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Clackline Biological Assessment
Main Roads Western Australia
25-Jan-2017 D R A F T

# Clackline Flora, Vegetation and Fauna Assessment

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# Clackline Flora, Vegetation and Fauna Assessment

Client: Main Roads Western Australia

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Prepared by F de Wit and J Leigh

Reviewed by L Kirchner

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| B | 25-Jan-2017 | Draft for client review | Linda Kirchner<br>Associate Director - Environment |  |

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# Executive Summary

Main Roads Western Australia (Main Roads) requires land that provides suitable offsets for environmental impacts due to various infrastructures projects undertaken in the Perth Metropolitan area. AECOM Australia Pty Ltd (AECOM) was engaged to undertake an ecological assessment of a property in Clackline (the Survey Area). This property is adjoining the Clackline Nature Reserve to the south and a large area of remnant vegetation along the northern boundary. Clackline is approximately 70 km northeast of Perth, Western Australia.

A Level 1 flora and vegetation survey, Level 1 fauna survey and a targeted Black Cockatoo assessment were undertaken, comprising a desktop review and field survey. This report presents the existing environment, methodology and the results of these assessments.

A detailed desktop assessment was undertaken which identified:

- One Threatened Ecological Community (TEC), the EPBC Act-listed 'Eucalypt Woodland of the WA Wheatbelt', known to occur at several distinct locations east of the Survey Area.
- Twenty conservation significant flora species potentially occurring within or in the vicinity of the Survey Area. Of these, three Priority flora species are known to occur, three Priority species are likely to occur, and eight species may occur.
- Eighteen conservation significant fauna species could potentially occur. Of these, two species are likely to occur, nine species may occur and seven species are unlikely to occur. The fauna species likely to occur in the Survey Area were the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso)* and Carnaby's Black Cockatoo (*C. latirostris)*. The likelihood of occurrence of fauna species was determined by assessing the likely presence of suitable habitat in the Survey Area, and reviewing the recent records and distribution of the species.

The field surveys were undertaken by Botanist Floora de Wit and Ecologist Jared Leigh on 12th and 13th October 2016. The Survey Area was largely traversed on foot, due to the infrequent tracks and difficulty in vehicle access. Flora and vegetation data was captured at 15 sample point locations considered representative of the vegetation within the Survey Area. Eleven fauna habitat assessments were completed across the Survey Area. These included recording direct and indirect observations whilst traversing the Survey Area. Four microhabitat searches of leaf litter, bark, fallen logs and rocks were conducted opportunistically in appropriate areas. The Black Cockatoo assessment included assessments of19 breeding habitat sites and 12 foraging sites for Forest Red-tailed Black Cockatoo and Carnaby's Black Cockatoo. Opportunistic observations of Black Cockatoos and potential roosting sites were also recorded.

The *Eucalyptus accedens* and *E. wandoo* woodlands recorded in the Survey Area are unlikely to represent the EPBC Act-listed 'Eucalypt Woodland of the WA Wheatbelt'. Advice from the Commonwealth and DPaW suggest that as these communities in the Survey Area are recorded on gravelly substrates associated with a hilly landscape and with understorey species common in the Jarrah Forest, it is more representative of Darling Scarp woodlands.

One vegetation community is considered locally significant. The tall shrubland community, EbMrCc supports a population of the Priority 3 flora species *Eremaea blackwelliana* which is the dominant tall shrub species. This population includes more than 100 individuals.

One potential Priority species, *Hibbertia ?montana* (P4) was recorded at one location. This species could not be verified due to lack of suitable flowering material.

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Thirty fauna species were recorded within the Survey Area during the field survey. This comprised 24 bird and seven mammal species. Of the 30 fauna species observed, seven species were of conservation significance, including Carnaby's Black Cockatoo (Endangered under the EPBC Act and WC Act*)* and the Glossy Ibis (*Plegadis falcinellus* – Migratory under the EPBC Act and International Agreement under the WC Act). The remaining five species were all listed as Marine under the EPBC Act and are therefore only considered conservation significant within Commonwealth land. Five introduced fauna species were also recorded in the Survey Area. Three Declared Pest fauna species were recorded, listed under the *Biosecurity and Agricultural Management Act 2007* (BAM Act), including the European Wild Rabbit (*Oryctolagus cuniculus*), the feral Dog (*Canis lupus* subsp. *familiaris*) and the Red Fox (*Vulpes vulpes*).

Seven fauna habitats (including Cleared areas) have been defined and mapped within the Survey Area. The most common fauna habitat was the Open Eucalypt Woodland at approximately 50% of the Survey Area. This habitat varies in the species of eucalypt present but would generally support many of the common and conservation significant fauna species likely to occur in the Survey Area, such as Carnaby's Black Cockatoo and the Forest Red-tailed Black Cockatoo.

The Survey Area contains significant areas of mature eucalypt trees, with Black Cockatoo breeding potential (Diameter at Breast Height [DBH] >500cm). These are generally not at a high density. It also contains several freshwater sources. The Black Cockatoo foraging assessments determined that the Survey Area contains approximately 460 ha of foraging habitat for Carnaby's Black Cockatoo and 457 ha for the Forest Red-tailed Black Cockatoo. Carnaby's Black Cockatoo were observed within the Survey Area on four occasions, with recent foraging evidence of Carnaby's Black Cockatoo recorded an additional four times during the field survey.

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# 1.0 Introduction

## 1.1 Project Background and Location

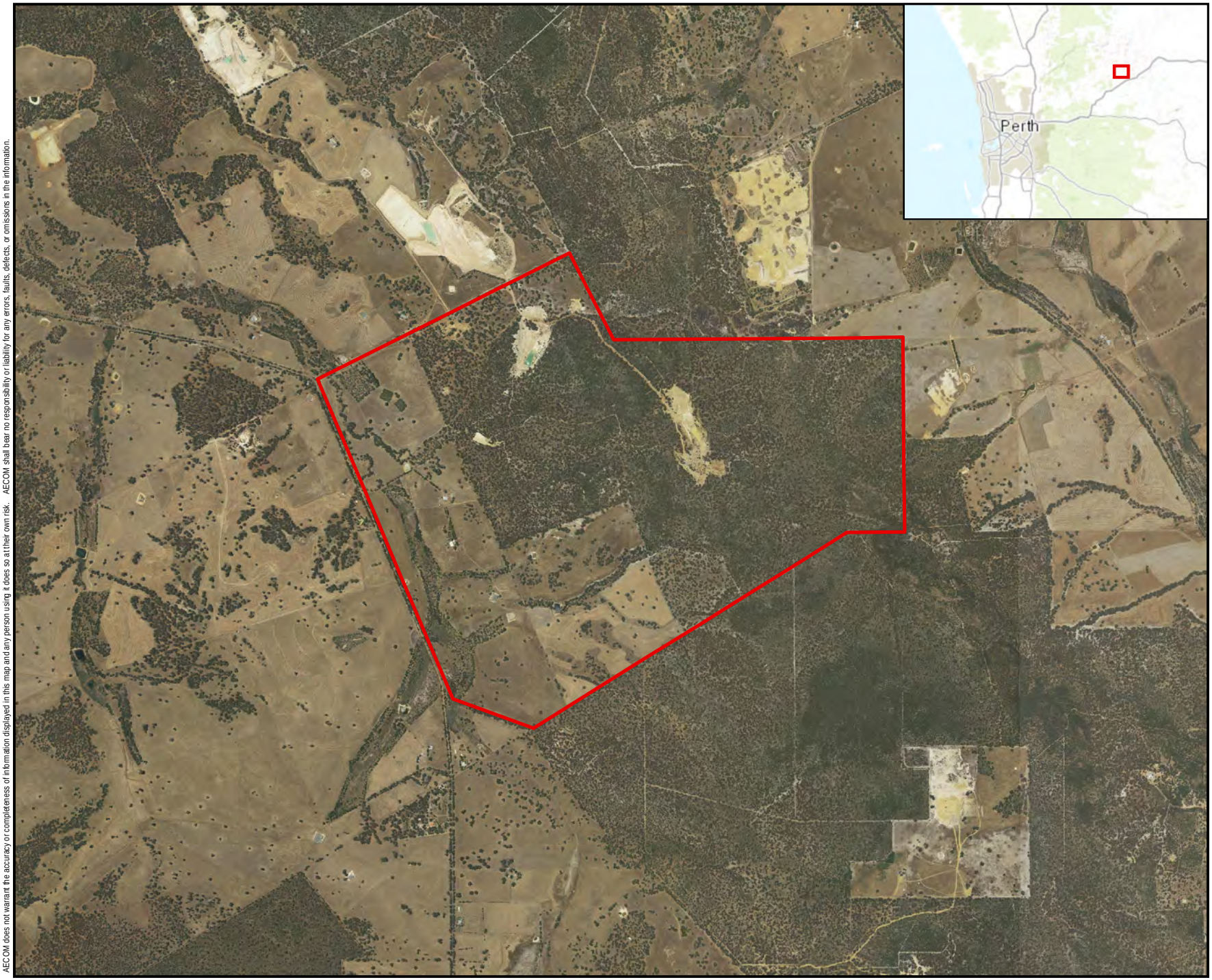
Main Roads Western Australia (Main Roads) requires land with suitable environmental attributes to provide offsets for environmental impacts due to various infrastructure projects to be undertaken in the Perth Metropolitan area. AECOM Australia Pty Ltd (AECOM) was engaged to undertake an ecological assessment of a potentially suitable property (the Survey Area) in Clackline (Figure 1). This property is adjoining the Clackline Nature reserve (700 ha) to the south and a large area of remnant vegetation along the northern boundary. Clackline is approximately 70 km northeast of Perth in the Shire of Toodyay, Western Australia.

## 1.2 Objective

The objective of this ecological assessment is to survey the relevant environmental factors of the Survey Area, including vegetation, flora, Black Cockatoo breeding, foraging and roosting habitat. The specific objectives of the assessment were to:

- conduct a Level 1 flora and vegetation survey
- assess the presence of the Eucalypt Woodland of the Wheatbelt using the key diagnostic features presented in the approved conservation advice for this federally listed Threatened Ecological Community (TEC)
- conduct a Level 1 fauna survey
- assess the presence of suitable Black Cockatoo foraging species at sample sites and search for evidence of foraging, breeding or roosting by Black Cockatoos.

This technical document describes the methodology, desktop and field results and provides a preliminary discussion of results.

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Survey Area Boundary



# Project Location and Survey Area

**MAIN ROADS WESTERN AUSTRALIA**

*CLACKLINE FLORA, VEGETATION AND FAUNA*

**Figure**

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# 2.0 Legislative Framework

## 2.1 Overview

Key legislation governing the protection and management of Western Australia's conservation significant flora and vegetation are summarised in Table 1 and further discussed below.

**Table 1 Relevant legislation, regulations and guidance**

| Legislation | Purpose |
|---|---|
| **Commonwealth of Australia** | |
| *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) | Provides for the protection of the environment and the conservation of biodiversity.<br>Gosnells Quarry is exempt from the assessment and approval provisions of the EPBC Act in accordance with Section 43B of the EPBC Act. |
| **Western Australia** | |
| *Wildlife Conservation Act 1950* (WC Act) | Provides for the conservation and protection of Western Australia's wildlife. |
| *Environmental Protection Act 1986* (EP Act) | Preventing, controlling and abating environmental harm and conserving, preserving, protecting, enhancing and managing the environment. |
| *Biosecurity and Agriculture Management Act 2007* (BAM Act) | Provides for the management, control and prevention of certain plants and animals, and for the protection of agriculture and related resources generally. |

## 2.2 Commonwealth legislation

The EPBC Act is the main piece of federal legislation protecting biodiversity in Australia. If an action or project is likely to have a significant impact on a matter of national environmental significance this action must be referred to the Minister for the Environment for a decision on whether assessment and approval is required under the EPBC Act.

### 2.2.1 Matters of National Environmental Significance

Matters of national environmental significance include:

- listed threatened species and ecological communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- world Heritage properties
- national Heritage places
- Great Barrier Reef Marine Park
- a water resource, in relation to coal seam gas development and large coal mining development
- nuclear actions.

### 2.2.2 Flora

Species at risk of extinction are recognised at a Commonwealth level and are categorised in one of six categories as outlined in Table 2.

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**Table 2 Categories of species listed under Schedule 179 of the EPBC Act**

| Conservation code | Category |
|---|---|
| Ex | Extinct Taxa |
| ExW | Extinct in the Wild |
| CE | Critically Endangered |
| E | Endangered |
| V | Vulnerable |
| CD | Conservation Dependent |

### 2.2.3 Communities

Communities can be classified as Threatened Ecological Communities (TECs) under the EPBC Act. The EPBC Act protects Australia's ecological communities by providing for:

- identification and listing of ecological communities as threatened
- development of conservation advice and recovery plans for listed ecological communities
- recognition of key threatening processes
- reduction of impacts of these processes through threat abatement plans.

Categories of federally listed TECs are described in Table 3.

**Table 3 Categories of TECs that are listed under the EPBC Act**

| Conservation Code | Category |
|---|---|
| CE | Critically Endangered - is facing an extremely high risk of extinction in the wild in the immediate future |
| E | Endangered - not critically endangered and is facing a very high risk of extinction in the wild in the near future |
| V | Vulnerable - not critically endangered or endangered, but is facing a high risk of extinction in the wild in the medium-term future |

## 2.3 Western Australian legislation

### 2.3.1 Flora

Plants that are considered threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the WC Act. These categories are defined in Table 4.

**Table 4 Conservation codes for WA flora listed under the WA Act**

| Conservation Code | Category |
|---|---|
| CR | Critically endangered species |
| EN | Endangered species |
| VU | Vulnerable species |
| EX | Presumed extinct species |

Species that have not yet been adequately surveyed to warrant being listed under the WA Act are added to the Priority flora List by the State Minister of Environment.

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**Table 5 Conservation codes for WA flora as endorsed by the Minister for Environment**

| Conservation Code | Category |
|---|---|
| Priority One | Poorly known species |
| Priority Two | Poorly known species |
| Priority Three | Poorly known species |
| Priority Four | Rare, Near Threatened and other species in need of monitoring |
| Priority Five | Conservation Dependent species |

### 2.3.2 Communities

State listed TECs are not protected under any legislation, rather they are endorsed by the Minister for Environment. Categories of TECs are defined in Table 6. Priority Ecological Communities (PECs) are endorsed by the Minister for Environment as having insufficient information available to be considered as a TEC, or which are rare but not currently threatened. These categories are described in Table 7.

**Table 6 Conservation codes for State-listed Threatened Ecological Communities**

| Conservation Code | Category |
|---|---|
| PD | Presumed Totally Destroyed |
| CR | Critically Endangered |
| EN | Endangered |
| VU | Vulnerable |

**Table 7 Conservation codes for Priority Ecological Communities**

| Conservation | Code Category |
|---|---|
| P1 | Priority One - poorly-known ecological communities |
| P2 | Priority Two - poorly-known ecological communities |
| P3 | Priority Three - poorly known ecological communities |
| P4 | Priority Four - 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. |
| P5 | Priority Five - Conservation Dependent ecological communities |

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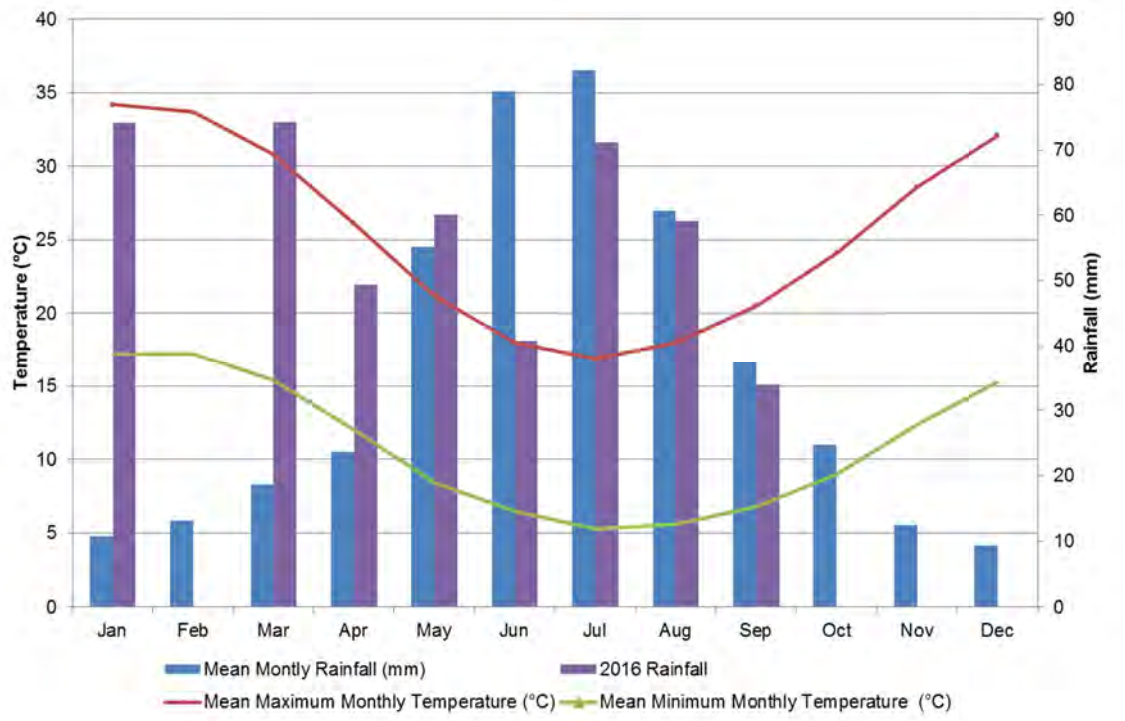
# 3.0 Existing Environment

## 3.1 Climate

The survey area is located on the Darling Scarp which experiences a Warm Mediterranean, characterised by a wet winter and dry summer. The nearest Australian Government Bureau of Meteorology (BoM) recording site with long term data is Station No. 010111, approximately 15.1 km northeast of the Survey Area. Station No. 010111 recorded an average annual rainfall of 426.9 mm since 1877, with the majority of rainfall occurring during May and August. Since 1902, Station No. 010111 recorded average maximum temperatures peaking between December and February, coinciding with low rainfall averages. In 2016, significantly above average rainfall was received during the first four months of the year (BoM, 2016).




Source: BOM (2016)

**Figure 2 Climate Data from Station No. 010111**

## 3.2 Interim Biogeographic Regionalisation for Australia

There are 89 recognised Interim Biogeographic Regionalisation for Australia (IBRA) regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (Department of Conservation and Land Management [CALM], 2002). The majority of the survey area lies within the Northern Jarrah Forest subregion, with two kilometres of the eastern end located within the Avon Wheatbelt region (CALM, 2002).

