condition

Excellent

Very Good

Good

Degraded

Degraded - Completely Degraded

Completely Degraded

Cleared

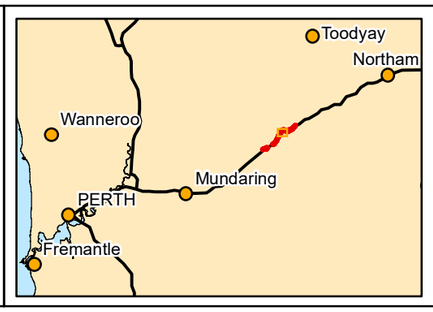
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022

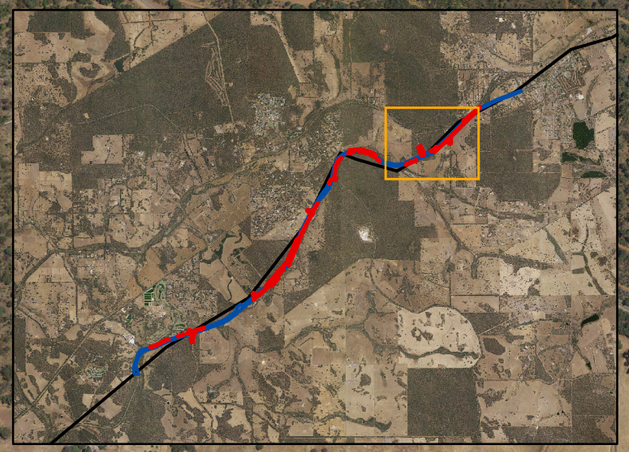


MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.8d: Vegetation condition of the Survey Area

445000
446000
447000
6486000
6485000



Legend

Current Survey Area
Previous Survey Area

Current Survey
Vegetation Condition
Excellent
Very Good
Good
Degraded
Completely Degraded
Cleared

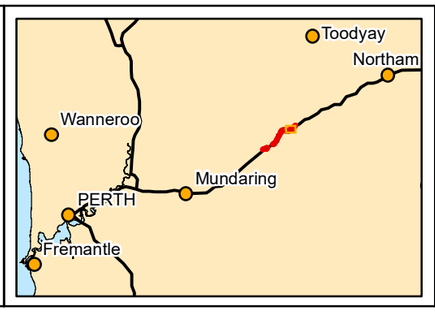
360 (2019)
Vegetation Condition
Excellent
Very Good
Good
Degraded
Completely Degraded
Cleared

N

biologic Environmental Survey

Scale: 1:8,000
0 200 400 Meters

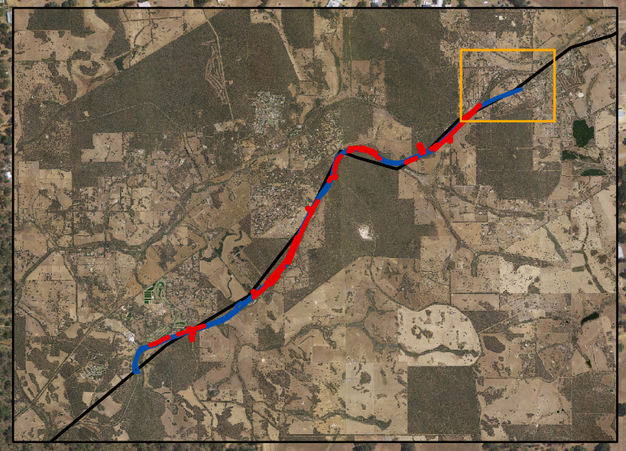
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA
Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.8e: Vegetation condition of the Survey Area

446000
447000
448000
449000
6487000
6486000



Legend

- Current Survey Area
- Previous Survey Area

Current Survey

Vegetation Condition

- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared

360 (2019)

Vegetation Condition

- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared

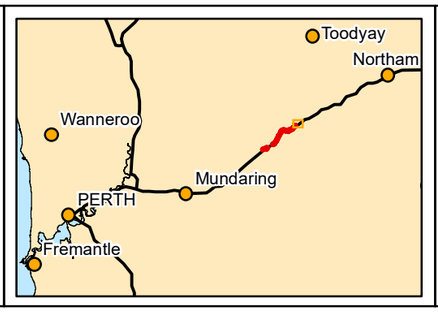
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.8f: Vegetation condition of the Survey Area

4.4 Vertebrate Fauna Field Results

4.4.1 Fauna Habitat

Based on the mapped vegetation units by the concurrent flora and vegetation survey, 360 Environmental (2019), and Bamford Consulting (2015), six broad fauna habitats are considered to occur within the survey area (Table 4.12 and Figure 4.9).

The habitats of greatest significance within the survey area are the "woodland' habitat types, comprising; *Eucalyptus wandoo* woodland over *Banksia* (25.36 ha, 33.8%) and *Corymbia* and *Eucalyptus marginata* woodland (4.44 ha, 5.9%). Combined, these habitats also cover the greatest proportion of the survey area for fauna habitats. Wandoo was the dominant eucalypt species in the *Eucalyptus wandoo* woodland over *Banksia* habitat, with small patches or scattered trees of or jarrah and marri present. The mid and lower storey included proteaceous shrubs such as *Banksia* species (*B. sessilis* and *B. squarrosa*), and grasstree *Xanthorrhoea preissii*. Eucalypt woodlands are significant for black cockatoos, with wandoo, marri, and jarrah recognised nesting tree species for all three cockatoo species (Cale, 2003; Chapman, 2007; Johnstone *et al.*, 2013b). Carnaby's cockatoo are known to breed primarily in smooth-barked eucalypts such as wandoo and salmon gum (Cale, 2003).

The *Corymbia* and *Eucalyptus marginata* woodland habitat upper canopy comprised primarily of jarrah or marri, with occasional small patches of flooded gum *Eucalyptus rudis* and wandoo. Marri is the primary nesting tree used by forest red-tailed black cockatoo (Johnstone *et al.*, 2013b), and with jarrah comprises 90% of the species diet (Johnstone *et al.*, 2017). As with the wandoo woodland, the mid and lower story is a tall shrubland of *Banksia squarrosa*, *Banksia sessilis* and *Xanthorrhoea preissii over Hibbertia sp*; however, *Banksia* species were present at a lower density. In addition to black cockatoo, the composition and density of the "woodland" habitat types provides the potential to support other conservation significant species such as quenda (recorded in these habitat types during the field surveys) and western brush wallaby, likely as foraging or dispersal habitat, as well as reptile species. These habitats may also provide denning habitat for chuditch and south-western brush-tailed phascogale, as they contain core habitat requirements such as hollows and logs.

The Jarrah Forest bioregion, within which the survey area is located, is characterised by these jarrah and marri forests and marri-wandoo woodlands (Hearn *et al.*, 2002). Large nature reserves comprised of habitats of this nature are located within the immediate local area (e.g., Coates Reserve, Kwolyinine Nature Reserve, Woondowing Nature Reserve, and Keaginine Nature Reserve). As such, these woodland habitats have some connectivity extending outside of the study area in the broader vicinity, and the habitats are not restricted to the survey area.

The *Melaleuca* Shrubland habitat type (3.05 ha, 4.1%) comprises of tall *Melaleuca viminea* shrubs (from scattered to closed composition) over mixed open sedges such as **Juncus acutus* and *Tecticornia lepidosperma* samphire, with some scattered wandoo trees present. The habitat type was considered in general of "Good" condition. The habitat had areas of surface water present during the current (2021) field survey, and is prone to pooling. The high proportion of leaf litter cover and understorey of grasses and sedges provides suitable dispersal and foraging habitat for ground-dwelling species. Damp

heathlands (including *Melaleuca* shrublands) are suggested as having the maximum densities of quenda present of the habitat types considered suitable for the species (Everard & Bamford, 2014). Diggings attributed to this species were recorded within the *Melaleuca* Shrubland in the survey area during the previous (Bamford Consulting, 2015) field survey (Appendix N, Figure 4.10). The western brush wallaby is also known to occur within *Melaleuca* woodlands ore broadly (Wann & Bell, 1997; Woinarski *et al.*, 2014b). The lack of canopy cover is suited to support larger birds such as raptors for foraging (Bechard, 1982; Preston, 1990). The channels and areas of inundation may be important for facilitating fauna movements through the landscape. The habitat type is not restricted to the survey area; however, the habitat is not widespread and does not show extensive connectivity between patches.

The Isolated Trees habitat type (7.03 ha, 9.4%) consists of isolated or small clumps of mature trees including jarrah, marri, wandoo, blackbutt, or flooded gum along cleared road verges or within paddocks over weeds. The habitat lacks dense native understorey to support dispersal of ground-dwelling species such as quenda and western brush wallaby. The mature eucalypts present offer limited foraging habitat for black cockatoos other than for pairs or small flocks and may increase risk of vehicle collision as the trees are often along roadsides. Where the grass understorey is dense, quenda may use the habitat for dispersal (Fitzgibbon *et al.*, 2011). This habitat type is not restricted to the survey area; the region has a high proportion of isolated trees along country roads and agricultural crops and paddocks.

The Sedgeland habitat (0.79 ha, 1.1%) was defined as Degraded wetland areas by Bamford Consulting (2015). This habitat type was not recorded within the current survey area. Vegetation is comprised primarily of sedge species such as **Juncus acutus, *Watsonia meriana,* and *Cenchrus clandestinus.* There is no defined upper canopy; however, scattered *Melaleuca viminea* trees are present. Surface water was present during the field surveys within the habitat; however, it is expected to be ephemeral (non-permanent). The habitat type is not restricted to the survey area; however, the habitat is not widespread and does not show extensive connectivity between patches.

The remainder of the survey area (34.37 ha, 45.8%) is comprised of existing cleared areas, including road, unsealed tracks, and verge. These areas are sparsely vegetated or devoid of vegetation, and provide very little complexity, cover, and food resources for vertebrate fauna, and are not considered fauna habitat of value (Figure 4.9).

Table 4.12: Fauna habitat descriptions

Fauna habitat	Vegetation associations	Description of key habitat characteristics	Conservation significant species likely to support	Area (ha) and% of survey area	Photo
Eucalyptus wandoo woodland over *Banksia*	**Biologic (2021)** • Bsq • AhEw • EwCc • EwAla • EwBsq • **Cc** **360 (2015)** • Ew • EwBsq • EwCc • EwXp • EpEw • AhEw	Tall, open woodland habitat with a canopy dominated by wandoo over mid and understory of *Banksia* species (*B. sessilis* and *B. squarrosa*) and grasstree *Xanthorrhoea preissii*. The habitat type includes small patches of marri *Corymbia calophylla* and jarrah *Eucalyptus marginata*. Significant microhabitat features to support fauna denning such as fallen logs and tree hollows are present. The understory present supports nest sites for species such as quenda (Broughton & Dickman, 1991).	This broad fauna habitat type has potential to support conservation significant species. • Black cockatoo species may utilize the habitat for night roosting, breeding (particularly Carnaby's cockatoo) and foraging (the mature eucalypt trees and *Banksia sp*. mid-storey). Black cockatoo individuals of all three species were recorded in this habitat during the field surveys. • The habitat is also highly suitable for foraging, nesting, and dispersal for quenda (dense understory including *Xanthorrhoea*). • May provide both denning and foraging habitat for small-medium sized mammals such as chuditch and phascogale. • Western brush wallaby may utilise the habitat for foraging or dispersal.	Biologic (2021): 5.79 ha 360 Environmental (2019): 19.57 ha **Total: 25.36 ha (33.8%)**	
Corymbia and *Eucalyptus marginata* woodland	**Biologic (2021)** • ErErc • EwCc • Cc • Er • ErAh • ErErc **360 (2015)** • NeEm • ErBs • EwCc • EmCc • ErLc • ErAh • ErSg	Tall, open woodland habitat dominated by marri *Corymbia calophylla* and jarrah *Eucalyptus marginata* trees, with occasional small patches of flooded gum *Eucalyptus rudis* and wandoo. The mid and lower storey is a tall shrubland of *Banksia squarrosa*, *Xanthorrhoea preissii, Banksia sessilis, over Hibbertia sp.* Significant microhabitat features to support fauna denning such as fallen logs and tree hollows are present. The understory present supports nest sites for species such as quenda (Broughton & Dickman, 1991).	This broad fauna habitat type has potential to support conservation significant species. • Black cockatoo species may utilize the habitat for foraging (primarily jarrah, marri, and *Allocasuarina*), night roosting, or breeding (particularly the marri trees). Black cockatoo individuals were recorded in this habitat during the current survey. • The habitat is also highly suitable for foraging, nesting, and dispersal for quenda (dense understory including *Xanthorrhoea*). • May provide both denning and foraging habitat for small-medium sized mammals such as chuditch and phascogale. • Western brush wallaby may utilise the habitat for foraging or dispersal.	Biologic (2021): 0.91 ha 360 Environmental (2019): 3.52 ha **Total: 4.44 ha (5.9%)**	

Fauna habitat	Vegetation associations	Description of key habitat characteristics	Conservation significant species likely to support	Area (ha) and% of survey area	Photo
Isolated trees	**Biologic (2021)** • Er • Ew • Cc • EwCc • ErAh • ErErc • Pasture • AhEw • MaArc • MvEw • MvTl **360 (2015)** • Cc • Em • Er • Ew • Goab	Isolated or small stands of mature trees (*Eucalyptus marginata*, *Eucalyptus wandoo, Eucalyptus patens, Eucalyptus rudis* and/or *Corymbia calophylla*) along road verges or cleared areas (e.g., tracks). This habitat type has limited understory species present, primarily consisting of paddock grasses or introduced species.	This broad fauna habitat type has limited potential to support conservation significant species. • Pairs or small flocks of black cockatoos may use the scattered eucalypt trees for foraging or perching, but the trees are unlikely to provide roosting or breeding potential. The trees are also in close proximity to threat sources such as roads. Foraging evidence attributed to Carnaby's cockatoo and forest red-tailed black cockatoo was recorded in this habitat type. • The lack of canopy cover may be suited to support larger birds such as raptors for foraging. • There is a lack of dense and connecting patches of understorey to support ground-dwelling species such as quenda.	Biologic (2021): 6.25 ha 360 Environmental (2019): 0.78 ha **Total: 7.03 ha (9.4%)**	
Melaleuca shrubland	**Biologic (2021)** • MvEw • Mv*Ja • MvTl • Er • ErAh • ErErc • Pasture **360 (2015)** • ErMv*Ja • Mv*Ja • MvEw • MvBa • Mv	Tall *Melaleuca viminea* shrubs (from scattered to closed composition) over mixed open sedges such as **Juncus acutus* and *Tecticornia lepidosperma* samphire. Scattered wandoo trees are present. The habitat had areas of surface water present during the Biologic (2021) field survey, and is prone to pooling.	This broad fauna habitat type has limited potential to support conservation significant species. • The lack of canopy cover may be suited to support larger birds such as raptors for foraging. • The habitat provides limited foraging opportunities for black cockatoos • Ground-dwelling animals such as chuditch and quenda may utilise the habitat for foraging in areas of dense vegetation.	Biologic (2021): 0.65 ha 360 Environmental (2019): 2.40 ha **Total: 3.05 ha (4.1%)**	
Sedgeland	**360 (2015)** • *Ja • Tsp*Ja	Degraded wetland areas. Vegetation is comprised primarily of sedge species such as **Juncus acutus, *Watsonia meriana,* and *Cenchrus clandestinus.* There is no defined upper canopy; however, scattered *Melalecua viminea* trees are present. Water was present during the field surveys within the habitat; however, it is expected to be ephemeral (non-permanent).	This broad fauna habitat type has limited potential to support conservation significant species • The habitat provides limited foraging opportunities for black cockatoos • Ground-dwelling animals such as chuditch and quenda may utilise the habitat for foraging due to the more riparian environment and areas of dense vegetation.	Biologic (2021): 0.0 ha 360 Environmental (2019): 0.79 ha **Total: 0.79 ha (1.1%)**	

Fauna habitat	Vegetation associations	Description of key habitat characteristics	Conservation significant species likely to support	Area (ha) and% of survey area	Photo
Cleared	**Biologic (2021)** • Cleared **360 (2015)** • Cleared	The predominant area of Cleared habitat is the major roads (e.g., Great Eastern Highway) that bisect the survey area. There are also unsealed tracks present that are devoid of vegetation.	This broad fauna habitat type is not considered to be of value to vertebrate fauna.	Biologic (2021): 2.52 ha 360 Environmental (2019): 31.85 ha **Total: 34.37 ha (45.8%)**	
Total				Biologic (2021): 16.11 ha 360 Environmental (2019): 58.92 ha **Total: 75.03 ha**	

438000

439000

440000

6480000

6480000

Habitat Type (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees
- Cleared

Legend

- Current Survey Area
- Previous Survey Area
- Isolated trees
- Cleared

Habitat Type (Current Survey)

- *Eucalyptus wandoo* woodland over Banskia

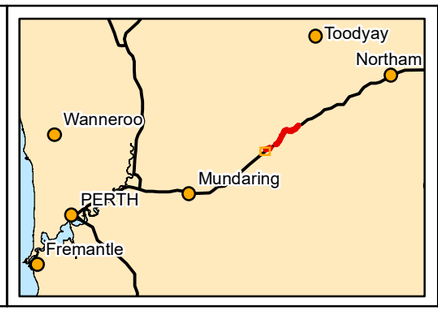
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022

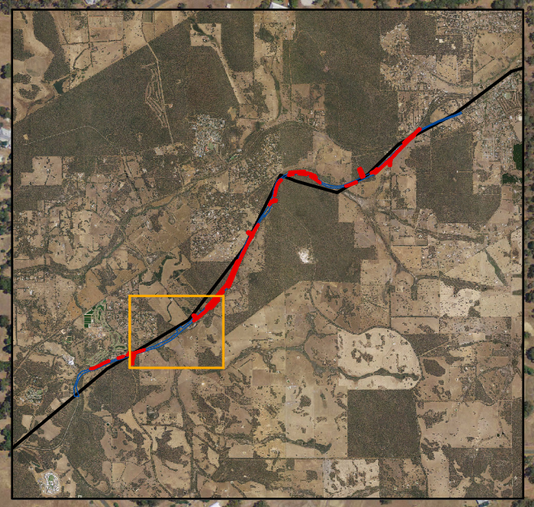


MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.9a: Broad fauna habitats of the Survey Area

440000
441000
442000
6482000
6481000



Habitat Type (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees
- Melaleuca shrubland
- Sedgeland
- Cleared

Legend

- Current Survey Area
- Previous Survey Area

Habitat Type (Current Survey)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees
- Melaleuca shrubland
- Cleared

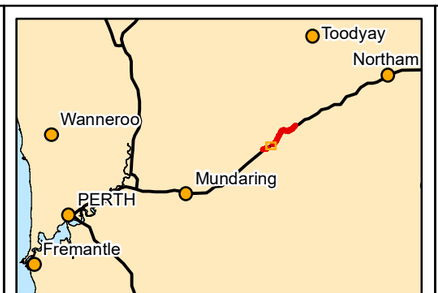
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022

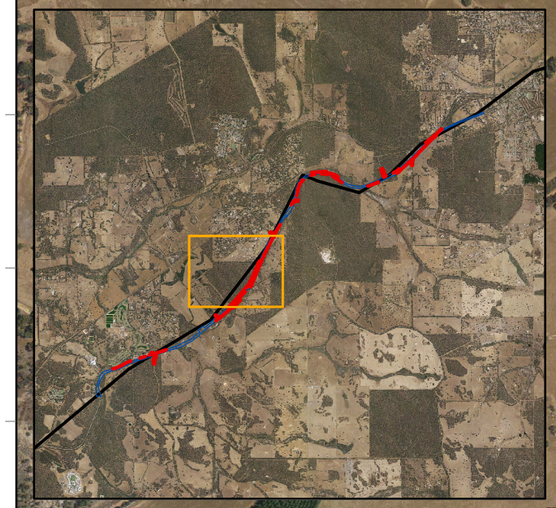


MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.9b: Broad fauna habitats of the Survey Area

441000
442000
443000
6483000
6482000



Habitat Type (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees
- Cleared

Legend

- Current Survey Area
- Previous Survey Area

Habitat Type (Current Survey)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees
- Melaleuca shrubland
- Cleared

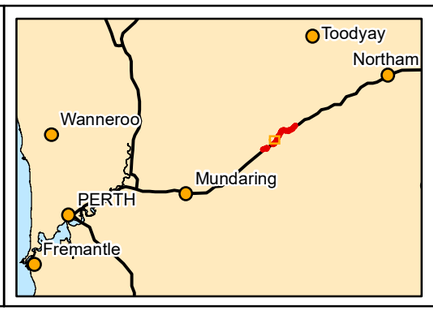
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

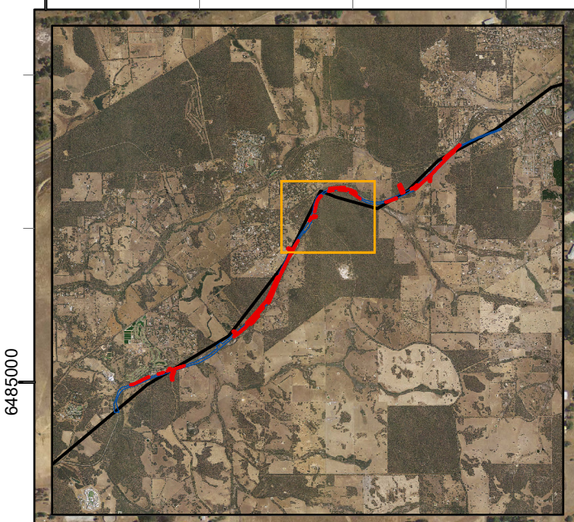
Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.9c: Broad fauna habitats of the Survey Area

442000 443000 444000 445000

6485000

6484000



Habitat Type (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees
- Melaleuca shrubland
- Cleared

Legend

- Current Survey Area
- Previous Survey Area

Habitat Type (Current Survey)

- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees
- Melaleuca shrubland
- Cleared

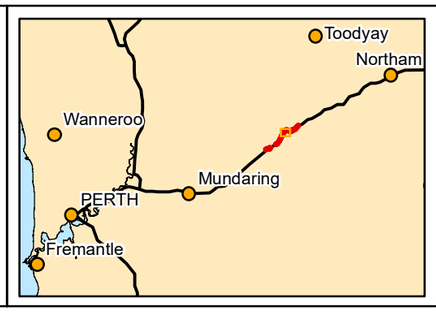
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.9d: Broad fauna habitats of the Survey Area

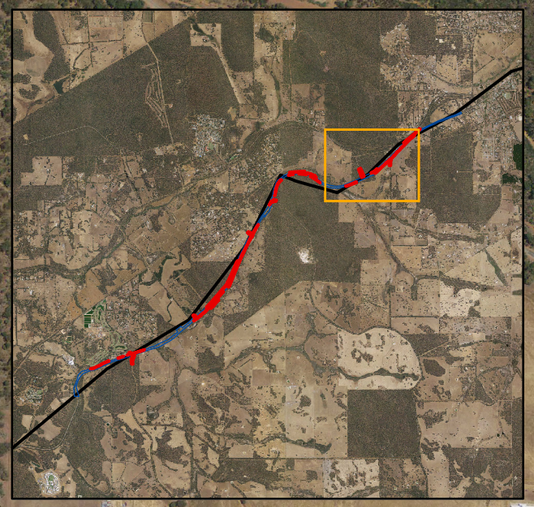
445000

446000

447000

6486000

6485000



Habitat Type (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees
- Melaleuca shrubland
- Cleared

Legend

- Current Survey Area
- Previous Survey Area

Habitat Type (Current Survey)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees
- Cleared

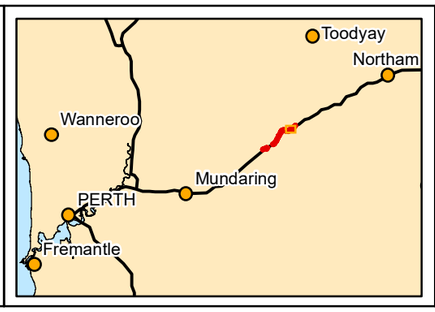
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022

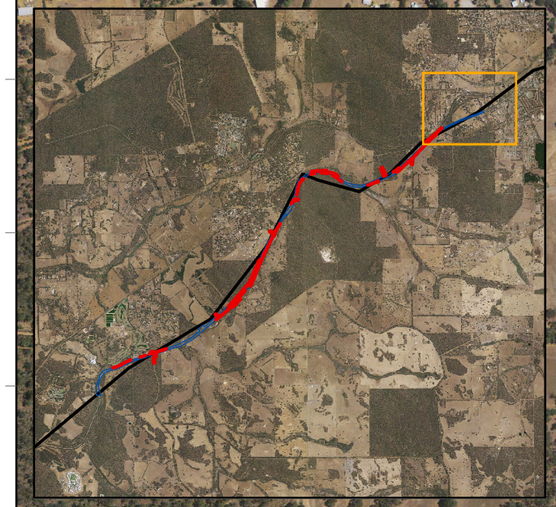


MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.9e: Broad fauna habitats of the Survey Area

446000
447000
448000
449000
6487000
6486000



Habitat Type (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees
- Cleared

Legend

- Current Survey Area
- Previous Survey Area

Habitat Type (Current Survey)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees
- Cleared

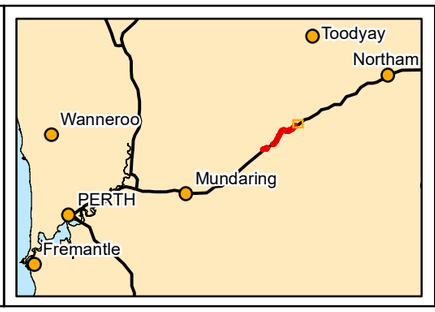
N

biologic Environmental Survey

Scale: 1:8,000

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.9f: Broad fauna habitats of the Survey Area

4.4.2 Fauna Recorded

A total of 40 species of vertebrate fauna were recorded from the survey area during the current field survey, from both direct and/or secondary evidence (i.e., diggings, scats, burrows) (Appendix M). This comprised seven mammalian species (including three introduced mammals), 31 birds and two reptiles. An additional eleven vertebrate species were recorded by Bamford Consulting (2015), comprising of one mammal (introduced), eight birds, and two reptiles (Appendix M). All recorded species were identified in the desktop assessment. In total, between both field surveys undertaken within the survey area, 51 vertebrate fauna species have been recorded, comprising of eight mammals (four introduced), 39 birds, and four reptiles.

Some introduced or naturalised species were recorded from motion camera and direct or secondary evidence within the survey area. Bamford Consulting (2015) recorded red fox *Vulpes vulpes* on motion camera, from tracks, and from two dens. A deceased cat (killed via vehicle collision) was recorded during the current field survey (2021). The presence of these species is likely to have an influence of the species present, in particular the presence of fox dens which suggests a permanent presence of the species within the survey area. The risk of predation by foxes is likely to be higher around breeding dens, with foxes concentrating their efforts around den sites during the breeding season and regularly visiting dens during other times of year (Carter *et al.*, 2012).

Other introduced species recorded within the survey area are rabbit *Oryctolagus cuniculus* via diggings and a warren, and sheep *Ovis aries* via direct observation and motion camera.

4.4.3 Fauna of Conservation Significance

Four conservation significant vertebrate fauna species were recorded by the field surveys by Bamford Consulting (2015) and Biologic (2021); Carnaby's cockatoo *Calyptorhynchus latirostris*, Baudin's cockatoo *Calyptorhynchus baudinii*, forest red-tailed black cockatoo *Calyptorhynchus banksii naso*, and quenda *Isoodon fusciventer* (Table 4.13). No other conservation significant species or evidence of their occurrence was recorded within or surrounding the survey area during the field survey. Suitable habitat (including marginal habitat) for a further 19 conservation significant species identified in the desktop review may possibly occur within the survey area; however, based on the species' distribution, ecology, and previous records, only five of these species are considered Possible to occur. The remaining species (*n* = 22) are considered Unlikely or Highly Unlikely to occur (Table 4.13). Although some conservation significant bird species may infrequently occur in the airspace above the survey area, they are likely to only be transient movements due to the lack of suitable habitat within the survey area.

4.4.3.1 Species Confirmed within the survey area

Carnaby's cockatoo

Known habitat and distribution

Carnaby's cockatoo *Calyptorhynchus latirostris* is classified as Endangered under the EPBC and BC Act. Carnaby's cockatoo is endemic to south west Western Australia, and is distributed from the Murchison River to Esperance and inland to Coorow, Kellerberrin and Lake Cronin (Cale, 2003). The

species was once common, but the population has declined significantly in the last half century (Johnstone & Storr, 1998) and is now locally extinct in some areas (Shah, 2006).

Previous records

The species is considered moderately common within the local vicinity, with 101 previous records of Carnaby's cockatoo within 15 km of the survey area, in addition to 55 *Calyptorhynchus* sp. 'white-tailed black cockatoo' records (either Carnaby's or Baudin's cockatoo) (DBCA, 2020d). These records are spread throughout native bushland in the local region and are not restricted to a singular remnant patches or reserves.

Current survey

Carnaby's cockatoo was recorded during the current field survey via direct observation of individuals, as well as nine instances of foraging evidence (chewed marri nuts and *Allocasuarina* nuts). The species was also recorded on multiple occasions during the previous field survey by Bamford Consulting (2015); two separate mixed flocks of seven and four individuals of Carnaby's and Baudin's black cockatoo were observed within the survey area, as well as two instances of foraging evidence. A white-tailed black cockatoo roost was recorded on Mairinger Way, Wundowie by Bamford Consulting (2015); a mixed flock of approximately 30 black cockatoos (both Carnaby's and Baudin's cockatoo) were recorded at sunset flying over Great Eastern Highway during October 2015 and roosting in small groups in several trees approximately 600 m west of the survey area (see Section 4.4.4).

The survey area contains habitat types for foraging, and a total of 4.44 ha (5.91%) of the survey area was classified as High-Quality foraging habitat for Carnaby's cockatoo as per the habitat quality scoring system outlined in Section 3.3.3. Common night roosting and breeding tree species were also recorded within the survey area (e.g., wandoo, marri and jarrah). The black cockatoo habitat assessment is discussed in greater detail in Section 4.4.4 below.

Baudin's cockatoo

Known habitat and distribution

Baudin's cockatoo (*Calyptorhynchus baudinii*) is classified as Endangered under the EPBC and BC Act. The species is distributed through the south western humid and sub-humid zones, from the northern Darling Range and adjacent far east of the Swan Coastal Plain (south of the Swan River), south to Bunbury and east to Albany (Johnstone & Storr, 1998). Baudin's cockatoos nest in tree hollows in the deep southwest of Western Australia, with primary nesting trees being karri, marri, and wandoo (Johnstone & Kirkby, 2008).

Previous records

There are 29 previous records of Baudin's cockatoo within 15 km of the survey area prior to the field surveys, as well as 55 *Calyptorhynchus* sp. 'white-tailed black cockatoo' records (either Carnaby's or Baudin's cockatoo) (DBCA, 2020d). The nearest confirmed record (observed in 1995) of the species exists approximately 1.7 km west of the survey area; however, there are more contemporary records from 2011 (6.9 km south-east) and 2013 (10.4 km north-west). The species is also recorded as

occurring within several nature reserves of the region, including Clackline, St. Ronan's, Wambyn, and Mokine (CALM, 1987). Baudin's cockatoo has very similar morphological characteristics to Carnaby's cockatoo, and many early accounts of white-tailed black cockatoos did not distinguish between the two species (Chapman, 2007). In addition, the two species commonly occur together in mixed flocks (Peck *et al.*, 2019), and therefore correct identification of white-tailed black cockatoos is difficult, and it is possible that additional Baudin's cockatoo records occur in proximity to the survey area.

Current survey

The current survey recorded three instances of chewed marri nuts characteristic of Baudin's cockatoo (Figure 4.10). The species was also recorded on multiple occasions during the previous survey by Bamford Consulting (2015); two separate mixed flocks of seven and four individuals of Carnaby's and Baudin's black cockatoo were observed within the survey area, as well as two instances of foraging and Baudin's cockatoos were observed, as well as two instances of foraging evidence. A black cockatoo roost was recorded on Mairinger Way, Wundowie by Bamford Consulting (2015); a mixed flock of approximately 30 black cockatoos (both Carnaby's and Baudin's cockatoo) were recorded as sunset flying over Great Eastern Highway during October 2015 and roosting in small groups in several trees approximately 600 m west of the survey area.

The survey area contains habitat types suitable for foraging, and a total of 4.44 ha (5.91%) of the survey area was classified as High-Quality foraging habitat for Baudin's cockatoo as per the habitat quality scoring system outlined in Section 3.3.3. Common night roosting and breeding tree species were also recorded within the survey area (e.g., marri, jarrah). The black cockatoo habitat assessment is discussed in greater detail in Section 4.4.4 below.

Forest red-tailed black cockatoo

Known habitat and distribution

Forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*, EPBC and BC Act Vulnerable) is endemic to south west Western Australia, and is distributed through the humid and subhumid southwest of Western Australia from Gingin through the Darling Ranges to the southwest, from approximately Bunbury to Albany (Johnstone & Storr, 1998). The species has experienced a severe decline in numbers and range since European colonisation (Johnstone *et al.*, 2017). Since 2010, there has also been records of forest red-tailed black cockatoo flocks driven east into the Wheatbelt (Johnstone *et al.*, 2017). Their population in the recent past has been estimated at approximately 15,000 birds (Johnstone & Kirkby, 1999).

Forest red-tailed black cockatoos feed primarily on marri and jarrah fruit (Johnstone & Kirkby, 1999). Forest red-tailed black cockatoos can obtain energy faster when feeding on these two flora species than other food sources (Cooper *et al.*, 2002b), and together they make up 90% of their diet (Johnstone & Kirkby, 1999). They also have been known to feed on blackbutt (*Eucalyptus patens*), Albany blackbutt (*Eucalyptus staeri*), karri, sheoak (*Allocasuarina fraseriana*) and snottygobble (*Persoonia longifolia*) (Johnstone *et al.*, 2017).

Previous records

The survey area lies within the distribution of the species. There are 41 previous records of forest red-tailed black cockatoo within 15 km of the survey area prior to the field surveys. The nearest record of the species exists approximately 1.5 km south-west of the survey area from a day sighting at Wooroloo in 2020 (DBCA, 2020d). Multiple recent sightings have also been recorded at known forest red-tailed black cockatoo roosts in the local region (see Section 4.2.2), as well as local townsites (e.g. Stoneville, Mundaring) (DBCA, 2020d).

Current survey

During the current field survey, the species was observed on multiple occasions; two groups of two birds were recorded, as well as a single bird (Figure 4.10, Figure , Appendix N). In addition, twenty-one instances of foraging evidence (both marri and jarrah nuts) were recorded (Figure 4.10, Appendix N). Some trees were observed to have high quantities of freshly chewed marri nuts present. Forest red-tailed black cockatoo is known to selectively forage from trees with fruits that have a high seed yield (Cooper *et al.*, 2003), with flocks returning to the same tree until its food supply is exhausted (Johnstone & Kirkby, 1999). The previous survey (Bamford Consulting, 2015) recorded two groups of forest red-tailed black cockatoo within the survey area; a pair flying in a westerly direction, and a group of four individuals perched in a wandoo tree. Foraging evidence within the survey area was also attributed to the species by Bamford Consulting (2015).

The survey area contains habitat types comprised of flora species suitable for foraging. A total of 4.44 ha (5.91%) of the survey area was classified as High-Quality foraging habitat for forest red-tailed black cockatoo as per the habitat quality scoring system outlined in Section 3.3.3. The survey area also contains suitable night roosting and potential breeding habitat for the species, in particular the jarrah and marri present. The quantitative classification of potential black cockatoo habitat within the survey area is discussed in greater detail in Section 4.4.4.

Quenda

Known habitat and distribution

The quenda (*Isoodon fusciventer*) is classified as Priority 4 by the DBCA. The species is distributed along coastal margins in Western Australia ranging from Yanchep to Cape Le Grand and inland to Wyalcatchem and Hyden (Pentland, 1999). The habitat for the species is described as jarrah forest and swamp habitats, in dense vegetation around wetland fringes and heathland (Cooper, 1998; Woinarski *et al.*, 2014b). The species prefers dense, low shrubland to forage underneath (Woinarski *et al.*, 2014b), and low grass trees with leaves that touch the ground for diurnal nests to provide protection from predators (Lohr *et al.*, 2018). The dense vegetation surrounding waterways also provides protection and foraging opportunities. Their presence is often identified by distinctively shaped foraging pits dug

searching for invertebrates, tubers, and fungi, and can range in size from “nose-pokes” in leaf litter to well-excavated holes (Lohr *et al.*, 2018).

Previous records

The species has been recorded 90 times within the local vicinity from primary (direct observations during both day and night) and secondary evidence within 15 km of the survey area; however, 77 of these records were located within Karakamia Wildlife Sanctuary (DBCA, 2020d). Outside of Karakamia, the most proximate quenda records to the survey area are a small concentration of day sightings within the Chidlow townsite (*n* = 7), both within the developed area and opposite Crown reserve 4041 from 1965 to 2012 (DBCA, 2020d).

Current survey

The current field surveys did not record any live individuals through primary observation or via motion camera. However, evidence of quenda diggings were recorded on four occasions during the current field survey throughout the southern section of the survey area within the *Eucalyptus wandoo* woodland over *Banksia* habitat where the understorey was dense and with preferred refugia such as *Xanthorrhoea* (Plate 4.5, Figure 4.10, Appendix N). Both old and fresh quenda foraging signs were also recorded at four locations during the previous survey by Bamford Consulting (2015) (Appendix N, Figure 4.10) within the *Corymbia* and *Eucalyptus marginata* woodland and *Melaleuca* Shrubland. Overall, 33.64 ha (44.8%) of the survey area is considered highly suitable habitat for the species across both the “woodland” and “riparian” (*Melaleuca* Shrubland, and Sedgeland) habitats. Additional limited foraging and dispersal opportunities may be provided in the Isolated Trees habitat (7.03 ha, 9.4%) where the patches of the understorey are dense and provide protection.

Overall, the species is most likely to utilise the survey area during dispersal events between regional reserves such as Coates Reserve, Kwolyinine Nature Reserve, and Woondowing Nature Reserve (likely to represent the core area of the local populations) or as foraging habitat. The survey area is likely to represent the fringes of the species preferred habitat, and as such individuals would not be permanently residing in such areas and therefore dependent on them. Bandicoots have been generally found in lower population densities with foxes (Carter *et al.*, 2012); the presence of fox dens within the survey area may also contribute to a non-permanent population.

Plate 4.5: Example of secondary evidence (diggings) from quenda observed during the current (2020) field survey

4.4.3.2 Species Possible to occur in the survey area

Chuditch

Known habitat and distribution

The chuditch *Dasyurus geoffroii* is classified as Vulnerable under the EPBC and BC Act. Chuditch formerly occurred over nearly 70% of Australia and occurred throughout arid and semi-arid regions; but the species is now patchily distributed throughout the jarrah forests and mixed karri, marri, and jarrah forests of southwestern Australia (DoEE, 2019; Dunlop & Morris, 2012). Chuditch are known to occur in a wide range of habitats from woodlands, dry sclerophyll forests of jarrah, marri, and karri, riparian vegetation, beaches and deserts (DEC, 2012). Riparian vegetation appears to support higher densities of chuditch, possibly attributable to better, more reliable food sources and superior cover offered by dense vegetation (Serena & Soderquist, 2008).

Previous records

There are 17 previous records of the species from within 15 km of the survey area; of which only one is located within Karakamia Wildlife Sanctuary. The nearest record to the survey area is approximately 1.5 km north from 2008, an opportunistic dead specimen record from Foundry Place in Bakers Hill (DBCA, 2020d). Other contemporary records from the region of the survey area are two separate day sightings in 2005 at McMullen Road, Wundowie, approximately 2.5 km north-west, and a secondary sign at the Voyager Quarry, 6.5 km south (DBCA, 2020d).

Current survey

The current field surveys did not record the species from motion camera, scat observations, or denning evidence. The survey was undertaken outside the period where males are moving greater distances in search of females to mate with (April to July), where detection may be more likely (DSEWPaC, 2012). The presence of introduced predators such as red foxes and cats, may also potentially discourage the species from occurring other than in low densities (Glen *et al.*, 2009).

The species utilises a number of habitats for foraging, including dirt roads and tracks (Dunlop & Morris, 2012). Chuditch are known to scavenge the remains of animals killed on roads (Dunlop & Morris, 2012). As such, the presence of a large highway bisecting the survey area may not reduce the likelihood of the species presence in relation to foraging, although the threat level and edge effect of the road is significant. Suitable denning habitat to support the species is present in the "woodland" habitat types where there is the presence of fallen logs and tree hollows (*Eucalyptus wandoo* woodland over *Banksia*, and *Corymbia* and *Eucalyptus marginata* woodland), covering 29.79 ha (39.7%) of the survey area. Horizontal hollow logs and burrows are noted as key aspects required for chuditch survival in an area (Dunlop & Morris, 2012), although they have also been recorded in tree hollows and cavities. An adult female chuditch may utilise an estimated 66 logs and 110 burrows within her home range (Orell & Morris, 1994a). Fallen hollow logs were recorded within the survey area, such as site VCOG-01 where a motion camera was deployed. The *Melaleuca* Shrubland and Sedgeland (3.84 ha total, 5.1% of the survey area) may also provide additional marginal foraging opportunities.

In consideration that the survey area contains foraging habitat with potential den resources (33.63 ha total, 44.8%), there is multiple contemporary records within the vicinity of the survey area, the species is considered Possible to occur. However, given that suitable habitat in the survey area is often comprises thin linear strips of suitable habitat and/or is adjacent to a major road, it is unlikely that the survey area forms part of any individuals core home-range. For this reason, the species presence is most likely restricted to occasional foraging events and potentially during dispersal events between regional reserves such as Coates Reserve, Kwolyinine Nature Reserve, and Woondowing Nature Reserve (where a greater population density is likely if they are present). As such, chuditch are not considered dependent on the habitat provided and would be infrequently encountered.

South-western brush-tailed phascogale

Known habitat and distribution

The south-western brush-tailed phascogale *Phascogale tapoatafa wambenger* (BC Act Conservation Dependent) populations in Western Australia fluctuate markedly in response to climatic conditions (Rhind, 2002); however, the species is thought to have declined significantly, most likely due to habitat degradation, clearance, and fragmentation (Woinarski *et al.*, 2014b). South-western brush-tailed phascogales are known from Perth southwards to Albany (DEC, 2000), although it is less common in the wetter forests of the extreme south-west (Cannella *et al.*, 2019). The species is an obligate

arborealist, highly dependent on trees for nest hollows and bark invertebrates, especially jarrah and marri below 400 mm DBH (Rhind, 1996).

Previous records

The species is known to occur within the area, with 10 previous records within 15 km of the survey area; one of which is located within Karakamia Wildlife Sanctuary (DBCA, 2020d). The most proximate of these records are located 6.7 km and 7.5 south of the survey area from 2001 and 2002 respectively, from dead specimens at the Lakes quarry (DBCA, 2020d). In 2019, an individual was recorded 10.9 km north-east of the survey area from an opportunistic dead individual (DBCA, 2020d).

Current survey

The field surveys (both Bamford Consulting, 2015; Biologic, 2021) did not record the species from motion camera, scat observations, or denning evidence. Ninety-five percent of habitat trees used by the species are either marri (52.5%) or jarrah (41.2%), with a mean hollow entrance width of 3.9 cm and length of 7.3 cm (Rhind, 1996). Hollow-bearing trees with these characteristics were observed during the current field survey (e.g., Plate 4.6, Appendix O). As such, phascogales have the potential to den and forage through the survey area, in particular within the *Eucalyptus wandoo* woodland over *Banksia*, and *Corymbia* and *Eucalyptus marginata* woodland habitats, covering 29.79 ha (39.7%) of the survey area.

In consideration that the survey area contains foraging habitat and den resources with the potential to support the species, and the proximity of previous contemporary records, the species is considered Possible to occur. Overall, the species is most likely to utilise the survey area during dispersal events between regional reserves such as Coates Reserve, Kwolyinine Nature Reserve, and Woondowing Nature Reserve (where a greater population density is likely if they are present) or as marginal foraging habitat. The survey area is unlikely to be part of an individual's core range, and as such the south western brush-tailed phascogale would be infrequently encountered.

Plate 4.6: Example of suitable hollow for brush-tailed phascogale present in the survey area

Western brush wallaby

Known habitat and distribution

The western brush wallaby *Notamacropus irma* (DBCA Priority 4) inhabits a wide range of habitats including low *Banksia* woodlands, jarrah/marri woodlands and moist *Melaleuca* lowlands, favouring open, grassy areas (Wann & Bell, 1997; Woinarski *et al.*, 2014b). The species abundance is noted to have significantly declined until widespread fox control was implemented in state forests and conservation estates (Woinarski *et al.*, 2014b).

Previous records

The species is known to occur from the local area, with 11 previous records within 15 km of the survey area; one of which is located within Karakamia Wildlife Sanctuary (DBCA, 2020d). The most proximate records to the survey area are considered historic, from 1931 (2.4 km south-west) and 1968 (3.2 km south-west) (DBCA, 2020d). However, a contemporary record of a deceased individual from 2004 is located 7.5 km south-east from an unnamed reserve, with an additional deceased individual was recorded 6.5 km south of the survey area from 2002 (DBCA, 2020d). The species was previously recorded as present within Clackline Reserve, St Ronan's Reserve, Wambyn Reserve, and Mokine Reserve (CALM, 1987); however, these reserves have not been recently surveyed.

Current survey

The field surveys (both Bamford Consulting, 2015; Biologic, 2021) did not record the species from motion camera, scat observations, or direct observation. However, western brush wallabies have the potential to forage and disperse through the survey area, in particular within the two "woodland" habitats (*Eucalyptus wandoo* woodland over *Banksia*, and *Corymbia* and *Eucalyptus marginata* woodland), particularly the wandoo woodland that contained *Banksia* and *Hibbertia* and a diverse understorey (known habitat preferences (Povh et al., 2019)). The *Melaleuca* Shrublands (containing seasonally damp soil and supporting thickets) (Bamford *et al.*, 2003), and Isolated Trees habitat (where dense vegetation patches exist) may also provide suitable habitat for the species. Overall, these habitats cover 39.87 ha (53.2%) of the survey area.

In consideration of the suitable habitat present in the survey area, and presence of contemporary records of the species in the region, the western brush wallaby is considered Possible to occur. Overall, the species is most likely to utilise the survey area during dispersal events between regional reserves such as Coates Reserve, Kwolyinine Nature Reserve, and Woondowing Nature Reserve (where a greater population density is likely if they are present) or as marginal foraging habitat. The survey area is unlikely to be part of an individual's core range, and as such western brush wallaby would be infrequently encountered.

Fork-tailed swift

Known habitat and distribution

The fork-tailed swift *Apus pacificus* is classified as Migratory under the EPBC and BC Act. It is a wide ranging but sparsely distributed species that occurs in a wide range of dry and/or open habitats (Johnstone & Storr, 1998). The species does not breed in Australia, migrating from breeding grounds in the northern Hemisphere. The species usually arrives in Australia in October, where it remains in various parts of the continent until as late in the year as April. During its occurrence in Australia, the species is almost exclusively aerial, feeding, and possibly also roosting aerially (DoE, 2018). The species is often observed during foraging or migration, with flocks ranging from 10 to 1,000 individuals (DoE, 2018).

Previous records

There are two previous records of the species within 15 km of the survey area. The nearest observation of the species is approximately 1.9 km north-west of the survey area from 1981, with the additional record 11.5 km west-north-west from the same year (DBCA, 2020d).

Current survey

The field surveys (both Bamford Consulting, 2015; Biologic, 2021) did not record the species from direct observation. Based on the presence of some records within the vicinity of the survey area (although of

reasonable age), the species is considered Possible to infrequently occur within the airspace above the survey area to forage; however, it is unlikely to land or nest within the survey area.

