AECOM Imagine it. Delivered.

City of Kalamunda
28-Feb-2020

Wattle Grove South Ecological Surveys

Wattle Grove South Ecological Surveys

Client: City of Kalamunda

ABN: 60 741 095 678

Prepared by

AECOM Australia Pty Ltd
Level 3, 181 Adelaide Terrace, Perth WA 6004, GPO Box B59, Perth WA 6849, Australia
T +61 8 6230 5600 www.aecom.com
ABN 20 093 846 925

28-Feb-2020

Job No.: 60611889

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

Quality Information

Document Wattle Grove South Ecological Surveys

Ref 60527304

Date 28-Feb-2020

Prepared by Floora de Wit & Jared Leigh

Reviewed by Linda Kirchner

Revision History

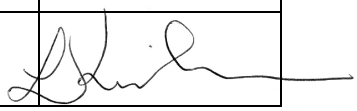
Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	24-Jan-2020	Draft for Internal Review	Linda Kirchner Associate Director - Environment	
B	24-Jan-2020	Draft for Client Review	Linda Kirchner Associate Director - Environment	
0	13-Feb-2020	Final Submission (Client Review)	Linda Kirchner Associate Director - Environment	
1	21-Feb-2020	Final Submission (additional Client comments)	Linda Kirchner Associate Director - Environment	
2	28-Feb-2020	Final Submission	Linda Kirchner Associate Director - Environment	

Table of Contents

List of Figures

Executive Summary

AECOM Australia Pty Ltd (AECOM) was engaged by City of Kalamunda (the City) to conduct ecological assessments for the Wattle Grove South Project. The ecological assessments included a detailed flora and vegetation assessment, a level 1 fauna assessment and a Black Cockatoo assessment.

The desktop assessment was completed to identify the flora, fauna and communities of conservation significance that may occur in the Wattle Grove South area. The results identified 14 communities, 51 flora species and 26 fauna species of conservation significance that may occur in the survey area. The high number of communities and flora species reflects the unique landforms of the eastern Swan Coastal Plain including claypan wetlands, gravel substrates and influences from the Darling Scarp.

Field surveys commenced following stakeholder consultation (led by the City) to obtain permission to access private properties. Properties where access was granted were defined as the survey area within the Wattle Grove South area. The field surveys were conducted across six days and included all roadside/public access areas and 94 private properties. Most properties supported a mix of native and planted trees and landscaped gardens. These properties were represented by observation points and black cockatoo breeding and foraging assessments. Areas of native vegetation were traversed on foot and subject to detailed surveys including flora quadrats, targeted flora surveys, fauna habitat surveys and black cockatoo assessments.

Key outcomes of the ecological surveys are presented below:

- Banksia Woodlands of the Swan Coastal Plain (*Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act] Endangered) was mapped in three patches extending across 2.41 ha within the survey area.
- Three WA Threatened Ecological Communities (TECs) and one WA Priority Ecological Community (PEC) were identified across 4.55 ha, including WA TEC *B. attenuata* over species rich dense shrublands (SCP20a); WA TEC *B. attenuata* and/or *E. marginata* woodlands of the Eastern SCP (SCP20b); WA TEC *Corymbia calophylla – Eucalyptus marginata* woodlands on sandy clay soils of the southern SCP (SCP3b); and WA PEC Banksia dominated woodlands of the SCP.
- *Conospermum undulatum* (EPBC Act Vulnerable, WA Vulnerable) was recorded on two properties comprising 95 individuals. *Isopogon drummondii* (WA P3) populations were recorded at the same two locations comprising 160 individuals.
- Three fauna species of conservation significance were recorded including the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii* (EPBC Act and BC Act Vulnerable), Carnaby's Cockatoo *Calyptorhynchus latirostris* (EPBC Act and BC Act Endangered) and the Quenda *Isoodon fusciventer* (WA P4).
- A total of 730 breeding and potential breeding trees were recorded including 17 trees with one or more hollows considered suitable for breeding black cockatoos (27 hollows in total).
- Foraging habitat quality was mapped for Carnaby's Cockatoo, Baudin's Cockatoo *Calyptorhynchus baudinii* and the Forest Red-tailed Black Cockatoo. This included 41.14 ha of Very High and High Quality foraging habitat for Carnaby's Cockatoo and Baudin's Cockatoo, and 33.52 ha of Very High and High Quality foraging habitat for the Forest Red-tailed Black Cockatoo.

The ecological assessments were successfully completed for the Wattle Grove South Project. Obtaining access to all private properties was a significant limitation with 94 properties accessible from approximately 262 properties. It is likely that the other properties that were not surveyed have significant environmental value.

1.0 Introduction

1.1 Background

The Western Australian Planning Commission (WAPC) adopted the North-East Sub-Regional Planning Framework (the Framework) in March 2018. This plan identifies Wattle Grove South as Urban Expansion, with an eastern portion identified as Urban Investigation. The City of Kalamunda's (the City) 2010 Local Planning Strategy identified the whole area as an investigation area. The City is preparing Concept Plans for the area to investigate the most appropriate land use and development outcomes for the area. The Council may decide to proceed with further detailed planning in order to support the preferred development approach determined during concept planning.

In September 2017, the City appointed consultants to undertake the Wattle Grove South Feasibility Study. This study investigated the potential opportunities and constraints of Wattle Grove South, which outlined the key considerations for future planning and recommended appropriate future land uses. During this process the environmental desktop review identified a number of Threatened flora, fauna habitat and Environmentally Sensitive Areas (ESAs) within and/or adjacent to Wattle Grove South.

In order to finalise the concept plans and to support any future detailed planning, detailed information regarding the environmental values within the area is required. This will ensure that any conservation significant factors are accounted for and environmental assets are understood and managed appropriately. AECOM Australia Pty Ltd (AECOM) was engaged by the City to conduct ecological assessments for Wattle Grove South.

1.2 Location

Wattle Grove South is located within the south-eastern portion of the suburb Wattle Grove in Western Australia. It is bounded by Welshpool Road East (north), Tonkin Highway (west) and Kelvin Road, Judith Road, Fontano Road and the City's border with the City of Gosnells (east), shown in Figure 1. Wattle Grove South incorporates 340 ha of land comprising private and council land with 262 properties defined by cadastral boundaries.

1.3 Objectives

The objective of the ecological assessments was to define the environmental values within the survey area to inform Concept Plans and future detailed planning for Wattle Grove South. Specifically, the Project included:

- a desktop assessment to identify significant flora, vegetation and fauna that potentially occur in the area
- a detailed flora and vegetation assessment in accordance with relevant standards and technical guides, including targeted flora and vegetation community surveys
- a Level 1 fauna assessment in accordance with relevant standards and technical guides
- a targeted black cockatoo assessment.
- a Environmental Area Assessment

This technical report presents the methods, results and retention area assessment.

PROJECT ID	60611889
CREATED BY	KW
APPROVED BY	FDW
LAST MODIFIED	24 JAN 2020

AECOM
www.aecom.com

N
1:20,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 100 200 300 400
Metres

Data sources:

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

LEGEND
- Wattle Grove South Area
- Suburb Boundary

Wattle Grove South Area

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 1

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig1_WattleGroveSouthArea_A4P_v1.mxd (WyattK2)

A4 size

2.0 Existing Environment

2.1 Climate

The climate of the Perth Metropolitan Region is described as Warm Mediterranean (Mitchell et al 2002). A Mediterranean climate is characterised by warm to hot dry summers and mild to cool wet winters. The Mediterranean climate in Australia is a result of the Indian Ocean High, a high pressure cell that shifts towards the poles in summer and the equator in winter, playing a major role in the formation of the deserts of Western Australia, and the Mediterranean climate of southwest and south-central Australia. Precipitation occurs during winter months, with the possibility of some summer storms.

The closest meteorological station to the survey area with comprehensive data is Perth Airport (Station 009021), which is located 6 km northwest of the survey area. Perth Airport meteorological station is maintained by the Bureau of Meteorology (BoM) and commenced recording in 1944.

Perth Airport has experienced an average annual rainfall of 762 mm, with the majority of rainfall occurring between May and September. In the twelve months preceding the survey rainfall was below average for most months, except for June which was slightly above average (Figure 2). The months with the greatest decline (<40mm) include May, July and September with an overall reduction in annual rainfall. No significant evidence of this was noted in the field, however some orchid species and other ephemeral species may have been missing due to lower rainfall. Furthermore, an earlier start to the Spring season in 2019 may have influenced the presence of ephemeral species.

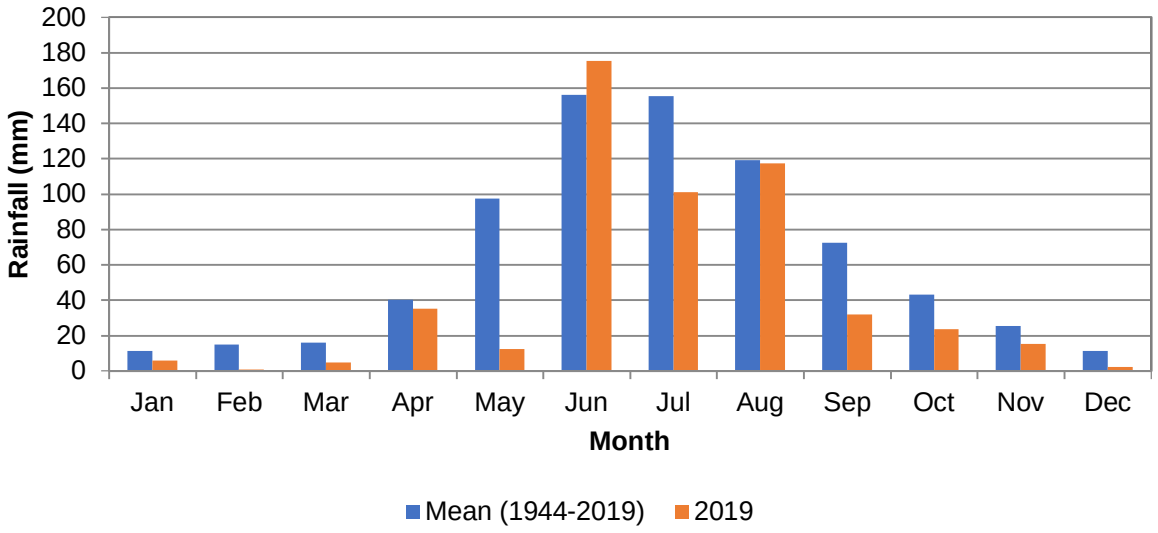


Figure 2 Rainfall Data From Perth Airport Weather Station (9021) (BOM, 2019)

2.1 IBRA Regions

The survey area is located on the Swan Coastal Plain bioregion described in CALM (2002), including Perth and the outer suburbs (excluding the Hills suburbs). The Swan Coastal Plain consists of the Dandaragan Plateau and the Perth Coastal Plain and is comprised of a narrow belt less than 30 km wide of Aeolian, alluvial and colluvial deposits of Holocene or Pleistocene age incorporating a complex series of seasonal fresh water wetlands, alluvial river flats, coastal limestone and several offshore islands. Younger sandy areas and limestone are dominated by heath and/or Tuart woodlands, while *Banksia* and *Jarrah-Banksia* woodlands are found on the older dune systems.

The Swan Coastal Plain subregion, described by Mitchell *et al.* (2002), is a low-lying coastal plain covered with woodlands dominated by *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. The area includes a complex series of seasonal wetlands and includes Rottnest, Carnac and Garden Islands. Land use is predominantly cultivation, conservation, urban and rural residential. The area contains a number of rare features including Holocene dunes and wetlands and a large number of threatened species and ecological communities.

2.2 Vegetation

There are three Beard (1981) vegetation associations mapped within the survey area comprising of Jarrah, Marri and/or Wandoo woodlands (Table 1). Of these Association 968 is below the applicable 10% threshold as set by EPA (2015).

Table 1 Pre-European vegetation associations of the survey area (Beard, 1979) and percent remaining (Govt. of WA, 2018)

Association	Description	Percent Remaining
3	Medium Jarrah and Marri forest	18.13
4	Medium woodland; Marri and Wandoo	18.89
968	Medium woodland; Jarrah, Marri and Wandoo	6.56

Heddle *et al.* (1980) completed vegetation complex mapping which used to assess the extent of pre-European vegetation. The survey area is situated on the border of three vegetation complexes, including the Forrestfield, Southern River, and Guildford complex. These complexes align with three major landforms, Foothills (Ridge Hill Shelf) in the east of the survey area, the Pinjarra Plain, and a combination of Bassendean Dunes and Pinjarra Plain. The Guildford Complex is currently below the 10% threshold. These three are described in Table 2.

Table 2 Vegetation complexes of the survey area (Heddle *et al.* 1980) and percent remaining in the Perth-Peel region (EPA, 2015)

Complex	Description	Percent Remaining
Forrestfield complex	Vegetation ranges from open forest of *Corymbia calophylla – Eucalyptus wandoo – E. marginata* to open forest of *E. marginata – C. calophylla – A. fraseriana – Banksia* spp. With fringing woodland of *E. rudis* in the gullies that dissect this landform	10.3
Southern River	Open woodland of Marri-Jarrah-banksia on the elevated areas and a fringing woodland of Eucalyptus rudis-Melaleuca rhaphiophylla along the streams.	16.8
Guildford complex	A mixture of open forest to tall open forest of *C. calophylla – E. wandoo – E. marginata* and woodland of *E. wandoo* (with rare occurrences of *E. lane-poolei*). Minor components include *E. rudis – M. rhaphiophylla*.	5.87

2.3 Environmentally Sensitive Areas and Conservation Estates

Environmentally Sensitive Areas (ESAs) are areas that have been identified for protection due to their environmental significance as outlined in the Western Australian Environmental Protection (Environmentally Sensitive Areas) Notice 2005, which was gazetted on 8 April 2005.

Exceptions offered for clearing under Regulation 5 of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 do not apply within ESAs. ESAs are gazetted due to supporting environmental values of State or Commonwealth importance and, in this situation, include:

- Declared World Heritage properties (EPBC Act)
- areas included on the Register of the National Estate
- defined wetlands and associated buffers
- vegetation within 50 m of rare flora
- TECs.

Several ESAs occur within Wattle Grove South. One of these represents a TEC listed under the EPBC Act which is also captured in Bush Forever site 51. This bush block is located outside the survey area. The others are likely to represent locations (current and old) of Threatened flora populations and TECs. There are no Bush Forever sites within Wattle Grove South and no conservation estates within or directly adjacent to the survey area.

2.4 Wetlands

The locations of wetlands have been determined using the Geomorphic Wetlands of the Swan Coastal Plain dataset adapted from *Hill et al* (1996). The dataset displays the location, boundary, geomorphic classification (wetland type) and management category of wetlands of the Swan Coastal Plain.

Two unnamed resource enhancement wetlands are located within the survey area including sumpland UFI 8037 and palusplain UFI 15257. Both wetlands have been almost entirely or entirely cleared.

3.0 Legislative Framework

3.1 Overview

Table 3 summarises the key legislation governing the protection and management of Western Australia's conservation significant species and communities, which are further discussed below.

Table 3 Relevant legislation, regulations and guidance

Legislation	Purpose
Commonwealth of Australia	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Provides for the protection of the environment and the conservation of biodiversity.
EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species.	To assist in determining whether an action needs to be referred to the Australian Government. Also provides guidance on black cockatoo survey methodology.
EPBC Act Draft Referral Guidelines, 2017	These draft guidelines are intended to assist proponents in determining whether an action needs to be referred to the Australian Government. Definitions of habitat are provided as are criteria used to judge significant impact for these black cockatoo species.
Western Australia	
Biodiversity Conservation Act 2016 (BC Act)	Provides for the conservation and protection of Western Australia's biodiversity and biodiversity components.
Environmental Protection Act 1986 (EP Act)	Preventing, controlling and abating environmental harm and conserving, preserving, protecting, enhancing and managing the environment.
Biosecurity and Agriculture Management Act 2007 (BAM Act)	Provides for the management, control and prevention of certain plants and animals, and for the protection of agriculture and related resources generally.
EPA Technical Guidance – Terrestrial Fauna Surveys, 2016	Provides guidance on the standard of survey required to assist in collecting the appropriate data for decision-making associated with the protection of Western Australia's terrestrial fauna.
EPA Technical Guidance – flora and vegetation Surveys for Environmental Impact Assessment, 2016	Provides guidance to ensure adequate flora and vegetation data of an appropriate standard are obtained and used in EIA.

3.2 *Environment Protection and Biodiversity Conservation Act 1999*

3.2.1 Matters of National Environmental Significance

Matters of national environmental significance include:

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

If an action is likely to have a significant impact on a MNES this action must be referred to the Minister for the Environment for a decision on whether assessment and approval is required under the EPBC Act.

3.2.2 Flora and fauna

The EPBC Act is the main piece of Federal legislation protecting biodiversity in Australia. Species at risk of extinction are recognised at a Commonwealth level and are categorised in one of six categories as outlined in Table 4, with an additional category for other specially protected fauna.

Table 4 Categories of species listed under Schedule 179 of the EPBC Act

Code	Conservation Category
Ex	Extinct Taxa
ExW	Extinct in the Wild
CE	Critically Endangered
E	Endangered
V	Vulnerable
CD	Conservation Dependent
OS	Other specially protected fauna

3.2.3 Vegetation Communities

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

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

Categories of federally listed TECs are described in Table 5.

Table 5 Categories of TECs that are listed under the EPBC Act

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

3.3 Western Australian Legislation

3.3.1 Flora and Fauna

Threatened flora are plants which have been assessed as being at risk of extinction (DPaW, 2019). Under the BC Act, the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection (WAH, 1998).

Plants and animals that are considered Threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the BC Act. These categories are defined in Table 6.

Table 6 Conservation codes for flora and fauna listed under the *Biodiversity Conservation Act 2016* (Jan 2019)

Code	Conservation Category
CR	**Critically Endangered Species** Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future.
EN	**Endangered Species** Threatened species considered to be facing a very high risk of extinction in the wild in the near future.
VU	**Vulnerable Species** Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future.
EX	**Extinct Species** Species where there is no reasonable doubt that the last member of species has died.
MI	**Migratory species** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth. Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.
CD	**Species of special conservation interest (conservation dependent fauna)** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
OS	**Other specially protected species** Fauna otherwise in need of special protection to ensure their conservation.

Species that have not yet been adequately surveyed to warrant being listed under the BC Act, or are otherwise data deficient, are added to a Priority Lists under Priorities 1, 2 or 3 by the State Minister for Environment. 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. Categories and definitions of Priority Flora and Fauna species are provided in Table 7.

Table 7 Conservation codes for WA flora and fauna listed by DBCA and endorsed by the Minister for Environment

Code	Conservation Category
P1	**Priority One – 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.
P2	**Priority Two – 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.
P3	**Priority Three – 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.
P4	**Priority Four – 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. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

3.3.2 Vegetation Communities

Threatened Ecological Communities (TECs) are naturally occurring biological assemblages that occur in a particular type of habitat and that may be subject to processes that threaten to destroy or significantly modify the assemblage across its range. TECs are listed by both state and commonwealth legislation.

Vegetation communities in Western Australia are described as TECs if they have been endorsed by the Western Australian Minister for Environment following recommendations made by the Threatened Species Scientific Committee. Categories of TECs are defined in Table 8.

Department of Biodiversity, Conservation and Attractions (DBCA) maintains a database of state listed TECs which is available for online searches via their website. Possible TECs that do not meet survey criteria or are not adequately defined are listed as Priority Ecological Communities (PECs) under Priorities 1, 2 and 3. 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. Conservation dependent communities are classified as Priority 5. PECs are endorsed by the Minister for Environment and are described in Table 9.

DBCA requires that all Priority and Threatened ecological communities are considered during environmental impact assessments and clearing permit applications.

There is currently no formal protection afforded to TECs or PECs listed at the state level.

Table 8 Conservation codes for State listed ecological communities

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

Table 9 Conservation categories for Priority Ecological Communities

Code	Conservation Category
P1	Priority One: poorly-known ecological communities
P2	Priority Two: poorly-known ecological communities
P3	Priority Three: poorly known ecological communities
P4	Priority Four: ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list.
P5	Priority Five: conservation dependent ecological communities

3.3.3 Biosecurity and Agriculture Management Act 2007

Biosecurity is the management of the risk of animal and plant pests and diseases entering, emerging, establishing or spreading in WA to protect the economy, environment and community. Biosecurity is managed under the BAM Act which came into effect 1 May 2013. Exotic animals and plants can become an invasive species if they can establish in new areas where local conditions are favourable for their growth. Each organism listed under the BAM Act comes with certain legal / import requirements:

- Declared Pest, Prohibited - s12. Prohibited organisms are declared pests by virtue of section 22(1), and may only be imported and kept subject to permits.
- Permitted - s11. Permitted organisms may be subject to an import permit if they are potential carriers of high-risk organisms.
- Declared Pest - s22(2). Declared pests may be subject to an import permit if they are potential carriers of high-risk organisms, and may also be subject to control and keeping requirements once within Western Australia.
- Permitted, Requires Permit - r73. Regulation 73 permitted organisms may only be imported subject to an import permit.

Declared pests can be assigned to a C1, C2 or C3 control category under the Biosecurity and Agriculture Management Regulations 2013:

- C1 Exclusion - Organisms which should be excluded from part or all of Western Australia.
- C2 Eradication - Organisms which should be eradicated from part or all of Western Australia.
- C3 Management - Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
- Unassigned - Declared pests that are recognised as having a harmful impact under certain circumstances, where their subsequent control requirements are determined by a Plan or other legislative arrangements under the BAM Act.

3.3.4 *Environmental Protection Act 1986* (and Clearing Regulations)

Section 38 (Part IV) of the EP Act provides that any person may refer a significant proposal (one that is likely to have a significant effect on the environment) to the EPA. The EP Act also states that where the environmental impact of a proposal can be adequately assessed and managed through other legislative mechanisms the proposal is unlikely to require formal environmental impact assessment.

If a proposal is not formally assessed by the EPA under Part IV of the EP Act, a Part V native Vegetation Clearing Permit may be required. Under Section 51C of the EP Act, clearing of native vegetation without a Native Vegetation Clearing Permit is an offence unless an exemption applies. Exemptions offered for clearing under Regulation 5 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply within Environmentally Sensitive Areas (ESA).

4.0 Methodology

4.1 Desktop Assessment

The desktop assessment involved gathering background information for the local area. Desktop database searches were requested from the following government databases (including a 10 km buffer from the survey area boundary):

- Department of Biodiversity Conservation and Attractions (DBCA) threatened and priority flora, fauna and communities database
- WA Herbarium (WAH) records
- Atlas of Living Australia (AoLA)
- NatureMap
- EPBC Act Protected Matters search.

All flora, fauna and communities of conservation significance identified in the desktop assessment were assessed for their likelihood of occurrence within the survey area (Table 10). Available literature was consulted to describe the existing environment and define broad vegetation types. References included Beard (1981) vegetation mapping, the Biodiversity Audit of Western Australia (CALM 2002), and Heddle *et al.* (1980) vegetation complex mapping.

Table 10 Categories of likelihood of occurrence for species and communities

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

4.2 Flora and Vegetation Assessment

A detailed flora and vegetation survey was undertaken by Floora de Wit (collection permit FB62000137). Floora de Wit has 13 years' experience undertaking flora and vegetation assessments on the Swan Coastal Plain. Floora completed a Bachelor of Science in Environmental Biology (Environmental Restoration) and completed a Postgraduate Diploma in Environmental Management and Impact Assessment.

A field survey was undertaken on 1 to 4, 8, 18 and 21 October 2019 and included all properties where access was allowed (see Figure 3). Floristic data was collected from 12 non-permanent quadrats and 8 relevés. Quadrats were used in native vegetation in Good or better condition while degraded patches were recorded as relevés.

Quadrats were 10x10 metres (m) defined by a measuring tape. Data collected from quadrats included the presence of plant species, their cover abundance, structural composition of vegetation, physical environment, and presence/absence of disturbance. Each Site was given a unique site number, and the following parameters recorded:

- date
- location using hand-held GPS (accuracy of 5 m)
- sample site type (quadrat/relevé and size)
- photograph (northwest corner)
- soil details (type, colour, moisture)
- landform
- vegetation condition using the Keighery (1994) scale and description of disturbance
- fire history
- comprehensive species list
- estimated height
- estimated percentage cover (for trees both percentage within quadrat and within community was recorded to enable better description of vegetation community).

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

4.2.1 Vegetation mapping

Vegetation communities were described and mapped based on changes in dominant species composition and landform. Quadrat data was analysed using cluster analysis to determine their floristic similarity and support vegetation community delineation. Vegetation community descriptions were based on the National Vegetation Information System (NVIS) framework (Commonwealth of Australia, 2003).

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

Table 11 Bushland condition ratings (Keighery, 1994)

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

4.2.2 Floristic Community Type Analysis

The Keighery (2012) SCP dataset was used for the FCT analysis. The survey data was reconciled with this dataset and all species coded using the three first letters of the genus and species, reducing infra-specific names. All nomenclature of species followed the WA Plant Census.

The program PC Ord was used to undertake the Bray Curtis distance measure. The Bray Curtis dissimilarity measure was used to quantify the compositional dissimilarity between the quadrats based on presence absence data. Subtracting the results from 1 gives the similarity index, also known as the Bray Curtis index. This method is easily interpretable and provides meaningful results. A sense check was completed incorporating appropriate geology, soils, landscape and the description provided in the Gibson *et al.* (1994) reference material and Bush Forever (Government of WA, 2000).