The Northern Jarrah Forest subregion incorporates the area east of the Darling Scarp which overlies Archaean granite and metamorphic rocks capped by extensive lateritic duricrust, dissected by drainage and broken by occasional granite hills (Williams & Mitchell, 2001). The subregion consists of Jarrah-Marri forest in the west, Bullich-Blackbutt in the valleys which shifts to Wandoo-Marri in the east, and Powder bark on breakaways. The granite rocks support heath communities and comprise the common understorey of the woodlands in the north and east. Land use is predominantly forestry, conservation, grazing and mining. Rare features of the area include the extensive native forest cover.

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## 3.3 Pre-European Vegetation

Beard (1981) and Heddle et al. (1980) mapping is used to determine the current extent of remnant vegetation remaining when compared to pre-European vegetation extent. EPA's objective is to retain at least 30% of all pre-European ecological communities, which is consistent with recognised retention levels (EPA 2000; EPA 2015).

**Table 8 Pre-European vegetation associations present in the Project Area as mapped by Beard (1981) and the percent of native vegetation remaining according to the Statewide Vegetation Statistics (Government of WA, 2015)**

| Vegetation Association | Description | Percent Remaining | | |
|---|---|---|---|---|
| | | State | IBRA | Shire of Toodyay |
| 4 | Medium Woodland; Marri and Wandoo | 27.88 | 28.05 | 53.86 |

Vegetation complex mapping has been undertaken on the Darling Scarp with spatial data available from Heddle *et al*. (1980) and per cent remaining published by the Local Biodiversity Program (2013) and Perth Peel @ 3.5 Million (EPA, 2015). The data shows four complexes that intersect with the survey area, described in Table 9.

**Table 9 Vegetation complexes within the survey area and percent remaining as provided in Local Biodiversity Program (2013) and EPA (2015)**

| Vegetation Complex | Description | Percent Remaining |
|---|---|---|
| Michibin | Open woodland of *Eucalyptus wandoo* over *Acacia acuminate* with some *Eucalyptus loxophleba* on valley slopes, with low woodland of *Allocasuarina huegeliana* on or near shallow granite outcrops in arid and perarid zones. | 26.41 |
| Coolakin in low rainfall | Woodland of *Eucalyptus wandoo* with mixtures of *Eucalyptus patens, Eucalyptus marginata* subsp. *thalassica* and *Corymbia calophylla* on valley slopes in arid and perarid zones. | 39.85 |
| Cooke | Vegetation ranging from open forest of *Eucalyptus marginata – Corymbia calophylla* on deep soils through heath and herbland to lichens on granite rocks. | 83.43 |
| Yalanbee in low rainfall | 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. | 46.9[1] |

1. Derived from Perth-Peel paper (EPA, 2015)

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# 4.0 Methodology

The biological assessment had a desktop assessment, field surveys and reporting components. The methodologies for these components are described below.

## 4.1 Desktop Assessment

A detailed desktop assessment focussed on defining the values of the existing environment and determining the locations of Threatened and Priority flora, fauna, and communities. Desktop database searches were requested for the Project Area with a 10 km buffer. Sources consulted included:

- DPaW Threatened Species and Communities database including Threatened and Priority flora, fauna and communities (obtained from Main Roads)
- Western Australian Herbarium (WAH) records
- EPBC Act Protected Matters Search Tool (PMST).

The search results were reviewed to assess the potential presence of conservation significant environmental values. All conservation significant matters including flora, fauna and communities were reviewed and a likelihood of occurrence was completed based on the categories outlined in Table 10.

**Table 10 Categories of Likelihood of Occurrence for Species and Communities**

| Likelihood | Flora | Fauna | Communities |
|---|---|---|---|
| Likely to occur | Habitat is present in the survey area and the species has been recorded in close proximity to the survey area | survey area is within the known distribution of the species, habitat is present in the survey area and the species has been recorded in close proximity to the survey area | Known occurrences of the community in close proximity to the survey area. Vegetation looks the same within the known occurrence and survey area based on aerial imagery. Geographic location is similar to the survey area |
| May occur | Habitat may be present and/or the species has been recorded in close proximity to the survey area | survey area is within the known distribution of the species, marginal habitat may be present and/or the species has been recorded in close proximity to the survey area | Known occurrence of the community in the local area, and/or vegetation looks the same within known occurrence and survey area based on aerial imagery. Geographic location is similar to the survey area |
| Unlikely to occur | No suitable habitat is present and the species has not been recorded in close proximity to the survey area | survey area is outside the known distribution for the species, or no suitable habitat is present and the species has not been recorded in close proximity to the survey area | Known occurrence of the community in close proximity to the project area however geographic location does not occur in survey area |

## 4.2 Field surveys

### 4.2.1 Flora and Vegetation

A level 1 flora and vegetation survey was conducted in accordance with EPA Guidance Statement No. 51 (EPA, 2004a) and the Flora and Vegetation Technical Guide (EPA & DPaW, 2015). The survey was conducted by Senior Botanist Floora de Wit on 12-13 October 2016.

Floristic data was collected at sample point locations using relevés to document the floristics, vegetation composition and structure, condition, and other identifying features of the vegetation community. Floristic data was collected at 16 relevès within the survey area (Figure 3). Sample point locations were selected to ensure accurate representation of native vegetation within the survey area.

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Any species unable to be identified in the field were collected for identification in AECOM's in-house herbarium and the specimens and taxonomic references and keys at the WAH. Naming of species followed the convention of the WAH.

Quantitative flora species data were used to define the vegetation communities. Vegetation communities were described and mapped based on changes in dominant species composition and landform. Vegetation community descriptions were done at the Level IV Sub-Association level in accordance with the National Vegetation Information System (NVIS) framework (Commonwealth of Australia, 2003).

Vegetation condition was determined using the scale published by the Wildflower Society WA (Keighery, 1994) condition scale (Table 11). The scale is based on disturbance (e.g. grazing, erosion), degree of alteration to community and habitat structure and site ecology.

**Table 11 Bushland Condition Ratings (Keighery, 1994)**

| Descriptor | Explanation |
|---|---|
| Pristine | Pristine or nearly so, no obvious signs of disturbance |
| Excellent | Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species |
| Very Good | Vegetation structure altered obvious signs of disturbance. For example, 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. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing |
| Degraded | Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance of vegetation structure caused by very frequent fires, the presence of very aggressive weeds, 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 or shrubs |

### 4.2.2 Threatened Ecological Community Assessment

Patches of native vegetation located in the Avon Wheatbelt IBRA region were visited and assessed to determine whether the EPBC Act-listed TEC *Eucalypt Woodlands of the Western Australian Wheatbelt* occurs within the Survey Area. All vegetated sections of the survey corridor were traversed on foot and vegetation assessed against the key diagnostic features and condition thresholds as published in the Approved Conservation Advice (Threatened Species Scientific Committee [TSSC], 2015) and summarised in Table 12 and Table 13.

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**Table 12 Key Diagnostic Features Considered During Survey**

| Key Diagnostic Features – the patch must show the following key diagnostic features | Y/N |
|---|---|
| Distribution of the ecological community is limited to one of the following IBRA regions:<br>· Avon Wheatbelt - subregions AVW01 Merredin and AVW02 Katanning;<br>· Mallee - MAL02 Western Mallee only;<br>· Jarrah Forest – 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, and receive less than 600 mm mean annual rainfall. | |
| Community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10% | |
| Key species of the tree canopy are species of *Eucalyptus* as identified in Table 2a of the Approved Conservation Advice (TSSC, 2015) | |
| A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table A1 of Appendix A of the Approved Conservation Advice | |

Where the vegetation met the key diagnostic features contained in Table 12, the condition thresholds and considerations of Table 13 were applied.

**Table 13 Condition thresholds applicable to the TEC**

| Cover of weeds AND | Mature trees AND | Min. patch size (non-roadside patches) OR | Min. patch width (roadsides only) |
|---|---|---|---|
| **Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014).** | | | |
| 0-30% of total understorey vegetation cover | May be present or absent | 2 ha+ | 5 m+ |
| **Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.** | | | |
| 30-50% | Present with at least 5 trees/0.5ha | 2 ha+ | 5 m+ |
| **Category C: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014).** | | | |
| 30-50% | Either absent or LESS THAN 5 trees/0.5ha | 5 ha+ | 5 m+ |
| **Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features.** | | | |
| More than 50-70% | Present with at least 5 trees/0.5ha | 5 ha+ | 5 m+ |

### 4.2.3 Fauna Survey

The Level 1 fauna survey primarily focused on recording observations of fauna within the Survey Area, which included evidence of fauna activity such as scats, tracks, burrows, foraging evidence and diggings. This survey was undertaken in accordance with EPA (2002) Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection, and EPA (2004b) Guidance Statement No. 56 Guidance for the Assessment of Environmental Factors – Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Particular attention was given to locating species of conservation significance that have the potential to occur in the Project Area, as identified in the desktop assessment. All observations were made during daylight hours of 0700 and 1800.

Microhabitat searches of leaf litter, bark, fallen logs and rocks were also conducted opportunistically when appropriate areas were located. This included raking soil and leaf litter, inspecting dead logs and timber, inspecting burrows, lifting rocks and inspecting loose bark on trees. Four microhabitat searches were conducted across the Survey Area (refer to Figure 3 for locations).

The taxonomy and nomenclature of vertebrate species for mammals, reptiles and amphibians is consistent with the Western Australian Museum's Checklist of Vertebrates of Western Australia (2016) and for bird species the Bird's Australia Checklist of Australian Birds by Christidis and Boles (2008).

#### 4.2.3.1 Fauna Habitats

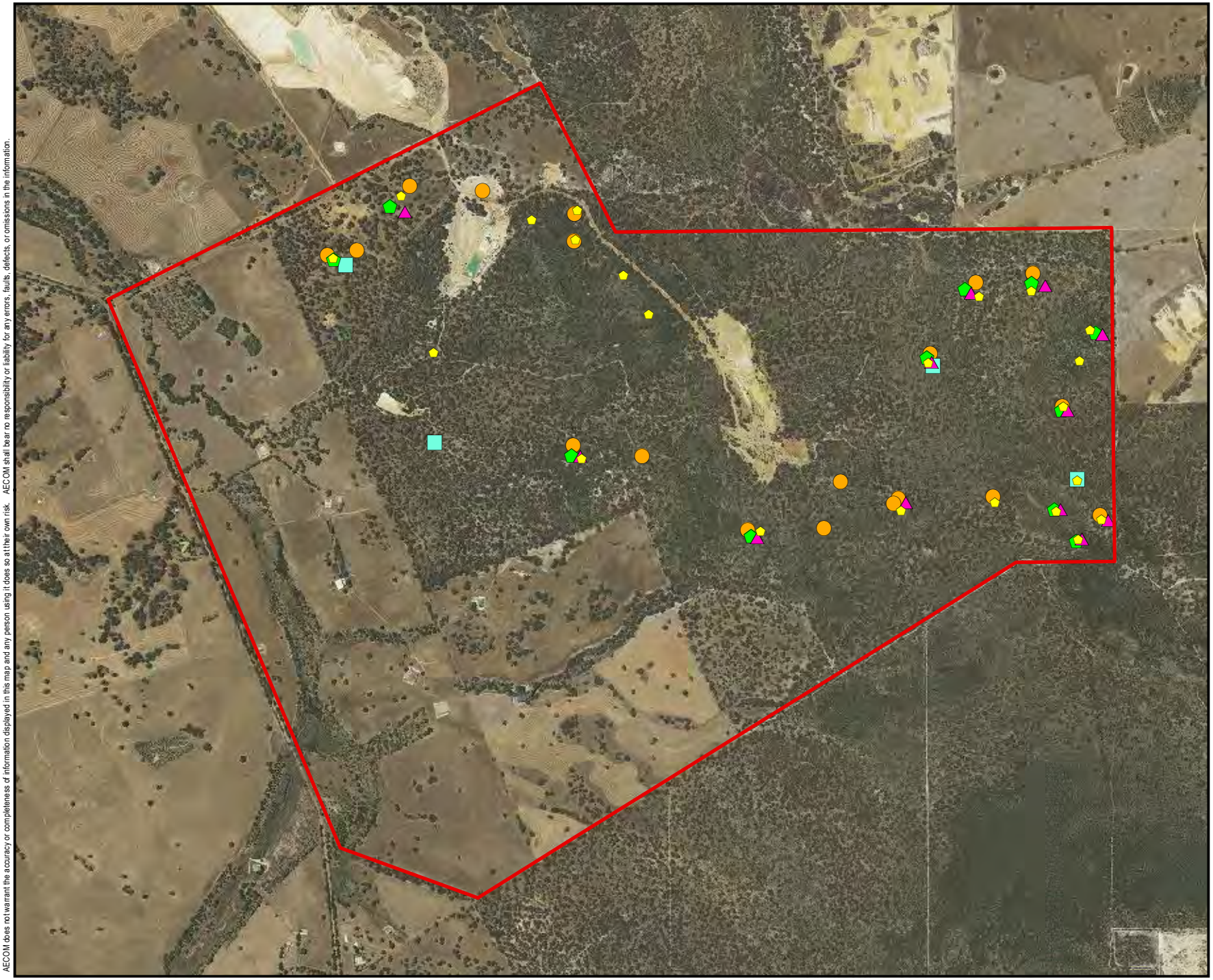
The fauna habitats of the Survey Area were assessed and mapped during the field survey, in conjunction with the vegetation mapping. Eleven detailed habitat assessments were completed throughout the Survey Area. Fauna habitats were assessed for specific habitat components in order to determine the potential for these habitats to support conservation significant species.

Information collected included:

- Location
- General habitat description
- Habitat condition and disturbance types
- Dominant / characteristic flora species and vegetation layers
- Presences and abundance of hollows, fallen logs, leaf litter, bare ground, grass, stones and boulders, rock crevices, soil cracks, cryptogramic crust, vines, mistletoe, dense shrubs, water bodies etc.
- Presence of animal signs (e.g. scats, digging, tracks, burrows, egg shell, bones, feathers etc.)
- Fauna observations
- Connectivity and potential significance of habitat.

#### 4.2.3.2 Targeted Black Cockatoo Survey

A targeted Black Cockatoo survey was conducted to identify potential Black Cockatoo breeding habitat, as well as assessing quantity of potential foraging habitat for Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii* subsp. *naso*). The Black Cockatoo survey was carried out in conjunction with the Level 1 fauna survey by Ecologist Jared Leigh and Botanist Floora de Wit.



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**LEGEND**

- Flora Sites
- Survey Area Boundary
- Black Cockatoo Foraging Habitat Assessments
- Fauna Habitat Assessment
- Microhabitat Searches
- Black Cockatoo Breeding Tree Assessment Locations

Data sources: Service Layer Credits:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

## Survey Effort

**MAIN ROADS WESTERN AUSTRALIA**

***CLACKLINE FLORA, VEGETATION AND FAUNA***

**Figure 3**



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#### 4.2.3.2.1 Breeding Habitat

The Black Cockatoo breeding habitat assessment focussed on quantifying potential breeding trees and associated habitat. Table 14 defines breeding habitat and identifies those trees that Black Cockatoos will utilised as breeding trees, according to the DSEWPaC (2012). Vegetation communities were assessed for their potential to provide breeding habitat by installing a 50 x 50 m quadrat as a sample point. All trees within this quadrat were then assessed for their suitability as a breeding tree. A total of 19 quadrats were assessed (refer to Figure 3). These quadrats were used to provide a representative sample to determine the total amount of breeding habitat (and approximate number of trees). The following information was collected for all potential breeding trees with a Diameter at Breast Height (DBH) >500 mm (*Eucalytpus wandoo* >300 mm):

- location
- fire scarring present
- tree species
- DBH
- height
- number of hollows
- number of potentially suitable hollows.

Photographs were also taken of each tree.

**Table 14 Potential Breeding Habitat for Black cockatoo species**

| Habitat | Carnaby's | Forest Red-Tailed |
|---|---|---|
| Specific breeding habitat | Nest in hollows in live or dead trees of *E. salmonophloia, E. wandoo, E. gomphocephala*, *E. marginata*, *E. rudis*, *E. loxophleba* subsp. *loxophleba, E. accedens, E. diversicolor* and *Corymbia calophylla*. | Nest in hollows in live or dead trees of *E. diversicolor* and *Corymbia calophylla, E. wandoo, E. megacarpa*, *E. patens*, *E. gomphocephala* and *E. marginata*. |
| Definition of breeding habitat | 'Breeding habitat' is defined in these referral guidelines 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 DBH to develop a nest hollow. For most tree species, suitable DBH is 500 mm. Note that *E. wandoo* is DBH >300 mm. | |

Source: DSEWPaC (2012).

### 4.2.4 Foraging Habitat

The Black Cockatoo foraging habitat assessments focussed on mapping the area of potential foraging habitat within the Survey Area. Table 15 defines the foraging species for the Forest Red-tailed Black Cockatoo and Carnaby's Black Cockatoo. Vegetation communities were assessed for their potential to provide foraging habitat by installing a 50 x 50 m quadrat as a sample point. Vegetation within this quadrat was then assessed for its suitability as foraging habitat. A total of 12 quadrats for each species were assessed (refer to Figure 3). These quadrats were used to provide a representative sample to determine the total amount of potential foraging habitat within the Survey Area for each Black Cockatoo species.

**D R A F T**

**Table 15 Foraging Species utilised by the three Western Australian Threatened Black Cockatoo species**

| Carnaby's Black Cockatoo | Forest Red-tail Black Cockatoo |
|---|---|
| Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species (e.g. *Banksia* sp., *Hakea* sp. and *Grevillea* sp.) as well as eucalypt woodland and forest that is dominated by foraging species. Also will feed on Callistemon, seeds of introduced species such as *Pinus* species and *Erodium* species, wild radish, canola, almonds and pecan nuts and occasionally apples and persimmons. | The principal foods of the Forest Red-tailed Black Cockatoo are the seeds of Marri and Jarrah. Other less important foods include Blackbutt *E. patens, E. wandoo,* Sheoak *A. fraseriana,* Snottygobble *P. longifolia*, *Hakea* spp., also introduced species (including Cape Lilac *Melia azedarach,* Spotted Gum *C. maculata,* Lemon-scented Gum *C. citriodora,* Silver Princess *E. caesia,* Illyarrie *E. erythrocorys* and Kaffir Plum *Harpephyllum caffrum*) and in southern forests Albany Blackbutt *E. staeri* and Karri *E. diversicolor*. Rarely observed grubbing for insect larvae on *Allocasuarina* spp. |

Source: DSEWPaC (2012) and Johnstone *et al.* (2013)

**D R A F T**

# 5.0 Limitations

The limitations of the biological assessment are outlined in Table 16.