Peregrine falcon

Known habitat and distribution

The peregrine falcon is classified as Other Specially Protected Fauna (OS) under the BC Act. The species typically nests on rocky ledges occurring on tall, vertical cliff faces, or occasionally within tall trees occurring along major drainage lines. It has occasionally been recorded nesting in human made structures providing high vantage points, such as radio-towers (Olsen & Olsen, 1989).

Previous records

There are six contemporary records of the species within 15 km of the survey area, ranging in age from 1999 to 2010 (DBCA, 2020d). The most proximate record is located approximately 2.5 km north from 1999 at Bakers Hill (DBCA, 2020d). The other records are located at Bailup (6.6 km north-west from 2005 and 8.6 km north-west from 1999), The Lakes (9.4 km south from 2009, and 11.25 km south-east from 2010), and Morangup (14.8 km north-west from 2006) (DBCA, 2020d). All records from the local vicinity are observational sightings of individual birds; no breeding evidence has been recorded.

Current survey

The field surveys (both Bamford Consulting, 2015; Biologic, 2021) did not record the species from direct observation. Peregrine falcon may use all of the available habitats of the survey area for foraging, in particular the *Melaleuca* Shrubland with a more open canopy cover. In consideration of the contemporary records present within the vicinity of the survey area, the peregrine falcon is considered Possible to irregularly occur flying over the survey area whilst foraging. The survey area does not contain typical breeding habitat and is unlikely to be utilised for roosting or breeding by peregrine falcon.

Table 4.13: Conservation significant species likelihood assessment

Species	Conservation Status			Preferred Broad Habitats	Within Current Known Distribution (DoEE, 2018)	Distance to Nearest Record - Year	Potential Habitat Within survey area	Recorded Within survey area	Post-Survey Likelihood of Occurrence
	EPBC Act	BC Act	DBCA						
MAMMALS									
DASYURIDAE									
Chuditch *(Dasyurus geoffroii*)	VU	VU		In the Jarrah forest, Chuditch occur in moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest particularly in Riparian vegetation (Orell & Morris, 1994b)	Yes (Species habitat likely to occur)	1.5 km N (2008) (DBCA, 2020d) 13.6 km NW (2018) (DBCA, 2020d)	Yes -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia* -*Melaleuca* Shrubland -Sedgeland	No	**Possible** -contemporary records within local vicinity -some suitable habitat
Red-tailed phascogale *(Phascogale calura*)	VU	CD		Wandoo-rock Sheoak uplands, and lowland habitat with riverine fringing vegetation of swamp Sheoak , York Gum and Wandoo (Short *et al.*, 2011).	Yes (Species habitat likely to occur)	57 km SE (2000) (ALA, 2021)	Yes -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia*	No	**Unlikely** -no contemporary records within region
Wambenger, brush-tailed phascogale *(Phascogale tapoatafa wambenger*)		CD		Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover (Woinarski *et al.*, 2014b).	Yes (Species habitat may occur)	6.7 km south (2001) (DBCA, 2020d) 10.9 km ENE (2019) (DBCA, 2020d)	Yes -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia*	No	**Possible** -contemporary records within local vicinity -some suitable habitat present
MACROPODIDAE									
Tammar *(Notamacropus eugenii derbianus)*			P4	Dense, low vegetation for daytime shelter and open grassy areas for feeding. Inhabits coastal scrub, heath and dry sclerophyll forest (Woinarski *et al.*, 2014b).	Yes (Species habitat may occur)	9.1 km W (2017) – Karakamia Sanctuary (DBCA, 2020d)	Yes -*Melaleuca* Shrubland -Isolated Trees -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia*	No	**Unlikely** -records are restricted to translocations to Karakamia Sanctuary
Western brush wallaby (*Notamacropus irma*)	-		P4	The species inhabits a wide-range of habitats including low *Banksia* woodlands, Jarrah/Marri woodlands and moist *Melaleuca* lowlands, favours open, grassy areas (Wann & Bell, 1997; Woinarski *et al.*, 2014a).	Yes (Species habitat may occur)	2.4 km SSW (1931) (DBCA, 2020d) 7.5 km SE (2004) (DBCA, 2020d)	Yes -*Melaleuca* Shrubland -Isolated Trees -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia*	No	**Possible** -contemporary record in local vicinity -some suitable habitat present
Black-footed rock-wallaby, mooroorong *(Petrogale lateralis lateralis)*	EN	EN		Rocky outcrops with *Acacia* thickets and open low eucalypt woodlands with an understorey of grasses and low shrubs (Willers *et al.*, 2011).	No	11.8 km WNW (2005) (DBCA, 2020d)	Yes (marginal) -*Melaleuca* Shrubland -Isolated Trees -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia*	No	**Unlikely** -lack of contemporary records in local vicinity -lack of suitable habitats -outside current distribution
Quokka (*Setonix brachyurus*)	VU	VU		Habitat varies but prefer *Acacia* and *Melaleuca* thickets. In Jarrah Forest associated with tea-tree, *Taxandria linearifolia* (de Tores, 2008).	Yes (adjacent to eastern boundary, species habitat may occur)	9.5 km W (1996) – Karakamia Sanctuary (DBCA, 2020d)	Yes -*Melaleuca* Shrubland -Isolated Trees -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia*	No	**Unlikely** -records are restricted to translocations to Karakamia Sanctuary

Species	Conservation Status			Preferred Broad Habitats	Within Current Known Distribution (DoEE, 2018)	Distance to Nearest Record - Year	Potential Habitat Within survey area	Recorded Within survey area	Post-Survey Likelihood of Occurrence
	EPBC Act	BC Act	DBCA						
MURIDAE									
Water rat *(Hydromys chrysogaster)*			P4	Permanent bodies of fresh or brackish water, subalpine streams to lakes and farm dams and on sheltered coastal beaches, mangroves and offshore islands (Van Dyck & Strahan, 2008).	Yes (Species habitat may occur)	7.6 km NE (1924) (DBCA, 2020d) 10.1 km WSW (2013) (DBCA, 2020d)	Marginal -some water resources present in *Melaleuca* Shrubland and Sedgeland, but not permanent	No	**Unlikely** -contemporary record restricted to Karakamia Sanctuary -marginal habitat present (no permanent water sources)
MYRMECOBIIDAE									
Numbat *(Myrmecobius fasciatus)*	EN	EN		Eucalypts forests and woodland, notably wandoo and jarrah woodland (Van Dyck & Strahan, 2008). Known from few localised populations (Friend & Page, 2015)	No	8.1 km SSW (1961) (DBCA, 2020d) 9.5 km W (1999) – Karakamia Sanctuary (DBCA, 2020d)	Yes -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia*	No	**Highly Unlikely** -contemporary records are restricted to translocations to Karakamia Sanctuary -outside current distribution
PERAMELIDAE									
Quenda (*Isoodon fusciventer*)			P4	Jarrah Forest and swamp habitats, preferring dense vegetation around wetland fringes and heathland (Cooper, 1998; Woinarski *et al.*, 2014a).	Yes (Species habitat may occur)	7.7 km SE (1978) (DBCA, 2020d) 9.7 km W (2017) (DBCA, 2020d)	Yes -*Melaleuca* Shrubland -Isolated Trees -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia* -Sedgeland	Yes Bamford Consulting (2015) and current survey (Biologic, 2021)	**Confirmed** (both surveys)
POTOROIDAE									
Woylie *(Bettongia penicillate)*	EN	CR		Woodlands and adjacent heaths with a dense understorey of shrubs particularly *Gastrolobium* sp. (Woinarski *et al.*, 2014b). Species confined to two indigenous colonies in south-west and a small number of reintroduced areas (Start *et al.*, 1995).	No	1.7 km W (2002) (DBCA, 2020d) 9.7 km W (2017) – Karakamia Sanctuary (DBCA, 2020d)	Yes -*Banksia* Shrubland -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia*	No	**Highly Unlikely** -contemporary records are restricted to translocations to Karakamia Sanctuary -outside current distribution
PSEUDOCHEIRIDAE									
Western ringtail possum, ngwayir *(Pseudocheirus occidentalis)*	CR	CR		Coastal *Agonis flexuosa* forest or eucalypt woodland or forest with a Midstorey of *Agonis flexuosa* (Burbidge & de Tores, 1998; Jones *et al.*, 1994)	No	9.5 km W (2002) (DBCA, 2020d) 10.1 km WSW (2011) – Karakamia Sanctuary (DBCA, 2020d)	Marginal -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia*	No	**Highly Unlikely** -contemporary records are restricted to translocations to Karakamia Sanctuary -outside current distribution
THYLACOMYIDAE									
Greater bilby *(Macrotis lagotis)*	VU	VU		Sandy spinifex and tussock grasslands/shrublands throughout current distribution. In the southwest, MGxture of woodland including Jarrah, Marri and Wandoo (Abbott, 2001)	No	2.9 km WNW (1956) (DBCA, 2020d) 10.8 km NNE (1974) (DBCA, 2020d)	No	No	**Highly Unlikely** -no contemporary records within local vicinity -outside current distribution -no suitable habitat available

Species	Conservation Status			Preferred Broad Habitats	Within Current Known Distribution (DoEE, 2018)	Distance to Nearest Record - Year	Potential Habitat Within survey area	Recorded Within survey area	Post-Survey Likelihood of Occurrence
	EPBC Act	BC Act	DBCA						
VESPERTILIONIDAE									
Western false pipistrelle *(Falsistrellus mackenziei)*			P4	Jarrah, Marri, Tuart and Karri forests with high rainfall. Has also found in *Banksia* woodlands on the Swan Coastal Plain (Armstrong *et al.*, 2017).	Yes (Species habitat may occur)	2.2 km SSW (1973) (DBCA, 2020d)	Marginal -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia*	No	**Unlikely** -lack of contemporary records in local vicinity -marginal habitat present
BIRDS									
ACCIPITRIDAE									
Osprey (*Pandion haliaetus)*	MI	MI		Occurs mainly in sheltered seas around islands, tidal creeks, estuaries and saltwork ponds, also large river pools (Johnstone *et al.*, 2013a)	Yes (Species habitat may occur)	35 km SW (2017) – John Forrest National Park (ALA, 2021)	No	No	**Highly Unlikely** -lack of contemporary records within local vicinity -no suitable habitat present
APODIDAE									
Fork-tailed swift (*Apus pacificus*)	MI	MI		Aerial species, which forages high above the tree canopy and rarely lower (Johnstone & Storr, 1998).	Yes (Species habitat likely to occur)	2 km NW (1981) (DBCA, 2020d)	Yes (all habitats)	No	**Possible** (aerial only) -recorded at Karakamia Sanctuary -Within species distribution
CACATUIDAE									
Forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*)	VU	VU		Eucalypts forests. Attracted to seeding Marri, Jarrah, Blackbutt, Karri and Sheoak (Johnstone & Storr, 1998).	Yes (species habitat may occur)	1.5 km SSW (2020) (DBCA, 2020d)	Yes -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia* -Isolated Trees	Yes Bamford Consulting (2015) and current survey (Biologic, 2021)	**Confirmed** (both surveys)
Baudin's cockatoo (*Calyptorhynchus baudinii*)	EN	EN		Species forages primarily in Eucalypt forest, feeding on Marri nuts, flowers, nectar and seeds (Johnstone & Storr, 1998). Nesting trees are Karri, Marri, and Wandoo (Johnstone & Kirkby, 2008).	Yes (Species foraging habitat likely to occur)	1.7 km W (1995) (DBCA, 2020d) 6.9 km SE (2011) (DBCA, 2020d)	Yes -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia* -Isolated Trees	Yes Bamford Consulting (2015) and current survey (Biologic, 2021)	**Confirmed** (both surveys)
Carnaby's cockatoo (*Calyptorhynchus latirostris*)	EN	EN		Proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests (Johnstone & Storr, 1998).	Yes (foraging and breeding)	0.37 km NW (2008) (DBCA, 2020d)	Yes -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia* -Isolated Trees	Yes Bamford Consulting (2015) and current survey (Biologic, 2021)	**Confirmed** (both surveys)
FALCONIDAE									
Grey falcon *(Falco hypoleucos)*	VU	VU		Timbered lowlands, particularly *Acacia* shrubland and along inland drainage systems. Also frequent spinifex and tussock grassland (Burbidge *et al.*, 2010; Olsen & Olsen, 1986)	No	25 km NE (no date) (ALA, 2021)	Yes (foraging) -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia* -Isolated Trees -*Melaleuca* Shrubland	No	**Unlikely** -lack of contemporary records within local vicinity -outside current distribution

Species	Conservation Status			Preferred Broad Habitats	Within Current Known Distribution (DoEE, 2018)	Distance to Nearest Record - Year	Potential Habitat Within survey area	Recorded Within survey area	Post-Survey Likelihood of Occurrence
	EPBC Act	BC Act	DBCA						
Peregrine falcon *(Falco peregrinus)*		OS		The species occurs along coastal cliffs, rivers and ranges as well as wooded watercourses and lakes nesting on cliffs, granite outcrops, quarries and in the wheatbelt, old Raven and Whistling Kite nests (Johnstone & Storr, 1998).	Yes (Species habitat likely to occur)	2.5 km N (1999) (DBCA, 2020d) 11.2 km SSE (2010) (DBCA, 2020d)	Yes (foraging) -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia* -Isolated Trees -*Melaleuca* Shrubland	No	**Possible** -within current distribution -some contemporary records within local vicinity -some marginal habitat present
MEGAPODIIDAE									
Malleefowl (*Leipoa ocellata*)	VU	VU		Inhabits semi-arid shrublands and low woodlands dominated by mallee eucalypts and/or *Acacia*s with sandy loam soils (Benshemesh, 2007).	Yes (Species habitat likely to occur)	5.4 km S (1961) (DBCA, 2020d) 13.7 km NNW (2004) (DBCA, 2020d)	No	No	**Highly Unlikely** -lack of contemporary records within local vicinity -outside current distribution - no suitable habitat present
MOTACILLIDAE									
Grey wagtail (*Motacilla cinerea*)	MI	MI		A rare vagrant to Western Australia where it has been recorded within various habitats with open waterbodies (Johnstone & Storr, 2004).	Yes (Species habitat may occur)	203 km N (no date) (BirdLife, 2021)		No	**Highly Unlikely** -lack of contemporary records within local vicinity -rare visitor to Western Australia
ROSTRATULIDAE									
Australian painted snipe (*Rostratula australis)*	EN	EN		Generally, occupies shallow terrestrial freshwater wetlands (i.e. temporary and permanent lakes, swamps and claypans) with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire (Johnstone & Storr, 1998).	Yes (Species habitat likely to occur)	35 km ESE (ALA, 2021)	No	No	**Highly Unlikely** -lack of contemporary records within local vicinity -no suitable habitat present
SCOLOPACIDAE									
Sharp-tailed sandpiper (*Calidris acuminata)*	MI	MI		Coastal and inland areas saline and freshwater but prefers non-tidal fresh or brackish wetlands (Geering *et al.*, 2007)	Yes (Species habitat may occur)	28 km S (no date) (ALA, 2021)	No	No	**Highly Unlikely** -lack of contemporary records within local vicinity -no suitable habitat present
Curlew sandpiper *(Calidris ferruginea)*	CR/ MI	CR/ MI		Inhabits intertidal mudflats in sheltered coastal areas (i.e. estuaries, bays, inlets and lagoons) (Geering *et al.*, 2007). This rare species generally roosts on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands (Geering *et al.*, 2007).	Yes (Species habitat may occur)	42 km SW (2012) - Kalamunda (ALA, 2021)	No	No	**Highly Unlikely** -lack of contemporary records within local vicinity -no suitable habitat present
Pectoral sandpiper (*Calidris melanotos*)	MI	MI		Coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands (Johnstone & Storr, 2004; Johnstone *et al.*, 2013a). It prefers wetlands with open fringing mudflats and low, emergent or fringing vegetation (Geering *et al.*, 2007).	Yes (Species habitat may occur)	55 km SW (2012) – Herdsman Lake (ALA, 2021)	No	No	**Highly Unlikely** -lack of contemporary records within local vicinity -no suitable habitat present
Eastern curlew *(Numenius madagascariensis)*	CR/ MI	CR/ MI		Mainly tidal mudflats, also reef flats, sandy beaches and rarely near-coastal lakes including saltwork ponds (Johnstone & Storr, 1998).	Yes (Species habitat may occur)	42 km SW (2012) (ALA, 2021)	No	No	**Highly Unlikely** -lack of contemporary records within local vicinity -no suitable habitat present

Species	Conservation Status			Preferred Broad Habitats	Within Current Known Distribution (DoEE, 2018)	Distance to Nearest Record - Year	Potential Habitat Within survey area	Recorded Within survey area	Post-Survey Likelihood of Occurrence
	EPBC Act	BC Act	DBCA						
Common sandpiper (*Actitis hypoleucos*)	MI	MI		Estuaries and deltas of streams, as well as banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans (Johnstone & Storr, 1998).	Yes (Species habitat may occur)	21 km NE (2011) - Northam (ALA, 2021)	No	No	**Highly Unlikely** -lack of contemporary records within local vicinity -no suitable habitat present
Common greenshank *(Tringa nebularia)*	MI	MI		Species occurs as a non-breeding summer Migrant which occurs throughout the region. Occurs mainly in Tidal mudflats, mangrove creeks, flooded samphire flats, beaches, river pools, and saltwork and sewage ponds (Johnstone *et al.*, 2013a).	Yes (on the boundary of the eastern distribution)	19 km NNE (2010) (ALA, 2021)	No	No	**Highly Unlikely** -lack of contemporary records within local vicinity -no suitable habitat present
REPTILES									
SCINCIDAE									
Dell's skink *(Ctenotus delli)*			P4	Dry sclerophyll forest on stony hills and ranges (Cogger, 2014), but otherwise undocumented.	Yes (Species habitat may occur)	12.1 km SSW (1977) (DBCA, 2020d)	Yes -*Corymbia* and E. marginata Woodland -*Eucalyptus wandoo* Woodland over *Banksia* -Isolated Trees	No	**Unlikely** -lack of contemporary records within local vicinity, however suitable habitat present and there is a lack of survey effort in the vicinity

438000 440000 442000 444000

6482000

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Previous Record (Bamford, 2015)

- White-tailed black cockatoo (EN) - Individual (alive)
- White-tailed black cockatoo (EN) - Foraging evidence

Great Eastern Hwy

Legend

- Current Survey Area
- Previous Survey Area

Current Study

- Forest red-tailed black cockatoo (EN) - Chewed Allocasuarina
- Forest red-tailed black cockatoo (EN) - Foraging evidence (jarrah)
- Forest red-tailed black cockatoo (EN) - Foraging evidence (marri)
- Forest red-tailed black cockatoo (EN) - Individual (alive)

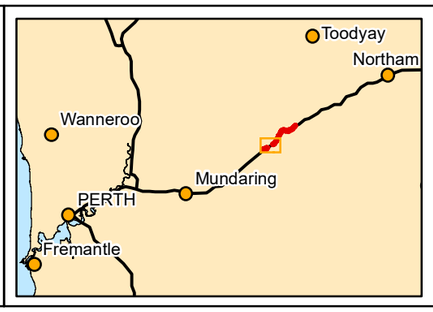
N

biologic Environmental Survey

Scale: 1:17,000

0 0.5 1 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 24/01/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.10a: Fauna of conservation significance recorded in the Survey Area

442000 444000 446000 448000

6486000 6484000

Previous Record (Bamford, 2015)

- Baudin's cockatoo (EN) - Foraging evidence
- Baudin's cockatoo (EN) - Individual (alive)
- White-tailed black cockatoo (EN) - Individual (alive)
- White-tailed black cockatoo (EN) - Foraging evidence
- Forest red-tailed black cockatoo (EN) - Foraging evidence
- Forest red-tailed black cockatoo (EN) - Individual (alive)
- Forest red-tailed and White-tailed black cockatoo (EN) - Foraging evidence
- Quenda (P4) - Digging

Great Eastern Hwy

Legend

- Current Survey Area
- Previous Survey Area

Current Study

- Baudin's cockatoo (EN) - Foraging evidence
- Carnaby's cockatoo (EN) - Foraging evidence
- Carnaby's cockatoo (EN) - Individual (alive)
- Forest red-tailed black cockatoo (EN) - Foraging evidence (jarrah)
- Forest red-tailed black cockatoo (EN) - Foraging evidence (marri)
- Forest red-tailed black cockatoo (EN) - Individual (alive)
- Quenda (P4) - Digging

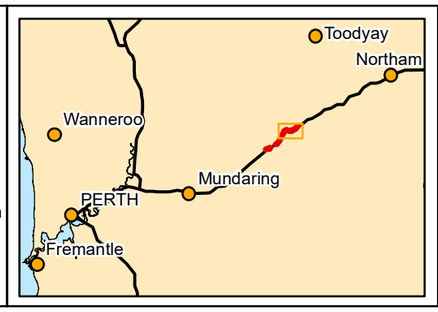
N

biologic Environmental Survey

Scale: 1:17,000

0 0.5 1 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 24/01/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.10b: Fauna of conservation significance recorded in the Survey Area

4.4.4 Black Cockatoo Habitat Assessment

Potential Foraging Habitat

The described habitat types within the survey area have been assessed in regard to potential foraging habitat as described in Section 3.3.3. One assessment was made within each habitat type present, which categorised the foraging quality within the study area between “High Quality” and “Low Quality” for each of the black cockatoo species (Table 4.15). Overall, the habitat of greatest foraging quality was the *Corymbia* and *Eucalyptus marginata* woodland (4.44 ha), scored as High Quality for all three cockatoo species. This woodland provides a high abundance of core primary resources for the species, namely mature marri and jarrah trees. Marri and jarrah comprise 90% of the diet of the forest red-tailed black cockatoo (Johnstone *et al.*, 2013c) and is a core component of foraging diet for Baudin’s cockatoo as well (Weerheim, 2008). Secondary foraging species such as *Allocasuarina*, *Hakea*, and blackbutt were also present within the habitat. Foraging evidence attributed to both Baudin’s and Carnaby’s cockatoo was recorded by the field surveys within this habitat type during both the field surveys. Calls of Carnaby’s cockatoo were also recorded during the current field survey in this habitat type. It is highly likely that forest red-tailed cockatoo will utilise this habitat type. Overall, the proportion of the survey area categorised as High Quality was low, comprising 5.91% of the total area.

The *Eucalyptus wandoo* woodland over *Banksia* habitat (25.36 ha) is also considered foraging habitat of significance, categorised as “Medium” quality for all three species. Wandoo is not a primary food resource for black cockatoos, used more as a potential breeding tree species, particularly for Carnaby’s cockatoo (Cale, 2003); however, the presence of scattered or small patches of marri and jarrah and a mid-storey of *Banksia* species (e.g. *B. squarrosa, B. sessilis*) make the habitat valuable for foraging resources. The *Banksia* present is considered of most significance for Carnaby’s cockatoo due to its strong association with *Banksia* species for foraging in comparison to the other black cockatoo species (TSSC, 2016). Secondary foraging species such as *Allocasuarina*, *Hakea*, and blackbutt were also present within the habitat. Individuals of all three species were observed within the habitat across the survey area, in addition to foraging evidence. The habitat covers the highest proportion of broad fauna habitats within the survey area, comprising 33.9% of the total area.

The Isolated Trees habitat (7.03 ha, 9.4%) was considered of “Low Quality” due to the general characteristic of containing only individual or small stands of foraging plants. The presence of foraging evidence under isolated trees during the field surveys immediately adjacent to Great Eastern Highway demonstrates that the habitat has some value to black cockatoos, and that the noise and disturbance from vehicles is not a major determent to foraging birds; however, the threat source from vehicle collision is considered high. The *Melaleuca* Shrubland (3.05 ha, 4.1%) and Sedgeland (0.79 ha, 1.1%) were also considered of “Low” quality for Carnaby’s cockatoo due to the presence of low quantities of foraging resources such as wandoo and melaleuca, which are not utilised by the other cockatoo species.

Black cockatoos rely upon the availability of foraging resources across their range, particularly to build condition in the post-breeding period (DSEWPaC, 2012). As discussed in Section 4.2, the survey area

is in close proximity to both night roosts (e.g., Mairinger Way, NORWUNR001) and two active breeding nests in Wooroloo Reserve (Wheatbelt Natural Resource Management, 2021). Maintenance of available of foraging habitat within a 6 – 12 km radius of breeding sites is necessary to successfully raise chicks, with breaks of more than 4 km shown to prevent breeding birds reaching resources (DSEWPaC, 2012). Hence any habitat of known foraging potential should be considered valued in the local vicinity, even where the abundance and cover of primary and secondary resources is low. Other areas of foraging habitat are found is in the vicinity; Coates Reserve (90 ha) Kwolyinine Nature Reserve (570 ha), Woondowing Nature Reserve (3,100 ha), and Keaginine Nature Reserve (100 ha).

The location of the survey area within the Jarrah Forest region places it along the migratory route between the breeding (Wheatbelt) and non-breeding (Swan Coastal Plain) for Carnaby's cockatoo (Johnstone & Kirkby, 2019). Since 2010, there has also been records of forest red-tailed black cockatoo flocks driven east into the Wheatbelt (Johnstone *et al.*, 2017). Baudin's cockatoo displays long-ranging flock movements between breeding and non-breeding grounds, and recent studies have illustrated the importance of maintaining vegetation connectivity across this route, with the species showing high revisitation rates of roadside vegetation (Rycken *et al.*, 2020). Hence overall, in consideration of the habitat types and utilisation observed, the foraging habitat in the survey area is valued not only on a local level to support roosting and breeding sites, but also on a minor regional level as a "stepping-stone" between seasonal grounds.

Table 4.14: Foraging evidence of black cockatoo recorded in the survey area during the current field survey

Species	Foraging species	Photo	Foraging species	Photo
Carnaby's cockatoo	Marri nut		Allocasuarina nut	
Baudin's cockatoo	Marri nut			

Species	Foraging species	Photo	Foraging species	Photo
Forest red-tailed black cockatoo	Marri nut		Jarrah nut	

Table 4.15: Summary of foraging habitat scores for black cockatoo

Habitat	Carnaby's cockatoo			Baudin's cockatoo			Forest red-tailed black cockatoo		
	Primary foraging resources and canopy	Other considerations	Overall foraging quality	Primary foraging resources and abundance	Other considerations	Overall foraging quality	Primary foraging resources and abundance	Other considerations	Overall foraging quality
Eucalyptus wandoo* woodland over *Banksia (25.36 ha, 33.8%)	**Primary**: marri and jarrah canopy 30 - 50%, *B. sessilis* present in midstory **Secondary**; wandoo, *Allocasuarina, X. preissii, E. patens, H. lissocarpha*	Proximity of High primary foraging resources to breeding records (~5 km) and night roosts (~ 500 m), connectivity to remnant vegetation outside survey area exists	**Medium**	**Primary**: marri and jarrah canopy <10% **Secondary**; *Allocasuarina, X. preissii, B. sessilis*	Proximity of primary and secondary foraging resources to night roosts (~ 500 m), connectivity to remnant vegetation outside survey area exists	**Medium**	**Primary**: marri and jarrah canopy < 10% **Secondary**; *Allocasuarina, E. patens, H. lissocarpha*	Proximity of some primary and secondary foraging resources to night roosts (~ 500 m), connectivity to remnant vegetation outside survey area exists	**Medium**
***Corymbia* and *Eucalyptus marginata* woodland** (4.44 ha, 5.9%)	**Primary**: marri and jarrah canopy > 50%, *B. sessilis* present in midstory **Secondary**: *Allocasuarina*, *B. squarrosa*, *X. preissii*	Proximity of High primary foraging resources to breeding records (~5 km) and night roosts (~ 500 m), connectivity to remnant vegetation outside survey area exists	**High**	**Primary**: marri and jarrah canopy > 50%, present in midstory **Secondary**: *B. sessilis, B. squarrosa*, *X. preissii*	Proximity of High primary foraging resources to night roosts (~ 500 m), connectivity to remnant vegetation outside survey area exists	**High**	**Primary**: marri and jarrah canopy > 50% **Secondary**: *Allocasuarina*	Proximity of High primary and secondary foraging resources to night roosts (~ 500 m), connectivity to remnant vegetation outside survey area exists	**High**
Isolated trees (7.03 ha, 9.4%)	**Primary**: marri, jarrah canopy < 30% **Secondary**: Wandoo (low)	Low connectivity to surrounding remnant vegetation.	**Low**	**Primary**: marri, jarrah canopy < 30% **Secondary:** n/a	Low connectivity to surrounding remnant vegetation.	**Low**	**Primary**: marri, jarrah canopy < 30% **Secondary:** n/a	Low connectivity to surrounding remnant vegetation.	**Low**
***Melaleuca* shrubland** (3.05 ha, 4.1%)	**Primary:** n/a **Secondary:** Wandoo (low)	Contains ephemeral water resources	**Low**	**Primary:** n/a **Secondary:** n/a	No foraging species present Minimal canopy cover. Contains ephemeral water resources	**Nil**	**Primary:** n/a **Secondary:** n/a	No foraging species present Minimal canopy cover. Contains ephemeral water resources	**Nil**
Sedgeland (0.79 ha, 1.1%)	**Primary**: n/a **Secondary**: *M. viminea* (< 10%)	Minimal foraging species present. < 10% canopy cover.	**Low**	**Primary:** n/a **Secondary:** n/a	No foraging species present No canopy cover. Contains ephemeral water resources	**Nil**	**Primary:** n/a **Secondary:** n/a	No foraging species present No canopy cover. Contains ephemeral water resources	**Nil**
Cleared (34.37 ha, 45.8%)	**Primary**: n/a **Secondary**: n/a	No foraging species present No canopy cover	**Nil**	**Primary:** n/a **Secondary:** n/a	No foraging species present No canopy cover	**Nil**	**Primary:** n/a **Secondary:** n/a	No foraging species present No canopy cover	**Nil**
Total	**High:** 4.44 ha (5.9%) **Medium**: 25.36 ha (33.8%) **Low:** 10.87 ha (14.5%) **Nil:** 34.37 ha (45.8%)			**High:** 4.44 ha (5.9%) **Medium:** 25.36 ha (33.8%) **Low:** 7.03 ha (9.4%) **Nil:** 38.21 ha (50.9%)			**High:** 4.44 ha (5.9%) **Medium:** 25.36 ha (33.8%) **Low:** 7.03 ha (9.4%) **Nil:** 38.21 ha (50.9%)		

437000

438000

439000

440000

6480000

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Potential Foraging Habitat (360, 2019)

- High Quality for all three species
- Medium Quality for all three species
- Low Quality for all three species
- Low Quality for Carnaby's cockatoo

Legend

- Current Survey Area
- Previous Survey Area

Potential Foraging Habitat (Current survey)

- Medium Quality for all three species
- Low Quality for all three species

N

biologic Environmental Survey

Scale: 1:8,500

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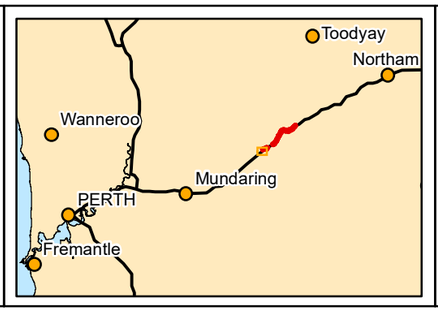
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.11a: Potential black cockatoo foraging habitat in the Survey Area

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441000
442000
6482000
6481000

Potential Foraging Habitat (360, 2019)
- High Quality for all three species
- Medium Quality for all three species
- Low Quality for all three species
- Low Quality for Carnaby's cockatoo

Legend
- Current Survey Area
- Previous Survey Area

Potential Foraging Habitat (Current survey)
- High Quality for all three species
- Medium Quality for all three species
- Low Quality for all three species
- Low Quality for Carnaby's cockatoo

N

biologic Environmental Survey

Scale: 1:8,500

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Coordinate System: GDA 1994 MGA Zone 50
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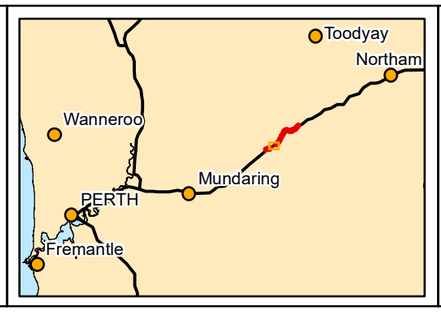


MAIN ROADS WA
Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.11b: Potential black cockatoo foraging habitat in the Survey Area

441000
442000
443000
6483000
6482000

Potential Foraging Habitat (360, 2019)
- High Quality for all three species
- Medium Quality for all three species
- Low Quality for all three species
- Low Quality for Carnaby's cockatoo

Legend
- Current Survey Area
- Previous Survey Area

Potential Foraging Habitat (Current survey)
- High Quality for all three species
- Medium Quality for all three species
- Low Quality for all three species
- Low Quality for Carnaby's cockatoo

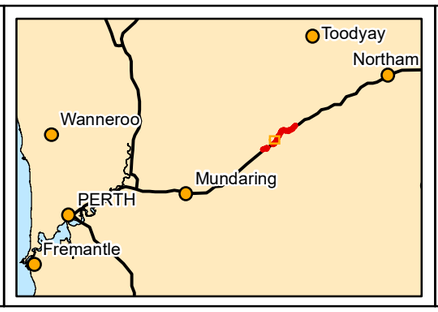
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.11c: Potential black cockatoo foraging habitat in the Survey Area

442000 443000 444000 445000

6485000

6484000

alive)

EN) - Foraging evidence

Potential Foraging Habitat (360, 2019)

- High Quality for all three species
- Medium Quality for all three species
- Low Quality for all three species
- Low Quality for Carnaby's cockatoo

Legend

- Current Survey Area
- Previous Survey Area

Potential Foraging Habitat (Current survey)

- Medium Quality for all three species
- Low Quality for all three species
- Low Quality for Carnaby's cockatoo

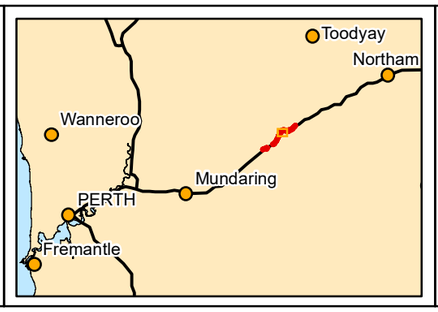
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.11d: Potential black cockatoo foraging habitat in the Survey Area

444000
445000
446000
447000
6486000
6485000

vidence
alive)
EN) - Foraging evidence

Potential Foraging Habitat (360, 2019)
- High Quality for all three species
- Medium Quality for all three species
- Low Quality for all three species
- Low Quality for Carnaby's cockatoo

Legend
- Current Survey Area
- Previous Survey Area

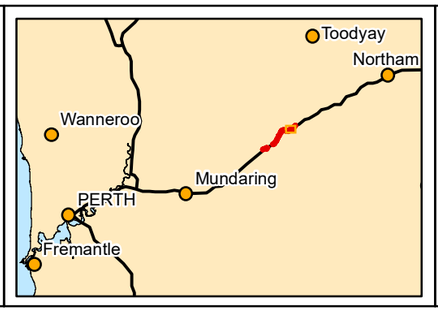
Potential Foraging Habitat (Current survey)
- High Quality for all three species
- Medium Quality for all three species
- Low Quality for all three species

N

biologic Environmental Survey

Scale: 1:8,500
0 200 400 Meters

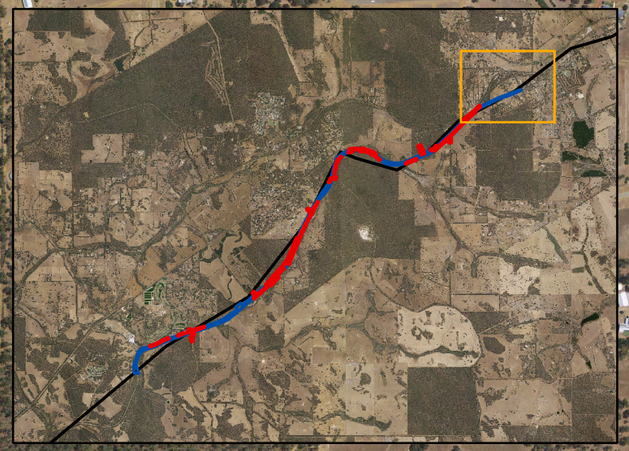
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA
Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.11e: Potential black cockatoo foraging habitat in the Survey Area

446000
447000
448000
449000
6487000
6486000



Potential Foraging Habitat (360, 2019)

- High Quality for all three species
- Medium Quality for all three species
- Low Quality for all three species
- Low Quality for Carnaby's cockatoo

Legend

- Current Survey Area
- Previous Survey Area

Potential Foraging Habitat (Current survey)

- High Quality for all three species
- Medium Quality for all three species
- Low Quality for all three species

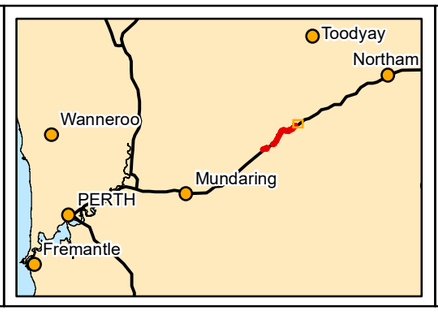
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.11f: Potential black cockatoo foraging habitat in the Survey Area

Potential Night Roosting Habitat

Black cockatoo roosting habitat is defined by DSEWPaC (2012) as a communal site used by black cockatoo species during the evening, generally located in the tallest trees in an area. The species of tree is often not critical for night roosting and a suite of species are commonly used by black cockatoos, including species recorded within the survey area (Le Roux, 2017), although Carnaby's cockatoo will generally roost in or near riparian environments (DSEWPaC, 2012).

No evidence of black cockatoo night roosting activity was recorded during the current field survey within the survey area (e.g., clipped leaves and branches or droppings under suitable trees). Bamford Consulting (2015) identified a white-tailed black cockatoo roost approximately 600 metres west of the survey area on Mairinger Way, Wundowie (Figure 4.12, Figure). This roost was utilised by approximately 30 birds (a mixed flock of Carnaby's and Baudin's cockatoo) across several trees. Roost site NORWUNR001 is located 500 m from the survey area and approximately 1.1 km from the Mairinger Way roost site recorded during the previous field survey (Bamford Consulting, 2015). It has been monitored since 2010, where 125 birds were recorded. Night roosts can include tall trees within approximately 1 km of a central roost area of larger roost sites (>150 birds at any given time), with patches of trees usually 2-3 ha in area with smaller clumps used on any individual night for roosting (Glossop *et al.*, 2011). Carnaby's cockatoo are known to shift the roost location of a large Bentley roost within a 2 km x 2 km area where a clump of trees used on any individual (Glossop *et al.*, 2011). As such, there is a possibility that the Mairinger Way roost identified by Bamford Consulting (2015) forms a wider part of the monitored Birdlife roost. Roost site NORBAKR001, approximately 1.2 km north-east of the survey area in the Bakers Hill Golf Club, is also highly active as a white-tailed black cockatoo roost, with 160 birds observed roosting during the Great Cocky Count in 2019, 52 birds roosting in 2017, and 94 birds roosting in 2016 (BirdLife Australia, 2021).

Although no forest red-tailed black cockatoos were observed utilising roost sites within the vicinity by the field surveys, site NORWUNR001 located 500 m from the survey area has previously recorded roosting individuals of the species in low numbers (n = 6 in 2015 and n = 8 in 2017) (BirdLife Australia, 2021).

There are only nine known night roosts within 20 km of the survey area; as such, the presence of two within 500 metres of the survey area is significant. Overall, although no roosting sites were recorded within the survey area boundary, the presence of active black cockatoo roosts in the immediate vicinity adds significance to the habitat types containing suitable roosting trees within the survey area. The *Eucalyptus wandoo* woodland over *Banksia* (25.36 ha, 33.8%), *Corymbia* and *Eucalyptus marginata* woodland (4.44 ha, 5.9%), and Isolated Trees (7.05 ha, 9.4%), are considered potential roosting habitat for black cockatoo (Figure 4.12). These habitats display characteristics of suitable night roosting habitat, including medium foliage density and habitats that are not too densely forested amongst other trees (Le Roux, 2017). Well-spaced and tall trees may offer greater protection from predators, and may allow cockatoos to enter and exit more easily (Le Roux, 2017). The presence of smooth-barked tree species such as wandoo enhances the potential suitability of these habitats; Groom (2015) found that Carnaby's cockatoo most commonly roost in 20+ year smooth-barked eucalypts.

Black cockatoos will favour night roost sites that are within two kilometres to water sources (DoEE, 2017). Although there may not be permanent water sources within the survey area (the Coates Gully, and water sources in the Sedgeland are likely ephemeral); numerous waterbodies within 5 km of the survey area including numerous farm dams. Black cockatoos also favour night roost sites within 1 – 6 km of quality foraging resources; in addition to the foraging resources outlined in the previous section, several conservation estates occur in the local vicinity that provide broadly connecting patches of foraging habitat across the region (e.g., Kwolyinine Nature Reserve, Keaginine Nature Reserve, see Section 2.6).

437000

438000

439000

440000

6480000

6480000

Potential Roosting Habitat (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Legend

- Current Survey Area
- Previous Survey Area

Potential Roosting Habitat (Current survey)

- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

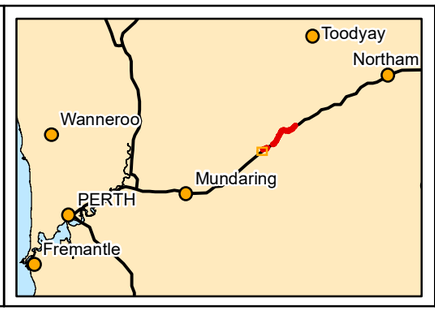
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022

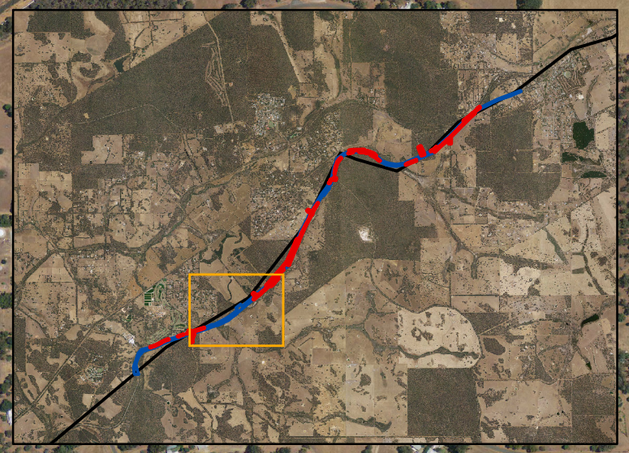


MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.12a: Potential night roosting habitat in the Survey Area

440000
441000
442000
6482000
6481000



Potential Roosting Habitat (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Legend

- Current Survey Area
- Previous Survey Area

Potential Roosting Habitat (Current survey)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

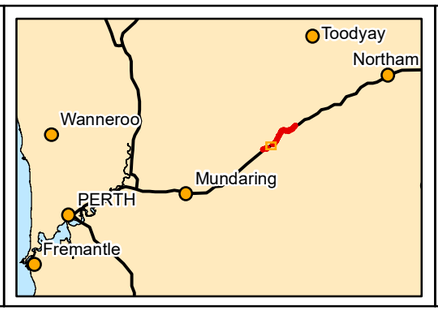
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.12b: Potential night roosting habitat in the Survey Area

441000
442000
443000
6483000
6482000

Potential Roosting Habitat (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Legend

- Current Survey Area
- Previous Survey Area

Potential Roosting Habitat (Current survey)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

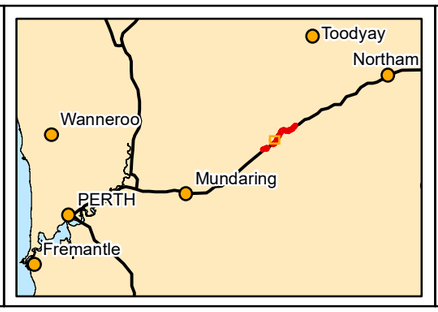
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.12c: Potential night roosting habitat in the Survey Area

442000 443000 444000 445000

6485000

6484000

NORWUNR001

Potential Roosting Habitat (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Legend

- Current Survey Area
- Previous Survey Area

Potential Roosting Habitat (Current survey)

- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Roost (Birdlife, 2021)

- Forest red-tailed and White-tailed black cockatoo

Bamford (2015)

- Roost

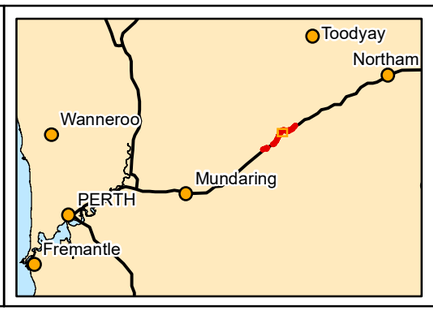
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.12d: Potential night roosting habitat in the Survey Area

444000
445000
446000
447000
6486000
6485000

Potential Roosting Habitat (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Legend

- Current Survey
- Previous Survey

Potential Roosting Habitat (Current survey)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

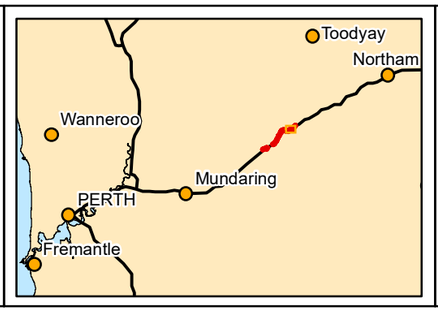
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.12e: Potential night roosting habitat in the Survey Area

446000 447000 448000 449000

6487000

6486000

NORBAKR001

Potential Roosting Habitat (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Legend

- Current Survey Area
- Previous Survey Area

Potential Roosting Habitat (Current survey)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Roost (Birdlife, 2021)

- White-tailed black cockatoo

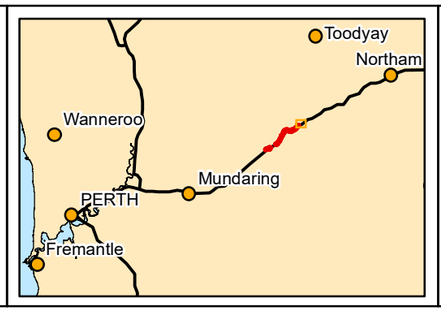
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.12f: Potential night roosting habitat in the Survey Area

Potential Breeding Habitat

Following consolidation of the spatial data, 963 potential black cockatoo breeding trees have been recorded within the survey area between the previous (Bamford Consulting, 2015) (*n* = 474) and current (2021) (*n* = 489) field surveys. These trees were of a suitable DBH and species to support black cockatoo breeding with the most common species being wandoo (*Eucalyptus wandoo*) (*n* = 646 overall). A summary of potential breeding trees recorded with greater than 500 mm DBH (or 300 mm DBH for wandoo) within the survey area are shown in Table 4.16, and Figure 4.13. A more detailed assessment of the trees recorded is provided in Appendix O.

