Lot 9000 Corner Wanneroo and Dundebar Roads, Sinagra

Flora, vegetation and Black Cockatoo habitat survey

Prepared for
The Order of the Servants of Mary Incorporated
C/- Woodsome Management Pty Ltd
by Strategen-JBS&G

February 2020

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Lot 9000 Corner Wanneroo and Dundebar Roads, Sinagra

Flora, vegetation and Black Cockatoo habitat survey

Strategen-JBS&G is a trading name of
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February 2020

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Client: The Order of the Servants of Mary Incorporated C/- Woodsome Management Pty Ltd

Report Version	Revision No.	Purpose	Strategen-JBS&G author/reviewer	Submitted to Client	
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Final Report	C	Submission	T Sleigh	Electronic (email)	12/02/2020

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1. Introduction

This report presents the findings of a detailed flora and vegetation survey and black cockatoo habitat assessment undertaken for Lot 9000 Wanneroo Road Sinagra. (survey area).

1.1 Background

Woodsome Management is assisting The Order of the Servants of Mary Incorporated (Servite Order) to assess the development potential for the subject site (Figure 1).

The proposed development of the site has the potential to impact approximately 31 ha of native vegetation and as such, a flora and vegetation survey was deemed necessary to determine the environmental values of the potential clearing area.

Clearing of vegetation may result in the removal of vegetation potentially containing habitat for Forest Red-tailed Black-Cockatoos (FRTBC), Baudin's Black Cockatoos (BBC) and Carnaby's Black-Cockatoos (CBC). All three species of black cockatoos are listed as Threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Wildlife Conservation Act 1950* (WC Act). Given this, an assessment of the habitat values is required to support potential future assessment and approval requirements and to inform development design.

1.2 Scope

The scope of this flora and vegetation survey and black cockatoo habitat assessment was to undertake a desktop assessment and field assessment within the survey area (Figure 1).

The objectives were to:

- conduct a desktop survey for Threatened and Priority flora which have been identified as being present in or around the survey area
- collect and identify the vascular plant species present within the survey area
- search areas of suitable habitat for Threatened and/or Priority flora
- define and map the native vegetation communities present within the survey area
- map vegetation condition within the survey area
- provide recommendations on the local and regional significance of the vegetation communities
- define and map black cockatoo habitat within the survey area
- prepare a report summarising the findings.

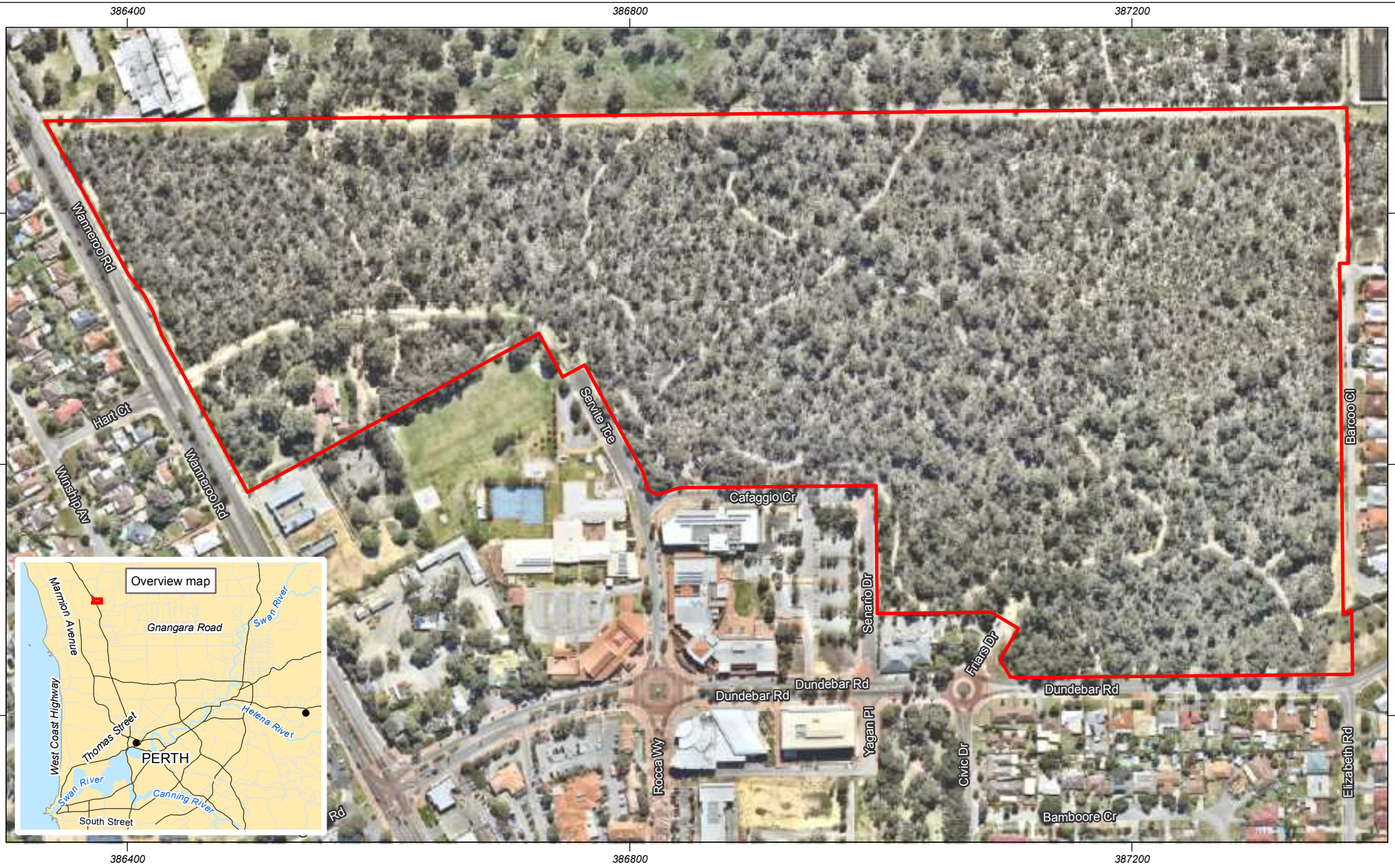

Figure 1: Survey area

Scale 1:4,000 at A4

0 40 80 120 Metres

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 18/01/2018
Author: vdinh
Source: Nearmap: Aerial imagery - August 2017.

Path: Q:\Consult\2017\MPG\MPG17391\01_GIS_documents\ArcMap_documents\MPG17391_G002_RevB.mxd

Legend

Survey area

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2. Context

2.1 Legislative context

This biological survey has been conducted with reference to the following Australian and Western Australian legislation:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – Australian Government
- *Wildlife Conservation Act 1950* (WC Act) – State
- *Environmental Protection Act 1986* (EP Act) – State
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) – State.

2.1.1 Conservation significant flora and ecological communities

Conservation significant flora and ecological communities are determined at a state and federal legislative level.

Flora within Western Australia that is considered to be under threat may be classed as either Threatened flora or Priority flora. Where flora has been gazetted as Threatened flora under the WC Act, the taking of such flora without the written consent of the Minister is an offence. The WC Act defines "to take" flora as to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means. The Department of Biodiversity, Conservation and Attractions (DBCA) (2017a) contains the current list of Threatened flora in Western Australia.

Priority flora are considered to be species which are potentially under threat, but for which there is insufficient information available concerning their distribution and/or populations to make a proper evaluation of their conservation status. Parks and Wildlife categorises Priority flora according to their conservation priority using five categories, P1 (highest conservation significance) to P5 (lowest conservation significance), to denote the conservation priority status of such species. Priority flora species are regularly reviewed and may have their priority status changed when more information on the species becomes available. Appendix 1 defines levels of Threatened and Priority flora (Western Australian Herbarium 1998-).

At the national level, the EPBC Act lists Threatened species as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent. Appendix 1 defines each of these categories of Threatened species. The EPBC Act prohibits an action that has or will have a significant impact on a listed Threatened species without approval from the Australian Government Minister for the Environment. The current EPBC Act list of Threatened flora may be found on the DEE (2017d) website.

Threatened Ecological Communities (TECs) are listed under both the EPBC Act and EP Act (Appendix 1). Priority Ecological Communities (PECs) are listed by Parks and Wildlife and include species of significant conservation value (Appendix 1).

A TEC is defined under the EP Act as an ecological community listed, designated or declared under a written law or a law of the Australian Government as Threatened, Endangered or Vulnerable. There are four State categories of TECs (DEC 2013)[1]:

- presumed totally destroyed (PD)
- critically endangered (CR)
- endangered (EN)
- vulnerable (VU).

[1] The Department of Environment and Conservation is still listed as the author of all TEC and PEC databases and have been referred to as such in this document instead of the Department of Department of Biodiversity, Conservation and Attractions (DBCA).

A description of each of these TEC categories is presented in Appendix 1. TECs are gazetted as such (Parks and Wildlife 2016) and some Western Australian TECs listed by Parks and Wildlife (2016) are also listed as Threatened under the EPBC Act.

Under the EPBC Act, a person must not undertake an action that has or will have a significant impact on a listed TEC without approval from the Australian Government Minister for the Environment, unless those actions are not prohibited under the EPBC Act. A description of each of these categories of TECs is presented in Appendix 1. The current EPBC Act list of TECs can be located on the DEE (2017e) website.

Ecological communities identified as Threatened, but not listed as TECs, are classified as Priority Ecological Communities (PECs). These communities are under threat, but there is insufficient information available concerning their distribution to make a proper evaluation of their conservation status. Parks and Wildlife categorises PECs according to their conservation priority, using five categories, P1 (highest conservation significance) to P5 (lowest conservation significance), to denote the conservation priority status of such ecological communities. Appendix 1 defines PECs (DEC 2013). Parks and Wildlife (2017) contains a list of current PECs.

2.1.2 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under section 51B of the Act. ESAs are relevant in the context of exemptions in the Clearing Regulations which do not apply in ESAs. The following areas are considered ESAs:

- World Heritage areas
- areas included on the National Estate Register
- defined wetlands and associated buffers
- vegetation within 50 m of a listed Threatened species
- TECs.

2.1.3 Protection of native vegetation

Native vegetation is defined under the EP Act as “indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation”.

This definition of native vegetation does not include vegetation that was intentionally sown, planted or propagated unless either of the following applies:

(a) the vegetation was sown, planted or propagated as required under the EP Act or another written law

(b) the vegetation is declared to be native under Regulation 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Regulation 4 prescribes the kinds of intentionally planted indigenous vegetation that are “native vegetation” and which therefore require a clearing permit or exemption to clear and includes:

(c) planting that was funded (fully or partly)
  i. by a person who was not the owner of the land
  ii. for the purpose of biodiversity conservation or land conservation

(d) intentionally planted vegetation that has one of the following:
  i. a conservation covenant or agreement to reserve under section 30B of the *Soil and Land Conservation Act 1945*
  ii. a covenant to conserve under section 21A of the *National Trust of Australia (WA) Act 1964*
  iii. restrictive covenant to conserve under section 129B of the *Transfer of Land Act 1983*
  iv. some other form of binding or undertaking to establish and maintain, or maintain, the vegetation.

Native vegetation can only be cleared with a clearing permit, unless for some circumstances where exemptions apply pursuant to the EP Act and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (the Regulations). Clearing permits issued pursuant to the Regulations may be issued as area permits or purpose permits. Exemptions for clearing under Regulation 5 of the Regulations do not apply within ESAs.

2.1.4 Introduced species

The BAM Act provides for management and control of listed organisms, including introduced flora species (weeds). Species listed as declared pests under the BAM Act are classified under three categories:

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

Under the BAM Act, land managers are required to manage populations of declared pests as outlined under the relevant category.

2.1.5 Fauna

DBCA Priority Lists

The DBCA lists 'Priority' fauna that have not been assigned statutory protection as Declared Rare or 'Scheduled' under the WC Act, but which are under consideration for declaration as 'Scheduled' fauna. Fauna assessed as Priority 1-3 are in urgent need of further survey. Priority 4 fauna require monitoring every 5-10 years and Priority 5 fauna are subject to a specific conservation programme (Appendix 1).

2.2 Environmental setting

2.2.1 Soils and topography

The survey area is located within the Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion) of Western Australia (Mitchell et al. 2002). The subregion comprises five major geomorphologic systems that lie parallel to the coast, namely (from west to east) the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf (Churchward & McArthur 1980; Gibson *et al.* 1994). Each major system is composed of further subdivisions in the form of detailed geomorphologic units (Churchward & McArthur 1980; Semeniuk 1990; Gibson *et al.*1994). Beard (1990) describes the Swan Coastal Plain as a low-lying coastal plain, often swampy, with sandhills also containing dissected country rising to the duricrusted Dandaragan plateau on Mesozoic, mainly sandy, yellow soils.

The survey area is located on the Karrakatta landform unit, on Spearwood dunes and can be described as an undulating landscape with deep yellow sands over limestone (aeolian deposits) (Churchward & McArthur 1980).

2.2.2 Climate

The survey area experiences a Mediterranean climate characterised by mild, wet winters and warm to hot, dry summers. The nearest Bureau of Meteorology (BoM) weather station at Wanneroo (Station No. 9105) provides average monthly rainfall statistics for the survey area (Figure 2). Average annual rainfall recorded at Wanneroo since 1905 is 801 mm (BoM 2017). Rainfall may occur at any time of year; however, most occurs in winter in association with cold fronts from the southwest. The BoM weather station at Perth (Station No. 9225) provides the most representative monthly temperature data for the survey area. Highest temperatures occur between December and March, with average monthly maximums ranging from 29.1°C in December to 31.6°C in February (BoM 2017). Lowest temperatures occur between June and August, with average monthly minimums ranging from 18.4 °C in July to 19.5 °C in June (BoM 2017).

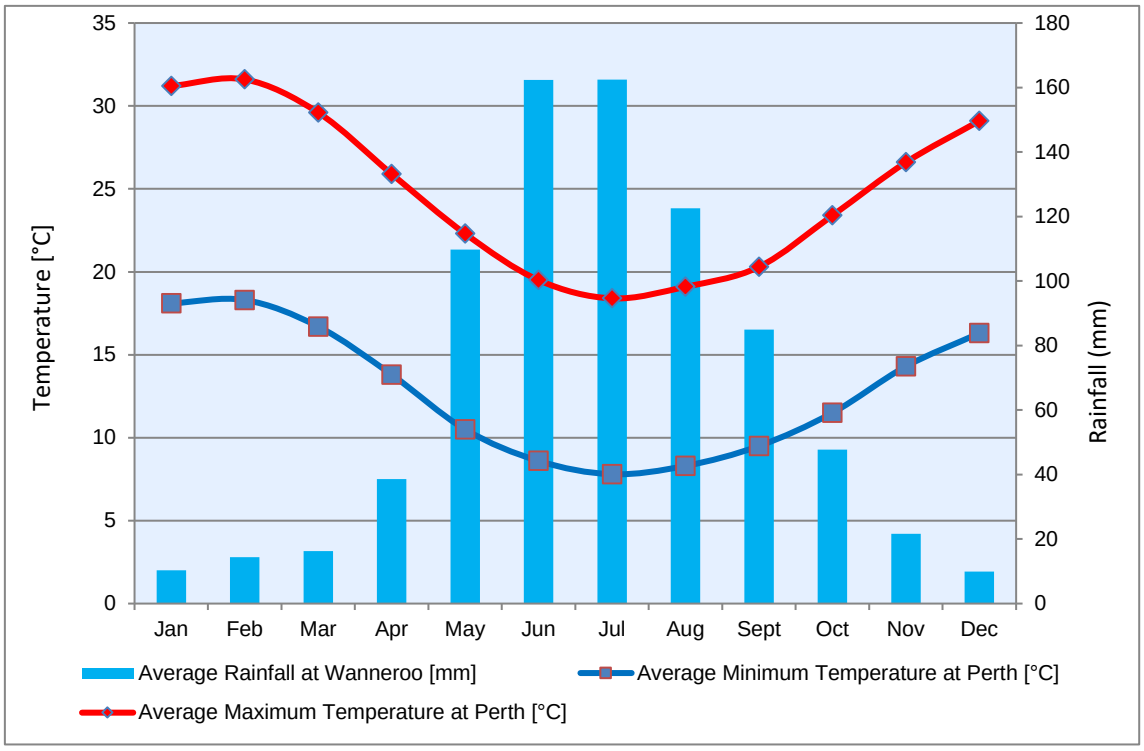

Figure 2: Mean monthly temperature for Perth Metro (Station No. 09225) and rainfall for Wanneroo (Station No. 09105)

2.2.3 Regional vegetation

Vegetation occurring within the region was initially mapped at a broad scale (1:1 000 000) by Beard during the 1970s. This dataset has formed the basis of several regional mapping systems, including physiographic regions defined by Beard (1981) which led to the delineation of botanical districts as described in Beard (1990); the biogeographical region dataset (Interim Biogeographic Regionalisation for Australia, IBRA) for Western Australia (DEE 2017a) and System 6 Vegetation Complex mapping undertaken by Heddle et al. (1980).