4.2.3 Banksia Woodlands TEC Verification

All patches of native vegetation were assessed to determine the presence of the Banksia Woodlands TEC. Patches are defined as a discreet and mostly continuous area of the ecological community. All native vegetation in Good or better condition were considered for an assessment against the key diagnostic criteria for the TEC.

A preliminary review of Banksia species present was undertaken. Patches that were clearly not associated with Banksia Woodlands, e.g. had no Banksia overstorey species were excluded for further consideration. This is in line with the Approved Conservation Advice key diagnostic criteria which defines the requirement of at least one of the following Banksia species: *B. attenuata, B. menziesii B. prionotes* or *B. ilicifolia*. Their omission was further supported by a review of vegetation condition and FCT analysis results.

The native vegetation has been separated into five patches:

- Patch 1 = quadrats 4 and 6
- Patch 2 = quadrats 12 and 13
- Patch 3 = quadrats 18 and 19
- Patch 4 = relevé 08 and quadrat 09
- Patch 5 = relevé 14.

For each patch the key diagnostic characteristics, condition, size and relevant contextual information was considered. The key diagnostic characteristics summarise the main features that characterise the Banksia Woodland. The condition categories are applied to identify the varying quality of patches, usually as a result of degradation, and ensure that patches of high quality are considered a Matter of National Significance (MNES). The condition of the patch was informed by species richness of quadrat data compared to available datasets, most notably the Keighery *et al.* (2012) SCP dataset and weed cover. The condition of the patch and size thresholds are then used to determine whether the quality of the patch is suitable to meet MNES standards.

4.3 Level 1 Fauna Survey

A Level 1 fauna survey was conducted in accordance with Technical Guidance – Terrestrial Fauna Surveys (EPA, 2016b) and Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna (EPA, 2016c). The fauna survey was conducted by Ecologist Jared Leigh, in conjunction with the detailed flora and vegetation survey. Conducting the two surveys concurrently enabled consistent and clear mapping of the fauna habitats and vegetation communities.

The Level 1 fauna survey primarily focused on mapping of fauna habitat and assessing this habitat for potential utilisation by conservation significant fauna species. Fauna habitats were assessed for specific habitat components, including consideration of structural diversity and refuge opportunities for fauna. The fauna habitat assessments included:

- Location
- General habitat description
- Habitat condition and disturbance types
- Dominant / characteristic flora species and vegetation layers
- Presence and abundance of:
    - large mature trees
    - small and large hollows
    - varying sizes of fallen logs
    - course and fine litter
    - decorticating bark
    - bare ground
    - grass
    - varying sizes of stones and boulders
    - rock crevices
    - soil cracks
    - cryptogramic crust
    - vines
    - dense shrubs
    - water bodies etc.
- Presence of fauna and secondary signs (e.g. scats, digging, tracks, burrows, egg shell, bones, feathers etc.)
- Connectivity of habitat.

In addition to the habitat mapping, records of all observed fauna and birds identified from distinctive calls, details of indirect evidence such as scats, tracks and diggings were documented. Particular attention was given to searching for conservation significant species identified in the desktop assessment as having the potential to occur in the area. All observations were made between daylight hours of 0700 and 1700.

The taxonomy and nomenclature of all vertebrate species is consistent with the Western Australian Museum's (2019) Checklist of Vertebrates of Western Australia.

4.4 Targeted Black Cockatoo Survey

A targeted black cockatoo survey was conducted in conjunction with the Level 1 fauna survey and detailed flora and vegetation survey by Ecologists Jared Leigh and Cassandra House, and Botanist Floora de Wit. This survey was conducted over multiple mobilisations due to site accessibility, including 9 and 10 September 2019; 1 to 4, 8 October 2019; 18 and 21 November.

The targeted black cockatoo survey was conducted to identify potential breeding, roosting and foraging habitat for the three threatened black cockatoo species that occur in WA, as all three species have the potential to utilise the habitats of the survey area. These are Carnaby's Cockatoo *Calyptorhynchus latirostris* (Endangered under the EPBC Act and under the BC Act), Baudin's Cockatoo *Calyptorhynchus baudinii* (Endangered under the EPBC Act and under the BC Act) and the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* (Vulnerable under the EPBC Act and under the BC Act). Refer to Section 5.2.2 for further information on these species. The survey was undertaken in accordance with the DSEWPaC (2012), also utilising the draft DotEE (2017) Referral Guidelines.

4.4.1.1 Breeding Habitat

The black cockatoo breeding habitat assessment focussed on quantifying breeding and potential breeding trees within the survey area. "Potential breeding trees" are generally considered to be hollow-forming eucalypt trees with a Diameter at Breast Height (DBH) >500 mm with "breeding trees" containing potentially suitable hollows. Details collected for each tree included:

- location
- tree species
- DBH
- number of potentially suitable hollows.
- hollow details – including dimensions, height from ground, direction, type of hollow, evidence of use etc.

4.4.1.2 Roosting Habitat

Carnaby's and Baudin's Cockatoos roost in or near riparian environments or near other permanent water sources, generally within any tall trees, but particularly Flat-topped Yate, Salmon Gum, Wandoo, Marri, Karri, Blackbutt, Tuart, introduced eucalypts and introduced pines. The Forest Red-tailed Black Cockatoo prefers the edges of forests for roosting, within any tall trees, but particularly tall Jarrah, Marri, Blackbutt, Tuart and introduced eucalypt trees (DotEE, 2017). Potential roosting trees were searched for and assessed during the field survey.

4.4.1.3 Foraging Habitat

The quality of foraging habitat not only reflects the availability of food sources, but also the proximity to reliable water sources, connectivity to other suitable habitat, presence of breeding habita, and proximity to confirmed roost and breeding sites (amongst others). These parameters were utilised by the DotEE (2017) to produce a draft quality of foraging habitat scoring system (Table 13). This scoring system was amended slightly to incorporate additional habitats and utilised to assess potential foraging habitat throughout the survey area.

The scoring tool is used by initially defining the quality of the overall habitat present (i.e. Very High Quality, High Quality, Quality and Low Quality) and then adding or subtracting points from this depending on the ecological values of the habitat (i.e. proximity to water, proximity to a known roost site, evidence of foraging material etc.). This determines an overall quantitative rating. These scores were then used as representative scores for that unit.

Table 12 defines the levels of foraging habitat quality used during the assessment.

Table 12 Black cockatoo foraging assessment scoring

Score	Foraging Quality
1 – 3	Low Quality
4 – 6	Quality
7 – 8	High Quality
>8	Very High Quality

Table 13 Foraging habitat quality scoring tool for the three Western Australian black Cockatoo species

	Carnaby's Cockatoo	Baudin's Cockatoo	Forest Red-tailed Black Cockatoo
10	Foraging habitat that is being managed for black cockatoos, including successful rehabilitation and/or has some level of protection from clearing.	Foraging habitat that is being managed for black cockatoos, including successful rehabilitation and/or has some level of protection from clearing.	Foraging habitat that is being managed for black cockatoos, including successful rehabilitation and/or has some level of protection from clearing.
7	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as *Banksia* species (including *Dryandra* species) *Hakea* species and *Grevillea* species as well as eucalypt woodland and forest that contains foraging species. Does not include orchards, canola, or areas under RFA	Eucalyptus woodlands and forest of suitable foraging species and proteaceous woodland and heath, particularly Marri. Does not include orchards or areas under RFA	Jarrah and Marri woodlands and forest, and edges of Karri forests, including Wandoo and Blackbutt, within the range of the subspecies. Does not include areas under RFA.
5	Pine plantation, introduced eucalypts and areas of native vegetation that are not dominated by foraging species but contain more than the occasional plant	Pine plantation, introduced eucalypts and areas of native vegetation that are not dominated by foraging species but contain more than the occasional plant	Introduced eucalypts as well as the introduced Cape lilac (*Melia acedarach*), an areas of native vegetation that are not dominated by foraging species but contain more than the occasional plant
1	Individual foraging plants or small stand of foraging plants (≤2 ha)	Individual foraging plants or small stand of foraging plants (≤2 ha)	Individual foraging plants or small stand of foraging plants (≤2 ha)
Additions: Context adjustor – attributes improving habitat quality			
+3	Is within the Swan Coastal Plain	Is within known foraging area	Jarrah and/or Marri shows good recruitment
+3	Contains trees with suitable nest hollows		
+2	Primarily comprises Marri	Primarily contains Marri	Primarily contains Marri and/or Jarrah
+2	Contains trees with potential to be used for breeding (DBH ≥500 mm or ≥300 mm for Salmon Gum and Wandoo)		
+1	Is used for roosting		

	Carnaby's Cockatoo	Baudin's Cockatoo	Forest Red-tailed Black Cockatoo
Subtractions: Context adjustor – attributes reducing habitat quality			
-2	No clear evidence of foraging debris		
-2	No other foraging habitat within 6 km		
-1	Is >12 km from known breeding location		
-1	Is >12 km from known roosting location		
-1	Is >2 km from watering point		
-1	Disease present (e.g. *Phytophthora cinnamomi* or Marri canker)		

Notes: Scoring tool sourced from DotEE (2017) and amended slightly by AECOM

4.5 Environmental Values Assessment

The Environmental Values Assessment (EVA) included consideration of the Ecology survey outcomes and the inclusion of areas outside the ecology survey boundary for which a series of assumptions were made. The three categories used for the EVA are defined in Table 14.

Table 14 Categories for the environmental values assessment

Category	Values
High	• Good connectivity and/or suitable size for maintaining ecological integrity • BC foraging and/or breeding trees • All populations of *C. undulatum* that were recorded during the survey • Incorporates all TECs with the exception of two patches that are <0.2 ha which are captured as Medium • Includes 90% of areas mapped as “native vegetation” with exception of areas <0.2 ha with poor connectivity.
Medium	• Connects high value areas to adjacent high value areas or as ‘stepping stone’ • Includes BC foraging and/or breeding • May include native vegetation (understorey) species
Low	• Mostly cleared open areas or stands of trees over grassland • Includes planted gardens and hardscape

A significant limitation of the assessment is the proportion of areas not able to be assessed during the field survey. Assumptions for these areas were made based on aerial imagery and some on-ground observations. It is possible that areas not surveyed include ‘high’ value areas that were not captured in the EVA.

4.6 Survey Limitations

Limitations of the Flora and Vegetation, Level 1 fauna and targeted black cockatoo surveys are discussed in Table 15.

Wattle Grove South includes 262 private properties. Of these, 94 landowners granted access permission to facilitate the field surveys. The ecological surveys are therefore restricted to public access areas and these 94 properties.

Table 15 Limitations of the Ecological Surveys

Limitation	Flora and Vegetation Survey	Targeted Black Cockatoo Survey	Level 1 Fauna Survey
Availability of contextual information on the region	**Nil** Sufficient resources for the Swan Coastal Plain (SCP) were available to provide contextual information including Beard (1981), Heddle *et al*. (1980) vegetation mapping, Perth @ 3.5 million (Government of WA, 2015) and the Gibson *et al.* (1994) and Keighery *et al.* (2012) swan coastal plain datasets.	**Minor** Sufficient contextual information is generally available on the SCP and survey area. Some of the resources utilised to inform the black cockatoo survey include the DBCA database, DotEE (2017), Birdlife (2018) and DSEWPaC (2012), though not all layers within these resources are updated regularly.	**Nil** Sufficient contextual information is available on the SCP and survey area. Some of the resources utilised to inform the level 1 fauna survey include the DBCA database, Naturemap, EPBC Act PMST, AoLA, as well as several field guides and other publications.
Competency/experience of consultant conducting survey	**Nil** The flora and vegetation assessment was led by Floora de Wit who has more than 10 years' experience conducting surveys of similar scope.	**Nil** Floora has more than 10 years of experience with ecological surveys, and over six years' experience conducting targeted black cockatoo surveys. Jared is an ecologist with over 16 years' experience in the environmental industry and over three years' experience conducting targeted black cockatoo surveys.	**Nil** Jared is an ecologist with over 16 years' experience in the environmental industry who has conducted multiple Level 1 fauna surveys on the SCP.

Limitation	Flora and Vegetation Survey	Targeted Black Cockatoo Survey	Level 1 Fauna Survey
Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity)	**Moderate** The survey area comprised of mostly landscaped gardens, houses/development, and paddocks with remnant native trees (stand-alone and in patches). Native tree crowns were not readily identified using aerial imagery so vegetation mapping relied on field observations. Best effort was made to accurately identify and map all stands of native trees. The vegetation map was done to a scale where all crowns of native trees were captured.	**Minor** The objective of the targeted black cockatoo survey is not necessarily to record black cockatoos within the survey area, but to map the habitat present. However, both Carnaby's Cockatoo and the Forest Red-tailed Black Cockatoo were recorded through either direct sightings or indirect (foraging) evidence. Foraging evidence can be searched for at any time of year, and can remain on the ground for up to two years (DotEE, 2017). Tree hollow presence and suitability for utilisation by black cockatoos cannot always be assessed adequately at ground level, and hence the Precautionary Principle is utilised where appropriate.	**Minor** Information gained for a Level 1 fauna survey was sufficient for those areas surveyed. Fauna were observed (through direct or indirect evidence) during daylight hours (0700 and 1700hrs) and all habitats were assessed. Nocturnal species were only predominantly observed through indirect evidence.
Completion (is further work needed)	**Moderate to High** Flora and vegetation values were adequately assessed on properties where access was granted. These properties are considered 'complete' for the survey. However, surveying the remainder of the survey area is required to gain a full understanding of the environmental values present.	**Moderate to High** Potentially suitable hollows could be assessed further by utilising elevated work platforms (EWPs) or specialist tree climbers, however this is probably not required at this stage and the objectives of the targeted black cockatoo survey were met**.** Black cockatoo values were adequately assessed on properties where access was granted. These properties are considered 'complete' for the survey. However, surveying the remainder of the survey area is required to gain a full understanding of the environmental values present.	**Moderate to High** The objectives of the level 1 fauna survey were met and no further work is required for those properties that are considered 'complete.' However, surveying the remainder of the survey area is required to gain a full understanding of the environmental values present.

Limitation	Flora and Vegetation Survey	Targeted Black Cockatoo Survey	Level 1 Fauna Survey
Remoteness and/or access problems	**High** Property access was denied for approximately 50% of the survey area (see Figure 3). This report presents the results of properties visited and no access limitations are associated with these properties. This data gap represents a significant limitation for informing the Retention Area Assessment as several properties were noted to support large areas of native vegetation.	**High** The owners of numerous properties have denied access for the survey and as such these properties have been removed from the assessment. The lack of data for these properties may however pose a limitation to the overall understanding of environmental values within the survey area outlined by the City. The objectives of the targeted black cockatoo survey were met for areas that were accessed.	**High** The owners of numerous properties have denied access for the survey and as such these properties have been removed from the assessment. The lack of data for these properties may however pose a limitation to the overall understanding of environmental values within the survey area outlined by the City. The objectives of the level 1 fauna assessment were met for areas that were accessed.
Timing, weather, season, cycle	**Nil** Rainfall was below average in the months preceding the survey. No significant limitations were identified relating to timing, weather, season or cycle.	**Nil** No limitations were identified relating to timing, weather, season or cycle. Foraging evidence can be searched for at any time of year and can remain on the ground for up to two years (DotEE, 2017).	**Nil** The survey was conducted during a period of reasonable weather in Spring. Although it was limited to one seasonal survey period during one year, and predominantly during daylight hours, this does not significantly impact a Level 1 fauna survey.
Disturbances (e.g. fire flood, accidental human intervention) which affected results of the survey	**Nil** The survey area represents a fragmented near-rural landscape that includes maintained gardens, grazed paddocks, hardscape, and native vegetation. Best effort was made to access all patches of native vegetation all of which were subject to degrading processes (edge effects, weeds, drying climate).	**Nil** The targeted black cockatoo survey was not disrupted or impacted.	**Nil** The Level 1 fauna survey was not disrupted or impacted.

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:15,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 100 200 300 400
Metres

Data sources:

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

LEGEND
Wattle Grove South Area
Survey Area

Survey Area

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
3

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig3_SurveyArea_A4P_v1.mxd (WyattK2)

A4 size

5.0 Desktop Assessment Results

5.1 Threatened and Priority Ecological Communities

The database searches identified 14 conservation significant communities that may occur in the survey area. These results include six TECs that are listed under the EPBC Act. At the State-level TECs and PECs are determined by Floristic Community Type (FCTs) therefore some federally listed TECs represent one or more TEC/PEC at a State level.

The number of TECs and PECs identified reflect the unique landforms in a highly fragmented environment that occur at the base of the Darling Scarp. This area is influenced by the Scarp and the Swan Coastal Plain and supports a mix of Banksia and Eucalypt woodlands, Heath shrublands and wetlands.

The 14 significant communities are described in Table 16 including their State and Federal conservation status and the relationship of State listed communities to Federal listings. TECs and PECs are mapped in Figure 4.

Table 16 Threatened Ecological Communities identified in the desktop assessment

Community Name and Description	Cons. Status		Likelihood
	State	EPBC	
Banksia Woodlands of the Swan Coastal Plain The Banksia Woodlands TEC (TSSC, 2017) incorporates woodland of *Banksia* species with scattered Eucalypts and other tree species over a species rich mix of sclerophyllous shrubs, graminoids, and forbs. The community shows high endemism and considerable local variation in species composition across its range. It is restricted to the southwest of WA on the Swan Coastal Plain. It occurs mainly on deep Bassendean and Spearwood sands or occasionally on Quindalup sands. The TEC is identified using the key diagnostic features, condition thresholds and consideration of other environmental factors as described in the approved conservation advice. The community is associated with several State-listed TECs and PECs. Those relevant for this project include:	Various	E	Known/buffer overlaps
• *Banksia attenuata* woodlands over species rich dense shrublands (FCT20a)	EN		Known/buffer overlaps
• *Banksia attenuata* and/or *Eucalypt marginata* woodlands of the eastern side of the Swan Coastal Plain (SCP20b)	EN		Likely
• Low lying *Banksia attenuata* woodlands or shrublands (SCP21c)	P3		May
• Banksia dominated woodlands of the Swan Coastal Plain	P3		Likely
SCP20c Shrublands and Woodlands of the Eastern Swan Coastal Plain (FCT20c) Described in the approved conservation advice (DotEE, 2017b), this TEC is restricted to the eastern side of the SCP in the foothills of the Darling Scarp. It reflects the transitional landform and soil zone between the Scarp and SCP. It is known from approximately 130 ha at Talbot Road Bushland, Bushmead Rifle Range, Great Eastern Highway bypass/Roe Highway intersection, Farrall Road, and Clifford St/Tonkin Highway intersection. Critical habitat for this TEC includes: • Known occurrences • Areas within 200 m of known occurrences on sandy to gravelly soils on eastern SCP and foothills of Darling Scarp • Remnant vegetation that surrounds or links several occurrences. This TEC is identified through FCT analysis. It is recommended that outcomes would be verified by DBCA experts.	CR	E	Likely

Community Name and Description	Cons. Status		Likelihood
	State	EPBC	
Clay Pans of the Swan Coastal Plain This TEC occurs where clay soils form an impermeable layer close to the surface where wetlands form that rely solely on rainfall to fill in winter and dry in summer (DSEWPaC, 2012b). The community is a shrubland (sometimes a low open woodland) over geophytes, herbs and sedges in the wetter parts of the site. The TEC is associated with several Ramsar sites including Brixton Street Wetlands, Ellen Brook Swamps System and Forrestdale Lake Nature Reserve. The identification of this TEC relies on FCT analysis and a consideration of characteristics unique to this TEC including hydrological functions. Associated State-listed TECs include:		CE	Known/buffer overlaps
• Herb rich saline shrublands in clay pans (SCP07)	VU		Unlikely
• Herb rich shrublands in clay pans (SCP08)	VU		Known/buffer overlaps
• Shrublands on dry clay flats. (SCP10a)	EN		Unlikely
SCP 3a *Corymbia calophylla – Kingia australis* Woodlands on Heavy Soils of the Swan Coastal Plain (FCT3a) Described in DotEE (2017a) approved conservation advice, this TEC is located on heavy soils of the eastern SCP between Ruabon and Guildford. The floristic composition varies with water regime which is typically within 3 m of the natural ground surface therefore communities are likely to be heavily reliant on groundwater. Critical habitat for this TEC includes heavy soils, fresh superficial groundwater, and/or surface water that helps sustain flora species in these wetland communities, and the catchment for this groundwater and surface water. All areas meeting the description of the ecological community are habitat areas critical to its survival (i.e. no condition thresholds apply).	CR	E	Known/buffer overlaps
SCP3b *Corymbia calophylla – Eucalyptus marginata* Woodlands on Sandy Clay Soils of the southern Swan Coastal Plain (FCT3b) Occurs on alluvial soils near the Peel-Harvey estuary and on better drained sites on the eastern side of the plain with vegetation dominated by both *C. calophylla* and *E. marginata* (Gibson *et al.*, 1994). Common understorey species include *Bossiaea eriocarpa and Conostylis juncea*.	VU		May

Community Name and Description	Cons. Status		Likelihood
	State	EPBC	
SCP3c *Corymbia calophylla – Xanthorrhoea preissii* Woodlands and Shrublands, Swan Coastal Plain (FCT3c) Located on heavy soils of the eastern side of the Swan Coastal Plain between Bullsbrook and Capel. Dominant trees include *C. calophylla, E. wandoo* and shrubs *Xanthorrhoea preissii, Acacia pulchella, Banksia dallanneyi, Gompholobium marginatum* and *Hypocalymma angustifolium* and herbs *Burchardia congesta, Cyathochaeta avenacea* and *Neurachne alopecuroidea*.	CR	E	Likely
Central Northern Darling Scarp Granite Shrubland Community This PEC is described as shrublands and heath on deeper loams and red earths on fragmented granite/quartzite. Heath species typically consist of the taller shrubs Xanthorrhoea acanthostachya and Allocasuarina humilis over smaller proteaceous and myrtaceous shrubs, namely Melaleuca aff. scabra , Baeckea camphorosmae and to a lesser extent, the proteaceous shrubs Dryandra armata, Hakea incrassata and Hakea undulata . Located in central region of the Northern Darling Scarp near Perth.	P4		Unlikely
SCP02 Southern Wet Shrublands, Swan Coastal Plain (FCT02) Shrublands or open low woodlands identified by Gibson in the Busselton area but is now also known to occur at Perth Airport. The community occurs on seasonally inundated sandy clay soils that support diverse shrubs including *Kingia australis, Eutaxia virgata* and *Calothamnus lateralis*.	EN		Unlikely
Muchea Limestone – Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain Occurs on heavy soils on eastern side of the plain. Occurrences include wetland and well-drained habitats and a variety of landforms. Its presence is defined by limestone-influenced substrates. Soils and flora species are influenced by the type of limestone substrate.	EN	E	Unlikely

5.2 Conservation Significant Flora

A total of 51 flora species of conservation significance were identified in the desktop study. This included 32 species listed as threatened under the EPBC Act and 19 species listed by DBCA as Priority species. It should be noted that 22 of the 32 threatened species were identified in the Protected Matters Search with no known records from the vicinity of the survey area. The majority of these were considered unlikely to occur.

Four flora species are known to occur within the survey area, including two threatened species *Banksia mimica* and *Conospermum undulatum* and two Priority species *Isopogon drummondii* (Priority 3) and *Lasiopetalum glutinosum* subsp. *glutinosum* (Priority 3).

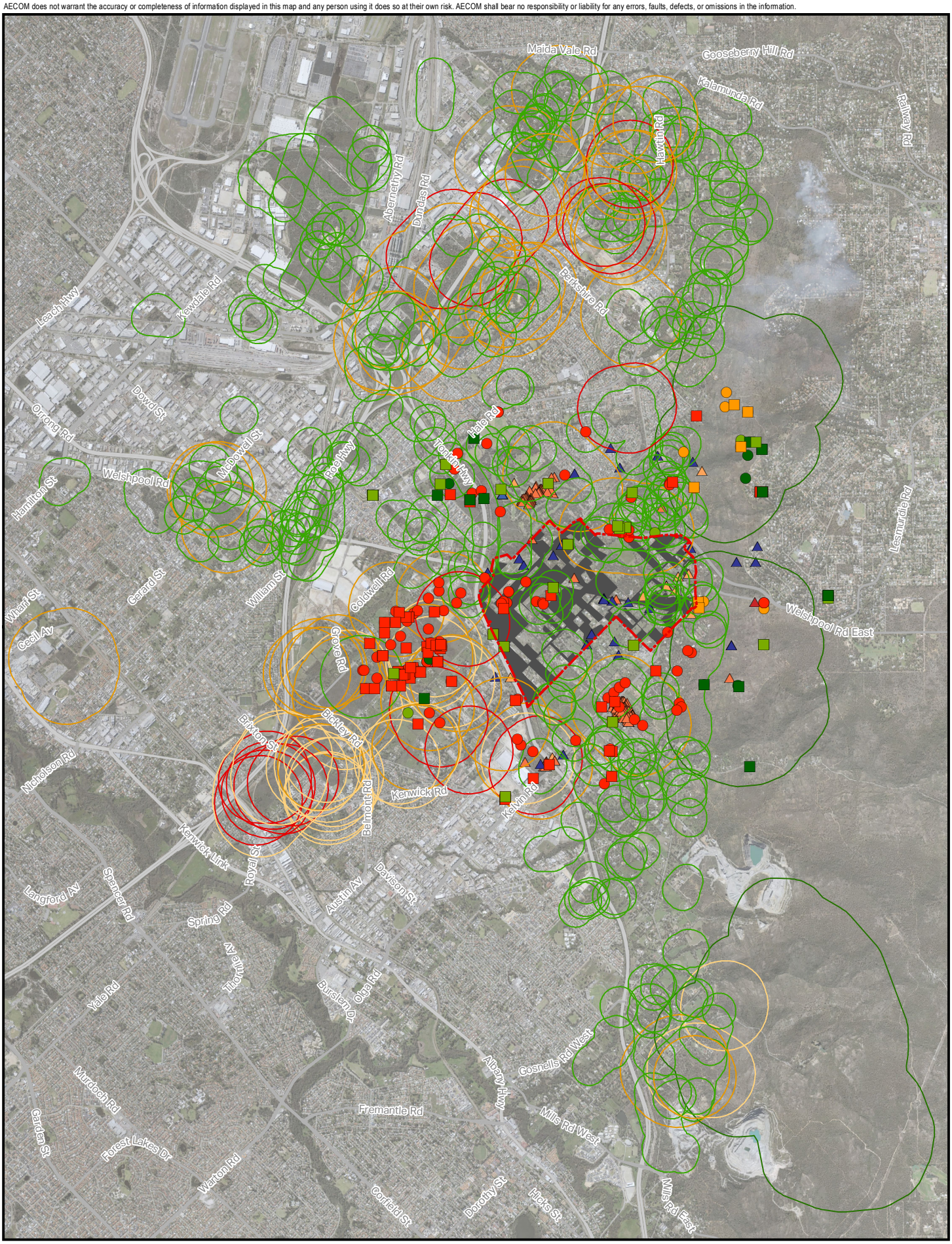
Further investigation determined that *L. glutinosum* subsp. *glutinosum* is unlikely to occur in the survey area as it is associated with lateritic outcrops on the Darling Scarp.