Table 4.16: Number of potential breeding trees with suitable DBH (> 300 mm or 500 mm as appropriate) recorded in the survey area

Tree species	Number of trees	DBH range (mm)
Bamford (2015)		
Blackbutt (*Eucalyptus patens*)	14	340-1320
Flooded gum (*Eucalyptus rudis*)	1	760
Jarrah (*Eucalyptus marginata*)	32	500-1190
Marri (*Corymbia calophylla*)	71	310-1240
Unknown (Dead)	9	520-770
Wandoo (*Eucalyptus wandoo*)	347	300-1050
Subtotal	**474**	**300-1320**
Biologic (2021)		
Flooded gum (*Eucalyptus rudis*)	9	400-745
Introduced *Eucalyptus*	1	608-608
Jarrah (*Eucalyptus marginata*)	30	500-1150
Marri (*Corymbia calophylla*)	123	497-1600
Tuart (*Eucalyptus gomphocephala*)	2	503-850
Unknown (Alive)	7	520-1038
Unknown (Dead)	18	360-1290
Wandoo (*Eucalyptus wandoo*)	299	300-1400
Subtotal	**489**	**300-1600**
Grand Total	**963**	**300-1600**

Following of attributes such as entry diameter, hollow angle, tree species, presence of competitors, and potential depth, 88 hollows (n = 58 from previous (Class 3 and 4 trees), n = 30 from current survey) overall were considered to have potential to support black cockatoo breeding in the future (nest hollow "stock") (Table 4.17). Three hollows recorded during the current survey (2021) were observed to have chew marks around the perimeter of the hollow; however, further investigation via telescopic camera would be required to further identify or confirm breeding activity. These hollow-bearing trees were concentrated in the Eucalypt-based habitat types; *Eucalyptus wandoo* woodland over *Banksia*, *Corymbia* and *Eucalyptus marginata* woodland, and Isolated Trees. Complete details of the hollow assessment are provided in Appendix O.

The previous field survey (Bamford Consulting, 2015) recorded seven hollows occupied by other avian fauna such as galahs (*n* = 3), ducks (from down; *n* = 1), and parrots (*n* = 1). These species are known competitors for nest hollows with black cockatoos (DoEE, 2017). The current survey recorded pardalote breeding activity within a hollow (*n* = 1). Bees were recorded in four hollows (two from the previous survey, two from the current survey), and as such were considered unsuitable at the time of survey (DoEE, 2017); however, these may become suitable in future years if the bees should vacate the hollow. Hollows that were occupied by competitors at the time of the field survey were not included in the overall potential hollow count recorded above.

Table 4.17: Summary of all potentially suitable hollows recorded within the survey area during the field surveys; either hollows of suitable entry diameter and other characteristics (Biologic, 2021) or Class 3 and 4 (Bamford Consulting, 2015).

Consultant	Species	Hollow type	Number of hollows
Bamford Consulting (2015)	Blackbutt	Class 4	1
	Jarrah	Class 3	1
		Class 4	1
	Marri	Class 3	2
		Class 4	7
	Unknown (Dead)	Class 3	2
		Class 4	1
	Wandoo	Class 3	27
		Class 4	16
Biologic (2021)	Jarrah	Chimney type in main trunk	1
		End of branch leading into main trunk	1
		Hollow in main trunk entry at V fork	1
	Marri	End of branch leading into main trunk	2
	Unknown (Dead)	Chimney type in main trunk	4
		End of branch leading into main trunk	1
		Side entry in main trunk	1
		Top entry at broken branch at main fork	1
	Wandoo	Chimney type in main trunk	3
		Elbow type entry in branch	2
		End of branch leading into main trunk	9
		Side entry in main trunk	1
		Chimney type in main trunk	1
		End of branch leading into main trunk	1
		Hollow in main trunk entry at V fork	1
Total		**88 hollows (in 105 trees)**	

Almost 70% of all potentially suitable hollows observed (*n* = 61) were observed in wandoo trees. Carnaby's cockatoo are known to breed primarily in smooth-barked eucalypts such as wandoo and salmon gum Cale (2003); as such, the presence of the majority of hollows within this species suggests potentially significant breeding habitat. Eleven trees containing potentially suitable hollows (12.5%) were marri; this is the primary nesting tree used by forest red-tailed black cockatoo (Johnstone *et al.*, 2013b), although jarrah, blackbutt, and wandoo are also known nest tree species. Five potentially

suitable hollows were present in jarrah trees; however, it is recognised that this species in general provides only around ten percent of black cockatoo hollows (Johnstone *et al.*, 2010; Kirkby, 2018), as although jarrah produce more hollows, they are of significantly smaller size than in marri (Whitford, 2002). The importance of stag (dead) trees is also widely recognised for black cockatoos (DoEE, 2017; Johnstone *et al.*, 2011); eighteen dead stag trees with hollows were identified by the two field surveys.

Although the hollows present in the survey area are likely not currently occupied by black cockatoo for nesting, the importance of veteran and stag trees are recognised in their potential to develop hollows in the future, as it can take more than 200 years for a tree to develop suitable hollows (DoEE, 2017; Johnstone *et al.*, 2011). As discussed in Section 4.2.2, there are two confirmed breeding records within dead stags of Carnaby's cockatoo within Wundowie Reserve, less than five kilometres from the survey area (Wheatbelt Natural Resource Management, 2021). One of these records was within a tree stag of only 300 mm DBH, with a hollow of estimated three metres in depth. Saunders (1980) reported that black cockatoos will forage 1.4 km from the nest where food is abundant (7.1 km maximum; Coomaloo Creek) and 2.5 km from the nest where food is scarce (12.1 km maximum; Manmanning). It is therefore likely that birds breeding in adjacent nature reserves such as Wundowie Reserve will forage on vegetation within the survey area during the breeding period. As such, the local region is significant not only in relation to providing potential breeding hollows, but also providing supporting foraging resources as found within the survey area for breeding pairs. Other supporting habitat resources are found in reserves adjacent to the survey area such as Coates Reserve (90 ha) Kwolyinine Nature Reserve (570 ha), Woondowing Nature Reserve (3,100 ha), and Keaginine Nature Reserve (100 ha).

An overall summary of black cockatoo presence and potential habitat uses within the survey area is provided below in Table 4.18.

Table 4.18: Summary of species presence and usage within the survey area

Species	Species presence	Foraging	Roosting	Breeding
Carnaby's cockatoo	Confirmed via direct observation and foraging evidence (Bamford Consulting, 2015; Biologic, 2021)	-3.71 ha of High Quality -24.90 ha of Medium Quality -12.77 ha of Low Quality	None observed within the survey area (Bamford Consulting, 2015; Biologic, 2021) Mairinger Way roost (~ 600 m west) Bamford Consulting (2015) NORWUNR001; 500 m from the survey	1,003 trees of suitable DBH and species 88 (*n* = 30 from Biologic (2021), *n* = 58 from Bamford Consulting (2015)) hollows showing potentially suitable attributes.

Species	Species presence	Foraging	Roosting	Breeding
Baudin's cockatoo	Confirmed via direct observation (Bamford Consulting, 2015) and foraging evidence (Bamford Consulting, 2015; Biologic, 2021)	-3.71 ha of High Quality -24.90 ha of Medium Quality -8.93 ha of Low Quality	area (BirdLife Australia, 2021) NORBAKR001; approximately 1.2 km north-east of the survey area in the Bakers Hill Golf Club (BirdLife Australia, 2021)	Two confirmed breeding records within dead stags of Carnaby's cockatoo within Wundowie Reserve, less than 5 km from the survey area (Wheatbelt Natural Resource Management, 2021).
Forest red-tailed black cockatoo	Confirmed via direct observation and foraging evidence (Bamford Consulting, 2015; Biologic, 2021)	-3.71 ha of High Quality -24.90 ha of Medium Quality -8.93 ha of Low Quality	NORWUNR001; 500 m from the survey area (BirdLife Australia, 2021) MUNWOOR001; 5.1 km west of the survey area (BirdLife Australia, 2021)	

437000
438000
439000
440000
6480000

Colour code for tree species

- *Corymbia calophylla*
- *Eucalyptus gomphocephala*
- *Eucalyptus marginata*
- *Eucalyptus patens*
- *Eucalyptus rudis*
- *Eucalyptus wandoo*
- Introduced *Eucalyptus*
- Unknown (Alive)
- Unknown (Dead)

Potential Breeding Habitat (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Legend

- Current Survey Area
- Previous Survey Area

Current Study

- Hollows
- No hollows

Bamford (2015)

- Hollows
- No hollows

Potential Breeding Habitat (Current Survey)

- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees

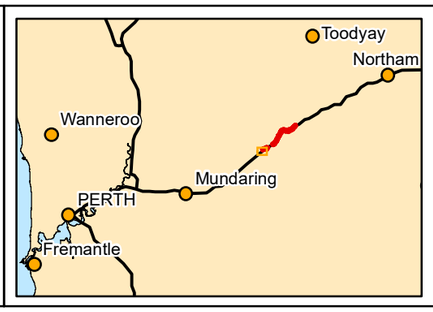
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.13a: Potential breeding habitat and trees in the Survey Area

440000 441000 442000

6482000

6481000

Colour code for tree species

- *Corymbia calophylla*
- *Eucalyptus gomphocephala*
- *Eucalyptus marginata*
- *Eucalyptus patens*
- *Eucalyptus rudis*
- *Eucalyptus wandoo*
- Introduced *Eucalyptus*
- Unknown (Alive)
- Unknown (Dead)

Potential Breeding Habitat (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Legend

- Current Survey Area
- Previous Survey Area

Current Study

- Hollows
- No hollows

Bamford (2015)

- Hollows
- No hollows

Potential Breeding Habitat (Current Survey)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

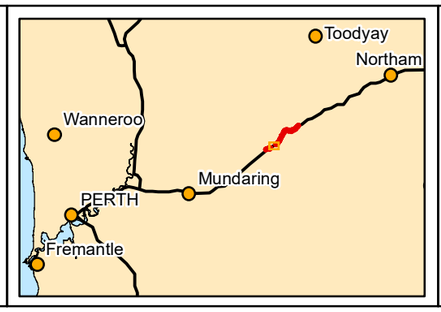
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.13b: Potential breeding habitat and trees in the Survey Area

441000 442000 443000

6483000

6482000

Colour code for tree species

- *Corymbia calophylla*
- *Eucalyptus gomphocephala*
- *Eucalyptus marginata*
- *Eucalyptus patens*
- *Eucalyptus rudis*
- *Eucalyptus wandoo*
- Introduced *Eucalyptus*
- Unknown (Alive)
- Unknown (Dead)

Potential Breeding Habitat (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Legend

- Current Survey Area
- Previous Survey Area

Current Study

- Hollows
- No hollows

Bamford (2015)

- Hollows
- No hollows

Potential Breeding Habitat (Current Survey)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees

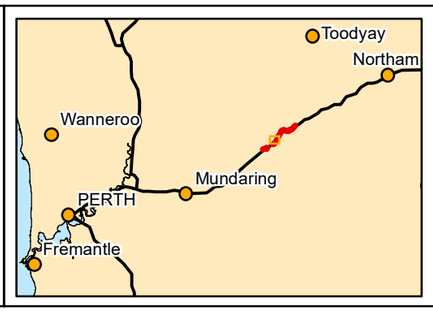
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.13c: Potential breeding habitat and trees in the Survey Area

442000 443000 444000 445000

6485000

6484000

Colour code for tree species

- *Corymbia calophylla*
- *Eucalyptus gomphocephala*
- *Eucalyptus marginata*
- *Eucalyptus patens*
- *Eucalyptus rudis*
- *Eucalyptus wandoo*
- Introduced *Eucalyptus*
- Unknown (Alive)
- Unknown (Dead)

Potential Breeding Habitat (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Legend

- Current Survey Area
- Previous Survey Area

Current Study

- Hollows
- No hollows

Bamford (2015)

- Hollows
- No hollows

Potential Breeding Habitat (Current Survey)

- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees

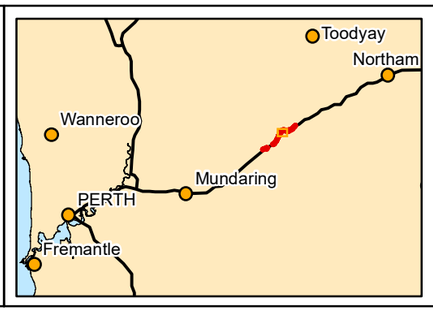
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.13d: Potential breeding habitat and trees in the Survey Area

444000 445000 446000 447000

6486000

6485000

Colour code for tree species

- *Corymbia calophylla*
- *Eucalyptus gomphocephala*
- *Eucalyptus marginata*
- *Eucalyptus patens*
- *Eucalyptus rudis*
- *Eucalyptus wandoo*
- Introduced *Eucalyptus*
- Unknown (Alive)
- Unknown (Dead)

Potential Breeding Habitat (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banskia
- Isolated trees

Legend

- Current Survey Area
- Previous Survey Area

Current Study

- Hollows
- No hollows

Bamford (2015)

- Hollows
- No hollows

Potential Breeding Habitat (Current Survey)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees

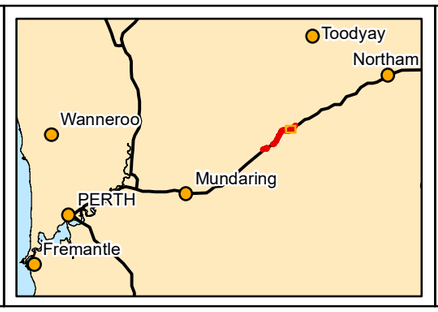
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

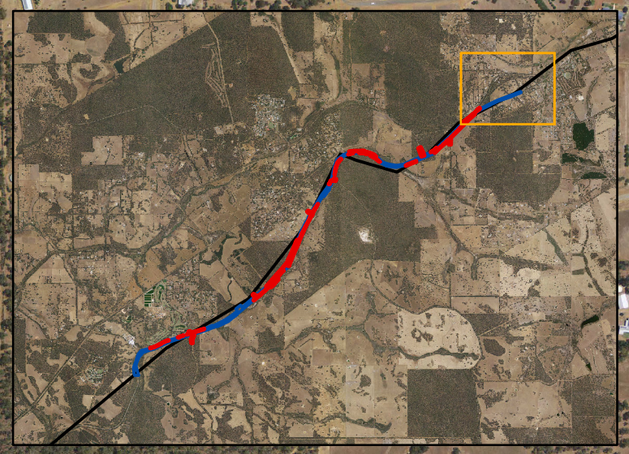
Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.13e: Potential breeding habitat and trees in the Survey Area

446000 447000 448000 449000

6487000

6486000



Colour code for tree species

- *Corymbia calophylla*
- *Eucalyptus gomphocephala*
- *Eucalyptus marginata*
- *Eucalyptus patens*
- *Eucalyptus rudis*
- *Eucalyptus wandoo*
- Introduced *Eucalyptus*
- Unknown (Alive)
- Unknown (Dead)

Potential Breeding Habitat (360, 2019)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees

Legend

- Current Survey Area
- Previous Survey Area

Current Study

- Hollows
- No hollows

Bamford (2015)

- Hollows
- No hollows

Potential Breeding Habitat (Current Survey)

- Corymbia and *Eucalyptus marginata* woodland
- *Eucalyptus wandoo* woodland over Banksia
- Isolated trees

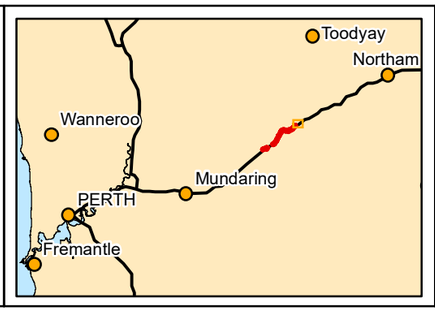
N

biologic Environmental Survey

Scale: 1:8,500

0 200 400 Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994 Created 15/07/2022



MAIN ROADS WA

Great Eastern Highway
Coates Gully (SLK 56.4-67.8)
Biological Survey

Figure 4.13f: Potential breeding habitat and trees in the Survey Area

5 CONCLUSION

A Detailed flora and vegetation survey, and Basic terrestrial vertebrate fauna survey, including Targeted black cockatoo habitat assessment, was undertaken at the GEH Coates Gully project, located along GEH between SLK 56.4 and 67.8. The surveys are a continuation of previous flora and fauna assessments undertaken within the survey area (360 Environmental, 2019; Bamford Consulting, 2015) due to modification of the design for Stage 2 of the project. Overall, the survey area is approximately 12.7 km in length, and covers 75.03 ha across both the previous and current survey areas. The flora survey was completed over three days on the 21st and 23rd of October, and the 20th of November 2020, whilst the fauna survey was undertaken over two days on the 24th and 30th of November 2020.

5.1 Flora and Vegetation

No significant limitations or constraints are considered to have affected the current flora survey.

The current field survey recorded 138 discrete vascular flora taxa, including 89 native taxa and 49 non-native taxa, representing 52 families and 103 genera. The combined total taxa recorded across the survey area totalled 223 flora taxa from 55 families and 149 genera.

The previous field survey conducted by 360 Environmental recorded three conservation significant flora taxa:

- *Lechenaultia hortii* (P2) – approximately 22 individuals from four point locations;
- *Tetratheca pilifera* (P3) – three individuals from three point locations; and
- *Grevillea olivacea* (P4) – two planted individuals from one point location – concluded by 360 Environmental (2019) to be planted, and therefore does not have any significance in relation to the survey area.

One flora taxon of conservation significance was located in the current survey area by the current survey, *Tetratheca pilifera* (P3) – 19 individuals from ten point locations. Of the records of this taxon recorded during the current survey; one individual from one point location was a previously known location from the previous survey area (checked for familiarity during the current survey), four individuals from four point locations are new locations within the previous survey area, three individuals from two point locations are new locations occurring outside both survey areas, and eleven individuals from three point locations are new locations recorded within the current survey area.

No new locations *Lechenaultia hortii* (P2) were recorded during the current survey. Upon review of the previous survey timing and taxonomic literature surrounding this taxon, it is considered that all of the previous 360 Environmental (2019) records of *Lechenaultia hortii* (P2) recorded represent the taxon *Lechenaultia biloba*, which is not a taxon of conservation significance.

A total of 49 non-native taxa were recorded from the survey area during the current field survey, with a combined total of 60. Of these 60 taxa, four are DPs (**Gomphocarpus fruticosus*, **Moraea flaccida,* **Zantedeschia aethiopica* and **Echium plantagineum*), one is a WoNS (**Genista linifolia* – ten individuals from one point location) and **Asparagus asparagoides* is both (39 individuals from 10 point locations).

Thirty-two vegetation types were described and delineated within the survey area, including five new vegetation types from the current survey:

- Bsq (0.23 ha / 0.3 %) – represented by a previously scraped gravel pit area now void of trees and dominated by *Banksia squarrosa*;
- EwAla (0.45 ha / 0.6 %) – Relatively open *Eucalyptus wandoo* woodland;
- *MaArc (0.15 ha / 0.2 %) – Planted Cape Lilac (**Melia azedarach*) trees over roadside weeds;
- MvTl (0.55 ha / 0.7 %) – Saline flat area next to a minor drainage line containing *Melaleuca viminea* shrubs over *Tecticornia lepidosperma* samphire shrubland; and
- Pasture (2.18 ha / 2.9 %) – Low mixed weedy grasses and herbs.

None of the vegetation mapped with the survey area is considered to be conservation significant.

The records of *Tetratheca pilifera* (P3) and the vegetation types that support this taxon (EwBsq and EwCc) recorded during this survey are not considered are to have any regional or local significance. Records of this taxon exist outside of the survey area in adjacent bushland (Woondowing Nature Reserve), while it is highly likely that additional occurrences of this taxon and supporting vegetation occur in other adjacent remnant bushland and Nature Reserves (Kwolyinine and Woondowing Nature Reserves).

Vegetation types ErMv*Ja, MvTl and Tsp*Ja are associated with the minor ephemeral drainage system Coates Gully. The vegetation types within this system were noted as supporting riparian and riverine vegetation, as well as supporting drainage line, drainage areas, saline flat and small wetland landforms all supporting intermittent ephemeral water-pooling. However, the condition of these vegetation types were noted as saline-affected and Degraded, with high covers of invasive weeds and dead trees.

The condition of the vegetation within the survey area ranged from Excellent to Completely Degraded, with the majority of the vegetation mapped as Excellent (10.76 ha, 14.3 %). The main disturbances observed in the survey area were mainly associated with Great Eastern Highway, included clearing, weeds and rubbish. A large portion of the survey area was mapped as cleared (34.0 ha, 45.3 %), mainly associated with roads, tracks and parking areas.

5.2 Vertebrate Fauna

Across the survey area, the habitats of greatest significance are the “woodland’ habitat types, particularly significant for black cockatoos with wandoo, marri, and jarrah recognized nesting trees for all three cockatoo species. These woodland habitats may also support other conservation significant species such as quenda, western brush wallaby, chuditch, and south-western brush-tailed phascogale. As the survey area is overlapped and in close proximity to two Regional Ecological Linkages, the habitats present are considered to extend and provide fauna corridors or connectivity to other habitats of value within the wider vicinity. Large patches of native vegetation are present in the surrounds of the survey area within the conservation reserves (e.g. Coates Reserve, Kwolyinine Nature Reserve, and Woondowing Nature Reserve), and the habitat provided supports connectivity for the dispersal and presence of the species listed above, particularly as habitat patches within the Shire of Northam are in general smaller than those found elsewhere in the Jarrah Forest (Zelinova, 2015). The remaining

habitats present in the survey area such as the Isolated Trees and associated understorey may assist with facilitating fauna movements through the landscape relative to the cleared areas common in the surrounding area. However, they are not uncommon or restricted to the survey area and provide little direct habitat for species of conservation significance.

Overall, a total of 51 vertebrate fauna species were recorded across the field surveys. Thirty-three conservation listed fauna species were identified as potentially occurring with the survey area during the desktop assessment. Of these, four species were recorded during the field surveys; Carnaby's cockatoo, Baudin's cockatoo, forest red-tailed black cockatoo, and quenda. An additional five species are considered Possible to occur in the survey area: chuditch, western brush wallaby, south-western brush-tailed phascogale, fork-tailed swift, and peregrine falcon. However, their core home ranges likely occur in the adjacent patches of remnant bush and the survey area is not a crucial contributing factor to their presence. Bird species such as the peregrine falcon and fork-tailed swift would flyover the survey area on occasion or for foraging purposes; however, it is unlikely to be utilised for roosting or breeding. The confirmed and potential mammalian species of conservation significance present (quenda (confirmed), chuditch, western brush wallaby, south-western brush-tailed phascogale), are most likely to utilise the survey area during dispersal events or for foraging on the outskirts of their home range; these species are not dependent on these habitat patches and would infrequently be recorded in them.

Black cockatoos from all three species were identified from the field surveys via direct observation and foraging evidence, with High and Medium Quality foraging habitat for black cockatoos identified across the woodland habitat types. Overall, the foraging habitat in the survey area is valued not only on a local level to support roosting and breeding sites, but also on a minor regional level as a "stepping-stone" between seasonal grounds. Potential night roosting habitat was identified within these same woodland habitat types, as well as within the Isolated Trees habitat. A night roost on Mairinger Way, approximately 500 m west of the survey area, was identified by Bamford Consulting (2015), with three other known night roosts identified within 5 km of the survey area. As such, the foraging habitat available within the survey area, although of small quantity in a regional context, is considered significant in its potential to support black cockatoo night roosting as the birds favour night roost sites within 1 - 6 km of quality foraging resources.

Following consolidation with the previous field survey, 963 potential breeding trees have been identified that are of suitable DBH and species to potentially support black cockatoo breeding. Of the 106 trees containing hollows, 88 hollows were considered to have some potential to support black cockatoo breeding in the future following consideration of attributes such as angle, tree species, presence of competitors, and potential depth. These hollow-bearing trees were concentrated in the Eucalypt-based habitat types; *Eucalyptus wandoo* woodland over *Banksia*, *Corymbia* and *Eucalyptus marginata* woodland, and Isolated Trees. Although no current breeding was identified within the survey area, there are two recent confirmed Carnaby's cockatoo breeding records within dead stags at Wundowie Reserve, less than five kilometres from the survey area (Wheatbelt Natural Resource Management, 2021). As such, the survey area and local region is significant not only in relation to supporting breeding through providing suitable hollows, but also providing supporting foraging resources for breeding pairs.

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7 APPENDICES

Appendix A – Conservation Codes

International Union for Conservation of Nature

Category	Definition
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a Threatened category in the near future.
Least Concern (LTC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that Threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a Threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, Threatened status may well be justified.
Not Evaluated (NE)	A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

Environment Protection and Biodiversity Conservation Act 1999

Category	Definition
Threatened Species	
Extinct (EX)	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.
Extinct in the Wild (EW)	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.
Critically Endangered (CR)	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.
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.
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.
Conservation Dependent (CD)	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: (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; or (iii) the plan of management is in force under a law of the Commonwealth of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Category	Definition
Threatened Ecological Communities (TEC)	
Critically Endangered	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	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	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 nor 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.
Migratory Species	
Migratory (MI)	Consists of species listed under the following International Conventions: Japan-Australia Migratory Bird Agreement (JAMBA); China-Australia Migratory Bird Agreement (CAMBA); Convention on the Conservation of Migratory Species of Wild animals (Bonn Convention)

Biodiversity Conservation Act 2016

Category	Definition
Threatened Flora Species	
Critically Endangered (CR)	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". Published under schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Critically Endangered flora.
Endangered (EN)	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". Published under schedule 2 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Endangered flora.
Vulnerable (VU)	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". Published under schedule 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Vulnerable flora.
Extinct (EX)	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 (Rare Flora) Notice 2018 for extinct flora.
Extinct in the Wild (EW)	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 flora species listed as extinct in the wild.
Threatened Ecological Communities (TEC)	
Critically Endangered (CR)	An ecological community is eligible for listing in the category of Critically Endangered ecological community at a particular time if, at that time — (a) it is facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines; and (b) listing in that category is otherwise in accordance with the ministerial guidelines.
Endangered (EN)	An ecological community is eligible for listing in the category of Endangered ecological community at a particular time if, at that time — (a) it is not a Critically Endangered ecological community; and (b) it is facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future, as determined in accordance with criteria set out in the ministerial guidelines; and (c) listing in that category is otherwise in accordance with the ministerial guidelines.

Category	Definition
Vulnerable (VU)	An ecological community is eligible for listing in the category of Vulnerable ecological community at a particular time if, at that time — (a) it is not a Critically Endangered ecological community or an Endangered ecological community; and (b) it is facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines; and (c) listing in that category is otherwise in accordance with the ministerial guidelines.
Presumed Totally Destroyed	An ecological community is eligible for listing as a Presumed Totally Destroyed ecological community at a particular time if, at that time — a) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or b) All occurrences recorded within the last 50 years have since been destroyed
Threatened Fauna Species	
Critically Endangered (CR)	Rare or likely to become extinct, as *Critically Endangered* fauna.
Endangered (EN)	Rare or likely to become extinct, as *Endangered* fauna.
Vulnerable (VU)	Rare or likely to become extinct, as *Vulnerable* fauna.
Extinct (EX)	Being fauna that is presumed to be extinct.
Migratory (MI)	Birds that are subject to international agreements relating to the protection of migratory birds.
Conservation Dependent (CD)	Special conservation need being species dependent on ongoing conservation intervention.
Other Specially Protected Species (OS)	Species otherwise in need of special protection to ensure their conservation.

Department of Biodiversity, Conservation and Attractions Priority Definitions

Category	Definition
Priority Flora and Fauna Species	
Priority 1 (P1)	**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.
Priority 2 (P2)	**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.
Priority 3 (P3)	**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 requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4 (P4)	**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.

Category	Definition
Priority Ecological Communities (PEC)	
Priority 1 (P1)	**Poorly-known ecological communities** Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2 (P2)	**Poorly-known Ecological Communities** Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3 (P3)	**Poorly-known Ecological Communities** (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Category	Definition
Priority 4 (P4)	**Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the Threatened list. These communities require regular monitoring.** (i) Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category. (iii) Ecological communities that have been removed from the list of Threatened communities during the past five years.

Appendix B – Vegetation Condition Rating Scale

Vegetation Condition Scale adapted from EPA (2016b)

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

Appendix C – Vegetation Structural Definition

NVIS Vegetation Structural Classifications

Cover Characteristics							
Foliage cover *	70-100	30-70	10-30	<10	≈0	0-5	unknown
Crown cover **	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
% Crown cover ***	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
Cover code	d	c	i	r	bi	bc	unknown

Growth Form	Height ranges (m)	Structural Formation Classes						
Tree, palm	>30 Tall	Closed forest	Open forest	Woodland	Open woodland	Isolated trees	Isolated clumps of trees	Trees
	10-30 Mid							
	<10 Low							
Tree mallee	10-30 Tall	Closed mallee forest	Open mallee forest	Mallee woodland	Open mallee woodland	Isolated mallee trees	Isolated clumps of mallee trees	Mallee trees
	<10 Mid							
	<3 Low							
Shrub, cycad, grass-tree, fern	>2 Tall	Closed shrubland	Shrubland	Open shrubland	Sparse shrubland	Isolated shrubs	Isolated clumps of shrubs	Shrubs
	1-2 Mid							
	<1 Low							
Mallee shrub	10-30 Tall	Closed mallee shrubland	Mallee shrubland	Open mallee shrubland	Sparse mallee shrubland	Isolated mallee shrubs	Isolated clumps of mallee shrubs	Mallee shrubs
	<10 Mid							
	<3 Low							

Growth Form	Height ranges (m)	Structural Formation Classes						
Heath shrub	>2 tall 1-2 Mid <1 Low	Closed heathland	Heathland	Open heathland	Sparse heathland	Isolated heath shrubs	Isolated clumps of heath shrubs	Heath shrubs
Chenopod shrub	>2 tall 1-2 Mid <1 Low	Closed chenopod shrubland	Chenopod shrubland	Open chenopod shrubland	Sparse chenopod shrubland	Isolated chenopod shrubs	Isolated clumps of chenopod shrubs	Chenopod shrubs
Samphire shrub	>0.5 low <0.5 Low	Closed samphire shrubland	Samphire shrubland	Open samphire shrubland	Sparse samphire shrubland	Isolated samphire shrubs	Isolated clumps of samphire shrubs	Samphire shrubs
Hummock grass	>2 tall <2 Tall	Closed hummock grassland	Hummock grassland	Open hummock grassland	Sparse hummock grassland	Isolated hummock grasses	Isolated clumps of hummock grasses	Hummock grasses
Tussock grass	>0.5 mid <0.5 Low	Closed tussock grassland	Tussock grassland	Open tussock grassland	Sparse tussock grassland	Isolated tussock grasses	Isolated clumps of tussock grasses	Tussock grasses
Other grass	>0.5 mid <0.5 Low	Closed grassland	Grassland	Open grassland	Sparse grassland	Isolated grasses	Isolated clumps of grasses	Other grasses
Sedge	>0.5 mid <0.5 Low	Closed sedgeland	Sedgeland	Open sedgeland	Sparse sedgeland	Isolated sedges	Isolated clumps of sedges	Sedges
Rush	>0.5 mid <0.5 Low	Closed rushland	Rushland	Open rushland	Sparse rushland	Isolated rushes	Isolated clumps of rushes	Rushes
Forb	>0.5 mid <0.5 Low	Closed forbland	Forbland	Open forbland	Sparse forbland	Isolated forbs	Isolated clumps of forbs	Forbs

Growth Form	Height ranges (m)	Structural Formation Classes						
Fern	>2 tall 1-2 Tall <1 Low	Closed fernland	Fernland	Open fernland	Sparse fernland	Isolated ferns	Isolated clumpsOf ferns	Ferns
Bryophyte	<0.5	Closed bryophyte land	Bryophyte land	Open bryophyte land	Sparse bryophyte land	Isolated bryophytes	Isolated clumps of bryophytes	Bryophytes
Lichen	<0.5	Closed lichenland	Lichenland	Open lichenland	Sparse lichenland	Isolated lichens	Isolated clumps of lichens	Lichens
Vine	>30 tall 10-30 Med <10 Low	Closed vineland	Vineland	Open vineland	Sparse vineland	Isolated vines	Isolated clumps of vines	Vines
Aquatic	<1 tall 0-0.5 Low	Closed aquatic bed	Aquatic bed	Open aquatic bed	Sparse aquatics	Isolated aquatics	Isolated clumps of aquatics	Aquatics
Seagrass	<1 tall 0-0.5 Low	Closed seagrass bed	Seagrass bed	Open seagrass bed	Sparse seagrass bed	Isolated seagrasses	Isolated clumps of seagrasses	Seagrasses

From: NVIS Structural Formation Terminology (Australian Vegetation Attribute Manual Version 7.0 November 2017 https://www.environment.gov.au/land/publications/australian-vegetation-attribute-manual-version-7)

* Foliage Cover is defined for each stratum as 'the proportion of the ground, which would be shaded if sunshine came from directly overhead'. It includes branches and leaves and is obtained by multiplying Crown Cover with Crown type (Hnatiuk *et al.*, 2009). It is applied to a stratum in a plot, rather than an individual crown, with the NVIS measure for a vegetation type ideally being a summary of several plots. Foliage Projective Cover, which considers only the vertical projection of photosynthetic components (generally leaves), can be measured by line interception methods for tree, shrub and ground layer vegetation (Specht & Specht, 1999).

** Crown Cover (canopy cover) as per Hnatiuk *et al.* (2009). Although relationships between this attribute and Foliage Cover are dependent on season, species, species age etc., the crown cover category classes have been adopted as the defining measure.

*** The percentage cover is defined as the percentage of a strictly defined plot area, covered by vegetation. This can be an estimate and is a less precise measure than using, for example, a point intercept transect method on ground layer, or overstorey vegetative cover. That is, for precisely measured values (e.g. crown densitometer or point intercept transects) the value measured would be 'foliage' cover. Where less precise or qualitative measures are used these will most probably be recorded as 'percentage' cover

Appendix D – Flora database search results

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Alismataceae	*Sagittaria platyphylla*					●				Y
Amaranthaceae	*Alternanthera nodiflora*	●	●							
	Ptilotus declinatus	●	●							
	Ptilotus drummondii	●	●							
	Ptilotus manglesii	●	●							
	Ptilotus polystachyus		●							
Apiaceae	*Actinotus leucocephalus*	●	●							
	Eryngium pinnatifidum	●	●							
	Homalosciadium homalocarpum	●	●							
	Pentapeltis peltigera	●	●							
	Xanthosia atkinsoniana	●	●							
	Xanthosia candida	●	●							
	Xanthosia ciliata	●	●							
	Xanthosia rotundifolia		●							
Apocynaceae	*Calotropis procera*					●				Y
	Cryptostegia madagascariensis					●				Y
	Gomphocarpus fruticosus					●				Y
Araceae	*Pistia stratiotes*					●				Y
	Zantedeschia aethiopica					●				Y
Araliaceae	*Hydrocotyle callicarpa*	●	●							
	Hydrocotyle ranunculoides					●				Y
	Hydrocotyle verticillata		●							
	Trachymene cyanopetala	●	●							
	Trachymene pilosa	●	●							
Asparagaceae	*Asparagus asparagoides*				●	●				Y
	Asparagus officinalis	●	●							Y
	Chamaescilla corymbosa		●							
	Laxmannia sessiliflora		●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Laxmannia sessiliflora subsp. *australis*	●								
	Lomandra hermaphrodita	●	●							
	Lomandra micrantha		●							
	Lomandra micrantha subsp. *micrantha*	●								
	Lomandra odora		●							
	Sowerbaea laxiflora		●							
	Sowerbaea multicaulis			●			P4			
	Thysanotus cymosus	●		●			P3			
	Thysanotus thyrsoideus	●	●							
	Thysanotus triandrus	●	●							
Asteraceae	*Actinobole uliginosum*	●	●							
	Asteridea gracilis			●			P3			
	Asteridea pulverulenta		●							
	Brachyscome glandulosa	●	●							
	Brachyscome iberidifolia	●	●							
	Centipeda cunninghamii		●							
	Chondrilla juncea					●				Y
	Chrysanthemoides monilifera				●					Y
	Chrysanthemoides monilifera subsp. *monilifera*				●					Y
	Craspedia variabilis	●	●							
	Crepis foetida		●							Y
	Crepis foetida subsp. *foetida*	●								Y
	Gnephosis tenuissima	●	●							
	Hyalosperma cotula	●	●							
	Hyalosperma simplex		●							
	Hyalosperma simplex subsp. *simplex*	●								
	Lagenophora huegelii	●	●							
	Millotia myosotidifolia	●	●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Millotia tenuifolia		●							
	Millotia tenuifolia var. *tenuifolia*	●								
	Myriocephalus occidentalis		●							
	Olearia axillaris	●	●							
	Olearia paucidentata	●	●							
	Onopordum acaulon					●				Y
	Pithocarpa cordata		●							
	Pithocarpa pulchella		●							
	Podolepis aristata		●							
	Podolepis aristata subsp. *aristata*	●								
	Podolepis gracilis	●	●							
	Podolepis lessonii		●							
	Podolepis nutans		●							
	Pogonolepis stricta	●	●							
	Pterochaeta paniculata	●	●							
	Rhodanthe corymbosa	●	●							
	Rhodanthe polycephala		●							
	Senecio gilbertii		●	●			P1			
	Senecio pinnatifolius	●	●							
	Siloxerus filifolius	●	●							
	Siloxerus humifusus	●	●							
	Siloxerus multiflorus	●	●							
	Silybum marianum					●				Y
	Sonchus asper	●	●							Y
	Trichocline spathulata	●	●							
	Waitzia podolepis	●	●							
	Waitzia suaveolens		●							
	Xanthium spinosum					●				Y

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Xanthium strumarium					●				Y
Boraginaceae	*Echium plantagineum*					●				Y
	Halgania anagalloides	●	●							
	Halgania cyanea		●							
	Heliotropium europaeum	●	●							Y
Brassicaceae	*Brassica x napus*	●	●							Y
	Diplotaxis muralis	●	●							Y
	Stenopetalum robustum		●							
Cactaceae	*Austrocylindropuntia cylindrica*					●				Y
	Austrocylindropuntia subulata					●				Y
	Cylindropuntia fulgida					●				Y
	Cylindropuntia imbricata					●				Y
	Cylindropuntia kleiniae					●				Y
	Cylindropuntia pallida					●				Y
	Cylindropuntia tunicata					●				Y
	Opuntia elata					●				Y
	Opuntia elatior					●				Y
	Opuntia engelmannii					●				Y
	Opuntia ficus-indica					●				Y
	Opuntia microdasys					●				Y
	Opuntia monacantha					●				Y
	Opuntia polyacantha					●				Y
	Opuntia puberula					●				Y
	Opuntia stricta					●				Y
	Opuntia tomentosa					●				Y
Campanulaceae	*Isotoma hypocrateriformis*	●	●							
	Isotoma scapigera	●	●							
	Lobelia anceps	●	●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Lobelia heterophylla		●							
	Lobelia rhombifolia		●							
	Monopsis debilis		●							Y
	Monopsis debilis var. *depressa*	●								Y
Caprifoliaceae	*Centranthus macrosiphon*	●	●							Y
Caryophyllaceae	*Cerastium glomeratum*	●	●							Y
	Polycarpon tetraphyllum	●	●							Y
	Spergula arvensis	●	●							Y
Casuarinaceae	*Allocasuarina corniculata*		●							
	Allocasuarina humilis		●							
Celastraceae	*Tripterococcus brunonis*		●							
Centrolepidaceae	*Aphelia brizula*	●	●							
	Aphelia cyperoides		●							
	Centrolepis aristata		●							
	Centrolepis polygyna	●	●							
Cladoniaceae	*Cladonia cervicornis*		●							
	Cladonia tessellata		●							
Colchicaceae	*Wurmbea dioica*		●							
	Wurmbea dioica subsp. *alba*	●								
Crassulaceae	*Crassula alata*	●	●							Y
	Crassula colorata		●							
Cucurbitaceae	*Citrullus amarus*	●	●							Y
	Cucumis myriocarpus		●							Y
	Cucumis myriocarpus subsp. *myriocarpus*	●								Y
Cyperaceae	*Baumea arthrophylla*	●	●							
	Baumea laxa	●	●							
	Chorizandra enodis	●	●							
	Cyathochaeta avenacea	●	●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Cyperus tenellus	●								Y
	Eleocharis keigheryi				●		T	VUL		
	Gahnia australis	●	●							
	Isolepis cyperoides	●	●							
	Isolepis levynsiana		●							Y
	Isolepis marginata	●	●							
	Lepidosperma drummondii		●							
	Lepidosperma longitudinale	●	●							
	Lepidosperma obtusum		●							
	Lepidosperma scabrum	●								
	Lepidosperma sp.	●								
	Mesomelaena tetragona		●							
	Schoenus lanatus		●							
	Schoenus nanus	●	●							
	Schoenus variicellae	●	●							
	Tetraria octandra	●	●							
Dilleniaceae	*Hibbertia aurea*		●							
	Hibbertia commutata	●	●							
	Hibbertia diamesogenos	●	●							
	Hibbertia gracilipes		●							
	Hibbertia huegelii	●	●							
	Hibbertia hypericoides		●							
	Hibbertia hypericoides subsp. *hypericoides*	●								
	Hibbertia lasiopus	●	●							
	Hibbertia montana	●								
	Hibbertia stellaris	●	●							
Droseraceae	*Drosera albonotata*			●			P2			
	Drosera bulbosa		●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Drosera collina	●	●							
	Drosera erythrorhiza	●	●							
	Drosera gigantea	●	●							
	Drosera glanduligera		●							
	Drosera hyperostigma		●							
	Drosera macrantha		●							
	Drosera menziesii	●	●							
	Drosera stolonifera	●	●							
	Drosera stricticaulis	●	●							
Elaeocarpaceae	*Tetratheca confertifolia*	●	●							
	Tetratheca hirsuta	●	●							
	Tetratheca hirsuta subsp. *hirsuta*	●								
	Tetratheca nuda	●	●							
	Tetratheca pilifera	●	●	●			P3			
Ericaceae	*Leucopogon capitellatus*		●							
	Leucopogon nutans	●	●							
	Leucopogon propinquus	●	●							
	Leucopogon sprengelioides		●							
	Styphelia pallida	●	●							
	Styphelia prostrata		●							
	Styphelia tenuiflora	●	●							
	Styphelia compacta	●	●							
	Styphelia discolor	●	●							
Euphorbiaceae	*Amperea micrantha*			●			P2			
	Bertya virgata		●							
	Jatropha gossypiifolia					●				Y
	Monotaxis grandiflora		●							
Fabaceae	*Acacia alata*		●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Acacia aphylla		●	●			T			
	Acacia applanata	●	●							
	Acacia baileyana	●	●							Y
	Acacia barbinervis		●							
	Acacia campylophylla			●			P3			
	Acacia celastrifolia	●	●							
	Acacia cochlearis		●							
	Acacia drummondii		●							
	Acacia drummondii subsp. *drummondii*	●								
	Acacia drummondii subsp. *elegans*	●								
	Acacia extensa		●							
	Acacia huegelii		●							
	Acacia lasiocarpa		●							
	Acacia lasiocarpa var. *sedifolia*	●								
	Acacia latipes		●							
	Acacia latipes subsp. *latipes*	●								
	Acacia microbotrya		●							
	Acacia nervosa	●	●							
	Acacia preissiana		●							
	Acacia pulchella		●							
	Acacia pulchella var. *glaberrima*	●								
	Acacia pulchella var. *pulchella*	●								
	Acacia saligna		●							
	Acacia saligna subsp. *lindleyi*	●								
	Acacia sp.	●								
	Acacia stenoptera	●	●							
	Acacia teretifolia		●							
	Acacia urophylla	●	●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Acacia willdenowiana	●	●							
	Alhagi maurorum					●				Y
	Bossiaea eriocarpa	●	●							
	Bossiaea ornata	●	●							
	Chorizema aciculare		●							
	Chorizema dicksonii	●	●							
	Daviesia cordata	●	●							
	Daviesia decipiens		●							
	Daviesia decurrens		●							
	Daviesia decurrens subsp. *decurrens*	●								
	Daviesia hakeoides		●							
	Daviesia hakeoides subsp. *hakeoides*	●								
	Daviesia hakeoides subsp. *subnuda*	●								
	Daviesia horrida	●	●							
	Daviesia incrassata		●							
	Daviesia longifolia	●	●							
	Daviesia nudiflora subsp. *drummondii*			●			P3			
	Daviesia oxylobium	●	●	●			P4			
	Daviesia physodes	●	●							
	Daviesia preissii	●	●							
	Daviesia rhombifolia	●	●							
	Dillwynia cinerascens		●							
	Dillwynia laxiflora		●							
	Gastrolobium brownii		●							
	Gastrolobium calycinum	●	●							
	Gastrolobium capitatum	●	●							
	Gastrolobium hookeri	●	●							
	Gastrolobium reticulatum		●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Gastrolobium spinosum	●	●							
	Gastrolobium villosum	●	●							
	Genista sp. X *Genista monspessulana*				●					Y
	Gompholobium knightianum		●							
	Gompholobium marginatum	●	●							
	Gompholobium polymorphum	●	●							
	Gompholobium shuttleworthii	●	●							
	Hovea chorizemifolia	●	●							
	Hovea trisperma	●	●							
	Isotropis cuneifolia		●							
	Isotropis cuneifolia subsp. *cuneifolia*	●								
	Jacksonia epiphyllum		●							
	Jacksonia furcellata	●	●							
	Jacksonia restioides	●	●							
	Kennedia coccinea	●	●							
	Kennedia prostrata	●	●							
	Kennedia stirlingii	●	●							
	Labichea punctata		●							
	Melilotus indicus	●	●							Y
	Mirbelia dilatata		●							
	Mirbelia spinosa		●							
	Parkinsonia aculeata					●				Y
	Prosopis glandulosa x *Prosopis velutina*					●				Y
	Senna alata					●				Y
	Senna obtusifolia					●				Y
	Sphaerolobium linophyllum		●							
	Sphaerolobium macranthum		●							
	Sphaerolobium medium	●	●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Templetonia drummondii	●	●							
	Trifolium subterraneum	●	●							Y
	Ulex europaeus					●				Y
	Viminaria juncea	●	●							
Geraniaceae	*Erodium botrys*		●							Y
Goodeniaceae	*Dampiera alata*	●	●							
	Dampiera lavandulacea	●	●							
	Dampiera linearis	●	●							
	Goodenia coerulea	●	●							
	Goodenia fasciculata	●	●							
	Goodenia micrantha	●	●							
	Goodenia pulchella	●	●							
	Lechenaultia biloba	●	●							
	Lechenaultia expansa	●	●							
	Lechenaultia laricina		●				T			
	Scaevola calliptera	●	●							
	Scaevola glandulifera	●	●							
	Scaevola lanceolata	●	●							
	Scaevola pilosa	●	●							
	Scaevola platyphylla	●	●							
	Scaevola repens		●							
	Velleia trinervis	●	●							
	Verreauxia reinwardtii		●							
Gyrostemonaceae	*Gyrostemon ramulosus*	●	●							
Haemodoraceae	*Anigozanthos humilis*		●							
	Anigozanthos humilis subsp. *chrysanthus*			●			P4			
	Anigozanthos manglesii		●							
	Anigozanthos manglesii subsp. *manglesii*	●								

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Conostylis aculeata		●							
	Conostylis aculeata subsp. *bromelioides*	●								
	Conostylis caricina		●							
	Conostylis caricina subsp. *caricina*	●								
	Conostylis setigera	●	●							
	Conostylis setosa	●	●							
	Haemodorum laxum	●								
	Haemodorum paniculatum	●	●							
	Haemodorum simplex	●	●							
	Tribonanthes longipetala	●	●							
Haloragaceae	*Gonocarpus cordiger*		●							
	Meionectes tenuifolia	●	●	●			P3			
	Myriophyllum tillaeoides	●	●							
Hemerocallidaceae	*Agrostocrinum hirsutum*	●	●							
	Arnocrinum preissii	●	●							
	Stypandra glauca	●	●							
	Tricoryne elatior		●							
	Tricoryne humilis		●							
Iridaceae	*Babiana angustifolia*	●								Y
	Ixia cultivar		●							
	Ixia maculata	●								Y
	Moraea flaccida					●				Y
	Moraea miniata					●				Y
	Orthrosanthus laxus		●							
	Orthrosanthus laxus var. *gramineus*	●								
	Patersonia juncea	●	●							
	Patersonia occidentalis		●							
Juncaceae	*Juncus bufonius*	●	●							Y