**Table 16 Limitations of the assessment**

| Limitation | Level 1 Flora and Vegetation Survey | Level 1 Fauna Survey and Black Cockatoo Assessment |
|---|---|---|
| Competency/experience of consultant conducting survey | **Nil**<br>Floora de Wit has eight years' experience conducting surveys of similar scope. | **Nil**<br>Floora de Wit has four years' experience conducting Black Cockatoo assessments and Jared Leigh is an Ecologist with over 14 years' experience in the environmental industry and has conducted fauna surveys and Black Cockatoo assessments in a range of bioregions within Western Australia. |
| Scope (i.e. what life forms were sampled) | **Nil**<br>As a Level 1 survey, effort was made to document all species within each stratum present in the vegetation communities. Where species were unable to be identified, they were collected and identified at the WAH.<br>The species list was merged with the DPaW field survey species list to provide a comprehensive overview of floristic values. | **Nil**<br>The Level 1 fauna survey:<br>· assessed all fauna habitats within the Survey Area<br>· documented secondary evidence (scats, diggings, burrows etc.) and fauna sightings<br>· Conducted microhabitat searches at appropriate sites.<br><br>Sufficient representative quadrats were assessed for breeding and foraging habitat for the targeted Western Australian Threatened Black Cockatoo species. |
| Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity) | **Nil**<br>Flora and vegetation was characterised at 15 relevès in the Survey Area and additional observational points captured on the GPS. This is consistent with requirements of a Level 1 survey. | **Minor**<br>Information gained for a Level 1 fauna survey was sufficient. Fauna were observed (through direct or indirect evidence) during daylight hours (0700 and 1800hrs). Therefore nocturnal species were only observed through indirect evidence.<br><br>Sufficient representative quadrats were assessed for breeding and foraging habitat for the targeted Western Australian Threatened Black Cockatoo species. |

**D R A F T**

| Limitation | Level 1 Flora and Vegetation Survey | Level 1 Fauna Survey and Black Cockatoo Assessment |
|---|---|---|
| Sources of information | **Minor**<br>Florabase, Naturemap, EPBC PMST and a previous DPaW field survey were used to inform the desktop assessment and provide regional and local context. DPaW and WAH database records were not obtained until the field survey was completed. | **Nil**<br>DPaW Threatened fauna database, Naturemap and EPBC Act PMST were utilised to inform the Level 1 fauna survey and Black Cockatoo assessment. |
| Completion (is further work needed) | **Nil**<br>No targeted flora surveys were undertaken and DPaW and WAH database records not taken into account during field surveys. If a comprehensive understanding of environmental values is required then additional surveys including quadrat-based sampling and targeted conservation significant flora surveys may be required. | **Nil**<br>The objectives of the Level 1 fauna survey and Black Cockatoo assessment for an offset site were met and no further work is required. |
| Timing, weather, season, cycle | **Nil**<br>The field survey was undertaken during Spring on 12th and 13th October 2016. This is considered the ideal survey time for the bioregion. | **Nil**<br>The field survey was undertaken during Spring on 12th and 13th October 2016. The weather was warm with a maximum of approximately 32°C on 12th and 30°C on 13th October 2016. No rainfall was received during the survey. Sufficient rainfall had been received in the preceding months of the survey. |
| Disturbances (e.g. fire flood, accidental human intervention) which affected results of the survey | **Nil**<br>The Level 1 flora and vegetation survey was not disrupted or impacted. | **Nil**<br>Neither the Level 1 fauna survey or Black Cockatoo assessment were disrupted or impacted. |
| Intensity (was the intensity adequate) | **Nil**<br>Flora and vegetation was sampled from 16 relevès. This is considered suitable for a Level 1 survey requiring broad-based sampling. | **Minor**<br>The Survey Area was surveyed over a two day period which required the field team to be very efficient. Additional time would have enabled additional microhabitat searches and a more extensive observed fauna species list. However, this did not significantly impact the results of the survey. |
| Resources (degree of expertise available in plant/animal identification) | **Nil**<br>Plant material was collected where specimens were not able to be identified in the field. These were identified by Sharnya Thomson at the WAH. | **Nil**<br>The resources (time, equipment and expertise) were sufficient for a Level 1 fauna survey and the Black Cockatoo assessment. |

**D R A F T**

| Limitation | Level 1 Flora and Vegetation Survey | Level 1 Fauna Survey and Black Cockatoo Assessment |
|---|---|---|
| Remoteness and/or access problems | **Minor**<br>Not all of the Project Area was covered on-ground due to the size of the Project Area and the limited availability of tracks. However, all of the vegetation communities of the Survey Area were assessed and this minor limitation was not deemed significant. | **Minor**<br>Not all of the Project Area was covered on-ground due to the size of the Project Area and the limited availability of tracks. However, all of the fauna habitats of the Survey Area were assessed and this minor limitation was not deemed significant. |
| Availability of contextual information on the region | **Minor**<br>Only the Proposed Reserve Inspection Report by DPaW (2015) was available in the public domain. | **Minor**<br>Only the Proposed Reserve Inspection Report by DPaW (2015) was available in the public domain. |

**D R A F T**

# 6.0 Desktop Assessment Results

## 6.1 Vegetation

One TEC listed under the EPBC Act as Critically Endangered was identified in the desktop assessment. The TEC, named “Eucalypt Woodlands of the Western Australian Wheatbelt”, was recently added to the TEC list in late 2015.

This community was described by DotEE (2015) as comprising a tree canopy dominated or co-dominated by a range of Eucalypt species, including iconic Wheatbelt trees such as *Eucalyptus salmonophloia* (Salmon Gum), *E. loxophleba* subsp. *loxophleba* (York Gum), *E. salubris* (Gimlet), *E. longicornis* (Red Morrel), *E. wandoo* (Wandoo) and various species of mallet, among other eucalypt species.

This TEC is applicable only in the Avon Wheatbelt subregion AVW01 Merredin, AVW02 Katanning and the Mallee subregion MAL02 Western Mallee. Some outlying patches of the ecological community may extend into adjacent areas south and east of the primary Wheatbelt bioregions, and in the easternmost parts of the Jarrah Forest bioregion. These outlier patches generally occur south of Northam, extending into the vicinity of localities such as Wandering, Williams, Kojonup and Mount Barker, and are limited to areas that are not on the Darling Range, receive less than 600 mm mean annual rainfall and overlie the Yilgarn Craton geology.

## 6.2 Flora

Twenty conservation significant flora species were identified in the desktop assessment that potentially occur within or in the vicinity of the Survey Area. The results included 13 flora species listed under the EPBC Act, and another seven that are listed as Priority species by DPaW. Of these:

- three Priority flora species are known to occur
- three Priority flora species are considered likely to occur
- eight species listed under the EPBC Act and WC Act as Threatened may occur.

These species are summarised in Table 17. The comprehensive desktop assessment results, including the complete list of conservation significant flora species identified as potentially occurring, their habitat, and likelihood of occurrence, is provided in Appendix A.

**D R A F T**

**Table 17 Desktop flora results**

| Species | Cons. code | | | Likelihood |
|---|---|---|---|---|
| | EPBC Act | WC Act | DPaW | |
| *Eremaea blackwelliana* | | | P4 | Known |
| *Lasiopetalum trichanthera* | | | P2 | Known |
| *Verticordia serrata* var. *linearis* | | | P3 | Known |
| *Caladenia integra* | | | P4 | Likely |
| *Eucalyptus loxophleba* x *wandoo* | | | P4 | Likely |
| *Grevillea candolleana* | | | P2 | Likely |
| *Acacia aphylla* | V | VU | | May |
| *Conospermum densiflorum* subsp. *unicephalatum* | E | EN | | May |
| *Dasymalla axillaris* | CE | CR | | May |
| *Gastrolobium hamulosum* | E | CR | | May |
| *Grevillea christineae* | E | EN | | May |
| *Thelymitra dedmaniarum* | E | CR | | May |
| *Verticordia fimbrilepis* subsp. *fimbrilepis* | E | VU | | May |
| *Verticordia staminosa* subsp. *staminosa* | E | CR | | May |

## 6.3 Fauna

The desktop fauna assessment identified 18 conservation significant fauna species that could potentially occur within the Survey Area. Of these:

- two species are likely to occur
- nine species may occur
- seven species are unlikely to occur.

The two conservation significant species likely to occur in the Survey Area are both bird species. The likelihood of occurrence of fauna species was determined by assessing the likely presence of suitable habitat in the Survey Area, and reviewing the recent records and distribution of the species. The results of the desktop assessment are presented in Table 18. The conservation significant categories as defined by DPaW, the WC Act and EPBC Act are defined in Appendix A.

**D R A F T**

**Table 18 Desktop Fauna Assessment**

| Name | Common Name | Conservation Statue | | Source | Last Record* | Number of Records* | Likelihood |
|---|---|---|---|---|---|---|---|
| | | Commonwealth | State | | | | |
| *Apus pacificus* | Fork-tailed Swift | Migratory & Marine | IA | PMST | - | - | **May** Species may fly over Survey Area |
| *Ardea modesta* | Great Egret | Migratory | IA | DPaW | 2010 | 1 | **Unlikely** Only one record of species in local area |
| *Calidris ferruginea* | Curlew Sandpiper | CE, Marine & Migratory | VU & IA | PMST | - | - | **Unlikely** Suitable habitat unlikely to occur in Survey Area |
| *Calyptorhynchus banksii naso* | Forest Red-tailed Black Cockatoo | V | VU | DPaW & PMST | 2012 | 4 | **Likely** Four records in total with three very recent, suitable habitat present |
| *Calyptorhynchus baudinii* | Baudin's Black Cockatoo | E | EN | DPaW & PMST | 2005 | 2 | **May** Two recent records with suitable habitat present |
| *Calyptorhynchus latirostris* | Carnaby's Black Cockatoo | E | EN | DPaW & PMST | 2013 | 44 | **Likely - Confirmed** Species recorded during field survey |
| *Dasyurus geoffroii* | Chuditch | V | VU | DPaW & PMST | 2002 | 2 | **May** Only two records in local area and significant areas of preferred habitat with dense understorey not present in Survey Area |
| *Falco peregrinus* | Peregrine Falcon | - | OS | DPaW | 2011 | 3 | **May** Multiple recent records in local area with potentially suitable habitat present |
| *Hydromys chrysogaster* | Water-rat | - | P4 | DPaW | 1924 | 2 | **Unlikely** No recent records in local area |
| *Idiosoma nigrum* | Shield-backed Trapdoor Spider | V | VU | PMST | - | - | **May** Potentially suitable habitat may occur in Survey Area |
| *Leipoa ocellata* | Malleefowl | V | VU | DPaW & PMST | 1972 | 2 | **Unlikely** No recent records in local area and habitat unlikely to be suitable |

**D R A F T**

| Name | Common Name | Conservation Statue | | Source | Last Record* | Number of Records* | Likelihood |
|---|---|---|---|---|---|---|---|
| | | Commonwealth | State | | | | |
| *Macrotis lagotis* | Bilby | | VU | DPaW | 1927 | 2 | **Unlikely** No recent records in local area |
| *Motacilla cinerea* | Grey Wagtail | Migratory & Marine | IA | PMST | - | - | **May** Potentially suitable habitat likely to occur in Survey Area |
| *Numenius madagascariensis* | Eastern Curlew | CE, Migratory & Marine | VU & IA | PMST | - | - | **Unlikely** Suitable habitat unlikely to occur in Survey Area |
| *Rostratula australis* | Australian Painted Snipe | E & Marine | EN | PMST | - | - | **May** Potentially suitable habitat may occur in Survey Area |
| *Pandion cristatus* | Osprey | Migratory & Marine | IA | PMST | - | - | **Unlikely** Suitable habitat unlikely to occur in Survey Area |
| *Phascogale calura* | Red-tailed Phascogale | E | CD | PMST | - | - | **May** *Allocasuarina* sp. and *Eucalyptus wandoo* in Survey Area but not in significant areas |
| *Tringa nebularia* | Common Greenshank | Migratory & Marine | IA | PMST | - | - | **May** Potentially suitable habitat likely to occur in Survey Area |

Notes: *DPaW (2016)

**D R A F T**

# 7.0 Field Survey Results and Discussion

## 7.1 Vegetation

### 7.1.1 Threatened Ecological Communities

An assessment against the key diagnostic features was undertaken to determine whether the Eucalypt Woodlands of the WA Wheatbelt TEC was present in the Survey Area (Table 19). Despite the woodland meeting all criteria, including being located in the eastern Jarrah Forest in an area receiving less than 600 mm of rainfall, DPaW and the Commonwealth have advised it is unlikely to represent the TEC.

The gravelly substrate and associated hilly landscape and the understorey species are considered more typical of the woodlands of the eastern Darling Scarp than those of the Wheatbelt region. The TEC therefore is not considered to occur within the Survey Area. The communication received from DPaW is provided in Appendix E.

**Table 19 Key Diagnostic Features Considered During Survey**

| **Key Diagnostic Features – the patch must show the following key diagnostic features** | **Y/N** |
|---|---|
| Distribution of the ecological community is limited to one of the following IBRA regions:<br>· Avon Wheatbelt - subregions AVW01 Merredin and AVW02 Katanning;<br>· Mallee - MAL02 Western Mallee only;<br>· Jarrah Forest – 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, and receive less than 600 mm mean annual rainfall. | Y – Jarrah Forest adjacent to Avon Wheatbelt off the Darling Range |
| Community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10% | Y |
| Key species of the tree canopy are species of *Eucalyptus* as identified in Table 2a (see Attachment A) | Y - predominantly *E. accedens* with one pocket of *E. wandoo* |
| A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in Table A1 of Appendix A of the Approved Conservation Advice | Y – average native species richness in the eleven relevès completed was 23 native species |

**D R A F T**

**Plate 1 Representative photographs of the Wandoo woodlands recorded in the Survey Area**

**D R A F T**

### 7.1.2 Vegetation Communities

Seven vegetation communities were recorded and described in the Survey Area (Table 20). These include:

- four woodland communities including two *Eucalyptus accedens* and one *E. wandoo* woodland representing the 'Eucalypt Woodlands of the WA Wheatbelt' TEC', and one *Allocasuarina* woodland
- One heath community
- one 'Mixed Trees' community, encompassing stands of native trees devoid of any native understorey species
- planted trees.

The remainder of the Survey Area was mapped as paddock or cleared. Cleared includes dams, tracks and the homestead.

A species by community matrix is presented in Appendix B.

**D R A F T**

**Table 20 Vegetation communities recorded in the survey area**

| Vegetation Community Description | Photograph |
|---|---|
| **EaMlSc**<br><br>*Eucalyptus accedens, Corymbia calophylla* and *Eucalyptus marginata* mid woodland over *Melaleuca leptospermoides, Leptospermum erubescens, Xanthorrhoea preissii* and *Gastrolobium microcarpum* tall shrubland over *Hibbertia hypericoides, Bossiaea eriocarpa, Hypocalymma angustifolium* and *Banksia dallanneyi* low open shrubland with *Stylidium calcaratum, Borya sphaerocephala, Lepidosperma* sp. and *Goodenia pinifolia* low sparse forbland.<br><br>*E. accedens* is the dominant tree with isolated occurrences of the other two species and *E. wandoo*. The shrub layer forms a mosaic of alternative dominant species and highly variable foliage cover. Occasional *Xanthorrhoea drummondii* and *Allocasuarina humilis* recorded. Found on undulating landscape with deep drainage lines. Soils were mostly sandy gravels with seams of clay and loam.<br><br>**Regionally significant**: this community represents the 'Eucalypt Woodland of the WA Wheatbelt' TEC.<br>Condition was considered 'Excellent'.<br>Area: 345.65 ha |  |

**D R A F T**

| Vegetation Community Description | Photograph |
|---|---|
| **EbMrCc**<br><br>*Corymbia calophylla* mid sparse woodland over *Eremaea blackwelliana*, *Kunzea glabrescens*, *Adenanthos cygnorum* subsp. *cygnorum* and *Banksia attenuata* tall shrubland over *Macrozamia riedlei* and *Hibbertia subvaginata* low sparse shrubland over *Cotula coronopifolia*, *Wahlenbergia capensis* and *Podotheca angustifolia* low open forbland with *Ehrharta longiflora* and *Briza maxima* mid open grassland.<br><br>There is evidence of shrub senescence with high density of leaf litter including branches, logs, leaves and twigs. Other areas have high exposure of soil surface to erosion and weed invasion. This community is isolated to one part of the survey area.<br><br>**Locally significant**: supports a population of *Eremaea blackwelliana* Priority 3 species.<br>Condition was considered 'Very Good'.<br>Area: 7.12 ha |  |
| **TlMr**<br><br>*Trymalium ledifolium, Trymalium odoratissimum* and *Allocasuarina huegeliana* mid closed shrubland over *Melaleuca radula*, *Hibbertia hypericoides, Banksia fraseri* and *Gompholobium marginatum* low shrubland with *Cheilanthes sieberi* subsp. *sieberi, *Ursinia anthemoides* and *Trachymene pilosa* low sparse forbland.<br><br>This community includes emergent *Allocasuarina huegeliana* which is encroaching from the adjacent community. TlHh is isolated to one small occurrence on an east-facing slope with some exposed granite on gravelly sandy soils.<br><br>Condition was considered 'Excellent'.<br><br>Area: 5.10 ha |  |