Two flora species are considered likely to occur including *Haemodorum loratum* (Priority 3) and *Verticordia lindleyi* subsp. *lindleyi* (Priority 4). An additional 12 species may occur based on habitat and proximity of known records. The fragmented and mostly cleared private residences within the survey area and lack of wetland habitat as led to the exclusion of many species as being likely to occur.

Table 17 Threatened and Priority Flora that are likely to, or known to occur within the survey area

Species	Cons. Code[1]		Habitat[2]	Count Date	Likelihood of Occurrence
	EPBC	WA			
Banksia mimica	E	VU	Flat to gentle slopes on grey sand in open woodlands. DBCA population 3 occurs within the survey area where it occurs in mixed low heath with a *Banksia attenuata/B. menziesii* open-low woodland overstorey. It is associated with species such as *Adenanthos cygnorum, Eucalyptus todtiana, Nuytsia floribunda, Jacksonia floribunda, Xanthorrhoea preissii, Banksia chamaephyton, Hakea conchifolia* and *Stirlingia latifolia*	2000	Known. DBCA population 3 recorded in 2000 on properties southeast of Crystal Brook Road and Brentwood Road.
Conospermum undulatum	V	VU	Grows on sand and sandy clay soils, often over laterite, on flat or gently sloping sites between the Swan and Canning Rivers. The species is known from *Banksia* and jarrah/marri woodland, with a few records from slightly swampy habitat	2011	Known. Population no. 11 occurs within the survey area.
Haemodorum loratum		P3	Grey or yellow sand and gravel.	2004	Likely. Suitable habitat and record in close proximity to survey area.
Isopogon drummondii		P3	No information available on WAH (1998-). Database results describe flats on grey brown sand with or without gravel in Banksia woodlands.	2013	Known. Numerous records in vicinity of survey area.
Lasiopetalum glutinosum subsp. *glutinosum*		P3	No information available on WAH (1998-). One record nearby recorded on sandplain with Darling Scarp outwash in Banksia/Jarrah woodland.	2008	Known. No suitable habitat in survey area. Records on Darling Scarp.
Verticordia lindleyi subsp. *lindleyi*		P4	Grows in white to grey and yellow sand, often with or over clay and gravel, usually low-lying and winter-wet (George, 2002). Frequently in association with a few other verticordias in heath, shrubland and open woodland (George, 2002). Records from 1990 and 1994.		Likely. Suitable habitat present, several records in close proximity.

1. Conservation codes are outlined in Section 3.0
2. Sourced from Florabase (WAH, 1998-) and DotEE (2019) unless otherwise referenced



PROJECT ID	60611889
CREATED BY	KW
APPROVED BY	FDW
LAST MODIFIED	24 JAN 2020

AECOM
www.aecom.com

N
1:60,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 500 1,000
Metres

Data sources:

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

LEGEND

- Wattle Grove South
- Project Area

WAHerb
- Threatened
- Priority 1
- Priority 3
- Priority 4

Threatened and Priority Flora Database
- Threatened
- Priority 1
- Priority 3
- Priority 4

TEC / PEC
- Critically Endangered
- Endangered
- Vulnerable
- Priority 3
- Priority 4

Desktop Threatened Fauna
- Critically Endangered
- Endangered
- Vulnerable
- Priority 3
- Priority 4

Desktop Flora and Fauna Results

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 4

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig4_DesktopFloraFauna_A4P_v1.mxd (WyattK2)

A4 size

5.3 Conservation Significant Fauna

The NatureMap search identified a total of 192 vertebrate and invertebrate fauna species that have been recorded within the survey and surrounding area. This included seven amphibian, 108 bird, one fish, 31 invertebrate, 14 mammal and 31 reptile species. A review of species habitat was undertaken at which time 26 conservation significant fauna species may occur within the survey area. The likelihood assessment concluded that:

- three species are ‘likely to occur’
- two species ‘may occur’
- 21 species are ‘unlikely to occur’.

The five species considered as ‘likely to occur’ and ‘may occur’ in the survey area include three bird, one invertebrate and one mammal species. Table 18 identifies these species and provides relevant ecological information. The conservation significant categories as defined by DBCA, the BC Act and the EPBC Act are defined in Section 3. The comprehensive desktop results are presented in Appendix A.

The EPBC Protected Matters Search identified five fauna species listed as Marine under the EPBC Act. These were omitted as they only pertain to Commonwealth Land.

Table 18 Conservation significant fauna species that are Likely to Occur or May Occur in the survey area

Scientific Name	Common Name	Conservation Status		Ecology
		WA	EPBC Act	
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	VU	V	Requires tree hollows to nest and breed, occurs in forests of Karri *Eucalyptus diversicolor*, Jarrah *E. marginata* and Marri *Corymbia calophylla*, with flocks moving out onto the Swan Coastal Plain in search of food from exotic trees such as White Cedar (Johnstone *et al.*, 2010). Foraging habitat for the species consists of Jarrah and Marri woodlands and forest throughout its range. Has become more common in the Metropolitan area in the past few years.
Calyptorhynchus baudinii	Baudin's Cockatoo	EN	E	Habitat critical to the survival of this species includes forests of Karri, Jarrah and Marri, in areas of 600 mm average rainfall per year. Individuals typically move north through the Perth region from March to May and south through the Perth region from August to October. This species ranges north to Gidgegannup and Hoddy Well and west to the Eastern Strip of the Swan Coastal Plain including West Midland in the north, heading south through Armadale, Byford and south and towards the coast until Lake Clifton where it continues to hug the coastline to east of Albany (Johnstone *et al.,* 2010). Breeding has been recorded to the south-west of the area bounded by Leschenault, Collie and Albany (DSEWPaC, 2012), with the most northerly record at Lowden, near Donnybrook (Johnstone & Storr, 1998). Breeding has also been recorded at Serpentine (hills area), and east to Kojonup and near Albany (Johnstone & Kirkby, 2008).
Calyptorhynchus latirostris	Carnaby's Cockatoo	EN	E	The species nests in hollows in eucalypts, particularly Salmon Gum *Eucalyptus salmonophloia* and Wandoo *E. Wandoo*, but nests have been found in other eucalypts including York Gum *E. loxophleba*, Flooded Gum *E. rudis*, Tuart *E. gomphocepha*la and Marri *Corymbia calophylla* (Johnstone *et al.*, 2010). Breeding success is largely dependent on suitable feeding habitat adjacent to the nest site to provide the necessary food for the survival of the chick (Johnstone *et al.*, 2010). Diet consists of an array of Proteaceous and *Eucalyptus* species.
Isoodon fusciventer	Quenda	P4	-	The Quenda exists only in a fragmented distribution to its former range in southern south western and eastern Australia. It is found in forest, woodland, heath and shrub communities in these regions. Preferred habitat usually consists of a combination of sandy soils and dense heathy vegetation (Van Dyck & Strahan, 2008).
Westralunio carteri	Carter's Freshwater Mussel	VU	V	The only reasonably large bivalve in freshwaters of south-west Western Australia. Occurs in greatest abundance in slower flowing waters with stable sediments that are soft enough for burrowing. Salinity tolerance is quite low (>3 g /L is lethal) (TSSC, 2018).

6.0 Field Survey Results and Discussion

6.1 Vegetation

6.1.1 Floristic Community Type Analysis

A total of 11 quadrats were subject to the statistical analysis to infer the FCT for these quadrats and associated vegetation patches. Five FCTs were inferred, including:

- FCT3b *C. calophylla-E. marginata* woodlands on sandy clay soils (WA TEC)
- FCT20a *B. attenuata* over species rich dense shrublands (EPBC TEC, WA TEC)
- FCT20b eastern *B. attenuata* and/or *E. marginata* woodlands (partial EPBC TEC, WA TEC)
- FCT21a central *B. attenuata-E. marginata* woodlands (partial EPBC TEC)
- FCT23a central *B. attenuata-B. menziesii* woodlands (partial EPBC TEC)

The FCT analysis results were used to inform the TEC and PEC assessment discussed in the following Section. Details for each quadrat, the top three to four similar SCP quadrats, and inferred FCT conclusions are presented in Table 19.

The survey area extends across three major landforms; the Foothills (Ridge Hill Shelf) (east), the Pinjarra Plain, and a combination of Bassendean Dunes and Pinjarra Plain. Because of this, some of the inferred FCTs remain slightly cryptic as it is unclear what landform they would represent at this scale. Furthermore, low similarity was observed across all quadrats analysed, suggesting poor comparability to the SCP data. A number of factors would influence this, such as:

- position of survey area along the base of the Darling Scarp. It crosses three major landforms and species present may not be typical of that landform due to the proximity of the scarp.
- single quadrat sampling event
- drying climate
- isolation native vegetation patches and existing disturbances.

Table 19 Inferred FCT for Wattle Grove quadrats

Quadrat	Quadrat, % similarity, FCT	Inferred FCT
01	ACTON-1, 31%, 1a Hart01, 31%, 20a Sams01 31%, 28	None of these FCTs align with quadrat data. FCT cannot be inferred.
04	Rush 02, 46%, 20b Hart01, 43%, 20a APBF-2, 40%, 20a	FCT20a *B. attenuata* over species rich dense shrublands is a good fit. High diversity with 61 species/quadrat.
06	Activ03, 47%, 20a Bushm01, 45%, 20a Hart01, 45%, 20a Talb8, 45%, 20a	FCT20a *B. attenuata* over species rich dense shrublands is a good fit. High diversity with 46 species/quadrat. Some edge effects have degraded condition.
07	BURNRD02, 26%, 3b 5C01, 23%, S18 Serp04, 23%, 3b Yarl03, 23%, 3b	FCT3b *C. calophylla-E. marginata* woodlands on sandy clay soils is a good fit. TEC description suggests 'southern SCP' only however Gibson *et al.* (1994) includes better drained sites on eastern side of plain.
09	Kens01, 44%, 23a Perth04, 43%, 23a Perth08, 43%, 23a Tele01, 43%, 23a	FCT23a central *B. attenuata-B. menziesii* woodlands is a good fit.

Quadrat	Quadrat, % similarity, FCT	Inferred FCT
10	Yarl03, 39%, 3b BURNRD02, 37%, 3b KOOLJ-5, 32%, 3b Sunday02, 32%, 21a	FCT3b *C. calophylla-E. marginata* woodlands on sandy clay soils is a good fit. TEC description suggests 'southern SCP' only however Gibson *et al.* (1994) includes better drained sites on eastern side of plain.
11	AMBRAL-1, 38%, 1b Yarl01, 37%, 3c BURNRD02, 35%, 3b R116703, 35%, 1b Waro 02, 35%, 3b	FCT3b *C. calophylla-E. marginata* woodlands on sandy clay soils is a good fit. FCT1b is restricted to southern SCP.
13	Activ03, 44%, 20a BNR18, 41%, S09 Card2, 41%, 20b ELE28, 41%, 23b KOON-1, 41%, 20a KOON-2, 41%, 20a	Does not meet description of FCT20a or 23b. Could be S09 *Banksia attenuata* woodlands over dense low shrubs however its geographical location aligns better with FCT20b eastern *B. attenuata* and/or *E. marginata* woodlands may also be accurate.
15	KING-2, 30%, 28 Cavs11, 30%, 21a Star01, 29%, 24 WOODV-2, 29%, 28	Poor alignment with FCT28 and 24 as they pertain to Spearwood dunes dominated by *Banksia* overstorey. Vegetation represented by Q15 is representative of *E. marginata* woodland therefore may be aligned with FCT21a central *B. attenuata-E. marginata* woodlands.
18	Perth08, 42%, 23a Wire01, 42%, 28 Activ03, 40%, 20a	Similar to Q19, likely to represent FCT20b as it aligns with geographical location, key species, and species richness.
19	Activ03, 42%, 20a Rush02, 42%, 20b KING-2, 38%, 28 Tele01, 38%, 23a	Could represent FCT20a or 20b with presence of key species and correct landform (Ridge Hill Shelf). The lower species richness indicates FCT20b eastern *B. attenuata* and/or *E. marginata* woodlands.
20	Activ03, 37%, 20a Perth04, 36%, 23a	Does not align with 20a or 23a. Is a better fit with FCT20b eastern *B. attenuata* and/or *E. marginata* woodlands. Confirmation from DBCA would be required however as a precaution we have determined this area to be the State listed TEC.

6.1.2 Threatened and Priority Ecological Communities

Native vegetation was mapped for 7.41 ha within the 168 ha survey area. Of this area, 4.55 ha is considered a TEC or PEC. This reflects the condition of vegetation and the size of the patch.

Four conservation significant communities were recorded and mapped, all of which are either wholly or partially under one federally listed TEC:

- EPBC TEC Banksia Woodlands of the SCP
- WA TEC FCT20a *B. attenuata* over species rich dense shrublands (SCP20a)
- WA TEC FCT20b *B. attenuata* and/or *E. marginata* woodlands of the Eastern SCP (SCP20b)
- WA TEC *Corymbia calophylla – Eucalyptus marginata* woodlands on sandy clay soils of the southern SCP (SCP3b)
- WA PEC Banksia dominated woodlands of the SCP.

These communities are described in detail below.

Banksia Woodlands of the Swan Coastal Plain – EPBC Endangered

The presence of the EPBC Act-listed Banksia Woodlands of the Swan Coastal Plain has been confirmed. Native vegetation within the survey area was grouped into patches as defined in the Approved Conservation Advice. Each patch was assessed separately.

Five patches were defined:

- Patch 1 = quadrats 4 and 6
- Patch 2 = quadrats 12 and 13
- Patch 3 = quadrats 18 and 19
- Patch 4 = relevé 08 and quadrat 09
- Patch 5 = relevé 14

Of these, patches 1, 2 and 3 met all criteria to be considered the EPBC TEC Banksia Woodlands of the SCP. The vegetation within these patches was often co-dominated by a mix of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana* and *Eucalyptus marginata* subsp. *marginata*. The vegetation varied from 'Good' to 'Excellent' condition. Patch 1 and 2 also support EPBC threatened flora species *Conospermum undulatum*.

The three patches of Banksia Woodlands TEC represent three State listed communities, discussed separately. The total area of native vegetation representing this TEC is 2.41 ha. A detailed assessment of each of these patches is provided in Appendix B.

FCT20a *B. attenuata* over species rich dense shrublands (SCP20a) – WA TEC Endangered

The identification of this TEC was supported by FCT analysis of two quadrats (04 and 06). This area was notably species rich with an average of 53.5 species/quadrat. This TEC is isolated to one location, represented by vegetation community BaEpPf extending for 0.94 ha.

This TEC was identified in the desktop assessment as known to occur in Wattle Grove and coincides with Patch 1 of the Banksia Woodlands TEC.

Plate 1 Photograph representative of FCT20a

FCT20b *B. attenuata* and/or *E. marginata* woodlands of the Eastern SCP (SCP20b) – WA TEC Endangered

This TEC has been tentatively mapped at two locations that correspond with Patch 2 and 3 of the Banksia Woodlands TEC. The low confidence mapping is a result of poor clarity from the FCT analysis (low similarity). Verification from DBCA is advisable.

This TEC is represented by three vegetation communities in the survey area including EmMpLp, BaEpPf and BmXpEc and is mapped across 1.80 ha.

***Corymbia calophylla – Eucalyptus marginata* woodlands on sandy clay soils of the southern SCP (SCP3b) – WA TEC Vulnerable**

This TEC was identified following FCT analysis for three quadrats (07, 10 and 11). Further confirmation from DBCA would be required to verify the presence of this TEC. FCT3b is more commonly known from the Peel-Harvey estuary further south, but has been recorded on 'better drained sites on the eastern side of the plain' (Gibson *et al.*, 1994). This TEC is represented by vegetation communities EmPcAh and EmLpFa extending for 1.71 ha.

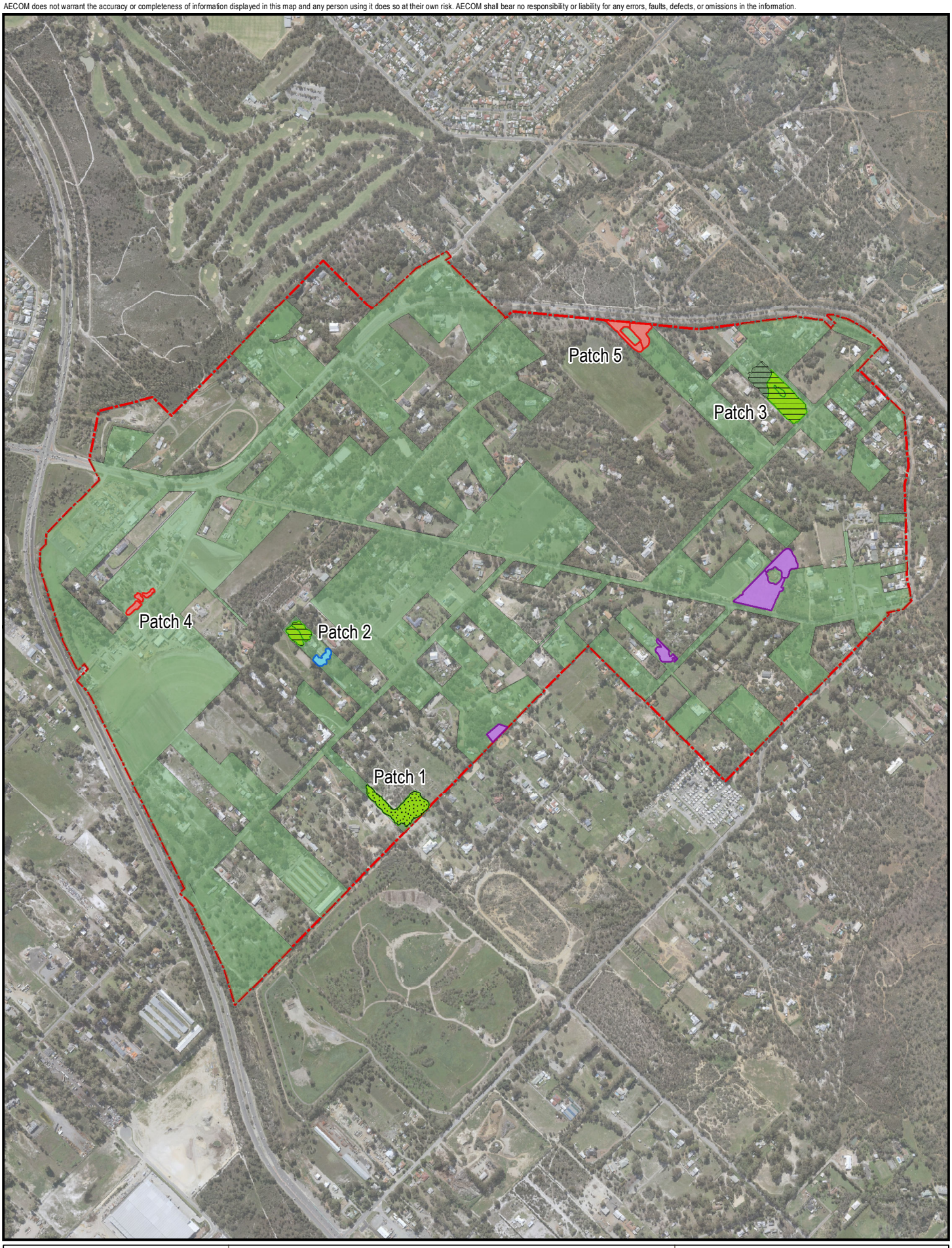
A precautionary approach has been adopted, where liaison with DBCA may help facilitate a better understanding of the TECs present as this TEC is generally associated with areas further south.

Banksia dominated woodlands of the SCP – WA P3 PEC

This PEC was recorded at one location which coincides with Patch 2 of the EPBC TEC Banksia Woodlands of the SCP. This TEC is not associated with a specific FCT therefore has been assumed to refer to all occurrences of the federal TEC listing. This PEC extends for 0.15 ha.

Tuart Woodlands of the SCP – EPBC TEC, WA P3 PEC

E. gomphocephala trees were observed in the survey area, however all trees were recorded in Completely Degraded areas devoid of native understorey species. For this reason, these patches were excluded for consideration as the EPBC TEC Tuart Woodlands of the SCP.



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:15,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 100 200 300 400
Metres

Data sources:

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

LEGEND

- Wattle Grove South Area
- Survey Area
- EPBC TEC *Banksia* Woodlands of the Swan Coastal Plains
- WA TEC *C. calophylla-E. marginata* Woodlands on Sandy Clay Soils (FCT3b)
- WA TEC *Banksia attenuata* Woodland over Species Rich Dense Shrublands
- WA PEC *Banksia* dominated woodlands of the SCP
- Tentative WA TEC *Banksia attenuata* and/or *Eucalyptus marginata* Woodlands of the Eastern Side of the Swan Coastal Plain (SCP20b)
- Not a TEC

Conservation Significant Vegetation

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 5

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig5_Conservation Significant Vegetation_A4P_v1.mxd (WyattK2)

A4 size

6.1.3 Vegetation Communities

Six native vegetation communities were described and mapped. These communities fall into three broad categories including Banksia Woodlands, Eucalypt Woodlands and Riparian Vegetation.

Vegetation descriptions are presented in Table 20 and mapped in Figure 7.

The delineation of vegetation communities was supported by cluster analysis of floristic data. The cluster outcomes are presented below.