Beard (1990) Botanical Subdistrict

The survey area occurs within the Drummond Botanical Subdistrict which is characterised by low *Banksia* woodlands on leached sands; *Melaleuca* swamps on poorly-drained depressions; and *Eucalyptus gomphocephala* (Tuart), *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) woodlands on less leached soils (Beard 1990).

IBRA subregion

IBRA describes a system of 85 'biogeographic regions' (bioregions) and 403 subregions covering the entirety of the Australian continent (Thackway & Cresswell 1995). Bioregions are defined on the basis of climate, geology, landforms, vegetation and fauna.

The survey area occurs within the Swan Coastal Plain 2 IBRA subregion which is dominated by *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains and paperbark (*Melaleuca*) in swampy areas (Mitchell et al. 2002).

System 6 and vegetation system association mapping

System 6 mapping refers to vegetation mapping undertaken at a Vegetation Complex scale by Heddle *et al.* (1980). This is the primary source of information used to calculate potential impacts of proposals to clear native vegetation on the Swan Coastal Plain. The survey area occurs within the 'Karrakatta complex – central and south' (Figure 3) which is described as:

> *Predominantly open forest of Eucalyptus gomphocephala (Tuart) - Eucalyptus marginata (Jarrah) - Corymbia calophylla (Marri) and woodland of Eucalyptus marginata (Jarrah) - Banksia species. Agonis flexuosa (Peppermint) is co-dominant south of the Capel River.*

This vegetation complex has 23.61 % of its pre-European extent remaining within the Swan Coastal Plain bioregion (Government of Western Australia 2017b).

At a finer scale, the survey area falls within the Spearwood 6 vegetation system association (i.e. jarrah, marri and wandoo woodland) as defined in Government of Western Australia (2017a). This system association has 24.40% of its pre-European extent remaining within the Swan Coastal Plain bioregion (Government of Western Australia 2017a).

Figure 3A: Regional vegetation mapping - Vegetation class

Scale 1:20,000 at A4

0 200 400 600 Metres

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 18/01/2018
Author: vdinh
Source: Nearmap: Aerial imagery - August 2017.
Path: Q:\Consult\2017\MPG\MPG17391\01_GIS_documents\ArcMap_documents\MPG17391_G003_RevB.mxd

Legend

Survey area

Vegetation Class (Heddle)

- Cottesloe complex - central and south
- Herdsman Complex
- Karrakatta complex - central and south
- Pinjar complex

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Figure 3B: Regional vegetation mapping - Vegetation association

Scale 1:20,000 at A4

0 200 400 600 Metres

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 18/01/2018
Author: vdinh
Source: Nearmap: Aerial imagery - August 2017.
Path: Q:\Consult\2017\MPG\MPG17391\01_GIS_documents\ArcMap_documents\MPG17391_G004_RevA.mxd

Legend

Survey area

System association

- Bassendean 126
- Bassendean 37
- Bassendean 949
- Guilderton 1007
- Spearwood 126
- Spearwood 37
- Spearwood 6
- Spearwood 949
- Spearwood 998

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2.2.4 Black cockatoo habitat

Background Ecological Information for Black Cockatoos

All three species of Black Cockatoo (Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC) could potentially occur in the Survey Area. The distribution of all three species can be seen in the 2017 DEE distribution maps in Appendix 2.

Carnaby's Black Cockatoo

Carnaby's Cockatoo is endemic to south-west WA, and is distributed from the Murchison River to Esperance and inland to Coorow, Kellerberrin and Lake Cronin (Cale 2003). The species was once common, but the population has declined significantly in the last half century, and is now locally extinct in some areas (Johnstone & Storr 1998; Shah 2006). In the last 45 years (prior to Cale 2003) the species has suffered a 50% reduction in its abundance (Cale 2003). More recent information suggests this decline has continued. This reduction is due to the clearing of core breeding habitat in the wheatbelt, the deterioration of nesting hollows, and clearing of food resources on the Swan Coastal Plain (SCP) (Cale 2003). The total population of Carnaby's Cockatoo was estimated to be 40,000 (Johnstone & Kirkby 2008) in 2008. Since then, trend analyses of the seven Great Cocky Counts 2010 – 2016 identified strong indications that the population of Carnaby's Black-Cockatoo inhabiting the Perth-Peel Coastal Plain continues to decline.

Carnaby's Cockatoos feed on seeds, nuts and flowers of a variety of native and exotic plants. Food plants include a variety of Eucalyptus species, such as Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*), Swan River Blackbutt (*Eucalyptus patens*), Coastal Blackbutt (*Eucalyptus todtiana*), Caesia (*Eucalyptus caesia*) and Salmon Gum (*Eucalyptus salmonophloia*), as well as Pine trees (*Pinus* sp.), Grevillea, Allocasuarina, and Hakea species (Shah 2006). Marri nuts that are damaged extensively, especially on the main body of the nut, are likely to have been chewed by Carnaby's Cockatoo. The 'levering' of Marri nuts by Carnaby's Cockatoos tends to leave different marks on the fruit casings, particularly in the location of indentations by the lower mandible and in the amount of damage caused to the rim of the fruit casing. Carnaby's Cockatoos also generally feed on green Marri nuts that are soft enough for their beaks to manipulate. The seeds from a variety of Banksia species and the cones of Pine trees provide the highest energetic yield (Cooper *et al*. 2002).

Breeding has been recorded from early July to mid-December, and primarily occurs in the wheatbelt in the semi-arid and subhumid interior (Johnstone & Storr 1998). However, this species is currently expanding its breeding range westward and south into the Jarrah-Marri forests of the Darling Scarp (e.g. Wungong Dam Catchment) and into the Tuart (*Eucalyptus gomphocephala*) forests of the SCP including Yanchep, Baldivis, Lake Clifton and near Bunbury (Johnstone & Kirkby 2011).

Carnaby's Cockatoo display strong pair bonds and mate for life. They nest in hollows of smooth-barked eucalypts particularly Salmon Gum and Wandoo (*Eucalyptus wandoo*) but nests have also been found in other Eucalypt species including York Gum (*Eucalyptus loxophleba*), Flooded Gum (*Eucalyptus rudis*), the rough-barked Marri and Tuart (Johnstone & Kirkby 2011). In most nests in Tuart, eggs are laid on a mat of wood chips at the bottom of a large hollow (mostly top entry hollows) ranging from a few cm's to five m deep (Johnstone & Kirkby 2011). Clutch size is 1–2 eggs, more typically two; only one young is reared (Saunders 1986). Incubation lasts for 29 days and only the female incubates and broods. The nestling is brooded by the female during which time both rely on food from the male. Once brooding is complete, the female then leaves the nest each day at dawn, sometimes returning mid-morning (with the male) to feed the chick (Johnstone & Kirkby 2011). After approximately three weeks she ceases to brood and the chick is fed by one or both parents in the morning and in the late evening (Johnstone & Kirkby 2011).

Approximately 87% (525,732 ha) of potential Carnaby's Cockatoo habitat (i.e. areas of vegetation that contain flora species and vegetation types that could support the species' breeding, feeding and night roosting activities) has been cleared in the wheatbelt since European settlement (DEC 2012). The south-west region is now a severely fragmented landscape and the further loss of foraging habitat, the lack of suitable breeding sites, climate change, alterations in the landscape, changing forest structure with almost every part of the Jarrah-Marri forest logged in the past and with most trees too young to form hollows, and competition with exotic species, exacerbate the future conservation of Carnaby's Cockatoo (Johnstone & Kirkby 2011).

Baudin's Black Cockatoo

This species is distributed through the south-western humid and subhumid zones, from the northern Darling Range and adjacent far east of the SCP (south of the Swan River), south to Bunbury and across to Albany (Johnstone & Kirkby 2011). Baudin's Cockatoo rarely occurs near the coast north of Mandurah, and rarely occurs north of the Swan River (Johnstone & Kirkby 2008, Johnstone & Storr 1998). Baudin's Cockatoo usually occur in small flocks of up to 30, or occasionally up to 50 and rarely in aggregations of up to 1200 (Johnstone & Kirkby 2008). Baudin's Cockatoo is distinguished from Carnaby's Cockatoo by its longer bill and slightly different call.

This species forages primarily in Eucalypt forest, where it feeds on Marri seeds, flowers, nectar and buds. They also feed on a wide range of seeds of Eucalyptus, Banksia, Hakea and Pines (*Pinus* sp.) as well as fruiting apples and pears and beetle larvae from under the bark of trees (Johnstone & Kirkby 2008, Johnstone & Storr 1998). Baudin's Cockatoo forages at all levels of the forest, from the canopy to the ground, often feeding in the understorey on proteaceous trees and shrubs, especially Banksia, and in orchards both in trees and on dropped or fallen fruit on the ground.

The breeding biology of this species is poorly known. It has been recorded breeding in deep south-west, north to the Whicher Range and Lowden and also isolated records at Wungong Catchment, Serpentine (hills area) and east to Kojonup and near Albany (Johnstone & Kirkby 2008). They nest in large, mostly vertical, hollows of Karri (*E. diversicolor*), Marri, Wandoo, and Bullich *(E. megacarpa*). Baudin's Cockatoos display strong pair bonds are monogamous and most likely mate for life (Johnstone & Kirkby 2008). The pair remains together all year round except when the female is incubating and brooding. Both adults play a part in selecting the nest hollow, but only the female is responsible for renovation and preparing the hollow for breeding. Preparation of the hollow consists of chewing around the entrance of the hollow and down one part of the interior wall. Pairs have also been recorded prospecting for hollows in most months and outside the breeding range (Johnstone & Kirkby 2008).

Forest Red-tailed Black Cockatoo

The FRTBC is distributed through the humid and subhumid south-west of WA from Gingin through the Darling Ranges to the south-west from Bunbury to Albany (primarily in the hilly interior) (Johnstone & Storr 1998, Johnstone et al. 2013a). In these areas, the FRTBC inhabits dense Jarrah, Karri, and Marri forests that receive more than 600 mm average annual rainfall (Johnstone & Storr 1998). However, in recent years the FRTBC has moved on to the SCP to forage in the Perth metropolitan area (Johnstone & Kirkby 2011). The FRTBC occurs in pairs or small flocks, or occasionally large flocks of up to 200 birds (Johnstone & Storr 1998).

The FRTBC feeds primarily on Marri and Jarrah fruit, but also Tuart and to a lesser extent on Blackbutt, Albany Blackbutt (*E. staeri*), Karri, Sheoak (*Allocasuarina fraseriana*) and Snottygobble (*Persoonia longifolia*) (Johnstone *et al*. 2013). The FRTBC can obtain energy faster when feeding on Marri and Jarrah than other food sources (Cooper *et al*. 2002), and these two plant species make up the majority of their diet (Johnstone *et al*. 2013b).

FRTBC shear the base of Marri nuts at a 45º angle to remove seeds (the 'bottom slice' method), while Baudin's Cockatoos use their elongated upper mandible to pry seeds out, leaving the nut intact (the 'lever') (Johnstone & Kirkby 1999, Cooper et al. 2002). Carnaby's Cockatoos may use either technique to feed on Marri nuts, but generally with some modification, e.g. the 'slicing' of fruits may occur along the side of the fruit casing.

The FRTBC is monogamous and pairs nest in tree hollows from 6.5 – 33 m above ground and most nests are in large and old mature Marri, and these trees are the most important nesting tree throughout the FRTBC range (Johnstone *et al*. 2013a). Nest trees of the FRTBC have a mean circumference at breast height of 2.79 m, a mean estimated age of 222 years and a mean overall height of 20.24 m (Johnstone *et al*. 2013a).

Breeding has been recorded in all months, with peaks in April-June and August-October. Only one egg is laid, which the female incubates for 29 to 31 days, before a nestling hatches and weighs between 27 and 32 g. The female remains in the hollow during incubation and only leaves for a short period in the evening to be fed by the male, usually at dusk (Johnstone *et al.* 2013b). Brooding is for up to 10 days, after which the female leaves the nest between dawn and dusk. Pairs of birds appear to recognise each other by calls, not responding to calls by others in the area. Chicks only respond when the parent is heard and are fully feathered at 48 days (Johnstone *et al*. 2013b).

3. Methods

3.1 Flora and vegetation

3.1.1 Desktop assessment

A desktop assessment was conducted using FloraBase, Parks and Wildlife, and Department of the Environment and Energy (DEE) databases to identify the possible occurrence of TECs, PECs and Threatened and Priority flora potentially occurring within the survey area. Reports that document regional flora, vegetation and fauna within the surrounds of the survey area were also reviewed prior to the field assessment.

3.1.2 Field assessment

The field survey was conducted according to standards set out in the Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016). The assessment of flora and vegetation within the survey area was undertaken by one ecologist from Strategen (now Strategen-JBS&G) on 8 September 2017. Table 1 identifies staff involved in the field surveys, their role and qualifications.

Table 1: Personnel

Name	Role	Flora collection permit
Mr. T. Sleigh Strategen-JBS&G (Senior Ecologist)	Planning, fieldwork, plant identification, data interpretation and report preparation	SL012160

The survey area was traversed on foot to record changes in vegetation structure and type. Six vegetation quadrats and two opportunistic sites were surveyed to identify vegetation types. Site selection for vegetation mapping was determined from aerial photographs and based on differences in structure and species composition of the communities present within the survey area.

Flora and vegetation was described and sampled systematically at each quadrat and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each site the following floristic and environmental parameters were noted:

- GPS location
- topography
- soil type and colour
- outcropping rocks and their type
- percentage cover and average height of each vegetation stratum.

For each vascular plant species, the average height, number of plants and percent cover were recorded.

All plant specimens collected during the field surveys were identified using appropriate reference material or through comparisons with pressed specimens housed at the Western Australian Herbarium where necessary. Nomenclature of the species recorded is in accordance with Western Australian Herbarium (1998-).

3.1.3 Data analysis and vegetation mapping

Due to the uniform distribution of vegetation within the survey area; quadrat data were grouped into a species by site matrix to delineate individual vegetation types (VTs) present within the survey area. Aerial photography interpretation and field notes taken during the survey were then used to develop VT mapping polygon boundaries over the survey area. These polygon boundaries were then digitised using Geographic Information System (GIS) software.