**D R A F T**

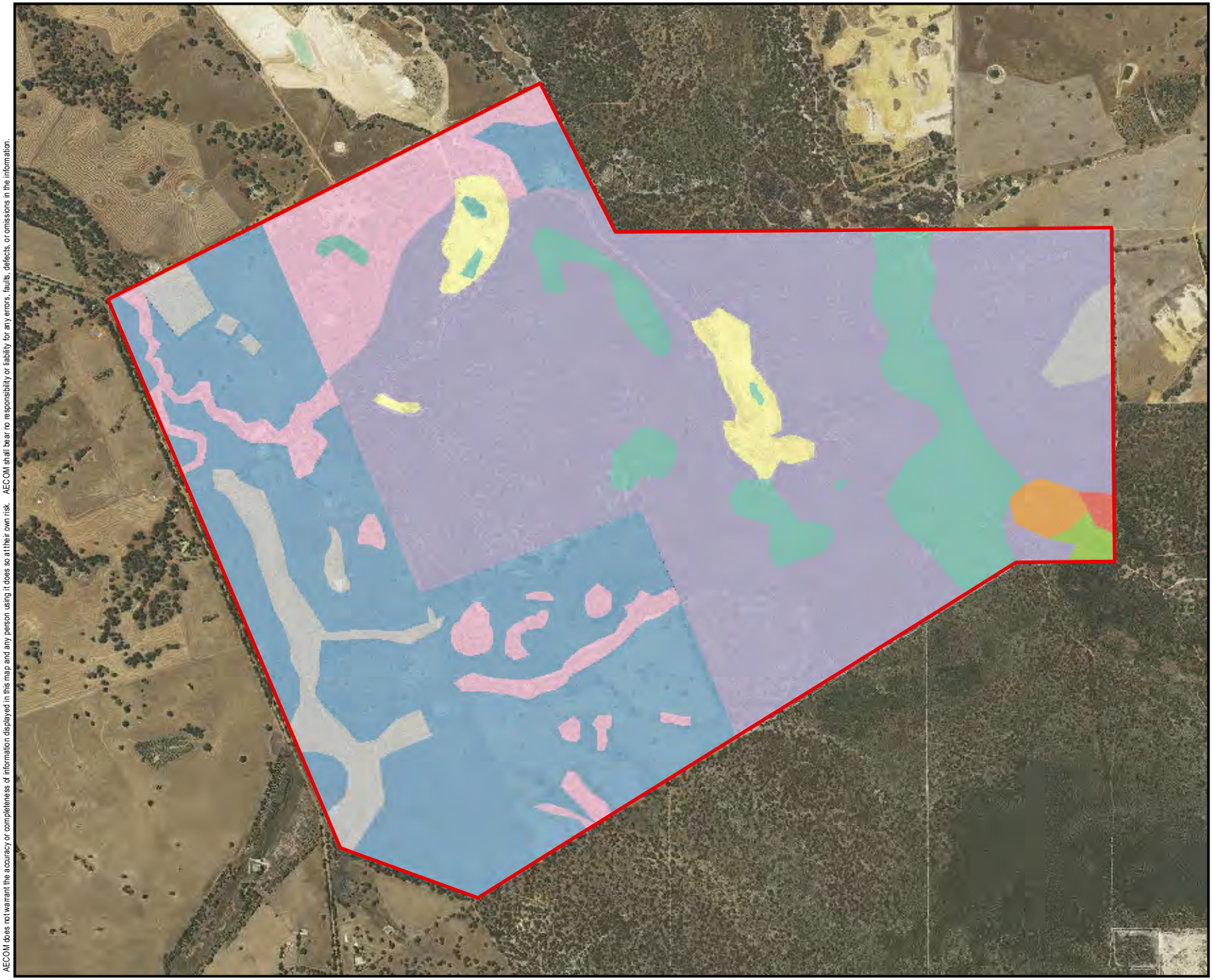
| Vegetation Community Description | Photograph |
|---|---|
| **EaXaPa**<br><br>*Eucalyptus accedens, Corymbia calophylla* and *Eucalyptus wandoo* mid open woodland over *Xanthorrhoea acanthostachya*, *Leptospermum erubescens*, *Gastrolobium microcarpum* and *Banksia armata* var. *armata* mid open shrubland over *Hemigenia incana, Hibbertia hypericoides, Melaleuca aspalathoides* and *Hibbertia commutata* low open shrubland with *Podotheca angustifolia, Stylidium calcaratum* and *Stylidium affine* low mixed open shrub and forbland.<br><br>*E. accedens* is the dominant tree with intermittent presence of other species in low numbers. Shrubs and herbs form a mosaic of understorey species. This community is isolated to the top of ridges with exposed granite rocks and quartz.<br><br>**Regionally significant**: this community represents the 'Eucalypt Woodland of the WA Wheatbelt' TEC.<br>Condition was considered 'Excellent'.<br>Area: 62.32 ha |  |
| **AhTlHh**<br><br>*Allocasuarina huegeliana* and *Eucalyptus wandoo* low to mid forest over *Trymalium ledifolium*, *Xanthorrhoea preissii* tall open shrubland over *Hibbertia hypericoides, Hakea incrassata,* and *Banksia fraseri* low sparse shrubland with *Stylidium calcaratum, Stackhousia monogyna* and *Chamaescilla corymbosa* low forbland.<br><br>This community was recorded on slopes, isolated to one patch in the Survey Area.<br><br>Condition was considered 'Very Good'.<br>Area: 3.00 ha |  |

**D R A F T**

| Vegetation Community Description | Photograph |
|---|---|
| **EwGsAs**<br><br>*Eucalyptus wandoo* mid woodland over *Gastrolobium* sp., *Xanthorrhoea preissii* and *Babingtonia camphorosmae* mid open shrubland over *Agrostocrinum scabrum*, *Stylidium calcaratum* and **Hypochaeris glabra* low sparse forbland.<br><br>This *E. wandoo* woodland was isolated to one pocket in the east of the Survey Area, crossing into the adjacent nature reserve. Weed invasion from nearby paddocks has caused a decline in condition, with low native species richness.<br><br>**Regionally significant**: this community represents the 'Eucalypt Woodland of the WA Wheatbelt' TEC.<br>Condition was considered 'Very Good'.<br>Area: 1.57 ha |  |

**D R A F T**

| Vegetation Community Description | Photograph |
|---|---|
| **Mixed Trees**<br><br>Stands of trees where canopy cover resembles original woodland composition however the understorey is devoid of native species.<br><br>Tree stands encountered included<br>· Ea – Eucalyptus accedens<br>· Ew – Eucalyptus wandoo<br>· Cc – Corymbia calophylla<br><br>Condition was considered 'Degraded'.<br>Area: 70.68 ha |  |
| **Planted**<br><br>Planted vegetation includes eastern states Eucalypt species over weeds planted by previous land owners.<br><br>Condition was considered 'Degraded' and 'Completely Degraded'.<br>Area: 32.66 ha | |
| **Paddock**<br><br>Isolated trees or completely cleared paddocks.<br>Condition was considered 'Completely Degraded'.<br>Area: 227.37 ha | |



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|---|---|
| PROJECT ID | 60520925 |
| CREATED BY | DGF/RNM |
| APPROVED BY | FdW |
| LAST MODIFIED | 13 DEC 2016 |

AECOM
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N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 125 250 375 500

metres

1:17,500 (when printed at A4)

**LEGEND**

- Survey Area Boundary

**Vegetation Community**

- AhTlHh
- Cleared
- EaMlSc
- EaXaPa
- EbMrCc
- EwGsAs
- Paddock
- Planted
- TlMr
- Trees - mix
- Water

Data sources: Service Layer Credits:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

# Vegetation Communities

**MAIN ROADS WESTERN AUSTRALIA**

***CLACKLINE FLORA, VEGETATION AND FAUNA***

**Figure**

**4**



Map Document: \\AUPER1FP001.au.aecomnet.com\Projects\605X\60520925\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60520925_Fig4_VegetationCommunities_RNM_20161213_v03_A4.mxd (rob.mcgregor)

A4 size

**D R A F T**

### 7.1.3 Condition

The native vegetation was mostly in Excellent condition. Pockets of trees in paddocks were considered Degraded, where the original structure of vegetation has been significantly altered from extensive historical grazing.

Evidence of logging was observed particularly in the northeast native vegetation where it adjoins the neighbouring property. Stands of dense saplings indicate historical clearing followed by successful recruitment of native tree species.

Edge effects from adjacent cleared paddocks have led to some weed invasion; however no Declared Pest species or High Impact weed species were recorded in the large patch of native vegetation. Weeds were mostly limited to paddocks and drainage lines.

## 7.2 Flora

### 7.2.1 Threatened and Priority Flora

One Priority flora species was confirmed to occur in the Survey Area. *Eremaea blackwelliana,* a Priority 3 species, was recorded extensively within community EbMrCc where it formed the dominant tall shrub stratum of this community (Plate 2). The species was recorded on white sandy soils on lower slopes adjacent to cleared paddocks at the north-eastern edge of the Survey Area. *E. blackwelliana* has been recorded at eight locations in the vicinity of the Survey Area. This species is therefore considered locally common.

**Plate 2 Eremaea blackwelliana - Priority 3**

*Hibbertia montana* is a Priority 4 species and was recorded at one location, comprising two individuals. This species can only be correctly identified by assessing the morphological features of the flowers. Individuals recorded in the Survey Area were both sterile therefore identification cannot be confirmed at this time. The habit of this species was upright, with less foliage than usually observed in *Hibbertia commutata*. The species is from the *Hibbertia commutata* complex and is therefore very similar. However, recent targeted surveys undertaken for *H. montana* along Toodyay road showed many similarities in plant habit in species observed in the Survey Area.

It is likely that more intensive field surveys will identify more Priority species in the Survey Area as it is adjacent to the Clackline Nature Reserve and vegetation is mostly in Very Good or Excellent condition therefore relatively undisturbed.

**D R A F T**

### 7.2.2 Floristic diversity

A total of 140 native flora species were recorded in the Survey Area, including 87 genera and 38 families. The families that were best represented are Myrtaceae (17 native species), Fabaceae (16 native species), and Proteaceae (16 native species).

Collating the AECOM and DPaW species lists of the Survey Area shows 178 native flora species have been recorded in the Survey Area, from 98 genera and 40 families. The area is considered high in biodiversity, as published by DEC (no date) and evident from the high flora species richness and low weed count.

Seven weed species have been recorded in the Survey Area. This does not include weeds from paddocks, only those recorded in areas of native vegetation in Very Good or better condition. No weeds are listed as Declared Pests under the *Biosecurity Agricultural Management Act 2007*.

A species list is provided in Appendix C.

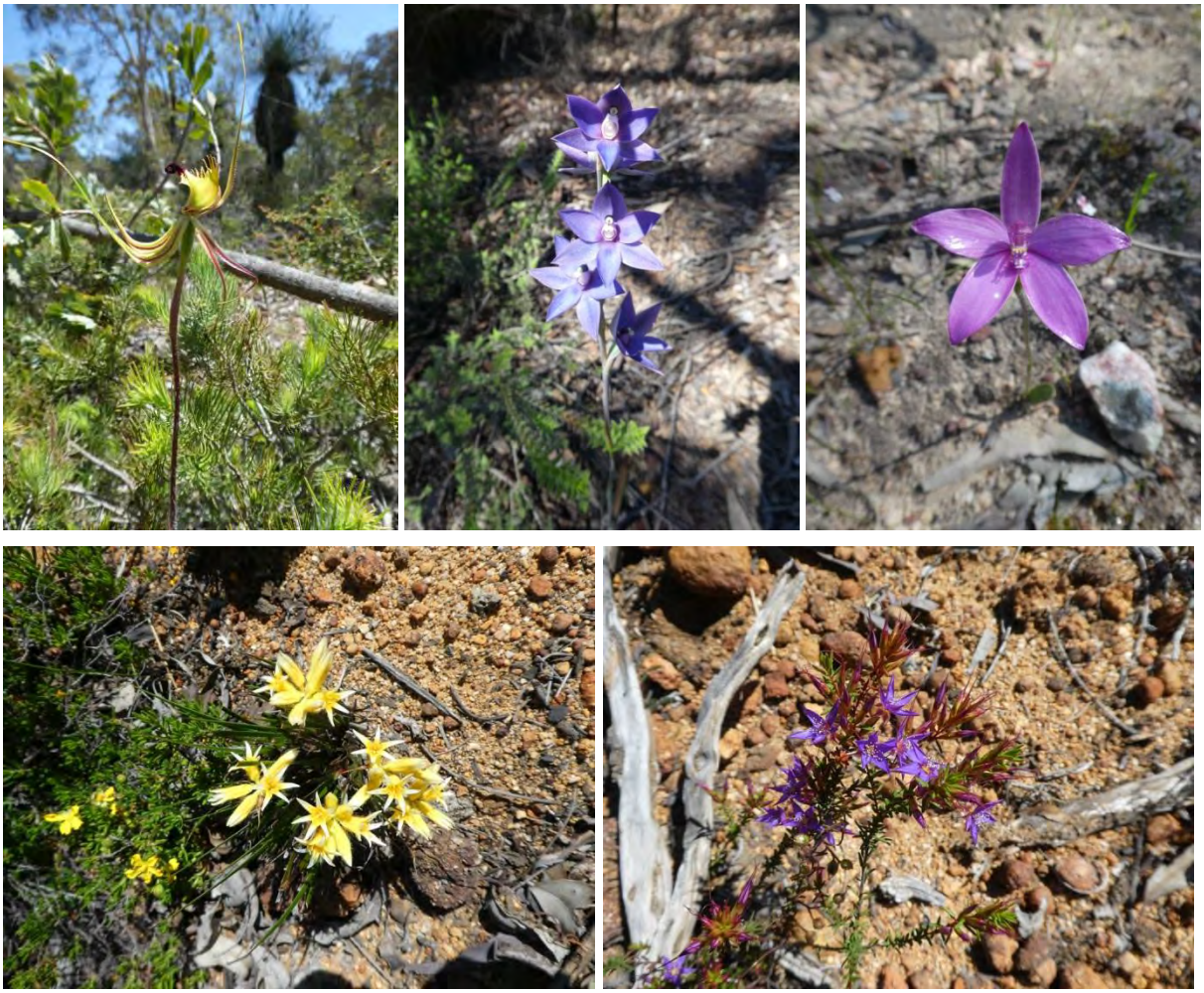
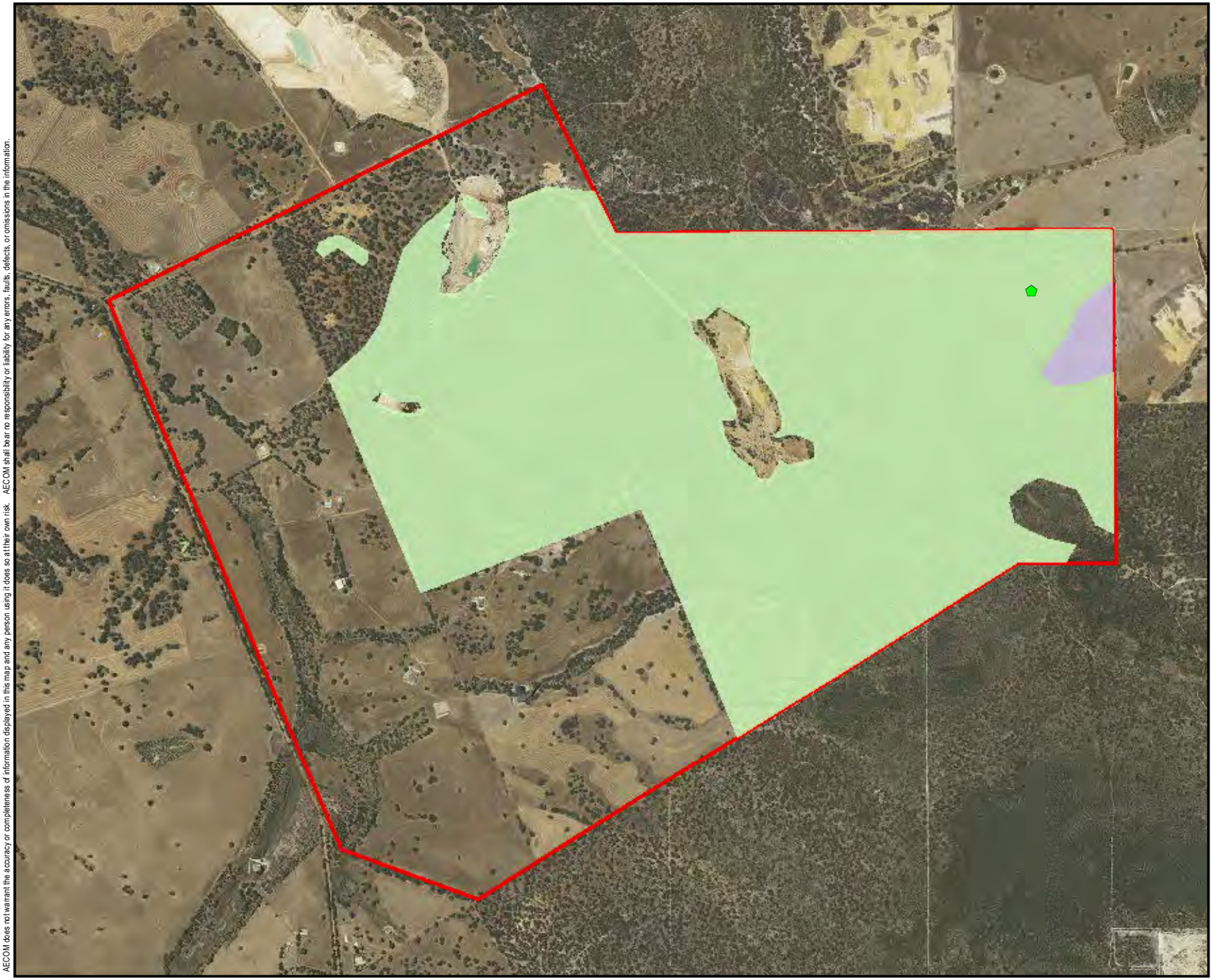


**Plate 3** **Orchids recorded during the survey including *Caladenia falcata, Thelymitra macrophylla* and *Elythranthera brunonis*, *Conostylis setigera,* and *Calytrix variabilis***



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**LEGEND**

- ***Hibbertia ?montana*** (P4)
- ***Eremaea blackwelliana*** (P3)
- Eucalypt Woodlands of the WA Wheatbelt TEC
- Survey Area Boundary

Data sources: Service Layer Credits:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

# Significant flora and vegetation values

**MAIN ROADS WESTERN AUSTRALIA**

***CLACKLINE FLORA, VEGETATION AND FAUNA***

**Figure 5**



Map Document: P:\605X\60520925\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60520925_Fig5_SigFlora_Veg_Values_RNM_20161213_v01_A4.mxd (rob.mcgregor)

A4 size

## 7.3 Fauna

Thirty vertebrate fauna species were recorded during the field survey. This comprised 24 bird species and six mammal species. A complete inventory of fauna species recorded within the Survey Area is provided in Table 21.