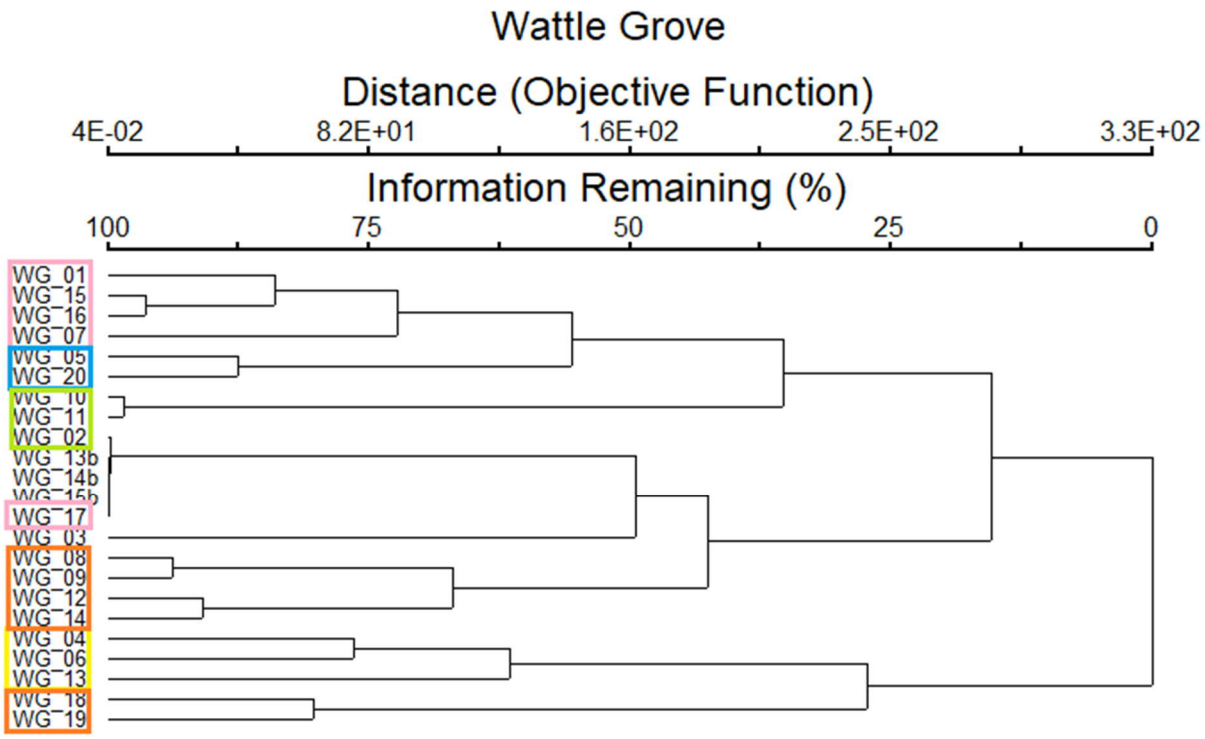


Figure 6 Dendrogram Showing Community Groups in Colours (pink = EmCaFa, blue = EmMpLp, green = EmPcAh, orange = BmXpEc, yellow = BaEpPf)

Table 20 Vegetation community descriptions including mapping code and photographs

Community Description	Additional Details	Photograph
EmCaFa ***E. marginata* Woodland** *Eucalyptus marginata* subsp. *marginata* and *Allocasuarina fraseriana* low woodland over *Cyathochaeta avenacea, Mesomelaena tetragona* and *Daviesia decurrens* subsp. *decurrens* mixed sedge and shrubland over **Freesia alba* x *leichtlinii*, *Lomandra preissii* and *Stylidium brunonianum* low forbland. Numerous strata present in understorey including forbs, sedges, rushes and shrubs. Other dominant species include *Tripterococcus brunonis, Neurachne alopecuroidea, Xanthorrhoea preissii, Labichea punctata* and *Hakea undulata.* Represents WA TEC *C. calophylla-E. marginata* woodlands on sandy clay soils.	Survey effort: Q01, Q07, Q15, R16 Species richness: 76 native and 12 weed species Area: 0.78 ha	
EmMpLp ***E. marginata* Woodland** *Eucalyptus marginata* subsp. *marginata* and *Allocasuarina fraseriana* mid open forest over *Mesomelaena pseudostygia* and *Tetraria octandra* low sedgeland with *Lomandra preissii, Tricoryne elatior* and *Dampiera linearis* low open forbland. Larger patch of this community represents WA TEC *B. attenuata* and/or *E. marginata* woodlands of the eastern SCP (SCP20b).	Survey effort: R05, Q20 Species richness: 42 native and 9 weed species Area: 0.48 ha	

Community Description	Additional Details	Photograph
EmPcAh ***E. marginata* Woodland** *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* mid open forest over *Phyllanthus calycinus*, *Xanthorrhoea preissii* and *Xanthorrhoea gracilis* low shrubland with *Agrostocrinum hirsutum*, *Lomandra sonderi* and *Thysanotus patersonii* low open forbland. Represents WA TEC *C. calophylla-E. marginata* woodlands on sandy clay soils	Survey effort: R02, Q10, Q11 Species richness: 47 native and 9 weed species Area: 1.61 ha	
CcHaEc **Riparian Vegetation** *Corymbia calophylla* mid open woodland over *Spyridium globulosum, Hypocalymma angustifolium* and *Acacia pulchel*la var. *pulchella* tall to low shrubland over **Ehrharta calycina, *Avena barbata* and **Briza minor* low grassland. Represents riparian vegetation associated with a minor water course.	Survey effort: 03 Species richness: 12 native and 5 weed species Area: 0.23 ha	

Community Description	Additional Details	Photograph
BaEpPf **Banksia Woodland** *Banksia attenuata, Banksia menziesii* and *Eucalyptus todtiana* low open woodland over *Eremaea pauciflora* var. *pauciflora*, *Hibbertia hypericoides* and *Allocasuarina humilis* low shrubland over *Phlebocarya filifolia, Mesomelaena pseudostygia* and *Lepidosperma leptostachyum* low sedgeland. Represents EPBC TEC Banksia Woodlands of the SCP. One patch also represents the WA TEC *Banksia attenuata* woodlands over species rich dense shrublands (SCP20a). Supports the Threatened *Conospermum undulatum* and Priority 3 *Isopogon drummondii.*	Survey effort: Q04, Q06, Q13 Species richness: 88 native and 7 weed species Area: 1.55 ha	
BmXpEc **Banksia Woodland** *Banksia menziesii, Allocasuarina fraseriana* and *Eucalyptus todtiana* low open woodland over Xanthorrhoea preissii, Eremaea pauciflora var. pauciflora and Stirlingia latifolia low open shrubland over *Ehrharta calycina, Dasypogon bromeliifolius and Anigozanthos manglesii subsp. manglesii mixed grass and forbland. Represents EPBC TEC Banksia Woodlands of the SCP and WA TEC eastern *B. attenuata* and/or *E. marginata* woodlands (SCP20b).	Survey effort: R08, Q09, R12, R14, Q18, Q19 Species richness: 80 native and 12 weed species Area: 1.92 ha	
Significantly Altered Includes planted, gardens, scattered trees (both native and introduced). Condition considered Completely Degraded.	Area: 56.56 ha	

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,125
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

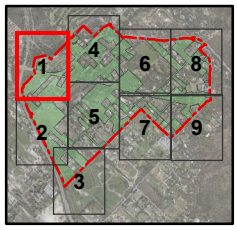
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND

- Wattle Grove South Area
- Survey Area
- Quadrat
- Relevé

Vegetation Communities

- BmXpEc
- Trees
- Planted
- Cleared
- Hardstand



Vegetation Communities

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 7.1

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig7_VegCommunities_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,125
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

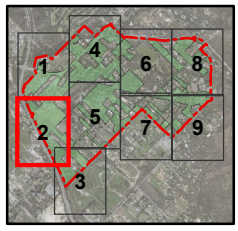
Data sources:

LEGEND

- Wattle Grove South Area
- Survey Area
- Quadrat
- Relevé

Vegetation Communities

- BmXpEc
- Trees
- Planted
- Cleared
- Hardstand



Vegetation Communities

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
7.2

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig7_VegCommunities_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,125
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

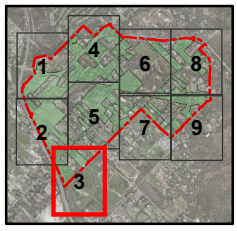
Data sources:

LEGEND

- Wattle Grove South Area
- Survey Area
- Quadrat
- Relevé

Vegetation Communities

- BaEpPf
- EmMpLp
- Trees
- Planted
- Cleared
- Hardstand



Vegetation Communities

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 7.3

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig7_VegCommunities_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

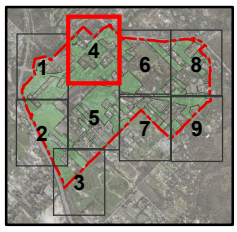
N
1:4,125
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

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

LEGEND
- Wattle Grove South Area
- Survey Area
- Relevé
- Vegetation Communities
  - CcHaEc
- Trees
- Planted
- Cleared
- Hardstand



Vegetation Communities

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 7.4

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig7_VegCommunities_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,125
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

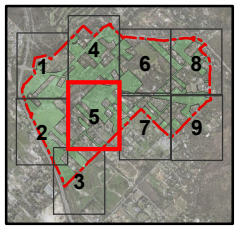
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND

- Wattle Grove South Area
- Survey Area
- Quadrat
- Relevé

Vegetation Communities

- BaEpPf
- BmXpEc
- EmLpFa
- EmMpLp
- Trees
- Planted
- Cleared
- Hardstand



Vegetation Communities

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
7.5

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig7_VegCommunities_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,125
(when printed at A4)

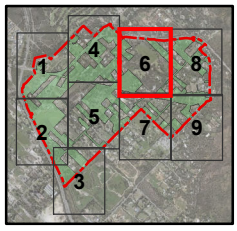
DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

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

LEGEND

- Wattle Grove South Area
- Survey Area
- Relevé
- Vegetation Communities
  - BmXpEc
  - EmPcAh
  - Trees
  - Planted
  - Cleared
  - Hardstand



Vegetation Communities

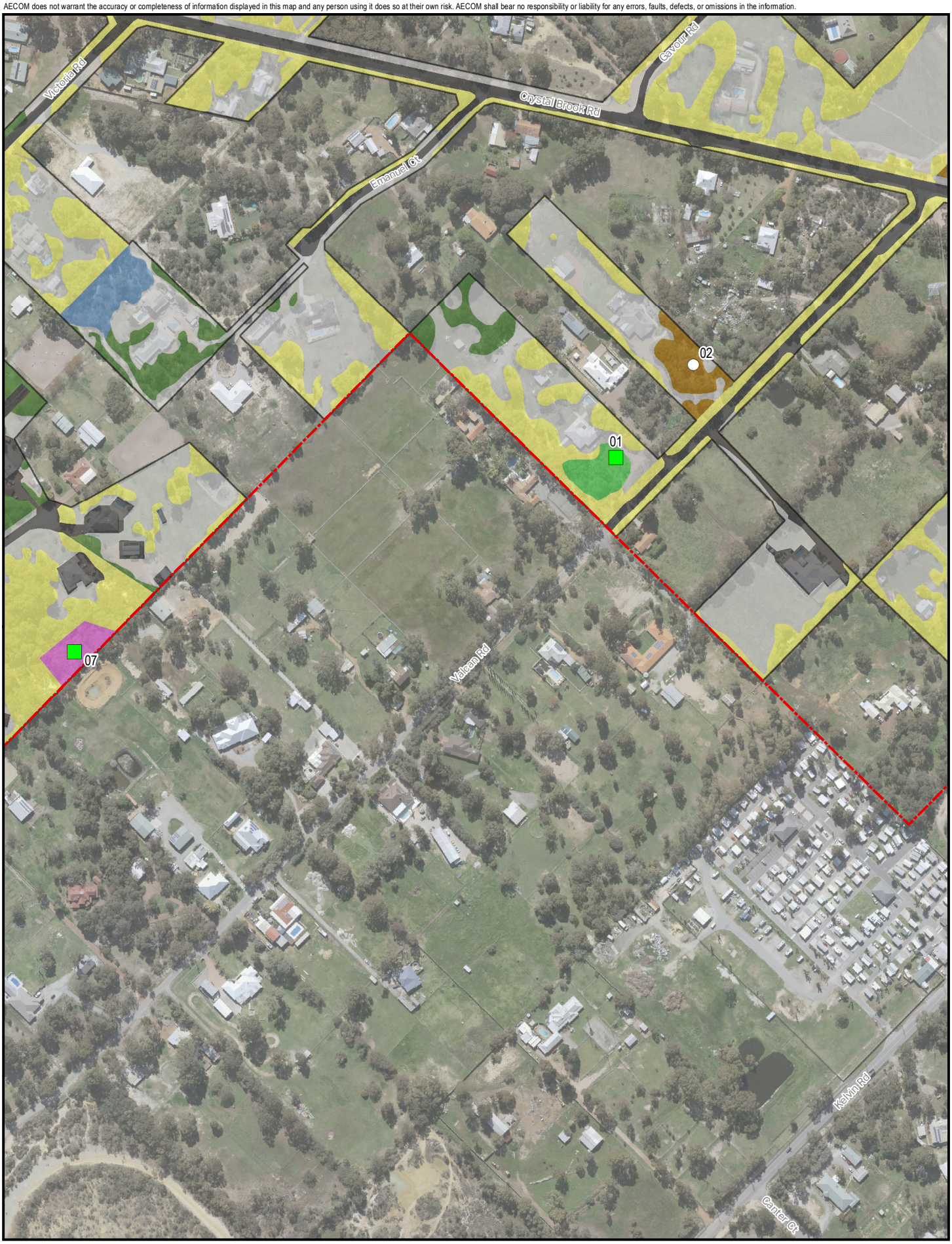
CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
7.6

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig7_VegCommunities_A4P_v1.mxd (WyattK2)

A4 size



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,125
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

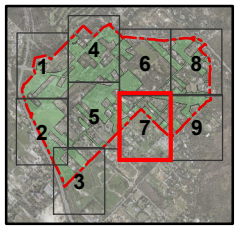
Data sources:

LEGEND

- Wattle Grove South Area
- Survey Area
- Quadrat
- Relevé

Vegetation Communities

- BaEpPf
- EmCaFa
- EmLpFa
- EmPcAh
- Trees
- Planted
- Cleared
- Hardstand



Vegetation Communities

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
7.7

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig7_VegCommunities_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,125
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

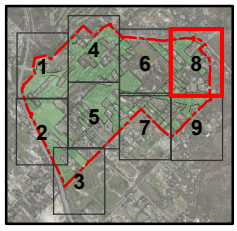
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND

- Wattle Grove South Area
- Survey Area
- Quadrat
- Relevé

Vegetation Communities

- BmXpEc
- EmCaFa
- EmLpFa
- EmMpLp
- EmPcAh
- Trees
- Planted
- Cleared
- Hardstand



Vegetation Communities

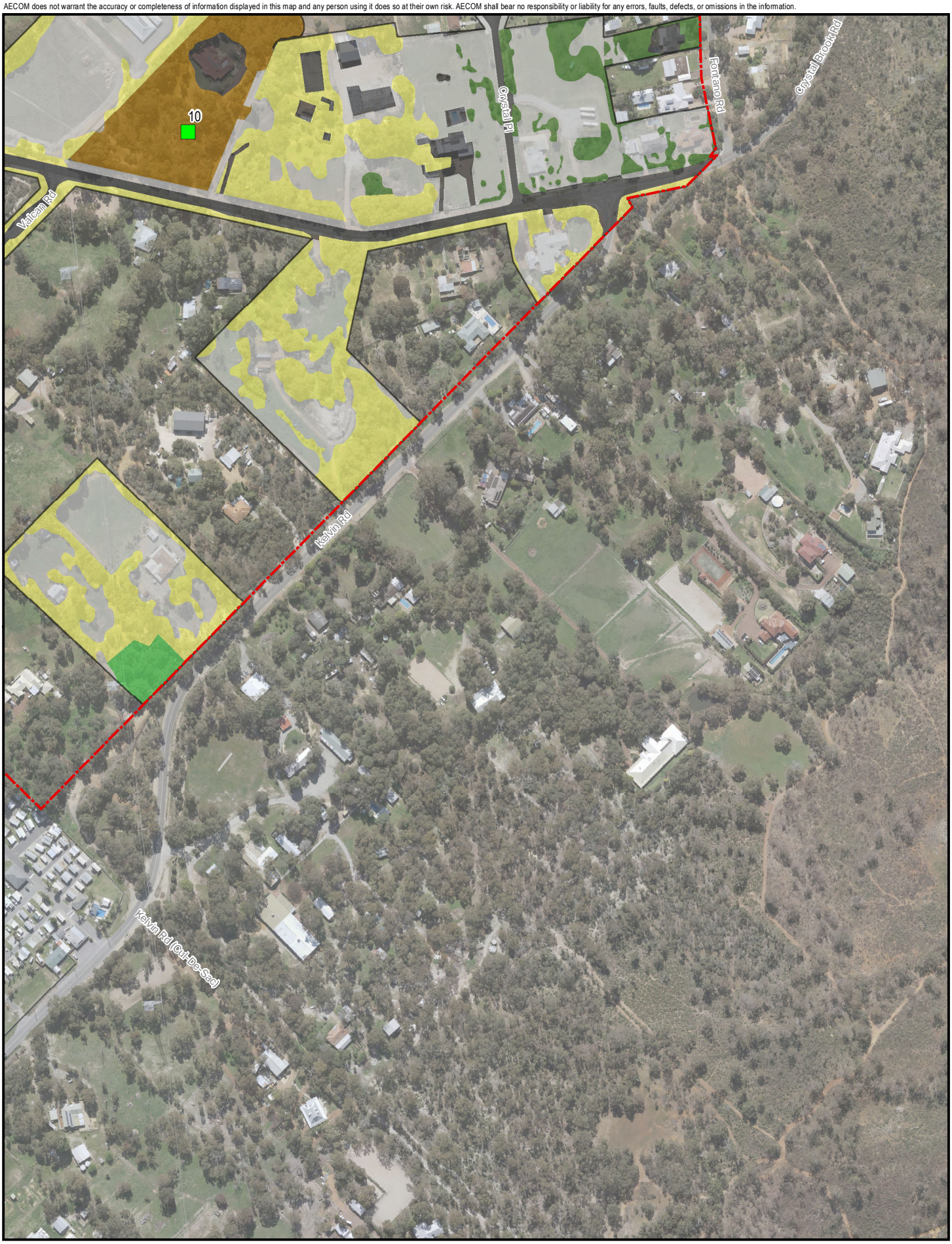
CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 7.8

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig7_VegCommunities_A4P_v1.mxd (WyattK2)

A4 size



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,125
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

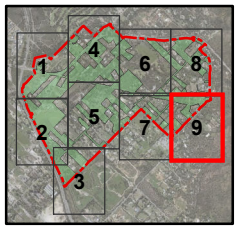
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND

- Wattle Grove South Area
- Survey Area
- Quadrat

Vegetation Communities
- EmCaFa
- EmPcAh

- Trees
- Planted
- Cleared
- Hardstand



Vegetation Communities

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 7.9

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig7_VegCommunities_A4P_v1.mxd (WyattK2)

A4 size

6.1.4 Vegetation Condition

Vegetation condition within the Survey area varied from 'Excellent' to 'Completely Degraded', shown in Figure 8. The condition map reflects the current land use (private estate). Majority of residences comprise cleared grasslands (lawn) and maintained gardens. Condition extent is presented in Table 21.

Table 21 Vegetation condition

Condition Rating	Area (ha)	Percentage of Survey area (%)
Excellent	2.24	20
Very Good	2.22	76
Good	1.45	1
Degraded	1.59	1
Completely Degraded	127.39	1
Cleared	33.07	1
Total	167.97	100

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

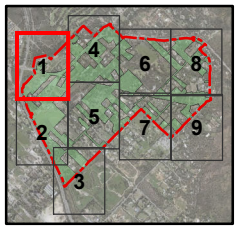
DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

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

LEGEND
- Wattle Grove South Area
- Survey Area

Vegetation Condition
- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared



Vegetation Condition

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 8.1

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig8_VegCondition_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

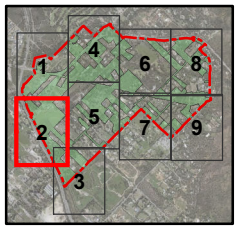
N
1:4,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

LEGEND
- Wattle Grove South Area
- Survey Area

Vegetation Condition
- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared



Vegetation Condition

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
8.2

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig8_VegCondition_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

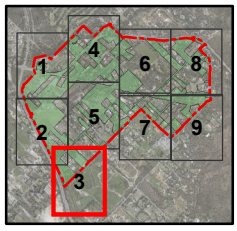
DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

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

LEGEND
- Wattle Grove South Area
- Survey Area

Vegetation Condition
- Excellent
- Very Good
- Completely Degraded
- Cleared



Vegetation Condition

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 8.3

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig8_VegCondition_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

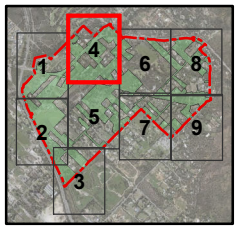
DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

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

LEGEND
- Wattle Grove South Area
- Survey Area

Vegetation Condition
- Degraded
- Completely Degraded
- Cleared



Vegetation Condition

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
8.4

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig8_VegCondition_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

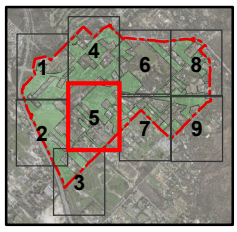
N
1:4,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

LEGEND
- Wattle Grove South Area
- Survey Area

Vegetation Condition
- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared



Vegetation Condition

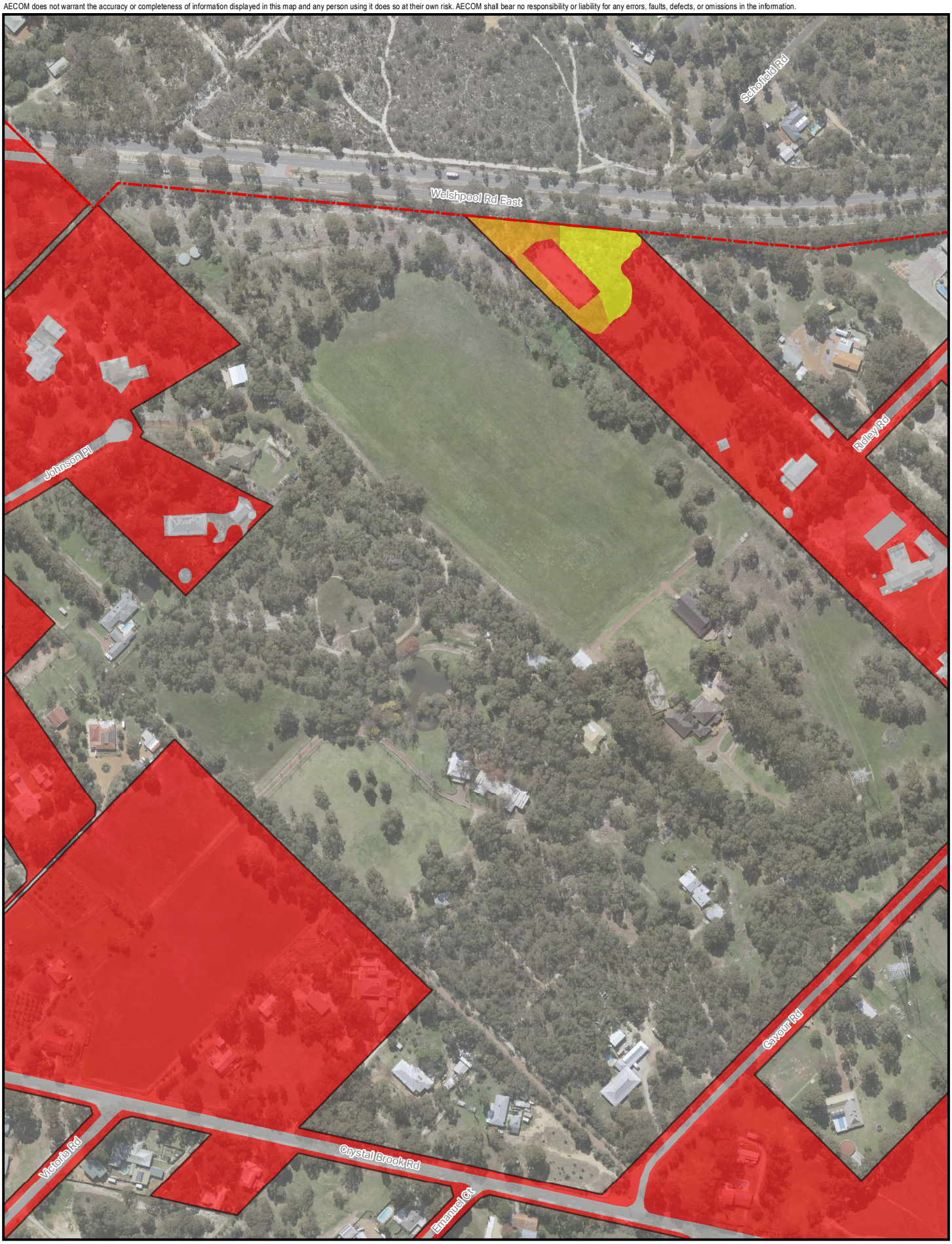
CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 8.5

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig8_VegCondition_A4P_v1.mxd (WyattK2)

A4 size



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

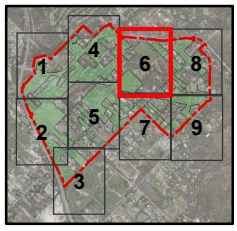
DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

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

LEGEND
- Wattle Grove South Area
- Survey Area

Vegetation Condition
- Good
- Degraded
- Completely Degraded
- Cleared



Vegetation Condition

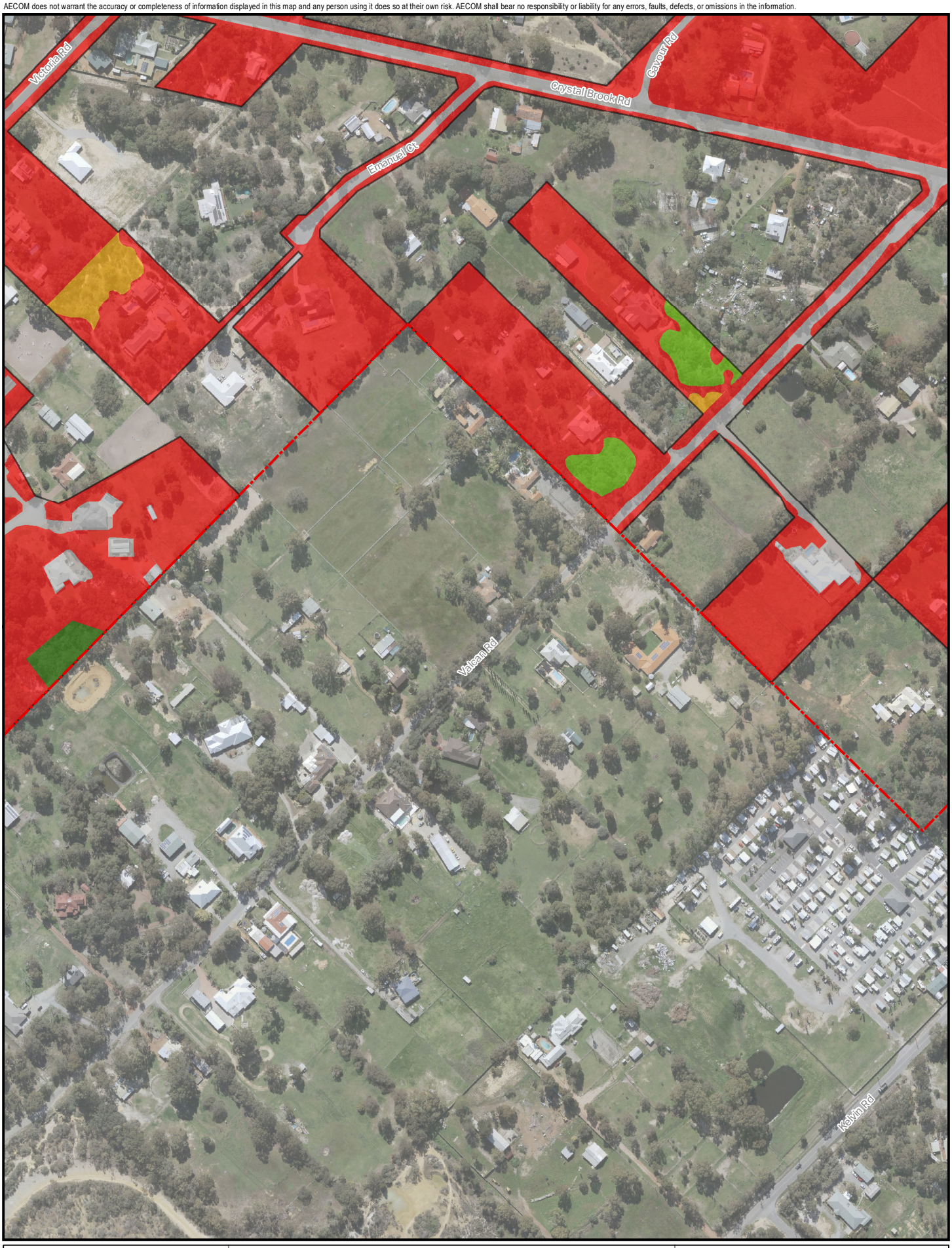
CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
8.6