VT descriptions (though floristic in origin) have been adapted from the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 6.0 (ESCAVI 2003), a system of describing structural vegetation units (based on dominant taxa). This model follows nationally-agreed guidelines to describe and represent vegetation types, so that comparable and consistent data is produced nation-wide. For the purposes of this report, a VT is considered equivalent to a NVIS sub-association as described in ESCAVI (2003).

Vegetation condition was recorded at all quadrats, and also opportunistically within the survey area during the field assessment where required. Vegetation condition was described using the vegetation condition scale for the South West Botanical Province (Keighery 1994). Vegetation condition polygon boundaries were developed using this information in conjunction with aerial photography interpretation, and were digitised as for vegetation type mapping polygon boundaries.

To identify possible TECs and PECs in the survey area, vegetation quadrats (and subsequently, Vegetation Types) were compared to Floristic Community Types (FCTs) defined by Gibson *et al.* (1994). Remnant vegetation of the southern Swan Coastal Plain was surveyed and mapped by Gibson *et al.* (1994) to provide an understanding of the major floristic types and transitions across the region. The major FCTs were defined by classifying the data collected according to the similarities in species composition between plots. When determining the FCT of a new record, a floristic analysis of species composition provides the most robust method that is consistent with the original classification.

The following multivariate analyses were used to analyse the data collected from the survey area, the results of which were compared to determine the most likely result:

- Hierarchical agglomerative clustering
- nearest neighbour.

Hierarchical agglomerative clustering is the first stage in classifying vegetation data into community types. This involves calculating the similarity (or more often, the dissimilarity) between plots within the dataset and then sequentially fusing the plots into groups according to their similarity.

Nearest neighbour analysis involves calculating a similarity or dissimilarity matrix for the combined new dataset and simply allocating each new plot to the FCT of the plot from the original dataset that shares the greatest similarity.

An averaged randomised Species Accumulation Curve, based on accumulated species compared against sites surveyed was used to provide an indication as to the level of adequacy of the survey effort. As the number of survey sites, and correspondingly the size of the area surveyed increases, there should be a diminishing number of new species recorded. At some point, the number of new species recorded becomes essentially asymptotic. As the number of new species being recorded for survey effort expended approaches this asymptotic value, the survey effort can be considered to be adequate.

3.1.4 Survey limitations and constraints

Table 2 displays the evaluation of the flora and vegetation assessment against a range of potential limitations that may have an effect on that assessment. Based on this evaluation, the assessment has not been subject to constraints that would affect the thoroughness of the assessment and the conclusions reached.

Table 2: Flora and vegetation survey potential limitations and constraints

Potential limitation	Impact on assessment	Comment
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	**Not a constraint.**	The survey has been undertaken in the Drummond Botanical Subdistrict on the Swan Coastal Plain which has been well studied and documented with ample literature available (Beard 1990).
Scope (i.e. what life forms, etc., were sampled).	**Not a constraint.**	Due to the uniform distribution of vegetation within the survey area and timing of the survey (i.e. spring); most life forms are likely to have been sampled adequately during the time of the survey.
Proportion of flora/fauna collected and identified (based on sampling, timing and intensity).	**Not a constraint.**	The proportion of flora surveyed was adequate. The entire survey area was traversed and flora species were recorded systematically.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	**Not a constraint**	The information collected during the survey was sufficient to assess the vegetation that was present during the time of the survey.
Mapping reliability.	**Not a constraint.**	Aerial photography of a suitable scale was used to map the survey area and identify potential fauna habitat. Sites were chosen from these aerials to reflect changes in community structure. Opportunistic sites were also used if differences were observed during on ground reconnaissance. Vegetation types were assigned to each site based on topography, soil type and presence/absence and percent foliage cover of vegetation.
Timing, weather, season, cycle.	**Not a constraint.**	Flora and vegetation surveys are normally conducted following winter rainfall in the South-West Province, ideally during spring (EPA 2004). The field assessment was conducted in September (i.e. spring) in fine weather conditions and therefore these factors are not deemed to be constraints.
Disturbances (fire flood, accidental human intervention, etc.).	**Not a constraint.**	The survey area and regional surrounds have been subject to disturbance over a significant period of time. Given the wide range of this disturbance, this is not considered to be a limitation within the survey area.
Intensity (in retrospect, was the intensity adequate).	**Not a constraint.**	The survey area was traversed on foot and all differences in vegetation structure were recorded appropriately.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	**Not a constraint.**	The available resources were adequate to complete the survey.
Access problems (i.e. ability to access survey area).	**Not a constraint.**	Existing tracks enabled adequate access to survey the vegetation and fauna within the survey area. Where access was not available by car, the area was easily traversed by foot.
Experience levels (e.g. degree of expertise in species identification to taxon level).	**Not a constraint.**	All survey personnel have the appropriate training in sampling and identifying the flora of the region.

3.2 Black cockatoo habitat assessment

The survey area was inspected on 8 September 2017 by Strategen-JBS&G personnel with relevant experience as specified by the *EPBC Act Referral guidelines for three threatened black cockatoo species* (DSEWPaC 2012). The habitat assessment involved traversing the Survey Area by foot. Any trees meeting the following criteria for potential breeding and foraging habitat were recorded, marked and electronically logged using a hand held Global Positioning System (GPS) unit:

- native trees (e.g. Jarrah, Tuart, Marri)
- diameter at breast height (DBH) > 500 mm (300 mm for Wandoo and Salmon Gum)
- hollows > 120 mm diameter
- evidence of feeding (chewed cones, seed and nut material)
- opportunistic observations of Black Cockatoos in the Survey Area.

The Black Cockatoo habitat assessment considered the recently revised Draft Referral Guidelines for Three Threatened Black Cockatoo Species (DEE 2017f). These draft guidelines include an assessment of Black Cockatoo foraging habitat quality, by attributing a habitat quality score.

It is important to note that these guidelines are currently in draft form. As such, the foraging habitat quality score has the potential to be altered in the future, if the final guidelines change considerably. At present the quality score included the elements above as well as the following:

- the presence of all plant species that provide foraging, including non-native food sources used by Black Cockatoos
- use as a roosting site
- the vegetation present in the surrounding area (i.e. at least 12 km from the impact area, including proximity to any breeding habitat, roosting sites or watering points
- numbers of any known nesting trees
- presence of disease, such as *Phytophthora cinnamomi*.

4. Results

4.1 Flora and vegetation

4.1.1 Desktop assessment results

A total of 295 native vascular plant taxa from 64 plant families have the potential to occur within the survey area (Parks and Wildlife 2007-; DEE 2017c). The majority of taxa were from within the Fabaceae (35 taxa), Myrtaceae (28 taxa) and Cyperaceae (23 taxa) families.

Threatened and Priority flora

The desktop assessment identified ten Threatened flora and 12 Priority flora species that have been recorded in the regional area (Table 3; Appendix 3). Of these, based on specific habitat requirements, two Threatened flora species and three Priority flora species were considered to have the potential to occur within the survey area:

- *Caladenia huegelii* (T)
- *Drakaea micrantha* (T)
- *Thelymitra variegata* (P2)
- *Styphelia filifolia* (P3)
- *Jacksonia sericea* (P4).

Table 3: Threatened and Priority flora potentially occurring within the survey area

Species	Conservation status		Source of Location Data	Description	Potential to occur
	EPBC Act	WC Act			
Andersonia gracilis	Endangered	Threatened	PMST	A slender, erect or open straggly shrub, 10 to 100 cm high. Flowers are white to pink to purple from September to November. Habitat for this species occurs in white/grey sand, sandy clay, gravelly loam within winter-wet areas and near swamps (Western Australian Herbarium 1998-). The species occurs in damp black, sandy clay flats near swamps in open low heath with Calothamnus hirsutus (hairy clawflower), Verticordia densiflora (compact featherflower), Kunzea recurva (recurved Kunzea) and Banksia telmatiaea over sedges.	**Unlikely** due to absence of preferred habitat.
Caladenia huegelii	Endangered	Threatened	PMST	A slender orchid from 30 to 50 cm tall. One or two striking flowers characterised by a greenish-cream lower petal with a maroon tip. Other petals are cream with red or pink suffusions. Habitat for this species occurs within well-drained, deep sandy soils in low mixed Banksia, Allocasuarina and Jarrah woodlands (Western Australian Herbarium 1998-, DEE 2017b).	**Possible** due to presence of preferred habitat.
Diuris purdiei	Endangered	Threatened	PMST	A slender orchid to 45 cm tall. Unusually flattened flowers, marked with brown blotches on their under surface. Habitat for this species occurs in areas subject to winter inundation within dense heath with scattered Myrtaceous trees (DEE 2017b).	**Unlikely** due to absence of preferred habitat.
Drakaea elastica	Endangered	Threatened	PMST	A slender orchid to 30 cm tall with a prostrate, round to heart shaped leaf. Singular, bright green, glossy flower. Habitat for this species is within bare patches of white sand over dark sandy loams on damp areas (DEE 2017b).	**Unlikely** due to absence of preferred habitat.
Lepidosperma rostratum	Endangered	Threatened	PMST	A rhizomatous sedge to 30 cm in diameter. Stems are circular in cross section and flowers are spike-like and up to 4 cm long. Habitat for this species occurs in sandy soils among low heath comprised of Banksia telmatiaea and Calothamnus hirsutus in winter-wet swamps (Western Australian Herbarium 1998-, DotE 2015d).	**Unlikely** due to absence of preferred habitat.
Anigozanthos viridis subsp. *terraspectans*	Vulnerable	Threatened	PMST	A small rhizomatous herb with narrow leaves 5–20 cm long and 0.1–0.2 mm wide, that are almost semi-circular in cross-section. The flowering stem is 10–15 cm tall and is held at a 45o to 80o angle, with the curved, paw-like flowers opening away from the stalk. This species occurs in winter-wet depressions where it grows on grey sandy clay loam, or grey sand, in low post-fire regenerating heath. It is associated with species such as Slender-leaved Banksia (Banksia leptophylla), melaleucas, Compact Featherflower (Verticordia densiflora), coneflowers (Conostylis spp.) and sedges (DotE 2015d).	**Unlikely** due to absence of preferred habitat.
Diuris micrantha	Vulnerable	Threatened	PMST	A slender orchid to 60 cm tall. Yellow flowers with reddish-brown markings measuring 1.3 cm across. Habitat for this species occurs within clay-loam substrates in winter-wet depressions or swamps (DEE 2017b).	**Unlikely** due to absence of preferred habitat.
Drakaea micrantha	Vulnerable	Threatened	PMST	A tuberous, terrestrial orchid to 30 cm tall. Silvery-grey heart shaped leaf with prominent green veins. Red and yellow singular flower. Habitat for this species occurs within cleared, open sandy patches (Brown *et al*. 1998).	**Possible** due to presence of preferred habitat.

Species	Conservation status		Source of Location Data	Description	Potential to occur
	EPBC Act	WC Act			
Eleocharis keigheryi	Vulnerable	Threatened	PMST	A rhizomatous, clumped perennial grass-like herb to 40 cm tall. Flowers are green and visible from August to November. Habitat for this species occurs in clay or sandy loam in freshwater creeks and claypans (Western Australian Herbarium 1998-).	**Unlikely** due to absence of preferred habitat.
Marianthus paralius	Nominated for Endangered	Threatened	DBCA Database	Prostrate, scandent woody shrub. Flowers are red, visible from September to November. Habitat for this species occurs on white sand over limestone on low coastal cliffs.	**Unlikely** due to absence of preferred habitat.
Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)	Not listed	P1	DBCA Database; NatureMap	Habitat for this species occurs on white sand over limestone	**Unlikely** due to absence of preferred habitat.
Acacia benthamii	Not listed	P2	DBCA Database	Shrub to 1 m tall. Flowers are yellow, visible from August to September. Habitat for this species is sand overlying limestone breakaways (Western Australian Herbarium 1998-).	**Unlikely** due to absence of preferred habitat.
Tetraria sp. Chandala (G.J. Keighery 17055)	Not listed	P2	DBCA Database; NatureMap	No species specific information available	**Unlikely** due to absence of preferred habitat.
Thelymitra variegata	Not listed	P2	DBCA Database; NatureMap	A tuberous, perennial orchid between 10‑35 cm tall. Flowers are orange-red-purple & pink and visible from June to September. Habitat for this species occurs on sandy clay, sand and laterite (Western Australian Herbarium 1998-).	**Possible** due to presence of preferred habitat.
Austrostipa mundula	Not listed	P3	DBCA Database	No species specific information available. The Austrostipa genus is known to occur throughout the southwest of Western Australia and species are mainly winter-active, perennial grasses (Bell 2008).	**Unknown** as there is no habitat description available, however the nearest location is 3 km from the project area.
Conostylis bracteata	Not listed	P3	DBCA Database; NatureMap	A rhizomatous, tufted or shortly proliferous perennial, grass-like or herb, 0.2-0.45 m high. Flowers are yellow, occurring in August to September. Habitat for this species includes sand or limestone on consolidated sand dunes (Western Australian Herbarium 1998-).	**Unlikely** due to absence of preferred habitat.
Cyathochaeta teretifolia	Not listed	P3	DBCA Database	A rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high and to 1.0 m wide. Flowers are brown. Habitat for this species includes grey sand or sandy clay within swamps or creek edges (Western Australian Herbarium 1998-).	**Unlikely** due to absence of preferred habitat.
Leucopogon sp. Yanchep (M. Hislop 1986)	Not listed	P3	DBCA Database; NatureMap	An erect shrub, 0.15-1 m tall, to 0.6 m wide. Flowers are white/pink, occurring from April to June or September. This species occurs in light grey-yellow sand, brown loam, limestone, laterite or granite on coastal plain, breakaways, valley slopes or low hills (Western Australian Herbarium 1998-)..	**Unlikely** due to absence of preferred habitat.
Pimelea calcicola	Not listed	P3	DBCA Database	An erect to spreading shrub to 1 m tall. Flowers are pink and visible from September to November. Habitat for this species occurs in sand on coastal limestone ridges (Western Australian Herbarium 1998-).	**Unlikely** due to absence of preferred habitat.

Species	Conservation status		Source of Location Data	Description	Potential to occur
	EPBC Act	WC Act			
Stylidium paludicola	Not listed	P3	DBCA Database; NatureMap	Reed-like perennial, herb, 35 to 100 cm tall. Leaves are tufted, linear or subulate or narrowly oblanceolate. Flowers are pink and occur in October to December. Habitat for this species occurs in peaty sand over clay and winter wet areas, often in Marri and Melaleuca woodland or Melaleuca shrubland (Western Australian Herbarium 1998-).	**Unlikely** due to absence of preferred habitat.
Styphelia filifolia	Not listed	P3	DBCA Database; NatureMap	Erect shrub to 90 cm tall. Leaves are linear to narrowly ovate. Flowers are white and occur in March to May. Habitat for this species includes sandy soils, usually in Banksia or Jarrah woodland and in low-lying situations.	**Possible** due to presence of preferred habitat.
Jacksonia sericea	Not listed	P4	DBCA Database; NatureMap	Low spreading shrub, to 0.6 m high. Flowers are orange, occurring usually in December or January to February. Habitat for this species includes calcareous & sandy soils.	**Highly likely** – has previously been recorded within the survey area (ENV 2004)

Threatened and Priority Ecological Communities

Two TECs and two PECs were identified within 10 km of the survey area (Figure 4). The closest TEC identified was *Banksia woodlands of the Swan Coastal Plain* which is listed as Endangered under the EPBC Act. Mapping of the extent of this TEC shows a number of occurrences within the survey area.