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Juncus capitatus	●	●							Y
	Juncus meianthus			●			P3			
Lamiaceae	*Hemiandra pungens*	●	●							
	Hemigenia incana	●	●							
	Hemigenia parviflora	●	●							
	Hemigenia platyphylla			●			P4			
	Hemigenia scabra		●							
	Lachnostachys ferruginea	●	●							
	Salvia verbenaca		●							Y
	Stachys arvensis	●	●				P4			
Lentibulariaceae	*Utricularia multifida*	●	●							
Linaceae	*Linum marginale*		●							
Loganiaceae	*Phyllangium divergens*		●							
Loranthaceae	*Nuytsia floribunda*		●							
Malvaceae	*Lasiopetalum glutinosum*		●							
	Lasiopetalum glutinosum subsp. *latifolium*	●								
	Lasiopetalum trichanthera			●			P2			
	Thomasia foliosa	●	●							
	Thomasia grandiflora		●							
Myrtaceae	*Astartea fascicularis*		●							
	Astartea scoparia		●							
	Babingtonia camphorosmae	●	●							
	Beaufortia purpurea			●			P3			
	Calothamnus quadrifidus		●							
	Calothamnus quadrifidus subsp. *quadrifidus*	●								
	Calothamnus sanguineus		●							
	Calytrix angulata		●							
	Calytrix depressa	●	●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Calytrix glutinosa	●	●							
	Calytrix variabilis	●	●							
	Corymbia calophylla		●							
	Darwinia citriodora		●							
	Eremaea blackwelliana			●			P4			
	Eucalyptus accedens	●	●							
	Eucalyptus drummondii		●							
	Eucalyptus loxophleba x *wandoo*			●			P4			
	Eucalyptus marginata		●							
	Eucalyptus marginata subsp. *thalassica*	●								
	Eucalyptus patens	●	●							
	Eucalyptus rigidula		●							
	Eucalyptus rudis		●							
	Eucalyptus wandoo		●							
	Eucalyptus wandoo subsp. *wandoo*	●								
	Hypocalymma angustifolium		●							
	Leptospermum erubescens	●	●							
	Melaleuca aspalathoides	●	●							
	Melaleuca leiopyxis		●							
	Melaleuca rhaphiophylla	●	●							
	Melaleuca viminea		●							
	Verticordia citrella			●			P2			
	Verticordia fimbrilepis subsp. *fimbrilepis*				●		T	EN		
	Verticordia grandiflora		●							
	Verticordia huegelii		●							
	Verticordia huegelii var. *huegelii*	●								
	Verticordia huegelii var. *tridens*			●			P3			
	Verticordia insignis		●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Verticordia insignis subsp. *insignis*	●								
	Verticordia pennigera	●	●							
	Verticordia plumosa		●							
	Verticordia plumosa var. *plumosa*	●								
	Verticordia serrata var. *linearis*			●			P3			
Orchidaceae	*Caladenia deformis*		●							
	Caladenia filamentosa		●							
	Caladenia flava		●							
	Caladenia gemmata		●							
	Caladenia hirta		●							
	Caladenia huegelii				●		T	EN		
	Caladenia integra			●			P4			
	Caladenia longicauda		●							
	Caladenia longiclavata		●							
	Caladenia patersoni		●							
	Caladenia reptans		●							
	Caladenia reptans subsp. *reptans*	●								
	Caladenia roei		●							
	Caladenia sericea		●							
	Caladenia splendens		●							
	Cyanicula gemmata	●	●							
	Cyanicula ixioides		●							
	Cyanicula ixioides subsp. *candida*			●			P2			
	Cyanicula ixioides subsp. *ixioides*	●		●			P4			
	Cyanicula sericea		●							
	Diplodium scabrum		●							
	Diuris carinata		●							
	Diuris laxiflora		●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Diuris longifolia	●	●							
	Diuris micrantha				●		T	VUL		
	Diuris purdiei				●		T	EN		
	Diuris setacea		●							
	Drakaea gracilis	●	●							
	Elythranthera brunonis		●							
	Elythranthera emarginata	●	●							
	Eriochilus dilatatus		●							
	Leptoceras menziesii	●	●							
	Pheladenia deformis	●	●							
	Prasophyllum elatum	●	●							
	Prasophyllum gracile	●	●							
	Prasophyllum hians	●	●							
	Prasophyllum ovale		●							
	Prasophyllum plumiforme		●							
	Prasophyllum regium		●							
	Prasophyllum ringens		●							
	Pterostylis atrosanguinea		●							
	Pterostylis recurva		●							
	Pterostylis vittata		●							
	Pyrorchis nigricans		●							
	Thelymitra antennifera		●							
	Thelymitra arenaria		●							
	Thelymitra crinita		●							
	Thelymitra dedmaniarum		●		●		T	EN		
	Thelymitra nuda		●							
	Thelymitra stellata				●		T	EN		
	Urochilus vittatus		●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Orobanchaceae	*Parentucellia latifolia*		●							Y
Oxalidaceae	*Oxalis purpurea*		●							Y
Papaveraceae	*Fumaria bastardii*	●	●							Y
	Papaver rhoeas	●	●							Y
Philydraceae	*Philydrella drummondii*		●							
	Philydrella pygmaea		●							
Phyllanthaceae	*Phyllanthus calycinus*	●	●							
	Poranthera ericoides		●							
	Poranthera huegelii		●							
Pinaceae	*Pinus radiata*				●					Y
Pittosporaceae	*Billardiera fraseri*	●	●							
	Billardiera fusiformis	●	●							
	Billardiera heterophylla		●							
	Marianthus bicolor	●	●							
	Marianthus candidus		●							
	Marianthus coeruleopunctatus	●	●							
Plantaginaceae	*Gratiola pubescens*	●	●							
	Kickxia elatine		●							Y
	Kickxia elatine subsp. *crinita*	●								Y
Plumbaginaceae	*Limonium sinuatum*		●							Y
Poaceae	*Aira cupaniana*	●	●							Y
	Amphipogon debilis		●							
	Amphipogon strictus		●							
	Austrostipa elegantissima	●	●							
	Briza minor		●							Y
	Bromus hordeaceus	●	●							Y
	Chloris truncata	●	●							
	Dichelachne crinita		●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Dichelachne micrantha		●							
	Ehrharta longiflora		●							Y
	Eragrostis curvula	●	●							Y
	Eragrostis elongata	●	●							
	Eriachne ovata	●	●							
	Holcus setiger	●	●							Y
	Microlaena stipoides		●							
	Neurachne alopecuroidea		●							
	Poa porphyroclados		●							
	Rytidosperma acerosum		●							
	Rytidosperma pilosum		●							
	Sorghum x *drummondii*	●	●							Y
	Themeda triandra		●							
	Vulpia myuros		●							Y
	Vulpia myuros forma *megalura*	●								Y
Polygalaceae	*Comesperma calymega*		●							
	Comesperma ciliatum	●	●							
	Comesperma volubile		●							
Polygonaceae	*Persicaria prostrata*	●	●							
Potamogetonaceae	*Potamogeton ochreatus*	●	●							
Proteaceae	*Adenanthos barbiger*	●	●							
	Adenanthos cygnorum		●							
	Adenanthos cygnorum subsp. *chamaephyton*	●		●			P3			
	Banksia armata		●							
	Banksia armata var. *armata*	●								
	Banksia bipinnatifida		●							
	Banksia bipinnatifida subsp. *bipinnatifida*	●								
	Banksia dallanneyi		●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Banksia dallanneyi subsp. *dallanneyi* var. *mellicula*	●								
	Banksia fraseri		●							
	Banksia fraseri var. *fraseri*	●								
	Banksia grandis		●							
	Banksia nivea subsp. Morangup (M. Pieroni 94/2)			●			P2			
	Banksia sessilis		●							
	Banksia squarrosa		●							
	Banksia squarrosa subsp. *squarrosa*	●								
	Banksia stuposa	●	●							
	Conospermum densiflorum		●							
	Conospermum densiflorum subsp. *densiflorum*	●								
	Conospermum stoechadis		●							
	Conospermum stoechadis subsp. *stoechadis*	●								
	Grevillea bipinnatifida		●							
	Grevillea bipinnatifida subsp. *bipinnatifida*	●								
	Grevillea candolleana			●			P2			
	Grevillea manglesii		●							
	Grevillea manglesii subsp. *manglesii*	●								
	Grevillea paniculata		●							
	Grevillea pilulifera	●	●							
	Grevillea pimeleoides	●	●	●			P4			
	Grevillea quercifolia	●	●							
	Grevillea synapheae		●							
	Grevillea synapheae subsp. *synapheae*	●								
	Grevillea wilsonii	●	●							
	Hakea cristata	●	●							
	Hakea gilbertii		●							
	Hakea incrassata	●	●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Hakea lissocarpha	●	●							
	Hakea prostrata	●	●							
	Hakea stenocarpa		●							
	Hakea undulata		●							
	Isopogon dubius	●	●							
	Lambertia multiflora		●							
	Lambertia multiflora var. *darlingensis*	●								
	Persoonia angustiflora	●	●							
	Persoonia elliptica		●							
	Petrophile striata	●	●							
	Synaphea decorticans	●	●							
	Synaphea diabolica			●			P3			
	Synaphea gracillima	●	●							
Ranunculaceae	*Clematis pubescens*		●							
Restionaceae	*Chordifex chaunocoleus*			●			P4			
	Desmocladus asper		●							
	Leptocarpus coangustatus	●	●							
	Leptocarpus laxus	●	●							
	Loxocarya cinerea		●							
	Loxocarya striata	●	●							
Rhamnaceae	*Cryptandra arbutiflora*		●							
	Cryptandra arbutiflora var. *arbutiflora*	●								
	Cryptandra nutans	●	●							
	Stenanthemum coronatum	●	●							
	Trymalium angustifolium	●	●							
	Trymalium ledifolium		●							
	Trymalium ledifolium var. *rosmarinifolium*	●								
	Trymalium odoratissimum		●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Trymalium odoratissimum subsp. *odoratissimum*	●								
	Ziziphus mauritiana					●				Y
Rosaceae	*Rubus anglocandicans*					●				Y
	Rubus fruticosus aggregate				●					Y
	Rubus laudatus					●				Y
	Rubus rugosus					●				Y
	Rubus ulmifolius					●				Y
Rubiaceae	*Galium aparine*					●				Y
	Galium divaricatum	●	●							Y
	Galium spurium					●				Y
	Opercularia apiciflora		●							
	Opercularia echinocephala		●							
Rutaceae	*Asterolasia grandiflora*	●		●			P4			
	Boronia ovata		●							
	Boronia ramosa		●							
	Boronia spathulata	●	●							
	Diplolaena andrewsii				●		T	EN		
	Philotheca spicata	●	●							
Salviniaceae	*Salvinia molesta*				●					Y
Santalaceae	*Leptomeria cunninghamii*	●	●							
Sapindaceae	*Diplopeltis huegelii*	●	●							
	Diplopeltis huegelii subsp. *lehmannii*	●								
	Dodonaea viscosa		●							
	Dodonaea viscosa subsp. *angustissima*	●								
Scrophulariaceae	*Phyllopodium cordatum*	●	●							Y
Solanaceae	*Anthocercis gracilis*				●		T	VUL		
	Lycium ferocissimum				●					Y
	Solanum elaeagnifolium					●				Y

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Solanum hoplopetalum	●	●							
	Solanum linnaeanum					●				Y
Stylidiaceae	*Levenhookia pusilla*		●							
	Levenhookia stipitata	●	●							
	Stylidium amoenum	●	●							
	Stylidium asteroideum			●			P3			
	Stylidium ciliatum		●							
	Stylidium crassifolium	●	●							
	Stylidium dichotomum	●	●							
	Stylidium eriopodum	●	●							
	Stylidium exappendiculatum			●			P3			
	Stylidium hispidum		●							
	Stylidium leptocalyx		●				P4			
	Stylidium leptophyllum	●	●							
	Stylidium periscelianthum			●			P3			
	Stylidium pubigerum	●	●							
	Stylidium pycnostachyum		●							
	Stylidium rhynchocarpum	●	●							
	Stylidium roseoalatum		●							
	Stylidium scariosum	●	●							
	Stylidium schoenoides	●	●							
	Stylidium striatum	●		●			P4			
	Stylidium tenue		●							
	Stylidium tenue subsp. *majusculum*	●								
	Stylidium utricularioides	●	●							
	Stylidium xanthellum	●	●							
Tamaricaceae	*Tamarix aphylla*					●				Y
Thymelaeaceae	*Pimelea angustifolia*		●							

Family	Taxon	Source					Conservation Status			Introduced
		NM	ALA	DBCA	EPBC	WAOL	DBCA	BC Act	EPBC Act	
	Pimelea argentea	●	●							
	Pimelea ciliata		●							
	Pimelea gilgiana		●							
	Pimelea imbricata		●							
	Pimelea imbricata var. *piligera*	●								
	Pimelea preissii	●	●							
	Pimelea rosea		●							
	Pimelea suaveolens		●							
	Pimelea suaveolens subsp. *suaveolens*	●								
	Pimelea sylvestris		●							
Typhaceae	*Typha orientalis*	●	●							Y
Verbenaceae	*Lantana camara*				●	●				Y
Violaceae	*Hybanthus floribundus*		●							
	Hybanthus floribundus subsp. *floribundus*	●								
Xanthorrhoeaceae	*Xanthorrhoea preissii*		●							
Zamiaceae	*Macrozamia riedlei*	●	●							

Appendix E – Introduced flora database search results

Family	Taxon	Source				Declared Plant Pests	Weeds of National Significance	Swan Region		Wheatbelt Region	
		NM	ALA	EPBC	WAOL			Ecological	Invasiveness	Ecological	Invasiveness
Alismataceae	*Sagittaria platyphylla*				●	Yes	Yes	High	Rapid	Not assessed	Not assessed
Apocynaceae	*Calotropis procera*				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Cryptostegia madagascariensis				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Gomphocarpus fruticosus				●	Yes	No	High	Rapid	Not assessed	Not assessed
Araceae	*Pistia stratiotes*				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Zantedeschia aethiopica				●	Yes	No	High	Rapid	High	Slow
Araliaceae	*Hydrocotyle ranunculoides*				●	Yes	No	High	Rapid	Not assessed	Not assessed
Asparagaceae	*Asparagus asparagoides*			●	●	Yes	Yes	High	Rapid	High	Moderate
	Asparagus officinalis	●	●			No	No	Low	Slow	Low	Moderate
Asteraceae	*Chondrilla juncea*				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Chrysanthemoides monilifera			●		No	No	Not assessed	Not assessed	Not assessed	Not assessed
	Chrysanthemoides monilifera subsp. *monilifera*			●		No	No	High	Rapid	Not assessed	Not assessed
	Crepis foetida		●			No	No	Unknown	Moderate	Not assessed	Not assessed
	Crepis foetida subsp. *foetida*	●				No	No	Not assessed	Not assessed	Not assessed	Not assessed
	Onopordum acaulon				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Silybum marianum				●	Yes	No	Low	Rapid	Unknown	Unknown
	Sonchus asper	●	●			No	No	Unknown	Rapid	Unknown	Rapid
	Xanthium spinosum				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Xanthium strumarium				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
Boraginaceae	*Echium plantagineum*				●	Yes	No	High	Moderate	Medium	Rapid
	Heliotropium europaeum	●	●			No	No	Not assessed	Not assessed	Not assessed	Not assessed
Brassicaceae	*Brassica x napus*	●	●			No	No	Not assessed	Not assessed	Not assessed	Not assessed
	Diplotaxis muralis	●	●			No	No	Low	Slow	Not assessed	Not assessed

Family	Taxon	Source				Declared Plant Pests	Weeds of National Significance	Swan Region		Wheatbelt Region	
		NM	ALA	EPBC	WAOL			Ecological	Invasiveness	Ecological	Invasiveness
Cactaceae	*Austrocylindropuntia cylindrica*				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Austrocylindropuntia subulata				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Cylindropuntia fulgida				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Cylindropuntia imbricata				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Cylindropuntia kleiniae				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Cylindropuntia pallida				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Cylindropuntia tunicata				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Opuntia elata				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Opuntia elatior				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Opuntia engelmannii				●	Yes	No	Not assessed	Not assessed	Unknown	Slow
	Opuntia ficus-indica				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Opuntia microdasys				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Opuntia monacantha				●	Yes	No	Not assessed	Not assessed	Unknown	Slow
	Opuntia polyacantha				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Opuntia puberula				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Opuntia stricta				●	Yes	No	Not assessed	Not assessed	Unknown	Slow
	Opuntia tomentosa				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
Campanulaceae	*Monopsis debilis*		●			No	No	Medium	Rapid	Unknown	Rapid
	Monopsis debilis var. *depressa*	●				No	No	Not assessed	Not assessed	Not assessed	Not assessed
Caprifoliaceae	*Centranthus macrosiphon*	●	●			No	No	High	Rapid	Not assessed	Not assessed
Caryophyllaceae	*Cerastium glomeratum*	●	●			No	No	Unknown	Rapid	Unknown	Unknown
	Polycarpon tetraphyllum	●	●			No	No	Medium	Rapid	Unknown	Moderate

Family	Taxon	Source				Declared Plant Pests	Weeds of National Significance	Swan Region		Wheatbelt Region	
		NM	ALA	EPBC	WAOL			Ecological	Invasiveness	Ecological	Invasiveness
	Spergula arvensis	●	●			No	No	Low	Rapid	Not assessed	Not assessed
Crassulaceae	*Crassula alata*	●	●			No	No	Not assessed	Not assessed	Unknown	Unknown
Cucurbitaceae	*Citrullus amarus*	●	●			No	No	Not assessed	Not assessed	Not assessed	Not assessed
	Cucumis myriocarpus		●			No	No	Low	Moderate	Not assessed	Not assessed
	Cucumis myriocarpus subsp. *myriocarpus*	●				No	No	Not assessed	Not assessed	Not assessed	Not assessed
Cyperaceae	*Cyperus tenellus*	●				No	No	Low	Unknown	Unknown	Rapid
	Isolepis levynsiana		●			No	No	Not assessed	Not assessed	Not assessed	Not assessed
Euphorbiaceae	*Jatropha gossypiifolia*				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
Fabaceae	*Acacia baileyana*	●	●			No	No	High	Moderate	Medium	Moderate
	Alhagi maurorum				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Genista sp. X *Genista monspessulana*			●		No	No	Not assessed	Not assessed	Not assessed	Not assessed
	Melilotus indicus	●	●			No	No	Unknown	Rapid	Unknown	Slow
	Parkinsonia aculeata				●	Yes	Yes	Not assessed	Not assessed	Not assessed	Not assessed
	Prosopis glandulosa x *Prosopis velutina*				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Senna alata				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Senna obtusifolia				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
	Trifolium subterraneum	●	●			No	No	Unknown	Unknown	Unknown	Unknown
	Ulex europaeus				●	Yes	Yes	Not assessed	Not assessed	Not assessed	Not assessed
Geraniaceae	*Erodium botrys*		●			No	No	Unknown	Moderate	Low	Moderate
Iridaceae	*Babiana angustifolia*	●				No	No	High	Rapid	High	Moderate
	Ixia maculata	●				No	No	High	Rapid	Unknown	Unknown
	Moraea flaccida				●	Yes	No	High	Rapid	High	Rapid
	Moraea miniata				●	Yes	No	High	Rapid	High	Rapid
Juncaceae	*Juncus bufonius*	●	●			No	No	Unknown	Rapid	Unknown	Rapid

Family	Taxon	Source				Declared Plant Pests	Weeds of National Significance	Swan Region		Wheatbelt Region	
		NM	ALA	EPBC	WAOL			Ecological	Invasiveness	Ecological	Invasiveness
	Juncus capitatus	●	●			No	No	Unknown	Rapid	Unknown	Rapid
Lamiaceae	*Salvia verbenaca*		●			No	No	Unknown	Rapid	Low	Rapid
	Stachys arvensis	●	●			No	No	Unknown	Rapid	Low	Rapid
Orobanchaceae	*Parentucellia latifolia*		●			No	No	Unknown	Rapid	Unknown	Rapid
Oxalidaceae	*Oxalis purpurea*		●			No	No	High	Slow	Medium	Slow
Papaveraceae	*Fumaria bastardii*	●	●			No	No	Not assessed	Not assessed	Not assessed	Not assessed
	Papaver rhoeas	●	●			No	No	Not assessed	Not assessed	Not assessed	Not assessed
Pinaceae	*Pinus radiata*			●		No	No	Unknown	Moderate	Low	Moderate
Plantaginaceae	*Kickxia elatine*		●			No	No	Not assessed	Not assessed	Not assessed	Not assessed
	Kickxia elatine subsp. *crinita*	●				No	No	Low	Unknown	Not assessed	Not assessed
Plumbaginaceae	*Limonium sinuatum*		●			No	No	Unknown	Unknown	Unknown	Unknown
Poaceae	*Aira cupaniana*	●	●			No	No	Unknown	Unknown	High	Rapid
	Briza minor		●			No	No	Unknown	Rapid	High	Rapid
	Bromus hordeaceus	●	●			No	No	High	Rapid	High	Rapid
	Ehrharta longiflora		●			No	No	Medium	Rapid	Unknown	Moderate
	Eragrostis curvula	●	●			No	No	High	Rapid	High	Moderate
	Holcus setiger	●	●			No	No	High	Unknown	Unknown	Unknown
	Sorghum x *drummondii*	●	●			No	No	Not assessed	Not assessed	Not assessed	Not assessed
	Vulpia myuros		●			No	No	Not assessed	Not assessed	Unknown	Rapid
	Vulpia myuros forma *megalura*	●				No	No	Not assessed	Not assessed	Not assessed	Not assessed
Rhamnaceae	*Ziziphus mauritiana*				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed
Rosaceae	*Rubus anglocandicans*				●	Yes	No	High	Moderate	Not assessed	Not assessed
	Rubus fruticosus aggregate			●		No	Yes	Not assessed	Not assessed	Not assessed	Not assessed
	Rubus laudatus				●	Yes	No	High	Moderate	Not assessed	Not assessed
	Rubus rugosus				●	Yes	No	Not assessed	Not assessed	Not assessed	Not assessed

Family	Taxon	Source				Declared Plant Pests	Weeds of National Significance	Swan Region		Wheatbelt Region	
		NM	ALA	EPBC	WAOL			Ecological	Invasiveness	Ecological	Invasiveness
	Rubus ulmifolius				●	Yes	No	High	Moderate	Not assessed	Not assessed
Rubiaceae	*Galium aparine*				●	Yes	No	High	Rapid	Unknown	Unknown
	Galium divaricatum	●	●			No	No	Low	Rapid	Unknown	Unknown
	Galium spurium				●	Yes	No	Not assessed	Not assessed	Unknown	Unknown
Salviniaceae	*Salvinia molesta*			●		No	Yes	High	Moderate	Not assessed	Not assessed
Scrophulariaceae	*Phyllopodium cordatum*	●	●			No	No	Unknown	Rapid	Unknown	Rapid
Solanaceae	*Lycium ferocissimum*			●		No	Yes	High	Moderate	High	Moderate
	Solanum elaeagnifolium				●	Yes	Yes	Not assessed	Not assessed	Not assessed	Not assessed
	Solanum linnaeanum				●	Yes	No	High	Rapid	Not assessed	Not assessed
Tamaricaceae	*Tamarix aphylla*				●	Yes	Yes	High	Rapid	High	Moderate
Typhaceae	*Typha orientalis*		●			No	No	High	Rapid	High	Rapid
Verbenaceae	*Lantana camara*			●	●	Yes	Yes	Not assessed	Not assessed	Not assessed	Not assessed

Appendix F - Assessment of conservation significant flora likelihood

Taxon	Conservation Status			Habit and Habitat	Habitat within survey area	Within Current known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
Lechenaultia hortii	P2			Erect to spreading perennial, herb or shrub (subshrub), to 0.4 m high. White-cream sandy soils. Low slopes and flats, road verges.	Yes	Yes	Within	Confirmed	Unlikely
Tetratheca pilifera	P3			Spreading shrub, 0.1-0.3 m high. Fl. purple, Aug to Oct. Gravelly soils	Yes	Yes	Within	Confirmed	Confirmed
Drosera albonotata	P2			Rosetted herb, to 2.5 cm diameter. Fl. orange/red. Grey/brown lateritic clay loam. Flats, sandplains, gentle slopes.	Possible	Adjacent	7.7 km SE	Possible	Unlikely
Grevillea candolleana	P2			Spreading shrub, 0.2-0.8 m high. Fl. white-cream, Aug to Sep. Laterite, lateritic loam. Hillsides.	Yes	Yes	6.8 km NE	Possible	Unlikely
Acacia campylophylla	P3			Dense, rigid, spreading shrub, 0.1-0.6 m high. Fl. yellow, Jul to Aug. Lateritic gravelly soils.	No	Adjacent	7.5 km E	Possible	Unlikely
Adenanthos cygnorum subsp. *chamaephyton*	P3			Prostrate, mat-forming, non-lignotuberous shrub, to 0.3 m high. Fl. white-cream-pink-green/green, Jul or Sep to Dec or Jan. Grey sand, lateritic gravel	Yes	Yes	3.5 km WSW	Possible	Unlikely
Asteridea gracilis	P3			Annual, herb, 0.15-0.35 m high. Fl. white-pink, Sep to Dec. Sand, clay, gravelly soils	Possible	Yes	6.7 km NNW	Possible	Unlikely
Synaphea diabolica	P3			Clumped, sprawling shrub (subshrub), 0.2-0.6 m high. Dry, yellow-brown laterite soil with laterite gravel. In undulating areas.	Yes	Adjacent	7.4 km SSE	Possible	Unlikely
Thysanotus cymosus	P3			Caespitose perennial, herb (with fibrous roots with ellipsoidal tubers), to 0.3 m high. Fl. purple, Sep to Oct. Clay, granitic or lateritic sand.	Yes	Yes	1.4 km NE	Possible	Unlikely
Verticordia serrata var. *linearis*	P3			Shrub, to 1 m high, differs from other varieties in the linear acuminate leaves 6-20 mm long; cilia to 1.2 mm long. Fl. other, Sep to Oct. White sand, gravel. Open woodland	Possible	Yes	7.8 km NNE	Possible	Unlikely
Anigozanthos humilis subsp. *chrysanthus*	P4			Rhizomatous, perennial, herb, 0.2-0.4(-0.8) m high. Fl. yellow, Jul to Oct. Grey or yellow sand.	Possible	Yes	7 km NE	Possible	Unlikely
Asterolasia grandiflora	P4			Slender open shrub, 0.2-0.6(-0.8) m high. Fl. pink/white, Jul to Oct. Lateritic soils, clay over granite. Breakaways, hills.	Possible	Yes	2.1 km NE	Possible	Unlikely
Caladenia integra	P4			Tuberous, perennial, herb, 0.2-0.5 m high. Fl. green & red, Sep to Oct. Clayey loam. Granite outcrops, rocky slopes	Possible	Yes	9.9 km NE	Possible	Unlikely

Taxon	Conservation Status			Habit and Habitat	Habitat within survey area	Within Current known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
Cyanicula ixioides subsp. *ixioides*	P4			Tuberous, perennial, herb, 0.05-0.15 m high. Fl. yellow, Aug to Oct. Laterite, gravel	Yes	Yes	0.6 km SSE	Possible	Unlikely
Daviesia oxylobium	P4			Glaucous shrub, 0.5-1 m high. Fl. yellow & red & pink, Jul to Aug. Sandy lateritic soils. Undulating plains	Yes	Yes	4.3 km W	Possible	Unlikely
Sowerbaea multicaulis	P4			Tufted perennial, herb, 0.075-0.25 m high. Fl. purple-violet, Oct to Dec or Jan. Yellow-brown sand	Possible	No	8.7 km N	Possible	Unlikely
Stylidium leptocalyx	P4			Rosetted perennial, herb, 0.08-0.4 m high. Fl. pink, Oct to Nov. Laterite soils. Upland, breakaways. Eucalypt woodland or shrubland.	Possible	No	9.4 km ESE	Possible	Unlikely
Stylidium striatum	P4			Rosetted perennial, herb, 0.15-0.55 m high. Fl. yellow, Oct to Nov. Brown clay loam over laterite. Hillslopes. Jarrah/Marri forest, Wandoo woodland.	Yes	Yes	1.4 km NE	Possible	Unlikely
Acacia aphylla	T	VU	VU	Divaricately branched, spinescent, glaucous shrub, 0.9-2.5 m high. Fl. yellow, Aug to Oct. Sand, loam, clay loam. Granite outcrops, hills	Possible	Yes	6.9 km W	Unlikely	Highly Unlikely
Lechenaultia laricina	T	VU	EN	Diffuse, ascending shrub, 0.15-0.7 m high. Fl. red/red-orange, Sep to Dec or Jan. Sand, gravelly loam	No	Adjacent	13.2 km ENE	Unlikely	Highly Unlikely
Thelymitra dedmaniarum	T	CR	EN	Tuberous, perennial, herb, to 0.8 m high. Fl. yellow, Nov to Dec or Jan. Granite.	Possible	Yes	4.9 km W	Unlikely	Highly Unlikely
Thelymitra stellata	T	EN	EN	Tuberous, perennial, herb, 0.15-0.25 m high. Fl. yellow & brown, Oct to Nov. Sand, gravel, lateritic loam	Possible	Adjacent	25.6 km WSW	Unlikely	Highly Unlikely
Senecio gilbertii	P1			Erect, slender perennial, herb, to 1.5 m high. Fl. yellow, Sep to Nov. Peaty sand. Swamps, slopes	Possible	Yes	5.1 km W	Unlikely	Highly Unlikely
Amperea micrantha	P2			Low, spreading, bushy perennial, herb, 0.1-0.3 m high. Fl. brown, Oct to Nov. Sandy soils	Possible	No	9.5 km E	Unlikely	Highly Unlikely
Banksia nivea subsp. Morangup (M. Pieroni 94/2)	P2			Non-lignotuberous shrub, 0.15-1.5 m high. Fl. cream-yellow-orange-pink/red-brown, Apr to Aug or Sep. Loam-clay gravel on laterite.	Possible	No	11.8 km NW	Unlikely	Highly Unlikely
Cyanicula ixioides subsp. *candida*	P2			Tuberous, perennial, herb, 0.04-0.12 m high. Fl. white, Aug to Oct. Sand, laterite, gravel.	Possible	Yes	11.1 km SSE	Unlikely	Highly Unlikely

Taxon	Conservation Status			Habit and Habitat	Habitat within survey area	Within Current known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
Lasiopetalum trichanthera	P2			Erect, spreading shrub, 0.8-1.2 m. Stems hairy. Fl. pink or purple, Oct or Nov. Grey/white quartzite sand. Slopes, flats, shade/semi-shaded areas.	Yes	Adjacent	11.4 km NE	Unlikely	Highly Unlikely
Verticordia citrella	P2			Erect, slender shrub, 0.3-1 m high. Fl. yellow, Oct to Nov. Gravelly loam or sand. Low-lying damp areas, swamps	Possible	Adjacent	11 km NW	Unlikely	Highly Unlikely
Beaufortia purpurea	P3			Erect or spreading shrub, 0.3-1.5 m high. Fl. red-purple, Oct to Dec or Jan to Feb. Lateritic or granitic soils. Rocky slopes	Possible	Yes	11.8 km WNW	Unlikely	Highly Unlikely
Daviesia nudiflora subsp. *drummondii*	P3			Bushy shrub, 0.3-1.5 m high. Fl. orange/yellow & red, Jul to Aug. White or grey sand. Undulating low rises	Possible	No	12.9 km ENE	Unlikely	Highly Unlikely
Juncus meianthus	P3			Tufted perennial, herb, 0.05-0.2 m high, to 0.4 m wide. Fl. brown, Nov to Dec or Jan. Black sand, sandy clay. Creeks, seepage areas.	Possible	No	13 km W	Unlikely	Highly Unlikely
Meionectes tenuifolia	P3			Prostrate, annual semi aquatic herb, erect stems to 0.35 m high. Fl. orange. Red/green trifid and linear leaves. Grey/black loam over granite. Seasonally wet flats, swamps, granite flats.	Possible	Yes	4.4 km W	Unlikely	Highly Unlikely
Stylidium asteroideum	P3			Erect plant to c. 7 cm. Fl. white and pink, red/pink below. Orange/brown clay or loam. Drainage lines, winter-wet flats.	Possible	Yes	7 km NE	Unlikely	Highly Unlikely
Stylidium exappendiculatum	P3			Small, erect annual, to 0.07 m high. Fl. cream, red/yellow at throat. Loamy clay soil. Seasonal damp areas, along drainage lines.	No	Adjacent	13.6 km ESE	Unlikely	Highly Unlikely
Stylidium periscelianthum	P3			Bulb-forming perennial, herb, 0.07-0.15 m high. Fl. pink, Sep to Oct. Loamy clay, moist soils pockets. Wet flats, low granitic hills.	Possible	Yes	13.7 km E	Unlikely	Highly Unlikely
Verticordia huegelii var. *tridens*	P3			Shrub, 0.15-0.6 m high. Fl. green-yellow/red, Sep to Nov. Sandy or gravelly loam. Winter-wet areas, low hills	Possible	Yes	13.2 km NW	Unlikely	Highly Unlikely
Chordifex chaunocoleus	P4			Rhizomatous, erect perennial, herb, 0.15-0.5 m high. Fl. brown, Sep. Grey, siliceous or peaty sand, well to poorly drained. Drainage lines, depressions	No	Yes	6.8 km NE	Unlikely	Highly Unlikely
Eremaea blackwelliana	P4			Erect shrub, 1-3 m high, to 3 m wide. Fl. orange, Sep to Nov. White sand. Sandy depressions, gentle hillside	No	Adjacent	8.5 km NNE	Unlikely	Highly Unlikely
Eucalyptus loxophleba x *wandoo*	P4			(Mallee) or tree, 4-20 m high, bark rough black-brown on trunk. Sandy clay or loam.	No	Yes	7.6 km NE	Unlikely	Highly Unlikely

Taxon	Conservation Status			Habit and Habitat	Habitat within survey area	Within Current known Distribution	Distance to Nearest Record	Likelihood Pre-Survey	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
Grevillea pimeleoides	P4			Non-lignotuberous shrub, 0.4-2.4 m high. Fl. yellow-orange, May to Nov. Gravelly soils over granite. Rocky hillsides	Possible	Yes	4.5 km SSE	Unlikely	Highly Unlikely
Hemigenia platyphylla	P4			Spreading shrub, 0.2-1.5 m high. Fl. blue-purple, Sep to Nov. Sandy & loamy soils. Granite rocks, slopes	Possible	Yes	8 km NE	Unlikely	Highly Unlikely
Anthocercis gracilis	T	VU	VU	Erect, spindly shrub, to 0.6(-1) m high. Fl. yellow-green, Sep to Oct. Sandy or loamy soils. Granite outcrops	No	No	31 km SW	Highly Unlikely	Highly Unlikely
Caladenia huegelii	T	CR	EN	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey or brown sand, clay loam	No	No	21 km N	Highly Unlikely	Highly Unlikely
Diplolaena andrewsii	T	EN	EN	Erect shrub, 0.5-1 m high, inner involucral bracts glabrous, leaves broadly cordate. Fl. red, Jul to Oct. Loam, clay. Granite outcrops & hillsides	No	No	26.1 km W	Highly Unlikely	Highly Unlikely
Diuris micrantha	T	VU	VU	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct. Brown loamy clay. Winter-wet swamps, in shallow water.	No	No	>50 km SW	Highly Unlikely	Highly Unlikely
Diuris purdiei	T	EN	EN	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct. Grey-black sand, moist. Winter-wet swamps	No	No	39 km SW	Highly Unlikely	Highly Unlikely
Eleocharis keigheryi	T	VU	VU	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. green, Aug to Nov. Clay, sandy loam. Emergent in freshwater: creeks, claypans.	No	Yes	28 km SW	Highly Unlikely	Highly Unlikely
Verticordia fimbrilepis subsp. *fimbrilepis*	T	VU	EN	Shrub, 0.3-0.7 m high. Fl. pink-white, Oct to Dec or Jan. Gravelly sandy or clayey soils. Flats, road verges	No	No	>50 km WSW	Highly Unlikely	Highly Unlikely

Appendix G – Flora Quadrat Data

Coates Gully **Site MCG-01**

Date	21/10/2020
Described by	KG & SC
Type	R
Location	MGA Zone 50 438984 mE; 6480564 mN 116.355360 E -31.808909 S
Veg Condition	Degraded
Soil	Sandy Clay Loam
Rock Type	River
Fire Age	>10 yrs
Habitat	Drainage Area/ Floodplain
Vegetation	*Eucalyptus rudis* mid woodland over *Hakea prostrata* tall open shrubland over mixed weed grassland of **Eragrostis curvula*, **Ehrharta calycina* and **Avena barbata* with dense patches of **Watsonia meriana*.

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
**Avena barbata*					
Dampiera lavandulacea					
**Ehrharta calycina*					
**Eragrostis curvula*					
Eucalyptus rudis					
Hakea prostrata				MCG01-01	
Hibbertia diamesogenos				MCG01-02	
Trymalium odoratissimum subsp. *odoratissimum*				MCG01-03	
**Watsonia meriana*					

Coates Gully **Site MCG-02**

Date	21/10/2020
Described by	KG & SC
Type	R
Location	MGA Zone 50 441287 mE; 6481757 mN 116.379766 E -31.798271 S
Veg Condition	Poor
Soil	Sandy Clay Loam
Rock Type	Laterite
Fire Age	>10 yrs
Habitat	Undulating Low Hills
Vegetation	Mid open *Eucalyptus wandoo* woodland over tall sparse *Xanthorrhoea preissii* shrubland over low sparse *Gastrolobium hookeri*, *Dampiera lavandulacea* and *Hemegenia incana* shrubland with scattered **Ehrharta calycina*, **Eragrostis curvula* and **Avena barbata* grasses.

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Austrostipa elegantissima	0.1		0.6		
**Avena barbata*	1		0.6		
**Briza maxima*	0.1		0.3		
Dampiera lavandulacea	2		0.4		
Desmocladus asper	0.1		0.1		
**Disa bracteata*	0.1		0.2		
**Ehrharta calycina*	2		0.6		
**Eragrostis curvula*	2		0.7		
Eucalyptus wandoo	8		10		
Gastrolobium hookeri	6		0.5	MCG02-01	
**Gladiolus* sp.	0.1		0.4		
Gompholobium marginatum	0.1		0.1		
Hemigenia incana	2		0.4		
Hibbertia commutata	0.1		0.2	MCG02-04	
**Hypochaeris glabra*	0.1		0.1		
Lepidosperma obtusum	0.5		0.4	MCG02-03	
Microtis media	0.1		0.3		
**Moraea flaccida*	0.1		0.3		
Neurachne alopecuroidea	0.1		0.3		
**Romulea rosea*	0.1		0.1		
Thelymitra macrophylla	0.1		0.3		
Tricoryne elatior	0.1		0.2		
**Ursinia anthemoides*	0.1		0.1		
Wahlenbergia capensis	0.1		0.3		
Xanthorrhoea preissii	6		2.5		

Coates Gully **Site MCG-05**

Date	21/10/2020
Described by	KG & SC
Type	Q 10m x 10m
Location	MGA Zone 50 441825 mE; 6482145 mN 116.385470 E -31.794797 S
Veg Condition	Poor
Soil	Medium Clay
Rock Type	None
Fire Age	>10 yrs
Habitat	Drainage Area/ Floodplain
Vegetation	Tall scattered *Melaleuca viminea* shrubs over tall **Juncus acutus* and *Bolboschoenus caldwellii* mixed open sedgeland and rushland over low open *Tecticornia lepidosperma* samphire shrubland over low open **Cynodon dactylon* grassland.

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Bolboschoenus caldwellii	2		0.6	MCG05-02	
**Cotula coronopifolia*	0.1		0.1	MCG05-05	
**Cynodon dactylon*	16		0.5		
**Eragrostis curvula*	0.5		0.7		
**Juncus acutus*	5		1	MCG05-01	
Melaleuca viminea	1		4		
Tecticornia lepidosperma	6		0.4	MCG05-03	
Triglochin striata	1		0.3	MCG05-04	

Coates Gully **Site MCG-06**

Date	21/10/2020
Described by	KG & SC
Type	Q 10m x 10m
Location	MGA Zone 50 442097 mE; 6482568 mN 116.388364 E -31.790996 S
Veg Condition	Very Good
Soil	Sandy Clay Loam
Rock Type	Laterite
Fire Age	>10 yrs
Habitat	Undulating Low Hills
Vegetation	Mid *Eucalyptus wandoo* woodland over tall open *Xanthorrhoea preissii* shrubland over low open mixed shrubland.

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia lasiocarpa	0.5		0.3	MCG06-06	
Banksia dallanneyi subsp. *dallanneyi* var. *dallanneyi*	0.1		0.1	SCKGOPP20	
Banksia squarrosa	1		2		
**Briza maxima*	0.1		0.1		
Conostylis setigera subsp. *setigera*	0.1		0.1	MCG06-02	
Cryptandra nutans	1		0.3	MCG06-07	
Dampiera lavandulacea	0.1		0.2		
Desmocladus asper	0.1		0.1		
Eucalyptus wandoo	20		11		
Gompholobium marginatum	0.1		0.2		
Gonocarpus cordiger	0.1		0.4	MCG06-08	
Hakea prostrata	0.1		0.1		
Hakea undulata	0.1		1.2		
Hemigenia incana	1		0.3		
Hibbertia commutata	0.1		0.3	MCG02-04	
Hibbertia diamesogenos	0.1		0.1	MCG01-02	
Hovea trisperma	0.1		0.3		
Laxmannia squarrosa	0.1		0.1		
Lechenaultia biloba	1		0.3	SCKGOPP05	
Macrozamia riedlei	1		1.2		
Neurachne alopecuroidea	0.1		0.1		
**Oxalis* sp.	0.1		0.1		
Ptilotus manglesii	0.1		0.1		
Stackhousia monogyna	0.1		0.3		
Styphelia compacta	0.1		0.1	MCG06-04	
Styphelia pallida	0.1		0.1	MCG06-05	
Styphelia sp.	0.1		0.3		
Tetraria octandra	0.1		0.3		
Tetratheca confertifolia	0.1		0.2	SCKGopp03	
Tetratheca pilifera	0.1		0.1	MCG06-03	
**Ursinia anthemoides*	0.1		0.3		
Xanthorrhoea preissii	2		2		

Coates Gully **Site MCG-08**

Date	20/11/2020
Described by	KG & SC
Type	Q 10m x 10m
Location	MGA Zone 50 439752 mE; 6480689 mN 116.363479 E -31.807820 S
Veg Condition	Excellent
Soil	Sandy Clay Loam
Rock Type	Laterite
Fire Age	>10 yrs
Habitat	Undulating Low Hills
Vegetation	Mid *Eucalyptus wandoo* woodland over low open *Acacia lasiocarpa*, *Gastrolobium hookeri* and *Hakea lissocarpha* shrubland.

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia lasiocarpa	1		0.4	MCG06-06	
Acacia lasiocarpa	8		0.8	MCG08-03	
**Aira cupaniana*	0.1		0.1		
Austrostipa elegantissima	0.1		0.4		
**Avena barbata*	0.1		0.4		
Billardiera fusiformis	0.1		0.8		
Caesia sp. Indet	0.1		0.3	MCG08-08	
Dampiera lavandulacea	0.1		0.2		
Desmocladus asper	0.1		0.2	MCG08-04	
Eucalyptus wandoo	25		11		
Gastrolobium hookeri	2		0.5	MCG08-01	
Hakea lissocarpha	2		0.4		
Hibbertia montana	0.1		0.1	MCG08-06	
Lepidosperma leptostachyum	0.1		0.3	MCG08-05	
Lomandra caespitosa	0.1		0.3		
**Lysimachia arvensis*	0.1		0.1		
Marianthus bicolor	1		0.5	MCG08-02	
Neurachne alopecuroidea	0.1		0.2		
Opercularia vaginata	0.1		0.2	MCG08-07	
Phyllanthus calycinus	0.1		0.3		
Ptilotus drummondii var. *drummondii*	0.1		0.3		
Ptilotus manglesii	0.1		0.1		
**Ursinia anthemoides*	0.1		0.3		

Coates Gully **Site MCG-09**

Date	20/11/2020
Described by	KG & SC
Type	Q 10m x 10m
Location	MGA Zone 50 443343 mE; 6485011 mN 116.401674 E -31.769015 S
Veg Condition	Excellent
Soil	Clay Loam
Rock Type	Laterite
Fire Age	>10 yrs
Habitat	Hillslope
Vegetation	Mid *Eucalyptus wandoo* woodland over tall sparse *Banksia squarrosa* shrubland over mid sparse *Xanthorrhoea preissii* and *Macrozamia reidlei* over low mixed shrubland.

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
**Acacia iteaphylla*	1		2		
Acacia lasiocarpa	0.1		0.3	MCG06-06	
Acacia pulchella	0.1		0.5		
Allocasuarina fraseriana	0.1		2.5		
Austrostipa elegantissima	0.1		0.3		
Banksia dallanneyi subsp. *dallanneyi* var. *dallanneyi*	0.1		0.1	SCKGOPP20	
Banksia squarrosa	3		3		
**Briza maxima*	0.1		0.1		
Conostylis setigera subsp. *setigera*	0.1		0.1	MCG09-01	
Conostylis setigera subsp. *setigera*	0.1		0.1	MCG06-02	
Dampiera lavandulacea	0.1		0.2		
Desmocladus asper	0.5		0.1	MCG08-04	
**Ehrharta calycina*	0.1		1.2		
Eucalyptus wandoo	30		12		
Gastrolobium spinosum	1		0.8	MCG09-05	
Gompholobium tomentosum	0.1		0.3	MCG09-04	
Gonocarpus pithyoides	0.1		0.3		
Hakea lissocarpha	1		0.3		
Hakea undulata	0.1		1.5		
Hemigenia incana	0.1		0.2		
Hibbertia hypericoides	1		0.3		
Hibbertia montana	0.1		0.2	MCG08-06	
Kennedia prostrata	0.1		0.1		
Lepidosperma leptostachyum	0.1		0.3	MCG08-05	
Macrozamia riedlei	0.1		1		
Opercularia vaginata	0.1		0.2	MCG08-07	
Phyllanthus calycinus	0.1		0.3		
Pimelea ciliata subsp. *ciliata*	0.1		0.3	MCG09-02	
Ptilotus manglesii	0.1		0.1		
Rytidosperma setaceum	0.1		0.1	MCG09-06	
Stylidium sp.	0.1		0.2		
Styphelia nitens	2		1.2	MCG09-07	
Synaphea decorticans	0.1		0.3	SCopp07	
Trymalium ledifolium var. *lineare*	0.1		0.3	MCG09-03	
Xanthorrhoea preissii	2		1.8		

Coates Gully **Site MCG-11**

Date	20/11/2020
Described by	KG & SC
Type	Q 10m x 10m
Location	MGA Zone 50 446526 mE; 6486090 mN 116.435341 E -31.759435 S
Veg Condition	Very Good
Soil	Sandy Clay Loam
Rock Type	Laterite
Fire Age	>10 yrs
Habitat	Hillslope
Vegetation	Mid *Corymbia calophylla* woodland over tall open *Allocasuarina fraseriana* and *Banksia sessilis* shrubland over mixed mid to low shrubland.