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig8_VegCondition_A4P_v1.mxd (WyattK2)

A4 size



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

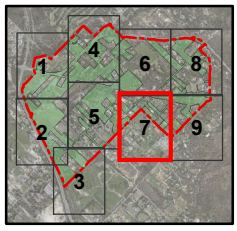
DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

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

LEGEND
- Wattle Grove South Area
- Survey Area

Vegetation Condition
- Excellent
- Very Good
- Degraded
- Completely Degraded
- Cleared



Vegetation Condition

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
8.7

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig8_VegCondition_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

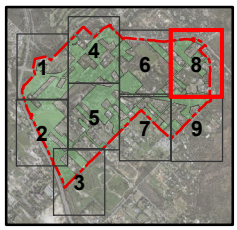
DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

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

LEGEND
- Wattle Grove South Area
- Survey Area

Vegetation Condition
- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared



Vegetation Condition

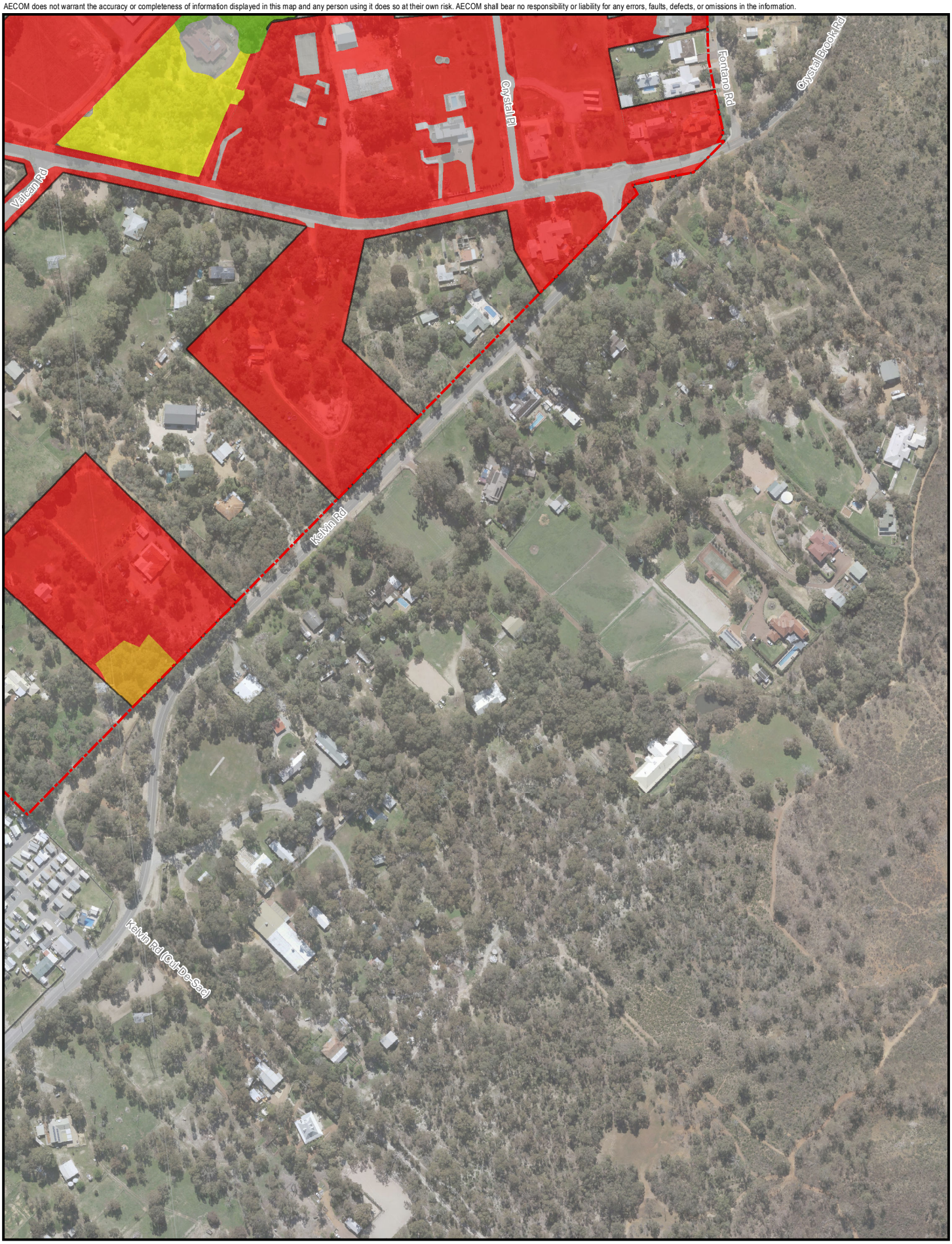
CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 8.8

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig8_VegCondition_A4P_v1.mxd (WyattK2)

A4 size



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

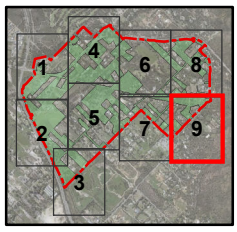
DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

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

LEGEND
- Wattle Grove South Area
- Survey Area

Vegetation Condition
- Very Good
- Good
- Degraded
- Completely Degraded
- Cleared



Vegetation Condition

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 8.9

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig8_VegCondition_A4P_v1.mxd (WyattK2)

A4 size

6.2 Flora

6.2.1 Threatened and Priority Flora

***Conospermum undulatum* (T)**

One Threatened species listed under the EPBC Act and BC Act was recorded within the survey area. *Conospermum undulatum* (EPBC Vulnerable, BC Vulnerable) has been previously recorded in the survey area. This was verified during the field survey where two populations were recorded comprising 95 individuals (see Table 22 and Figure 9). No photograph was taken of this species in the survey area.

DBCA population 11 is located within the survey area. This population is located on land where no access was granted for this field survey.

Populations of *C. undulatum* recorded during this survey are not represented in the DBCA dataset.

Table 22 *C. undulatum* population information within and in vicinity of survey area

Parameter	AECOM[1]		DBCA[2]	
	Populations	Individuals	Populations	Individuals
Within survey area	2	95	3	528
In vicinity			10	3694

1. Restricted to properties for which access was granted
2. applicable to wider Wattle Grove survey area.

Isopogon drummondii

One Priority 3 species, *Isopogon drummondii*, was recorded in the survey area. These two populations correspond with the *C. undulatum* populations. There is one known record of this species in the survey area from 1990 (see Table 23 and Figure 9). This species is regionally restricted but locally common.

Table 23 *I. drummondii* population information within and in vicinity of survey area

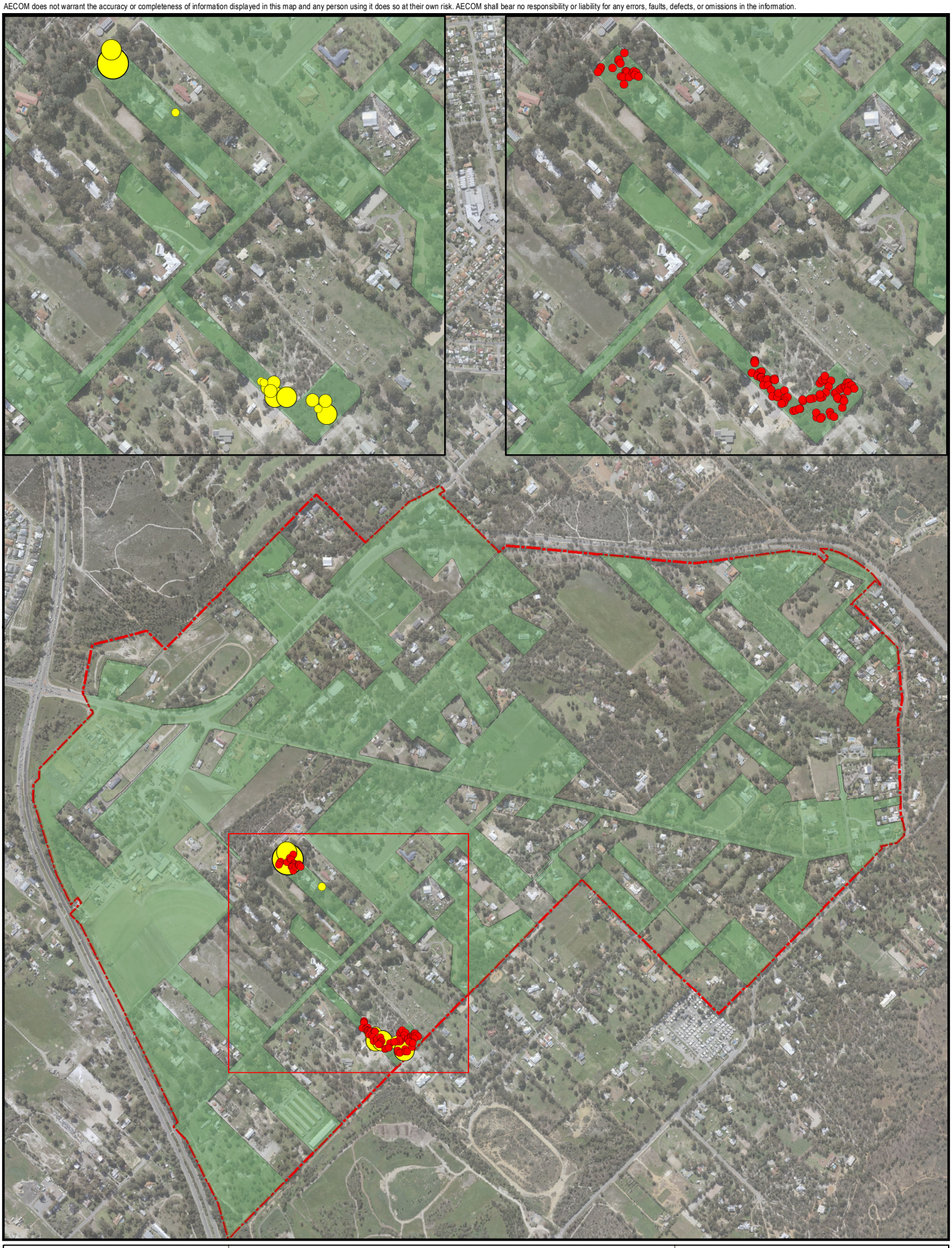
Parameter	AECOM[1]		DBCA[2]	
	Populations	Individuals	Populations	Individuals
Within survey area	2	160	1	Not available
In vicinity			9	Described as ‘locally abundant’

1. Restricted to properties for which access was granted
2. applicable to wider Wattle Grove survey area.

Plate 2 ***Isopogon drummondii*** **recorded in the survey area**

Banksia mimica

The *B. mimica* population (DBCA population 3) was previously recorded south east of the Crystal Brook Road and Brentwood Road junction. All properties in this vicinity have been cleared for development and no native vegetation remains. *B. mimica* was not recorded during the field survey.



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:15,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 100 200 300 400
Metres

Data sources:

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

LEGEND

Survey Area
Wattle Grove South Area
Conospermum undulatum T
Abundance:
1

Isopogon drummondii P3
Abundance:
1
2-5
6-25
26-100

Conservation Significant Vegetation

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
9

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig9_Conservation Significant Flora_A4P_v1.mxd (WyattK2)

A4 size

6.2.2 Inventory of Flora Species

A total of 165 native species from 95 genera and 38 families were recorded during the field survey. Families with the highest representation are Proteaceae (25 native taxa), Fabaceae (23 native taxa) and Myrtaceae (17 native taxa).

The full list of vascular flora species recorded and representative communities in which they occur in are presented in Appendix C. Qualitative data recorded from individual quadrats is presented in Appendix D.

In total, 21 introduced species were recorded. Of these, one is listed as a Declared Pest under the BAM Act. *Asparagus asparagoides,* Bridal Creeper (Declared Pest – S22(2) is listed as Exempt therefore no permit or conditions are applicable.

Rubus ulmifolius (Declared Pest – s22(2), also known as Blackberry, was observed along a drainage channel where access was restricted due to fencing (despite the area being zoned as Reserve). This species is listed as C3 – Management / Exempt where some form of management should be applied to alleviate the harmful impacts of this species.

6.3 Fauna

6.3.1 Level 1 Fauna Survey

6.3.1.1 Fauna Inventory

Fifty-one vertebrate fauna species were recorded within the survey area during the field survey. This comprised three reptile, one amphibian, 11 mammal and 36 bird species. The observed species are presented in Table 24.

6.3.1.2 Conservation Significant Fauna Species

Seven of the 51 recorded vertebrate fauna species were of conservation significance, including six birds and one mammal. These include:

- Forest Red-Tailed Black Cockatoo *Calyptorhynchus banksii* (listed as Vulnerable under the EPBC Act and the BC Act). Refer to 6.3.3 for further details.
- Carnaby's Cockatoo *Calyptorhynchus latirostris* (listed as Endangered under the EPBC Act and the BC Act). Refer to 6.3.3 for further details.
- Quenda *Isoodon fusciventer* (listed as Priority 4 by DBCA). Refer to Plate 3 for photographs of Quenda diggings and scat recorded within the survey area.
- Fan-Tailed Cuckoo *Cacomantis flabelliformis,* Horsfield's Bronze Cuckoo *Chrysococcyx basalis*, Magpie Lark *Grallina cyanoleuca* and Rainbow Bee-Eater *Merops ornatus* (listed as Marine under the EPBC Act). Species listed as Marine under the EPBC Act are only considered significant in Commonwealth land and as the survey area does not contain Commonwealth land these species will not be further discussed within the report.

Based on the desktop assessment and the field survey, the following additional conservation significant fauna species are considered to have the potential to utilise the habitats within the survey area:

- Baudin's Cockatoo *Calyptorhynchus baudinii* - listed as Vulnerable under the BC Act and the EPBC Act
- Carter's Freshwater Mussel *Westralunio carteri* - listed as Vulnerable under the BC Act and the EPBC Act.

Refer to Table 25 and Appendix A for further detail on these conservation significant species.




Plate 3 Quenda observations within the survey area

Table 24 Vertebrate fauna species recorded within the survey area

Species	Vernacular	Status	Observations
Birds			
Anas superciliosa	Pacific Black Duck	Native	Observed in artificial ponds
Anthochaera carunculata	Red Wattlebird	Native	Commonly seen and heard throughout survey area
Cacatua roseicapilla roseicapilla	Galah	Native	Observed multiple times during survey
Cacatua sanguinea	Western Corella	Native	Small flock observed in trees
Cacomantis flabelliformis	Fan-tailed Cuckoo	Native	Heard in trees in paddock
Calyptorhynchus banksii	Forest Red-tailed Black Cockatoo	Native	Two birds observed foraging in Marri tree, multiple birds seen flying over area, multiple observations of foraging evidence
Calyptorhynchus latirostris	Carnaby's Cockatoo	Native	Foraging evidence observed
Chenonetta jubata	Australia Wood Duck	Native	Observed multiple times during survey

Species	Vernacular	Status	Observations
Birds			
Chrysococcyx basalis	Horsfield's Bronze Cuckoo	Native	Heard multiple times
Colluricincla harmonica	Grey Shrikethrush	Native	Heard in Flooded Gums adjacent drainage line
Corvus coronoides	Australian Raven	Native	Commonly seen and heard throughout survey
Cracticus tibicen	Australian Magpie	Native	Commonly seen and heard throughout survey
Cracticus torquatus	Grey Butcherbird	Native	Observed flying through maintained gardens
Dacelo novaeguineae	Laughing Kookaburra	Naturalised exotic	Commonly seen and heard throughout survey area
Dromaius novaehollandiae	Emu	Native	Individual observed in an enclosure
Petrochelidon nigricans	Tree Martin	Native	Flock of approx. 10 birds observed flying in survey area
Gerygone fusca	Western Gerygone	Native	Seen in survey area
Grallina cyanoleuca	Magpie Lark	Native	Commonly seen and heard throughout Survey
Gavicalis virescens	Singing Honeyeater	Native	Common throughout survey area
Malurus splendens	Splendid Fairywren	Native	Seen and heard twice in survey area
Merops ornatus	Rainbow Bee-Eater	Native	Multiple observations recorded throughout survey area
Ocyphaps Lophotes	Crested Pigeon	Native	Observed several times
Pardalotus striatus	Striated Pardalote	Native	Commonly seen and heard throughout survey area
Pavo cristatus	Common Peafowl	Introduced	Heard several times
Phaps chalcoptera	Common Bronzewing	Native	Observed several times in survey area
Phylidonyris niger	White-cheeked Honeyeater	Native	Observed multiple times in survey area
Phylidonyris novaehollandiae	New Holland Honeyeater	Native	Commonly seen and heard throughout survey
Platycercus spurius	Red-capped Parrot	Native	Observed individuals and foraging evidence multiple times
Platycercus zonarius	Australian Ringneck	Native	Commonly seen and heard throughout survey area
Rhipidura leucophrys	Willie Wagtail	Native	Commonly seen and heard throughout survey area
Spilopelia senegalensis senegalensis	Laughing Turtle Dove	Introduced	Seen and heard multiple times in trees and flying over survey area
Taeniopygia guttata	Zebra Finch	Native	Two finches observed in Jarrah tree
Threskiornis moluccus	Australian White Ibis	Native	Observed multiple times during survey

Species	Vernacular	Status	Observations
Birds			
Todiramphus sanctus	Sacred Kingfisher	Native	Individual in tree in maintained garden
Trichoglossus moluccanus	Rainbow Lorikeet	Introduced	Seen and heard multiple times within survey area
Zosterops lateralis	Silver Eye	Native	Observed twice in survey area, flying through trees and in banksia woodland
Mammals			
Canis familiaris	Dog	Introduced	Common throughout survey area
Capra hircus	Goat	Introduced	Observed in paddock
Equus asinus	Donkey	Introduced	Observed in field
Equus caballus	Horse	Introduced	Horses observed in multiple paddocks in survey area
Felis catus	Cat	Introduced	Seen once during survey
Isoodon fusciventer	Quenda	Native	Observed directly and indirectly (conical digging and scat) several times in survey area
Lama glama	Llama	Introduced	Observed in field
Macropus fuliginosus	Western Grey Kangaroo	Native	Observed directly and indirectly several times in survey area
Oryctolagus cuniculus	Rabbit	Introduced	Observed directly and indirectly several times in survey area
Ovis aries	Sheep	Introduced	Observed in paddock
Vulpes vulpes	Red Fox	Introduced	Multiple scats recorded
Amphibians			
Crinia glauerti	Clicking Froglet	Native	Heard calling multiple times in drainage lines
Reptiles			
Cryptoblepharus buchananii	Buchanan's Snake-Eyed Skink	Native	Seen multiple times on trees throughout survey area
Pogona minor minor	Western Bearded Dragon	Native	Observed in survey area
Tiliqua rugosa rugosa	Bobtail	Native	Observed twice during survey

6.3.1.3 Introduced Species

Thirteen introduced and naturalised exotic species were recorded during the field survey. The species and their legal status under the BAM Act are listed below:

- Cat *Felis catus* – Permitted – s11
- Common Peafowl *Pavo cristatus* – Permitted – s11 (Exempt)
- Domestic Dog *Canis familiaris* – Permitted – s11
- Donkey *Equus asinu* - Permitted - s11
- Horse *Equus caballus* - Permitted - s11
- European Wild Rabbit *Oryctolagus cuniculus* – Declared Pest – s22(2) (C3 Prohibited)
- Goat *Capra hircus* - Permitted - s11
- Laughing Kookaburra *Dacelo novaeguineae* – Permitted – s11
- Laughing Turtle-Dove *Streptopelia senegalensis* – Permitted – s11.
- Llama *Lama glama* - Permitted - s11
- Rainbow Lorikeet *Trichoglossus haematodus* - Declared Pest - s22(2) (C3 Exempt)
- Red Fox *Vulpes vulpes* - Declared Pest – s22(2) (C3 Prohibited)
- Sheep *Ovis aries* - Permitted - s11.

The European Wild Rabbit, Red Fox and Rainbow Lorikeet are listed as Declared Pests under the BAM Act. Generally, these species were recorded sporadically throughout the survey area and were observed directly, or identified by tracks, scats and burrows.

Refer to Section 3.0 for explanations of BAM Act categories.

6.3.2 Fauna Habitat

Six broadly defined fauna habitats have been mapped within the survey area (Table 25 and Figure 10). Other than cleared areas, the most common fauna habitat is Scattered Trees. This habitat is highly variable and highly modified, and includes a mix of native and non-native eucalypts and other tree species over predominantly cleared ground. This habitat occupies 48.78 ha (28.5%) of the survey area. This habitat may be utilised as breeding, roosting and foraging habitat by the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Baudin's Cockatoo (*Calyptorhynchus baudinii*), depending on the tree species present. This habitat is also likely to be utilised by many of the common avian species in the area.

Table 25 describes these fauna habitats, includes the area and percentage these cover within the survey area, and the conservation significant fauna species likely to utilise these habitats.

6.3.3 Fauna Habitat Linkages

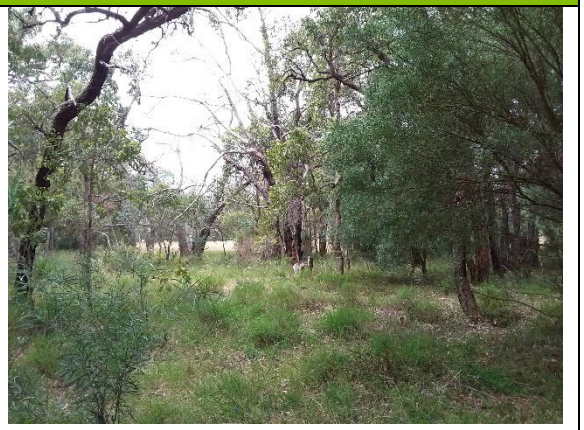
Habitat linkages are typically areas or corridors of vegetation that link (larger) areas of fauna habitat. Linkages are important as they enable fauna to move freely between remnant bushland patches, therefore increasing gene-flow between populations. A study conducted by Gilbert *et al.* (1998) found that corridors and/or linkages do maintain species richness in the fragmented landscapes.

The survey area is located on the edge of a metropolitan area with significant amounts of cleared and highly modified land. Although the survey area probably does not contain any significant habitat linkages, predominantly due to clearing, habitat fragmentation and arterial roads bisecting the area, it does contain degraded drainage lines that may enable some fauna taxa to move through the area. It also sits near the Kenwick Wetlands and habitat adjacent the Hartfield Golf Club, and the survey area may provide for movement of fauna into and out of these areas. In saying the above, avian fauna species are more likely to utilise the survey area as a stepping stone from the larger areas of fauna habitat on the darling scarp, to the fragmented habitats of the Swan Coastal Plain.