The closest PEC identified in proximity to the survey area was SCP 25 – *Southern Eucalyptus gomphocephala-Agonis flexuosa woodlands* which is located approximately 1.5 km from the survey area.

In addition to mapped location of the above TECs and PECs, one ecological community, *Tuart woodlands and forests of the Swan Coastal Plain*, is currently being considered for listing as a TEC under the EPBC Act. While no mapped extents of this community are currently available, the landforms and soils within the survey area are likely to support this community. Given the listing of this community is likely to occur by the middle of 2018, the potential for its occurrence within the survey area has been assessed.

Figure 4: Location of Threatened and Priority Ecological Communities within 5 km of the Survey Area

Scale 1:70,000 at A4

0 700 1,400 2,100 Metres

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 18/01/2018
Author: vdinh
Source: Nearmap: Aerial imagery - August 2017.
Path: Q:\Consult\2017\MPG\MPG17391\01_GIS_documents\ArcMap_documents\MPG17391_G005_RevB.mxd

Legend

- Survey area
- 5km survey area buffer

Threatened & Priority ecological communities

- Banksia Woodlands of the Swan Coastal Plain
- SCP20a
- SCP24
- SCP25

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Wetlands

No wetlands are mapped as occurring within the survey area. The closest mapped wetland is Lake Joondalup, a conservation category wetland, located 560 m west of the survey area.

Bush Forever

No Bush Forever sites are located within the survey area. The closest Bush Forever site is Yellagonga Regional Park (site 299), located 380 m west of the survey area

4.1.2 Field survey results

Native flora

A total of 69 native vascular plant taxa from 51 plant genera and 32 plant families were recorded from quadrats within the survey area. The majority of taxa were recorded within the Fabaceae (nine taxa) and Proteaceae (five taxa) families (Appendix 4; Appendix 5).

Threatened and Priority flora

No Threatened flora species as listed under section 178 of the EPBC Act were recorded within the survey area. No Threatened flora species pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) and no Priority flora species as listed by Western Australian Herbarium (1998-) were also recorded within the survey area

Introduced (exotic) taxa

A total of 15 introduced (exotic) taxa were recorded within the survey area (Appendix 4):

- *Arctotheca calendula*
- *Avena barbata*
- *Briza maxima*
- *Briza minor*
- *Cenchrus clandestinus*
- *Conyza bonariensis*
- *Ehrharta calycina*
- *Gladiolus caryophyllaceus*
- *Hypochaeris glabra*
- *Lysimachia arvensis*
- *Oxalis pes-caprae*
- *Romulea rosea*
- *Solanum nigrum*
- *Sonchus oleraceus*
- *Ursinia anthemoides*.

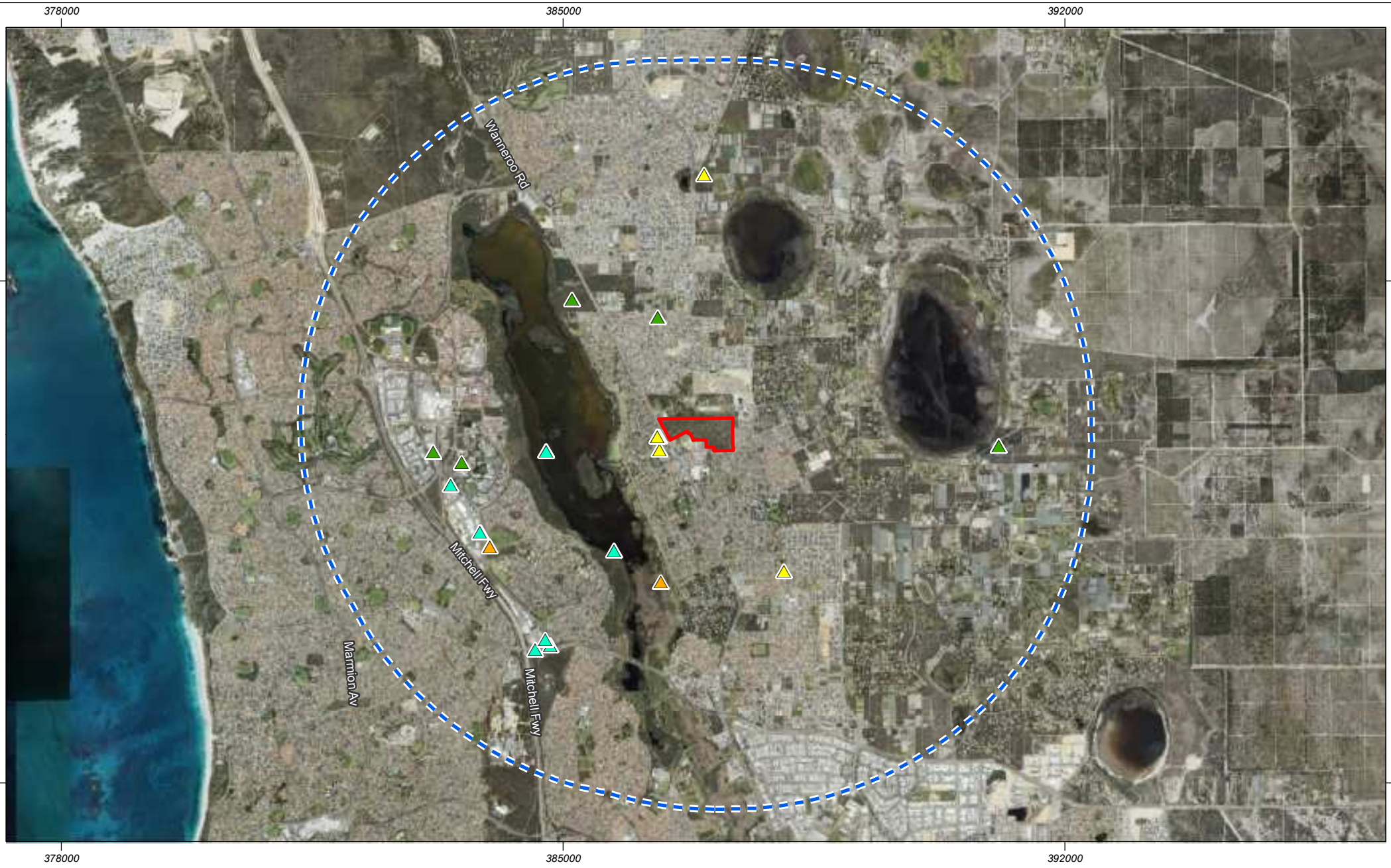

Figure 5: Location of Threatened and Priority Flora within 5 km of the Survey Area

Scale 1:70,000 at A3

0 700 1,400 2,100 Metres

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 18/01/2018
Author: vdinh
Source: Nearmap: Aerial imagery - August 2017.

Path: Q:\Consult\2017\MPG\MPG17391\01_GIS_documents\ArcMap_documents\MPG17391_G006_RevB.mxd

Legend

- Survey area
- 5km survey area buffer

Threatened & Priority Flora

- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare, Near Threatened and other species in need of monitoring

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Accumulated species – sites surveyed (species-area curve)

The species-area curve (Figure 6) based on a species accumulation analysis was used to evaluate the adequacy of sampling (Colwell 2013). The asymptotic value was determined using Michaelis-Menten modelling. Using this analysis, the incidence based coverage estimator of species richness (ICE) was calculated to be 87.68 (Chao 2005). Based on this value, and the total of 68 species recorded during the survey, approximately 78% of the native flora species potentially present within the survey area were recorded.

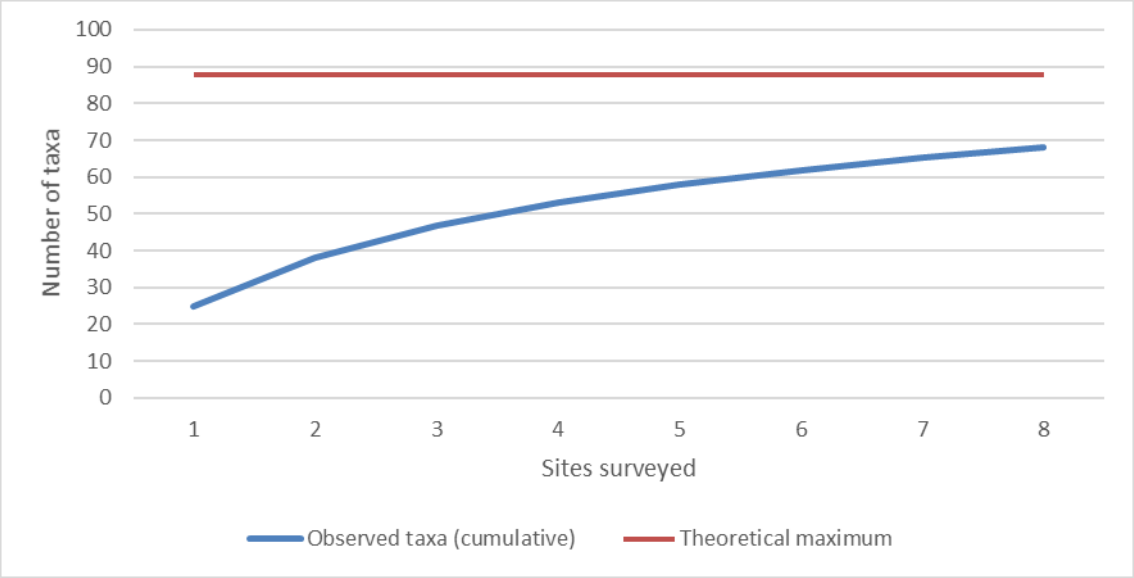

Figure 6: Averaged randomised species accumulation curve

Vegetation types

Two native vegetation types (VTs) were defined and mapped within the survey area (Appendix 5; Figure 7) and are summarised in Table 4. Areas containing vegetation in parkland cleared or highly degraded state have not been counted as unique native VTs but have been included in Table 4 for area calculation purposes.

The total area mapped within the survey area was 31.5 ha which includes fully cleared areas (Table 4). The dominant native VT within the survey area was VT 2 which can be broadly described as a woodland of *Banksia attenuata and Banksia menziesii* with emergent *Eucalyptus marginata*..

Table 4: Vegetation Types

Vegetation Type	Description	Area (ha)	Percentage of the Survey area
VT1	*Eucalyptus marginata, Corymbia calophylla* mid woodland over *Xanthorrhoea preissii* and *Macrozamia riedlei* sparse mid shrubland over *Hibbertia hypericoides* and *Mesomelaena pseudostygia* low shrubland.	11.77	37.38
VT2	*Eucalyptus marginata* open mid woodland over *Banksia attenuata*, *Banksia menziesii* and *Allocasuarina fraseriana* low woodland over *Jacksonia sternbergiana*, *Hibbertia hypericoides* and *Mesomelaena pseudostygia* open low to mid shrubland.	15.92	50.57
C	Cleared areas.	3.80	12.05
Total		**31.49**	**100**

Figure 7: Vegetation Types (VTs) mapped within the survey area

Scale 1:4,000 at A4

0 40 80 120 Metres

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 18/01/2018
Author: vdinh
Source: Nearmap: Aerial imagery - August 2017.
Path: Q:\Consult\2017\MPG\MPG17391\01_GIS_documents\ArcMap_documents\MPG17391_G007_RevBmxd.mxd

Legend

Survey area

VT2

Vegetation type

Cleared

VT1

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Vegetation condition

The survey area comprises both disturbed and undisturbed vegetation. Weed invasion is the principle evidence of disturbance with heavier infestations present at the survey area boundaries and have likely occurred due to edge effects. A number of tracks occur within the survey area which appear to be regularly used by vehicles. As such, vegetation condition within the survey area ranged from excellent to completely degraded (Keighery 1994; Figure 8; Table 5).

Table 6 gives a numerical breakdown of the area occupied by each vegetation condition rating within the survey area.

Table 5: Vegetation condition scale (Keighery 1994)

Condition rating	Description
Pristine (1)	Pristine or nearly so, no obvious sign of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	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 (4)	Vegetation structure significantly altered by 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, grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	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.

Table 6: Area (ha) covered by each vegetation condition category within the survey area

Vegetation Condition	Area (ha)	Percentage of the survey area
Excellent	5.65	17.94
Very Good - Excellent	11.42	36.26
Very Good	8.93	28.35
Good	0.35	1.11
Degraded	1.35	4.29
Completely Degraded	3.80	12.05
Grand Total	**31.49**	100

Figure 8: Vegetation Types (VTs) mapped within the survey area

Scale 1:4,000 at A4

0 40 80 120 Metres

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 18/01/2018
Author: vdinh
Source: Nearmap: Aerial imagery - August 2017.
Path: Q:\Consult\2017\MPG\MPG17391\01_GIS_documents\ArcMap_documents\MPG17391_G008_RevA.mxd

Legend

Survey area

Vegetation condition

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

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4.1.3 FCT similarity analysis

The results for the hierarchical clustering analysis show quadrats from both vegetation types fusing with FCT28 (Table 7). Site Q05 produced undetermined results which was likely due to the degraded nature and high density of weed species recorded.

The three nearest neighbours for each site using the Bray-Curtis distance are shown in Table 8, respectively. The nearest neighbour assignment for both vegetation types is consistent with the results from the hierarchical clustering analysis with both vegetation types showing affinities to FCT28.

Given the results of the analysis, one FCT (FCT28) was identified within the survey area. FCT28 can be described as *Spearwood Banksia attenuata or Banksia attenuata – Eucalyptus woodlands* (Gibson 1994).

Table 7: Results of hierarchical analysis for plots from the survey area

Site	VT	FCT First fusion	FCT of nearest main group fusion	Likely FCT
Q01	VT1	28	28	28
Q022	VT2	28	28	28
Q03	VT2	28	28	28
Q04	VT2	28	28	28
Q05	VT1	30a2	24	Undetermined – high density of weed species
Q06	VT2	28	28	28

Table 8: Results of Nearest Neighbour analysis using the Bray-Curtis dissimilarity coefficient

Site	VT	Nearest Neighbour (FCT)	2nd Nearest Neighbour (FCT)	3rd Nearest Neighbour (FCT)
Q01	VT1	Depot-1 (28)	Trig-3 (28)	Kero-2 (24)
Q02	VT2	Harry-5 (21a)	King-2 (28)	Depot-1 (28)
Q03	VT2	Wari-2 (28)	Neer-2 (28)	King-2 (28)
Q04	VT2	Depot-1 (28)	King-2 (28)	Harry-2 (28)
Q05	VT1	Depot-1 (28)	Neer-3 (28)	Trig-3 (28)
Q06	VT2	King-2 (28)	Wari-2 (28)	Low04 (21a)

Limitations are associated with determining and mapping the presence of FCTs within the survey area. Species richness (per quadrat) in the current survey was markedly lower than that recorded by Gibson *et al.* (1994). In addition, vegetation mapping requires the extrapolation of quadrat data to generalise vegetation communities and map 'like' vegetation over relatively small spatial scales. Significant groupings of quadrats and resultant delineation of vegetation communities are primarily determined *a-priori*. Comparing this type of data with that of Gibson *et al*. (1994), which contains accumulated species data over successive seasons within known vegetation communities across the Swan Coastal Plain, is problematic.