**Table 21 Fauna Observed in the Survey Area**

| Name | Common Name | Conservation Code | |
|---|---|---|---|
| | | Commonwealth | State |
| **Birds** | | | |
| *Barnardius zonarius semitorquatus* | Twenty-eight Parrot | - | - |
| *Cacomantis flabelliformis* | Fan-tailed Cuckoo | M | - |
| *Calyptorhynchus latirostris* | Carnaby's Black Cockatoo | E | EN |
| *Chenonetta jubata* | Australian Wood-duck | - | - |
| *Corvus coronoides* | Australian Raven | - | - |
| *Cracticus tibicen* | Australian Magpie | - | - |
| *Dacelo novaeguineae* | Laughing Kookaburra* | - | - |
| *Dromaius novaehollandiae* | Emu | - | - |
| *Eolophus roseicapilla* | Galah | - | - |
| *Falco berigora* | Brown Falcon | - | - |
| *Hieraaetus morphnoides* | Little Eagle | - | - |
| *Lichenostomus leucotis* | White-eared Honeyeater | - | - |
| *Merops ornatus* | Rainbow Bee-eater | M | - |
| *Microeca fascinans* | Jacky Winter | - | - |
| *Ninox novaeseelandiae* | Southern Boobook | M | - |
| *Petrochelidon nigricans* | Tree Martin | M | - |
| *Petroica goodenovii* | Red-capped Robin | - | - |
| *Phaps chalcoptera* | Common Bronzewing | - | - |
| *Phylidonyris novaehollandiae* | New Holland Honeyeater | - | - |
| *Platycercus icterotis* | Western Rosella | - | - |
| *Plegadis falcinellus* | Glossy Ibis | M / Migratory | IA |
| *Rhipidura albiscapa* | Grey Fantail | - | - |
| *Rhipidura leucophrys* | Willie Wagtail | - | - |
| *Todiramphus sanctus* | Sacred Kingfisher | M | - |

**D R A F T**

| Name | Common Name | Conservation Code | |
|---|---|---|---|
| | | Commonwealth | State |
| **Mammals** | | | |
| *Bos taurus* | Domestic Cattle* | - | - |
| *Canis lupis familiaris* | Dog* | - | - |
| *Macropus fuliginosus* | Western Grey Kangaroo | - | - |
| *Oryctolagus cuniculus* | European Wild Rabbit* | - | - |
| *Tachyglossus aculeatus* | Short-beaked Echidna | - | - |
| *Trichosurus vulpecula* | Common Brushtail Possum | - | - |
| *Vulpes vulpes* | European Red Fox* | - | - |

### 7.3.1 Threatened, Migratory and Priority Fauna Species

The two other Threatened fauna species recorded were the Carnaby's Black Cockatoo (*Calyptorhynchus latirostris* – Endangered under the EPBC Act and WC Act) and the Glossy Ibis *(Plegadis falcinellus* – Migratory under the EPBC Act and International Agreement under the WC Act*)*. These are discussed in further detail below.

#### 7.3.1.1 Carnaby's Black Cockatoo

Carnaby's Black Cockatoo was observed four times within the Survey Area. It was observed in eucalypt trees on two occasions, flying overhead once and heard on another occasion. Refer to Plate 4 and Figure 6 for further information.

Carnaby's Black Cockatoo is endemic to the southwest of Western Australia, extending from the Murchison River to Esperance, and inland to Coorow, Kellerberrin and Lake Cronin (DotEE, 2016). This black cockatoo has a white patch on its cheek, white bands on its tail, and a strong curved bill.

Carnaby's Black Cockatoo feed on seeds, nuts and flowers of a variety of native and exotic plants. Feed plants include the various proteaceous species (e.g. *Banksia, Grevillea* and *Hakea*), *Corymbia calophylla* (Marri*), Eucalyptus* (e.g. Jarrah [*Eucalyptus marginata*]), and seeds from the cones of Pine trees (*Pinus* sp.).

**D R A F T**

**Plate 4 Carnaby's Black Cockatoos Observed within the Survey Area**

Carnaby's Black Cockatoo display strong pair bonds and nest in the hollows of live or dead mature eucalypts including Salmon Gum (*Eucalyptus salmonophloia*), York Gum (*Eucalyptus loxophleba* subsp. *loxophleba*), Flooded Gum (*Eucalyptus rudis*), Karri (*Eucalyptus diversicolor*), Marri (*Corymbia calophylla*), Wandoo (*Eucalyptus wandoo*) and Tuart (*Eucalyptus gomphocephala* [DSEWPaC, 2012]). Nest hollows generally range from 2.5-12 m above ground, size of entrance from 23-30 cm and depth of hollows from 1-2.5 m (Johnstone & Storr,1998). The species appears to be expanding its current breeding range (Johnstone et al., 2008). After breeding, Carnaby's Black Cockatoo disperse to the higher rainfall coastal areas of the south-west of Western Australia to feed in late December to July. Breeding has been recorded from early July to mid-December.

Carnaby's Black Cockatoo has undergone a dramatic decline of approximately 50 percent in the past 45 years, with the main contributing factors the clearing of core breeding habitat in the Wheatbelt, the deterioration of nesting hollows, and clearing of foraging habitat.

#### 7.3.1.2 Glossy Ibis

The Glossy Ibis is the smallest ibis in Australia. It has a distinctive long, downwards curved bill with a reddish-brown neck and a body that is bronze-brown with a metallic iridescent sheen on the wings. Within Australia, the Glossy Ibis is generally located east of the Kimberley in Western Australia and Eyre Peninsula in South Australia, although the species is also known to be patchily distributed in the rest of Western Australia (DotEE, 2016).

The preferred foraging and breeding habitat for the Glossy Ibis are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation (DotEE, 2016). The species may retreat to permanent wetlands and/or coastal areas (including tidal wetlands) during drought (Marchant & Higgins, 1990).

The Glossy Ibis breeds from mid spring to the end of summer, though reproduction may extend if there is persistent food resources at breeding sites (DotEE, 2016). Australian breeding habitat types include wooded and shrubby swamps in the semi-arid and arid regions of the Northern Territory and Queensland. It breeds at only a limited number of locations within Australia. There are isolated records of small breeding colonies in the south-west of Western Australia (DotEE, 2016)

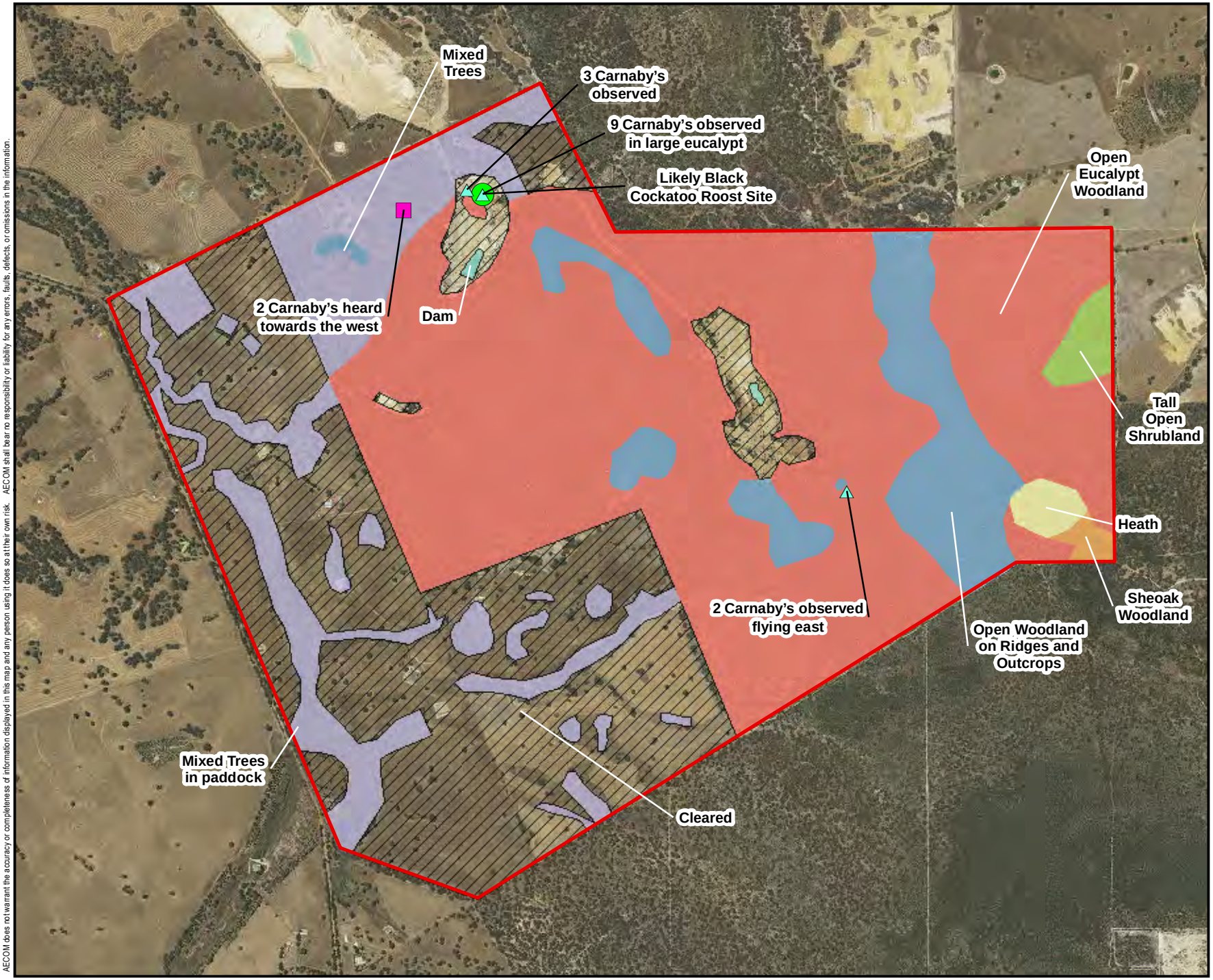
#### 7.3.1.3 Other

Based on the desktop assessment and field survey, the other conservation significant species considered likely to utilise habitats within the Survey Area is the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), listed as Vulnerable under the EPBC Act and the WC Act.

The Forest Red-tailed Black Cockatoo is endemic to the south-west humid and semi-humid zones of Western Australia, where it inhabits dense Jarrah, Karri and Marri forests which receive more than 600 mm average annual rainfall (DSEWPaC, 2012). The species has a pair of black central tail feathers and a bright red, orange or yellow barring on the tail.

This species predominantly feeds in eucalypt forests, preferring Marri (*Corymbia calophylla*) and Jarrah (*Eucalyptus marginata*) seeds, but also feeding in Blackbutt (*Eucalyptus patens*), Albany Blackbutt (*Eucalyptus staeri*), Karri (*Eucalyptus diversicolor*), Sheoak (*Allocasuarina fraseriana*) and Snottygobble (*Persoonia longifolia*) (Johnstone, 2016 pers. comm.). Forest Red-tailed Black Cockatoo are monogamous and pairs nest in tree hollows from 6.5–33 m above ground. Most nests are in very large and very old, mature Marri (*Corymbia calophylla* [Johnstone et al., 2013]), though they will nest in other eucalypts such as Tuart (Johnstone, 2016 pers. comm.).

The modelled distribution of Forest Red-tailed Black Cockatoos in the Referral Guidelines for three threatened black cockatoo species (DSEWPaC, 2012) ranges from Perth to Albany encompassing the south west of the state. Formerly common, but now rare to uncommon and patchily distributed, the Forest Red-tailed Black Cockatoo has disappeared from about 30% of its former range. It has suffered a marked decline in numbers over the past 60 years because of the destruction and fragmentation of habitat (especially Jarrah-Marri forest), the apparent decline in Marri along the eastern side of the Darling Scarp (possibly due to climate change), logging, the impact of competitors for nest hollows, and fire (Chapman, 2008).



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**LEGEND**

- Survey Area Boundary

**Carnaby's Black Cockatoo Observed**

- Heard Only
- Observed
- Roost Site

**Fauna Habitats**

- Cleared
- Dam
- Heath
- Mixed Trees
- Open Eucalypt Woodland
- Open Woodland on Ridges and Outcrops
- Sheoak Woodland
- Tall Open Shrubland

Data sources: Service Layer Credits:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

## Fauna Values

**MAIN ROADS WESTERN AUSTRALIA**

***CLACKLINE FLORA, VEGETATION AND FAUNA***

**Figure 6**

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A4 size

**D R A F T**

### 7.3.2 Introduced Species

Five introduced species were recorded during the field survey and their legal status under the BAM Act is listed below:

- Laughing Kookaburra (*Dacelo novaeguineae*) – Permitted – s11
- Domestic Cattle (*Bos Taurus*) – Permitted – s11
- Dog (*Canis lupus* subsp. *familiaris*) Domestic – Permitted – s11; Feral - Declared Pest – s22(2)
- Red Fox (*Vulpes vulpes*) (Feral) – Declared Pest – s22(2)
- Rabbit (*Oryctolagus cuniculus*) (Feral) – Declared Pest – s22(2).

### 7.3.3 Habitat

Seven fauna habitats were defined and mapped within the Survey Area (refer to Figure 6). The Open Eucalypt Woodland fauna habitat occupies the largest area within the Survey Area, covering approximately 347 ha at just under 50% of the Survey Area. This habitat provides breeding and foraging habitat for Carnaby's Black Cockatoo (*Calyptorhynchus latirostris)* and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*). The habitat occupying the second largest area within the Survey Area was the Cleared fauna habitat, at approximately 32% and 250 ha. This habitat includes any cleared areas and paddocks, and generally does not provide significant habitat for fauna.Table 22 describes the seven fauna habitats identified, includes the area and percentage these cover within the Survey Area, and the conservation significant fauna species that may utilise these habitats.

**D R A F T**

**Table 22 Fauna Habitats of the Survey Area**

| Fauna Habitat | Conservation significant fauna species likely to utilise habitat | Area (ha) | % of Survey Area | Photograph |
|---|---|---|---|---|
| **Open Eucalypt Woodland**<br>Open eucalypt woodland (generally *E. accedens* (with occasional Marri and Jarrah, and a pocket of *E. wandoo*) over open shrubland to 2 m. Occasional mature trees to 20 m, with hollows occasionally present. No dense understorey. Ground a mixture of coarse white and dark sandy gravel, occasional native grasses and an abundant course and fine litter layers. Fallen branches and logs of various sizes, with hollows, are also common.<br>Habitat is undulating and contains occasional rocky drainage channels (refer to photograph). | Carnaby's Black Cockatoo (*Calyptorhynchus latirostris),* Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) | 347.22 | 44.53 |   |

**D R A F T**

| Fauna Habitat | Conservation significant fauna species likely to utilise habitat | Area (ha) | % of Survey Area | Photograph |
|---|---|---|---|---|
| | | | |  |

**D R A F T**

| Fauna Habitat | Conservation significant fauna species likely to utilise habitat | Area (ha) | % of Survey Area | Photograph |
|---|---|---|---|---|
| **Tall Open Shrubland** Small pocket of tall moderately open shrubland (to 4m), with rare stunted Marri. Contains no large trees or hollows suitable for Black Cockatoos. Minimal understorey, bare ground abundant with fine dark sand and occasional herbaceous plants. Dead shrubs and branches of various sizes are abundant, with small hollows. | Carnaby's Black Cockatoo (*Calyptorhynchus latirostris),* Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) | 7.12 | 0.91 |  |

**D R A F T**

| Fauna Habitat | Conservation significant fauna species likely to utilise habitat | Area (ha) | % of Survey Area | Photograph |
|---|---|---|---|---|
| **Heath**<br>Moderately dense heath pocket to 1 m, with rare Sheoak to 5 m. Ground occasionally rocky with stones to 10 cm, bare sandy soils at approximately 20% cover, and low herbaceous plants. | | 5.10 | 0.65 |  |

**D R A F T**

| Fauna Habitat | Conservation significant fauna species likely to utilise habitat | Area (ha) | % of Survey Area | Photograph |
|---|---|---|---|---|
| **Open Woodland on Ridges and Outcrops**<br>Predominantly open *E. accedens* woodland on rocky granite ridges and outcroppings with lots of loose rocks and crevices. Small *E. accedens* up to generally <15 m in height without hollows. Very occasional Marri (generally stunted) and *E. wandoo*. Open understorey with *Xanthorrhoea* and shrubs to 1.5 m. Abundant bare ground covered with course leaf litter. Small fallen branches are abundant and fallen larger branches are occasionally present. Dense understorey absent.<br><br>This habitat occurs patchily throughout the entire Survey Area. | Carnaby's Black Cockatoo (*Calyptorhynchus latirostris),* Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) | 62.32 | 7.99 |     |

**D R A F T**

| Fauna Habitat | Conservation significant fauna species likely to utilise habitat | Area (ha) | % of Survey Area | Photograph |
|---|---|---|---|---|
| ***Allocasuarina* Woodland**<br>*Allocasuarina huegeliana* woodland to 5 m with 60% cover, with rare *Eucalyptus wandoo* to 10 m. No large trees or hollows. Moderately open understorey shrub layer to 50 cm. Ground either covered in thick litter layer or native grasses / herbaceous plants. No bare ground present. | | 3.00 | 0.38 |  |

**D R A F T**

| Fauna Habitat | Conservation significant fauna species likely to utilise habitat | Area (ha) | % of Survey Area | Photograph |
|---|---|---|---|---|
| **Mixed Trees**<br>The paddocks contain stands of mature native eucalypt and planted trees. The areas of mature trees surrounded by paddocks were generally not surveyed in detail but include *Corymbia calophylla*, *Eucalyptus wandoo* and *E. accedens*. | Carnaby's Black Cockatoo (*Calyptorhynchus latirostris),* Glossy Ibis *(Plegadis falcinellus),* Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) | 61.68 | 7.91 |  |

**D R A F T**

| Fauna Habitat | Conservation significant fauna species likely to utilise habitat | Area (ha) | % of Survey Area | Photograph |
|---|---|---|---|---|
| **Dams**<br>Several dams occur within the Survey Area and provide habitat and a water source for fauna. The dams provide varied habitat, some with vegetated banks and adjacent mature eucalypts, and some with bare and eroding banks surrounded by cleared paddocks. Dams don't generally contain aquatic vegetation, and depth appears to vary considerably.<br><br>Note: * this only includes the large dams within the native vegetation section of the Survey Area, not the multitude of smaller dams within the paddocks. | Carnaby's Black Cockatoo (*Calyptorhynchus latirostris),* Glossy Ibis *(Plegadis falcinellus),* Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) | 0.82* | 0.10* |  |

**D R A F T**

| Fauna Habitat | Conservation significant fauna species likely to utilise habitat | Area (ha) | % of Survey Area | Photograph |
|---|---|---|---|---|
| | | | |  |
| **Cleared**<br>These are areas that have been cleared and include the paddocks. Note that the paddocks do contain occasional isolated mature trees, which could provide potential breeding and foraging habitat depending on the species. | Glossy Ibis *(Plegadis falcinellus*) | 250.83 | 32.17 | |
| **Total** | | **779.75** | **100** | |

## 7.4 Black Cockatoos

### 7.4.1 Breeding Habitat

The Survey Area contains approximately 451 ha of Black Cockatoo breeding habitat, with approximately 6,300 potentially suitable breeding trees (>500 mm DBH). Note that this does not include the areas of mature planted and mixed trees within the paddocks, and isolated trees scattered throughout the paddocks. These areas are highly likely to contain some additional breeding habitat for Black Cockatoos but were not assessed in detail during the survey.