Table 25 Fauna habitats recorded within the survey area

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
Banksia Woodland	This habitat generally comprised a low open woodland of Banksia and Eucalyptus over a low open shrubland on loamy, sandy brown soil. The habitat is generally considered high quality due to presence of Banksia, its complexity and limited disturbance levels. Habitat quality is be reduced where areas are significantly degraded due to impacts from clearing and edge effects. Significant habitat characteristics include: • dense understorey common • logs of various sizes are common • fine and course leaf litter common to abundant • bare ground occasionally present • absence of stones and boulders • Large mature trees in rare to occasional abundance • Large hollows generally absent, small hollows common.	• Generally good quality foraging habitat for Carnaby's Cockatoo and Baudin's Cockatoo • Moderate to low quality foraging habitat for the Forest Red-tailed Black Cockatoo • Contains occasional breeding tree for black cockatoos • Habitat for Quenda.	3.52	2.06	

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
Drainage Line	This riparian habitat is generally degraded and variable throughout the survey area, but often contains a drainage line with scattered Marri and Flooded Gum over shrubland and introduced weeds / reeds. The habitat is considered high to moderate quality due to its wetland and riparian nature, but often reduced in quality due to limited understorey, high weed cover and disturbance levels.	• May contain foraging, roosting and / or breeding habitat for all three black cockatoo species, where mature eucalypts are present • Habitat for Quenda • Potential marginal habitat for Carter's Freshwater Mussel.	1.27	0.74	 

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
Eucalyptus Woodland	This habitat is variable throughout the survey area though generally contains a *Eucalyptus* woodland / open forest over a low shrubland over sandy brown soils. This habitat is considered high to moderate (depending on degree of degradation) quality due to the structural complexity and disturbance levels. Significant habitat characteristics include: • presence of large mature eucalypts • dense understorey occasionally present • logs of various sizes in variable abundance • fine and course leaf litter common • bare ground occasionally present • absence of stones and boulders • large hollows occasionally present, small hollows common • soils of areas at base of Darling scarp contained pea gravel.	• Foraging, breeding and roosting habitat for: - Forest Red-tailed Black Cockatoo - Carnaby's Cockatoo - Baudin's Cockatoo • Habitat for Quenda	3.94	2.31	 

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
Shrubland	This habitat generally comprised small areas of open, often degraded shrubland on sandy soils. This habitat was generally considered moderate to low quality fauna due to being highly modified and disturbed, with limited structural complexity. The significant fauna habitat characteristics include: • bare ground occasional to common abundance • dense understorey present in patches • minimal large trees • vegetation containing occasional small hollows, large hollows rare • decorticating bark and course leaf litter present in patches • stones and boulders generally absent • small and medium sized fallen branches occasional abundance.	• Potentially provides low quality foraging habitat for all three black cockatoo species depending on flora species present. • Habitat for Quenda.	0.30	0.18	

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
Planted and Maintained Gardens	Highly variable habitat including areas of planted and maintained native and introduced vegetation. The habitat is considered low to moderate quality due to disturbance levels and limited habitat complexity. Significant habitat characteristics include: • mature trees rare • variability of understorey, with areas of dense understorey generally absent • general lack of hollows • bare sandy ground abundant • absence of stones, boulders and rock crevices.	• Predominantly foraging habitat, but also occasionally breeding and roosting habitat for: - Forest Red-tailed Black Cockatoo - Carnaby's Cockatoo - Baudin's Cockatoo • Habitat for Quenda.	7.25	4.24	
Scattered Trees	This habitat is varied and contains large mature native and non-native eucalypt trees, as well as other introduced species such as Cape Lilac and Jacaranda. Trees were generally recorded over cleared areas. The significant fauna habitat characteristics include: • Presence of large mature trees • Absence of dense understorey • Small hollows are common,	• Foraging, breeding and roosting habitat for: - Forest Red-tailed Black Cockatoo - Carnaby's Cockatoo - Baudin's Cockatoo • Marginal habitat for Quenda.	48.78	28.54	

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
	large hollows are rare • Logs of all sizes are rare to occasionally present • Course and fine litter are present but generally only under trees. • Bare sandy ground abundant • Absence of stones, boulders and rock crevices.				 

Fauna Habitat	Description	Conservation Significant Species with Potential to Utilise Habitat	Area (ha)	% of Survey Area	Photo
Cleared Ground	Generally areas which have been cleared (e.g. paddocks) and now comprise bare soil and / or weeds (may contain the occasional shrub / tree), or hardstand areas (e.g. roads). Habitat is considered very low quality	This habitat may contain the occasional individual foraging tree / shrub for black cockatoos.	71.82	42.02	

Note: Areas of hardstand (e.g. buildings, roads etc) were also mapped, however these provide little in the way of fauna habitat.

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

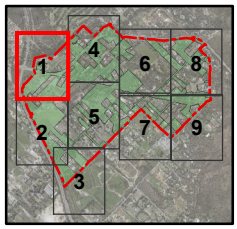
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations

FaunaHabit

- Banksia Woodland
- Drainage Line
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared



Fauna Habitats

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
10.1

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig10_FaunaHabitats_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

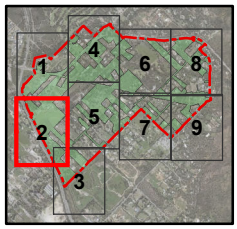
Data sources:

LEGEND

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations

FaunaHabit

- Banksia Woodland
- Drainage Line
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared



Fauna Habitats

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
10.2

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig10_FaunaHabitats_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

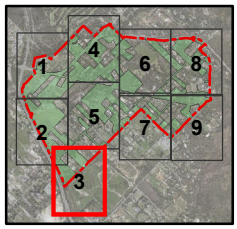
Data sources:

LEGEND

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations

FaunaHabit

- Banksia Woodland
- Drainage Line
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared



Fauna Habitats

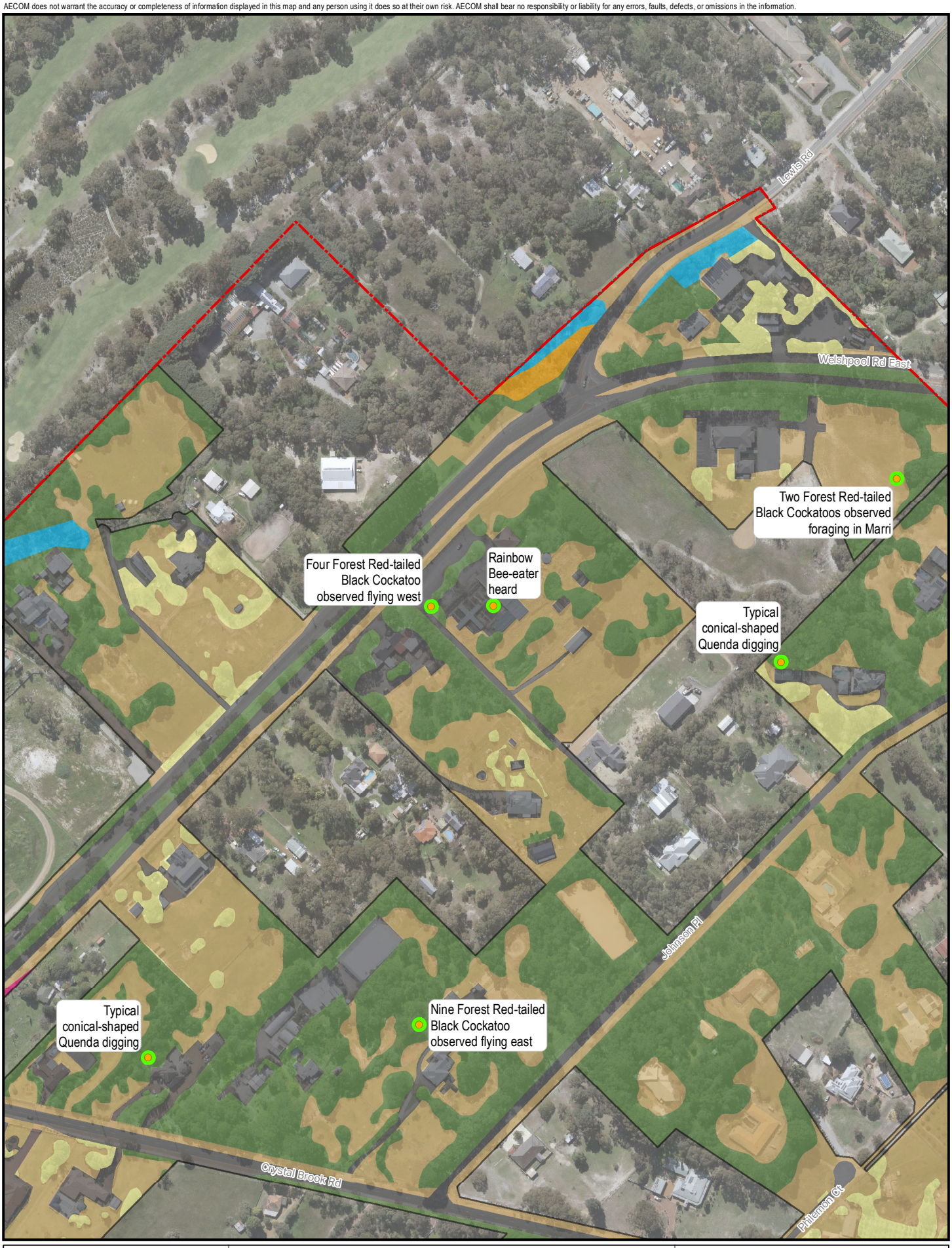
CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
10.3

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig10_FaunaHabitats_A4P_v1.mxd (WyattK2)

A4 size



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

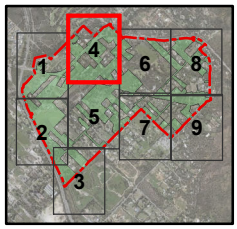
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations

FaunaHabit

- Banksia Woodland
- Drainage Line
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared



Fauna Habitats

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
10.4

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig10_FaunaHabitats_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

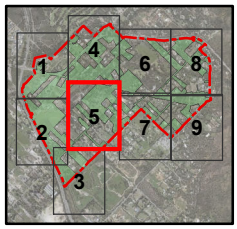
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations

FaunaHabit

- Banksia Woodland
- Drainage Line
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared



Fauna Habitats

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
10.5

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig10_FaunaHabitats_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

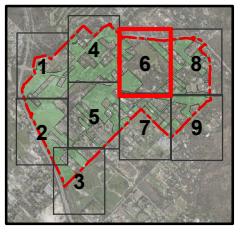
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations

FaunaHabit

- Banksia Woodland
- Drainage Line
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared



Fauna Habitats

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
10.6

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig10_FaunaHabitats_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

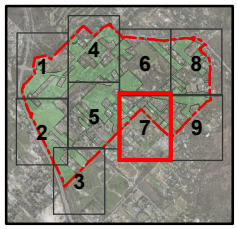
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations

FaunaHabit

- Banksia Woodland
- Drainage Line
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared



Fauna Habitats

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
10.7

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig10_FaunaHabitats_A4P_v1.mxd (WyattK2)

A4 size

PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

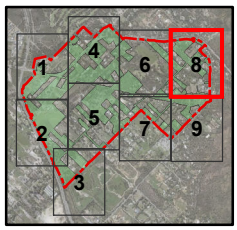
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations

FaunaHabit

- Banksia Woodland
- Drainage Line
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared



Fauna Habitats

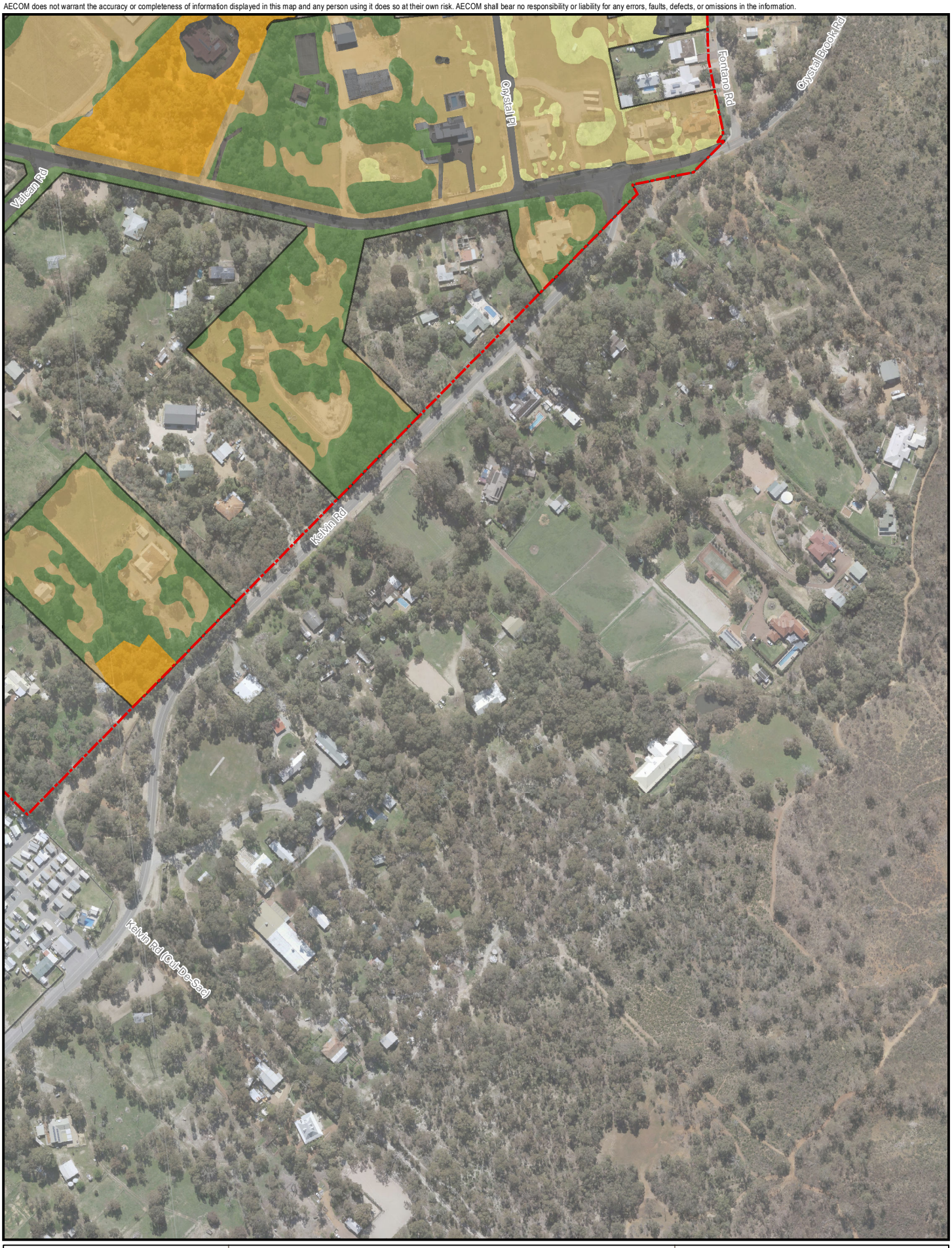
CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
10.8

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig10_FaunaHabitats_A4P_v1.mxd (WyattK2)

A4 size



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:4,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 25 50 75 100
Metres

Data sources:

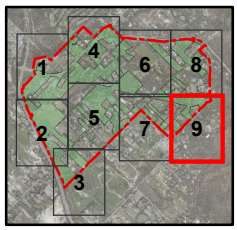
Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).Geoscience Australia, Streetpro

LEGEND

- Wattle Grove South Area
- Survey Area
- Opportunistic Fauna Observations

FaunaHabit

- Banksia Woodland
- Drainage Line
- Eucalyptus Woodland
- Planted and Maintained Gardens
- Scattered Trees
- Shrubland
- Hardstand
- Cleared



Fauna Habitats

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure
10.9

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig10_FaunaHabitats_A4P_v1.mxd (WyattK2)

A4 size

6.4 Black Cockatoos

6.4.1 Ecology

6.4.1.1 Carnaby's Cockatoo

Carnaby's Cockatoo *Calyptorhynchus latirostris* is endemic to the southwest of Western Australia, extending from the Murchison River to Esperance, and inland to Coorow, Kellerberrin and Lake Cronin. This black cockatoo has a white patch on its cheek, white bands on its tail, and a strong curved bill. Carnaby's Cockatoo is a seasonal visitor to the Swan Coastal Plain, which provides important foraging and roosting habitat during the non-breeding season.

Carnaby's Cockatoo feeds on seeds, nuts and flowers of a variety of native and exotic plants. Feed plants include the various proteaceous species (e.g. *Banksia*, *Grevillea* and *Hakea*), Marri *Corymbia calophylla*, Jarrah *Eucalyptus marginata*, and seeds from the cones of Pine *Pinus* sp. trees. Cockatoo flocks follow vegetation corridors and actively avoid cleared and open areas when moving between roosting, water and food resources. Habitat fragmentation increases the distances cockatoos need to travel between resources. Proximity of foraging habitat and water has been demonstrated to be critical to support roosting and breeding sites (Le Roux, 2017).

Carnaby's Cockatoo displays strong pair bonds and nest in the hollows of live or dead mature eucalypts including Salmon Gum *Eucalyptus salmonophloia*, York *Gum E. loxophleba* subsp*. loxophleba*, Flooded Gum *E. rudis*, Karri *E. diversicolor,* Wandoo *E. wandoo* and Tuart *E. gomphocephala* and Marri *Corymbia calophylla*, (DSEWPaC, 2012). Nest hollows generally range from 2.5-12 m above ground, size of entrance from 23-30 cm and depth of hollows from 1-2.5 m (Johnstone and Storr,1998).

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

Breeding habitat for this species occurs in the Wheatbelt, Jarrah Forest and South Coast regions, and the species is expanding its current breeding range with small patches of breeding habitat now being utilised across the SCP. After breeding, Carnaby's Cockatoo disperse to the higher rainfall coastal areas of the south-west of Western Australia to feed in late December to July. Breeding has been recorded from early July to mid-December.

Carnaby's Cockatoos were not directly observed during the field survey, however probable foraging evidence was recorded on three occasions.

6.4.1.2 Forest Red-tailed Black Cockatoo

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

This species predominantly feeds in eucalypt forests, preferring Marri *Corymbia calophylla* and Jarrah *Eucalyptus marginat*a seeds, but also feeding on Blackbutt *E. patens*, Albany Blackbutt *E. staeri*, Karri *E. diversicolor*, Sheoak *Allocasuarina sp.* and Snottygobble *Persoonia longifolia* (Johnstone, 2016 pers. comm.).

Forest Red-tailed Black Cockatoo are monogamous and pairs nest in tree hollows from 6.5 to 33 m above ground. Most nests are in very large and very old, mature Marri (Johnstone, Kirkby & Sarti, 2013), though they will nest in other eucalypts such as Tuart (Johnstone, 2016 pers. comm.). Breeding habitat for this species occurs in the eastern margins of the Jarrah forests of the Wheatbelt, and within the Jarrah Forest regions, and the Forest Red-tailed Black Cockatoo is expanding its current breeding range with small patches of breeding habitat now being utilised across the SCP.

Two individuals of the Forest Red-tailed Black Cockatoo were observed foraging in a Marri tree, multiple birds were seen and heard flying over the survey area, and multiple observations of old and recent foraging evidence (Table 24) was recorded during the field survey.

6.4.1.3 Baudin's Cockatoo

Baudin's Cockatoo *Calyptorhynchus baudinii* is distributed throughout 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 & Storr, 1998). It is a large black cockatoo with rectangular white patches in the tail. Males have a pink eye ring, the female a dark eye ring.

Baudin's Cockatoo forages primarily in eucalypt forest, where it feeds on seeds, flowers, nectar and buds from Marri *Corymbia calophylla*, and seeds of *Eucalyptus* and proteaceous species (e.g. *Banksia* and *Hakea*), as well as orchard fruits and Pines *Pinus* sp. It also takes insect larvae and insects (including beetle, wasp and moth larvae) from under bark and in wood of live and dead trees, from galls and from flower spikes of *Xanthorrhoea* and the pith of *Anigozanthos flavidus* (Johnstone & Kirkby, 2008).

This black cockatoo primarily nests in tree hollows in live or dead Karri *Eucalyptus diversicolor*, Marri *Corymbia calophylla*, Wandoo *Eucalyptus wandoo* and Tuart *Eucalyptus gomphocephala* (DSEWPaC, 2012b). Baudin's Cockatoo nests in spring in the deep southwest of Western Australia.

No Baudin's Cockatoos or foraging evidence were observed in or adjacent the survey area.

6.4.2 Breeding

Hollow formation in Eucalypt trees is a result of a number of processes including fungal attack, termites and fire, and the propensity for hollow formation varies between species (Whitford, 2002). In order to be suitable for black cockatoos, hollow entrances need to be at least 100 mm in diameter.

A total of 730 hollow-forming (generally native) breeding habitat trees were identified within the survey area. Just over 56% of these were Marri and 27% were Jarrah, with the remaining Tuart, stags, Flooded Gums, Wandoo and *Eucalyptus todtiana*. Hollows in Jarrah tend to be smaller than those found in Marri, consequently, black cockatoos, particularly Forest Red-tailed Black Cockatoos breed predominantly in Marri in the Jarrah-Marri forest of the south west (Whitford, 2002; Johnstone *et al*., 2013). On the Swan Coastal Plain most black cockatoo breeding records, particularly for Carnaby's Cockatoo are in Tuart (Johnstone & Kirkby, 2011), which were just over 6% of the total number of breeding habitat trees within the survey area.

Seventeen of the 730 trees contain a total of 26 potentially suitable hollows for breeding black cockatoos. All were considered to be large enough at their entrances with potentially sufficient floor and chamber space (when observed from the ground). However, hollows could not generally be fully inspected from the ground to determine if the hollows were deep enough for nesting to occur.

Refer to Appendix E for the details of the 17 trees with potentially suitable hollows, Figure 11 for locations of these trees and Appendix F full details of all 730 breeding habitat trees.

6.4.3 Roosting

Carnaby's and Baudin's Cockatoos roost in or near riparian environments or near other permanent water sources, generally within any tall trees, but particularly Flat-topped Yate, Salmon Gum, Wandoo, Marri, Karri, Blackbutt, Tuart, introduced eucalypts and introduced pines. The Forest Red-tailed Black Cockatoo prefers the edges of forests for roosting, within any tall trees, but particularly tall Jarrah, Marri, Blackbutt, Tuart and introduced eucalypt trees (DotEE, 2017). The Birdlife (2018) black cockatoo roosting data contains a confirmed Forest Red-tailed Black Cockatoo roosting site in the survey area at 35 Gavour Road, with one unconfirmed roost site located at 121 Crystal Brooke Road.

No additional roosting sites were confirmed during the field survey.

6.4.4 Foraging habitat

6.4.4.1 Carnaby's Cockatoo

The survey area contains a total of 69.39 ha of foraging habitat for Carnaby's Cockatoo. This includes 41.14 ha of Very High and High Quality foraging habitat. This generally consisted of habitats contiaing scattered mature eucalypts (potential breeding trees). Foraging habitat is presented in Figure 12, and total areas for each foraging quality are presented in Table 26. The foraging quality assessments are presented in Appendix E.

Carnaby's Cockatoo foraging evidence was recorded at three locations within the survey area (refer to Table 27).

Table 26 Carnaby's Cockatoo foraging habitat areas

Foraging Quality	Area (ha)
Low Quality (1-3)	10.33
Quality (4-6)	17.91
High Quality (7-8)	4.52
Very High Quality (>8)	36.62
TOTAL	69.39

Table 27 Potential Carnaby's Cockatoo foraging evidence

ID	Coordinates	Plate
16	116.0177, -32.0122	
46	116.004, -32.0048	

ID	Coordinates	Plate
107	116.0022, -32.0219	

6.4.4.2 Forest Red-tailed Black Cockatoo

The survey area contains a total of 59.53 ha of foraging habitat for the Forest Red-tailed Black Cockatoo. This includes 33.52 ha of Very High and High Quality foraging habitat, which generally consists of scattered mature Jarrah and Marri trees (potential breeding trees). Foraging habitat is presented spatially in Figure 13, and the total areas for each foraging quality are presented in Table 28. The foraging quality assessments are presented in Appendix E.

Potential foraging evidence from the Forest Red-tailed Black Cockatoo were recorded commonly throughout the survey area (Table 30).

Table 28 Forest Red-tailed Black Cockatoo foraging habitat areas

Foraging Quality	Area (ha)
Low Quality (1-3)	22.10
Quality (4-6)	3.92
High Quality (7-8)	0.00
Very High Quality (>8)	33.52
TOTAL	59.53

6.4.4.3 Baudin's Cockatoo

The survey area contains a total of 69.39 ha of foraging habitat for the Baudin's Cockatoo. This includes 41.14 ha of High Quality and Very High Quality foraging habitat, which generally consists of scattered eucalypts (potential breeding trees). Foraging habitat is presented spatially in Figure 14, and the total areas for each foraging quality are presented in Table 29. The foraging quality assessments are presented in Appendix E.

No foraging evidence from the Baudin's Cockatoo was recorded within the survey area.