The degraded nature of parts of the survey area coupled with the broad nature of FCTs lead many vegetation types to characterise admixtures and transition zones between FCTs. In addition, the survey area was mapped based on extrapolated quadrat data from a single flora assessment, rather than accumulated species data over successive seasons within known vegetation community types as per Gibson *et al.* (1994). Consequently, assigned FCTs within the survey area are inferred and not absolute; i.e. a vegetation code assigned to an FCT is inferred to resemble floristic aspects of that FCT as defined by Gibson *et al.* (1994).

Threatened and Priority Ecological Communities

Site observations and quadrat data collected during the survey indicated that one TEC is potentially represented by vegetation types within the project area. This is:

* *Banksia woodlands of the Swan Coastal Plain* TEC potentially represented by VT2.

The TEC/PEC database search (DBCA 2017c) identified the entire project area as comprising *Banksia woodlands of the Swan Coastal Plain* TEC or the associated buffer. Vegetation within the study area was assessed against the key diagnostic criteria for the *Banksia woodlands of the Swan Coastal Plain* TEC (TSSC 2016). One vegetation type within the project area, VT2, was found to meet the diagnostic criteria provided in the approved conservation advice for the *Banksia woodlands of the Swan Coastal Plain* TEC (Table 9; Figure 9).

Table 9: Characteristics of the Banksia woodland within the survey area compared to the key diagnostic criteria as per TSSC (2016)

Key diagnostic criteria (TSSC 2016)	Banksia woodlands within the project area
Location: Occurs in the Swan Coastal Plain or Jarrah Forest IBRA bioregions.	Yes. Banksia woodlands within the project area occur on the Swan Coastal Plain.
Soils and landform: Occurs on: • well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands • sandy colluviums and aeolian sands of the Ridge Hill Shelf, Whicher Scarp and Dandaragan Plateau • transitional substrates and sandflats.	Yes. Banksia woodlands within the project area occur on Spearwood sands.
Structure: Low woodland to forest with: • a distinctive upper sclerophyllous layer of low trees (occasionally large shrubs more than 2 m tall), typically dominated or co-dominated by one or more of the banksia species identified below • emergent trees of medium or tall (>10 m) height. *Eucalyptus* or *Allocasuarina* species may sometimes be present above the banksia canopy • an often highly species-rich understorey.	Yes. VT2 represents a low woodland structure.
Composition: Contains at least one of the following species: • *Banksia attenuata* • *Banksia menziesii* • *Banksia prionotes* • *Banksia ilicifolia.*	Yes. VT2 contains *Banksia attenuata* and/or *Banksia menziesii*.
Condition (Keighery 1994): 'Pristine': no minimum patch size 'Excellent': 0.5 ha 'Very Good': 1 ha 'Good': 2 ha.	Yes. Banksia woodlands within the project area are in Degraded to Excellent condition. One patch of Banksia woodland in the project area comprises 8.90 ha in Degraded to excellent. Another patch in the eastern part of the project area comprises 7.13 ha of Banksia woodland very good to excellent condition. Both patches meet the criteria.

One ecological community, *Tuart woodlands and forests of the Swan Coastal Plain,* has the potential to occur given the landforms, soils and vegetation within the survey area. This community is currently under consideration for listing as a TEC under the EPBC Act. Given this, vegetation within the study area was assessed against the draft diagnostic criteria for the *Tuart woodlands and forests of the Swan Coastal Plain* (TSSC 2017). This assessment concluded the survey area was unlikely to contain the community as defined by the draft diagnostic criteria (Table 10).

Table 10: Characteristics of the *Tuart woodlands and forests of the Swan Coastal Plain* within the survey area compared to the draft key diagnostic criteria as per TSSC (2017)

Key diagnostic criteria (TSSC 2016)	Survey area
Location: Occurs in the Swan Coastal Plain Bioregion within the State of Western Australia	**Yes.** The survey area is located within the Swan Coastal Plain Bioregion.
Soils and landform: Can occur on: • Spearwood and Quindalup dune systems • Bassendean dunes and Pinjarra Plain • below the Darling and Whicher escarpments where they define a plateau to the east of the Swan Coastal Plain • banks of rivers and wetlands.	**Yes.** The survey area occurs on Spearwood dune systems
Structure: Often occurs as a woodland but can occur in a variety of structural forms, including closed forest, open forest, woodland, open woodland, closed mallee forest, open mallee forest, mallee woodland and open mallee woodland	**Yes**. Vegetation containing tuarts occurs as a woodland.
Composition: The dominant canopy species is tuart (Eucalyptus gomphocephala), being the most abundant tree species in the canopy.	**Potentially.** Established tuarts are the dominant or co-dominant canopy species in isolated areas within the vegetation
Condition (Keighery 1994): 'Pristine' to 'Excellent': 0.5 ha 'Very Good' to 'Good': 1 ha 'Degraded' but retain important habitat, regeneration or landscape features: 2 ha.	**Unlikely**. Vegetation containing established tuarts rages in condition from 'Good' to 'Very Good'. However both patch sizes are less than 1 ha in size and as such so not meet the draft criteria.

Figure 9: Extent of Banksia woodlands of the Swan Coastal Plain TEC within the survey area

Scale 1:4,000 at A4

0 40 80 120 Metres

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 18/01/2018
Author: vdinh
Source: Nearmap: Aerial imagery - August 2017.
Path: Q:\Consult\2017\MPG\MPG17391\01_GIS_documents\ArcMap_documents\MPG17391_G009_RevB.mxd

Legend

- Survey area
- Banksia woodland TEC

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4.2 Black cockatoo habitat

During the habitat assessment, no Black Cockatoos were observed in or flying over the Survey Area.

4.2.1 Potential Breeding Habitat

Three species of Eucalypts, Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*) and Tuart (*Eucalyptus gomphocephala*) recorded in the Survey Area are considered Black Cockatoo potential breeding habitat when their DBH are >500 mm. The Survey Area contains 125 potential breeding trees with a DBH > 500 mm - Marri (61), Jarrah (47) and Tuart (17). The dimensions and the locations of the potential breeding trees are displayed in Figure 10 and Appendix 6. There were very few observable hollows from the ground present in these trees and none had hollow entrances considered large enough.

4.2.2 Foraging Habitat

Within the Survey Area, 27.7 ha is considered foraging habitat (Figure 2). Foraging species in the Survey Area consist of *Banksia attenuata, Banksia menziesii. Allocasuarina fraseriana* and *Xanthorrhoea preissii,* Marri, Jarrah and Tuart and includes trees that are of various sizes, however, all are considered mature (i.e. had fruit or large enough to produce fruit). The same potential breeding trees (above) are also considered foraging species. Chewed Marri nuts with markings from FRTBC were observed throughout the site, particularly under Marri trees throughout the Survey Area.

4.2.3 Foraging Habitat Quality Score

The Draft Black Cockatoo foraging habitat scoring tool (DEE 2017f) was used to determine the quality of Black Cockatoo foraging habitat in the Survey Area. As per the scoring tool, the Survey Area has an overall score of 14 (Table 11). Only aspects of the table that are applicable to the Survey Area have been included. Consequently, none of the subtractions from the table have been included as none are relevant.

As previously stated, it is important to note that these guidelines are currently in draft form. As such, the foraging habitat quality score has the potential to be altered in the future, if the final guidelines change considerably.

While all three Black Cockatoo species were considered in the scoring, due to its location on the Swan Coastal Plain, it was focused mainly on Carnaby's Black Cockatoo and FRTBC (FRTBC foraging evidence in the form of chewed Marri nuts was recorded throughout the Survey Area [Plate 1]). However, it is important to note that although the Survey Area is on the edge of the known distribution of Baudin's Black Cockatoo, the species is highly mobile and as such has been included in the assessment.

Table 11: DEE Black Cockatoo foraging habitat scoring tool (DEE 2017f).

Starting Score	Foraging habitat for Carnaby's Cockatoo	Foraging habitat for Baudin's Cockatoo	Foraging habitat for FRTBC
7 (High quality)	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as Banksia spp. (including Dryandra spp.), Hakea spp. And Grevillea spp., as well as native eucalypt woodland and forest that contains foraging species, including roadsides.	Native eucalypt woodlands and forest and proteaceous woodland and heath, particularly Marri, including along roadsides.	Jarrah and Marri woodlands and forest and edges of Karri forests, including Wandoo and Blackbutt, within the range of the subspecies, including along roadsides.
Additions	Context adjustor – attributes improving functionality of foraging habitat.	Context adjustor – attributes improving functionality of foraging habitat.	Context adjustor – attributes improving functionality of foraging habitat.
+3	Is within the Swan Coastal Plain (important foraging area).		Jarrah and/or marri show good recruitment (i.e. evidence of young trees).
+2	Primarily contains Marri.	Primarily contains Marri.	Primarily contains Marri and/or jarrah.

Starting Score	Foraging habitat for Carnaby's Cockatoo	Foraging habitat for Baudin's Cockatoo	Foraging habitat for FRTBC
+2	Contains trees with potential to be used for breeding (DBH > 500 mm).	Contains trees with potential to be used for breeding (DBH > 500 mm).	Contains trees with potential to be used for breeding (DBH > 500 mm).

Plate 1: Evidence of foraging on marri nuts by FRTBC in the survey area

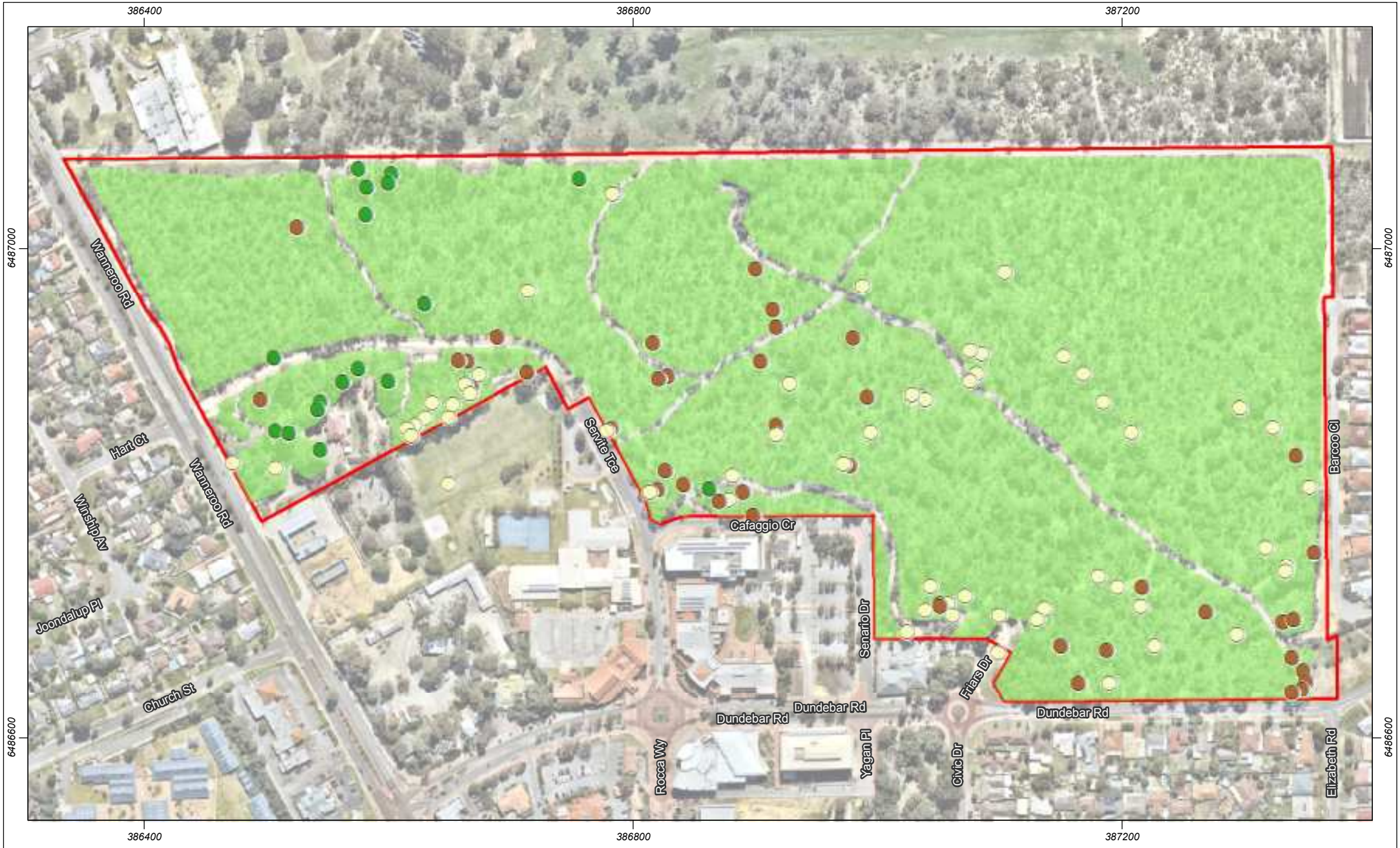

Figure 10: Black Cockatoo habitat and potential breeding trees

Scale 1:4,000 at A4

0 40 80 120 Metres

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 18/01/2018
Author: vdinh
Source: Nearmap: Aerial imagery - August 2017.
Path: Q:\Consult\2017\MPG\MPG17391\01_GIS_documents\ArcMap_documents\MPG17391_G010_RevB.mxd

Legend

Survey area

Black Cockatoo foraging habitat

High quality

Black cockatoo tree

Corymbia calophylla (Marri)

Eucalyptus gomphocephala (Tuart)

Eucalyptus marginata (Jarrah)

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5. Discussion

5.1 Flora and vegetation

The flora and vegetation assessment of the survey area was conducted during September 2017, which was prime flowering time for the majority of species within the region. The field survey focussed on traversing the entire survey area to delineate vegetation types and is consistent with the requirements of a detailed flora and vegetation survey as specified in *Technical Guidance: Flora and Vegetation surveys for Environmental Impact Assessment* (EPA 2016).

One broad-scale vegetation association falls within the survey area, Spearwood 6, of which 24.40% of its pre-European extent remains, as at the most recent assessment in 2016 (Government of Western Australia 2017a). The survey area occurs within the 'Karrakatta complex – central and south' vegetation complex of which 23.61 % of its pre-European extent remains within the Swan Coastal Plain bioregion (Government of Western Australia 2017b). Two native VTs were mapped within the survey area, as well as cleared areas. The survey area was dominated by woodland of *Banksia attenuata and Banksia menziesii* with emergent *Eucalyptus marginata*.

Statistical analyses of vegetation data from the survey area determined one broad FCT (FCT28), was present. FCT28 is included as one of the FCTs constituting the *Banksia woodlands of the Swan Coastal Plain* TEC, which is listed as Endangered under the EPBC Act. While both vegetation types aligned with FCT28, only vegetation comprising VT2 contained distinctive Banksia woodland and was considered to constitute the *Banksia woodlands of the Swan Coastal Plain* TEC (TSSC 2016), meeting all of the diagnostic characteristics of the TEC (Table 9). As such, areas mapped as VT2 should be considered to be part of the *Banksia woodlands of the Swan Coastal Plain* TEC.

Vegetation within the survey area was also assessed against the draft diagnostic criteria of the Tuart woodlands of the Swan Coastal Plain ecological community, current under consideration for listing as a TEC. The assessment showed vegetation within the survey area was unlikely to meet the draft criteria of the community and would not be considered to constitute the ecological community as currently described. Changes to the listing and criteria would require reassessment to confirm presence or absence of the ecological community.

Vegetation condition within the survey area ranged from Completely Degraded to Excellent (Keighery 1994), with the majority of vegetation (>70%) rated as Good – Very Good or better. Areas rated as Completely Degraded corresponded with cleared tracks and the residence fronting Wanneroo Road.