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
Acacia pulchella	1		0.5		
Agrostocrinum scabrum	0.1		0.6	MCG11-08	
Allocasuarina fraseriana	3		4.5		
Austrostipa ?trichophylla	0.1		0.5	MCG11-01	
Austrostipa sp.	0.1		0.6	MCG11-07	
**Avena barbata*	0.1		0.5		
Banksia sessilis	5		3.5		
Bossiaea eriocarpa	4		0.3		
**Briza maxima*	8.1		0.2		
Caesia sp. Indet	0.1		0.3	MCG08-08	
Callistachys lanceolata	0.1		0.2	MCG11-05	
Corymbia calophylla	15		12		
Daviesia decurrens subsp. *decurrens*	0.1		0.4	MCG11-03	
Daviesia hakeoides subsp. *subnuda*	2		0.3	MCG11-02	
**Ehrharta calycina*	0		0.3		
Gastrolobium spinosum	0.1		0.4	MCG09-05	
Hibbertia hypericoides	1		0.3		
**Hypochaeris glabra*	0.1		0.1		
Kennedia coccinea	0.1		0	MCG11-06	
Kennedia prostrata	0.1		0.1		
Lechenaultia biloba	0.1		0.2		
Lepidosperma obtusum	2		0.4	MCG02-03	
**Lysimachia arvensis*	0.1		0.1		
Olearia paucidentata	0.1		0.3	MCG11-09	
Phyllanthus calycinus	0.1		0.3		
Ptilotus manglesii	0.1		0.1		
Schenkia australis	0.1		0.1		
Synaphea decorticans	0.1		0.1	SCopp07	
Tetraria octandra	0.1		0.3		
Trachymene pilosa	0.1		0.1		
Tricoryne elatior	0.1		0.3		
**Ursinia anthemoides*	0.1		0.2		
Xanthorrhoea preissii	3		1.5		
Xerochrysum macranthum	0.1		0.3	MCG11-04	

Coates Gully **Site Opps**

Date
Described by
Type
Location MGA Zone
mE; mN
E S
Veg Condition
Soil
Rock Type
Fire Age
Habitat
Vegetation
Notes

SPECIES LIST

Name	Cover	C Class	Height	Specimen	Notes
**Acacia dealbata*					
**Acacia iteaphylla*					
**Acacia iteaphylla*					
**Acacia podalyriifolia*					
**Acacia podalyriifolia*					
**Acacia pycnantha*				SCKGopp01	
**Aira cupaniana*					
**Arctotheca calendula*					
**Arctotheca calendula*					
**Asparagus asparagoides*					
**Asparagus asparagoides*					
**Asparagus asparagoides*					
**Asparagus asparagoides*					
**Asparagus asparagoides*					
**Asparagus asparagoides*					
**Asparagus asparagoides*					
**Asparagus asparagoides*					
**Asparagus asparagoides*					
**Asparagus asparagoides*					
Austrostipa elegantissima					
**Avena barbata*					
**Avena barbata*					
**Avena barbata*					
**Avena barbata*					
Banksia dallanneyi subsp. *dallanneyi* var. *dallanneyi*				SCKGOPP20	
**Briza maxima*					
**Bromus diandrus*					
Callistemon phoeniceus					
**Chamaecytisus palmensis*					
**Chamaecytisus palmensis*					
**Chamaecytisus palmensis*					
**Chamaecytisus palmensis*					
**Chamaecytisus palmensis*					
**Cotula turbinata*					
Dianella revoluta					
Dodonaea pinifolia					
**Echium plantagineum*					
**Echium plantagineum*					
**Echium plantagineum*					
**Echium plantagineum*					
**Echium plantagineum*					
**Echium plantagineum*					

**Echium plantagineum*	
**Ehrharta calycina*	
**Ehrharta calycina*	
**Ehrharta calycina*	
**Eragrostis curvula*	
**Eragrostis curvula*	
**Eragrostis curvula*	
**Eragrostis curvula*	
**Erigeron bonariensis*	
Erodium cygnorum	
Eucalyptus rudis	
Eucalyptus wandoo	
Euphorbia peplus	
Ficus sp.	
**Freesia alba* x *leichtlinii*	
**Fumaria capreolata*	
**Genista linifolia*	SCKGOPP08
**Gomphocarpus fruticosus*	
Hakea prostrata	MCG01-01
**Hypochaeris glabra*	
**Hypochaeris glabra*	
Juncus kraussii	
Kennedia prostrata	
**Lavandula stoechas*	
Lechenaultia biloba	SCKGopp06
Lechenaultia biloba	SCKGopp07
Lechenaultia biloba	SCopp02
Lechenaultia biloba	SCopp05
Lechenaultia biloba	SCopp05
Lechenaultia biloba	SCopp05
Lechenaultia biloba	SCopp06
Lechenaultia biloba	SCopp10
Lechenaultia biloba	SCKGopp05
Lechenaultia biloba	SCopp08
Lechenaultia biloba	SCopp11
Lechenaultia biloba	SCopp03
Lechenaultia biloba	SCopp08
**Lotus angustissimus*	
**Lupinus angustifolius*	
**Lupinus angustifolius*	
**Lupinus cosentinii*	
Melia azedarach	
Melia azedarach	
**Olea europaea*	
**Orobanche minor*	
**Osteospermum ecklonis*	
**Oxalis pes-caprae*	
**Pinus pinaster*	
**Pinus* sp.	
**Pyrus* sp.	
**Raphanus raphanistrum*	
Scaevola platyphylla	SCopp09
**Solanum nigrum*	
**Solanum nigrum*	
Synaphea sp.	SCopp07
Tetraria octandra	
Tetratheca confertifolia	SCKGopp03
Tetratheca confertifolia	SCKGopp03
Tetratheca confertifolia	SCKGopp03
Tetratheca confertifolia	SCKGopp03
Tetratheca confertifolia	SCKGopp03
Tetratheca confertifolia	SCKGopp03
Tetratheca confertifolia	SCKGopp03
Tetratheca confertifolia	SCKGopp03
Tetratheca confertifolia	SCKGopp03
Tetratheca confertifolia	SCKGopp03

Tetratheca confertifolia	SCKGopp03
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCKGOPP21
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCKGOPP21
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCKGOPP21
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCKGopp09
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca hirsuta subsp. *hirsuta*	SCopp01
Tetratheca nuda	SCKGopp04
Tetratheca nuda	
Tetratheca nuda	SCKGopp04
Tetratheca nuda	SCKGopp04
Tetratheca nuda	SCKGopp04
Tetratheca nuda	SCKGopp04
Tetratheca nuda	SCKGopp04
Tetratheca nuda	SCKGopp04
Tetratheca nuda	SCKGopp04
Tetratheca nuda	SCKGopp04
Tetratheca pilifera	SCopp14
Tetratheca pilifera	SCopp14
Tetratheca pilifera	SCopp14
Tetratheca pilifera	SCOPP15
Tetratheca pilifera	SCopp16
Tetratheca pilifera	SCopp14
Tricoryne elatior	
**Trifolium arvense*	
**Trifolium arvense*	
**Watsonia meriana*	
Xanthorrhoea preissii	
**Zantedeschia aethiopica*	

Appendix H – Flora taxa of the survey area

Family	Species	Phase 1	Phase 2
Amaranthaceae	*Ptilotus drumondii* var. *drumondii*		●
	Ptilotus mangelsii	●	●
Apiaceae	**Foeniculum vulgare*	●	
	Xanthosia candida	●	
Apocynaceae	**Gomphocarpus fruticosus*		●
	**Vinca major*	●	
Araceae	*Zantedeschia aethiopica*	●	●
Araliaceae	*Trachymene Pilosa*	●	●
Asparagaceae	**Asparagus asparagoides*	●	●
	Dichopogon capillipes	●	
	Laxmannia squarrosa	●	●
	Lomandra hermaphrodita	●	
	Lomandra caespitosa	●	●
	Sowerbaea laxiflora	●	
	Thysanotus manglesianus	●	
	Thysanotus sp.	●	
	Thysanotus thyrsoideus	●	
Asteraceae	* *Arctotheca calendula*	●	●
	**Cotula coronopifolia*	●	●
	**Cotula turbinate*		●
	**Erigeron bonariensis*		●
	**Hypochaeris glabra*	●	●
	**Oleraria paucidentata*		●
	**Osteospermum ecklonis*		●
	**Ursinia anthemoides*	●	●
	Blennospora drummondii	●	
	Lagenophora huegelii	●	
	Podotheca angustifolia	●	
	Pterochaeta paniculata	●	
	Xerochrysum macranthum	●	●
Boraginaceae	**Echium plantagineum*	●	●
Brassicaceae	**Raphanus raphanistrum*		●
Campanulaceae	**Wahlenbergia capensis*		●
Casuarinaceae	*Allocasuarina huegeliana*	●	
	Allocasuarina fraseriana		●
	Allocasuarina humilis	●	
Celastraceae	*Stackhousia monoguna*	●	●
Chenopodiaceae	*Tecticornia* sp.	●	
	Tecticornia lepidosperma		●
Cyperaceae	*Gahnia trifida*	●	
	Lepidosperma leptostachyum	●	
	Mesomelaena tetragona	●	
	Baumea articulata	●	
	Bolboschoenus caldwelii	●	●
	Cyperus bulbosus	●	
	Isolepis cernua	●	
	Lepidosperma aff. *Apricola*	●	
	Lepidosperma aff. *Costale*	●	
	Lepidosperma leprostachyum	●	●
	Lepidosperma obtusum	●	●
	Schoenus subfascicularis	●	
	Schoenus unispiculatu	●	
	Tetraria octandra		●
Dilleniaceae	*Hibbertia commutate*	●	●
	Hibbertia diamesogenos	●	●
	Hibbertia huegelii	●	
	Hibbertia hypercoides	●	●
Dilleniaceae	*Hibbertia montana*		●
Droseraceae	*Drosera stolonifera*	●	
Elaeocarpaceae	*Tetratheca confertifolia*	●	●
	Tetratheca hirsuita	●	●
	Tetratheca nuda	●	●

Family	Species	Phase 1	Phase 2
	Tetratheca pilifera (P3)	●	●
Ericaceae	*Leucopogon nutans*	●	
	Leucopogon propinquus	●	
	Styphelia compacta		●
	Styphelia nitens		●
	Styphelia pallida		●
	Styphelia sp.		●
Euphorbiaceae	**Euphorbia peplus*		●
Fabaceae	**Acacia baileyana*	●	
	**Acacia dealbata*		●
	**Acacia iteaphylla*	●	●
	**Acacia longifolia*	●	
	**Acacia podalyriifolia*	●	●
	**Acacia pycnantha*		●
	**Chamaecytisus palmensis*	●	●
	**Genista linifolia*		●
	**Lotus angustissimus*		●
	**Lupinus angustifolius*	●	●
	**Lupinus cosentinii*		●
	**Trifolium arvense*		●
	**Trifolium campestre*	●	
	Acacia ?acuminata	●	
	Acacia decurrens	●	
	Acacia lasiocarpa		●
	Acacia nervosa	●	
	Acacia pulchella var. *pulchella*	●	●
	Acacia willdenowiana	●	
	Bossiaea aquifolium	●	
	Bossiaea eriocarpa	●	●
	Bossiaea ornate	●	
	Callistachys lanceolata		●
	Chorizema dicksonii	●	
	Daviesia decurrens subsp. *Decurrens*	●	●
	Daviesia hakeoides subsp. *Subnuda*	●	●
	Dillwynia acerosa	●	
	Gastrolobium hookeri		●
	Gastrolobium spinosum	●	●
	Gompholobium marginatum	●	●
	Gompholobium tomentosum		●
	Hovea trisperma		●
	Kennedia coccinea	●	●
	Kennedia prostrata	●	●
	Sphaerolobium medium	●	
	Viminaria juncea	●	
Gentianaceae	*Schenkia australis*		●
Geraniaceae	*Erodium cygnorum*		●
Goodeniaceae	*Dampiera lavandulace*	●	●
	Goodenia pulchella subsp. *Wheatbelt* (L.W. Sage & F. Hort 7 95)	●	
	Lechenaultia aff. *biloba*	●	
	Lechenaultia biloba	●	●
	Scaevola calliptera	●	
Goodeniaceae	*Scaecola platyphylla*		●
Haemodoraceae	*Conostylis setigera* subsp. *setigera*	●	●
	Haemodorum simplex	●	
	Haemodorum sp.	●	
Haloragaceae	*Glischrocaryon aureum*	●	
	Gonocarpus cordiger		●
	Gonocarpus pithyoides	●	●
Hemerocallidaceae	*Agrostocrinum scabrum*		●
	Arnocrinum preissii	●	
	Caesia micrantha	●	

Family	Species	Phase 1	Phase 2
	Caesia sp. *Indet*		●
	Dianella revoluta	●	●
	Stypandra glauca	●	
	Tricoryne elatior	●	●
Iridaceae	**Freesia alba* × *leichtl*	●	●
	**Gladiolus caryophyllaceus*	●	
	**Gladiolus* sp.		●
	**Moraea flaccida*	●	●
	**Romulea rosea*	●	●
	**Watsonia meriana* var. *bulbillifera*	●	●
	Orthrosanthus laxus var. *gramineus*	●	
	Patersonia occidentalis	●	
Juncaceae	**Juncus acutus*	●	
	Juncus kraussii		●
Juncaginaceae	*Triglochin striata*		●
Lamiaceae	**Lavandula stoechas*		●
	**Lavandula* sp.	●	
	Hemigenia incana	●	●
Lauraceae	*Cassytha glabella*	●	
Meliaceae	*Melia azedarach*		●
Moraceae	*Ficus* sp.		●
Myrtaceae	*Leptospermum erubescens*	●	
	**Leptospermum laevigatum*	●	
	Babingtonia camphorosmae	●	
	Callistemon phoeniceus		●
	Corymbia calophylla	●	●
	Eucalyptus marginata	●	
	Eucalyptus patens	●	
	Eucalyptus rudis	●	●
	Eucalyptus wandoo	●	●
	Melaleuca viminea	●	●
Oleaceae	**Olea europaea*	●	●
Orchidaceae	*Caladenia flava*	●	
	Caladenia sp.	●	
	**Disa bracteata*		●
	Microtis media		●
	Pterostylis ?vittata	●	
	Pterostylis recurva	●	
	Pyrorchis nigricans	●	
	Thelymitra macrophylla		●
Orobanchaceae	**Orobanche minor*	●	●
Oxalidaceae	**Oxalis pes-caprae*	●	●
	**Oxalis* sp.		●
Papaveraceae	**Fumaria capreolata*	●	●
Phyllanthaceae	*Phyllanthus calycinus*	●	●
Pinaceae	*Pinus pinaster*	●	●
	Pinus sp.		●
Pittosporaceae	*Billardiera ?fraseri*	●	
	Billardiera fusiformis	●	●
	Billardiera heterophylla	●	
	Marianthus bicolor		●
Poaceae	**Aira cupaniana*		●
	**Avena barbata*	●	●
	**Briza maxima*	●	●
	**Briza minor*	●	
	**Bromus diandrus*	●	●
	**Cortaderia selloana*	●	
	**Cynodon dactylon*		●
	**Ehrharta calycina*	●	●
	**Eragrostis curvula*	●	●
	**Lolium rigidum*	●	
	Austrostipa campylachne	●	

	Austrostipa elegantissima	●	●
	Austrostipa ?trichophylla		●
	Rytidosperma ?setaceum	●	
	Rytidosperma setaceum		●
	Neurachne alopecuroidea	●	●
Polygonaceae	**Rumex crispus*	●	
Primulaceae	**Lysimachia arvensis*	●	●
Proteaceae	*Hakea prostrata*	●	●
	?Synaphea decorticans	●	
	Synaphea sp.		●
	Adenanthos cygnorum subsp. *cygnorum*	●	
	Banksia dallanneyi	●	●
	Banksia sessilis	●	●
	Banksia squarrosa	●	●
	Grevillea olivacea (Planted)	●	
	Grevillea synapheae subsp. *synapheae*	●	
	Hakea lissocarpha	●	●
	Hakea undulata	●	
	Hakea ilicifolia	●	
	Hakea undulata	●	●
	Synaphea decorticans	●	●
Restionaceae	*Desmocladus asper*	●	●
	Leptocarpus coangustata	●	
Rhamnaceae	*Cryptandra arbutiflora*	●	
	Cryptandra nutans		●
	Trymalium ledifolium var. *lineare*		●
	Trymalium odoratissimum subsp. *Odoratissimum*		●
Rosaxeae	**Pyrus* sp.		●
Rubiaceae	*Opercularia vaginata*	●	●
Sapindaceae	*Diplopeltis huegelii*	●	
	Dodonaea pinifolia		●
Solanaceae	**Solanum nigrum*		●
Stylidiaceae	*Levenhookia pusilla*	●	
	Stylidium sp.		●
	Stylidium tenue subsp. *tenue*	●	
Xanthorrhoeaceae	*Chamaescilla corymbosa*	●	
	Xanthorrhoea preissii	●	●
Zamiaceae	*Macrozamia riedlei*	●	●

Appendix I – Location of Environmental (WoNS & DP) Weed Taxa

Species	Latitude	Longitude	Status		Site ID	Date	No. of Individuals
			DPP	WoNS			
Asparagus asparagoides	-31.757858	116.43743	Y	Y	Opp	23/10/2020	1
Asparagus asparagoides	-31.809639	116.35351	Y	Y	Opp	21/10/2020	6
Asparagus asparagoides	-31.809532	116.3539	Y	Y	Opp	21/10/2020	1
Asparagus asparagoides	-31.809465	116.35417	Y	Y	Opp	21/10/2020	3
Asparagus asparagoides	-31.809397	116.35446	Y	Y	Opp	21/10/2020	2
Asparagus asparagoides	-31.809316	116.35459	Y	Y	Opp	21/10/2020	3
Asparagus asparagoides	-31.809125	116.35495	Y	Y	Opp	21/10/2020	15
Asparagus asparagoides	-31.808885	116.35544	Y	Y	Opp	21/10/2020	6
Asparagus asparagoides	-31.809662	116.35351	Y	Y	Opp	21/10/2020	1
Asparagus asparagoides	-31.838438	115.95701	Y	Y	Opp	22/10/2020	
Echium plantagineum	-31.808606	116.35603	Y		Opp	21/10/2020	30
Echium plantagineum	-31.807101	116.36118	Y		Opp	21/10/2020	5
Echium plantagineum	-31.809641	116.35338	Y		Opp	21/10/2020	6
Echium plantagineum	-31.807316	116.36036	Y		Opp	21/10/2020	
Echium plantagineum	-31.80628	116.36414	Y		Opp	21/10/2020	5
Echium plantagineum	-31.796176	116.38397	Y		Opp	21/10/2020	10
Echium plantagineum	-31.80951	116.35379	Y		Opp	21/10/2020	
Genista linifolia	-31.795847	116.38412		Y	Opp	21/10/2020	10
Gomphocarpus fruticosus	-31.757888	116.4375	Y		Opp	23/10/2020	5
Moraea flaccida	-31.79834	116.3798	Y		MCG-02	21/10/2020	
Zantedeschia aethiopica	-31.840783	115.95753	Y		Opp	22/10/2020	4

Appendix J – Flora of conservation significance locations

Species	Latitude	Longitude	Site ID	Date	Count	Comments
Tetratheca pilifera (P3)	-31.790981	116.38841	MCG-06	21/10/2020	1	New to previous survey area
Tetratheca pilifera (P3)	-31.793673	116.38567	No site	23/10/2020	1	Outside of both survey areas
Tetratheca pilifera (P3)	-31.793918	116.38544	No site	23/10/2020	2	Outside of both survey areas
Tetratheca pilifera (P3)	-31.794529	116.38504	No site	23/10/2020	1	Known location from previous survey area
Tetratheca pilifera (P3)	-31.793858	116.3858	No site	23/10/2020	1	New to previous survey area
Tetratheca pilifera (P3)	-31.794211	116.38546	No site	23/10/2020	1	New to previous survey area
Tetratheca pilifera (P3)	-31.793921	116.38574	No site	23/10/2020	1	New to previous survey area
Tetratheca pilifera (P3)	-31.76913622	116.4016142	No site	20/11/2020	3	New to current survey area
Tetratheca pilifera (P3)	-31.7691515	116.4016192	No site	20/11/2020	2	New to current survey area
Tetratheca pilifera (P3)	-31.76878023	116.4018269	No site	20/11/2020	6	New to current survey area

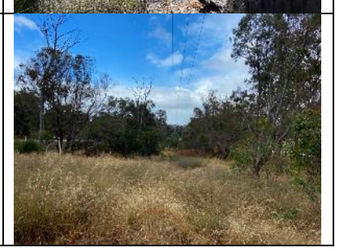
Appendix K – Vertebrate fauna sampling locations

Site	Start Date	End Date	Method	Habitat	Latitude	Longitude
Current Survey (2021)						
BCOG-01	25/11/2020	25/11/2020	Black Cockatoo Assessment	*Eucalyptus wandoo* woodland over *Banksia*	-31.759	116.435
BCOG-02	30/11/2020	30/11/2020	Black Cockatoo Assessment	*Eucalyptus wandoo* woodland/Cleared	-31.787	116.391
VCOG-01	25/11/2020	25/11/2020	Habitat Assessment	*Eucalyptus wandoo* woodland over *Banksia*	-31.758	116.438
VCOG-01	25/11/2020	30/11/2020	Camera trap	*Eucalyptus wandoo* woodland over *Banksia*	-31.758	116.438
VCOG-02	25/11/2020	25/11/2020	Habitat Assessment	Isolated Trees	-31.764	116.431
VCOG-03	25/11/2020	25/11/2020	Habitat Assessment	*Corymbia* and *Eucalyptus marginata* woodland	-31.767	116.426
VCOG-03	25/11/2020	30/11/2020	Camera trap	*Corymbia* and *Eucalyptus marginata* woodland	-31.767	116.426
VCOG-04	25/11/2020	25/11/2020	Habitat Assessment	Isolated Trees	-31.766	116.405
VCOG-04	25/11/2020	25/11/2020	Camera trap	Isolated Trees	-31.766	116.405
VCOG-05	25/11/2020	25/11/2020	Habitat Assessment	*Eucalyptus wandoo* woodland over *Banksia*	-31.768	116.423
VCOG-05	25/11/2020	30/11/2020	Camera trap	*Eucalyptus wandoo* woodland over *Banksia*	-31.767	116.423
VCOG-06	30/11/2020	30/11/2020	Habitat Assessment	*Corymbia* and *Eucalyptus marginata* woodland	-31.809	116.355
VCOG-07	25/11/2020	25/11/2020	Habitat Assessment	*Melaleuca* Shrubland	-31.773	116.400
VCOG-08	30/11/2020	30/11/2020	Habitat Assessment	*Eucalyptus wandoo* woodland over *Banksia*	-31.787	116.391
VCOG-09	25/11/2020	25/11/2020	Habitat Assessment	*Eucalyptus wandoo* woodland over *Banksia*	-31.809	116.364
VCOG-09	25/11/2020	30/11/2020	Camera trap	*Eucalyptus wandoo* woodland over *Banksia*	-31.809	116.364
VCOG-10	30/11/2020	30/11/2020	Habitat Assessment	*Eucalyptus wandoo* woodland/Cleared	-31.795	116.384
VCOG-11	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.783	116.393
VCOG-12	30/11/2020	30/11/2020	Habitat Assessment	*Eucalyptus wandoo* woodland over *Banksia*	-31.768	116.411
VCOG-13	30/11/2020	30/11/2020	Habitat Assessment	*Eucalyptus wandoo* woodland over *Banksia*	-31.770	116.401
VCOG-14	30/11/2020	30/11/2020	Habitat Assessment	*Eucalyptus wandoo* woodland over *Banksia*	-31.771	116.401
VCOG-15	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.786	116.392
VCOG-16	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.788	116.391
VCOG-17	30/11/2020	30/11/2020	Habitat Assessment	*Eucalyptus wandoo* woodland over *Banksia*	-31.768	116.402
VCOG-18	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.788	116.391
VCOG-19	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.789	116.390
VCOG-20	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.792	116.389
VCOG-21	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.789	116.390
VCOG-22	30/11/2020	30/11/2020	Habitat Assessment	*Eucalyptus wandoo* woodland over *Banksia*	-31.792	116.388
VCOG-23	30/11/2020	30/11/2020	Habitat Assessment	*Corymbia* and *Eucalyptus marginata* woodland	-31.794	116.387
VCOG-24	30/11/2020	30/11/2020	Habitat Assessment	*Corymbia* and *Eucalyptus marginata* woodland	-31.795	116.386

Site	Start Date	End Date	Method	Habitat	Latitude	Longitude
VCOG-25	30/11/2020	30/11/2020	Habitat Assessment	*Melaleuca* Shrubland	-31.795	116.385
VCOG-26	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.796	116.385
VCOG-27	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.795	116.385
VCOG-28	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.796	116.384
VCOG-29	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.797	116.383
VCOG-30	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.798	116.382
VCOG-31	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.798	116.381
VCOG-32	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.799	116.380
VCOG-33	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.799	116.380
VCOG-34	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.806	116.367
VCOG-35	30/11/2020	30/11/2020	Habitat Assessment	Isolated Trees	-31.806	116.364
Previous Survey (2015)						
Aud 9	28/10/2015	4/11/2015	Camera trap	*Eucalyptus wandoo* woodland over *Banksia*	-31.809	116.363
Aud R1	28/10/2015	4/11/2015	Camera trap	*Eucalyptus wandoo* woodland over *Banksia*	-31.773	116.404
Aud R2	28/10/2015	4/11/2015	Camera trap	*Corymbia* and *Eucalyptus marginata* woodland	-31.772	116.402
Aud 8	28/10/2015	4/11/2015	Camera trap	*Eucalyptus wandoo* woodland over *Banksia*	-31.771	116.414
Aud 5	28/10/2015	4/11/2015	Camera trap	*Eucalyptus wandoo* woodland over *Banksia*	-31.770	116.411
Aud 2	28/10/2015	4/11/2015	Camera trap	*Eucalyptus wandoo* woodland over *Banksia*	-31.767	116.425
Roost site 1	5/10/2015	5/10/2015	Roost survey site	*Eucalyptus wandoo* woodland over *Banksia*	-31.7732	116.408
Roost site 2	6/10/2015	6/10/2015	Roost survey site	Isolated Trees	-31.7836	116.389
Roost site 3	8/10/2015	8/10/2015	Roost survey site	*Eucalyptus wandoo* woodland over *Banksia*	-31.770	116.412

Appendix L – Fauna habitat assessments undertaken during the current field survey

Date	Habitat Type (field)	Landform	Aspect	Slope	Soil Type	Soil Avail.	Outcropping Rock Type	Rock Size	Veg. Litter	Dominant Veg. Type	Rocky Cracks / Crevices	Burrowing Suitability	Hollows <10cm	Hollows > 10cm	Water present	Disturbances	Last Fire	Notes
25/11/2020	Eucalypt Woodland	Undulating Low Hills	South	Low	Loamy Sand	Few Small Patches	Limited Outcropping / Conglomerate	Small Rocks (11-20cm)	Many Large Patches	Eucalypt Woodland,Wandoo woodland. open. no midstorey. xanth or shrub understorey (low).	Nil	Low	Scarce	Scarce	None	Road/ Access Track, Rubbish/ Litter	Old (6+ yr)	
30/11/2020	Dense Shrubland	Artificial low hill	Flat	Moderate	Clayey Sand	Scarce	Negligible	Gravel (1-4cm)	Evenly Spread	TBC	Nil	Low			Prone to Pooling		Moderate (3 to 5 yr)	
30/11/2020	Sedge wetland	Wetland	Flat	Flat	Clayey Sand	Many Large Patches	Negligible	Pebbles (5-10cm)	Scarce	"Scattee Wandoo, sedges, grass"	Nil	Moderate			Prone to Pooling		Moderate (3 to 5 yr)	
30/11/2020	Wandoo Woodland	Sand Plain	Flat	Flat	Clayey Sand	Scarce	Negligible	Negligible	Evenly Spread	"Wandoo, grass tree"	Nil	Low			None		Old (6+ yr)	
30/11/2020	Casuarina Woodland	Sand Plain	Flat	Flat	Clayey Sand	Scarce	Negligible	Pebbles (5-10cm)	Evenly Spread	Casuarina	Nil	High			None		Old (6+ yr)	
30/11/2020	Wandoo Woodland	Undulating Low Hills	Flat	Flat	Sandy Loam	Many Small Patches	Limited Outcropping / Laterite	Gravel (1-4cm)	Many Large Patches	"E. Wandoo, over Xthanthorea, gastrolobium and grevillea"	Nil	Moderate			None		Old (6+ yr)	

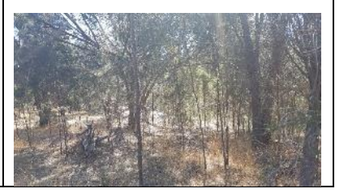
Date	Habitat Type (field)	Landform	Aspect	Slope	Soil Type	Soil Avail.	Outcropping Rock Type	Rock Size	Veg. Litter	Dominant Veg. Type	Rocky Cracks / Crevices	Burrowing Suitability	Hollows <10cm	Hollows > 10cm	Water present	Disturbances	Last Fire	Notes
30/11/2020	Wandoo Woodland	Undulating Low Hills	Flat	Flat	Sandy Loam	Many Small Patches	Limited Outcropping / Laterite	Gravel (1-4cm)	Many Small Patches	"E. Wandoo, over Allocasuarina and *Banksia*, over Xthanthorea"	Nil	Moderate			None		Old (6+ yr)	
30/11/2020	Wandoo Woodland	Undulating Low Hills	Flat	Flat	Sandy Loam	Few Small Patches	Limited Outcropping / Laterite	Gravel (1-4cm)	Evenly Spread	"E. Wandoo, over Xthanthorea"	Nil	Moderate			None		Old (6+ yr)	
25/11/2020	Wandoo Woodland	Undulating Low Hills	North	Flat	Loamy Sand	Few Small Patches	Negligible	Gravel (1-4cm)	Many Large Patches	Eucalypt Woodland,Scattered Eucalypts,open woodland of wandoo and marri. midstorey of casuarina. lower storey very open with grass tree and juvenile hakea and shrubs	Nil	Moderate			None		Old (6+ yr)	
25/11/2020	Marri Woodland	Undulating Low Hills	East	Low	Loamy Sand	Few Small Patches	Limited Outcropping / Conglomerate	Gravel (1-4cm)	Few Large Patches	Eucalypt Woodland,open marri woodland. xanthan. lower to mid of banksia sess and hakea and	Nil	Moderate			None		Old (6+ yr)	
25/11/2020	Marri Woodland	Sand Plain	East	Low	Loamy Sand	Few Small Patches	Negligible	Negligible	Evenly Spread	Eucalypt Woodland,xanthan. open marri and jarrah with some wandoo and marri. understorey becomes open and limited	Nil	High			channel. dry		Recent (0 to 2 yr)	
30/11/2020	Wandoo Woodland	Sand Plain	Flat	Low	Clayey Sand	Few Small Patches	Negligible	Negligible	Few Large Patches	Wandoo	Nil	Nil			Prone to Pooling. Water nearby.		Old (6+ yr)	

Date	Habitat Type (field)	Landform	Aspect	Slope	Soil Type	Soil Avail.	Outcropping Rock Type	Rock Size	Veg. Litter	Dominant Veg. Type	Rocky Cracks / Crevices	Burrowing Suitability	Hollows <10cm	Hollows > 10cm	Water present	Disturbances	Last Fire	Notes
30/11/2020	Open paddock with isolated Marri and Wandoo	Undulating Low Hills	Flat	Flat	Sandy Loam	Many Small Patches	Negligible	Negligible	Many Small Patches	Eucalypt Woodland,Tussock Grassland	Nil	Moderate			Water currently present		Old (6+ yr)	
30/11/2020	Drainage Area/ Minor Drainage Line	Drainage Area/ Floodplain	Flat	Flat	Clayey Sand	Many Small Patches	Negligible	Negligible	Many Small Patches	"E. rudis, over sedge and annual grass weeds"	Nil	Moderate			Prone to Pooling		Moderate (3 to 5 yr)	
30/11/2020	Flooded Gum Woodland	Drainage Area/ Floodplain	Flat	Flat	Sandy Loam	Few Small Patches	Negligible	Gravel (1-4cm)	Many Small Patches	Eucalypt Woodland,Tussock Grassland	Nil	Moderate			Prone to Pooling		Old (6+ yr)	
30/11/2020	Cleared/ Disturbed	Undulating Low Hills	Flat	Flat	Sandy Loam	Many Large Patches	Negligible	Gravel (1-4cm)	Few Small Patches	Tussock Grassland	Nil	Moderate			None		Moderate (3 to 5 yr)	
30/11/2020	Wandoo Woodland	Undulating Low Hills	Flat	Flat	Sandy Loam	Few Small Patches	Negligible	Gravel (1-4cm)	Many Large Patches	"E. Wandoo, over Allocasuarina, over Xthanthorea, over annual grass weeds"	Nil	Moderate			None		Moderate (3 to 5 yr)	

Date	Habitat Type (field)	Landform	Aspect	Slope	Soil Type	Soil Avail.	Outcropping Rock Type	Rock Size	Veg. Litter	Dominant Veg. Type	Rocky Cracks / Crevices	Burrowing Suitability	Hollows <10cm	Hollows > 10cm	Water present	Disturbances	Last Fire	Notes
30/11/2020	Cleared/ Disturbed	Undulating Low Hills	Flat	Flat	Sandy Loam	Evenly Spread	Negligible	Gravel (1-4cm)	Few Small Patches	Tussock Grassland	Nil	Moderate			None		Old (6+ yr)	
30/11/2020	Wandoo Woodland	Undulating Low Hills	Flat	Flat	Sandy Loam	Many Small Patches	Negligible	Gravel (1-4cm)	Evenly Spread	"E. Wandoo, over Allocasuarina, Acacia and Xanthorea, over annual grass weeds"	Nil	Moderate			None		Old (6+ yr)	
30/11/2020	Native Planting	Undulating Low Hills	Flat	Flat	Sandy Loam	Many Small Patches	Negligible	Negligible	Many Large Patches	"E. rudis over Acacia, over annual grass weeds"	Nil	Moderate			None		Old (6+ yr)	
30/11/2020	Drainage Area/ Minor drainage line	Drainage Area/ Floodplain	Flat	Flat	Clayey Sand	Few Small Patches	Negligible	Negligible	Many Small Patches	"Isolated E. rudis, over sedge sp. over annual grass and herb weeds"	Nil	Moderate			Prone to Pooling. Currently water present		Old (6+ yr)	
30/11/2020	Drainage Area/ Minor Drainage	Drainage Area/ Floodplain	Flat	Flat	Clayey Sand	Many Small Patches	Negligible	Negligible	Many Small Patches	E. rudis over Allocasuarina over annual grass weeds	Nil	Moderate			Prone to Pooling. Water currently present		Old (6+ yr)	

Date	Habitat Type (field)	Landform	Aspect	Slope	Soil Type	Soil Avail.	Outcropping Rock Type	Rock Size	Veg. Litter	Dominant Veg. Type	Rocky Cracks / Crevices	Burrowing Suitability	Hollows <10cm	Hollows > 10cm	Water present	Disturbances	Last Fire	Notes
30/11/2020	Isolated Planted Trees	Undulating Low Hills	Flat	Flat	Sandy Loam	Few Small Patches	Negligible	Gravel (1-4cm)	Many Small Patches	Mixed planted trees over annual grass weeds	Nil	Moderate			None		Old (6+ yr)	
30/11/2020	Flooded Gum	Drainage Area/ Floodplain	Flat	Flat	Clayey Sand	Few Small Patches	Negligible	Gravel (1-4cm)	Many Large Patches	Eucalypt Woodland,Tussock Grassland	Nil	Moderate			Prone to Pooling		Old (6+ yr)	
30/11/2020	Wandoo Woodland	Undulating Low Hills	Flat	Flat	Sandy Loam	Many Small Patches	Negligible	Gravel (1-4cm)	Many Small Patches	"E. Wandoo, over Xthanthorea, over annual grass weeds"	Nil	Moderate			None		Old (6+ yr)	
30/11/2020	E. rudis Planting	Undulating Low Hills	Flat	Flat	Sandy Loam	Few Small Patches	Negligible	Gravel (1-4cm)	Many Small Patches	Scattered Eucalypts,Tussock Grassland	Nil	Moderate			None		Old (6+ yr)	
30/11/2020	Cleared/ Degraded	Undulating Low Hills	Flat	Flat	Sandy Loam	Many Small Patches	Negligible	Gravel (1-4cm)	Many Small Patches	Tussock Grassland	Nil	Moderate			None		Old (6+ yr)	

Date	Habitat Type (field)	Landform	Aspect	Slope	Soil Type	Soil Avail.	Outcropping Rock Type	Rock Size	Veg. Litter	Dominant Veg. Type	Rocky Cracks / Crevices	Burrowing Suitability	Hollows <10cm	Hollows > 10cm	Water present	Disturbances	Last Fire	Notes
30/11/2020	Non-native Revegetation	Undulating Low Hills	Flat	Flat	Clayey Sand	Few Small Patches	Negligible	Gravel (1-4cm)	Many Small Patches	Non Native Revegetation	Nil	Moderate			None		Old (6+ yr)	
30/11/2020	Planted Flooded Gum	Drainage Area/ Floodplain	Flat	Flat	Clayey Sand	Few Small Patches	Negligible	Negligible	Many Small Patches	E. rudis over annual grass weeds	Nil	Moderate			Prone to Pooling		Old (6+ yr)	
30/11/2020	Drainage Area	Drainage Area/ Floodplain	Flat	Flat	Clayey Sand	Many Small Patches	Negligible	Negligible	Many Small Patches	"Allocasuarina, over sedge and annual grass weeds"	Nil	Moderate			Prone to Pooling		Old (6+ yr)	
30/11/2020	Cleared/ Distributed	Undulating Low Hills	Flat	Flat	Sandy Loam	Many Large Patches	Negligible	Gravel (1-4cm)	Many Small Patches	Tussock Grassland	Nil	High			None		Old (6+ yr)	
30/11/2020	Cape Lilac Planting	Undulating Low Hills	Flat	Flat	Sandy Loam	Many Small Patches	Negligible	Gravel (1-4cm)	Few Small Patches	Cape Lilac,Tussock Grassland	Nil	Nil			Scarce		Old (6+ yr)	

Date	Habitat Type (field)	Landform	Aspect	Slope	Soil Type	Soil Avail.	Outcropping Rock Type	Rock Size	Veg. Litter	Dominant Veg. Type	Rocky Cracks / Crevices	Burrowing Suitability	Hollows <10cm	Hollows > 10cm	Water present	Disturbances	Last Fire	Notes
25/11/2020	Wetland	Wetland	Flat	Flat	Clay Loam	Many Small Patches	Negligible	Negligible	Scarce	Salmon Gum	Nil	Moderate			Prone to Pooling		Moderate (3 to 5 yr)	
25/11/2020	Marri Woodland	Sand Plain	South/ West	Low	Sand	Scarce	Negligible	Gravel (1-4cm)	Few Large Patches	Marri	Nil	Low			None		Old (6+ yr)	
25/11/2020	Allocasuarina thicket	Sand Plain	West	Flat	Clay Loam	Few Large Patches	Negligible	Negligible	Evenly Spread	Allocasuarina. understorey of grass and weeds . midstorey more allo	Nil	Moderate			None		Old (6+ yr)	

Appendix M – Summarised results of the fauna database searches (including vertebrate species records excluded from discussion).

Scientific Name	Common name	Conservation listing				Database searches					Literature Review											
		EPBC Act	BC Act	DBCA	IUCN	NatureMap (15 km)	EPBC (15km)	DBCA Priority and Threatened Database (15km)	ALA (15 km)	Birdlife (15km)	Bamford Consulting Ecologists (2015). Great Eastern Highway SLK 55.8 – 68.5 Fauna and Black-Cockatoo Habitat	Karakamia Wildlife Sanctuary Species List. Australian Wildlife Conservancy (AWC) (2013)	Current field survey (Biologic, 2021)	Kabay (2007)	Bamford (2013)	Strategen JBS&G (2020)	Nature Reserves of the Shires of York and Northam: Clackline Nature Reserve (CALM, 1987)	Nature Reserves of the Shires of York and Northam: St Ronans (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Wambyn (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Mokine (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Throssell (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Meenaar (CALM, x985)
BOVIDAE																						
Bos taurus	**European cattle*						•															
Capra hircus	**Goat*						•															
Ovis aries	**Sheep*												•									
BURRAMYIDAE																						
Cercartetus concinnus	*Western pygmy-possum*					•			•			•						•	•	•		
CANIDAE																						
Canis familiaris	**Dog*						•															
Vulpes vulpes	**Red fox*					•	•				•								•	•		
DASYURIDAE																						
Antechinomys laniger	*Kultarr*					•			•													
Antechinus flavipes	*Yellow-footed antechinus*											•										
Dasyurus geoffroii	*Chuditch*	*VU*	*VU*			•	•	•	•			•		*Uncon firmed*								
Phascogale calura	*Red-tailed phascogale*	*VU*	*CD*				•															
Phascogale tapoatafa wambenger	*Wambenger brush-tailed phascogale*		*CD*					•						*Uncon firmed*								
Sminthopsis dolichura	*Little long-tailed dunnart*																	•	•			
Sminthopsis fuliginosus	*Grey-bellied dunnart*								•			•										
Sminthopsis gilberti	*Gilbert's dunnart*					•			•													
FELIDAE																						
Felis catus	**Cat*					•	•						•	•				•				
LEPORIDAE																						
Oryctolagus cuniculus	**Rabbit*					•	•				•		•	•			•	•	•	•	•	•
MACROPODIDAE																						
Macropus fuliginosus	*Western grey kangaroo*					•			•		•	•	•	•			•	•	•	•		
Notamacropus eugenii derbianus	*Tammar*			*P4*				•				•										
Notamacropus irma	*Western brush wallaby*			*P4*		•		•				•		•			•	•	•	•		
Osphranter robustus	*Euro*								•								•					
Petrogale lateralis lateralis	*Black-footed rock-wallaby, moororong*	*EN*	*EN*		*NT*			•														
Setonix brachyurus	*Quokka*	*VU*	*VU*				•	•				•										
MOLOSSIDAE																						
Austronomus australis	*White-striped freetail-bat*											•						•		•		
MURIDAE																						

Scientific Name	Common name	Conservation listing				Database searches					Literature Review											
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Hydromys chrysogaster	*Water-rat*			*P4*		●		●	●													
Mus musculus	**House mouse*					●	●		●									●	●	●		
Rattus rattus	**Black rat*						●															
MYRMECOBIIDAE																						
Myrmecobius fasciatus	*Numbat*	*EN*	*EN*					●														
PERAMELIDAE																						
Isoodon fusciventer	*Quenda*			*P4*				●			●	●	●	*Uncon firmed*								
PHALANGERIDAE																						
Trichosurus vulpecula	*Common brushtail possum*					●			●		●	●	●	●								
POTOROIDAE																						
Bettongia penicillata	*Woylie*	*EN*	*CR*			●	●		●			●										
PSEUDOCHEIRIDAE																						
Pseudocheirus occidentalis	*Western ringtail possum, ngwayir*	*CR*	*CR*					●				●										
SCIURIDAE																						
Funambulus pennanti	**Indian palm squirrel*						●															
SUIDAE																						
Sus scrofa	**Pig*						●															
TACHYGLOSSIDAE																						
Tachyglossus aculeatus	*Short-beaked echidna*					●			●		●	●	●				●	●	●	●	●	●
THYLACOMYIDAE																						
Macrotis lagotis	*Bilby*	*VU*	*VU*		*VU*	●		●	●													
VESPERTILIONIDAE																						
Chalinolobus gouldii	*Gould's wattled bat*											●										
Falsistrellus mackenziei	*Western false pipistrelle*			*P4*				●														
Nyctophilus geoffroyi	*Lesser long-eared bat*					●			●			●										
Nyctophilus major	*Greater long-eared bat*								●													
Vespadelus regulus	*Southern forest bat*											●										
ACANTHIZIDAE																						
Acanthiza apicalis	*Inland thornbill*					●			●	●		●					●	●	●	●		
Acanthiza chrysorrhoa	*Yellow-rumped thornbill*					●			●	●	●	●	●				●	●	●	●		●
Acanthiza inornata	*Western thornbill*					●			●	●	●	●	●				●	●	●	●		
Acanthiza uropygialis	*Chestnut-rumped thornbill*																				●	●
Gerygone fusca mungi	*Desert gerygone*					●																

Scientific Name	Common name	Conservation listing				Database searches					Literature Review											
		EPBC Act	BC Act	DBCA	IUCN	NatureMap (15 km)	EPBC (15km)	DBCA Priority and Threatened Database (15km)	ALA (15 km)	Birdlife (15km)	Bamford Consulting Ecologists (2015). Great Eastern Highway SLK 55.8 – 68.5 Fauna and Black-Cockatoo Habitat	Karakamia Wildlife Sanctuary Species List. Australian Wildlife Conservancy (AWC) (2013)	Current field survey (Biologic, 2021)	Kabay (2007)	Bamford (2013)	Strategen JBS&G (2020)	Nature Reserves of the Shires of York and Northam: Clackline Nature Reserve (CALM, 1987)	Nature Reserves of the Shires of York and Northam: St Ronans (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Wambyn (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Mokine (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Throssell (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Meenaar (CALM, x985)
Gerygone fusca	*Western gerygone*								●	●	●	●	●				●	●	●	●	●	●
Sericornis frontalis	*White-browed scrubwren*					●			●	●		●										
Smicrornis brevirostris	*Weebill*					●			●	●	●	●	●				●	●	●	●	●	●
ACCIPITRIDAE																						
Accipiter cirrocephalus	*Collared sparrowhawk*					●			●	●		●						●				
Accipiter fasciatus	*Brown goshawk*					●			●	●		●					●		●	●		●
Aquila audax	*Wedge-tailed eagle*					●			●	●	●	●					●			●		●
Circus approximans	*Swamp harrier*								●													
Elanus axillaris	*Black-shouldered kite*					●			●	●		●										
Haliaeetus leucogaster	*White-bellied sea-eagle*						●															
Haliastur sphenurus	*Whistling kite*								●	●		●										
Hamirostra isura	*Square-tailed kite*											●						●				
Hieraaetus morphnoides	*Little eagle*					●			●	●		●					●	●	●		●	●
ACROCEPHALIDAE																						
Acrocephalus australis	*Australian reed warbler*								●	●		●										
AEGOTHELIDAE																						
Aegotheles cristatus	*Australian owlet-nightjar*								●			●						●		●		
ALCEDINIDAE																						
Dacelo novaeguineae	*Laughing kookaburra*					●			●	●	●	●	●				●	●	●	●	●	●
Todiramphus pyrrhopygius	*Red-backed kingfisher*								●													●
Todiramphus sanctus	*Sacred kingfisher*					●			●	●	●	●	●						●	●	●	●
ANATIDAE																						
Anas castanea	*Chestnut teal*					●			●	●		●										
Anas gracilis	*Grey teal*					●			●	●	●											
Anas platyrhynchos	**Mallard*						●															
Anas rhynchotis	*Australasian shoveler*					●			●													
Anas superciliosa	*Pacific black duck*					●			●	●	●	●	●									
Biziura lobata	*Musk duck*								●			●										
Chenonetta jubata	*Australian wood duck*					●			●	●	●	●									●	
Cygnus atratus	*Black swan*											●										
Cygnus olor	**Mute swan*								●													
Malacorhynchus membranaceus	*Pink-eared duck*								●	●												
Oxyura australis	*Blue-billed duck*			P4	NT							●										