Breeding habitat was further assessed as High, Valued or Low quality breeding habitat depending on the density of mature eucalypt trees. Table 23 provides further detail on the breeding habitat assessment and a breeding habitat map has been produced in Figure 7. Raw data is available in Appendix D.

**Table 23 Black Cockatoo Breeding Habitat Assessment**

| Breeding Habitat | Vegetation Unit | Number of Breeding Tree Quadrats | Total Number of Trees within Quadrats | Total Area of Vegetation Units (Ha) | Approximate Number of Trees in Total Vegetation Units |
|---|---|---|---|---|---|
| High | - | - | - | - | - |
| Valued | EaMlBe and Trees Mix | 10 | 40 | 387 | 6,197 |
| Low | EaXaHi and EwGsAs | 9 | 3 | 64 | 85 |
| **Totals** | | | | **451** | **6,282** |

Valued breeding habitat was defined as habitat that contained mature eucalypt trees (considered to be potential Black Cockatoo breeding habitat trees, in accordance with the DSEWPaC [2012a] guidelines) at a moderate density across a vegetation unit. Approximately 387 ha of Valued breeding habitat was mapped within the Survey Area, which equates to approximately 6,200 trees (Plate 5).

**Plate 5 Valued Breeding Habitat**

**D R A F T**

Low quality breeding habitat was defined as habitat that contained scattered Eucalypt trees (considered to be potential Black Cockatoo breeding habitat trees, in accordance with the DSEWPaC [2012a] guidelines) at a low density across a vegetation unit. Approximately 64 ha of Low quality breeding habitat was mapped within the Survey Area. This equates to approximately 100 trees.

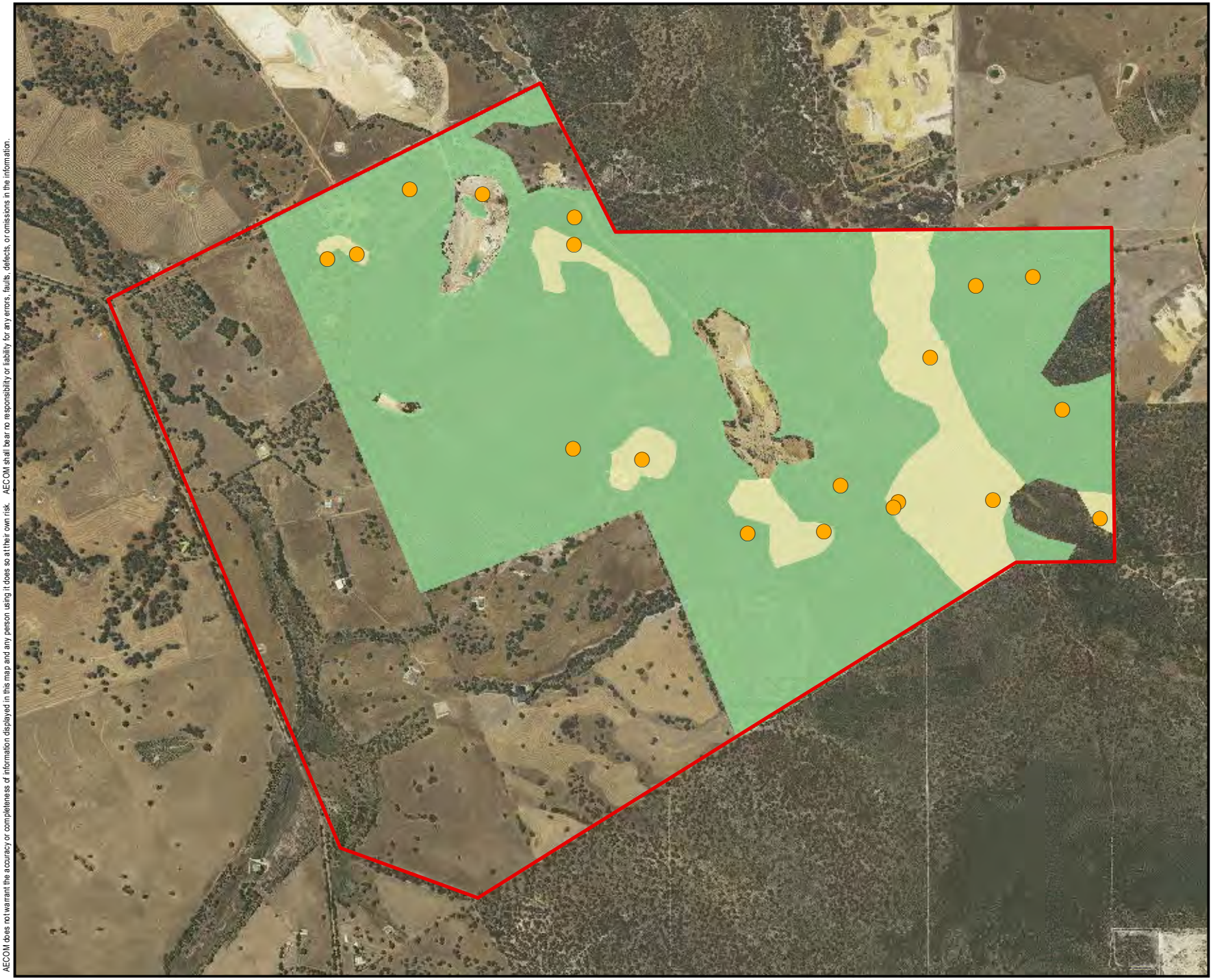
None of the vegetation units within the Survey Area were classed as High quality breeding habitat. Now of these units contained dense stands of large, mature, hollow bearing trees.

Of the 43 trees recorded during the assessment, 16 trees had hollows that were potentially suitable for Black Cockatoos. These 16 trees had 63 potential hollows in total, with 24 hollows potentially suitable for Black Cockatoos. Hollows are not always easy to identify and assess accurately from the ground. Some evidence of bees utilising these hollows was observed. Approximately 50% of these trees recorded had little to no fire scarring.

**Plate 6 Low Quality Breeding Habitat**

### 7.4.2 Roosting Habitat

Black Cockatoo roosting habitat is generally found in or near riparian vegetation, close to fresh water and typically is comprised of the tallest trees in these areas (DSEWPaC, 2012). Although no confirmed roosting trees were recorded in the Survey Area, Carnaby's Black Cockatoo were observed at the claypit dam where there are large trees high in the landscape, and anecdotal evidence from the landowner suggests that Black Cockatoos do roost in this location (refer to Figure 6)



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**LEGEND**

- Survey Area
- Black Cockatoo Breeding Tree Assessment Locations

**Breeding Tree Habitat Quality**

- Low
- Valued

Data sources: Service Layer Credits:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

# Black Cockatoo Breeding Habitat

**MAIN ROADS WESTERN AUSTRALIA**

***CLACKLINE FLORA, VEGETATION AND FAUNA***

**Figure**

**7**

**D R A F T**

### 7.4.3 Foraging Habitat

#### 7.4.3.1 Carnaby's Black Cockatoo

The Survey Area contains areas containing moderate cover of proteaceous species and significant areas of *Eucalytpus accedens*, with scattered Marri, Jarrah and *E. wandoo.* A total of 457 ha of vegetation within the Survey Area was considered to contain foraging habitat for Carnaby's Black Cockatoo (refer to Figure 8). Note that the mature stands of trees within the paddocks are also highly likely to provide some additional foraging habitat for Carnaby's Black Cockatoo but these areas were not assessed.

Chew markings suspected to belong to Carnaby's Black Cockatoo were recorded at four locations within the Survey Area. Refer to Table 24and Figure 8.

Refer to Section 7.3.1.1 for Carnaby's Black Cockatoo ecological information.

**Table 24 Carnaby's Black Cockatoo Foraging Evidence**

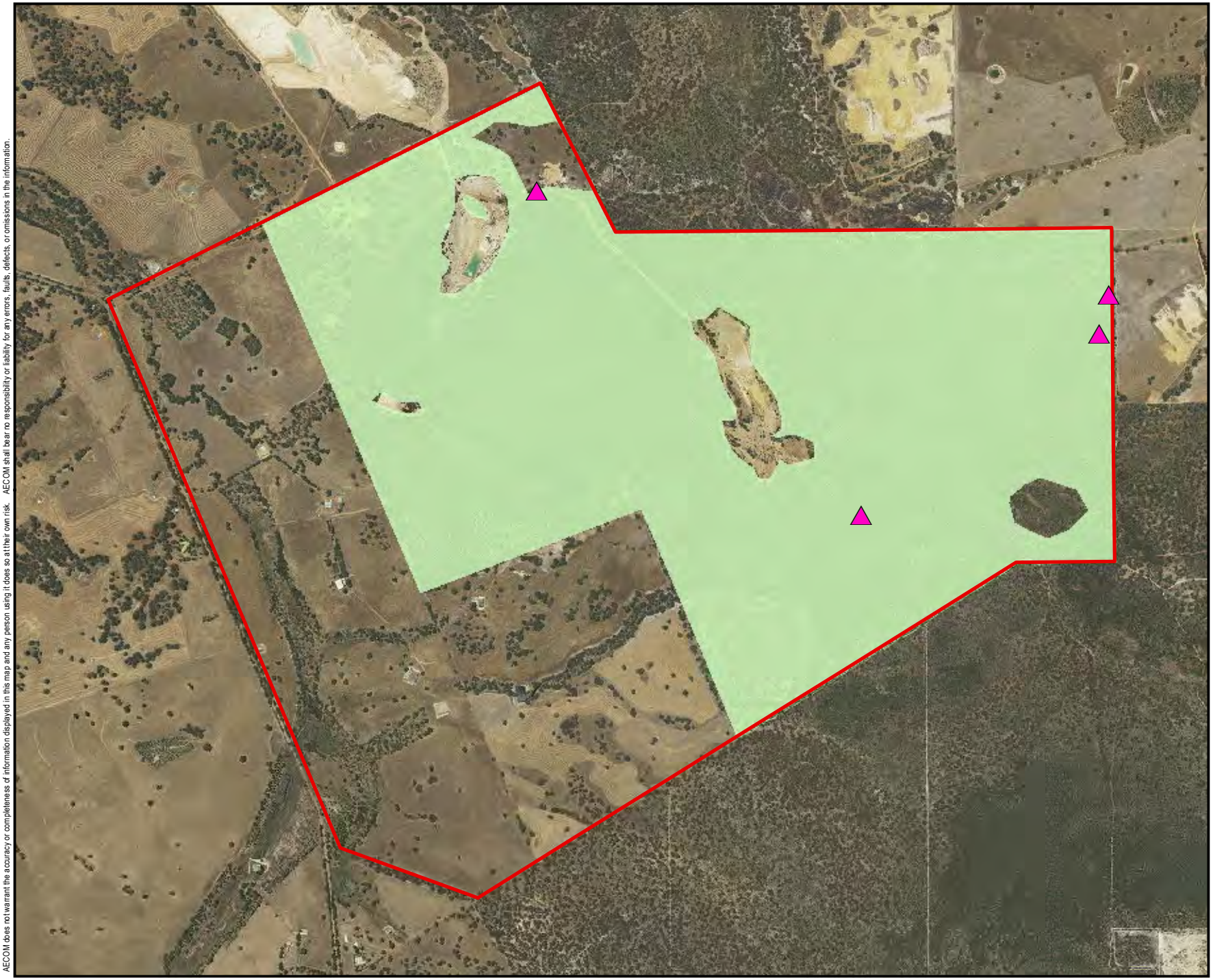
| Observation ID | Coordinates | | Photo |
|---|---|---|---|
| 6 | 116.498759 | -31.677898 |  |
| 7 | 116.498414 | -31.679097 |  |

**D R A F T**

| Observation ID | Coordinates | | Photo |
|---|---|---|---|
| 12 | 116.489881 | -31.684622 |  |
| 18 | 116.478374 | -31.674654 |  |

#### 7.4.3.2 Forest Red-tailed Black Cockatoo

A total of approximately 457 ha of vegetation within the Survey Area was considered to contain foraging habitat for the Forest Red-tailed Black Cockatoo (refer to Figure 9), with areas containing scattered Marri and Jarrah. Note that the mature stands of trees within the paddocks are also likely to provide some additional foraging habitat for the Forest Red-tailed Black Cockatoo but these areas were not assessed.



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**LEGEND**

- Survey Area Boundary
- Carnaby's Black Cockatoo Foraging Evidence
- Carnaby's Black Cockatoo Foraging Habitat

Data sources: Service Layer Credits:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

# Carnaby's Black Cockatoo Foraging Habitat

**MAIN ROADS WESTERN AUSTRALIA**

***CLACKLINE FLORA, VEGETATION AND FAUNA***

**Figure**

**8**



Map Document: P:\605X\60520925\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60520925_Fig8_CarnabysBlackCockatooForagingHabitat_RNM_20161213_v02_A4.mxd (rob.mcgregor)

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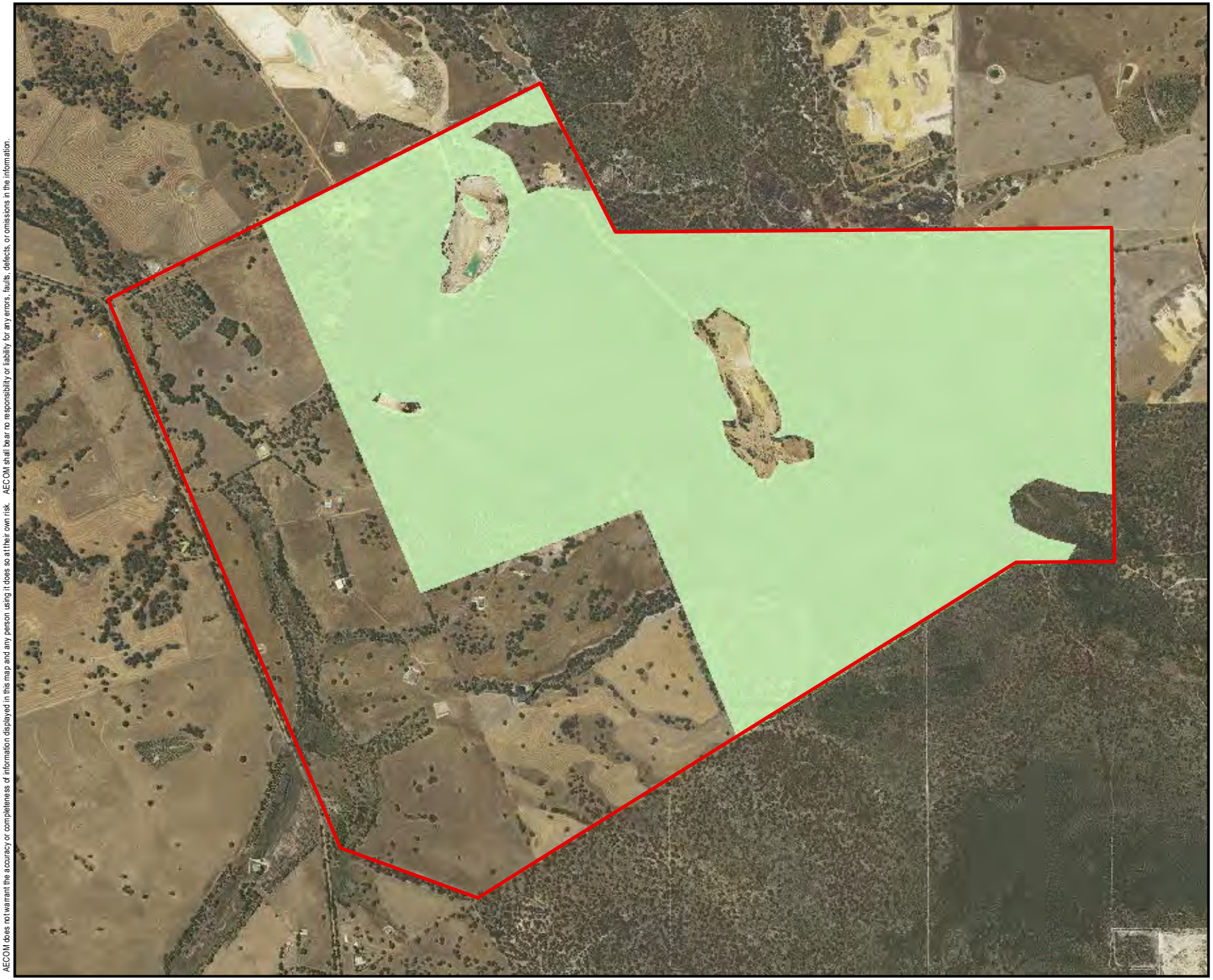

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**LEGEND**

- Survey Area Boundary
- Forest Red-tailed Black Cockatoo Foraging Habitat

Data sources: Service Layer Credits:

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# Forest Red-tailed Black Cockatoo Foraging Habitat

**MAIN ROADS WESTERN AUSTRALIA**

***CLACKLINE FLORA, VEGETATION AND FAUNA***

**Figure**

**9**



Map Document: P:\605X\60520925\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60520925_Fig9_ForestRedTailedBlackCockatooForagingHabitat_RNM_20161213_v02_A4.mxd (rob.mcgregor)

A4 size

**D R A F T**

# 8.0 Conclusion

AECOM completed ecological investigations at a proposed Main Roads offset site at Clackline in October 2016. The ecological investigations included a level 1 flora and vegetation assessment, level 1 fauna assessment, and a targeted Black Cockatoo assessment. There were no significant limitations identified that may have impacted the results of the field survey in accordance with the objectives and level of survey undertaken.

One Priority 3 flora species, *Eremaea blackwelliana*, was recorded at one location. This population is comprised of 100+ individuals, isolated to community EbMrCc. One potential Priority 4 flora species, *Hibbertia ?montana* was recorded. This species was unable to be confirmed due to a lack of suitable flowering material.