Sixty-nine native vascular plant taxa from 51 plant genera and 32 plant families as well as 15 exotic taxa were recorded within the survey area. No Declared Plant species pursuant to section 22 of the BAM Act were recorded within the survey area.

The following Threatened and Priority Flora species have the potential to occur within the survey area based on habitat requirements:

- *Caladenia huegelii* (T)
- *Drakaea micrantha* (T)
- *Thelymitra variegata* (P2)
- *Styphelia filifolia* (P3)
- *Jacksonia sericea* (P4).

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) were recorded within the survey area. Additionally, no Priority flora species as listed by Western Australian Herbarium (1998-), including those listed above, were recorded. *Jacksonia sericea* was previously recorded within the survey area from a single location. While not recorded during this survey, given it is a perennial species it is likely that is remains within the survey area. *Jacksonia sericea* is well represented both locally (25 records within 10km) and regionally within the Swan Coastal Plain bioregion (83 records). Given this, the population within the survey area is not considered significant in a local or regional context.

Of the remaining four conservation significant flora species with potential to occur in the survey area, three have flowering periods coinciding with the time of survey. The remaining species, *Styphelia filifolia*, is unlikely to have been flowering at the time of survey; however, it is a perennial species and would have been visible and identifiable if present. Given the above four conservation significant species would have been identifiable during the time of survey, and they were not recorded during this survey, it is unlikely that they occur within the survey area.

5.2 Black cockatoo habitat

During the Black Cockatoo habitat assessment, potential foraging and breeding habitat was identified in the Survey Area.

Black Cockatoos breed in large hollow-bearing trees, generally within woodlands or forests (Johnstone et al. 2013). The size of the tree can be a useful indication of the hollow-bearing potential of the tree. Trees of suitable DBH are potentially important for maintaining breeding in the long-term, through maintaining the integrity of the habitat and allowing trees to provide future nest hollows. Maintaining the long-term supply of trees of a size to provide suitable nest hollows is particularly important in woodland stands that are known to support Black Cockatoo breeding (DSEWPaC 2012).

The Black Cockatoo habitat assessment revealed that the Survey Area contains Marri, Jarrah and Tuart trees which have reached a size that are potential future hollow bearing trees, therefore potential breeding trees (i.e. >500 mm) according to the EPBC Act Black Cockatoo draft revised referral guideline.

In total, 125 trees were recorded which met the criteria to be classed as a potential breeding tree. This suggests that these trees may develop hollows and have the potential to be use for breeding in the future. To be suitable for Black Cockatoos, the hollow entrances need to be greater than 120 mm diameter. None of these potential breeding trees contained any observable hollows from the ground which would be considered suitable for nesting.

There were other Marri, Jarrah and Tuart trees in the Survey Area, however they all had a DBH of < 500 mm and therefore are not considered as potential breeding trees. These trees, however, are all considered to be foraging habitat. The Survey Area also contained other known foraging species including *Banksia attenuata, Banksia menziesii Allocasuarina fraseriana* and *Xanthorrhoea preissii.*

All three Black Cockatoo species leave unique feeding patterns on Marri nuts as they extract the seeds. Each species has a different style – from the inelegant “chomp-chomp” style of the FRTBC and Carnaby’s Cockatoo to the delicate style of the Baudin’s Cockatoo which use their long upper beak to extract the Marri seeds (WAM 2013).

Evidence of FRTBC foraging was recorded throughout the Survey Area, with many chewed Marri nuts observed.

The DEE foraging habitat scoring tool was used to determine the quality of the habitat. Again, it is important to note that these guidelines are currently in draft form. As such, the foraging habitat quality score has the potential to be altered in the future, if the final guidelines change considerably.

The Survey Area was given a quality score of 14, which is high quality foraging habitat. Foraging habitat with a score of seven or above is considered high quality and is important for the log-term survival of Black Cockatoos. This score was attributed to the Survey Area because it contained both potential breeding habitat, including Marri, Jarrah and Tuart (which are also considered foraging habitat), as well as other foraging species including Banksia attenuata, Allocasuarina fraseriana and Xanthorrhoea preissii.

The Survey Area was also scored on its proximity to other elements such as roosting and water points. There are numerous Black Cockatoo roosting locations within a 12 km radius of the Survey Area. The Survey Area is also located approximately 1 km from Lake Joondalup, 2 km from Lake Mariginiup, 3 km from Lake Jandabup and 8 km from Lake Gnangara, all of which are important wetlands in the East Wanneroo area, particularly for Carnaby's Black Cockatoo and FRTBC (Johnstone & Kirkby 2011).

6. Conclusion

One FCTs encompassing two native vegetation types, were recorded within the survey area. The entire survey area comprised conservation significant vegetation, as follows:

* one TEC, *Banksia Woodlands of the Swan Coastal Plain*, as listed under the EPBC Act.

Two Threatened flora and three Priority flora species have the potential to be present within the survey area. None of these species were observed during the September 2017 survey.

Within the survey area, 125 potential breeding trees were recorded; however, none were considered suitable for nesting as no hollows were observed to be of suitable size. The entire survey area contains high quality foraging habitat.

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Appendix 1
Conservation significant flora and ecological community definitions

Conservation Codes for Western Australian Flora and Fauna (Parks and Wildlife 2017)

Specially protected fauna or flora are species which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such.

Categories of specially protected fauna and flora are:

T **Threatened species**

Published as Specially Protected under the Wildlife Conservation Act 1950, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

Threatened fauna is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the Wildlife Conservation Act.

Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the Wildlife Conservation Act.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR **Critically endangered species**

Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

EN **Endangered species**

Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

VU **Vulnerable species**

Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

EX **Presumed extinct species**

Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.

IA **Migratory birds protected under an international agreement**

Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.

CD **Conservation dependent fauna**

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice.

OS **Other specially protected fauna**

Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Priority Flora and Fauna

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1 **Priority 1: Poorly-known species**

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2 **Priority 2: Poorly-known species**

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

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

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

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

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

Definition of Threatened Ecological Communities (DEC 2013)

A threatened ecological community(TEC) is one which is found to fit into one of the following categories; “presumed totally destroyed”, “critically endangered”, “endangered” or “vulnerable”.

Presumed Totally Destroyed (PD)

An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):

A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats, or

B) All occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply:

* geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years)
* modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply:

* geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years)
* there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
* there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply:

* the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years)
* modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and one or more of the following apply"

* geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years)
* there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes
* there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium (within approximately 50 years) to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definition of Priority Ecological Communities (DEC 2013)

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly-known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

- Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation
- communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat
- communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

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. These communities require regular monitoring. These include:

a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

c) Ecological communities that have been removed from the list of threatened communities during the past five years.

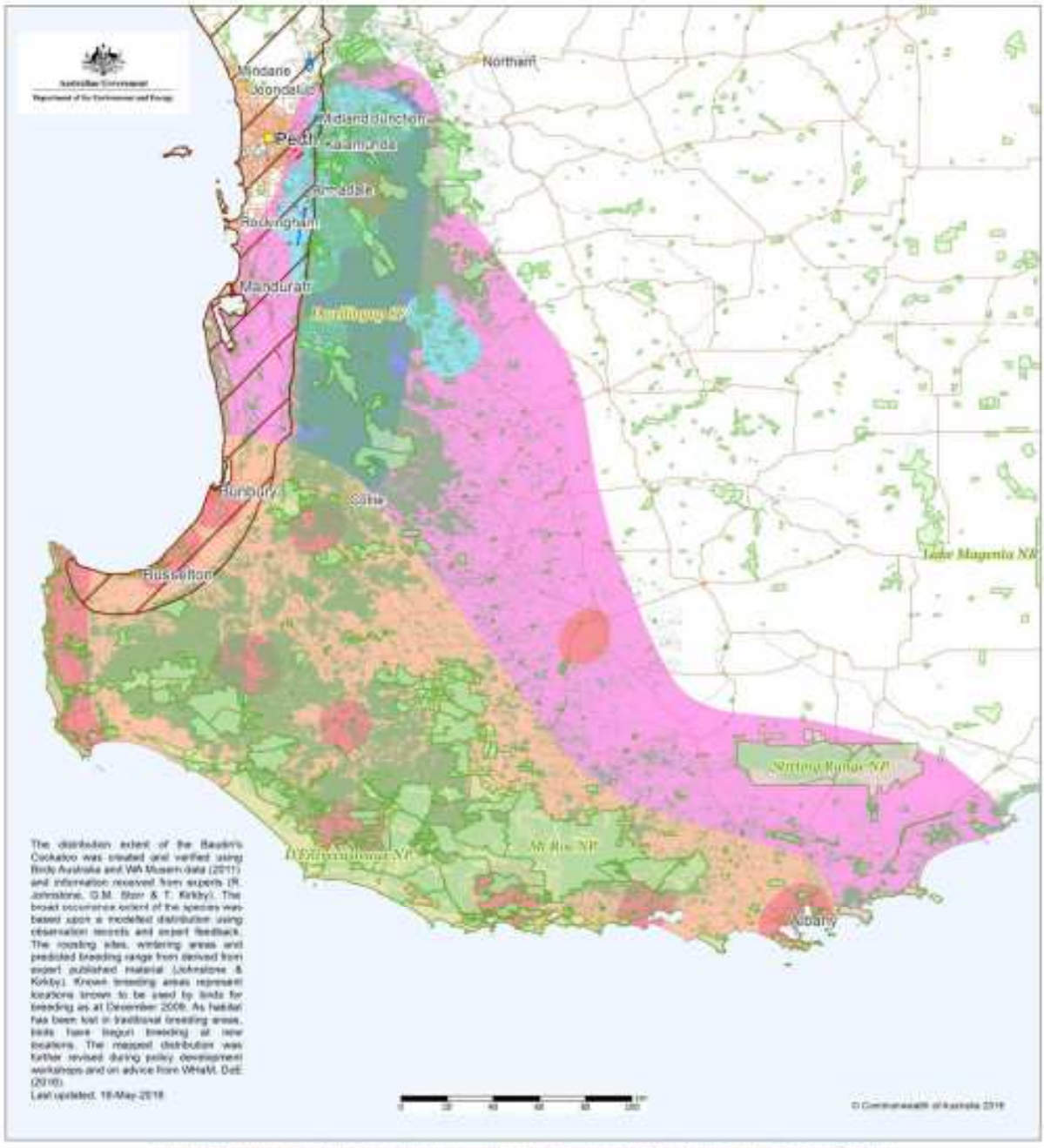
Priority Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

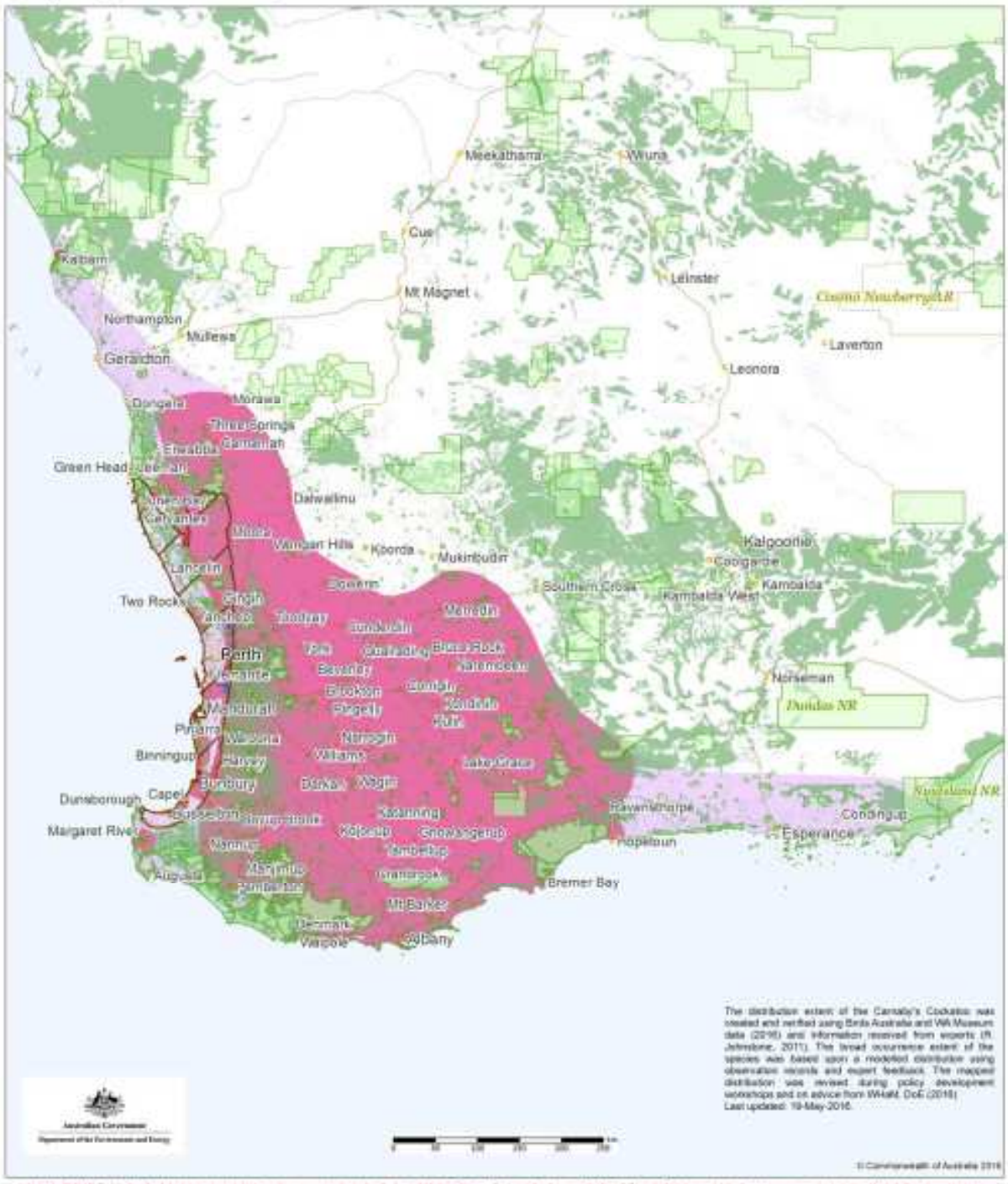
Appendix 2
Black Cockatoo distribution maps

Appendix A – Distribution maps for the three black cockatoos

Map 2: Modelled distribution for Baudin's Cockatoo
(*Calyptorhynchus baudinii*)



Map 3: Modelled distribution for Carnaby's Cockatoo
(*Calyptorhynchus latirostris*)



The distribution extent of the Carnaby's Cockatoo was created and verified using Birds Australia and WA Museum data (2016) and information received from experts (R. Johnstone, 2011). The broad occurrence extent of the species was based upon a modelled distribution using observation records and expert feedback. The mapped distribution was revised during policy development workshops and on advice from WAM, DoE (2016).
Last updated: 19-May-2016.