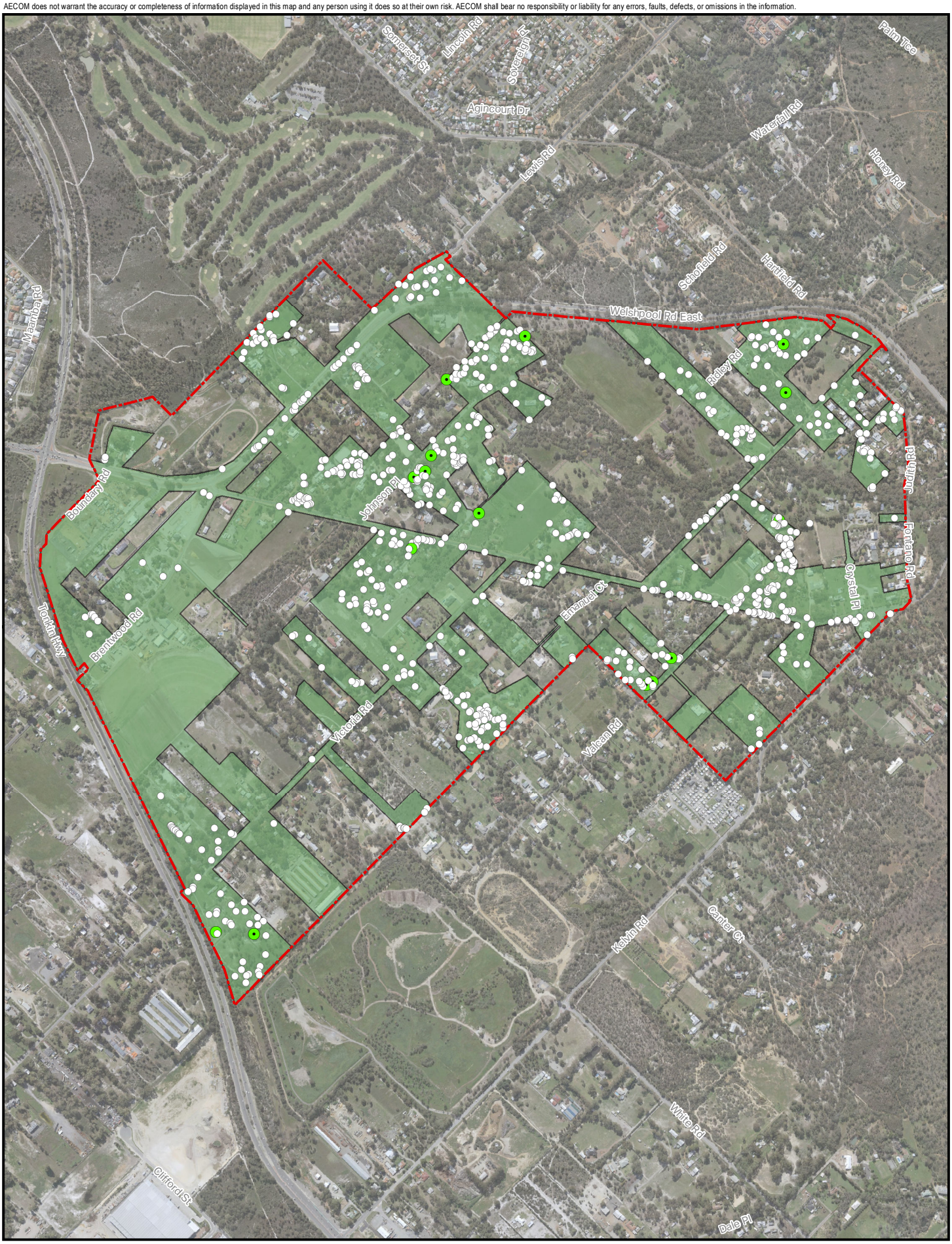
Table 29 Baudin's Cockatoo foraging habitat areas

Foraging Quality	Area (ha)
Low Quality (1-3)	13.73
Quality (4-6)	14.51
High Quality (7-8)	4.52
Very High Quality (>8)	36.62
TOTAL	69.39

Table 30 Potential Forest Red-tailed Black Cockatoo foraging evidence

ID	Coordinates	Plate	ID	Coordinates	Plate
5	116.0183, -32.0100		48	116.0067, -32.0058	
7	116.0177, -32.0105		59	116.0133, -32.0094	
10	116.0207, -32.0128		72	116.0207, -32.0106	
11	116.02, -32.01267		83	116.018, -32.0070	
12	116.0185, -32.01241		85	116.0208, -32.0056	
27	116.0084, -32.0040		87	116.0196, -32.0163	

ID	Coordinates	Plate	ID	Coordinates	Plate
30	116.0051, -32.00934		89	116.02, -32.0162	
31	116.0055, -32.0092		90	116.0233, -32.0129	
39	116.0166, -32.0135		94	116.0071, -32.0058	
42	116.0115, -32.0059		106	116.003, -32.0227	



PROJECT ID	60611889
CREATED BY	KW
APPROVED BY	FDW
LAST MODIFIED	06 FEB 2020

AECOM
www.aecom.com

N
DATUM GDA 1994 MGA Zone 50
1:15,000 (when printed at A4)
0 100 200 300 400
Metres

Data sources:

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

LEGEND
- Wattle Grove South Area
- Survey Area

Black Cockatoo Breeding Trees
- Black Cockatoo Breeding Trees
- Potential Black Cockatoo Breeding Trees

Black Cockatoo Breeding Trees

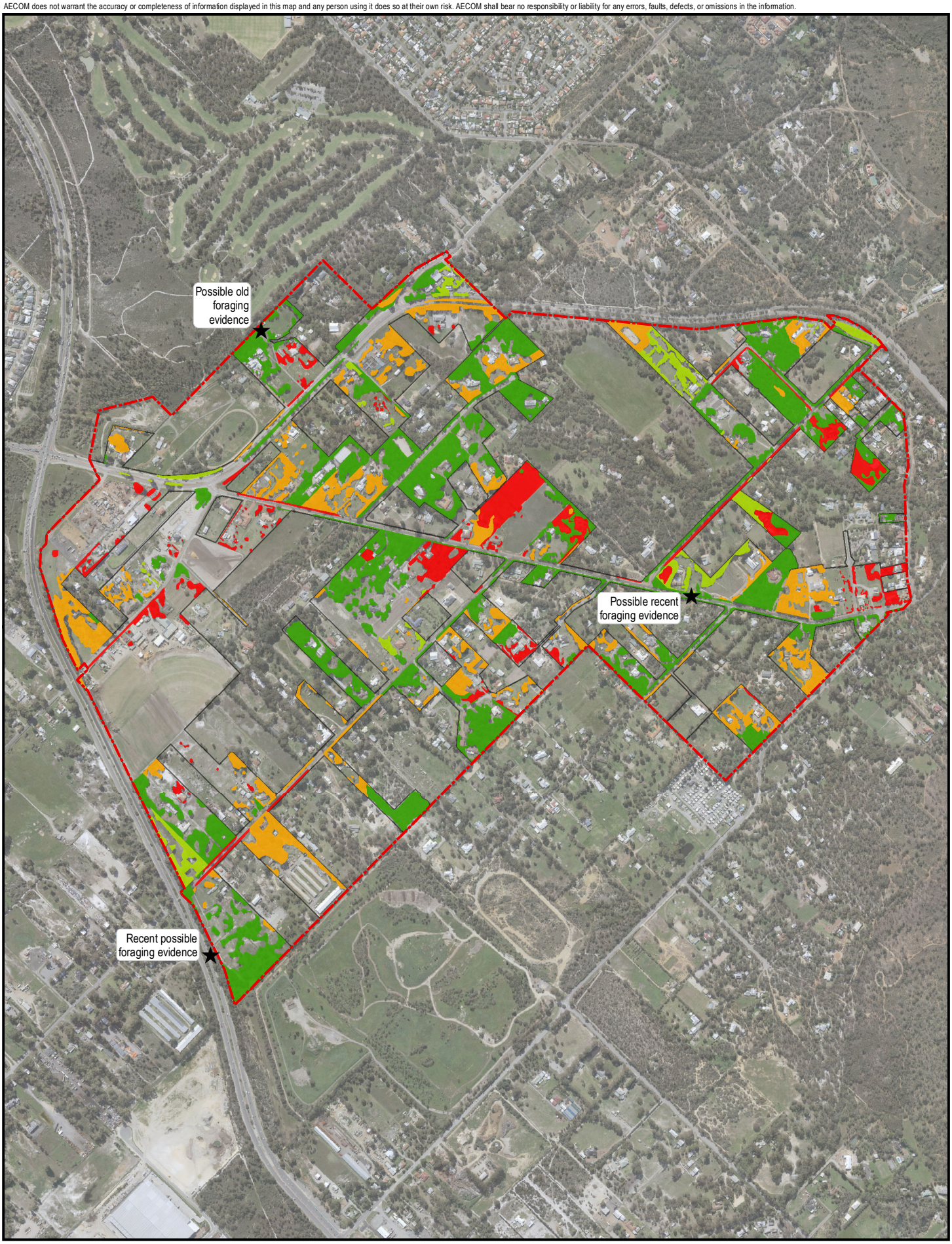
CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 11

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig11_BC_BreedingTrees_A4P_v1.mxd (WyattK2)

A4 size



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:15,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 100 200 300 400
Metres

Data sources:

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

LEGEND
- Wattle Grove South Area
- Survey Area
- Low Quality
- Quality
- High Quality
- Very High Quality
- ★ Opportunistic Fauna Observations

Carnaby's Cockatoo Foraging Habitat

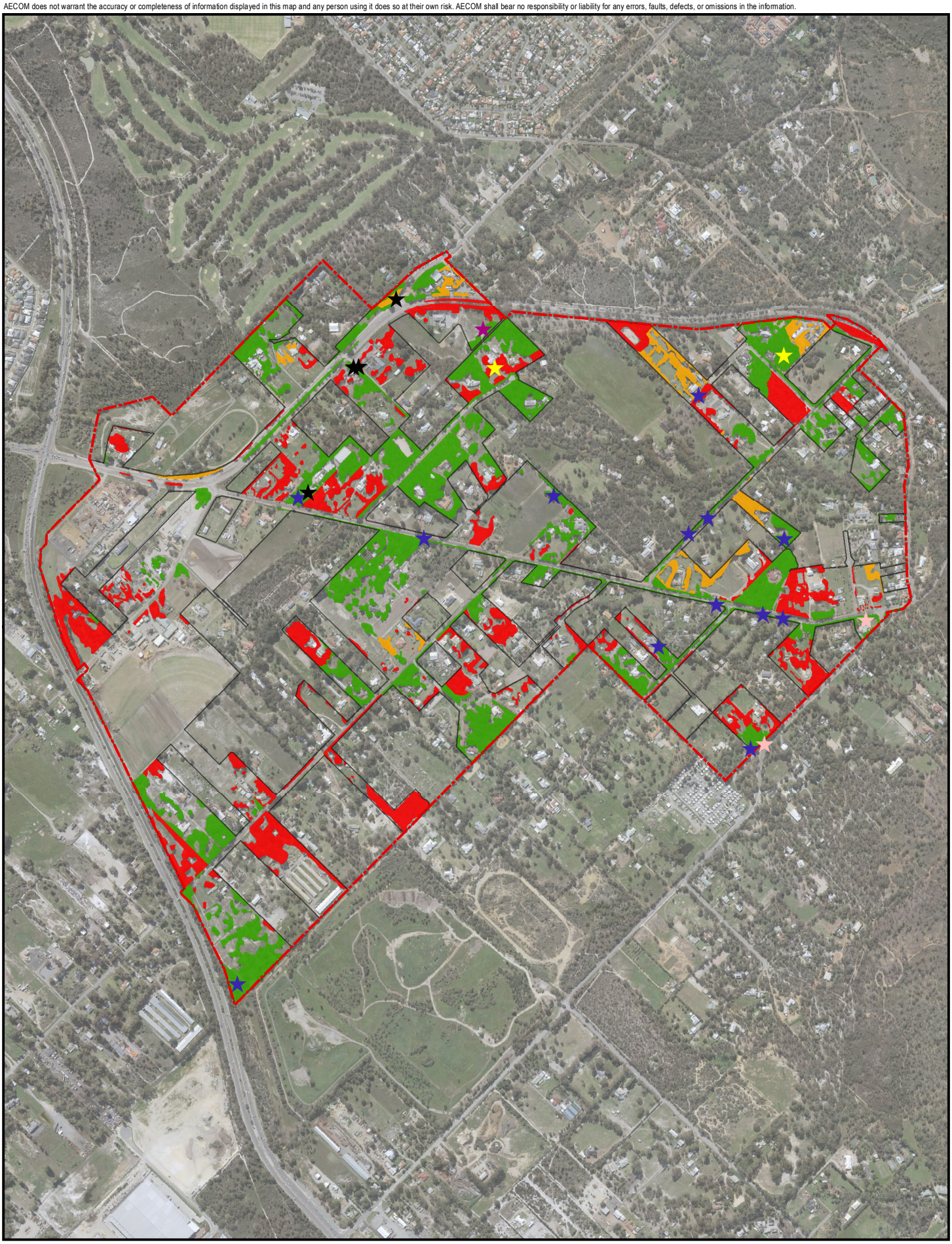
CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 12

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig12_CarnabysForagingHabitat_A4P_v1.mxd (WyattK2)

A4 size



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
DATUM GDA 1994 MGA Zone 50
1:15,000
(when printed at A4)
0 100 200 300 400
Metres

Data sources:

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

LEGEND

- Wattle Grove South Area
- Survey Area
- Low Quality
- Quality
- Very High Quality

Opportunistic Fauna Observations

- Possible foraging evidence
- Possible old foraging evidence
- Possible recent foraging evidence
- Recent and old possible foraging evidence
- Two Forest Red-tailed Black Cockatoos observed foraging in Marri

Forest Red-tailed Black Cockatoo Foraging Habitat

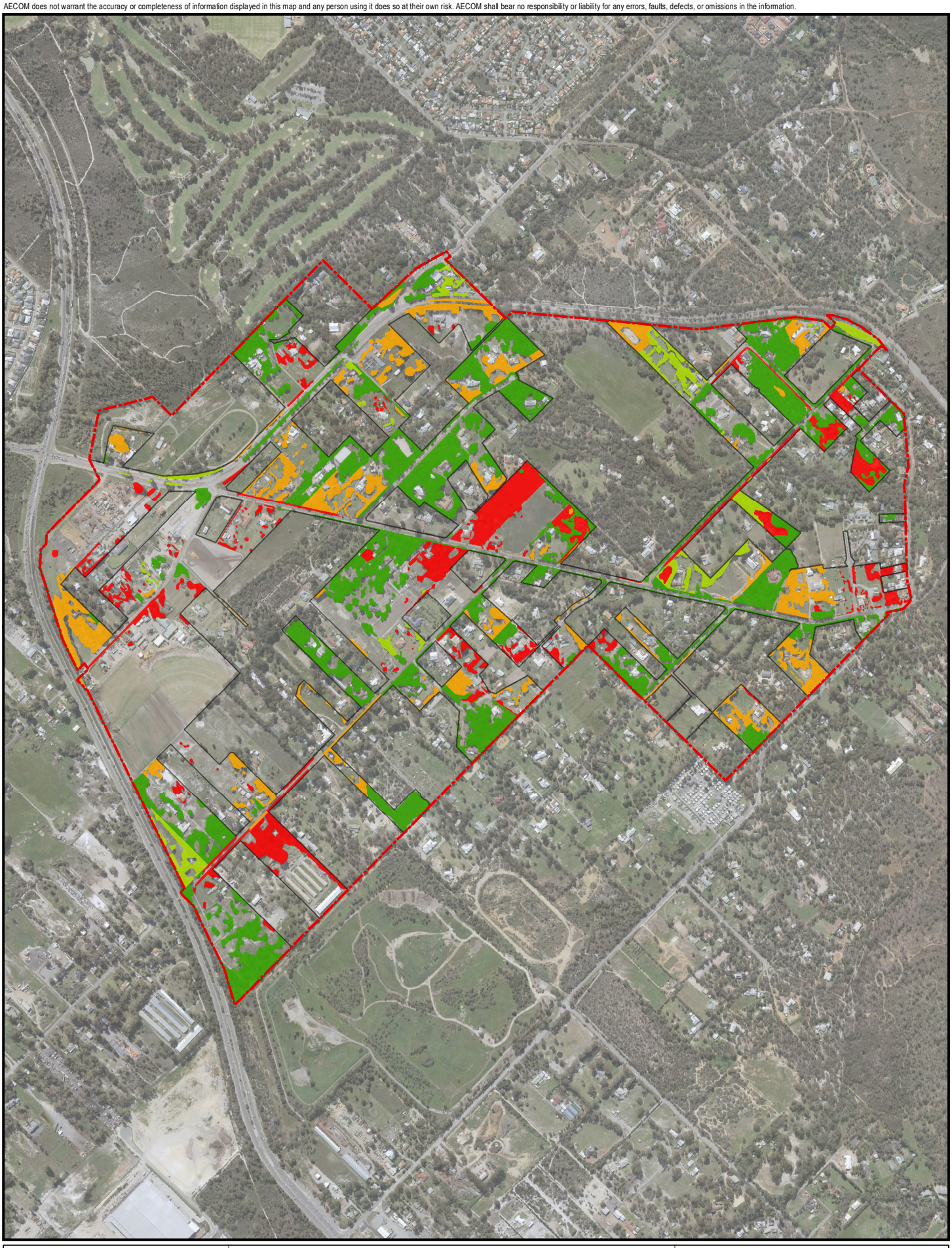
CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 13

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig13_FRTBCForagingHabitat_A4P_v1.mxd (WyattK2)

A4 size



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 24 JAN 2020

AECOM
www.aecom.com

N
1:15,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 100 200 300 400
Metres

Data sources:

LEGEND
- Wattle Grove South Area
- Survey Area
- Low Quality
- Quality
- High Quality
- Very High Quality

Baudin's Cockatoo Foraging Habitat

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 14

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig14_BaudinsForagingHabitat_A4P_v1.mxd (WyattK2)

A4 size

6.5 Environmental Values Assessment

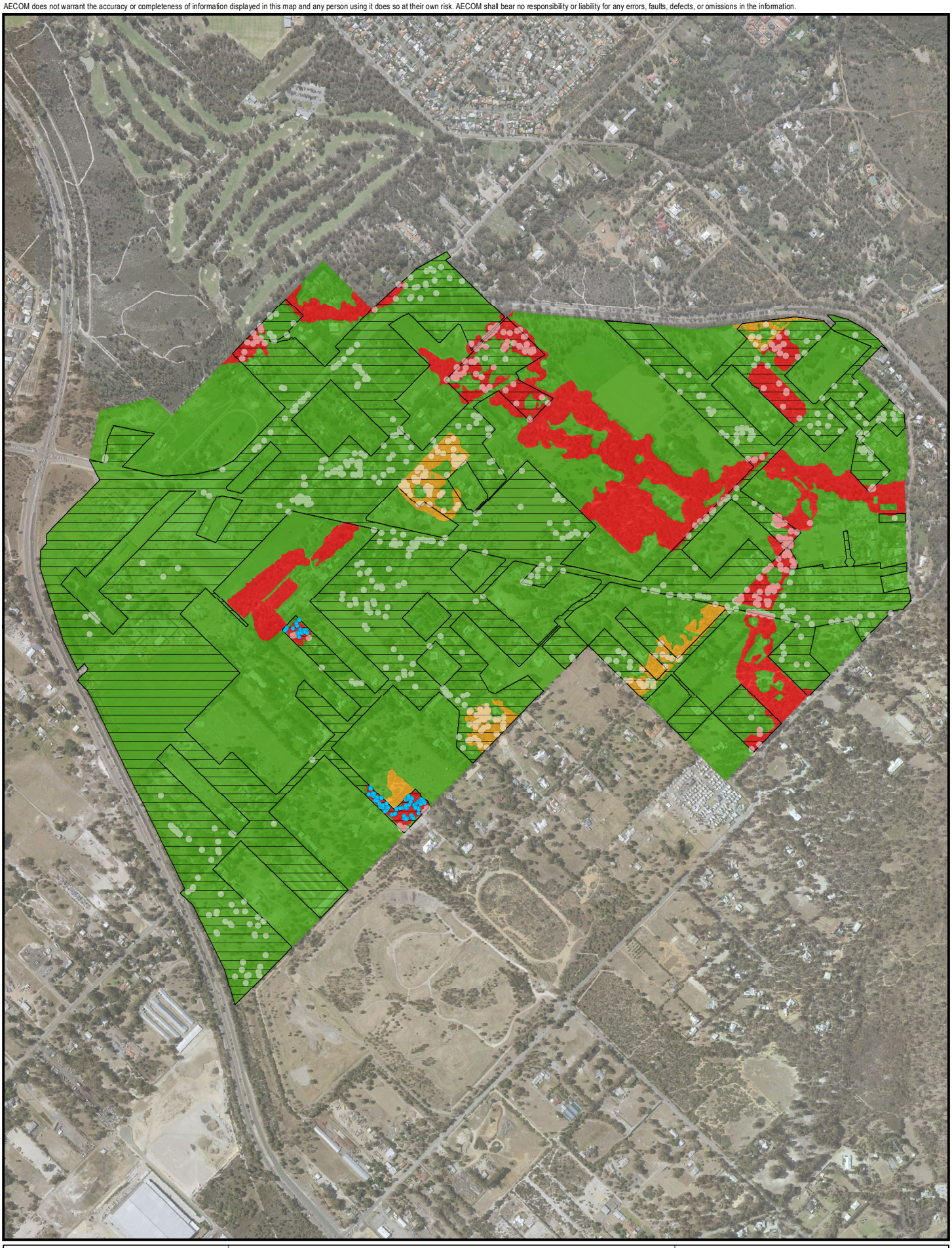
The EVA was undertaken for the entire Wattle Grove South survey area (Figure 15). This Figure shows the high, medium and low value areas. Evaluation for areas that were not surveyed was based on observations taken from outside the property and review of aerial photographs. The Environmental Values assessment for areas surveyed is presented in Figure 16.

The resultant values assessment map also depicts black cockatoo habitat trees (with a 10 m buffer) to ensure these valuable assets are captured. These buffer areas are not included as part of the EVA unless they form part of a dense collection or support remnant understorey as such because they reflect point data. It is recommended that all trees are retained wherever possible. Mature trees take decades to establish and as such should be considered high value throughout. It is likely that areas not surveyed would also support black cockatoo breeding habitat trees that are as yet undefined in the EVA.

The extent of areas captured in high, medium and low are presented in Table 31.

Table 31 Categories for the environmental values assessment

Category	Values	Area
High	• Good connectivity and/or suitable size for maintaining ecological integrity • BC foraging and/or breeding trees • All populations of *C. undulatum* that were recorded during the survey • Incorporates all TECs with the exception of two patches that are <0.2 ha which are captured as Medium • Includes 90% of areas mapped as “native vegetation” with exception of areas <0.2 ha with poor connectivity.	35.13 ha
Medium	• Connects high value areas to adjacent high value areas or as ‘stepping stone’ • Includes BC foraging and/or breeding • May include native vegetation (understorey) species	6.88 ha
Low	• Mostly cleared open areas or stands of trees over grassland • Includes planted gardens and hardscape	301.36 ha



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 20 FEB 2020

AECOM
www.aecom.com

N
1:15,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 100 200 300 400
Metres

Data sources:

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

LEGEND
- Survey Area
- High Value
- Medium Value
- Low Value
- Black Cockatoo Breeding Habitat
- *Conospermum undulatum* Locations

Environmental Values – Extrapolated and Surveyed

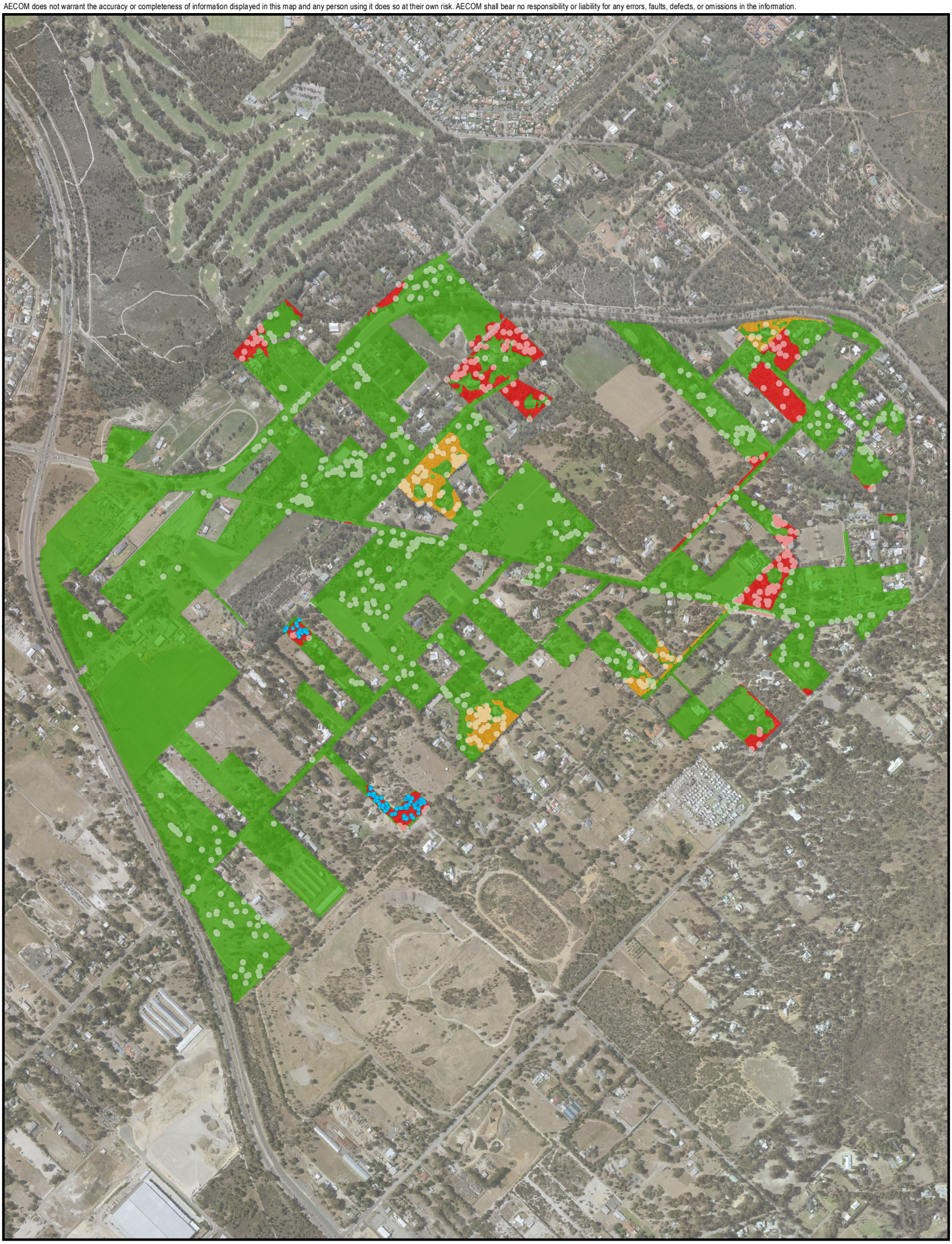
CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 15