Two fauna species listed under the EPBC Act were recorded during the field survey including Carnaby's Black Cockatoo (*Calyptorhynchus latirostris* – Endangered under the EPBC Act and WC Act*)* and the Glossy Ibis (*Plegadis falcinellus* – Migratory under the EPBC Act and International Agreement under the WC Act).

The Black Cockatoo foraging assessments determined that the Survey Area contains 457 ha of foraging habitat for Carnaby's and the Forest Red-tailed Black Cockatoo.

No additional surveys are recommended to meet the objectives for this project.

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# Appendix A

## Clackline Flora Desktop Results

# Appendix A Clackline Flora Desktop Results

| Species | Cons. code | | | Habitat | Likelihood |
|---|---|---|---|---|---|
| | EPBC Act | WC Act | DPaW | | |
| *Acacia aphylla* | V | VU | | This species is largely associated with laterite and granite outcrops on hillsides (WAH, 1998-). | May |
| *Caladenia huegelii* | E | CE | | The species dies back to underground tubers over summer. *Caladenia huegelii* grows in well-drained, deep sandy soils in low mixed woodlands of Coast Banksia (*Banksia attenuata*), Firewood Banksia (*B. menziesii*), Holly-leaved Banksia (*Banksia ilicifolia*), Western Sheoak (*Allocasuarina fraseriana*) and Jarrah (*Eucalyptus marginata*) (Brown et al., 2013). | Unlikely |
| *Caladenia integra* | | | P4 | Found between Tenterden and Clackline growing under *Allocasuarina huegeliana* predominantly on and around the margins of granite outcrops and sometimes in open *Eucalyptus wandoo* woodland (Brown et al., 2013). There is one database record located 5 km east of the study area from 1986. | Likely |
| *Chordifex chaunocoleus* | | | P4 | Grey, siliceous or peaty sand, well to poorly drained. Drainage lines, depressions (WAH, 1998). The database shows one record from 2000 located 1.2 km southeast of the study area. | Unlikely |
| *Conospermum densiflorum* subsp. *unicephalatum* | E | EN | | Grows in low-lying areas in clay soil (WAH, 1998-). | May |
| *Dasymalla axillaris* | CE | CR | | Known from sandy soils in the Yalgoo area of the northern area of the Avon Wheatbelt (DotEE, 2016) | May |
| *Diuris micrantha* | V | VU | | Known from between Perth and Boyup Brook growing in seasonally-wet flats amongst sedges and scattered shrubs (Brown et al., 2013). | Unlikely |
| *Eremaea blackwelliana* | | | P4 | White sand. Sandy depressions, gentle hillside (WAH, 1998). There are six populations located in close proximity to the study area recorded between 1989 and 2002. Each population is comprised of 100+ individuals. | Known |
| *Eucalyptus loxophleba x wandoo* | | | P4 | Sandy clay or loam (WAH, 1998-). There are two records located 10 km southeast of the study area from 1987. | Likely |
| *Eucalyptus recta* | E | VU | | Known from 9 subpopulations 250 km north-east from Perth. All populations occur within a 15 km radius in the Cadoux area, with the exception of one subpopulation that occurs in the Wongan Hills area. It is restricted to prominent lateritic landforms associated with the Cadoux fault line (DotEE, 2016). | Unlikely |

| Species | Cons. code | | | Habitat | Likelihood |
|---|---|---|---|---|---|
| | EPBC Act | WC Act | DPaW | | |
| *Gastrolobium hamulosum* | E | CR | | Sandy, often gravelly soils or clay. Flats, slopes, ridges (WAH, 1998-). | May |
| *Grevillea candolleana* | | | P2 | Laterite, lateritic loam. Hillsides (WAH, 1998-). There are three records located within 7 km of the study area all recorded in 1986. | Likely |
| *Grevillea christineae* | E | EN | | Amongst tall (sclerophyll) shrubland; in rocky or stony soil, or sand, or loam; occupying breakaways. | May |
| *Lasiopetalum trichanthera* | | | P2 | No information available. There are two populations, one recorded within the study area in 2001, and the other recorded 10 km east southeast also from 2001. | Known |
| *Symonanthus bancroftii* | E | CR | | Known from southeast Wheatbelt. No habitat information available. | Unlikely |
| *Thelymitra dedmaniarum* | E | CR | | This species inhabits open wandoo woodland on red-brown sandy loam, associated with dolerite and granite outcropping. Associated vegetation consists of *Eucalyptus wandoo, E. accedens* and *Corymbia calophylla*, over low scrub of *Acacia pulchella, A. saligna, Calothamnus quadrifidus, Melaleuca radula* and *Hakea lissocarpha* (Brown *et al.,* 2013). | May |
| *Thelymitra stellata* | E | EN | | Found between Three Springs and Pinjarra. In the Darling Range the species grows in *E. marginata* forest (Brown *et al.,* 2013). | Unlikely |
| *Verticordia fimbrilepis* subsp. *fimbrilepis* | E | VU | | Grows in low-lying shallow grey sand and yellowish-white sandy loam over gravel, sometimes with clay; in heath and shrubland and in open wandoo woodland (George, 2002). | May |
| *Verticordia serrata* var. *linearis* | | | P3 | White sand, gravel. Open woodland (WAH, 1998-). There are two records, one from within the study area from 2001 and one 7 km southeast of the study area from 1985. | Known |
| *Verticordia staminosa* subsp. *staminosa* | E | CR | | Grows in pockets of soil and crevices on exposed granite slopes. | May |

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# Appendix B

## Species by Community Matrix

**Appendix B Species by Community Matrix, Clackline 2016**

| | Taxon | Community | | | | | |
|---|---|---|---|---|---|---|---|
| | | AhTlHh | EaMlSc | EaXaPa | EbMrCc | EwGsAs | TlMr |
| | *Acacia celastrifolia* | | | x | | | |
| | *Acacia divergens* | | x | | | | |
| | *Acacia drummondii* subsp. *drummondii* | | | x | | | |
| | *Acacia pulchella* var. *pulchella* | | x | x | | | |
| | *Adenanthos cygnorum* subsp. *cygnorum* | | | | x | | |
| | *Agrostocrinum scabrum* | x | | | | x | x |
| * | *Aira cupaniana* | | | x | x | | x |
| | *Allocasuarina huegeliana* | x | | | | | x |
| | *Allocasuarina humilis* | | x | x | | | |
| | *Amyema miquelii* | | | x | | | |
| * | *Arctotheca calendula* | | x | | x | | |
| | *Babingtonia camphorosmae* | | x | | | x | |
| | *Banksia armata* var. *armata* | | x | x | | | |
| | *Banksia attenuata* | | | | x | | |
| | *Banksia dallanneyi* | | x | x | | | |
| | *Banksia fraseri* | x | x | | | | x |
| | *Banksia sessilis* var. *sessilis* | | x | x | | | |
| | *Banksia sphaerocarpa* | | | | | | |
| | *Beaufortia incana* | | x | x | | | |
| | *Boronia scabra ? subsp. scabra or condensata* | | | x | | | |
| | *Borya sphaerocephala* | | x | | | | |
| | *Bossiaea eriocarpa* | | x | x | | | |
| | *Brachyloma preissii* | | | x | | | |
| * | *Briza maxima* | | | | x | | |
| | *Burchardia sp.* | x | | | | | |
| | *Caladenia falcata - check longiclavata* | | x | | | | |
| | *Caladenia flava* | | x | x | x | | |
| | *Caladenia sp.* | | x | | | | |
| | *Calandrinia eremaea* | | | | x | | |
| | *Calothamnus sanguineus* | | x | x | | | |
| | *Calytix variabilis* | | x | x | | | |
| | *Calytrix variabilis* | | x | | | | |
| | *Cassytha sp.* | | | | | | x |
| | *Chamaescilla corymbosa* | x | x | | x | | |
| | *Cheilanthes sieberi subsp. sieberi* | | | | | | x |
| | *Chorizema diversifolium* | | x | | | | |
| | *Conostephium pendulum* | | x | x | | | |
| | *Conostylis setigera* | | x | | | | |
| | *Conostylis sp.* | | x | x | | | |
| | *Corymbia calophylla* | | x | x | x | | |
| | *Cotula coronopifolia* | | | | x | | |
| | *Cyanostegia angustifolia* | | | x | | | |
| | *Dampiera alata* | | x | | | | |
| | *Dampiera lavandulacea* | | | x | | | |
| | *Daviesia preissii* | | x | | | | |
| | *Dianella revoluta* | | x | | | | |
| | *Drosera erythrorhiza* | | x | x | | | |
| | *Drosera glanduligera* | | x | | | | |
| | *Drosera hyperostigma* | | x | x | | | |
| | *Drosera macrophylla* | | x | | | | |
| | *Drosera sp. Climbing pink* | | | | | x | |
| | *Drosera stricticaulis* | | x | | | | |

| | Taxon | Community | | | | | |
|---|---|---|---|---|---|---|---|
| | | AhTlHh | EaMlSc | EaXaPa | EbMrCc | EwGsAs | TlMr |
| * | *Ehrharta longiflora* | | | | x | | |
| | *Elythranthera brunonis* | | x | x | | | |
| | *Elythranthera emarginata* | x | x | | | | |
| | *Eremaea blackwelliana (P4)* | | | | x | | |
| | *Eucalyptus accedens* | | 7 | x | | | |
| | *Eucalyptus marginata* | | x | | | | |
| | *Eucalyptus wandoo* | x | x | x | | x | |
| | *Eutaxia sp.* | | x | | | | |
| | *Gastrolobium microcarpum* | | x | x | | x | |
| | *Gastrolobium retusum* | | x | | | | |
| | *Glischrocaryon flavescens* | x | x | x | | | x |
| | *Gompholobium knightianum* | | x | x | | | |
| | *Gompholobium marginatum* | | x | x | | | x |
| | *Gompholobium tomentosum* | | x | | | | |
| | *Goodenia pinifolia* | | x | x | | | |
| | *Grevillea synaphea* | | x | | | | |
| | *Hakea incrassata* | x | | | | | x |
| | *Hakea lissocarpa* | | x | x | | | |
| | *Hakea ruscifolia* | | | | | | |
| | *Hakea trifurcata* | | x | | | | |
| | *Hakea undulata* | | x | | | | |
| | *Hemigenia incana* | | | x | | | x |
| | *Hibbertia ?montana (P4)* | | x | | | | |
| | *Hibbertia acerosa* | | x | | | | |
| | *Hibbertia commutata* | | | x | | | |
| | *Hibbertia commutata (hairy form)* | x | | | | | |
| | *Hibbertia hypericoides* | x | x | x | | | x |
| | *Hibbertia serrata* | | | | | | |
| | *Hibbertia sp.* | | x | | x | | |
| | *Hibbertia subvaginata* | | | | x | | |
| | *Hovea chorizemifolia* | | x | | | | |
| | *Hovea sp.* | | x | | | | |
| | *Hypocalymma angustifolium* | | x | | | | |
| * | *Hypochaeris glabra* | | x | x | x | | x |
| | *Isolepis marginata* | | x | | | | |
| | *Jacksonia restioides* | | x | | | | |
| | *Kunzea glabrescens* | | | | x | | |
| | *Laxmannia squarossa* | | x | | | | |
| | *Lechenaultia biloba* | | x | x | | | |
| | *Lepidosperma leptostachyum* | | x | x | | | |
| | *Lepidosperma sp.* | | x | | | | |
| | *Leptospermum erubescens* | | x | x | | | x |
| | *Leucopogon pulchellus* | | x | x | | | |
| | *Levenhookia pusilla* | x | | x | | x | |
| | *Lobelia anceps* | | x | | | | |
| * | *Lysimachia arvensis* | x | x | | | | |
| | *Macrozamia riedlei* | | x | x | x | | |
| | *Melaleuca aspalathoides* | | x | x | | | |
| | *Melaleuca leptospermoides* | | x | | | | |
| | *Melaleuca radula* | | | | | | x |
| | *Neurachne alopecuroidea* | | x | x | | | |
| | *Olearia rudis* | | x | x | | | |
| | *Opercularia vaginata* | | | x | | | |
| | *Patersonia juncea* | | x | | | | |
| | *Patersonia rudis* | | x | | | | |
| | *Petrophile drummondii* | | x | | | | |
| | *Petrophile heterophylla* | | | x | | | |

| Taxon | Community | | | | | |
|---|---|---|---|---|---|---|
| | AhTlHh | EaMlSc | EaXaPa | EbMrCc | EwGsAs | TlMr |
| *Petrophile serruriae* | | x | | | | x |
| *Petrophile striata* | | x | | | | |
| *Phyllanthus calycinus* | | x | | | | |
| *Pimelea ?sylvestris* | | x | x | | | |
| *Pimelea imbricata* | | | | | | |
| *Podotheca angustifolia* | | | x | x | | |
| *Pterostylis recurva* | | x | x | | | |
| *Pterostylis sanguinea* | | | | | | |
| *Pyrorchis nigricans* | | x | x | | | |
| *Senecio sp.* | | x | | | | |
| *Siloxerus sp.* | | x | | | | |
| *Sowerbaea laxiflora* | x | | | | | |
| *Stackhousia monogyna* | x | x | | | | |
| *Stylidium affine* | | x | x | | | |
| *Stylidium brunonianum* | | | x | | | |
| *Stylidium calcaratum* | x | x | x | | x | |
| *Stylidium dichotomum* | | x | | | | |
| *Stylidium hispidum* | | x | x | | | |
| *Stylidium piliferum* | | x | x | | | |
| *Stylidium repens* | | | x | | | |
| *Stylidium schoenoides* | | x | | | | |
| *Stylidium sp.* | | x | | | | |
| *Styphelia tenuiflora* | | x | | | | |
| *Synaphea* sp. Udumung (A.S. George 17058) | | x | x | | | |
| *Tetraria octandra* | | x | | | | |
| *Tetratheca confertifolia* | | x | | | | |
| *Tetratheca nuda* | | | | | | |
| *Tetratheca virgata* | | x | x | | | |
| *Thelymitra macrophylla* | | x | | | | |
| *Thomasia grandiflora* | | | x | | | |
| *Thysanotus manglesianus* | | | | x | | |
| *Thysanotus scaber* | | x | | | | |
| *Trachymene pilosa* | | x | x | | x | x |
| *Trichocline spathulata* | | | x | | | |
| *Trymalium ledifolium* | x | x | | | | x |
| *Trymalium odoratissimum* | | | | | | x |
| *Ursinia anthemoides* | | x | | x | | x |
| *Verticordia sp.* | x | x | | | | |
| * *Wahlenbergia capensis* | | | | x | | |
| *Xanthorrhoea acanthostachya* | | x | x | | | |
| *Xanthorrhoea preissii* | x | x | | | x | x |
| *Xanthosia huegelii* | | x | | | | |

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# Appendix C

## Flora Species List

**Appendix C Flora Species List**

| Family | Weed | Taxon | DPAW | AECOM |
|---|---|---|---|---|
| **Apiaceae** | | | | |
| | | *Xanthosia huegelii* | | x |
| **Araliaceae** | | | | x |
| | | *Trachymene pilosa* | | x |
| **Asparagaceae** | | | x | x |
| | | *Chamaescilla corymbosa* | | x |
| | | *Laxmannia squarossa* | | x |
| | | *Lomandra effusa* | x | |
| | | *Sowerbaea laxiflora* | | x |
| | | *Thysanotus manglesianus* | | x |
| | | *Thysanotus scaber* | | x |
| | | *Thysanotus* sp. | x | |
| **Asteraceae** | | | | x |
| | * | *Arctotheca calendula* | | x |
| | | *Cotula coronopifolia* | | x |
| | * | *Hypochaeris glabra* | | x |
| | | *Olearia rudis* | | x |
| | | *Podotheca angustifolia* | | x |
| | | *Senecio* sp. | | x |
| | | *Siloxerus* sp. | | x |
| | | *Trichocline spathulata* | | x |
| | | *Ursinia anthemoides* | | x |
| **Boryaceae** | | | | x |
| | | *Borya sphaerocephala* | | x |
| **Campanulaceae** | | | | x |
| | * | *Lobelia anceps* | | x |
| | | *Wahlenbergia capensis* | | x |
| **Casuarinaceae** | | | | x |
| | | *Allocasuarina huegeliana* | | x |
| | | *Allocasuarina humilis* | | x |
| **Celastraceae** | | | x | x |
| | | *Stackhousia monogyna* | x | x |
| **Colchicaceae** | | | | x |
| | | *Burchardia* sp. | | x |
| **Cupressaceae** | | | x | |
| | | *Callitris* sp. | x | |
| **Cyperaceae** | | | | x |
| | | *Isolepis marginata* | | x |
| | | *Lepidosperma leptostachyum* | | x |
| | | *Lepidosperma sp.* | | x |
| | | *Tetraria octandra* | | x |
| **Dillenaceae** | | | x | x |
| | | *Hibbertia ?montana* (P4) | | x |
| | | *Hibbertia acerosa* | | x |
| | | *Hibbertia commutata* | | x |
| | | *Hibbertia commutata* (hairy form) | | x |
| | | *Hibbertia hypericoides* | | x |
| | | *Hibbertia serrata* | x | |
| | | *Hibbertia* sp. | | x |
| | | *Hibbertia subvaginata* | | x |

| Family | Weed | Taxon | DPAW | AECOM |
|---|---|---|---|---|
| **Droseraceae** | | | | x |
| | | *Drosera erythrorhiza* | | x |
| | | *Drosera glanduligera* | | x |
| | | *Drosera hyperostigma* | | x |
| | | *Drosera macrophylla* | | |
| | | *Drosera sp.* Climbing | | x |
| | | *Drosera stricticaulis* | | x |
| **Elaeocarpaceae** | | | x | x |
| | | *Tetratheca confertifolia* | | x |
| | | *Tetratheca nuda* | x | |
| | | *Tetratheca virgata* | | x |
| **Ericaceae** | | | x | x |
| | | *Brachyloma preissii* | | x |
| | | *Brachyloma preissii* subsp. *lanceolatum* | x | |
| | | *Conostephium pendulum* | | x |
| | | *Leucopogon pulchellus* | x | x |
| | | *Lysinema pentapetalum* | x | |
| | | *Styphelia tenuiflora* | | x |
| **Fabaceae** | | | x | x |
| | | *Acacia acuminata* | x | |
| | | *Acacia celastrifolia* | | x |
| | | *Acacia divergens* | | x |
| | | *Acacia drummondii* subsp. *drummondii* | | x |
| | | *Acacia pulchella* var. *pulchella* | | x |
| | | *Bossiaea eriocarpa* | | x |
| | | *Chorizema diversifolium* | | |
| | | *Daviesia preissii* | | x |
| | | *Eutaxia* sp. | | |
| | | *Gastrolobium epacridoides* | x | |
| | | *Gastrolobium microcarpum* | | x |
| | | *Gastrolobium retusum* | | x |
| | | *Gompholobium knightianum* | | x |
| | | *Gompholobium marginatum* | | x |
| | | *Gompholobium tomentosum* | | x |
| | | *Hovea chorizemifolia* | | x |
| | | *Hovea pungens* | x | |
| | | *Hovea* sp. | | x |
| | | *Jacksonia floribunda* | x | |
| | | *Jacksonia restioides* | | x |
| | | *Mirbelia grandiflora* | x | |
| **Goodeniaceae** | | | x | x |
| | | *Dampiera alata* | | |
| | | *Dampiera lavandulacea* | | x |
| | | *Dampiera linearis* | x | |
| | | *Goodenia pinifolia* | | x |
| | | *Lechenaultia biloba* | | x |
| **Haemodoraceae** | | | | x |
| | | *Conostylis setigera* | | x |
| | | *Conostylis* sp. | | x |
| **Haloragaceae** | | | | x |
| | | *Glischrocaryon flavescens* | | x |