INDICATIVE MAP ONLY. For the latest departmental information, please refer to the Protected Matters Search Tool and the Species Profiles & Threats Database at http://www.environment.gov.au/biodiversity/threatened/index.html

Produced by:
Environmental Resources Information Network 2016

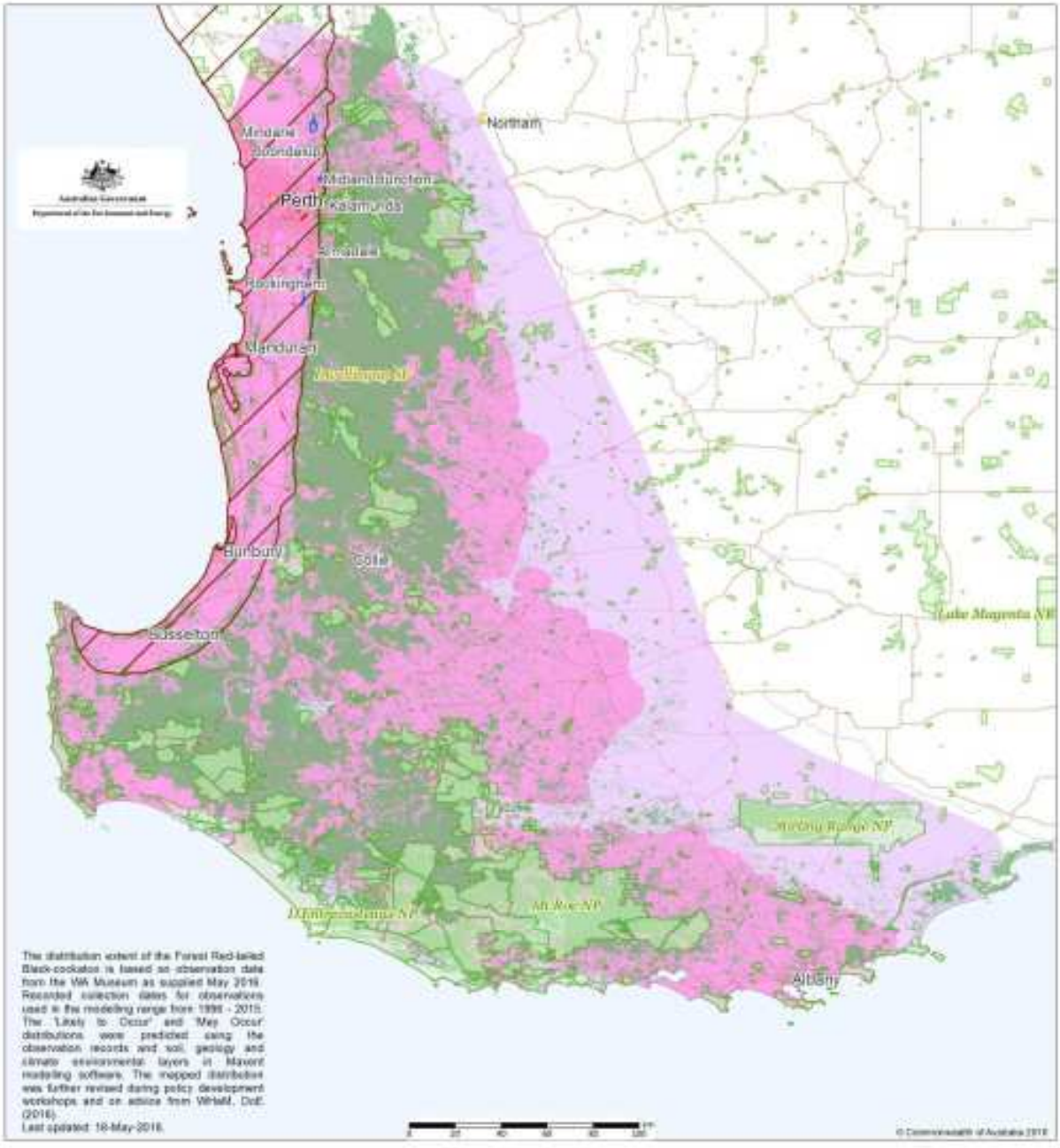
Contextual data source:
National Vegetation Information System (NVIS 4.2) 2016
Interim Biogeographic Regionalisation for Australia (IBRA) version 7 2012
Collaborative Australian Protected Area Database (CAPAD) 2014
Geoscience Australia GEODATA TOPO 250K Topographic Data Series 3 2006

Projection: Geographic
Datum: GDA94

Conservation Areas
Species
Breeding Range
Non-breeding Range
Ecological Communities

Cities & Towns
Roads (sealed)
Roads (unsealed)
State Border
Major Rivers
Lakes/Reservoirs
Non-perennial Lakes

Map 4: Modelled distribution for Forest Red-tailed Black-Cockatoo
(*Calyptorhynchus banksii naso*)



Appendix 3
Desktop assessment results (Parks and Wildlife 2007-, DEE 2017c)

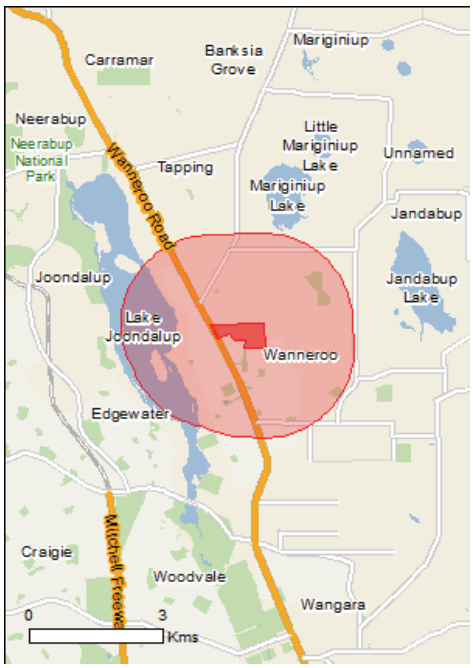
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

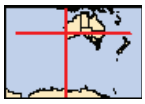
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 22/08/17 15:14:20



Coordinates
Buffer: 2.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	17
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	34
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Anigozanthos viridis subsp. terraspectans Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat may occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pandion haliaetus		
Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris ruficollis		
Red-necked Stint [860]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Lake Joondalup	WA

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Joondalup Lake	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-31.746149 115.800048,-31.746149 115.800048,-31.746149 115.800048,-31.745906 115.810818,-31.750268 115.811022,-31.750198 115.806935,-31.748895 115.806996,-31.74893 115.804932,-31.747765 115.804094,-31.748634 115.801519,-31.748061 115.801111,-31.746149 115.800048

Acknowledgements

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-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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NatureMap Species Report

Created By Guest user on 22/08/2017

Kingdom Plantae
Conservation Status Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 48' 22" E,31° 44' 51" S
Buffer 3km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	3237	*Acacia benthamii*		P2	
2.	34161	*Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)*		P1	
3.	1425	*Conostylis bracteata*		P3	
4.	4027	*Jacksonia sericea (Waldjumi)*		P4	
5.	5237	*Pimelea calcicola*		P3	
6.	48297	*Styphelia filifolia*		P3	
7.	35581	*Tetraria sp. Chandala (G.J. Keighery 17055)*		P2	
8.	1717	*Thelymitra variegata (Queen of Sheba)*		P2	

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix 4
Vascular plant taxa recorded within the survey area

Family	Taxa
Amaranthaceae	*Ptilotus manglesii*
	Ptilotus polystachyus
Anarthriaceae	*Anarthria gracilis*
Araliaceae	*Trachymene pilosa*
Asparagaceae	*Chamaescilla corymbosa* var. *corymbosa*
	Lomandra caespitosa
	Sowerbaea laxiflora
Asteraceae	**Arctotheca calendula*
	**Hypochaeris glabra*
	**Sonchus oleraceus*
	**Ursinia anthemoides*
	**Conyza bonariensis*
	Asteraceae sp.
	Lagenophora huegelii
Brassicaceae	*Brassicaceae* sp.
Campanulaceae	*Lobelia tenuior*
Casuarinaceae	*Allocasuarina fraseriana*
Celastraceae	*Tripterococcus brunonis*
Colchicaceae	*Burchardia congesta*
Cupressaceae	*Callitris preissii*
Cyperaceae	*Lepidosperma leptostachyum*
	Mesomelaena pseudostygia
Dasypogonaceae	*Calectasia grandiflora*
Dilleniaceae	*Hibbertia commutata*
	Hibbertia huegelii
	Hibbertia hypericoides
Droseraceae	*Drosera erythrorhiza*
	Drosera macrantha
Ericaceae	*Leucopogon propinquus*
Fabaceae	*Acacia applanata*
	Bossiaea eriocarpa
	Bossiaea ornata
	Daviesia triflora
	Fabaceae sp.
	Gompholobium tomentosum
	Hardenbergia comptoniana
	Jacksonia sternbergiana
	Kennedia coccinea
Goodeniaceae	*Scaevola repens*
Haemodoraceae	*Anigozanthos manglesii*
	Conostylis setigera subsp. *Setigera*
	Haemodoraceae sp.
	Haemodorum laxum

Family	Taxa
	Haemodorum sp.
Hemerocallidaceae	*Corynotheca micrantha*
	Dianella revoluta
	Tricoryne elatior
Iridaceae	**Gladiolus caryophyllaceus*
	**Romulea rosea*
	Orthrosanthus laxus var. *laxus*
Loranthaceae	*Amyema miquelii*
Myrtaceae	*Corymbia calophylla*
	Eucalyptus gomphocephala
	Eucalyptus marginata
	Hypocalymma angustifolium
Orchidaceae	*Caladenia arenicola*
	Caladenia flava
	Caladenia sp.
	Cyanicula gemmata
	Diuris sp.
	Pyrorchis nigricans
Oxalidaceae	**Oxalis pes-caprae*
Phyllanthaceae	*Phyllanthus calycinus*
Poaceae	**Avena barbata*
	**Briza maxima*
	**Briza minor*
	**Cenchrus clandestinus*
	**Ehrharta calycina*
	Poaceae sp.
Primulaceae	**Lysimachia arvensis*
Proteaceae	*Banksia attenuata*
	Banksia dallanneyi
	Banksia menziesii
	Petrophile linearis
	Stirlingia latifolia
Restionaceae	*Alexgeorgea nitens*
	Desmocladus fasciculatus
	Desmocladus flexuosus
Rutaceae	*Philotheca spicata*
Solanaceae	**Solanum nigrum*
Stylidiaceae	*Stylidium piliferum*
Xanthorrhoeaceae	*Xanthorrhoea gracilis*
	Xanthorrhoea preissii
Zamiaceae	*Macrozamia riedlei*

Appendix 5
Raw quadrat data

Q01

GPS Co-ordinate 50H 387095mE; 6486792mN

Landform	Undulating plain
Slope	Mid-slope
Aspect	west
Soils	Grey white sand
Coarse surface particles	N/A
Ground Cover (%)	Bare soil 1%
	Litter 40%
Condition	Very good to excellent
Fire age	3-5 years
Disturbance	weeds
Vegetation	*Eucalyptus marginata* and *Corymbia calophylla* mid woodland over *Xanthorrhoea preissii* and *Macrozamia riedlei* sparse mid shrubland over *Hibbertia hypericoides* and *Mesomelaena pseudostygia* low shrubland.

Species List

Taxon	Height (cm)	Cover (%)
Bossiaea eriocarpa	20	1
**Briza minor*	10	0.3
Burchardia congesta	40	1
**Cenchrus clandestinus*	10	0.5
Conostylis setigera subsp. *setigera*	20	1
Corymbia calophylla	20	50
Desmocladus flexuosus	15	2
Diuris sp.	20	0.2
**Ehrharta calycina*	60	30
Eucalyptus marginata	20	3
**Gladiolus caryophyllaceus*	30	0.1
Gompholobium tomentosum	10	+
Haemodorum sp.	30	0.1
Hardenbergia comptoniana	-	3
Hibbertia hypericoides	40	10
**Hypochaeris glabra*	-	0.5
Jacksonia sternbergiana	30	+
Lepidosperma leptostachyum	20	0.1
Leucopogon propinquus	20	0.5

Q01		
Lomandra caespitosa	15	+
**Lysimachia arvensis*	5	0.1
Macrozamia riedlei	150	5
Mesomelaena pseudostygia	30	5
Phyllanthus calycinus	20	0.2
Poaceae sp.	10	5
**Solanum nigrum*	60	0.3
**Sonchus oleraceus*	20	+
Trachymene pilosa	5	+
Tripterococcus brunonis	40	+
Xanthorrhoea gracilis	100	0.5
Xanthorrhoea preissii	150	2

Q02

GPS Co-ordinate	50H 387234mE; 6486876mN

Landform	Undulating plain
Slope	Upper-slope
Aspect	North-west
Soils	Grey white sand
Coarse surface particles	N/A
Ground Cover (%)	Bare soil 20%
	Litter 10%
Condition	Very good
Fire age	3-5 years
Disturbance	weeds
Vegetation	*Eucalyptus marginata* open mid woodland over *Banksia attenuata*, *Banksia menziesii* and *Allocasuarina fraseriana* low woodland over *Jacksonia sternbergiana*, *Hibbertia hypericoides* and *Mesomelaena pseudostygia* open low to mid shrubland.

Species List

Taxon	Height (cm)	Cover (%)
Allocasuarina fraseriana	700	4
Anarthria gracilis		0.2
Anigozanthos manglesii	40	0.2
**Arctotheca calendula*	20	0.1
Banksia attenuata	800	10
Bossiaea ornata		+
**Briza maxima*	10	0.5
**Briza minor*		1
Burchardia congesta	30	0.5
Caladenia flava		+
Chamaescilla corymbosa var. *corymbosa*	20	0.1
Conostylis setigera subsp. *Setigera*		0.2
Cyanicula gemmata		+
Desmocladus flexuosus	10	1.5
Diuris sp.	40	+
**Ehrharta calycina*	50	2
**Gladiolus caryophyllaceus*	60	1
Gompholobium tomentosum		+
Haemodoraceae sp.		+
Haemodorum sp.	60	0.5

Q02		
Hardenbergia comptoniana		0.1
Hibbertia hypericoides	50	15
Hypocalymma angustifolium	60	1
**Hypochaeris glabra*		2
Jacksonia sternbergiana	180	2
Lagenophora huegelii		+
Lepidosperma leptostachyum	30	+
Leucopogon propinquus	20	0.2
Lobelia tenuior	20	2
Lomandra caespitosa		+
Macrozamia riedlei	100	4
Mesomelaena pseudostygia	40	3
Petrophile linearis	4	2
Phyllanthus calycinus	20	+
Poaceae sp.	20	1
Pyrorchis nigricans		0.1
Scaevola repens	10	0.6
Sowerbaea laxiflora	20	+
Stirlingia latifolia	50	0.1
Stylidium piliferum		+
Trachymene pilosa	10	0.3
**Ursinia anthemoides*	10	2
Xanthorrhoea preissii	150	2

Q03

GPS Co-ordinate	50H 387309mE; 6487022mN

Landform	Undulating plain
Slope	Flat
Aspect	N/A
Soils	Grey white sand
Coarse surface particles	N/A
Ground Cover (%)	Bare soil 2% Litter 30%
Condition	Very good to excellent
Fire age	3-5 years
Disturbance	weeds
Vegetation	*Eucalyptus marginata* open mid woodland over *Banksia attenuata*, *Banksia menziesii* and *Allocasuarina fraseriana* low woodland over *Jacksonia sternbergiana*, *Hibbertia hypericoides* and *Mesomelaena pseudostygia* open low to mid shrubland.