Scientific Name	Common name	Conservation listing				Database searches					Literature Review											
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Tadorna tadornoides	*Australian shelduck*					•			•	•	•	•								•	•	•
ANHINGIDAE																						
Anhinga novaehollandiae	*Australiasian darter*					•			•	•		•										
APODIDAE																						
Apus pacificus	*Fork-tailed swift*	*MI*	*MI*				•	•	•			•										
ARDEIDAE																						
Ardea ibis	*Cattle egret*						•															
Ardea modesta	*Eastern great egret*						•					•										
Egretta novaehollandiae	*White-faced heron*					•						•										•
Ardea pacifica	*White-necked heron*					•			•	•		•										
Nycticorax caledonicus	*Nankeen night heron*					•			•	•		•										
ARTAMIDAE																						
Artamus cinereus	*Black-faced woodswallow*					•			•	•		•									•	•
Artamus cyanopterus	*Dusky woodswallow*					•			•	•		•	•				•		•	•		
Artamus personatus	*Masked woodswallow*								•			•										
Artamus superciliosus	*White-browed woodswallow*					•																
BURHINIDAE																						
Burhinus grallarius	*Bush stone-curlew*					•			•													
CACATUIDAE																						
Cacatua galerita	*Sulphur-crested cockatoo*								•													
Cacatua pastinator	*Western long-billed corella*					•			•	•												
Cacatua roseicapilla	*Galah*					•					•	•	•				•		•	•	•	•
Cacatua sanguinea	*Little corella*					•			•	•	•											
Cacatua tenuirostris	*Eastern long-billed corella*																				•	
Calyptorhynchus banksii	*Red-tailed black cockatoo*					•			•	•												
Calyptorhynchus banksii naso	*Forest red-tailed black cockatoo*	*VU*	*VU*			•	•	•			•	•	•			•						
Calyptorhynchus baudinii	*Baudin's cockatoo*	*EN*	*EN*			•	•	•	•		•	•	•				•	•	•	•		
Calyptorhynchus latirostris	*Carnaby's cockatoo*	*EN*	*EN*			•	•	•	•		•	•	•	•		•						
Calyptorhynchus sp. 'white-tailed black cockatoo'	*White-tailed black cockatoo*	*EN*	*EN*			•		•														
CAMPEPHAGIDAE																						
Coracina novaehollandiae	*Black-faced cuckoo-shrike*					•			•	•		•	•				•	•	•	•	•	•
Lalage tricolor	*White-winged triller*					•				•	•	•					•	•	•	•	•	•
CASUARIIDAE																						

Scientific Name	Common name	Conservation listing				Database searches					Literature Review												
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Dromaius novaehollandiae	*Emu*					•			•	•							•	•				
CHARADRIIDAE																						
Elseyornis melanops	*Black-fronted dotterel*					•						•										
Charadrius ruficapillus	*Red-capped plover*								•													
Vanellus tricolor	*Banded lapwing*								•			•										
CLIMACTERIDAE																						
Climacteris rufus	*Rufous treecreeper*								•			•					•	•	•	•		
COLUMBIDAE																						
Columba livia	**Domestic pigeon*						•															
Geopelia cuneata	*Diamond dove*								•													
Ocyphaps lophotes	*Crested pigeon*					•			•	•		•							•		•	•
Phaps chalcoptera	*Common bronzewing*					•			•	•		•	•				•	•	•	•		•
Phaps elegans	*Brush bronzewing*											•										
Spilopelia chinensis	**Spotted turtle-dove*								•													
Spilopelia senegalensis	**Laughing turtle-dove*					•	•		•	•												•
CORVIDAE																						
Corvus bennetti	*Little crow*								•													
Corvus coronoides	*Australian raven*					•			•	•	•	•	•				•	•	•	•	•	•
CRACTICIDAE																						
Cracticus nigrogularis	*Pied butcherbird*					•			•	•		•										•
Cracticus tibicen	*Australian magpie*					•			•	•	•	•	•				•	•	•	•	•	•
Cracticus torquatus	*Grey butcherbird*					•			•	•		•										•
Strepera versicolor	*Grey currawong*					•			•	•		•					•					
CUCULIDAE																						
Cacomantis flabelliformis	*Fan-tailed cuckoo*					•			•	•		•					•					
Heteroscenes pallidus	*Pallid cuckoo*					•			•			•					•	•				•
Chrysococcyx basalis	*Horsfield's bronze cuckoo*																	•				•
Chrysococcyx lucidus	*Shining bronze cuckoo*								•			•						•				•
Chrysococcyx osculans	*Black-eared cuckoo*						•															
DICAEIDAE																						
Dicaeum hirundinaceum	*Mistletoebird*					•			•	•		•							•			•
ESTRILDIDAE																						
Taeniopygia guttata	*Zebra finch*																					•

Scientific Name	Common name	Conservation listing				Database searches					Literature Review											
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FALCONIDAE																						
Falco berigora	*Brown falcon*					•			•	•		•					•	•	•	•		•
Falco cenchroides	*Australian kestrel*					•			•	•	•	•					•				•	•
Falco hypoleucos	*Grey falcon*		*VU*		*VU*		•															
Falco longipennis	*Australian hobby*					•			•	•		•								•	•	•
Falco peregrinus	*Peregrine falcon*		*OS*			•		•	•	•		•										
FRINGILLIDAE																						
Carduelis carduelis	**European goldfinch*						•															
HIRUNDINIDAE																						
Cheramoeca leucosterna	*White-backed swallow*					•											•					•
Hirundo neoxena	*Welcome swallow*					•			•	•		•										•
Petrochelidon ariel	*Fairy martin*								•													
Petrochelidon nigricans	*Tree martin*					•			•	•	•	•	•				•	•	•	•	•	•
LARIDAE																						
Larus novaehollandiae	*Silver gull*											•										
LOCUSTELLIDAE																						
Megalurus cruralis	*Brown songlark*											•										
Megalurus gramineus	*Little grassbird*											•										
Megalurus mathewsi	*Rufous songlark*											•						•				•
MALURIDAE																						
Malurus leucopterus	*White-winged fairy-wren*																					•
Malurus splendens	*Splendid fairy-wren*					•			•	•	•	•	•				•	•	•	•		
MEGAPODIIDAE																						
Leipoa ocellata	*Malleefowl*	*VU*	*VU*			•	•	•														
Acanthagenys rufogularis	*Spiny-cheeked honeyeater*																					•
Acanthorhynchus superciliosus	*Western spinebill*								•	•		•					•	•	•	•		
Anthochaera carunculata	*Red wattlebird*					•			•	•		•					•	•	•			•
Anthochaera lunulata	*Western little wattlebird*					•			•	•	•	•					•	•	•			
Epthianura albifrons	*White-fronted chat*					•			•	•												•
Epthianura tricolor	*Crimson chat*					•			•	•												
Gavicalis virescens	*Singing honeyeater*					•			•	•		•	•					•		•	•	•
Glyciphila melanops	*Tawny-crowned honeyeater*					•				•	•	•					•	•	•			
Lichmera indistincta	*Brown honeyeater*					•			•	•	•	•	•				•	•	•	•		•

Scientific Name	Common name	Conservation listing				Database searches					Literature Review											
		EPBC Act	BC Act	DBCA	IUCN	NatureMap (15 km)	EPBC (15km)	DBCA Priority and Threatened Database (15km)	ALA (15 km)	Birdlife (15km)	Bamford Consulting Ecologists (2015). Great Eastern Highway SLK 55.8 – 68.5 Fauna and Black-Cockatoo Habitat	Karakamia Wildlife Sanctuary Species List. Australian Wildlife Conservancy (AWC) (2013)	Current field survey (Biologic, 2021)	Kabay (2007)	Bamford (2013)	Strategen JBS&G (2020)	Nature Reserves of the Shires of York and Northam: Clackline Nature Reserve (CALM, 1987)	Nature Reserves of the Shires of York and Northam: St Ronans (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Wambyn (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Mokine (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Throssell (CALM, 1987)	Nature Reserves of the Shires of York and Northam: Meenaar (CALM, x985)
Manorina flavigula	*Yellow-throated miner*					•			•	•												•
Melithreptus brevirostris	*Brown-headed honeyeater*					•			•	•		•	•					•	•	•		•
Melithreptus chloropsis	*Western white-naped honeyeater*								•			•					•	•	•			
Phylidonyris nigra	*White-cheeked honeyeater*					•						•					•	•				
Phylidonyris novaehollandiae	*New holland honeyeater*					•			•	•		•					•	•	•	•		
Ptilotula ornatus	*Yellow-plumed honeyeater*											•							•	•		
Purnella albifrons	*White-fronted honeyeater*																					•
Sugomel niger	*Black honeyeater*								•													
MEROPIDAE																						
Merops ornatus	*Rainbow bee-eater*					•	•		•	•		•					•	•	•	•	•	•
MONARCHIDAE																						
Grallina cyanoleuca	*Magpie-lark*					•			•	•	•	•	•						•		•	•
Myiagra inquieta	*Restless flycatcher*					•			•	•		•								•		
MOTACILLIDAE																						
Anthus australis	*Australian pipit*																•	•				
Motacilla cinerea	*Grey wagtail*	*MI*	*MI*				•															
NEOSITTIDAE																						
Daphoenositta chrysoptera	*Varied sittella*					•			•	•		•	•						•	•	•	•
OREOICIDAE																						
Oreoica gutturalis	*Crested bellbird*																					•
PACHYCEPHALIDAE																						
Colluricincla harmonica	*Grey shrike-thrush*					•			•	•	•	•	•				•	•	•	•		•
Falcunculus frontatus	*Crested shrike-tit*					•			•	•												
Pachycephala occidentalis	*Western golden whistler*								•	•		•										
Pachycephala pectoralis	*Golden whistler*																•	•			•	
Pachycephala rufiventris	*Rufous whistler*					•			•	•	•	•	•				•	•	•	•		•
PANDIONIDAE																						
Pandion haliaetus	*Osprey*	*MI*	*MI*				•															
PARDALOTIDAE																						
Pardalotus punctatus	*Spotted pardalote*					•			•	•		•								•		
Pardalotus striatus	*Striated pardalote*					•			•	•	•	•	•				•	•	•	•	•	•
PASSERIDAE																						
Passer domesticus	**House sparrow*						•															

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Passer montanus	**Eurasian tree sparrow*						•															
PETROICIDAE																						
Eopsaltria australis griseogularis	*Western yellow robin*											•					•	•	•	•		
Eopsaltria georgiana	*White-breasted robin*					•			•													
Melanodryas cucullata	*Hooded robin*								•													
Microeca fascinans	*Jacky winter*					•			•	•		•										•
Petroica boondang	*Scarlet robin*					•						•	•				•	•	•	•		
Petroica goodenovii	*Red-capped robin*					•			•	•		•	•				•	•	•	•	•	•
PHAETHONTIDAE																						
Phalacrocorax carbo	*Great cormorant*											•										
Phalacrocorax melanoleucos	*Little pied cormorant*					•						•										
Phalacrocorax sulcirostris	*Little black cormorant*											•										
Phalacrocorax varius	*Pied cormorant*											•										
PHASIANIDAE																						
Coturnix pectoralis	*Stubble quail*					•			•	•		•					•		•		•	
PODARGIDAE																						
Podargus strigoides	*Tawny frogmouth*					•			•	•		•					•	•				
PODICIPEDIDAE																						
Podiceps cristatus	*Great crested grebe*											•										
Poliocephalus poliocephalus	*Hoary-headed grebe*					•			•	•												
Tachybaptus novaehollandiae	*Australasian grebe*					•			•	•		•										
POMATOSTOMIDAE																						
Pomatostomus superciliosus	*White-browed babbler*					•			•	•								•				•
PROCELLARIIDAE																						
Pterodroma mollis	*Soft-plumaged petrel*	*VU*				•			•													
PSITTACIDAE																						
Melopsittacus undulatus	*Budgerigar*					•			•	•											•	•
Neophema elegans	*Elegant parrot*					•			•	•		•						•	•	•	•	•
Parvipsitta porphyrocephala	*Purple-crowned lorikeet*								•			•						•	•			
Platycercus icterotis	*Western rosella*								•			•										
Platycercus spurius	*Red-capped parrot*					•					•	•					•	•				
Platycercus varius	*Mulga parrot*																					•
Platycercus zonarius	*Australian ringneck*					•					•	•	•				•	•	•	•	•	•

Scientific Name	Common name	Conservation listing				Database searches					Literature Review											
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Platycercus zonarius zonarius	*Port lincoln parrot*					•																
Polytelis anthopeplus	*Regent parrot*								•													•
Trichoglossus moluccanus	**Rainbow lorikeet*											•										
RALLIDAE																						
Fulica atra	*Eurasian coot*					•			•	•		•										
Gallinula tenebrosa	*Dusky moorhen*											•										
Gallirallus philippensis	*Buff-banded rail*											•										
Porphyrio porphyrio	*Purple swamphen*					•			•	•		•										
Porzana tabuensis	*Spotless crake*											•										
Tribonyx ventralis	*Black-tailed native-hen*								•	•												
RECURVIROSTRIDAE																						
Himantopus himantopus	*Black-winged stilt*					•			•			•										•
Cladorhynchus leucocephalus	*Banded stilt*											•										
RHIPIDURIDAE																						
Rhipidura albiscapa	*Grey fantail*					•			•		•	•	•				•	•	•	•		•
Rhipidura leucophrys	*Willie wagtail*					•			•	•		•						•	•	•	•	•
ROSTRATULIDAE																						
Rostratula benghalensis australis	*Australian painted snipe*	*EN*	*EN*		*EN*		•															
SCOLOPACIDAE																						
Calidris acuminata	*Sharp-tailed sandpiper*	*MI*	*MI*				•															
Calidris ferruginea	*Curlew sandpiper*	*CR/MI*	*CR/MI*		*NT*		•															
Calidris melanotos	*Pectoral sandpiper*	*MI*	*MI*				•															
Numenius madagascariensis	*Eastern curlew*	*CR/MI*	*CR/5*		*EN*		•															
Tringa hypoleucos	*Common sandpiper*	*MI*	*MI*				•															
Tringa nebularia	*Common greenshank*	*MI*	*MI*				•															
STRIGIDAE																						
Ninox boobook	*Boobook owl*									•		•					•	•	•	•		
Ninox connivens	*Barking owl*											•										
STURNIDAE																						
Sturnus vulgaris	**Common starling*						•															
THRESKIORNITHIDAE																						
Platalea flavipes	*Yellow-billed spoonbill*											•										
Threskiornis molucca	*Australian white ibis*											•										

Scientific Name	Common name	Conservation listing				Database searches					Literature Review											
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Threskiornis spinicollis	*Straw-necked ibis*					•			•	•		•										
TURNICIDAE																						
Turnix varius	*Painted button-quail*					•						•						•	•			
Turnix velox	*Little button-quail*					•			•	•		•										
TYTONIDAE																						
Tyto javanica	*Barn owl*					•			•			•										
Tyto novaehollandiae	*Masked owl*											•										
ZOSTEROPIDAE																						
Zosterops lateralis	*Silvereye*					•			•	•	•	•	•				•	•	•	•	•	
AGAMIDAE																						
Ctenophorus ornatus	*Ornate crevice dragon*					•			•									•		•		
Pogona minor												•					•	•	•	•		
PYTHONIDAE																						
Antaresia stimsoni	*Stimson's python*					•			•													
Morelia spilota	*Carpet python*					•			•			•					•					
CARPHODACTYLIDAE																						
Underwoodisaurus milii	*Southern barking gecko*					•			•			•					•	•	•	•		
CHELUIDAE																						
Chelodina colliei	*Oblong turtle*											•										
DIPLODACTYLIDAE																						
Diplodactylus granariensis									•								•	•	•	•		
Diplodactylus polyophthalmus												•										
Diplodactylus pucher																		•	•			
Hesperoedura reticulata																		•	•			
Christinus marmoratus	*Marbled gecko*											•						•				
ELAPIDAE																						
Brachyurophis semifasciatus						•			•			•					•	•	•	•		
Neelaps bimaculatus	*Black-naped snake*					•			•													
Notechis scutatus	*Tiger snake*											•										
Parasuta gouldii												•					•					
Parasuta nigriceps						•			•													
Pseudechis australis	*Mulga snake*					•			•										•			
Pseudonaja affinis	*Dugite*					•					•	•										

Scientific Name	Common name	Conservation listing				Database searches					Literature Review											
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Pseudonaja mengdeni	*Western brown snake*					•			•													
Simoselaps bertholdi	*Jan's banded snake*					•			•								•		•	•		
GEKKONIDAE																						
Crenadactylus ocellatus	*Clawless gecko*											•					•	•	•	•		•
Gehyra variegata						•			•			•					•	•	•	•		•
Hemidactylus frenatus	**Asian house gecko*								•													
PYGOPODIDAE																						
Aprasia pulchella												•							•			
Aprasia repens						•			•								•					
Delma fraseri						•			•			•					•	•	•	•		
Lialis burtonis						•			•			•					•	•	•	•		
Pygopus lepidopodus	*Common scaly foot*											•						•				
SCINCIDAE																						
Acritoscincus trilineatus												•										
Cryptoblepharus buchananii						•			•		•	•	•									
Cryptoblepharus plagiocephalus																	•	•	•	•		
Ctenotus delli	*Dell's skink*			P4				•														
Ctenotus labillardieri												•										
Ctenotus pantherinus	*Leopard ctenotus*					•			•										•			
Egernia kingii	*King's skink*					•			•			•										
Egernia napoleonis												•										
Eremiascincus richardsonii	*Broad-banded sand swimmer*											•							•	•		
Hemiergis initialis												•										
Lerista distinguenda						•			•			•					•	•	•	•		
Liopholis multiscutata						•			•								•	•	•			
Menetia greyii						•			•			•					•	•	•	•		
Morethia lineoocellata												•										
Morethia obscura												•						•	•			
Tiliqua rugosa						•			•		•	•	•				•	•	•	•	•	
TYPHLOPIDAE																						
Anilios australis									•			•					•		•	•		
Anilios pinguis												•							•			
VARANIDAE																						

Scientific Name	Common name	Conservation listing				Database searches					Literature Review											
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Varanus gouldii	*Sand monitor*					•			•		•	•					•	•				
Varanus tristis	*Racehorse monitor*											•					•	•		•		
PELODRYADIDAE																						
Litoria adelaidensis	*Slender tree frog*								•			•										
Litoria moorei	*Motorbike frog*								•			•										
LIMNODYNASTIDAE																						
Heleioporus albopunctatus	*Western spotted frog*					•			•								•	•		•		
Heleioporus barycragus	*Hooting frog*					•			•			•								•		
Limnodynastes dorsalis	*Western banjo frog*								•			•					•	•		•		
Neobatrachus pelobatoides	*Humming frog*																•					
MYOBATRACHIDAE																						
Crinia georgiana	*Quacking frog*					•					•	•										
Crinia glauerti	***Clicking frog***											•										
Crinia pseudinsignifera	*Bleating froglet*					•			•			•										
Geocrinia leai	*Ticking frog*											•										
Pseudophryne guentheri	*Crawling toadlet*					•			•			•					•	•		•	•	

Appendix N – Fauna of conservation significance recorded during the current field surveys

Species	Date Observed	Site ID	Latitude	Longitude	Observation Type	Individuals
Current Survey (2021)						
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7692	116.4207	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7615	116.4334	Individual (alive)	2
Calyptorhynchus banksii naso	30/11/2020	No Site	-31.7859	116.3917	Chewed Marri Nut	1
Calyptorhynchus banksii naso	30/11/2020	No Site	-31.7844	116.3924	Chewed Marri Nut	1
Calyptorhynchus banksii naso	30/11/2020	No Site	-31.7800	116.3940	Chewed Marri Nut	1
Calyptorhynchus banksii naso	30/11/2020	No Site	-31.7801	116.3945	Chewed Marri Nut	1
Calyptorhynchus banksii naso	30/11/2020	No Site	-31.7804	116.3949	Chewed Marri Nut	1
Calyptorhynchus banksii naso	30/11/2020	No Site	-31.7833	116.3932	Individual (alive)	1
Calyptorhynchus banksii naso	30/11/2020	No Site	-31.7869	116.3907	Chewed Jarrah Nuts	1
Calyptorhynchus banksii naso	30/11/2020	No Site	-31.7861	116.3911	Chewed Jarrah Nuts	1
Calyptorhynchus banksii naso	30/11/2020	No Site	-31.7852	116.3917	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7644	116.4297	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7590	116.4359	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7627	116.4320	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7660	116.4351	Individual (alive)	2
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7626	116.4320	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7621	116.4326	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7620	116.4327	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7611	116.4337	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7603	116.4347	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7602	116.4348	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7602	116.4348	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7596	116.4355	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	No Site	-31.7589	116.4365	Chewed Marri Nut	1
Calyptorhynchus banksii naso	25/11/2020	Vcog-09	-31.8086	116.3640	Call	1
Calyptorhynchus baudinii	30/11/2020	No Site	-31.7801	116.3944	Chewed Marri Nut	1
Calyptorhynchus baudinii	25/11/2020	No Site	-31.7602	116.4348	Chewed Marri Nut	1
Calyptorhynchus latirostris	30/11/2020	No Site	-31.7874	116.3912	Chewed Allocasuarina	1
Calyptorhynchus latirostris	30/11/2020	No Site	-31.7884	116.3903	Chewed Allocasuarina	1
Calyptorhynchus latirostris	30/11/2020	No Site	-31.7802	116.3943	Chewed Marri Nut	1
Calyptorhynchus latirostris	30/11/2020	No Site	-31.7801	116.3945	Chewed Marri Nut	1
Calyptorhynchus latirostris	25/11/2020	No Site	-31.7663	116.4266	Individual (alive)	1
Calyptorhynchus latirostris	25/11/2020	No Site	-31.7665	116.4264	Chewed Marri Nut	1
Calyptorhynchus latirostris	25/11/2020	No Site	-31.7667	116.4052	Individual (alive)	1
Calyptorhynchus latirostris	25/11/2020	No Site	-31.7619	116.4328	Chewed Marri Nut	1
Calyptorhynchus latirostris	25/11/2020	No Site	-31.7602	116.4348	Chewed Marri Nut	1
Calyptorhynchus latirostris	25/11/2020	No Site	-31.7600	116.4351	Chewed Marri Nut	1
Calyptorhynchus latirostris	25/11/2020	No Site	-31.7588	116.4366	Chewed Marri Nut	1
Isoodon fusciventer	30/11/2020	No Site	-31.7680	116.4110	Digging	1
Isoodon fusciventer	30/11/2020	No Site	-31.7688	116.4123	Digging	1
Isoodon fusciventer	30/11/2020	No Site	-31.7678	116.4106	Digging	1
Isoodon fusciventer	25/11/2020	No Site	-31.7676	116.4239	Digging	1
Previous Survey (2015)						

Species	Date Observed	Site ID	Latitude	Longitude	Observation Type	Individuals
Calyptorhynchus banksii naso	5 - 8/10/2015	No Site	-31.7671	116.4266	Foraging evidence	
Calyptorhynchus banksii naso	5 - 8/10/2015	No Site	-31.7663	116.4273	Foraging evidence	
Calyptorhynchus banksii naso	5 - 8/10/2015	No Site	-31.7686	116.4217	Individual	Group of 4 birds
Calyptorhynchus banksii naso	5 - 8/10/2015	No Site	-31.7661	116.4276	Individual	Group of 2 birds (flyover)
Calyptorhynchus banksii naso	5 - 8/10/2015	No Site	-31.7683	116.4222	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7689	116.4224	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7579	116.4368	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7619	116.4324	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7627	116.4316	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7638	116.4308	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7633	116.4315	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7604	116.4346	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7552	116.4442	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7547	116.4457	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7665	116.4265	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7668	116.4267	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7654	116.4285	Foraging evidence	
Calyptorhynchus baudinii, Calyptorhynchus latirostris	5 - 8/10/2015	No Site	-31.7826	116.3905	Individual	Mixed flock of 4 birds
Calyptorhynchus baudinii, Calyptorhynchus latirostris	5 - 8/10/2015	No Site	-31.7852	116.3917	Individual	Mixed flock of 7 birds
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7866	116.3913	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7859	116.3919	Foraging evidence	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7858	116.3917	Individual	
Calyptorhynchus baudinii	5 - 8/10/2015	No Site	-31.7683	116.4222	Foraging evidence	
Calyptorhynchus latirostris	5 - 8/10/2015	No Site	-31.7866	116.3913	Foraging evidence	
Calyptorhynchus latirostris	5 - 8/10/2015	No Site	-31.7859	116.3919	Foraging evidence	
Isoodon fusciventer	5 - 8/10/2015	No Site	-31.7779	116.3966	Diggings	
Isoodon fusciventer	5 - 8/10/2015	No Site	-31.7775	116.3963	Diggings	
Isoodon fusciventer	5 - 8/10/2015	No Site	-31.7605	116.4336	Diggings	
Calyptorhynchus baudinii, Calyptorhynchus latirostris	6/10/2015	Mairinger Way	-31.7792	116.3875	Roosting site	Mixed flock of 30 birds

Appendix O – Potential black cockatoo breeding trees recorded in the survey area

Tree information							Hollow information					
Tree ID	**Species**	**DBH (mm)**	**Height (m)**	**Status**	**Latitude**	**Longitude**	**Number of hollows**	**Hollow type**	**Entry diameter**	**Chew marks**	**Occupancy**	**Potential suitability**
TCOG-001	Wandoo (*Eucalyptus wandoo*)	1020	12	Live	-31.7672	116.4047	5	Elbow type entry in branch	13	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
								End of branch leading into main trunk	10	No	Unknown	Unlikely - hollow is open along its length, and is not at the preferred angle
								End of branch leading into main trunk	10	No	Unknown	Unlikely - hollow is open along its length, and is not at the preferred angle
								End of branch leading into main trunk	10	No	Unknown	Unlikely - hollow is open along its length, and is not at the preferred angle
								End of branch leading into main trunk	10	No	Unknown	Unlikely - hollow is open along its length, and is not at the preferred angle
TCOG-002	Wandoo (*Eucalyptus wandoo*)	320	6	Live	-31.7671	116.4049	0					
TCOG-003	Wandoo (*Eucalyptus wandoo*)	390	10	Live	-31.7671	116.4051	0					
TCOG-004	Wandoo (*Eucalyptus wandoo*)	630	10	Live	-31.7669	116.4075	0					
TCOG-005	Wandoo (*Eucalyptus wandoo*)	470	8	Live	-31.767	116.408	0					
TCOG-006	Wandoo (*Eucalyptus wandoo*)	360	8	Live	-31.7669	116.4081	0					
TCOG-007	Wandoo (*Eucalyptus wandoo*)	340	10	Live	-31.767	116.4081	0					
TCOG-008	Wandoo (*Eucalyptus wandoo*)	300	9	Live	-31.767	116.4083	0					
TCOG-009	Wandoo (*Eucalyptus wandoo*)	300	9	Live	-31.767	116.4083	0					
TCOG-010	Wandoo (*Eucalyptus wandoo*)	320	9	Live	-31.7669	116.4084	0					
TCOG-011	Wandoo (*Eucalyptus wandoo*)	430	9	Live	-31.7669	116.4084	0					
TCOG-012	Wandoo (*Eucalyptus wandoo*)	330	9	Live	-31.767	116.4084	0					
TCOG-013	Wandoo (*Eucalyptus wandoo*)	340	9	Live	-31.7671	116.4084	0					
TCOG-014	Wandoo (*Eucalyptus wandoo*)	360	8	Live	-31.7671	116.4085	0					
TCOG-015	Wandoo (*Eucalyptus wandoo*)	1150	10	Live	-31.767	116.4086	5	Side entry branch hollow	10	No	Unknown	Unlikely - hollow is at a non-preferred angle, and does not extend in depth
								Elbow type entry in branch	15	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
								End of branch leading into main trunk	20	No	Unknown	Unlikely - hollow does not appear stable along its length
								End of branch leading into main trunk	20	No	Unknown	Unlikely - hollow is open along its length
								End of branch leading into main trunk	20	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-016	Wandoo (*Eucalyptus wandoo*)	350	10	Live	-31.7686	116.4019	0					
TCOG-017	Wandoo (*Eucalyptus wandoo*)	330	10	Live	-31.7671	116.4088	0					
TCOG-018	Wandoo (*Eucalyptus wandoo*)	420	9	Live	-31.7675	116.4101	0					
TCOG-019	Wandoo (*Eucalyptus wandoo*)	450	8	Live	-31.7678	116.4105	0					
TCOG-020	Wandoo (*Eucalyptus wandoo*)	350	8	Live	-31.7692	116.4016	0					
TCOG-021	Wandoo (*Eucalyptus wandoo*)	340	8	Live	-31.7678	116.4106	0					
TCOG-022	Wandoo (*Eucalyptus wandoo*)	350	9	Live	-31.7703	116.401	0					
TCOG-023	Wandoo (*Eucalyptus wandoo*)	480	9	Live	-31.7679	116.4107	0					
TCOG-024	Unknown (Dead)	570	2	Live	-31.7679	116.4107	0					
TCOG-025	Wandoo (*Eucalyptus wandoo*)	330	5	Live	-31.768	116.411	0					
TCOG-026	Wandoo (*Eucalyptus wandoo*)	530	10	Live	-31.7685	116.4117	0					
TCOG-027	Wandoo (*Eucalyptus wandoo*)	410	9	Live	-31.7686	116.4119	0					
TCOG-028	Wandoo (*Eucalyptus wandoo*)	330	9	Live	-31.7687	116.4122	0					
TCOG-029	Wandoo (*Eucalyptus wandoo*)	360	8	Live	-31.7678	116.4114	0					
TCOG-030	Unknown (Dead)	400	8	Live	-31.7676	116.4111	0					
TCOG-031	Wandoo (*Eucalyptus wandoo*)	820	10	Live	-31.7676	116.411	0					
TCOG-032	Wandoo (*Eucalyptus wandoo*)	670	8	Live	-31.7675	116.4109	0					
TCOG-033	Wandoo (*Eucalyptus wandoo*)	520	8	Live	-31.7675	116.4108	0					
TCOG-034	Wandoo (*Eucalyptus wandoo*)	590	8	Live	-31.7674	116.4107	0					
TCOG-035	Wandoo (*Eucalyptus wandoo*)	500	5	Live	-31.7672	116.4103	0					

Tree information							Hollow information					
Tree ID	Species	DBH (mm)	Height (m)	Status	Latitude	Longitude	Number of hollows	Hollow type	Entry diameter	Chew marks	Occupancy	Potential suitability
TCOG-036	Wandoo (*Eucalyptus wandoo*)	320	6	Live	-31.7671	116.41	0					
TCOG-037	Wandoo (*Eucalyptus wandoo*)	450	6	Live	-31.7669	116.4093	0					
TCOG-038	Wandoo (*Eucalyptus wandoo*)	360	6	Live	-31.7668	116.4093	0					
TCOG-039	Wandoo (*Eucalyptus wandoo*)	940	7	Live	-31.7668	116.4091	0					
TCOG-040	Marri (*Corymbia calophylla*)	880	9	Live	-31.786	116.3918	0					
TCOG-041	Marri (*Corymbia calophylla*)	670	9	Live	-31.7859	116.3917	0					
TCOG-042	Marri (*Corymbia calophylla*)	760	10	Live	-31.7858	116.3918	0					
TCOG-043	Unknown (Alive)	520	6	Live	-31.7851	116.3921	0					
TCOG-044	Unknown (Alive)	560	8	Live	-31.7845	116.3924	0					
TCOG-045	Wandoo (*Eucalyptus wandoo*)	400	8	Live	-31.7844	116.3926	0					
TCOG-046	Wandoo (*Eucalyptus wandoo*)	370	6	Live	-31.7842	116.3926	0					
TCOG-047	Wandoo (*Eucalyptus wandoo*)	360	6	Live	-31.7842	116.3927	0					
TCOG-048	Unknown (Alive)	530	8	Live	-31.784	116.3927	0					
TCOG-049	Marri (*Corymbia calophylla*)	740	8	Live	-31.7802	116.3943	0					
TCOG-050	Wandoo (*Eucalyptus wandoo*)	420	10	Live	-31.7802	116.3943	0					
TCOG-051	Wandoo (*Eucalyptus wandoo*)	800	10	Live	-31.7802	116.3942	0					
TCOG-052	Wandoo (*Eucalyptus wandoo*)	530	10	Live	-31.7801	116.3941	0					
TCOG-053	Wandoo (*Eucalyptus wandoo*)	480	10	Live	-31.7801	116.3941	0					
TCOG-054	Wandoo (*Eucalyptus wandoo*)	320	8	Live	-31.78	116.3941	0					
TCOG-055	Wandoo (*Eucalyptus wandoo*)	570	10	Live	-31.78	116.394	0					
TCOG-056	Wandoo (*Eucalyptus wandoo*)	720	10	Live	-31.78	116.394	0					
TCOG-057	Wandoo (*Eucalyptus wandoo*)	460	10	Live	-31.7799	116.3939	0					
TCOG-058	Wandoo (*Eucalyptus wandoo*)	550	10	Live	-31.7799	116.3939	0					
TCOG-059	Jarrah (*Eucalyptus marginata*)	590	10	Live	-31.7799	116.3938	0					
TCOG-060	Wandoo (*Eucalyptus wandoo*)	500	10	Live	-31.7798	116.3937	0					
TCOG-061	Wandoo (*Eucalyptus wandoo*)	490	10	Live	-31.7798	116.394	0					
TCOG-062	Wandoo (*Eucalyptus wandoo*)	510	10	Live	-31.7785	116.3962	0					
TCOG-063	Wandoo (*Eucalyptus wandoo*)	390	10	Live	-31.7799	116.3941	0					
TCOG-064	Marri (*Corymbia calophylla*)	560	10	Live	-31.7801	116.3944	0					
TCOG-065	Marri (*Corymbia calophylla*)	540	10	Live	-31.7801	116.3945	0					
TCOG-066	Marri (*Corymbia calophylla*)	500	10	Live	-31.7801	116.3945	0					
TCOG-067	Wandoo (*Eucalyptus wandoo*)	510	8	Dead	-31.7728	116.4009	0					
TCOG-068	Unknown (Dead)	640	6	Dead	-31.7787	116.3961	1	Chimney type in main trunk	30	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-069	Marri (*Corymbia calophylla*)	1260	10	Live	-31.7791	116.3958	0					
TCOG-070	Wandoo (*Eucalyptus wandoo*)	660	8	Live	-31.7808	116.3948	0					
TCOG-071	Wandoo (*Eucalyptus wandoo*)	320	8	Live	-31.7807	116.3947	0					
TCOG-072	Wandoo (*Eucalyptus wandoo*)	700	8	Live	-31.7807	116.3947	0					
TCOG-073	Wandoo (*Eucalyptus wandoo*)	500	8	Live	-31.7808	116.3947	0					
TCOG-074	Wandoo (*Eucalyptus wandoo*)	330	8	Live	-31.7824	116.3937	0					
TCOG-075	Wandoo (*Eucalyptus wandoo*)	330	8	Live	-31.7825	116.3937	0					
TCOG-076	Wandoo (*Eucalyptus wandoo*)	400	8	Live	-31.7833	116.3932	0					
TCOG-077	Wandoo (*Eucalyptus wandoo*)	300	6	Live	-31.7985	116.3798	0					
TCOG-078	Wandoo (*Eucalyptus wandoo*)	330	8	Live	-31.7983	116.3798	0					
TCOG-079	Flooded Gum (*Eucalyptus rudis*)	550	10	Live	-31.7982	116.3802	0					

Tree information							Hollow information					
Tree ID	**Species**	**DBH (mm)**	**Height (m)**	**Status**	**Latitude**	**Longitude**	**Number of hollows**	**Hollow type**	**Entry diameter**	**Chew marks**	**Occupancy**	**Potential suitability**
TCOG-080	Wandoo (*Eucalyptus wandoo*)	390	9	Live	-31.7955	116.3838	0					
TCOG-081	Wandoo (*Eucalyptus wandoo*)	360	9	Live	-31.7943	116.3851	0					
TCOG-082	Unknown (Dead)	1020	12	Dead	-31.794	116.3854	1	End of branch leading into main trunk	20	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-083	Wandoo (*Eucalyptus wandoo*)	470	10	Live	-31.7937	116.3857	0					
TCOG-084	Wandoo (*Eucalyptus wandoo*)	480	8	Live	-31.7934	116.386	0					
TCOG-085	Flooded Gum (*Eucalyptus rudis*)	400	10	Live	-31.7933	116.3861	0					
TCOG-086	Wandoo (*Eucalyptus wandoo*)	350	10	Live	-31.7923	116.3872	0					
TCOG-087	Wandoo (*Eucalyptus wandoo*)	390	10	Live	-31.7922	116.3873	0					
TCOG-088	Unknown (Dead)	1150	6	Live	-31.7919	116.3876	0					
TCOG-089	Wandoo (*Eucalyptus wandoo*)	430	10	Live	-31.7917	116.3877	0					
TCOG-090	Wandoo (*Eucalyptus wandoo*)	310	8	Live	-31.7906	116.3888	0					
TCOG-091	Jarrah (*Eucalyptus marginata*)	510	6	Live	-31.7905	116.3887	1	End of branch leading into main trunk	6	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-092	Jarrah (*Eucalyptus marginata*)	810	10	Live	-31.7905	116.3888	1	End of branch leading into main trunk	10	No	Unknown	Possible - suitable depth, angle, and although small the diameter entry is suitable. No obvious signs of competitor occupancy
TCOG-093	Jarrah (*Eucalyptus marginata*)	500	9	Live	-31.7901	116.389	0					
TCOG-094	Wandoo (*Eucalyptus wandoo*)	520	10	Live	-31.7901	116.3889	0					
TCOG-095	Wandoo (*Eucalyptus wandoo*)	390	10	Live	-31.7888	116.3895	0					
TCOG-096	Wandoo (*Eucalyptus wandoo*)	370	10	Live	-31.7873	116.3904	0					
TCOG-097	Jarrah (*Eucalyptus marginata*)	1150	10	Live	-31.7861	116.3911	0					
TCOG-098	Flooded Gum (*Eucalyptus rudis*)	627	8	Live	-31.8072	116.361	0					
TCOG-099	Wandoo (*Eucalyptus wandoo*)	338	8	Live	-31.8072	116.3609	0					
TCOG-100	Flooded Gum (*Eucalyptus rudis*)	710	8	Live	-31.7665	116.4071	0					
TCOG-101	Wandoo (*Eucalyptus wandoo*)	398	7	Live	-31.809	116.3552	0					
TCOG-102	Wandoo (*Eucalyptus wandoo*)	395	8	Live	-31.8091	116.355	0					
TCOG-103	Wandoo (*Eucalyptus wandoo*)	487	8	Live	-31.8091	116.355	0					
TCOG-104	Wandoo (*Eucalyptus wandoo*)	360	5	Live	-31.8092	116.3549	0					
TCOG-105	Wandoo (*Eucalyptus wandoo*)	398	8	Live	-31.8092	116.3548	0					
TCOG-106	Flooded Gum (*Eucalyptus rudis*)	627	9	Live	-31.8097	116.353	0					
TCOG-107	Wandoo (*Eucalyptus wandoo*)	330	6	Live	-31.8074	116.3639	0					
TCOG-108	Wandoo (*Eucalyptus wandoo*)	760	5	Live	-31.8076	116.3639	0					
TCOG-109	Wandoo (*Eucalyptus wandoo*)	380	4	Live	-31.8081	116.3638	0					
TCOG-110	Wandoo (*Eucalyptus wandoo*)	310	4	Live	-31.8082	116.3638	0					
TCOG-111	Wandoo (*Eucalyptus wandoo*)	340	6	Live	-31.8085	116.3638	0					
TCOG-112	Wandoo (*Eucalyptus wandoo*)	300	5	Live	-31.8085	116.3638	0					
TCOG-113	Wandoo (*Eucalyptus wandoo*)	330	7	Live	-31.8086	116.3638	0					
TCOG-114	Wandoo (*Eucalyptus wandoo*)	1080	10	Live	-31.8087	116.3638	0					
TCOG-115	Wandoo (*Eucalyptus wandoo*)	600	6	Live	-31.8087	116.3636	0					
TCOG-116	Wandoo (*Eucalyptus wandoo*)	320	4	Live	-31.8087	116.3635	0					
TCOG-117	Wandoo (*Eucalyptus wandoo*)	400	5	Live	-31.8085	116.3635	0					
TCOG-118	Wandoo (*Eucalyptus wandoo*)	400	5	Live	-31.8086	116.3635	0					
TCOG-119	Wandoo (*Eucalyptus wandoo*)	560	7	Live	-31.8085	116.3636	0					
TCOG-120	Wandoo (*Eucalyptus wandoo*)	330	4	Live	-31.8085	116.3636	0					
TCOG-121	Wandoo (*Eucalyptus wandoo*)	380	6	Live	-31.8083	116.3635	0					

Tree information							Hollow information					
Tree ID	**Species**	**DBH (mm)**	**Height (m)**	**Status**	**Latitude**	**Longitude**	**Number of hollows**	**Hollow type**	**Entry diameter**	**Chew marks**	**Occupancy**	**Potential suitability**
TCOG-122	Wandoo (*Eucalyptus wandoo*)	300	4	Live	-31.8082	116.3635	0					
TCOG-123	Wandoo (*Eucalyptus wandoo*)	690	5	Live	-31.8081	116.3635	0					
TCOG-124	Wandoo (*Eucalyptus wandoo*)	630	8	Live	-31.808	116.3635	0					
TCOG-125	Wandoo (*Eucalyptus wandoo*)	310	4	Live	-31.8078	116.3635	0					
TCOG-126	Wandoo (*Eucalyptus wandoo*)	540	7	Live	-31.8077	116.3637	0					
TCOG-127	Wandoo (*Eucalyptus wandoo*)	630	9	Live	-31.8076	116.3637	0					
TCOG-128	Wandoo (*Eucalyptus wandoo*)	360	4	Live	-31.8075	116.3637	0					
TCOG-129	Wandoo (*Eucalyptus wandoo*)	590	9	Live	-31.8073	116.3637	0					
TCOG-130	Wandoo (*Eucalyptus wandoo*)	870	8	Live	-31.8073	116.3638	1	End of branch leading into main trunk	20	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-131	Wandoo (*Eucalyptus wandoo*)	480	7	Live	-31.8073	116.3638	0					
TCOG-132	Wandoo (*Eucalyptus wandoo*)	460	7	Live	-31.807	116.3638	0					
TCOG-133	Wandoo (*Eucalyptus wandoo*)	450	6	Live	-31.8069	116.3638	0					
TCOG-134	Wandoo (*Eucalyptus wandoo*)	1000	12	Live	-31.7672	116.4045	1	Chimney type in main trunk	50	Yes	Unknown	Suitable - chew marks present around hollow entry. Suitable entry diameter and depth.
TCOG-135	Marri (*Corymbia calophylla*)	656	10	Live	-31.7672	116.4043	0					
TCOG-136	Marri (*Corymbia calophylla*)	653	10	Live	-31.7673	116.4043	0					
TCOG-137	Wandoo (*Eucalyptus wandoo*)	968	18	Live	-31.7674	116.4041	2	Hollow in main trunk entry at V fork	5	No	Bees	Unlikely - hollow diameter is small, and hollow is occupied by bees
								End of branch leading into main trunk	6	No	Unknown	Unlikely - hollow diameter is small, and other hollow in tree is occupied by bees
TCOG-138	Wandoo (*Eucalyptus wandoo*)	939	15	Live	-31.7683	116.4025	5	End of branch leading into main trunk	8	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	6	No	Unknown	Unlikely - diameter entry is considered too small.
								Elbow type entry in branch	6	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	5	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	5	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-139	Wandoo (*Eucalyptus wandoo*)	573	14	Live	-31.7683	116.4024	0					
TCOG-140	Wandoo (*Eucalyptus wandoo*)	659	14	Live	-31.7684	116.4023	1	Side entry in main trunk	4	No	Striated pardalote	Unlikely - diameter entry is considered too small, and hollow is occupied by other fauna
TCOG-141	Wandoo (*Eucalyptus wandoo*)	404	12	Live	-31.7685	116.4022	0					
TCOG-142	Wandoo (*Eucalyptus wandoo*)	869	14	Live	-31.7685	116.4021	1	End of branch leading into main trunk	14	Yes	Unknown	Suitable - chew marks present around hollow entry. Suitable entry diameter and depth.
TCOG-143	Wandoo (*Eucalyptus wandoo*)	350	12	Live	-31.7665	116.4082	0					
TCOG-144	Wandoo (*Eucalyptus wandoo*)	325	12	Live	-31.7688	116.402	0					
TCOG-145	Wandoo (*Eucalyptus wandoo*)	389	12	Live	-31.7687	116.402	0					
TCOG-146	Wandoo (*Eucalyptus wandoo*)	382	12	Live	-31.7687	116.402	0					
TCOG-147	Wandoo (*Eucalyptus wandoo*)	385	12	Live	-31.7687	116.4019	0					
TCOG-148	Wandoo (*Eucalyptus wandoo*)	901	14	Live	-31.7688	116.4017	2	End of branch leading into main trunk	6	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	6	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-149	Wandoo (*Eucalyptus wandoo*)	325	12	Live	-31.7689	116.4018	0					
TCOG-150	Wandoo (*Eucalyptus wandoo*)	373	12	Live	-31.769	116.4017	0					
TCOG-151	Wandoo (*Eucalyptus wandoo*)	338	12	Live	-31.769	116.4017	0					
TCOG-152	Wandoo (*Eucalyptus wandoo*)	490	12	Dead	-31.7594	116.4354	0					
TCOG-153	Wandoo (*Eucalyptus wandoo*)	315	12	Live	-31.7691	116.4016	0					
TCOG-154	Wandoo (*Eucalyptus wandoo*)	404	12	Live	-31.7692	116.4015	0					
TCOG-155	Wandoo (*Eucalyptus wandoo*)	350	12	Live	-31.7667	116.4053	0					
TCOG-156	Wandoo (*Eucalyptus wandoo*)	401	12	Live	-31.7695	116.4015	0					
TCOG-157	Wandoo (*Eucalyptus wandoo*)	357	12	Live	-31.7696	116.4014	0					
TCOG-158	Wandoo (*Eucalyptus wandoo*)	761	12	Live	-31.7696	116.4013	3	End of branch leading into main trunk	8	No	Unknown	Unlikely - diameter entry is considered too small.