| Family | Weed | Taxon | DPAW | AECOM |
|---|---|---|---|---|
| **Hemerocallidaceae** | | | | x |
| | | *Agrostocrinum scabrum* | | x |
| | | *Dianella revoluta* | | x |
| **Iridaceae** | | | x | x |
| | | *Orthrosanthus laxus* | x | |
| | | *Patersonia juncea* | | x |
| | | *Patersonia rudis* | | x |
| **Lamiaceae** | | | | x |
| | | *Cyanostegia angustifolia* | | x |
| | | *Hemigenia incana* | | x |
| **Lauraceae** | | | | |
| | | *Cassytha* sp. | | |
| **Loranthaceae** | | | | x |
| | | *Amyema miquelii* | | x |
| **Malvaceae** | | | x | |
| | | *Thomasia foliosa* | x | |
| | | *Thomasia grandiflora* | | x |
| | | *Thomasia* sp. | x | |
| **Myrtaceae** | | | x | x |
| | | *Babingtonia camphorosmae* | | x |
| | | *Beaufortia incana* | | x |
| | | *Calothamnus sanguineus* | | x |
| | | *Calytix variabilis* | | x |
| | | *Calytrix leschenaultii* | x | x |
| | | *Calytrix variabilis* | | x |
| | | *Corymbia calophylla* | | x |
| | | *Eremaea blackwelliana* (P4) | | x |
| | | *Eucalyptus accedens* | | x |
| | | *Eucalyptus marginata* | | x |
| | | *Eucalyptus wandoo* | | x |
| | | *Hypocalymma angustifolium* | x | x |
| | | *Kunzea glabrescens* | | x |
| | | *Kunzea* sp. | x | |
| | | *Leptospermum erubescens* | | x |
| | | *Melaleuca aspalathoides* | | x |
| | | *Melaleuca leptospermoides* | | x |
| | | *Melaleuca radula* | | x |
| | | *Melaleuca subtrigona* | x | |
| | | *Verticordia* sp. | | x |
| **Orchidaceae** | | | x | x |
| | | *Caladenia falcata* | | x |
| | | *Caladenia flava* | | x |
| | | *Caladenia longicauda* | x | |
| | | *Caladenia longiclavata* | x | |
| | | *Caladenia* sp. | | x |
| | | *Diuris* sp. | x | |
| | | *Elythranthera brunonis* | | x |
| | | *Elythranthera emarginata* | | x |
| | | *Ericksonella saccharata* | x | |
| | | *Leporella fimbriata* | | |
| | | *Pterostylis recurva* | | x |
| | | *Pterostylis sanguinea* | x | |
| | | *Pyrorchis nigricans* | | x |
| | | *Thelymitra macrophylla* | | x |
| | | *Thelymitra sp.* | x | |

| Family | Weed | Taxon | DPAW | AECOM |
|---|---|---|---|---|
| **Phyllanthaceae** | | | x | x |
| | | *Phyllanthus calycinus* | x | x |
| **Pittosporaceae** | | | x | |
| | | *Billardiera fraseri* | x | |
| | | *Billardiera heterophylla* | x | |
| **Poaceae** | | | | |
| | * | *Aira cupaniana* | | x |
| | * | *Briza maxima* | | x |
| | * | *Ehrharta longiflora* | | x |
| | | *Neurachne alopecuroidea* | | x |
| **Portulacaceae** | | | | |
| | | *Calandrinia eremaea* | | x |
| **Primulaceae** | | | | |
| | * | *Lysimachia arvensis* | | x |
| **Proteaceae** | | | | |
| | | *Adenanthos cygnorum* subsp. *cygnorum* | | x |
| | | *Banksia armata* var. *armata* | | x |
| | | *Banksia attenuata* | | x |
| | | *Banksia dallanneyi* | | x |
| | | *Banksia fraseri* | | x |
| | | *Banksia grandis* | x | |
| | | *Banksia sessilis* var. *sessilis* | | x |
| | | *Banksia sphaerocarpa* | x | |
| | | *Grevillea synaphea* | | x |
| | | *Hakea anadenia* | x | |
| | | *Hakea incrassata* | | x |
| | | *Hakea lissocarpa* | | x |
| | | *Hakea ruscifolia* | x | |
| | | *Hakea trifurcata* | | x |
| | | *Hakea undulata* | | x |
| | | *Isopogon dubius* | x | |
| | | *Persoonia quinquenervis* | x | |
| | | *Petrophile divaricata* | x | |
| | | *Petrophile drummondii* | | x |
| | | *Petrophile heterophylla* | x | x |
| | | *Petrophile serruriae* | | x |
| | | *Petrophile striata* | | x |
| | | *Synaphea* sp. Udumung (A.S. George 17058) | x | x |
| **Pteridaceae** | | | | |
| | | *Cheilanthes sieberi subsp. sieberi* | | x |
| **Rhamnaceae** | | | x | x |
| | | *Trymalium ledifolium* | | x |
| | | *Trymalium odoratissimum* | | x |
| | | *Trymalium* sp. | x | |
| **Rubiaceae** | | | | x |
| | | *Opercularia vaginata* | | x |
| **Rutaceae** | | | x | x |
| | | *Boronia scabra* | | x |
| | | *Philotheca spicata* | x | |

| Family | Weed | Taxon | DPAW | AECOM |
|---|---|---|---|---|
| **Stylidiaceae** | | | x | x |
| | | *Levenhookia pusilla* | | x |
| | | *Stylidium affine* | | x |
| | | *Stylidium brunonianum* | | x |
| | | *Stylidium calcaratum* | | x |
| | | *Stylidium dichotomum* | | x |
| | | *Stylidium hispidum* | | x |
| | | *Stylidium piliferum* | | x |
| | | *Stylidium repens* | | x |
| | | *Stylidium schoenoides* | x | x |
| | | *Stylidium* sp. | | x |
| **Thymelaeaceae** | | | x | |
| | | *Pimelea ?sylvestris* | | |
| | | *Pimelea imbricata* | x | |
| **Xanthorrhoeaceae** | | | | x |
| | | *Xanthorrhoea acanthostachya* | | x |
| | | *Xanthorrhoea preissii* | | x |
| **Zamiaceae** | | | x | x |
| | | *Macrozamia riedlei* | | x |
| | | *Macrozamia* sp. | x | |

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# Appendix D

## Black Cockatoo Breeding Tree Raw Data

**D R A F T**

# Appendix D Black Cockatoo Breeding Tree Raw Data

| OBJECT ID * | Veg Unit | Quadrat ID | Fire Scarring Present? | Tree Species | DBH (cm) | Tree Height | No of Potential Hollows | No of Potentially Suitable Hollows | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 1 | EaMlBe | 1 | No | *Corymbia calophylla* (marri) | 80 | 20 | 0 | - | No hollows |
| 2 | EaMlBe | 1 | Yes | Stag (old dead tree, unknown species) | 95 | 15 | 0 | - | No hollows |
| 3 | EaMlBe | 1 | No | *Corymbia calophylla* (marri) | 85 | 10 | 0 | - | Main branch broken, tree stunted |
| 4 | EaMlBe | 1 | No | *Eucalyptus marginata* (jarrah) | 60 | 14 | 0 | - | No hollows |
| 6 | EaMlBe | 2 | Yes | Stag (old dead tree, unknown species) | 55 | 10 | 4 | 3 | 4 hollows, 3 potentially suitable spouts at 10 m |
| 7 | EaMlBe | 2 | Yes | *Eucalyptus marginata* (jarrah) | 57 | 10 | 1 | 0 | 1 hollow, not suitable |
| 8 | EaMlBe | 2 | Yes | *Eucalyptus accedens* | 95 | 15 | 6 | 3 | 6 potentially suitable 3 not suitable |
| 9 | EaMlBe | 2 | No | Stag (old dead tree, unknown species) | 60 | 5 | 1 | 1 | Exposed spout 50cm diameter - potenitally suitable |
| 10 | EaMlBe | 2 | Yes | Stag (old dead tree, unknown species) | 60 | 10 | 0 | 0 | No hollows |
| 11 | EaMlBe | 3 | No | *Eucalyptus accedens* | 67 | 18 | 2 | 0 | 2 hollows not suitable |
| 12 | EwGsAs | 4 | Yes | *Eucalyptus wandoo* (Wandoo) | 57 | 25 | 2 | 2 | 2 potentially suitable hollows |
| 13 | EaXaHi | 5 | Yes | *Eucalyptus accedens* | 95 | 20 | 5 | 1 | 5 hollows one potentially suitable |
| 14 | EaXaHi | 5 | Yes | Stag (old dead tree, unknown species) | 70 | 14 | 2 | 1 | 2 hollows, 1 potentially suitable |
| 16 | EaMlBe | 6 | Yes | *Eucalyptus accedens* | 57 | - | 0 | - | No hollows |
| 17 | EaMlBe | 6 | Yes | *Eucalyptus accedens* | 65 | 17 | 1 | 0 | Large hollow facing up, doesnt look deep - not suitable |
| 18 | EaMlBe | 6 | No | *Eucalyptus accedens* | 57 | 20 | 3 | 0 | 3 unsuitable hollows |
| 19 | EaMlBe | 6 | No | *Eucalyptus accedens* | 70 | 20 | 2 | 0 | 2 hollows end of branches, too small |
| 20 | EaMlBe | 6 | No | *Eucalyptus accedens* | 106 | - | 6 | 1 | 6 hollows, 1 suitable - 10m high facing north |
| 21 | EaMlBe | 6 | Yes | *Eucalyptus accedens* | 65 | 16 | 3 | 1 | 3 hollows, one potentially suitable |
| 22 | EaMlBe | 7 | No | *Eucalyptus accedens* | 85 | 17 | 0 | - | Main trunk broken |
| 23 | EaMlBe | 7 | Yes | *Eucalyptus accedens* | 73 | 20 | 2 | 2 | 2 potential suitable hollows |
| 24 | EaMlBe | 7 | Yes | *Eucalyptus accedens* | 51 | 20 | 2 | 1 | 2 hollows one potentially suitable |
| 25 | EaMlBe | 8 | Yes | *Eucalyptus accedens* | 62 | 18 | 4 | 0 | 4 unsuitable hollows |
| 26 | EaMlBe | 8 | No | *Eucalyptus accedens* | 60 | 20 | 2 | 0 | 2 small hollows end of broken branches |
| 27 | Tree - mix | 10 | No | *Eucalyptus wandoo* (Wandoo) | 33 | 25 | 1 | 0 | Hollow unsuitable facing down |
| 28 | Tree - mix | 10 | No | *Eucalyptus wandoo* (Wandoo) | 60 | 18 | 0 | - | No hollows |
| 29 | Tree - mix | 10 | No | *Eucalyptus wandoo* (Wandoo) | 37 | 15 | 0 | - | No hollows |
| 30 | Tree - mix | 10 | No | *Eucalyptus wandoo* (Wandoo) | 32 | 22 | 0 | - | No suitable hollows, bees in broken branch |
| 31 | Tree - mix | 11 | No | Eucalyptus accedens | 50 | 26 | 0 | - | No hollows |
| 33 | Tree - mix | 11 | No | *Corymbia calophylla* (marri) | 90 | 17 | 2 | 0 | 2 hollows, one too small the other too shallow |
| 34 | EaMlBe | 12 | Yes | *Eucalyptus accedens* | 80 | 18 | 4 | 1 | 4 hollows, one potentially suitable |

**D R A F T**

| OBJECT ID * | Veg Unit | Quadrat ID | Fire Scarring Present? | Tree Species | DBH (cm) | Tree Height | No of Potential Hollows | No of Potentially Suitable Hollows | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 35 | EaMlBe | 12 | No | *Eucalyptus accedens* | 65 | 20 | 7 | 2 | 7 hollows, 2 suitable but top very exposed. All hollows are broken branches |
| 36 | EaMlBe | 12 | Yes | *Eucalyptus accedens* | 54 | 18 | 1 | 0 | 1 unsuitable hollow |
| 37 | EaMlBe | 12 | Yes | *Eucalyptus accedens* | 60 | 20 | 5 | 1 | 5 hollows at end of dead branches, all fully exposed. Potentially 1 suitable |
| 38 | EaMlBe | 12 | Yes | *Eucalyptus accedens* | 57 | 18 | 5 | 1 | 5 hollows, one potentially suitable |
| 39 | EaMlBe | 12 | No | *Eucalyptus accedens* | 60 | 22 | 6 | 2 | 6 hollows, 2 potentially suitable. All hollows dead broken branches, mostly too small and unknown depth |
| 40 | EaMlBe | 12 | Yes | *Eucalyptus accedens* | 60 | 20 | 0 | 0 | No hollows |
| 41 | EaXaHi | 13 | - | - | - | - | - | - | No trees |
| 42 | EaXaHi | 14 | - | - | - | - | - | - | No trees |
| 43 | EaXaHi | 15 | - | - | - | - | - | - | No trees |
| 44 | EaXaHi | 16 | - | - | - | - | - | - | No trees |
| 45 | EaXaHi | 17 | - | - | - | - | - | - | No trees |
| 46 | EaXaHi | 18 | - | - | - | - | - | - | No trees |
| 47 | EaXaHi | 19 | - | - | - | - | - | - | No trees |
| 48 | EaMlBe | 9 | No | *Eucalyptus wandoo* (Wandoo) | 30+ | 20 | 0 | - | No suitable hollows |
| 48 | EaMlBe | 9 | No | *Eucalyptus wandoo* (Wandoo) | 30+ | 20 | 0 | - | No suitable hollows |
| 48 | EaMlBe | 9 | No | *Eucalyptus wandoo* (Wandoo) | 30+ | 15 | 0 | - | No suitable hollows |
| 48 | EaMlBe | 9 | No | Stag (old dead tree, unknown species) | 50+ | 15 | 3 | 1 | 3 hollows, one potentially suitable |
| 48 | EaMlBe | 9 | No | *Eucalyptus accedens* | 50+ | 18 | 2 | 0 | 2 unsuitable hollows |
| 48 | EaMlBe | 9 | No | *Eucalyptus accedens* | 50+ | 18 | 0 | - | No suitable hollows |

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# Appendix E

## DPaW Advice Regarding Eucalypt Woodland of the WA Wheatbelt TEC

## De Wit, Floora

From: Hudleston, Wendy <Wendy.Hudleston@DPaW.wa.gov.au>
Sent: Tuesday, 24 January 2017 4:28 PM
To: De Wit, Floora
Cc: Errington, Alex; English, Val
Subject: RE: Clackline TEC verification

Hi Floora

Apologies on the lateness of this reply, we have been waiting on a representative from the Commonwealth to respond upon their return from leave. In relation to whether the woodland on property M2039 constitutes the Wheatbelt Woodland TEC:

The vegetation of larger remnants in the vicinity of the eastern Darling Scarp is generally considered less likely to align with the nearby highly cleared valleys that contain the Wheatbelt woodlands TEC.

Patches dominated by Eucalyptus wandoo that retain a mostly native understorey could potentially be considered consistent with the wheatbelt woodland TEC, while other patches that lack a native understorey or are dominated by marri or jarrah would not be considered the listed EC. The site at Clackline is on the mapped margins of the wheatbelt woodland TECs distribution on the eastern edge of the Darling Scarp, where there are jarrah and marri forests with some patches of wandoo. This boundary between eastern jarrah forest and wheatbelt vegetation is not a fine line and there are pockets of woodlands that appear very similar to the Wheatbelt woodlands TEC in the area.

However, the gravelly substrate and associated hilly landscape at this site are considered to be more typical of the woodlands of the eastern Darling Scarp than those that occur in the wheatbelt proper. Also, some understorey flora species (eg Trymalium ledifolium) are considered more representative of Darling Scarp woodlands.

*Kind Regards*

Wendy Hudleston (Chow)| TEC Ecologist| Species & Communities Branch
Department of Parks and Wildlife | Kensington | Ph. 9219 9157| wendy.hudleston@dpaw.wa.gov.au

PARKS AND WILDLIFE

From: De Wit, Floora [mailto:Floora.DeWit@aecom.com]
Sent: Monday, 23 January 2017 1:16 PM
To: Hudleston, Wendy
Subject: RE: Clackline TEC verification

Hi Wendy,

How are your enquiries progressing?

**Floora de Wit**
Senior Botanist
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Floora.DeWit@aecom.com

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From: Hudleston, Wendy [mailto:Wendy.Hudleston@DPaW.wa.gov.au]
Sent: Tuesday, 13 December 2016 4:18 PM
To: De Wit, Floora
Subject: RE: Clackline TEC verification

Hi Floora

Just letting you know, I am currently working on this and may need to speak with someone from the Commonwealth to assist with determining if the woodland in question meets the conservation advice for the Wheatbelt Woodland TEC.

I did not receive the Toodyay Road email from you either but I have now added you to the safe senders list.

Regards

Wendy

---

From: De Wit, Floora [mailto:Floora.DeWit@aecom.com]
Sent: Friday, 9 December 2016 9:08 AM
To: Hudleston, Wendy; Communities Data
Subject: Clackline TEC verification

Hi Wendy

Please see attached the vegetation descriptions and a species by community matrix along with a zip file of representative photos.
Communities considered for inclusion include:

- EaMlSc
- EaXaPa
- EwGsAs

Also, I sent an email similar to this one but relating to the Toodyay Road project for Main Roads? Did you receive this email?
Happy to send you same details for that project, its basically the same question for an area of *E. accedens* woodland that occurs on the eastern edge of the Jarrah Forest just before Toodyay.

**Floora de Wit**
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