Species List

Taxon	Height (cm)	Cover (%)
Alexgeorgea nitens		0.3
Allocasuarina fraseriana		3
**Arctotheca calendula*		0.2
Banksia attenuata		4
Banksia menziesii		4
**Briza maxima*		1.5
Burchardia congesta		1
Caladenia arenicola		+
Caladenia flava		+
Caladenia sp.		+
Conostylis setigera subsp. *setigera*		1
**Conyza bonariensis*		+
Corynotheca micrantha		+
Cyanicula gemmata		+
Daviesia triflora		1
Desmocladus fasciculatus		+
Desmocladus flexuosus		1.5
Fabaceae sp.		0.1
**Gladiolus caryophyllaceus*		0.1
Haemodorum laxum		+

Q03	
Hardenbergia comptoniana	0.1
Hibbertia huegelii	0.3
Hibbertia hypericoides	25
Hypocalymma angustifolium	1
**Hypochaeris glabra*	2
Lagenophora huegelii	0.3
Lepidosperma leptostachyum	+
Lobelia tenuior	0.3
Lomandra caespitosa	0.1
Mesomelaena pseudostygia	10
Poaceae sp.	2
Ptilotus manglesii	+
Sowerbaea laxiflora	+
Stirlingia latifolia	3
**Ursinia anthemoides*	2
Xanthorrhoea preissii	1

Q04

GPS Co-ordinate	50H 386483mE; 6486988mN

Landform	Undulating plain
Slope	Mid-slope
Aspect	North west
Soils	Grey white sand
Coarse surface particles	N/A
Ground Cover (%)	Bare soil 15%
	Litter 10%
Condition	Very good to excellent
Fire age	> 5 years
Disturbance	weeds
Vegetation	*Eucalyptus marginata* open mid woodland over *Banksia attenuata*, *Banksia menziesii* and *Allocasuarina fraseriana* low woodland over *Jacksonia sternbergiana*, *Hibbertia hypericoides* and *Mesomelaena pseudostygia* open low to mid shrubland.

Species List

Taxon	Height (cm)	Cover (%)
Alexgeorgea nitens	10	+
Allocasuarina fraseriana	1000	3
Amyema miquelii		0.5
Asteraceae sp.		0.2
Banksia attenuata	800	8
Banksia menziesii	800	5
**Briza maxima*	30	5
Burchardia congesta	40	1
Chamaescilla corymbosa var. *corymbosa*	20	0.5
Conostylis setigera subsp. *setigera*	20	0.2
Desmocladus flexuosus	10	1.5
Drosera erythrorhiza		0.2
Drosera macrantha		+
Eucalyptus marginata	1500	5
**Gladiolus caryophyllaceus*	30	0.3
Gompholobium tomentosum	10	0.1
Haemodorum sp.	60	0.1
Hardenbergia comptoniana		0.1
Hibbertia hypericoides	60	15
Hypocalymma angustifolium	50	0.5

Q04		
**Hypochaeris glabra*		0.5
Mesomelaena pseudostygia	50	15
**Oxalis pes-caprae*	20	0.1
Petrophile linearis	40	0.1
Ptilotus polystachyus	60	1
**Romulea rosea*	20	1
Scaevola repens	20	0.6
**Sonchus oleraceus*		+
Trachymene pilosa		+
Tripterococcus brunonis	10	0.1
**Ursinia anthemoides*	10	0.5

Q05

GPS Co-ordinate	50H 386937mE; 6487051mN

Landform	Undulating plain
Slope	Undulating
Aspect	N/A
Soils	Grey white sand
Coarse surface particles	N/A
Ground Cover (%)	Bare soil 0%
	Litter 40%
Condition	Good to very good
Fire age	2-3 years
Disturbance	weeds
Vegetation	*Eucalyptus marginata* and *Corymbia calophylla* mid woodland over *Xanthorrhoea preissii* and *Macrozamia riedlei* sparse mid shrubland over *Hibbertia hypericoides* and *Mesomelaena pseudostygia* low shrubland.

Species List

Taxon	Height (cm)	Cover (%)
**Avena barbata*	30	15
**Briza maxima*	20	3
**Conyza bonariensis*	30	+
Corymbia calophylla	1600	13
Desmocladus flexuosus		1
**Ehrharta calycina*	60	10
Eucalyptus marginata	1800	7
Haemodorum sp.	60	0.3
Hardenbergia comptoniana		0.5
**Hypochaeris glabra*		1
Leucopogon propinquus	30	0.2
Macrozamia riedlei	180	5
Mesomelaena pseudostygia	50	10
Phyllanthus calycinus	60	0.2
**Sonchus oleraceus*		0.2
Trachymene pilosa		0.2
**Ursinia anthemoides*	10	0.1
Xanthorrhoea preissii	160	20

Q06

GPS Co-ordinate	50H 387258mE; 6486693mN

Landform	Undulating plain
Slope	Undulating
Aspect	N/A
Soils	Grey white sand
Coarse surface particles	N/A
Ground Cover (%)	Bare soil 10%
	Litter 10%
Condition	Very good to excellent
Fire age	3 to 5 years
Disturbance	weeds
Vegetation	*Eucalyptus marginata* open mid woodland over *Banksia attenuata*, *Banksia menziesii* and *Allocasuarina fraseriana* low woodland over *Jacksonia sternbergiana*, *Hibbertia hypericoides* and *Mesomelaena pseudostygia* open low to mid shrubland.

Species List

Taxon	Height (cm)	Cover (%)
Acacia applanata		0.2
Allocasuarina fraseriana		2
Anigozanthos manglesii		0.3
Banksia attenuata	800	15
Banksia dallanneyi		0.5
Bossiaea eriocarpa		0.5
Brassicaceae sp.		+
**Briza maxima*		5
Burchardia congesta		0.2
Calectasia grandiflora		0.2
Conostylis setigera subsp. *setigera*		1.2
Corymbia calophylla	1200	3
Daviesia triflora		0.5
Desmocladus flexuosus		0.5
Dianella revoluta		0.1
Drosera erythrorhiza		0.2
Eucalyptus marginata	1500	2
**Gladiolus caryophyllaceus*		0.3
Gompholobium tomentosum		0.2
Haemodorum laxum		0.2

Q06	
Haemodorum sp.	0.5
Hibbertia huegelii	0.1
Hibbertia hypericoides	5
Hypocalymma angustifolium	+
**Hypochaeris glabra*	1
Jacksonia sternbergiana	3
Kennedia coccinea	1.5
Lepidosperma leptostachyum	0.5
Lomandra caespitosa	0.2
Macrozamia riedlei	4
Orthrosanthus laxus var. *laxus*	0.2
Petrophile linearis	0.2
Philotheca spicata	0.1
Poaceae sp.	0.3
Ptilotus manglesii	0.1
Pyrorchis nigricans	0.1
Sowerbaea laxiflora	+
Stirlingia latifolia	5
Stylidium piliferum	0.1
Tricoryne elatior	0.3
**Ursinia anthemoides*	0.5
Xanthorrhoea preissii	4

R01

GPS Co-ordinate	50H 386693mE; 6486995mN

Landform	Undulating plain
Slope	Undulating
Aspect	N/A
Soils	Grey white sand
Coarse surface particles	N/A
Ground Cover (%)	Bare soil 2%
	Litter 15%
Condition	Very good
Fire age	1 to 2 years
Disturbance	weeds; fire
Vegetation	*Eucalyptus marginata* open mid woodland over *Banksia attenuata*, *Banksia menziesii* and *Allocasuarina fraseriana* low woodland over *Jacksonia sternbergiana*, *Hibbertia hypericoides* and *Mesomelaena pseudostygia* open low to mid shrubland.

Species List

Taxon	Height (cm)	Cover (%)
Allocasuarina fraseriana		2
**Arctotheca calendula*		0.1
Banksia attenuata		3
**Briza maxima*		2
Burchardia congesta		1
Callitris preissii		1
Corymbia calophylla		8
Desmocladus flexuosus		2
Eucalyptus marginata		5
**Gladiolus caryophyllaceus*		0.1
Haemodorum laxum		0.1
Haemodorum sp.		0.1
Hibbertia commutata		15
Hypocalymma angustifolium		0.5
**Hypochaeris glabra*		0.5
Macrozamia riedlei		5
Mesomelaena pseudostygia		1
**Sonchus oleraceus*		0.1
Tripterococcus brunonis		0.1
Xanthorrhoea preissii		8

R02

GPS Co-ordinate	50H 387068mE; 6486948mN

Landform	Undulating plain
Slope	Undulating
Aspect	N/A
Soils	Grey white sand
Coarse surface particles	N/A
Ground Cover (%)	Bare soil 40%
	Litter 10%
Condition	Very good
Fire age	2 to 3 years
Disturbance	weeds
Vegetation	*Eucalyptus marginata* and *Corymbia calophylla* mid woodland over *Xanthorrhoea preissii* and *Macrozamia riedlei* sparse mid shrubland over *Hibbertia hypericoides* and *Mesomelaena pseudostygia* low shrubland.

Species List

Taxon	Height (cm)	Cover (%)
Anigozanthos manglesii		+
Banksia attenuata		2
**Briza maxima*		2
Burchardia congesta		0.5
Caladenia flava		+
Caladenia sp.		+
Corymbia calophylla		12
Cyanicula gemmata		+
Drosera erythrorhiza		+
**Ehrharta calycina*		3
Eucalyptus marginata		8
**Gladiolus caryophyllaceus*		0.1
Haemodorum sp.		0.1
Hibbertia huegelii		0.3
Hibbertia hypericoides		10
Hypocalymma angustifolium		0.2
**Hypochaeris glabra*		5
Jacksonia sternbergiana		1
Leucopogon propinquus		0.3

R02	
Macrozamia riedlei	7
Mesomelaena pseudostygia	5
Poaceae sp.	1.5
**Solanum nigrum*	0.1
Stirlingia latifolia	2
Stylidium piliferum	+
Trachymene pilosa	0.2

Appendix 6
Black Cockatoo habitat tree locations

Tree No.	Species	DBH	Easting	Northing	Comments
1	Jarrah	54	386977	6486823	Forks at 3m
2	Marri	77	386972	6486824	
3	Marri	55	386994	6486850	Forks at 6m
4	Jarrah	77	386991	6486879	Forks at 1.5m
5	Marri	56	387027	6486880	Forks at 4m
6	Marri	70	387036	6486879	
7	Jarrah	98	386980	6486927	Forks at 3m
8	Marri	50	386987	6486970	
9	Jarrah	80	386998	6486043	Forks at 3m
10	Jarrah	62	386971	6486044	Forks at 4m
11	Jarrah	90	386921	6486002	
12	Jarrah	93	386900	6486984	Forks at 3m
13	Jarrah	70	386914	6486950	Forks at 4m
14	Jarrah	73	386917	6486936	
15	Jarrah	57	386904	6486908	Forks at 3m
16	Marri	54	386928	6486890	
17	Jarrah	74	386917	6486856	
18	Marri	65	386917	6486848	
19	Jarrah	52	386898	6486782	Forks at 5m
20	Jarrah	63	386890	6486801	Forks at 3m
21	Marri	60	386881	6486815	
22	Marri	54	386878	6486795	
23	Tuart	127	386862	6486804	
24	Jarrah	80	386870	6486794	Bees
25	Jarrah	56	386841	6486807	
26	Jarrah	73	386820	6486803	Forks at 2m
27	Marri	56	386813	6486801	
28	Jarrah	89	386826	6486819	Forks at 4m
29	Jarrah	99	386782	6486853	Forks at 2m
30	Marri	58	386778	6486851	Forks at 5m
31	Jarrah	60	386828	6486896	Forks at 2m
32	Jarrah	57	386821	6486894	Forks at 2m
33	Jarrah	90	386816	6486923	Forks at 2m
34	Jarrah	54	386785	6487045	Forks at 2m &5m
35	Marri	60	386783	6487045	
36	Tuart	62	386756	6487057	
37	Marri	51	386714	6486966	
38	Jarrah	63	386688	6486928	Forks at 4m
39	Jarrah	72	386713	6486899	A few small hollows
40	Marri	55	386674	6486897	Forks at 3m
41	Jarrah	70	386664	6486908	
42	Jarrah	100	386657	6486909	
43	Marri	78	386669	6486086	Forks at 4m

Tree No.	Species	DBH	Easting	Northing	Comments
44	Jarrah	82	386668	6486887	Forks at 3m
45	Marri	56	386662	6486889	
46	Marri	54	386666	6486882	
47	Marri	75	386652	6486873	Forks at 8m
48	Marri	106	386649	6486862	
49	Marri	60	386649	6486808	
50	Marri	64	386635	6486874	
51	Marri	90	386630	6486862	
52	Marri	70	386621	6486855	
53	Marri	57	386621	6486856	Forks at 3m
54	Marri	67	386615	6486853	Forks at 5m
55	Marri	56	386618	6486847	
56	Tuart	162	386599	6486892	
57	Tuart	107	386575	6486902	
58	Tuart	92	386562	6486891	
59	Tuart	90	386544	6486875	
60	Tuart	120	386507	6486851	
61	Marri	65	386507	6486821	
62	Marri	57	386472	6486825	
63	Jarrah	127	386495	6486877	Forks at 1m
64	Tuart	128	386506	6486911	Forks at 2m
65	Jarrah	110	386525	6487018	Bees in hollow
66	Tuart	87	386575	6487065	
67	Tuart	106	386602	6487061	
68	Tuart	62	386582	6487050	Forks at 5m
69	Tuart	90	386581	6487028	Forks at 2m
70	Tuart	69	386599	6487054	
71	Tuart	58	386629	6486955	
72	Jarrah	61	386689	6486928	
73	Marri	52	387024	6486687	
74	Marri	62	387039	6486704	
75	Marri	87	387043	6486724	Forks at 6m
76	Jarrah	54	387051	6486710	Forks at 3m
77	Marri	62	387057	6486710	Forks at 5m
78	Marri	55	387061	6486700	Forks at 5m
79	Jarrah	52	387051	6486708	Forks at 6m
80	Marri	60	387071	6486716	Forks at 6m
81	Marri	60	387099	6486700	
82	Marri	51	387136	6486706	Forks at 4m
83	Jarrah	52	387150	6486675	
84	Jarrah	58	387164	6486645	Forks at 7m
85	Marri	52	387189	6486645	
86	Jarrah	64	387187	6486672	

Tree No.	Species	DBH	Easting	Northing	Comments
87	Marri	56	387098	6486670	
88	Marri	72	387226	6486675	
89	Marri	109	387215	6486708	
90	Marri	56	387196	6486723	
91	Marri	60	387180	6486732	
92	Jarrah	63	387216	6486723	
93	Jarrah	50	387268	6486703	Forks at 3m
94	Marri	62	387293	6486685	
95	Jarrah	63	387331	6486695	
96	Jarrah	70	387340	6486697	
97	Jarrah	58	387339	6486666	
98	Jarrah	70	387348	6486655	
99	Jarrah	59	387350	6486646	
100	Jarrah	56	387347	6486640	Forks at 3m
101	Jarrah	98	387339	6486637	
102	Marri	79	387317	6486756	Forks at 3m
103	Marri	70	387334	6486740	
104	Marri	57	387333	6486736	
105	Jarrah	87	387357	6486752	
106	Marri	73	387353	6486805	
107	Jarrah	56	387342	6486831	Forks at 2.5m
108	Jarrah	60	387342	6486831	Forks at 6m
109	Marri	62	387323	6486854	
110	Marri	69	387296	6486870	
111	Marri	58	387207	6486850	
112	Marri	59	387184	6486875	
113	Marri	111	387168	6486898	
114	Marri	107	387152	6486912	
115	Marri	71	387130	6486697	
116	Marri	56	387104	6486981	
117	Marri	55	387085	6486914	
118	Marri	56	387075	6486917	
119	Marri	95	387081	6486898	
120	Marri	64	387075	6486892	
121	Marri	72	387039	6486877	
122	Marri	56	387028	6486881	
123	Tuart	70	386542	6486869	
124	Tuart	100	386518	6486849	
125	Tuart	90	386544	6486836	