Tree information							Hollow information					
Tree ID	**Species**	**DBH (mm)**	**Height (m)**	**Status**	**Latitude**	**Longitude**	**Number of hollows**	**Hollow type**	**Entry diameter**	**Chew marks**	**Occupancy**	**Potential suitability**
								End of branch leading into main trunk	20	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
								End of branch leading into main trunk	4	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-159	Wandoo (*Eucalyptus wandoo*)	959	12	Live	-31.77	116.4013	4	End of branch leading into main trunk	10	No	Unknown	Unlikely - hollow is at a non-preferred angle, and is of minimum entry diameter size
								End of branch leading into main trunk	8	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	8	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	6	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-160	Wandoo (*Eucalyptus wandoo*)	490	12	Live	-31.77	116.4012	1	Elbow type entry in branch	4	No	Bees	Unlikely - hollow diameter is small, and hollow is occupied by bees
TCOG-161	Wandoo (*Eucalyptus wandoo*)	385	12	Live	-31.7701	116.4011	0					
TCOG-162	Wandoo (*Eucalyptus wandoo*)	389	12	Live	-31.7701	116.4012	0					
TCOG-163	Wandoo (*Eucalyptus wandoo*)	315	12	Live	-31.7701	116.4011	0					
TCOG-164	Wandoo (*Eucalyptus wandoo*)	350	12	Live	-31.7671	116.4086	0					
TCOG-165	Wandoo (*Eucalyptus wandoo*)	439	12	Live	-31.7706	116.4009	0					
TCOG-166	Wandoo (*Eucalyptus wandoo*)	755	12	Live	-31.7707	116.401	0					
TCOG-167	Wandoo (*Eucalyptus wandoo*)	564	12	Live	-31.7708	116.4009	0					
TCOG-168	Wandoo (*Eucalyptus wandoo*)	306	10	Live	-31.7709	116.401	0					
TCOG-169	Wandoo (*Eucalyptus wandoo*)	443	12	Live	-31.771	116.401	0					
TCOG-170	Wandoo (*Eucalyptus wandoo*)	347	10	Live	-31.7711	116.4008	0					
TCOG-171	Wandoo (*Eucalyptus wandoo*)	1217	16	Dead	-31.7713	116.4008	4	Chimney type in main trunk	30	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
								End of branch leading into main trunk	30	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
								End of branch leading into main trunk	20	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
								End of branch leading into main trunk	12	No	Unknown	Unlikely - entry looks open walled, and is at non-preferred angle
TCOG-172	Wandoo (*Eucalyptus wandoo*)	494	12	Live	-31.7714	116.4007	0					
TCOG-173	Wandoo (*Eucalyptus wandoo*)	599	12	Live	-31.7715	116.4007	1	Elbow type entry in branch	6	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-174	Wandoo (*Eucalyptus wandoo*)	382	12	Live	-31.7716	116.4006	0					
TCOG-175	Wandoo (*Eucalyptus wandoo*)	637	10	Live	-31.786	116.3917	0					
TCOG-176	Marri (*Corymbia calophylla*)	656	14	Live	-31.7863	116.3915	0					
TCOG-177	Marri (*Corymbia calophylla*)	586	14	Live	-31.7864	116.3915	0					
TCOG-178	Marri (*Corymbia calophylla*)	732	12	Live	-31.7865	116.3913	0					
TCOG-179	Marri (*Corymbia calophylla*)	755	10	Live	-31.7866	116.3913	0					
TCOG-180	Wandoo (*Eucalyptus wandoo*)	318	8	Live	-31.7871	116.3911	0					
TCOG-181	Wandoo (*Eucalyptus wandoo*)	322	9	Live	-31.7873	116.3909	0					
TCOG-182	Wandoo (*Eucalyptus wandoo*)	424	12	Live	-31.7872	116.391	0					
TCOG-183	Wandoo (*Eucalyptus wandoo*)	306	7	Live	-31.7871	116.3912	0					
TCOG-184	Wandoo (*Eucalyptus wandoo*)	685	6	Dead	-31.7873	116.3911	2	End of branch leading into main trunk	4	No	Unknown	Unlikely - diameter entry is considered too small.
								Hollow in main trunk entry at V fork	30	No	Unknown	Unlikely - vegetation is growing from within hollow, suggesting depth is insufficient
TCOG-185	Wandoo (*Eucalyptus wandoo*)	322	7	Live	-31.7876	116.3909	0					
TCOG-186	Wandoo (*Eucalyptus wandoo*)	389	10	Live	-31.7874	116.3909	0					
TCOG-187	Wandoo (*Eucalyptus wandoo*)	379	10	Live	-31.7906	116.3893	0					
TCOG-188	Wandoo (*Eucalyptus wandoo*)	369	10	Live	-31.7877	116.3909	0					
TCOG-189	Wandoo (*Eucalyptus wandoo*)	481	8	Live	-31.7876	116.3909	0					
TCOG-190	Wandoo (*Eucalyptus wandoo*)	334	5	Live	-31.7915	116.389	0					
TCOG-191	Wandoo (*Eucalyptus wandoo*)	344	7	Live	-31.7905	116.3895	0					
TCOG-192	Wandoo (*Eucalyptus wandoo*)	328	7	Live	-31.7905	116.3895	0					

Tree information							Hollow information					
Tree ID	**Species**	**DBH (mm)**	**Height (m)**	**Status**	**Latitude**	**Longitude**	**Number of hollows**	**Hollow type**	**Entry diameter**	**Chew marks**	**Occupancy**	**Potential suitability**
TCOG-193	Unknown (Alive)	1038	16	Live	-31.7904	116.3895	0					
TCOG-194	Wandoo (*Eucalyptus wandoo*)	710	14	Live	-31.7902	116.3895	5	Hollow in main trunk entry at V fork	15	Yes	Unknown	Suitable - chew marks present around hollow entry. Suitable entry diameter and depth.
								End of branch leading into main trunk	14	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
								End of branch leading into main trunk	6	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	8	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	5	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-195	Wandoo (*Eucalyptus wandoo*)	347	10	Live	-31.7902	116.3895	0					
TCOG-196	Wandoo (*Eucalyptus wandoo*)	904	10	Live	-31.7893	116.3899	2	End of branch leading into main trunk	15	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
								End of branch leading into main trunk	30	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-197	Unknown (Alive)	583	8	Live	-31.789	116.39	0					
TCOG-198	Wandoo (*Eucalyptus wandoo*)	398	8	Live	-31.7889	116.39	0					
TCOG-199	Wandoo (*Eucalyptus wandoo*)	682	10	Live	-31.7895	116.3897	0					
TCOG-200	Wandoo (*Eucalyptus wandoo*)	653	12	Live	-31.7903	116.3894	0					
TCOG-201	Unknown (Dead)	583	17	Live	-31.7904	116.3893	0					
TCOG-202	Unknown (Alive)	605	10	Live	-31.7905	116.3893	0					
TCOG-203	Unknown (Alive)	615	16	Live	-31.7906	116.3892	0					
TCOG-204	Wandoo (*Eucalyptus wandoo*)	443	9	Live	-31.7908	116.3892	0					
TCOG-205	Unknown (Dead)	818	6	Dead	-31.791	116.3891	1	Chimney type in main trunk	50	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-206	Wandoo (*Eucalyptus wandoo*)	411	16	Dead	-31.7918	116.3887	1	End of branch leading into main trunk	3	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-207	Wandoo (*Eucalyptus wandoo*)	369	7	Live	-31.7918	116.3887	0					
TCOG-208	Wandoo (*Eucalyptus wandoo*)	551	17	Dead	-31.7928	116.3873	0					
TCOG-209	Wandoo (*Eucalyptus wandoo*)	739	12	Live	-31.7929	116.3872	0					
TCOG-210	Wandoo (*Eucalyptus wandoo*)	382	8	Dead	-31.7932	116.3869	0					
TCOG-211	Wandoo (*Eucalyptus wandoo*)	487	8	Live	-31.7932	116.3869	1	End of branch leading into main trunk	4	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-212	Wandoo (*Eucalyptus wandoo*)	500	8	Live	-31.7936	116.3865	0					
TCOG-213	Wandoo (*Eucalyptus wandoo*)	599	6	Dead	-31.7938	116.3863	3	End of branch leading into main trunk	8	No	Unknown	Unlikely - diameter entry is considered too small.
								Hollow in main trunk entry at V fork	14	No	Unknown	Unlikely - entry looks obstructed
								End of branch leading into main trunk	14	No	Unknown	Unlikely - angle and depth look potentially unsuitable
TCOG-214	Wandoo (*Eucalyptus wandoo*)	694	14	Live	-31.7938	116.3862	4	End of branch leading into main trunk	5	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	5	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	6	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	8	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-215	Wandoo (*Eucalyptus wandoo*)	615	14	Live	-31.794	116.3861	0					
TCOG-216	Wandoo (*Eucalyptus wandoo*)	382	14	Live	-31.794	116.3861	0					
TCOG-217	Wandoo (*Eucalyptus wandoo*)	876	14	Live	-31.7942	116.3859	2	End of branch leading into main trunk	7	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	7	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-218	Wandoo (*Eucalyptus wandoo*)	538	12	Live	-31.7943	116.3858	2	End of branch leading into main trunk	3	No	Unknown	Unlikely - diameter entry is considered too small.
								End of branch leading into main trunk	3	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-219	Wandoo (*Eucalyptus wandoo*)	318	14	Live	-31.7946	116.3855	0					
TCOG-220	Wandoo (*Eucalyptus wandoo*)	427	16	Live	-31.7946	116.3855	0					
TCOG-221	Wandoo (*Eucalyptus wandoo*)	392	14	Live	-31.7946	116.3854	0					
TCOG-222	Wandoo (*Eucalyptus wandoo*)	379	14	Live	-31.7947	116.3854	0					
TCOG-223	Wandoo (*Eucalyptus wandoo*)	411	8	Live	-31.7948	116.3852	0					

Tree information							Hollow information					
Tree ID	**Species**	**DBH (mm)**	**Height (m)**	**Status**	**Latitude**	**Longitude**	**Number of hollows**	**Hollow type**	**Entry diameter**	**Chew marks**	**Occupancy**	**Potential suitability**
TCOG-224	Flooded Gum (*Eucalyptus rudis*)	592	7	Live	-31.7952	116.3852	0					
TCOG-225	Flooded Gum (*Eucalyptus rudis*)	621	12	Live	-31.7962	116.3842	0					
TCOG-226	Flooded Gum (*Eucalyptus rudis*)	745	12	Live	-31.7963	116.3844	0					
TCOG-227	Flooded Gum (*Eucalyptus rudis*)	605	8	Live	-31.7965	116.3842	0					
TCOG-228	Wandoo (*Eucalyptus wandoo*)	449	6	Live	-31.7965	116.3841	0					
TCOG-229	Wandoo (*Eucalyptus wandoo*)	729	16	Live	-31.7964	116.3836	1	End of branch leading into main trunk	4	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-230	Wandoo (*Eucalyptus wandoo*)	532	10	Live	-31.7966	116.3833	0					
TCOG-231	Wandoo (*Eucalyptus wandoo*)	519	8	Live	-31.7967	116.3832	1	Chimney type in main trunk	6	No	Unknown	Unlikely - diameter entry is considered too small.
TCOG-232	Wandoo (*Eucalyptus wandoo*)	462	10	Live	-31.7968	116.3831	0					
TCOG-233	Wandoo (*Eucalyptus wandoo*)	462	12	Live	-31.7975	116.3821	0					
TCOG-234	Wandoo (*Eucalyptus wandoo*)	643	12	Live	-31.7976	116.382	0					
TCOG-235	Introduced Eucalyptus	608	12	Live	-31.7982	116.3814	0					
TCOG-236	Wandoo (*Eucalyptus wandoo*)	890	9	Live	-31.8071	116.3641	0					
TCOG-237	Wandoo (*Eucalyptus wandoo*)	360	10	Live	-31.8073	116.3639	0					
TCOG-238	Wandoo (*Eucalyptus wandoo*)	424	8	Live	-31.8056	116.3668	0					
TCOG-240	Marri (*Corymbia calophylla*)	497	11	Live	-31.7638	116.4308	0					
TCOG-241	Marri (*Corymbia calophylla*)	586	11	Live	-31.7637	116.4309	0					
TCOG-242	Marri (*Corymbia calophylla*)	650	9	Live	-31.7672	116.4237	0					
TCOG-243	Marri (*Corymbia calophylla*)	621	9	Live	-31.7624	116.4323	0					
TCOG-244	Marri (*Corymbia calophylla*)	548	11	Live	-31.7622	116.4325	0					
TCOG-245	Marri (*Corymbia calophylla*)	885	11	Live	-31.7622	116.4325	0					
TCOG-246	Marri (*Corymbia calophylla*)	710	11	Live	-31.7622	116.4326	0					
TCOG-248	Wandoo (*Eucalyptus wandoo*)	310	6	Live	-31.773	116.4006	0					
TCOG-249	Wandoo (*Eucalyptus wandoo*)	310	6	Live	-31.773	116.4006	0					
TCOG-250	Wandoo (*Eucalyptus wandoo*)	410	8	Live	-31.7729	116.4007	0					
TCOG-251	Wandoo (*Eucalyptus wandoo*)	340	7	Live	-31.773	116.4007	0					
TCOG-252	Wandoo (*Eucalyptus wandoo*)	510	7	Live	-31.7697	116.4192	0					
TCOG-253	Wandoo (*Eucalyptus wandoo*)	540	5	Live	-31.7728	116.4007	0					
TCOG-254	Wandoo (*Eucalyptus wandoo*)	960	10	Live	-31.7727	116.4006	0					
TCOG-255	Wandoo (*Eucalyptus wandoo*)	480	8	Live	-31.7727	116.4004	0					
TCOG-256	Marri (*Corymbia calophylla*)	510	6	Live	-31.7671	116.4232	0					
TCOG-257	Marri (*Corymbia calophylla*)	550	7	Live	-31.7695	116.4196	0					
TCOG-258	Wandoo (*Eucalyptus wandoo*)	620	12	Live	-31.7695	116.4195	0					
TCOG-259	Wandoo (*Eucalyptus wandoo*)	480	9	Live	-31.7695	116.4195	0					
TCOG-260	Wandoo (*Eucalyptus wandoo*)	320	7	Live	-31.7695	116.4194	0					
TCOG-261	Wandoo (*Eucalyptus wandoo*)	510	9	Live	-31.7695	116.4197	0					
TCOG-262	Wandoo (*Eucalyptus wandoo*)	450	10	Live	-31.7696	116.4192	0					
TCOG-263	Marri (*Corymbia calophylla*)	680	10	Live	-31.7697	116.4191	0					
TCOG-264	Wandoo (*Eucalyptus wandoo*)	510	12	Live	-31.7696	116.4193	0					
TCOG-265	Jarrah (*Eucalyptus marginata*)	990	12	Live	-31.7695	116.4198	0					
TCOG-266	Marri (*Corymbia calophylla*)	600	8	Live	-31.7694	116.4201	0					
TCOG-267	Marri (*Corymbia calophylla*)	980	10	Dead	-31.7694	116.4203	1	End of branch leading into main trunk	15	No	Unknown	Unlikely - hollow entry looks unstable.
TCOG-268	Wandoo (*Eucalyptus wandoo*)	500	9	Live	-31.7693	116.4204	0					
TCOG-269	Wandoo (*Eucalyptus wandoo*)	360	10	Live	-31.7693	116.4205	0					

Tree information							Hollow information					
Tree ID	**Species**	**DBH (mm)**	**Height (m)**	**Status**	**Latitude**	**Longitude**	**Number of hollows**	**Hollow type**	**Entry diameter**	**Chew marks**	**Occupancy**	**Potential suitability**
TCOG-270	Wandoo (*Eucalyptus wandoo*)	530	10	Live	-31.7693	116.4205	0					
TCOG-271	Wandoo (*Eucalyptus wandoo*)	400	7	Live	-31.7692	116.4207	0					
TCOG-272	Wandoo (*Eucalyptus wandoo*)	430	8	Live	-31.7692	116.4206	0					
TCOG-273	Wandoo (*Eucalyptus wandoo*)	530	10	Live	-31.7692	116.4205	0					
TCOG-274	Marri (*Corymbia calophylla*)	1600	12	Live	-31.7691	116.4209	0					
TCOG-275	Marri (*Corymbia calophylla*)	940	11	Live	-31.7691	116.4208	0					
TCOG-276	Marri (*Corymbia calophylla*)	840	7	Live	-31.769	116.4214	2	End of branch leading into main trunk	20	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
								Side entry in main trunk	20	No	Unknown	Unlikely - hollow entry looks unstable, and is at a non-preferred angle and depth
TCOG-277	Wandoo (*Eucalyptus wandoo*)	460	11	Live	-31.7676	116.4239	0					
TCOG-278	Jarrah (*Eucalyptus marginata*)	680	11	Live	-31.7675	116.4239	0					
TCOG-279	Wandoo (*Eucalyptus wandoo*)	320	9	Live	-31.7675	116.4238	0					
TCOG-280	Wandoo (*Eucalyptus wandoo*)	460	10	Live	-31.7675	116.4237	0					
TCOG-281	Wandoo (*Eucalyptus wandoo*)	300	7	Live	-31.7675	116.4237	0					
TCOG-282	Wandoo (*Eucalyptus wandoo*)	490	8	Live	-31.7691	116.4017	0					
TCOG-283	Wandoo (*Eucalyptus wandoo*)	390	9	Live	-31.7674	116.4236	0					
TCOG-284	Wandoo (*Eucalyptus wandoo*)	570	9	Live	-31.7674	116.4236	0					
TCOG-285	Wandoo (*Eucalyptus wandoo*)	310	5	Live	-31.7674	116.4237	0					
TCOG-286	Jarrah (*Eucalyptus marginata*)	740	6	Live	-31.7673	116.4237	0					
TCOG-287	Wandoo (*Eucalyptus wandoo*)	440	7	Live	-31.7673	116.4237	0					
TCOG-288	Jarrah (*Eucalyptus marginata*)	650	11	Live	-31.7635	116.431	0					
TCOG-289	Jarrah (*Eucalyptus marginata*)	780	6	Dead	-31.7671	116.4236	1	Hollow in main trunk entry at V fork	20	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-290	Wandoo (*Eucalyptus wandoo*)	460	6	Live	-31.7671	116.4235	0					
TCOG-291	Wandoo (*Eucalyptus wandoo*)	560	8	Live	-31.767	116.4234	0					
TCOG-292	Jarrah (*Eucalyptus marginata*)	540	6	Dead	-31.7669	116.4236	0					
TCOG-293	Jarrah (*Eucalyptus marginata*)	980	9	Dead	-31.7668	116.4236	0					
TCOG-294	Jarrah (*Eucalyptus marginata*)	830	13	Live	-31.7666	116.4233	0					
TCOG-295	Wandoo (*Eucalyptus wandoo*)	320	13	Live	-31.7666	116.4234	0					
TCOG-296	Jarrah (*Eucalyptus marginata*)	780	10	Dead	-31.7666	116.4234	0					
TCOG-297	Jarrah (*Eucalyptus marginata*)	520	5	Live	-31.7665	116.4234	0					
TCOG-298	Jarrah (*Eucalyptus marginata*)	820	6	Dead	-31.7665	116.4234	0					
TCOG-299	Wandoo (*Eucalyptus wandoo*)	490	12	Live	-31.7674	116.4237	0					
TCOG-300	Jarrah (*Eucalyptus marginata*)	820	9	Live	-31.7663	116.4232	0					
TCOG-301	Wandoo (*Eucalyptus wandoo*)	490	9	Live	-31.7664	116.4232	0					
TCOG-302	Jarrah (*Eucalyptus marginata*)	590	8	Live	-31.766	116.4231	0					
TCOG-303	Jarrah (*Eucalyptus marginata*)	930	12	Live	-31.7659	116.4229	1	Chimney type in main trunk	30	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-304	Marri (*Corymbia calophylla*)	610	9	Live	-31.7659	116.423	0					
TCOG-305	Wandoo (*Eucalyptus wandoo*)	400	8	Live	-31.7658	116.4229	0					
TCOG-306	Wandoo (*Eucalyptus wandoo*)	560	11	Live	-31.7659	116.4229	0					
TCOG-307	Wandoo (*Eucalyptus wandoo*)	600	10	Live	-31.766	116.4226	0					
TCOG-308	Wandoo (*Eucalyptus wandoo*)	770	12	Live	-31.766	116.4225	0					
TCOG-309	Wandoo (*Eucalyptus wandoo*)	370	8	Live	-31.766	116.4226	0					
TCOG-310	Wandoo (*Eucalyptus wandoo*)	440	7	Live	-31.766	116.4226	0					
TCOG-311	Wandoo (*Eucalyptus wandoo*)	440	9	Live	-31.7661	116.4226	0					
TCOG-312	Wandoo (*Eucalyptus wandoo*)	420	10	Live	-31.7661	116.4226	0					

Tree information							Hollow information					
Tree ID	**Species**	**DBH (mm)**	**Height (m)**	**Status**	**Latitude**	**Longitude**	**Number of hollows**	**Hollow type**	**Entry diameter**	**Chew marks**	**Occupancy**	**Potential suitability**
TCOG-313	Jarrah (*Eucalyptus marginata*)	660	8	Live	-31.7663	116.4226	0					
TCOG-314	Jarrah (*Eucalyptus marginata*)	530	8	Live	-31.7663	116.4227	0					
TCOG-315	Wandoo (*Eucalyptus wandoo*)	1400	14	Live	-31.7664	116.4227	0					
TCOG-316	Wandoo (*Eucalyptus wandoo*)	330	7	Live	-31.7666	116.423	0					
TCOG-317	Unknown (Dead)	900	6	Live	-31.7666	116.4229	0					
TCOG-318	Wandoo (*Eucalyptus wandoo*)	480	9	Live	-31.7666	116.4228	0					
TCOG-319	Wandoo (*Eucalyptus wandoo*)	520	9	Live	-31.7666	116.4228	0					
TCOG-320	Wandoo (*Eucalyptus wandoo*)	420	7	Live	-31.7668	116.4231	0					
TCOG-321	Wandoo (*Eucalyptus wandoo*)	330	8	Live	-31.7668	116.4231	0					
TCOG-322	Wandoo (*Eucalyptus wandoo*)	830	7	Live	-31.7669	116.4231	0					
TCOG-323	Wandoo (*Eucalyptus wandoo*)	360	6	Live	-31.767	116.4232	0					
TCOG-324	Marri (*Corymbia calophylla*)	510	5	Live	-31.7666	116.4069	0					
TCOG-325	Wandoo (*Eucalyptus wandoo*)	1260	12	Live	-31.7672	116.423	0					
TCOG-326	Wandoo (*Eucalyptus wandoo*)	1200	13	Live	-31.7671	116.423	1	Chimney type in main trunk	30	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-327	Wandoo (*Eucalyptus wandoo*)	400	7	Live	-31.7674	116.4232	0					
TCOG-328	Wandoo (*Eucalyptus wandoo*)	800	10	Live	-31.7674	116.4232	0					
TCOG-329	Wandoo (*Eucalyptus wandoo*)	430	8	Live	-31.7678	116.4233	0					
TCOG-330	Marri (*Corymbia calophylla*)	530	8	Live	-31.7677	116.4233	0					
TCOG-331	Marri (*Corymbia calophylla*)	540	6	Live	-31.7676	116.4234	0					
TCOG-332	Wandoo (*Eucalyptus wandoo*)	520	7	Live	-31.7677	116.4235	0					
TCOG-333	Unknown (Dead)	1290	14	Live	-31.7638	116.4308	0					
TCOG-334	Marri (*Corymbia calophylla*)	540	12	Live	-31.7639	116.4307	0					
TCOG-335	Marri (*Corymbia calophylla*)	540	4	Live	-31.764	116.4307	0					
TCOG-336	Marri (*Corymbia calophylla*)	600	9	Live	-31.7645	116.4307	0					
TCOG-337	Wandoo (*Eucalyptus wandoo*)	400	7	Live	-31.7646	116.4307	0					
TCOG-338	Marri (*Corymbia calophylla*)	540	8	Live	-31.7646	116.4307	0					
TCOG-339	Wandoo (*Eucalyptus wandoo*)	440	7	Live	-31.7648	116.4307	0					
TCOG-340	Wandoo (*Eucalyptus wandoo*)	360	7	Live	-31.7648	116.4307	0					
TCOG-341	Wandoo (*Eucalyptus wandoo*)	420	7	Live	-31.7648	116.4307	0					
TCOG-342	Wandoo (*Eucalyptus wandoo*)	340	7	Live	-31.7649	116.4307	0					
TCOG-343	Wandoo (*Eucalyptus wandoo*)	590	6	Live	-31.7651	116.4307	0					
TCOG-344	Wandoo (*Eucalyptus wandoo*)	430	5	Live	-31.7652	116.4307	0					
TCOG-345	Wandoo (*Eucalyptus wandoo*)	510	6	Live	-31.759	116.4364	0					
TCOG-346	Wandoo (*Eucalyptus wandoo*)	620	12	Live	-31.7649	116.4305	0					
TCOG-347	Marri (*Corymbia calophylla*)	560	11	Live	-31.7645	116.4305	0					
TCOG-348	Marri (*Corymbia calophylla*)	520	9	Live	-31.7645	116.4305	0					
TCOG-349	Marri (*Corymbia calophylla*)	620	10	Live	-31.7644	116.4305	0					
TCOG-350	Wandoo (*Eucalyptus wandoo*)	930	14	Live	-31.7642	116.4303	1	End of branch leading into main trunk	20	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-351	Unknown (Dead)	840	11	Live	-31.7642	116.4303	0					
TCOG-352	Marri (*Corymbia calophylla*)	990	10	Live	-31.764	116.4304	0					
TCOG-353	Jarrah (*Eucalyptus marginata*)	550	12	Live	-31.766	116.4272	0					
TCOG-354	Jarrah (*Eucalyptus marginata*)	970	11	Live	-31.766	116.427	0					
TCOG-355	Jarrah (*Eucalyptus marginata*)	1100	7	Live	-31.7664	116.4267	0					
TCOG-356	Marri (*Corymbia calophylla*)	930	11	Live	-31.7663	116.4266	0					

Tree information							Hollow information					
Tree ID	**Species**	**DBH (mm)**	**Height (m)**	**Status**	**Latitude**	**Longitude**	**Number of hollows**	**Hollow type**	**Entry diameter**	**Chew marks**	**Occupancy**	**Potential suitability**
TCOG-357	Marri (*Corymbia calophylla*)	1310	9	Live	-31.7664	116.4266	2	End of branch leading into main trunk	30	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
								Side entry in main trunk	30	No	Unknown	Unlikely - hollow does not appear to extend enough in depth
TCOG-358	Jarrah (*Eucalyptus marginata*)	920	12	Live	-31.7666	116.4263	0					
TCOG-359	Marri (*Corymbia calophylla*)	810	9	Live	-31.7666	116.4262	0					
TCOG-360	Marri (*Corymbia calophylla*)	560	8	Live	-31.7666	116.4261	0					
TCOG-361	Jarrah (*Eucalyptus marginata*)	740	14	Live	-31.7666	116.4261	0					
TCOG-362	Marri (*Corymbia calophylla*)	780	9	Live	-31.7669	116.4266	0					
TCOG-363	Marri (*Corymbia calophylla*)	930	10	Live	-31.7668	116.4267	0					
TCOG-364	Marri (*Corymbia calophylla*)	660	9	Live	-31.7667	116.4268	0					
TCOG-365	Marri (*Corymbia calophylla*)	560	5	Live	-31.7666	116.427	0					
TCOG-366	Marri (*Corymbia calophylla*)	1180	13	Live	-31.7665	116.4271	0					
TCOG-367	Marri (*Corymbia calophylla*)	630	7	Live	-31.7665	116.4271	0					
TCOG-368	Marri (*Corymbia calophylla*)	600	6	Live	-31.7665	116.4272	0					
TCOG-369	Jarrah (*Eucalyptus marginata*)	900	12	Live	-31.7663	116.4274	0					
TCOG-370	Marri (*Corymbia calophylla*)	500	7	Live	-31.7664	116.4273	0					
TCOG-371	Marri (*Corymbia calophylla*)	770	8	Live	-31.7662	116.4275	0					
TCOG-372	Marri (*Corymbia calophylla*)	580	7	Dead	-31.7628	116.4318	0					
TCOG-373	Marri (*Corymbia calophylla*)	620	7	Live	-31.7661	116.4277	0					
TCOG-374	Marri (*Corymbia calophylla*)	860	12	Live	-31.766	116.4278	0					
TCOG-375	Marri (*Corymbia calophylla*)	920	11	Live	-31.7659	116.4279	0					
TCOG-376	Marri (*Corymbia calophylla*)	520	6	Live	-31.7659	116.4279	0					
TCOG-377	Marri (*Corymbia calophylla*)	620	7	Live	-31.7657	116.4281	0					
TCOG-378	Wandoo (*Eucalyptus wandoo*)	420	6	Live	-31.7656	116.4283	0					
TCOG-379	Wandoo (*Eucalyptus wandoo*)	460	10	Live	-31.7656	116.4284	0					
TCOG-380	Marri (*Corymbia calophylla*)	650	9	Live	-31.7604	116.4346	0					
TCOG-381	Marri (*Corymbia calophylla*)	610	9	Live	-31.7655	116.4285	0					
TCOG-382	Marri (*Corymbia calophylla*)	650	8	Live	-31.7602	116.4349	0					
TCOG-383	Marri (*Corymbia calophylla*)	700	11	Live	-31.7654	116.4286	0					
TCOG-384	Marri (*Corymbia calophylla*)	760	10	Live	-31.7652	116.4288	0					
TCOG-385	Tuart (*Eucalyptus gomphocephala*)	850	12	Live	-31.765	116.4291	0					
TCOG-386	Wandoo (*Eucalyptus wandoo*)	440	9	Live	-31.765	116.4291	0					
TCOG-387	Wandoo (*Eucalyptus wandoo*)	360	8	Live	-31.7649	116.4292	0					
TCOG-388	Wandoo (*Eucalyptus wandoo*)	770	13	Live	-31.7648	116.4293	0					
TCOG-389	Marri (*Corymbia calophylla*)	560	7	Live	-31.7647	116.4296	0					
TCOG-390	Marri (*Corymbia calophylla*)	740	8	Live	-31.7646	116.4297	0					
TCOG-391	Marri (*Corymbia calophylla*)	770	8	Live	-31.7646	116.4298	0					
TCOG-392	Marri (*Corymbia calophylla*)	630	8	Live	-31.7645	116.4298	0					
TCOG-393	Wandoo (*Eucalyptus wandoo*)	1170	9	Live	-31.7599	116.4347	1	Chimney type in main trunk	30	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-394	Jarrah (*Eucalyptus marginata*)	580	10	Live	-31.7597	116.435	0					
TCOG-395	Marri (*Corymbia calophylla*)	780	10	Live	-31.7596	116.435	0					
TCOG-396	Unknown (Dead)	780	6	Dead	-31.7596	116.435	0					
TCOG-397	Unknown (Dead)	580	7	Dead	-31.7596	116.4351	0					
TCOG-398	Marri (*Corymbia calophylla*)	660	5	Dead	-31.7595	116.4352	0					
TCOG-399	Wandoo (*Eucalyptus wandoo*)	610	9	Live	-31.7595	116.4353	0					

Tree information							Hollow information					
Tree ID	**Species**	**DBH (mm)**	**Height (m)**	**Status**	**Latitude**	**Longitude**	**Number of hollows**	**Hollow type**	**Entry diameter**	**Chew marks**	**Occupancy**	**Potential suitability**
TCOG-400	Marri (*Corymbia calophylla*)	1440	8	Live	-31.7594	116.4354	0					
TCOG-401	Wandoo (*Eucalyptus wandoo*)	490	11	Live	-31.7662	116.4232	0					
TCOG-402	Wandoo (*Eucalyptus wandoo*)	560	7	Live	-31.7593	116.4355	0					
TCOG-403	Wandoo (*Eucalyptus wandoo*)	520	5	Live	-31.7592	116.4356	0					
TCOG-404	Marri (*Corymbia calophylla*)	560	7	Live	-31.7591	116.4358	0					
TCOG-405	Jarrah (*Eucalyptus marginata*)	500	7	Live	-31.7591	116.4359	0					
TCOG-406	Marri (*Corymbia calophylla*)	690	10	Live	-31.7591	116.4359	0					
TCOG-407	Jarrah (*Eucalyptus marginata*)	560	5	Live	-31.759	116.4359	0					
TCOG-408	Wandoo (*Eucalyptus wandoo*)	580	9	Live	-31.7589	116.436	0					
TCOG-409	Marri (*Corymbia calophylla*)	510	8	Live	-31.7588	116.4361	0					
TCOG-410	Marri (*Corymbia calophylla*)	560	8	Live	-31.7588	116.4362	0					
TCOG-411	Marri (*Corymbia calophylla*)	750	9	Live	-31.7586	116.4364	0					
TCOG-412	Marri (*Corymbia calophylla*)	970	9	Live	-31.7586	116.4365	0					
TCOG-413	Marri (*Corymbia calophylla*)	650	10	Live	-31.7585	116.4366	0					
TCOG-414	Marri (*Corymbia calophylla*)	940	14	Live	-31.7584	116.4368	0					
TCOG-415	Marri (*Corymbia calophylla*)	580	13	Live	-31.7583	116.437	0					
TCOG-416	Marri (*Corymbia calophylla*)	650	10	Live	-31.7582	116.437	0					
TCOG-417	Marri (*Corymbia calophylla*)	990	11	Live	-31.7581	116.4371	0					
TCOG-418	Marri (*Corymbia calophylla*)	570	14	Live	-31.7599	116.4352	0					
TCOG-419	Marri (*Corymbia calophylla*)	500	15	Live	-31.7581	116.4372	0					
TCOG-420	Marri (*Corymbia calophylla*)	510	16	Live	-31.758	116.4373	0					
TCOG-421	Unknown (Dead)	470	6	Dead	-31.7578	116.4376	1	Chimney type in main trunk	15	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-422	Wandoo (*Eucalyptus wandoo*)	810	131	Live	-31.7578	116.4376	0					
TCOG-423	Unknown (Dead)	600	7	Dead	-31.7577	116.4376	0					
TCOG-424	Unknown (Dead)	580	9	Dead	-31.7576	116.4378	0					
TCOG-425	Wandoo (*Eucalyptus wandoo*)	630	9	Dead	-31.7576	116.4379	0					
TCOG-426	Wandoo (*Eucalyptus wandoo*)	650	10	Live	-31.7576	116.438	1	End of branch leading into main trunk	15	No	Unknown	Unlikely - width of hollow is very narrow along its entire length. Suitable angle.
TCOG-427	Wandoo (*Eucalyptus wandoo*)	620	12	Live	-31.7575	116.4379	0					
TCOG-428	Wandoo (*Eucalyptus wandoo*)	440	10	Live	-31.7665	116.4061	0					
TCOG-429	Wandoo (*Eucalyptus wandoo*)	530	11	Live	-31.7666	116.4063	0					
TCOG-430	Wandoo (*Eucalyptus wandoo*)	560	15	Live	-31.7665	116.4063	0					
TCOG-431	Wandoo (*Eucalyptus wandoo*)	700	14	Live	-31.7665	116.4064	0					
TCOG-432	Wandoo (*Eucalyptus wandoo*)	710	14	Live	-31.7667	116.4047	0					
TCOG-433	Wandoo (*Eucalyptus wandoo*)	620	8	Live	-31.7666	116.4084	0					
TCOG-434	Wandoo (*Eucalyptus wandoo*)	350	4	Live	-31.7678	116.4105	0					
TCOG-435	Wandoo (*Eucalyptus wandoo*)	620	12	Live	-31.7666	116.4082	0					
TCOG-436	Wandoo (*Eucalyptus wandoo*)	1000	13	Live	-31.7666	116.408	0					
TCOG-437	Marri (*Corymbia calophylla*)	500	5	Live	-31.7666	116.4077	0					
TCOG-438	Wandoo (*Eucalyptus wandoo*)	890	13	Live	-31.7666	116.4074	0					
TCOG-439	Wandoo (*Eucalyptus wandoo*)	560	11	Live	-31.7666	116.4074	0					
TCOG-440	Wandoo (*Eucalyptus wandoo*)	510	6	Live	-31.7652	116.4305	0					
TCOG-441	Wandoo (*Eucalyptus wandoo*)	1180	15	Live	-31.7667	116.4064	1	Side entry in main trunk	40	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-442	Wandoo (*Eucalyptus wandoo*)	380	9	Live	-31.7667	116.4063	0					
TCOG-443	Wandoo (*Eucalyptus wandoo*)	560	12	Live	-31.7666	116.4061	0					

Tree information							Hollow information					
Tree ID	**Species**	**DBH (mm)**	**Height (m)**	**Status**	**Latitude**	**Longitude**	**Number of hollows**	**Hollow type**	**Entry diameter**	**Chew marks**	**Occupancy**	**Potential suitability**
TCOG-444	Unknown (Dead)	360	7	Dead	-31.7666	116.406	0					
TCOG-445	Wandoo (*Eucalyptus wandoo*)	320	8	Live	-31.7667	116.4059	0					
TCOG-446	Wandoo (*Eucalyptus wandoo*)	390	6	Live	-31.7667	116.4053	0					
TCOG-447	Wandoo (*Eucalyptus wandoo*)	350	7	Live	-31.7678	116.4107	0					
TCOG-448	Wandoo (*Eucalyptus wandoo*)	370	6	Live	-31.7667	116.4053	0					
TCOG-449	Wandoo (*Eucalyptus wandoo*)	430	7	Live	-31.7667	116.4053	0					
TCOG-450	Wandoo (*Eucalyptus wandoo*)	330	5	Live	-31.7667	116.4053	0					
TCOG-451	Wandoo (*Eucalyptus wandoo*)	710	5	Live	-31.8072	116.3608	0					
TCOG-452	Unknown (Dead)	659	9	Dead	-31.7676	116.424	3	Side entry in main trunk	30	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
								Side entry in main trunk	20	No	Unknown	Unlikely - entry looks obstructed
								Chimney type in main trunk	19	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-453	Wandoo (*Eucalyptus wandoo*)	640	13	Live	-31.7635	116.4311	0					
TCOG-454	Marri (*Corymbia calophylla*)	580	9	Live	-31.7661	116.4277	0					
TCOG-455	Marri (*Corymbia calophylla*)	513	11	Live	-31.7628	116.4319	0					
TCOG-456	Marri (*Corymbia calophylla*)	551	9	Live	-31.7627	116.432	0					
TCOG-457	Marri (*Corymbia calophylla*)	516	11	Live	-31.7627	116.432	0					
TCOG-458	Marri (*Corymbia calophylla*)	656	11	Live	-31.7626	116.4321	0					
TCOG-459	Marri (*Corymbia calophylla*)	573	11	Live	-31.7626	116.4322	0					
TCOG-460	Marri (*Corymbia calophylla*)	497	9	Live	-31.7625	116.4322	0					
TCOG-461	Marri (*Corymbia calophylla*)	576	9	Live	-31.7621	116.4327	0					
TCOG-462	Marri (*Corymbia calophylla*)	513	11	Live	-31.7621	116.4327	0					
TCOG-463	Marri (*Corymbia calophylla*)	532	9	Live	-31.7619	116.4328	0					
TCOG-464	Marri (*Corymbia calophylla*)	726	11	Live	-31.7617	116.4331	0					
TCOG-465	Marri (*Corymbia calophylla*)	602	11	Live	-31.7617	116.4331	0					
TCOG-466	Marri (*Corymbia calophylla*)	561	9	Live	-31.7617	116.4332	0					
TCOG-467	Marri (*Corymbia calophylla*)	532	10	Live	-31.7614	116.4334	0					
TCOG-468	Marri (*Corymbia calophylla*)	541	10	Live	-31.7614	116.4335	0					
TCOG-469	Marri (*Corymbia calophylla*)	516	11	Live	-31.7606	116.4344	0					
TCOG-470	Marri (*Corymbia calophylla*)	561	11	Live	-31.7606	116.4344	0					
TCOG-471	Tuart (*Eucalyptus gomphocephala*)	503	9	Live	-31.7605	116.4345	0					
TCOG-472	Marri (*Corymbia calophylla*)	650	8	Dead	-31.7655	116.4284	0					
TCOG-473	Marri (*Corymbia calophylla*)	529	11	Live	-31.7602	116.4348	0					
TCOG-474	Marri (*Corymbia calophylla*)	576	9	Live	-31.7602	116.4348	0					
TCOG-475	Marri (*Corymbia calophylla*)	611	11	Live	-31.7602	116.4348	1	Chimney type in main trunk	15	No	Unknown	Unlikely - hollow does not appear to extend enough in depth
TCOG-476	Marri (*Corymbia calophylla*)	650	11	Live	-31.7654	116.4286	0					
TCOG-477	Marri (*Corymbia calophylla*)	557	6	Live	-31.76	116.4351	0					
TCOG-478	Marri (*Corymbia calophylla*)	516	9	Live	-31.7599	116.4352	0					
TCOG-479	Marri (*Corymbia calophylla*)	570	10	Live	-31.7581	116.4372	0					
TCOG-480	Marri (*Corymbia calophylla*)	809	9	Live	-31.7597	116.4355	0					
TCOG-481	Marri (*Corymbia calophylla*)	723	10	Live	-31.7595	116.4356	0					
TCOG-482	Marri (*Corymbia calophylla*)	640	11	Live	-31.7595	116.4356	0					
TCOG-483	Marri (*Corymbia calophylla*)	599	10	Live	-31.7594	116.4358	0					
TCOG-484	Marri (*Corymbia calophylla*)	583	11	Live	-31.7592	116.436	0					
TCOG-485	Marri (*Corymbia calophylla*)	838	13	Live	-31.7592	116.4361	0					

Tree information							Hollow information					
Tree ID	**Species**	**DBH (mm)**	**Height (m)**	**Status**	**Latitude**	**Longitude**	**Number of hollows**	**Hollow type**	**Entry diameter**	**Chew marks**	**Occupancy**	**Potential suitability**
TCOG-486	Marri (*Corymbia calophylla*)	841	12	Live	-31.7591	116.4362	0					
TCOG-487	Marri (*Corymbia calophylla*)	583	8	Live	-31.7591	116.4362	0					
TCOG-488	Marri (*Corymbia calophylla*)	519	11	Live	-31.759	116.4364	0					
TCOG-489	Marri (*Corymbia calophylla*)	510	12	Live	-31.7799	116.3941	0					
TCOG-490	Unknown (Dead)	892	11	Dead	-31.7589	116.4365	1	Top entry at broken branch at main fork	30	No	Unknown	Possible - suitable depth, angle, and diameter entry. No obvious signs of competitor occupancy
TCOG-491	Marri (*Corymbia calophylla*)	596	12	Live	-31.7586	116.4369	0					
Bamford (2015)												
WPT_10	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.8141	116.3488	0			-	-	Class 5
WPT_11	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.8143	116.3487	0			-	-	Class 5
WPT_12	Wandoo (*Eucalyptus wandoo*)	390	-	Alive	-31.8143	116.3487	0			-	-	Class 5
WPT_13	Marri (*Corymbia calophylla*)	710	-	Dead	-31.8144	116.3489	0			-	-	Class 5
WPT_14	Wandoo (*Eucalyptus wandoo*)	480	-	Alive	-31.8146	116.3488	0			-	-	Class 5
WPT_15	Wandoo (*Eucalyptus wandoo*)	570	-	Alive	-31.8147	116.3488	0			-	-	Class 5
WPT_16	Wandoo (*Eucalyptus wandoo*)	620	-	Alive	-31.8148	116.3489	0			-	-	Class 5
WPT_17	Wandoo (*Eucalyptus wandoo*)	690	-	Alive	-31.8149	116.3489	0			-	-	Class 5
WPT_18	Jarrah (*Eucalyptus marginata*)	660	-	Alive	-31.8151	116.3488	0			-	-	Class 5
WPT_19	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.8151	116.3487	0			-	-	Class 5
WPT_21	Unknown (Dead)	580	-	Dead	-31.8153	116.3490	0			-	-	Class 5
WPT_22	Jarrah (*Eucalyptus marginata*)	690	-	Alive	-31.8154	116.3489	0			-	-	Class 5
WPT_23	Wandoo (*Eucalyptus wandoo*)	510	-	Alive	-31.8154	116.3489	0			-	-	Class 5
WPT_25	Wandoo (*Eucalyptus wandoo*)	480	-	Alive	-31.8157	116.3497	0			-	-	Class 5
WPT_26	Jarrah (*Eucalyptus marginata*)	760	-	Alive	-31.8155	116.3497	0			-	-	Class 5
WPT_27	Marri (*Corymbia calophylla*)	620	-	Alive	-31.8154	116.3497	0			-	-	Class 5
WPT_29	Jarrah (*Eucalyptus marginata*)	510	-	Dead	-31.8152	116.3497	1			-	Unknown	Class 3
WPT_30	Jarrah (*Eucalyptus marginata*)	790	-	Alive	-31.8153	116.3496	0			-	-	Class 5
WPT_31	Wandoo (*Eucalyptus wandoo*)	400	-	Alive	-31.8150	116.3496	0			-	-	Class 5
WPT_32	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.8148	116.3495	0			-	-	Class 5
WPT_33	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.8147	116.3494	0			-	-	Class 5
WPT_34	Blackbutt (Eucalyptus patens)	510	-	Alive	-31.8147	116.3494	0			-	-	Class 5
WPT_35	Marri (*Corymbia calophylla*)	820	-	Alive	-31.8145	116.3494	0			-	-	Class 5
WPT_36	Blackbutt (Eucalyptus patens)	820	-	Alive	-31.8143	116.3493	0			-	-	Class 5
WPT_58	Marri (*Corymbia calophylla*)	880	-	Alive	-31.8106	116.3505	1			-	Unknown	Class 4
WPT_69	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.8092	116.3548	0			-	-	Class 5
WPT_75	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.8081	116.3578	0			-	-	Class 5
WPT_76	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.8081	116.3578	0			-	-	Class 5
WPT_77	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.8080	116.3578	0			-	-	Class 5
WPT_78	Wandoo (*Eucalyptus wandoo*)	450	-	Alive	-31.8081	116.3578	0			-	-	Class 5
WPT_79	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.8080	116.3579	0			-	-	Class 5
WPT_80	Wandoo (*Eucalyptus wandoo*)	460	-	Alive	-31.8080	116.3580	0			-	-	Class 5
WPT_82	Wandoo (*Eucalyptus wandoo*)	580	-	Alive	-31.8079	116.3582	1			-	Unknown	Class 4
WPT_83	Wandoo (*Eucalyptus wandoo*)	680	-	Alive	-31.8079	116.3584	0			-	-	Class 5
WPT_84	Wandoo (*Eucalyptus wandoo*)	730	-	Alive	-31.8079	116.3586	1			-	Unknown	Class 3
WPT_86	Wandoo (*Eucalyptus wandoo*)	510	-	Alive	-31.8078	116.3588	0			-	-	Class 5
WPT_87	Wandoo (*Eucalyptus wandoo*)	550	-	Alive	-31.8077	116.3592	0			-	-	Class 5

Tree information							Hollow information					
Tree ID	Species	DBH (mm)	Height (m)	Status	Latitude	Longitude	Number of hollows	Hollow type	Entry diameter	Chew marks	Occupancy	Potential suitability
WPT_88	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.8076	116.3594	0			-	-	Class 5
WPT_89	Wandoo (*Eucalyptus wandoo*)	640	-	Alive	-31.8076	116.3594	0			-	-	Class 5
WPT_90	Wandoo (*Eucalyptus wandoo*)	430	-	Alive	-31.8076	116.3595	0			-	-	Class 5
WPT_91	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.8076	116.3595	0			-	-	Class 5
WPT_92	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.8076	116.3596	0			-	-	Class 5
WPT_93	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.8076	116.3597	0			-	-	Class 5
WPT_94	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.8075	116.3598	0			-	-	Class 5
WPT_97	Wandoo (*Eucalyptus wandoo*)	550	-	Alive	-31.8076	116.3608	0			-	-	Class 5
WPT_106	Wandoo (*Eucalyptus wandoo*)	490	-	Alive	-31.8079	116.3595	0			-	-	Class 5
WPT_110	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.8081	116.3588	0			-	-	Class 5
WPT_111	Wandoo (*Eucalyptus wandoo*)	440	-	Alive	-31.8082	116.3587	0			-	-	Class 5
WPT_116	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.8082	116.3581	0			-	-	Class 5
WPT_117	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.8082	116.3581	0			-	-	Class 5
WPT_118	Wandoo (*Eucalyptus wandoo*)	400	-	Alive	-31.8083	116.3578	0			-	-	Class 5
WPT_119	Wandoo (*Eucalyptus wandoo*)	510	-	Alive	-31.8084	116.3575	0			-	-	Class 5
WPT_120	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.8084	116.3575	0			-	-	Class 5
WPT_121	Wandoo (*Eucalyptus wandoo*)	950	-	Alive	-31.8086	116.3571	3			-	Duck down	Class 3
WPT_125	Unknown (Dead)	570	-	Dead	-31.8088	116.3566	1			-	Unknown	Class 3
WPT_126	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.8092	116.3555	0			-	-	Class 5
WPT_127	Wandoo (*Eucalyptus wandoo*)	800	-	Alive	-31.8093	116.3553	1			-	Unknown	Class 3
WPT_128	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.8095	116.3546	0			-	-	Class 5
WPT_129	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.8096	116.3546	0			-	-	Class 5
WPT_130	Marri (*Corymbia calophylla*)	530	-	Alive	-31.8097	116.3544	0			-	-	Class 5
WPT_138	Marri (*Corymbia calophylla*)	510	-	Alive	-31.8098	116.3542	0			-	-	Class 5
WPT_139	Marri (*Corymbia calophylla*)	510	-	Alive	-31.8098	116.3542	0			-	-	Class 5
WPT_140	Wandoo (*Eucalyptus wandoo*)	420	-	Alive	-31.8098	116.3537	0			-	-	Class 5
WPT_141	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.8099	116.3531	0			-	-	Class 5
WPT_142	Wandoo (*Eucalyptus wandoo*)	590	-	Alive	-31.8099	116.3531	0			-	-	Class 5
WPT_143	Blackbutt (Eucalyptus patens)	740	-	Alive	-31.8100	116.3531	0			-	-	Class 5
WPT_144	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.8099	116.3530	0			-	-	Class 5
WPT_145	Marri (*Corymbia calophylla*)	510	-	Alive	-31.8100	116.3528	0			-	-	Class 5
WPT_146	Unknown (Dead)	600	-	Dead	-31.8102	116.3526	1			-	Unknown	Class 3
WPT_147	Wandoo (*Eucalyptus wandoo*)	500	-	Alive	-31.8102	116.3520	1			-	Bees	Class 4
WPT_165	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7994	116.3787	0			-	-	Class 5
WPT_166	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7997	116.3783	0			-	-	Class 5
WPT_169	Wandoo (*Eucalyptus wandoo*)	400	-	Alive	-31.8000	116.3780	0			-	-	Class 5
WPT_170	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.8001	116.3778	0			-	-	Class 5
WPT_171	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.8001	116.3778	0			-	-	Class 5
WPT_175	Unknown (Dead)	620	-	Dead	-31.8004	116.3774	0			-	-	Class 5
WPT_179	Wandoo (*Eucalyptus wandoo*)	390	-	Alive	-31.8010	116.3761	0			-	-	Class 5
WPT_180	Unknown (Dead)	520	-	Dead	-31.8014	116.3760	1			-	Unknown	Class 4
WPT_181	Wandoo (*Eucalyptus wandoo*)	520	-	Alive	-31.8014	116.3761	0			-	-	Class 5
WPT_182	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.8012	116.3758	0			-	-	Class 5
WPT_183	Wandoo (*Eucalyptus wandoo*)	450	-	Alive	-31.8015	116.3753	0			-	-	Class 5
WPT_185	Wandoo (*Eucalyptus wandoo*)	760	-	Dead	-31.8024	116.3747	1			-	Unknown	Class 3

Tree information							Hollow information					
Tree ID	Species	DBH (mm)	Height (m)	Status	Latitude	Longitude	Number of hollows	Hollow type	Entry diameter	Chew marks	Occupancy	Potential suitability
WPT_186	Wandoo (*Eucalyptus wandoo*)	660	-	Alive	-31.8029	116.3742	1			-	Unknown	Class 4
WPT_187	Wandoo (*Eucalyptus wandoo*)	510	-	Alive	-31.8030	116.3741	0			-	-	Class 5
WPT_188	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.8031	116.3739	0			-	-	Class 5
WPT_189	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.8031	116.3738	0			-	-	Class 5
WPT_190	Wandoo (*Eucalyptus wandoo*)	460	-	Alive	-31.8033	116.3733	0			-	-	Class 5
WPT_191	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.8034	116.3730	0			-	-	Class 5
WPT_192	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.8035	116.3730	0			-	-	Class 5
WPT_193	Blackbutt (Eucalyptus patens)	780	-	Alive	-31.8050	116.3691	0			-	-	Class 5
WPT_194	Blackbutt (Eucalyptus patens)	650	-	Alive	-31.8050	116.3689	0			-	-	Class 5
WPT_195	Blackbutt (Eucalyptus patens)	530	-	Alive	-31.8051	116.3685	0			-	-	Class 5
WPT_196	Blackbutt (Eucalyptus patens)	1320	-	Alive	-31.8053	116.3680	0			-	-	Class 5
WPT_199	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.8074	116.3613	0			-	-	Class 5
WPT_202	Wandoo (*Eucalyptus wandoo*)	430	-	Alive	-31.8073	116.3616	0			-	-	Class 5
WPT_211	Unknown (Dead)	550	-	Dead	-31.8070	116.3630	0			-	-	Class 5
WPT_220	Blackbutt (Eucalyptus patens)	700	-	Alive	-31.8057	116.3675	0			-	-	Class 5
WPT_226	Blackbutt (Eucalyptus patens)	550	-	Alive	-31.8055	116.3682	0			-	-	Class 5
WPT_227	Blackbutt (Eucalyptus patens)	520	-	Alive	-31.8052	116.3692	0			-	-	Class 5
WPT_228	Blackbutt (Eucalyptus patens)	590	-	Alive	-31.8052	116.3695	0			-	-	Class 5
WPT_229	Blackbutt (Eucalyptus patens)	340	-	Alive	-31.8039	116.3727	0			-	-	Class 5
WPT_230	Wandoo (*Eucalyptus wandoo*)	810	-	Alive	-31.8015	116.3764	1			-	Unknown	Class 4
WPT_231	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.8007	116.3775	0			-	-	Class 5
WPT_232	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.8007	116.3775	0			-	-	Class 5
WPT_233	Wandoo (*Eucalyptus wandoo*)	680	-	Alive	-31.8005	116.3778	0			-	-	Class 5
WPT_234	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.8004	116.3779	0			-	-	Class 5
WPT_235	Wandoo (*Eucalyptus wandoo*)	340	-	Dead	-31.8003	116.3780	0			-	-	Class 5
WPT_236	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.8001	116.3783	0			-	-	Class 5
WPT_237	Wandoo (*Eucalyptus wandoo*)	500	-	Dead	-31.8000	116.3785	0			-	-	Class 5
WPT_238	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.8000	116.3785	0			-	-	Class 5
WPT_239	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7999	116.3786	0			-	-	Class 5
WPT_240	Wandoo (*Eucalyptus wandoo*)	440	-	Alive	-31.7998	116.3787	0			-	-	Class 5
WPT_241	Wandoo (*Eucalyptus wandoo*)	780	-	Dead	-31.7997	116.3788	0			-	-	Class 5
WPT_242	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7996	116.3790	0			-	-	Class 5
WPT_243	Wandoo (*Eucalyptus wandoo*)	580	-	Dead	-31.7995	116.3791	1			-	Nesting galahs	Class 4
WPT_244	Unknown (Dead)	770	-	Dead	-31.7991	116.3792	0			-	-	Class 5
WPT_286	Wandoo (*Eucalyptus wandoo*)	420	-	Alive	-31.7814	116.3939	0			-	-	Class 5
WPT_287	Wandoo (*Eucalyptus wandoo*)	400	-	Alive	-31.7819	116.3935	0			-	-	Class 5
WPT_289	Wandoo (*Eucalyptus wandoo*)	530	-	Alive	-31.7825	116.3932	0			-	-	Class 5
WPT_290	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7828	116.3929	0			-	-	Class 5
WPT_291	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7832	116.3927	0			-	-	Class 5
WPT_292	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7836	116.3925	0			-	-	Class 5
WPT_293	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7838	116.3924	0			-	-	Class 5
WPT_294	Marri (*Corymbia calophylla*)	730	-	Alive	-31.7843	116.3921	0			-	-	Class 5
WPT_295	Marri (*Corymbia calophylla*)	580	-	Alive	-31.7844	116.3921	0			-	-	Class 5
WPT_296	Wandoo (*Eucalyptus wandoo*)	570	-	Alive	-31.7845	116.3920	0			-	-	Class 5
WPT_297	Marri (*Corymbia calophylla*)	570	-	Alive	-31.7848	116.3918	0			-	-	Class 5

Tree information							Hollow information					
Tree ID	Species	DBH (mm)	Height (m)	Status	Latitude	Longitude	Number of hollows	Hollow type	Entry diameter	Chew marks	Occupancy	Potential suitability
WPT_298	Marri (*Corymbia calophylla*)	710	-	Alive	-31.7852	116.3917	0			-	-	Class 5
WPT_303	Marri (*Corymbia calophylla*)	1150	-	Dead	-31.7869	116.3907	1			-	Unknown	Class 4
WPT_305	Wandoo (*Eucalyptus wandoo*)	450	-	Dead	-31.7884	116.3899	0			-	-	Class 5
WPT_306	Wandoo (*Eucalyptus wandoo*)	350	-	Dead	-31.7884	116.3899	0			-	-	Class 5
WPT_307	Wandoo (*Eucalyptus wandoo*)	305	-	Alive	-31.7893	116.3896	0			-	-	Class 5
WPT_311	Blackbutt (Eucalyptus patens)	520	-	Alive	-31.7905	116.3889	1			-	Unknown	Class 4
WPT_312	Blackbutt (Eucalyptus patens)	670	-	Alive	-31.7905	116.3888	0			-	-	Class 5
WPT_313	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7908	116.3886	0			-	-	Class 5
WPT_314	Wandoo (*Eucalyptus wandoo*)	300	-	Alive	-31.7912	116.3884	0			-	-	Class 5
WPT_318	Wandoo (*Eucalyptus wandoo*)	520	-	Alive	-31.7917	116.3880	0			-	-	Class 5
WPT_319	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7919	116.3878	0			-	-	Class 5
WPT_323	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7927	116.3871	0			-	-	Class 5
WPT_324	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7927	116.3870	0			-	-	Class 5
WPT_329	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7934	116.3864	0			-	-	Class 5
WPT_330	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7935	116.3861	0			-	-	Class 5
WPT_333	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7938	116.3859	0			-	-	Class 5
WPT_334	Wandoo (*Eucalyptus wandoo*)	460	-	Alive	-31.7941	116.3854	0			-	-	Class 5
WPT_335	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7942	116.3854	0			-	-	Class 5
WPT_336	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7943	116.3854	0			-	-	Class 5
WPT_341	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7945	116.3850	0			-	-	Class 5
WPT_342	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7945	116.3850	0			-	-	Class 5
WPT_347	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7948	116.3846	0			-	-	Class 5
WPT_348	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7950	116.3845	0			-	-	Class 5
WPT_352	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.7959	116.3836	0			-	-	Class 5
WPT_353	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7960	116.3835	0			-	-	Class 5
WPT_354	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7962	116.3833	0			-	-	Class 5
WPT_355	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7962	116.3833	0			-	-	Class 5
WPT_357	Wandoo (*Eucalyptus wandoo*)	520	-	Dead	-31.7967	116.3824	2			-	Unknown	Class 3
WPT_358	Wandoo (*Eucalyptus wandoo*)	460	-	Alive	-31.7968	116.3826	0			-	-	Class 5
WPT_359	Wandoo (*Eucalyptus wandoo*)	740	-	Alive	-31.7970	116.3821	0			-	-	Class 5
WPT_360	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7978	116.3812	0			-	-	Class 5
WPT_361	Wandoo (*Eucalyptus wandoo*)	390	-	Dead	-31.7979	116.3809	1			-	Unknown	Class 4
WPT_363	Wandoo (*Eucalyptus wandoo*)	420	-	Dead	-31.7981	116.3811	0			-	-	Class 5
WPT_364	Wandoo (*Eucalyptus wandoo*)	560	-	Alive	-31.7981	116.3811	0			-	-	Class 5
WPT_365	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7978	116.3815	0			-	-	Class 5
WPT_366	Wandoo (*Eucalyptus wandoo*)	420	-	Alive	-31.7977	116.3817	0			-	-	Class 5
WPT_367	Wandoo (*Eucalyptus wandoo*)	440	-	Alive	-31.7977	116.3818	0			-	-	Class 5
WPT_368	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7977	116.3818	0			-	-	Class 5
WPT_369	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7976	116.3818	0			-	-	Class 5
WPT_370	Wandoo (*Eucalyptus wandoo*)	420	-	Alive	-31.7976	116.3820	0			-	-	Class 5
WPT_371	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7975	116.3821	0			-	-	Class 5
WPT_372	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7973	116.3824	0			-	-	Class 5
WPT_393	Wandoo (*Eucalyptus wandoo*)	440	-	Dead	-31.7928	116.3874	0			-	-	Class 5
WPT_394	Wandoo (*Eucalyptus wandoo*)	450	-	Alive	-31.7924	116.3879	0			-	-	Class 5
WPT_395	Wandoo (*Eucalyptus wandoo*)	760	-	Alive	-31.7922	116.3880	0			-	-	Class 5

Tree information							Hollow information					
Tree ID	Species	DBH (mm)	Height (m)	Status	Latitude	Longitude	Number of hollows	Hollow type	Entry diameter	Chew marks	Occupancy	Potential suitability
WPT_396	Wandoo (*Eucalyptus wandoo*)	630	-	Alive	-31.7922	116.3881	1			-	Nesting parrots	Class 4
WPT_397	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7920	116.3881	0			-	-	Class 5
WPT_398	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7919	116.3883	0			-	-	Class 5
WPT_401	Wandoo (*Eucalyptus wandoo*)	390	-	Alive	-31.7919	116.3886	0			-	-	Class 5
WPT_403	Wandoo (*Eucalyptus wandoo*)	950	-	Alive	-31.7918	116.3884	1			-	Nesting galahs	Class 3
WPT_404	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7916	116.3884	0			-	-	Class 5
WPT_405	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7915	116.3885	0			-	-	Class 5
WPT_406	Wandoo (*Eucalyptus wandoo*)	500	-	Dead	-31.7913	116.3886	1			-	Unknown	Class 3
WPT_407	Wandoo (*Eucalyptus wandoo*)	630	-	Alive	-31.7910	116.3889	0			-	-	Class 5
WPT_410	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7906	116.3892	0			-	-	Class 5
WPT_415	Wandoo (*Eucalyptus wandoo*)	560	-	Alive	-31.7900	116.3895	0			-	-	Class 5
WPT_419	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7887	116.3901	0			-	-	Class 5
WPT_420	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7887	116.3901	0			-	-	Class 5
WPT_426	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7873	116.3909	0			-	-	Class 5
WPT_427	Marri (*Corymbia calophylla*)	610	-	Alive	-31.7871	116.3910	0			-	-	Class 5
WPT_428	Marri (*Corymbia calophylla*)	590	-	Alive	-31.7870	116.3910	0			-	-	Class 5
WPT_445	Flooded Gum (Eucalyptus rudis)	760	-	Alive	-31.7848	116.3922	0			-	-	Class 5
WPT_446	Wandoo (*Eucalyptus wandoo*)	790	-	Dead	-31.7840	116.3925	1			-	Bees	Class 4
WPT_447	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7822	116.3936	0			-	-	Class 5
WPT_448	Wandoo (*Eucalyptus wandoo*)	450	-	Alive	-31.7820	116.3938	0			-	-	Class 5
WPT_449	Wandoo (*Eucalyptus wandoo*)	390	-	Alive	-31.7819	116.3938	0			-	-	Class 5
WPT_450	Wandoo (*Eucalyptus wandoo*)	400	-	Alive	-31.7818	116.3939	0			-	-	Class 5
WPT_451	Wandoo (*Eucalyptus wandoo*)	510	-	Alive	-31.7815	116.3942	0			-	-	Class 5
WPT_452	Wandoo (*Eucalyptus wandoo*)	400	-	Alive	-31.7813	116.3943	0			-	-	Class 5
WPT_453	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7813	116.3943	0			-	-	Class 5
WPT_454	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7811	116.3944	0			-	-	Class 5
WPT_455	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7811	116.3944	0			-	-	Class 5
WPT_459	Marri (*Corymbia calophylla*)	540	-	Dead	-31.7787	116.3959	0			-	-	Class 5
WPT_465	Wandoo (*Eucalyptus wandoo*)	400	-	Dead	-31.7782	116.3963	0			-	-	Class 5
WPT_467	Wandoo (*Eucalyptus wandoo*)	520	-	Alive	-31.7781	116.3963	0			-	-	Class 5
WPT_474	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7773	116.3969	0			-	-	Class 5
WPT_475	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7773	116.3969	0			-	-	Class 5
WPT_476	Wandoo (*Eucalyptus wandoo*)	400	-	Alive	-31.7772	116.3970	0			-	-	Class 5
WPT_477	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7772	116.3970	0			-	-	Class 5
WPT_478	Wandoo (*Eucalyptus wandoo*)	670	-	Alive	-31.7772	116.3970	1			-	Unknown	Class 4
WPT_479	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7771	116.3970	0			-	-	Class 5
WPT_480	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7771	116.3970	0			-	-	Class 5
WPT_481	Wandoo (*Eucalyptus wandoo*)	450	-	Alive	-31.7770	116.3971	0			-	-	Class 5
WPT_482	Wandoo (*Eucalyptus wandoo*)	430	-	Alive	-31.7770	116.3971	0			-	-	Class 5
WPT_483	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7770	116.3971	0			-	-	Class 5
WPT_484	Wandoo (*Eucalyptus wandoo*)	460	-	Alive	-31.7769	116.3972	0			-	-	Class 5
WPT_485	Wandoo (*Eucalyptus wandoo*)	430	-	Alive	-31.7768	116.3972	0			-	-	Class 5
WPT_486	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7767	116.3973	0			-	-	Class 5
WPT_487	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7767	116.3973	0			-	-	Class 5

Tree information							Hollow information					
Tree ID	Species	DBH (mm)	Height (m)	Status	Latitude	Longitude	Number of hollows	Hollow type	Entry diameter	Chew marks	Occupancy	Potential suitability
WPT_488	Wandoo (*Eucalyptus wandoo*)	320	-	Dead	-31.7762	116.3978	0			-	-	Class 5
WPT_489	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7761	116.3978	0			-	-	Class 5
WPT_490	Wandoo (*Eucalyptus wandoo*)	490	-	Dead	-31.7761	116.3978	0			-	-	Class 5
WPT_491	Wandoo (*Eucalyptus wandoo*)	570	-	Alive	-31.7761	116.3979	0			-	-	Class 5
WPT_492	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7760	116.3979	0			-	-	Class 5
WPT_493	Wandoo (*Eucalyptus wandoo*)	640	-	Alive	-31.7757	116.3983	0			-	-	Class 5
WPT_494	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7754	116.3988	0			-	-	Class 5
WPT_495	Wandoo (*Eucalyptus wandoo*)	460	-	Dead	-31.7757	116.3986	0			-	-	Class 5
WPT_496	Wandoo (*Eucalyptus wandoo*)	830	-	Alive	-31.7752	116.3992	0			-	-	Class 5
WPT_497	Wandoo (*Eucalyptus wandoo*)	540	-	Alive	-31.7746	116.3994	0			-	-	Class 5
WPT_498	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7744	116.3994	0			-	-	Class 5
WPT_499	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7741	116.3996	0			-	-	Class 5
WPT_500	Wandoo (*Eucalyptus wandoo*)	720	-	Alive	-31.7741	116.3997	1			-	Unknown	Class 4
WPT_501	Wandoo (*Eucalyptus wandoo*)	320	-	Dead	-31.7740	116.3996	0			-	-	Class 5
WPT_502	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7740	116.3996	0			-	-	Class 5
WPT_503	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7740	116.3996	0			-	-	Class 5
WPT_504	Wandoo (*Eucalyptus wandoo*)	530	-	Alive	-31.7739	116.3997	0			-	-	Class 5
WPT_506	Wandoo (*Eucalyptus wandoo*)	300	-	Dead	-31.7736	116.3999	0			-	-	Class 5
WPT_507	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7733	116.4002	0			-	-	Class 5
WPT_508	Wandoo (*Eucalyptus wandoo*)	520	-	Alive	-31.7733	116.4002	0			-	-	Class 5
WPT_519	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7768	116.3970	0			-	-	Class 5
WPT_520	Wandoo (*Eucalyptus wandoo*)	300	-	Alive	-31.7769	116.3970	0			-	-	Class 5
WPT_523	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7769	116.3969	0			-	-	Class 5
WPT_527	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7785	116.3957	0			-	-	Class 5
WPT_528	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7793	116.3952	0			-	-	Class 5
WPT_529	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7794	116.3951	0			-	-	Class 5
WPT_532	Wandoo (*Eucalyptus wandoo*)	510	-	Alive	-31.7697	116.4154	0			-	-	Class 5
WPT_533	Wandoo (*Eucalyptus wandoo*)	420	-	Alive	-31.7696	116.4153	0			-	-	Class 5
WPT_539	Wandoo (*Eucalyptus wandoo*)	440	-	Alive	-31.7696	116.4181	0			-	-	Class 5
WPT_540	Wandoo (*Eucalyptus wandoo*)	520	-	Dead	-31.7695	116.4185	1			-	Unknown	Class 4
WPT_542	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7695	116.4188	0			-	-	Class 5
WPT_543	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7695	116.4189	0			-	-	Class 5
WPT_544	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7694	116.4192	0			-	-	Class 5
WPT_545	Marri (*Corymbia calophylla*)	520	-	Dead	-31.7693	116.4195	1			-	Unknown	Class 4
WPT_546	Marri (*Corymbia calophylla*)	540	-	Dead	-31.7692	116.4198	0			-	-	Class 5
WPT_547	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7690	116.4200	0			-	-	Class 5
WPT_548	Wandoo (*Eucalyptus wandoo*)	300	-	Alive	-31.7690	116.4204	0			-	-	Class 5
WPT_549	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7689	116.4205	0			-	-	Class 5
WPT_550	Wandoo (*Eucalyptus wandoo*)	530	-	Alive	-31.7689	116.4205	0			-	-	Class 5
WPT_551	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7689	116.4206	0			-	-	Class 5
WPT_552	Marri (*Corymbia calophylla*)	640	-	Alive	-31.7688	116.4207	0			-	-	Class 5
WPT_553	Wandoo (*Eucalyptus wandoo*)	440	-	Alive	-31.7689	116.4208	0			-	-	Class 5
WPT_562	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7685	116.4215	0			-	-	Class 5
WPT_563	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7686	116.4215	0			-	-	Class 5
WPT_568	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.7684	116.4218	0			-	-	Class 5

Tree information							Hollow information					
Tree ID	Species	DBH (mm)	Height (m)	Status	Latitude	Longitude	Number of hollows	Hollow type	Entry diameter	Chew marks	Occupancy	Potential suitability
WPT_569	Wandoo (*Eucalyptus wandoo*)	510	-	Dead	-31.7686	116.4217	1			-	Unknown	Class 3
WPT_570	Jarrah (*Eucalyptus marginata*)	720	-	Alive	-31.7683	116.4222	1			-	Unknown	Class 4
WPT_571	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7683	116.4225	0			-	-	Class 5
WPT_572	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7682	116.4226	0			-	-	Class 5
WPT_576	Wandoo (*Eucalyptus wandoo*)	650	-	Alive	-31.7681	116.4228	0			-	-	Class 5
WPT_577	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7681	116.4228	0			-	-	Class 5
WPT_578	Wandoo (*Eucalyptus wandoo*)	490	-	Alive	-31.7680	116.4229	0			-	-	Class 5
WPT_582	Wandoo (*Eucalyptus wandoo*)	780	-	Alive	-31.7680	116.4231	0			-	-	Class 5
WPT_583	Wandoo (*Eucalyptus wandoo*)	470	-	Alive	-31.7679	116.4233	0			-	-	Class 5
WPT_587	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7682	116.4236	0			-	-	Class 5
WPT_596	Wandoo (*Eucalyptus wandoo*)	440	-	Alive	-31.7683	116.4233	0			-	-	Class 5
WPT_597	Wandoo (*Eucalyptus wandoo*)	300	-	Alive	-31.7683	116.4232	0			-	-	Class 5
WPT_598	Wandoo (*Eucalyptus wandoo*)	520	-	Alive	-31.7683	116.4231	0			-	-	Class 5
WPT_599	Wandoo (*Eucalyptus wandoo*)	470	-	Alive	-31.7684	116.4229	0			-	-	Class 5
WPT_600	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7684	116.4228	0			-	-	Class 5
WPT_606	Marri (*Corymbia calophylla*)	680	-	Alive	-31.7687	116.4224	0			-	-	Class 5
WPT_611	Marri (*Corymbia calophylla*)	850	-	Alive	-31.7687	116.4223	0			-	-	Class 5
WPT_615	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7688	116.4222	0			-	-	Class 5
WPT_616	Wandoo (*Eucalyptus wandoo*)	450	-	Alive	-31.7688	116.4221	0			-	-	Class 5
WPT_617	Wandoo (*Eucalyptus wandoo*)	470	-	Alive	-31.7689	116.4219	0			-	-	Class 5
WPT_620	Marri (*Corymbia calophylla*)	590	-	Dead	-31.7689	116.4213	1			-	Unknown	Class 4
WPT_621	Marri (*Corymbia calophylla*)	750	-	Alive	-31.7690	116.4210	0			-	-	Class 5
WPT_626	Wandoo (*Eucalyptus wandoo*)	300	-	Alive	-31.7693	116.4205	0			-	-	Class 5
WPT_628	Wandoo (*Eucalyptus wandoo*)	480	-	Alive	-31.7692	116.4204	0			-	-	Class 5
WPT_633	Unknown (Dead)	650	-	Dead	-31.7694	116.4199	0			-	-	Class 5
WPT_635	Jarrah (*Eucalyptus marginata*)	540	-	Alive	-31.7694	116.4198	0			-	-	Class 5
WPT_637	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7698	116.4194	0			-	-	Class 5
WPT_638	Wandoo (*Eucalyptus wandoo*)	420	-	Alive	-31.7698	116.4193	0			-	-	Class 5
WPT_639	Wandoo (*Eucalyptus wandoo*)	460	-	Alive	-31.7697	116.4191	0			-	-	Class 5
WPT_641	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7696	116.4192	0			-	-	Class 5
WPT_642	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.7696	116.4192	0			-	-	Class 5
WPT_643	Marri (*Corymbia calophylla*)	590	-	Alive	-31.7696	116.4190	0			-	-	Class 5
WPT_644	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7696	116.4190	0			-	-	Class 5
WPT_645	Wandoo (*Eucalyptus wandoo*)	530	-	Alive	-31.7697	116.4188	0			-	-	Class 5
WPT_646	Wandoo (*Eucalyptus wandoo*)	500	-	Alive	-31.7697	116.4188	0			-	-	Class 5
WPT_647	Wandoo (*Eucalyptus wandoo*)	520	-	Alive	-31.7697	116.4187	0			-	-	Class 5
WPT_648	Wandoo (*Eucalyptus wandoo*)	440	-	Alive	-31.7697	116.4186	0			-	-	Class 5
WPT_649	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7698	116.4186	0			-	-	Class 5
WPT_650	Wandoo (*Eucalyptus wandoo*)	700	-	Alive	-31.7698	116.4186	0			-	-	Class 5
WPT_651	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7699	116.4186	0			-	-	Class 5
WPT_652	Wandoo (*Eucalyptus wandoo*)	420	-	Alive	-31.7698	116.4185	0			-	-	Class 5
WPT_653	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7698	116.4184	0			-	-	Class 5
WPT_654	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7698	116.4184	0			-	-	Class 5
WPT_655	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7699	116.4183	0			-	-	Class 5
WPT_656	Wandoo (*Eucalyptus wandoo*)	360	-	Dead	-31.7698	116.4182	0			-	-	Class 5

Tree information							Hollow information					
Tree ID	Species	DBH (mm)	Height (m)	Status	Latitude	Longitude	Number of hollows	Hollow type	Entry diameter	Chew marks	Occupancy	Potential suitability
WPT_657	Wandoo (*Eucalyptus wandoo*)	390	-	Alive	-31.7699	116.4182	0			-	-	Class 5
WPT_661	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7699	116.4180	0			-	-	Class 5
WPT_662	Wandoo (*Eucalyptus wandoo*)	490	-	Alive	-31.7699	116.4179	0			-	-	Class 5
WPT_663	Wandoo (*Eucalyptus wandoo*)	460	-	Alive	-31.7699	116.4178	0			-	-	Class 5
WPT_664	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7699	116.4177	0			-	-	Class 5
WPT_665	Wandoo (*Eucalyptus wandoo*)	410	-	Dead	-31.7701	116.4172	0			-	-	Class 5
WPT_666	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7702	116.4168	0			-	-	Class 5
WPT_673	Wandoo (*Eucalyptus wandoo*)	390	-	Alive	-31.7684	116.4122	0			-	-	Class 5
WPT_674	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.7682	116.4120	0			-	-	Class 5
WPT_675	Wandoo (*Eucalyptus wandoo*)	420	-	Alive	-31.7682	116.4120	0			-	-	Class 5
WPT_676	Wandoo (*Eucalyptus wandoo*)	300	-	Alive	-31.7682	116.4120	0			-	-	Class 5
WPT_677	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.7681	116.4119	0			-	-	Class 5
WPT_679	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7678	116.4113	0			-	-	Class 5
WPT_680	Wandoo (*Eucalyptus wandoo*)	470	-	Alive	-31.7676	116.4110	0			-	-	Class 5
WPT_682	Wandoo (*Eucalyptus wandoo*)	460	-	Alive	-31.7675	116.4108	0			-	-	Class 5
WPT_686	Wandoo (*Eucalyptus wandoo*)	740	-	Alive	-31.7668	116.4090	1			-	Unknown	Class 4
WPT_687	Wandoo (*Eucalyptus wandoo*)	960	-	Alive	-31.7668	116.4088	1			-	Unknown	Class 4
WPT_688	Marri (*Corymbia calophylla*)	530	-	Dead	-31.7667	116.4087	0			-	-	Class 5
WPT_689	Wandoo (*Eucalyptus wandoo*)	490	-	Alive	-31.7667	116.4085	0			-	-	Class 5
WPT_694	Wandoo (*Eucalyptus wandoo*)	500	-	Alive	-31.7666	116.4076	0			-	-	Class 5
WPT_695	Wandoo (*Eucalyptus wandoo*)	540	-	Alive	-31.7666	116.4074	0			-	-	Class 5
WPT_697	Wandoo (*Eucalyptus wandoo*)	570	-	Alive	-31.7666	116.4071	0			-	-	Class 5
WPT_700	Wandoo (*Eucalyptus wandoo*)	460	-	Alive	-31.7666	116.4069	0			-	-	Class 5
WPT_709	Wandoo (*Eucalyptus wandoo*)	400	-	Alive	-31.7667	116.4059	0			-	-	Class 5
WPT_711	Wandoo (*Eucalyptus wandoo*)	460	-	Alive	-31.7667	116.4057	0			-	-	Class 5
WPT_712	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7667	116.4056	0			-	-	Class 5
WPT_713	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7667	116.4052	0			-	-	Class 5
WPT_714	Wandoo (*Eucalyptus wandoo*)	420	-	Alive	-31.7668	116.4051	0			-	-	Class 5
WPT_715	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.7668	116.4051	0			-	-	Class 5
WPT_718	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7668	116.4048	0			-	-	Class 5
WPT_719	Wandoo (*Eucalyptus wandoo*)	580	-	Alive	-31.7669	116.4044	0			-	-	Class 5
WPT_727	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7670	116.4041	0			-	-	Class 5
WPT_728	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7671	116.4037	0			-	-	Class 5
WPT_729	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7672	116.4035	0			-	-	Class 5
WPT_730	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7672	116.4034	0			-	-	Class 5
WPT_731	Wandoo (*Eucalyptus wandoo*)	410	-	Dead	-31.7673	116.4032	0			-	-	Class 5
WPT_732	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7674	116.4031	0			-	-	Class 5
WPT_741	Wandoo (*Eucalyptus wandoo*)	810	-	Alive	-31.7684	116.4015	1			-	Unknown	Class 4
WPT_742	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7687	116.4013	0			-	-	Class 5
WPT_743	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7688	116.4014	0			-	-	Class 5
WPT_747	Wandoo (*Eucalyptus wandoo*)	430	-	Alive	-31.7693	116.4010	0			-	-	Class 5
WPT_749	Wandoo (*Eucalyptus wandoo*)	390	-	Dead	-31.7698	116.4008	0			-	-	Class 5
WPT_750	Wandoo (*Eucalyptus wandoo*)	660	-	Alive	-31.7704	116.4006	1			-	Unknown	Class 4
WPT_755	Wandoo (*Eucalyptus wandoo*)	760	-	Alive	-31.7696	116.4013	2			No	Unknown	Class 3
WPT_756	Wandoo (*Eucalyptus wandoo*)	730	-	Alive	-31.7687	116.4017	1			-	Nesting galahs	Class 3

Tree information							Hollow information					
Tree ID	Species	DBH (mm)	Height (m)	Status	Latitude	Longitude	Number of hollows	Hollow type	Entry diameter	Chew marks	Occupancy	Potential suitability
WPT_758	Wandoo (*Eucalyptus wandoo*)	810	-	Alive	-31.7675	116.4034	3			No	Unknown	Class 3
WPT_759	Wandoo (*Eucalyptus wandoo*)	590	-	Alive	-31.7675	116.4037	1			-	Unknown	Class 3
WPT_763	Wandoo (*Eucalyptus wandoo*)	850	-	Alive	-31.7671	116.4091	1			No	Unknown	Class 3
WPT_765	Wandoo (*Eucalyptus wandoo*)	500	-	Alive	-31.7573	116.4386	0			-	-	Class 5
WPT_766	Wandoo (*Eucalyptus wandoo*)	810	-	Alive	-31.7574	116.4384	0			-	-	Class 5
WPT_767	Wandoo (*Eucalyptus wandoo*)	630	-	Alive	-31.7575	116.4382	0			-	-	Class 5
WPT_768	Wandoo (*Eucalyptus wandoo*)	970	-	Dead	-31.7577	116.4379	1			-	Unknown	Class 3
WPT_773	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7578	116.4378	0			-	-	Class 5
WPT_774	Marri (*Corymbia calophylla*)	550	-	Alive	-31.7579	116.4376	0			-	-	Class 5
WPT_775	Marri (*Corymbia calophylla*)	900	-	Alive	-31.7580	116.4375	0			-	-	Class 5
WPT_783	Marri (*Corymbia calophylla*)	1120	-	Alive	-31.7589	116.4361	0			-	-	Class 5
WPT_794	Marri (*Corymbia calophylla*)	680	-	Dead	-31.7597	116.4350	1			-	Unknown	Class 4
WPT_803	Wandoo (*Eucalyptus wandoo*)	390	-	Alive	-31.7603	116.4342	0			-	-	Class 5
WPT_804	Wandoo (*Eucalyptus wandoo*)	1050	-	Dead	-31.7603	116.4342	1			-	Unknown	Class 3
WPT_805	Wandoo (*Eucalyptus wandoo*)	840	-	Alive	-31.7604	116.4341	1			-	Unknown	Class 3
WPT_810	Wandoo (*Eucalyptus wandoo*)	470	-	Alive	-31.7607	116.4337	0			-	-	Class 5
WPT_811	Marri (*Corymbia calophylla*)	690	-	Dead	-31.7607	116.4338	0			-	-	Class 5
WPT_813	Marri (*Corymbia calophylla*)	920	-	Dead	-31.7612	116.4333	0			-	-	Class 5
WPT_814	Marri (*Corymbia calophylla*)	670	-	Dead	-31.7613	116.4332	0			-	-	Class 5
WPT_815	Marri (*Corymbia calophylla*)	780	-	Dead	-31.7615	116.4329	1			-	Unknown	Class 3
WPT_816	Marri (*Corymbia calophylla*)	880	-	Alive	-31.7617	116.4327	0			-	-	Class 5
WPT_817	Jarrah (*Eucalyptus marginata*)	560	-	Alive	-31.7618	116.4326	0			-	-	Class 5
WPT_818	Marri (*Corymbia calophylla*)	720	-	Dead	-31.7619	116.4324	1			-	Unknown	Class 3
WPT_819	Jarrah (*Eucalyptus marginata*)	700	-	Dead	-31.7621	116.4323	0			-	-	Class 5
WPT_821	Marri (*Corymbia calophylla*)	740	-	Dead	-31.7622	116.4322	1			0	Unknown	Class 4
WPT_822	Marri (*Corymbia calophylla*)	590	-	Dead	-31.7622	116.4321	0			0	-	Class 5
WPT_823	Wandoo (*Eucalyptus wandoo*)	610	-	Dead	-31.7623	116.4321	0			0	-	Class 5
WPT_824	Wandoo (*Eucalyptus wandoo*)	550	-	Dead	-31.7623	116.4321	0			0	-	Class 5
WPT_825	Wandoo (*Eucalyptus wandoo*)	460	-	Dead	-31.7623	116.4321	1			0	Unknown	Class 3
WPT_827	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7624	116.4317	0			0	-	Class 5
WPT_828	Marri (*Corymbia calophylla*)	780	-	Alive	-31.7627	116.4316	0			0	-	Class 5
WPT_829	Marri (*Corymbia calophylla*)	690	-	Alive	-31.7629	116.4313	0			0	-	Class 5
WPT_830	Jarrah (*Eucalyptus marginata*)	730	-	Dead	-31.7629	116.4312	0			0	-	Class 5
WPT_837	Jarrah (*Eucalyptus marginata*)	600	-	Alive	-31.7632	116.4310	0			0	-	Class 5
WPT_838	Jarrah (*Eucalyptus marginata*)	730	-	Alive	-31.7632	116.4309	0			No	-	Class 5
WPT_839	Marri (*Corymbia calophylla*)	550	-	Alive	-31.7633	116.4308	0			0	-	Class 5
WPT_841	Marri (*Corymbia calophylla*)	600	-	Dead	-31.7635	116.4311	0			0	-	Class 5
WPT_844	Wandoo (*Eucalyptus wandoo*)	430	-	Alive	-31.7624	116.4323	0			0	-	Class 5
WPT_855	Marri (*Corymbia calophylla*)	680	-	Alive	-31.7591	116.4361	0			0	-	Class 5
WPT_863	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.7582	116.4375	0			0	-	Class 5
WPT_864	Marri (*Corymbia calophylla*)	640	-	Alive	-31.7582	116.4375	0			0	-	Class 5
WPT_866	Wandoo (*Eucalyptus wandoo*)	550	-	Alive	-31.7581	116.4376	0			0	-	Class 5
WPT_867	Marri (*Corymbia calophylla*)	620	-	Alive	-31.7580	116.4378	0			0	-	Class 5
WPT_868	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.7572	116.4390	0			0	-	Class 5
WPT_877	Marri (*Corymbia calophylla*)	810	-	Alive	-31.7570	116.4395	0			0	-	Class 5

Tree information							Hollow information					
Tree ID	Species	DBH (mm)	Height (m)	Status	Latitude	Longitude	Number of hollows	Hollow type	Entry diameter	Chew marks	Occupancy	Potential suitability
WPT_878	Marri (*Corymbia calophylla*)	860	-	Alive	-31.7569	116.4398	0			0	-	Class 5
WPT_879	Marri (*Corymbia calophylla*)	520	-	Dead	-31.7569	116.4398	0			0	-	Class 5
WPT_880	Marri (*Corymbia calophylla*)	1070	-	Dead	-31.7568	116.4400	1			0	Unknown	Class 4
WPT_881	Marri (*Corymbia calophylla*)	670	-	Alive	-31.7567	116.4402	0			0	-	Class 5
WPT_885	Marri (*Corymbia calophylla*)	620	-	Dead	-31.7565	116.4406	0			No	-	Class 5
WPT_887	Marri (*Corymbia calophylla*)	590	-	Alive	-31.7565	116.4407	0			0	-	Class 5
WPT_888	Marri (*Corymbia calophylla*)	860	-	Alive	-31.7564	116.4408	0			No	-	Class 5
WPT_892	Jarrah (*Eucalyptus marginata*)	680	-	Alive	-31.7562	116.4414	0			0	-	Class 5
WPT_893	Jarrah (*Eucalyptus marginata*)	1190	-	Alive	-31.7561	116.4417	0			0	-	Class 5
WPT_894	Jarrah (*Eucalyptus marginata*)	820	-	Dead	-31.7561	116.4418	0			0	-	Class 5
WPT_895	Jarrah (*Eucalyptus marginata*)	850	-	Alive	-31.7558	116.4423	0			No	-	Class 5
WPT_896	Jarrah (*Eucalyptus marginata*)	590	-	Alive	-31.7558	116.4424	0			No	-	Class 5
WPT_898	Marri (*Corymbia calophylla*)	920	-	Alive	-31.7556	116.4428	0			0	-	Class 5
WPT_899	Marri (*Corymbia calophylla*)	1240	-	Alive	-31.7555	116.4432	0			0	-	Class 5
WPT_900	Jarrah (*Eucalyptus marginata*)	580	-	Alive	-31.7554	116.4433	0			0	-	Class 5
WPT_901	Marri (*Corymbia calophylla*)	810	-	Alive	-31.7552	116.4442	0			0	-	Class 5
WPT_902	Jarrah (*Eucalyptus marginata*)	710	-	Alive	-31.7550	116.4447	0			0	-	Class 5
WPT_903	Jarrah (*Eucalyptus marginata*)	720	-	Alive	-31.7549	116.4451	0			0	-	Class 5
WPT_904	Jarrah (*Eucalyptus marginata*)	660	-	Alive	-31.7548	116.4453	0			0	-	Class 5
WPT_905	Marri (*Corymbia calophylla*)	680	-	Alive	-31.7548	116.4456	0			0	-	Class 5
WPT_906	Marri (*Corymbia calophylla*)	500	-	Alive	-31.7547	116.4457	0			0	-	Class 5
WPT_907	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7546	116.4460	0			0	-	Class 5
WPT_908	Wandoo (*Eucalyptus wandoo*)	390	-	Alive	-31.7546	116.4461	0			0	-	Class 5
WPT_909	Jarrah (*Eucalyptus marginata*)	530	-	Alive	-31.7545	116.4462	0			0	-	Class 5
WPT_913	Jarrah (*Eucalyptus marginata*)	590	-	Dead	-31.7566	116.4409	0			0	-	Class 5
WPT_914	Marri (*Corymbia calophylla*)	540	-	Dead	-31.7567	116.4406	0			0	-	Class 5
WPT_920	Marri (*Corymbia calophylla*)	640	-	Alive	-31.7639	116.4300	0			0	-	Class 5
WPT_921	Jarrah (*Eucalyptus marginata*)	620	-	Alive	-31.7641	116.4299	0			0	-	Class 5
WPT_924	Jarrah (*Eucalyptus marginata*)	650	-	Alive	-31.7643	116.4295	0			0	-	Class 5
WPT_925	Jarrah (*Eucalyptus marginata*)	530	-	Alive	-31.7643	116.4294	0			0	-	Class 5
WPT_931	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7652	116.4283	0			0	-	Class 5
WPT_932	Wandoo (*Eucalyptus wandoo*)	520	-	Alive	-31.7653	116.4282	2			0	Unknown	Class 3
WPT_933	Wandoo (*Eucalyptus wandoo*)	620	-	Alive	-31.7654	116.4281	2			0	Unknown	Class 3
WPT_934	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7654	116.4282	0			0	-	Class 5
WPT_940	Marri (*Corymbia calophylla*)	570	-	Alive	-31.7658	116.4275	0			No	-	Class 5
WPT_950	Marri (*Corymbia calophylla*)	530	-	Alive	-31.7664	116.4267	0			0	-	Class 5
WPT_953	Marri (*Corymbia calophylla*)	500	-	Alive	-31.7667	116.4261	0			0	-	Class 5
WPT_954	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7667	116.4261	0			0	-	Class 5
WPT_955	Marri (*Corymbia calophylla*)	550	-	Alive	-31.7667	116.4261	0			0	-	Class 5
WPT_956	Wandoo (*Eucalyptus wandoo*)	630	-	Alive	-31.7669	116.4258	1			0	Unknown	Class 4
WPT_957	Wandoo (*Eucalyptus wandoo*)	420	-	Alive	-31.7670	116.4256	0			0	-	Class 5
WPT_958	Wandoo (*Eucalyptus wandoo*)	360	-	Alive	-31.7669	116.4256	0			0	-	Class 5
WPT_964	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7673	116.4250	0			0	-	Class 5
WPT_965	Wandoo (*Eucalyptus wandoo*)	420	-	Alive	-31.7673	116.4249	0			0	-	Class 5
WPT_968	Jarrah (*Eucalyptus marginata*)	560	-	Alive	-31.7674	116.4247	0			0	-	Class 5

Tree information							Hollow information					
Tree ID	Species	DBH (mm)	Height (m)	Status	Latitude	Longitude	Number of hollows	Hollow type	Entry diameter	Chew marks	Occupancy	Potential suitability
WPT_969	Unknown (Dead)	540	-	Dead	-31.7673	116.4246	0			0	-	Class 5
WPT_972	Jarrah (*Eucalyptus marginata*)	530	-	Alive	-31.7674	116.4244	0			0	-	Class 5
WPT_973	Jarrah (*Eucalyptus marginata*)	500	-	Alive	-31.7674	116.4245	0			0	-	Class 5
WPT_974	Jarrah (*Eucalyptus marginata*)	530	-	Alive	-31.7675	116.4244	0			0	-	Class 5
WPT_983	Wandoo (*Eucalyptus wandoo*)	350	-	Alive	-31.7680	116.4240	0			0	-	Class 5
WPT_984	Wandoo (*Eucalyptus wandoo*)	330	-	Alive	-31.7681	116.4241	0			0	-	Class 5
WPT_986	Wandoo (*Eucalyptus wandoo*)	390	-	Alive	-31.7680	116.4243	0			0	-	Class 5
WPT_987	Wandoo (*Eucalyptus wandoo*)	300	-	Alive	-31.7679	116.4246	0			0	-	Class 5
WPT_989	Marri (*Corymbia calophylla*)	520	-	Dead	-31.7677	116.4247	0			0	-	Class 5
WPT_990	Wandoo (*Eucalyptus wandoo*)	520	-	Alive	-31.7677	116.4247	0			0	-	Class 5
WPT_991	Wandoo (*Eucalyptus wandoo*)	440	-	Alive	-31.7675	116.4251	0			0	-	Class 5
WPT_992	Wandoo (*Eucalyptus wandoo*)	410	-	Alive	-31.7676	116.4252	0			0	-	Class 5
WPT_993	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7676	116.4253	0			0	-	Class 5
WPT_994	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7675	116.4253	0			0	-	Class 5
WPT_995	Wandoo (*Eucalyptus wandoo*)	340	-	Alive	-31.7675	116.4254	0			0	-	Class 5
WPT_996	Marri (*Corymbia calophylla*)	510	-	Dead	-31.7675	116.4257	0			0	-	Class 5
WPT_997	Wandoo (*Eucalyptus wandoo*)	320	-	Alive	-31.7673	116.4260	0			0	-	Class 5
WPT_998	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7672	116.4261	0			0	-	Class 5
WPT_1004	Wandoo (*Eucalyptus wandoo*)	370	-	Alive	-31.7672	116.4264	0			0	-	Class 5
WPT_1005	Jarrah (*Eucalyptus marginata*)	850	-	Alive	-31.7671	116.4266	0			0	-	Class 5
WPT_1009	Jarrah (*Eucalyptus marginata*)	760	-	Alive	-31.7661	116.4276	0			0	-	Class 5
WPT_1016	Marri (*Corymbia calophylla*)	550	-	Alive	-31.7654	116.4286	0			0	-	Class 5
WPT_1017	Wandoo (*Eucalyptus wandoo*)	620	-	Alive	-31.7653	116.4287	0			0	-	Class 5
WPT_1018	Marri (*Corymbia calophylla*)	520	-	Alive	-31.7653	116.4288	0			0	-	Class 5
WPT_1019	Wandoo (*Eucalyptus wandoo*)	530	-	Alive	-31.7652	116.4289	0			0	-	Class 5
WPT_1020	Marri (*Corymbia calophylla*)	680	-	Alive	-31.7650	116.4291	0			0	-	Class 5
WPT_1021	Wandoo (*Eucalyptus wandoo*)	610	-	Alive	-31.7648	116.4293	0			0	-	Class 5
WPT_1022	Wandoo (*Eucalyptus wandoo*)	400	-	Alive	-31.7648	116.4293	0			0	-	Class 5
WPT_1023	Wandoo (*Eucalyptus wandoo*)	380	-	Alive	-31.7647	116.4294	0			0	-	Class 5
WPT_1024	Wandoo (*Eucalyptus wandoo*)	310	-	Alive	-31.7647	116.4295	0			0	-	Class 5
WPT_1025	Marri (*Corymbia calophylla*)	620	-	Alive	-31.7644	116.4298	0			0	-	Class 5
WPT_1026	Marri (*Corymbia calophylla*)	500	-	Alive	-31.7643	116.4301	0			0	-	Class 5
WPT_1028	Marri (*Corymbia calophylla*)	770	-	Alive	-31.7640	116.4304	0			0	-	Class 5