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig15_EnvironmentalValuesMap1_A4P_v1.mxd (WyattK2)

A4 size



PROJECT ID 60611889
CREATED BY KW
APPROVED BY FDW
LAST MODIFIED 20 FEB 2020

AECOM
www.aecom.com

N
1:15,000
(when printed at A4)

DATUM GDA 1994 MGA Zone 50
0 100 200 300 400
Metres

Data sources:

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

LEGEND
- High Value
- Medium Value
- Low Value
- Black Cockatoo Breeding Habitat
- *Conospermum undulatum* Locations

Environmental Values – Surveyed

CITY OF KALAMUNDA

WATTLE GROVE SOUTH ECOLOGICAL SURVEYS

Figure 16

Map Document: \\AUPER1FP001\Projects\606X\60611889\900_CAD_GIS\920_GIS\02_MXDs\20200124_ReportFigures\G60611889_Fig16_EnvironmentalValuesMap2_A4P_v1.mxd (WyattK2)

A4 size

7.0 Conclusions

The significant ecological findings from the assessment of the survey area are outlined below:

- The EPBC TEC Banksia Woodlands of the SCP occurs in three patches, extending 2.41 ha.
- Three TECs and one PEC listed by DBCA were identified including;
  - WA TEC *C. calophylla-E. marginata* woodlands on sandy clay soils (SCP3b) – requires verification from DBCA, extending 1.71 ha across two patches
  - WA TEC *B. attenuata* and/or *E. marginata* woodlands of the eastern side of the SCP (SCP20b) – requires verification from DBCA extending 1.80 across three patches
  - WA TEC *Banksia attenuata* woodland over species rich dense shrublands (SCP20a) extending 0.94 ha at one location
  - WA PEC Banksia dominated woodlands of the SCP extending for 0.15 ha at one location.
- One Threatened flora species, *Conospermum undulatum* (Wavy-leaved Smokebush) was recorded on two properties comprising 95 individuals. These locations are not represented in the DBCA database records.
- Three conservation significant fauna species were recorded including the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii* (listed as Vulnerable under the EPBC Act and the BC Act), Carnaby's Cockatoo *Calyptorhynchus latirostris* (listed as Endangered under the EPBC Act and the BC Act) and the Quenda *Isoodon fusciventer* (listed as Priority 4 by DBCA).
- Six fauna habitats were mapped. The most common fauna habitat is the Scattered Trees habitat which may be utilised by conservation significant species including the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*, Carnaby's Cockatoo *Calyptorhynchus latirostris* and Baudin's Cockatoo *Calyptorhynchus baudinii,* as well as by many of the common bird species in the area.
- The presence of 730 hollow-forming (generally native) breeding and potential breeding trees including 410 (56%) Marri *Corymbia calophylla,* 195 (27%) Jarrah *Eucalyptus marginata*, and 125 mixed Flooded Gum **E. grandis*, Tuart *E. gomphocephala*, *E. todtiana*, E. w*andoo*, introduced species and stags (dead unidentifiable trees). Seventeen of the 730 trees contain a total of 26 potentially suitable hollows for breeding black cockatoos.
- A total of 69.39 ha of foraging habitat for Carnaby's Cockatoo. This includes 41.14 ha of Very High and High Quality foraging habitat which generally consisted of eucalypt and Banksia woodland and scattered mature eucalypts.
- A total of 59.53 ha of foraging habitat for the Forest Red-tailed Black Cockatoo. This includes 33.52 ha of Very High Quality foraging habitat which generally consists of eucalypt woodland containing breeding and potential breeding trees.
- A total of 69.39 ha of foraging habitat for Baudin's Cockatoo. This includes 41.14 ha of Very High and High Quality foraging habitat which generally consisted of eucalypt and Banksia woodland and scattered mature eucalypts.

The ecological assessments for the Wattle Grove project included significant access and completeness limitations. This report presents the results for a selection of private properties and public land where access was granted by private land owners. It is not a comprehensive assessment of ecological values of the Wattle Grove area with approximately 50% of landowners denying access.

8.0 References

Beard JS, 1981. Swan, 1:1,000,000 vegetation series : explanatory notes to sheet 7 : the vegetation of the Swan area Nedlands, W.A. : University of Western Australia

Bureau of Meteorology (BOM), 2019. Climate Statistics for Australian Locations. http://www.bom.gov.au/climate

Christidis L and Boles WE, 2008. Systematics and Taxonomy of Australian Birds. CSIRO Publishing, Australia.

DotEE, 2017a. Approved Conservation Advice for Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain. Canberra: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/17-conservation-advice.pdf.

DotEE, 2017b. Approved Conservation Advice for Shrublands and Woodlands of the eastern Swan Coastal Plain. Canberra: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/20-conservation-advice.pdf.

DotEE, 2019. Species Profile and Threats Database: Online resource. Available at: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl. Accessed August 2019.

DPaW, 2013. Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan. DPaW, Bentley, WA.

DSEWPaC 2012a. *Referral guidelines for three species of Western Australian black cockatoos*. Available from: http://www.environment.gov.au/epbc/publications/wa-black-cockatoos.html.

DSEWPaC, 2012b. Approved Conservation Advice for Clay Pans of the Swan Coastal Plain. Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/121-conservation-advice.pdf.

EPA, 2016a. Technical Guidance – Terrestrial flora and vegetation Surveys for Environmental Impact Assessment. EPA, Western Australia.

EPA, 2016b. Technical Guidance – Terrestrial Fauna Surveys. EPA, Western Australia.

EPA, 2016c. Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna. EPA, Western Australia.

EPA, 2015. Perth and Peel @ 3.5 Million Environmental Impacts, Risks and Remedies. Perth, Western Australia.

Gibson N, Keighery B, Keighery G, Burbidge A. & Lyons M, 1994. A Floristic Survey of the Southern Swan Coastal Plain. A report prepared by the Western Australian DEC and the Western Australian Conservation Council for the Australian Heritage Commission, Perth Western Australia.

Gilbert F, Gonzalez A, Evans-Freke I, 1998. *Corridors maintain species richness in the fragmented landscapes of a microecosystem*. Published in The Royal Society, 265, 577-582.

Govt. of WA, 2018. 2017 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of December 2017. WA Dept. of Biodiversity, Conservation and Attractions, Perth WA.

Heddle EM, Loneragan OW, Havell JJ, 1980. Vegetation of the Darling System in Atlas of Natural Resources, Darling System, Western Australia. Department of Environment and Conservation: Perth, Western Australia.

Johnstone RE, Johnstone C, & Kirkby T, 2010. Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo on the Swan Coastal Plain, Western Australia: Studies on distribution, status, breeding, food movements and historical changes. Report to the Department of Planning, Perth.

Johnstone RE, Kirkby T, & Sarti K, 2013. The breeding biology of the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* Gould in south-western Australia. 1. Characteristics of nest trees and nest hollows. *Pacific Conservation Biology*. 19(3). 121-42.

Keighery BJ, 1994. Bushland Plant Survey - A Guide to Plant Community Survey for the Community Wildflower Society of WA (inc) Nedlands WA.

Mitchell, D Williams, K Desmond, A 2002, 'Swan Coastal Plain 2 (SWA2 – Swan Coastal subregion)' in CALM 2002. *Bioregional Summary of the 2002 Biodiversity Audit for Western Australia*. Department of Conservation and Land Management, Perth, Western Australia.

TSSC, 2016. Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community. Canberra: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/131-conservation-advice.pdf

TSSC, 2018. Conservation Advice *Westralunio carteri* Carter's freshwater mussel. Canberra: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/86266-conservation-advice-15022018.pdf.

Van Dyck S, & Strahan R, 2008. *The Mammals of Australia Third Edition*. Reed New Holland: Chatswood, New South Wales.

Western Australian Museum (WA Museum), 2016. Checklist of Terrestrial Vertebrate Fauna of Western Australia. Online resource.

Western Australian Herbarium (WAH), 1998-. Florabase: Online Resource. Available at https://florabase.dpaw.wa.gov.au. Accessed January 2017.

Whitford, K.R. 2002. Hollows in Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) trees I. Hollow Sizes, Tree Attributes and Ages. Forest Ecology and Management 160, pages 201-214.

Appendix A

Desktop Results

Appendix A Desktop Results

A1: Protected Matters Search Report

A2: Desktop Flora

A3: Desktop Fauna

Australian Government
Department of the Environment and Energy

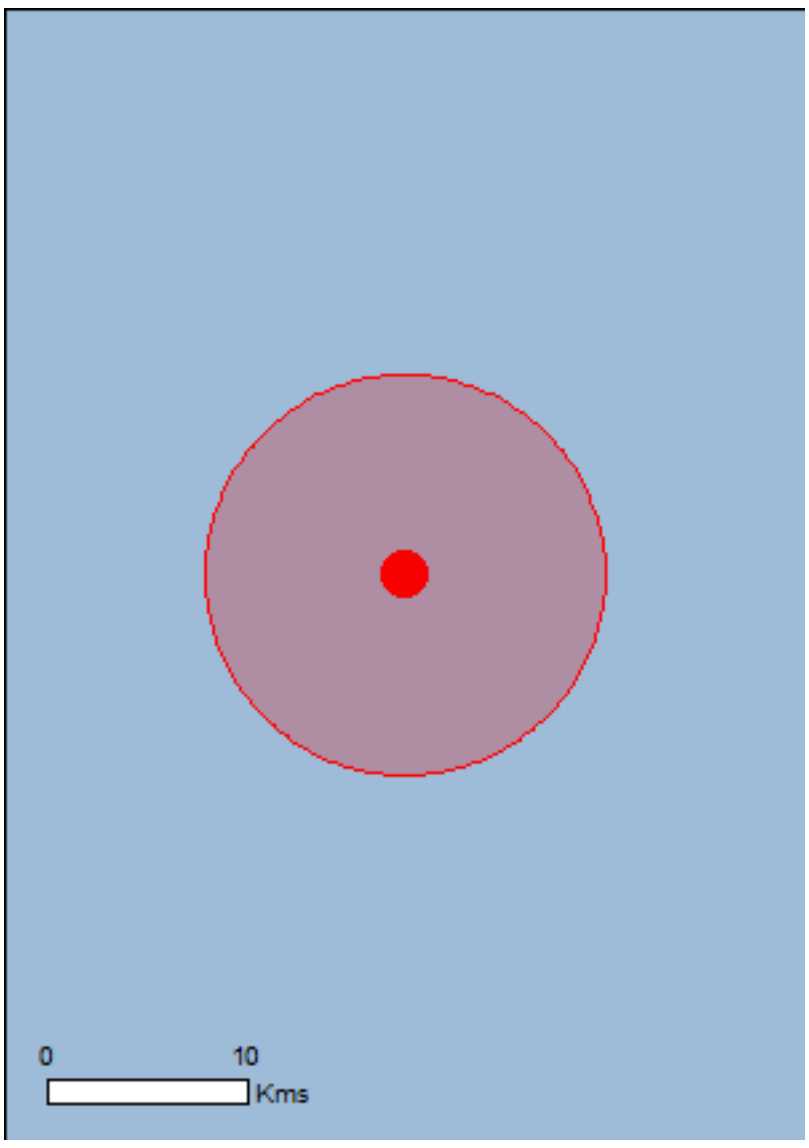
EPBC Act Protected Matters Report

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.

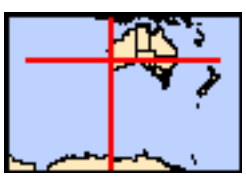
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

Report created: 07/08/19 13:28:02



Coordinates
Buffer: 10.0Km



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:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	47
Listed Migratory Species:	9

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:	4
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	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:	14
Regional Forest Agreements:	1
Invasive Species:	46
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Forrestdale and thomsons lakes	Within 10km of Ramsar

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
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Shrublands and Woodlands of the eastern Swan Coastal Plain	Endangered	Community known to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known 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
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Insects		
Leioproctus douglasiellus a short-tongued bee [66756]	Critically Endangered	Species or species habitat known to occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat likely to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Acacia anomala Grass Wattle, Chittering Grass Wattle [8153]	Vulnerable	Species or species habitat known to occur within area
Acacia aphylla Leafless Rock Wattle [13553]	Vulnerable	Species or species habitat known to occur within area
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat known to occur within area
Anthocercis gracilis Slender Tailflower [11103]	Vulnerable	Species or species habitat known to occur within area
Austrostipa bronwenae [87808]	Endangered	Species or species habitat known to occur within area
Austrostipa jacobsiana [87809]	Critically Endangered	Species or species habitat may occur within area
Banksia mimica Summer Honeypot [82765]	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Calytrix breviseta subsp. breviseta Swamp Starflower [23879]	Endangered	Species or species habitat known to occur within area
Chamelaucium sp. Gingin (N.G.Marchant 6) Gingin Wax [88881]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Conospermum undulatum Wavy-leaved Smokebush [24435]	Vulnerable	Species or species habitat likely to occur within area
Darwinia apiculata Scarp Darwinia [8763]	Endangered	Species or species habitat known to occur within area
Diplolaena andrewsii [6601]	Endangered	Species or species habitat likely to occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known 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 known to occur within area
Eremophila glabra subsp. chlorella [84927]	Endangered	Species or species habitat known to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area
Goodenia arthrotricha [12448]	Endangered	Species or species habitat known to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat likely to occur within area
Grevillea thelemanniana Spider Net Grevillea [32835]	Critically Endangered	Species or species habitat known to occur within area
Lasiopetalum pterocarpum Wing-fruited Lasiopetalum [64922]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat likely to occur within area
Ptilotus pyramidatus Pyramid Mulla-mulla [18216]	Critically Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Synaphea sp. Fairbridge Farm (D. Papenfus 696)		
Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area
Synaphea sp. Serpentine (G.R. Brand 103)		
[86879]	Critically Endangered	Species or species habitat may occur within area
Thelymitra dedmaniarum		
Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat likely to occur within area
Thelymitra stellata		
Star Sun-orchid [7060]	Endangered	Species or species habitat known 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 ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		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
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely 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 -
Defence - AIRTC CANNINGTON
Defence - BUSHMEAD RIFLE RANGE
Defence - BUSHMEAD TRAINING AREA

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]		Breeding 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 ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely 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
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Beelu	WA
Gooseberry Hill	WA
Kalamunda	WA
Kenwick Wetlands	WA
Korung	WA
Lesmurdie Falls	WA
Unnamed WA23076	WA
Unnamed WA24657	WA
Unnamed WA28740	WA
Unnamed WA29815	WA
Unnamed WA37997	WA
Unnamed WA47244	WA
Unnamed WA49079	WA
Unnamed WA49363	WA

Regional Forest Agreements	[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

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
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

Name	Status	Type of Presence
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
Turdus merula Common Blackbird, Eurasian Blackbird [596]		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
Capra hircus Goat [2]		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
Feral deer Feral deer species in Australia [85733]		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
Sus scrofa Pig [6]		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		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf		Species or species habitat likely to occur

Name	Status	Type of Presence
Madeiravine, Potato Vine [2643]		within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur 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
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		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
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to 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

Name	Status	Type of Presence within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		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

Nationally Important Wetlands [Resource Information]

Name	State
Brixton Street Swamps	WA
Perth Airport Woodland Swamps	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

-32.01135 116.01269

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-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.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix A2 Flora Desktop Results

Species	Cons. Code		Habitat[1]	Count Date	Likelihood of Occurrence
	EPBC	WA			
Acacia anomala	V	VU	Grows on laterite in shallow sand, loam, clay or gravel that is brown, yellow or grey. Found on ridges, slopes and low plains. It grows entangled amongst other low shrubs in dense vegetation. Known from 13 populations including Kalamunda/Bickley, Chittering/Bullsbrook, and Pickering Brook.	NA	Unlikely. No suitable habitat in survey area. Records on Darling Scarp.
Acacia aphylla	V	VU	Associated with laterite and granite outcrops on hillsides. Grows in open forest dominated by *Eucalyptus marginata, Corymbia calophylla* or *Eucalyptus loxophleba.*	NA	Unlikely. No suitable habitat in survey area. Known from Darling Scarp.
Acacia oncinophylla subsp. *patulifolia*		P4	Granitic soils, sometimes on laterite. Recorded on the Scarp.	1996	Unlikely. No suitable habitat, known from granite outcrops on the scarp.
Andersonia gracilis	E	VU	Known from Badgingarra, Dandaragan and Kenwick areas where it is found on seasonally damp, black sandy clay flats near margins of swamps in low open vegetation with species such as *Calothamnus hirsutus, Verticordia densiflora* and *Kunzea recurva*.	2009	Unlikely. No suitable habitat in survey area. Known from Darling Scarp.
Anthocercis gracilis	V	VU	Known from nine populations growing on steep granite slopes along the Darling Scarp in shallow, humus-rich sandy or loamy soils.	NA	Unlikely. No suitable habitat in survey area. Known from Darling Scarp.
Austrostipa bronwenae	E	EN	Known from flat low-lying calcareous winter wet habitat. Associated with Muchea Limestone in Kenwick, Kemerton and Bunbury.	2013	May. Suitable habitat may be present, known records associated with Kenwick Swamp.
Austrostipa jacobsiana	CE	CR	Known from flat low-lying area on fringe of seasonally wet depression on calcareous clay to fine sandy clay on the SCP, and at one location in Bunbury.	NA	Unlikely. Not recorded in the vicinity, suitable habitat may be present.

Species	Cons. Code		Habitat[1]	Count Date	Likelihood of Occurrence
	EPBC	WA			
Babingtonia urbana		P3	Associated with wetlands. Isolated to a few locations including east Perth and north near Dandaragan.	1978	May. Suitable habitat may be present, one record in vicinity (old record).
Banksia mimica	E	VU	Flat to gentle slopes on grey sand in open woodlands. DBCA population 3 occurs within the survey area where it occurs in mixed low heath with a *Banksia attenuata/B. menziesii* open-low woodland overstorey. It is associated with species such as *Adenanthos cygnorum, Eucalyptus todtiana, Nuytsia floribunda, Jacksonia floribunda, Xanthorrhoea preissii, Banksia chamaephyton, Hakea conchifolia* and *Stirlingia latifolia.*	2000	Known. Three records (2000) within survey area.
Banksia pteridifolia subsp. vernalis		P3	White/grey sand over laterite. Associated with the darling scarp in this locality.	1992	Unlikely. No suitable habitat.
Boronia tenuis		P4	Laterite, stony soils. Granite.	1990	Unlikely. No suitable habitat in survey area. Records on Darling Scarp.
Byblis gigantea		P3	Sandy-peat swamps and seasonally wet areas. One record nearby on golf course.	2006	May. Suitable habitat may be present and recent record in vicinity.
Caladenia huegelii	E	CR	Found between Perth and Capel growing in deep sandy soil in *Banksia-Eucalyptus marginata* woodland.	NA	Unlikely. Habitat may be present, no records in the vicinity.
Calytrix breviseta subsp. *breviseta*	E	CR	Sandy clay and swampy flats. Near the survey area it has been recorded on grey-brown sandy loam to light clays on flats and slopes and low-lying winter-wet areas. This species is known from two populations only, both restricted to Bush Forever Sites.	2012	May. Extensive surveys conducted by CALM (now DBCA) in Perth metro area have not recorded this species anywhere else but the two DBCA locations.
Chamelaucium sp. Gingin (N.G. Marchant 6)	E	VU	Confined to the Gingin/Chittering area within a 3km range. Occurs on white/yellow sand supporting open low woodlands of *Eucalyptus todtiana, Banksia attenuata* and *Hibbertia* species.	NA	Unlikely. No suitable habitat in survey area. Known from Darling Scarp.

Species	Cons. Code		Habitat[1]	Count Date	Likelihood of Occurrence
	EPBC	WA			
Conospermum undulatum	V	VU	Grows on sand and sandy clay soils, often over laterite, on flat or gently sloping sites between the Swan and Canning Rivers. The species is known from *Banksia* and jarrah/marri woodland, with a few records from slightly swampy habitat	2011	Known. Population no. 11 occurs within the survey area.
Darwinia apiculata	E	EN	Lateritic soils.	NA	Unlikely. No suitable habitat in survey area. Records on Darling Scarp.
Diplolaena andrewsii	E	EN	Known from granite outcrops and hillsides in the northern Jarrah Forest.	NA	Unlikely. No suitable habitat, recorded on Darling Scarp.
Diuris drummondii	V	VU	Found in low-lying depressions in peaty and sandy clay swamps. Plants are frequently observed standing in several centimetres of water even during the summer flowering period	NA	Unlikely. No suitable habitat and no known records.
Diuris micrantha	V	VU	Recorded between Perth and Boyup Brook growing in seasonally-wet flats amongst sedges and scattered shrubs.	NA	Unlikely. No suitable habitat and no known records.
Diuris purdiei	E	EN	Recorded between Perth and Yarloop, growing under dense shrubs in seasonally-wet swamps and drainage lines (Brown *et al.,* 2013).	NA	Unlikely. No suitable habitat and no known records.
Drakaea elastica	E	CR	Found on coastal plain between Ruabon and Cataby growing in sandy soil in *Banksia* woodlands and tall shrubs (Brown *et al.,* 2013).	NA	May. Suitable habitat may be present but no known records in vicinity.
Drakaea micrantha	V	EN	Species occurs in open sandy patches that have been disturbed where competition from other plants have been removed. It grows in infertile grey sands, in Banksia, Jarrah and Common Sheoak woodland or forest. Is found under thickets of Spearwood with Flying Duck orchid and other *Drakaea* species.	NA	May. Suitable habitat may be present but no known records in vicinity.
Drosera occidentalis		P4	Associated with wetlands.	1 record no date, manual GPS entry.	Unlikely. No suitable habitat, no recent known records.

Species	Cons. Code		Habitat[1]	Count Date	Likelihood of Occurrence
	EPBC	WA			
Eleocharis keigheryi	V	VU	Known from north of Eneabba and south-east of Qualeup. Grows in small clumps in a substrate of clay or sandy loam. It is emergent in freshwater creeks and transient waterbodies.	NA	Unlikely. No suitable habitat and no known records.
Eremophila glabra subsp. *chlorella*	E	EN	Record near survey area was from a seasonal wetland associated with *Melaleuca viminea* and *M. acutifolia* Tall Open Scrub over *Gahnia trifida* and *Juncus kraussii* Very Open Sedgeland and weeds.	2014	May occur. Suitable habitat may be present and record in vicinity of survey area.
Eucalyptus x balanites	E	CE	Recorded on light coloured sandy soils over laterite including gently sloping heathlands, open mallee woodland over shrubland or heathland with emergent mallees. Known from two populations including one in Badgingarra National Park and one in the City of Armadale.	NA	Unlikely. No suitable habitat and no known records.
Goodenia arthrotricha	E	EN	Gravel. Granite rocks, slopes.	NA	Unlikely. No suitable habitat and no known records.
Grevillea curviloba subsp. *incurva*	E	EN	Confined to area between Muchea and Badgingarra. Grows in open heath in winter-wet areas on sand over limestone or over ironstone.	NA	Unlikely. No suitable habitat and no known records.
Grevillea thelemanniana	CE	CR	Occurs on sandy clay soil in flat seasonally wet damplands. Limestone soils are associated with some of the sites. DBCA population 1 occurs near the survey area and is associated with Kenwick Swamp.	1990	May. Habitat may be present and one known populatoin occurs in the vicinity.
Haemodorum loratum		P3	Grey or yellow sand and gravel.	2004	Likely. Suitable habitat and record in close proximity to survey area.
Isopogon drummondii		P3	No information available on WAH (1998-). Database results describe flats on grey brown sand with or without gravel in Banksia woodlands.	2013	Known. Numerous records in vicinity of survey area.
Jacksonia gracillima		P3	One known record in vicinity grown from winter damp flats. Grey-black sand.	2013	May. Habitat may occur and one known record in vicinity.
Lasiopetalum bracteatum		P4	Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, and granite outcrops.	1993	Unlikely. No suitable habitat in survey area. Records on Darling Scarp.
Lasiopetalum glutinosum subsp. *glutinosum*		P3	No information available on WAH (1998-). One record nearby recorded on sandplain with Darling Scarp outwash in Banksia/Jarrah woodland.	2008	Known. No suitable habitat in survey area. Records on Darling Scarp.

Species	Cons. Code		Habitat[1]	Count Date	Likelihood of Occurrence
	EPBC	WA			
Lasiopetalum pterocarpum	E	CE	Occurs on slopes of Darling Range near Serpentine National Park. Occurs in riparian community with *Eucalyptus rudis.*	NA	Unlikely. No suitable habitat and no known records.
Lepidosperma rostratum	E	EN	Restricted to two seasonally wet swamps including Kenwick Swamp near the survey area. Grows on peaty sand and clay amongst low heath in winter-wet swamps.	2015	May. Not previously recorded in survey area but known population (DBCA population 1 and 2) nearby.
Macarthuria keigheryi	E	EN	White or grey sand. Records from north of Perth to Dandaragan.	NA	Unlikely. No known records in vicinity despite considerable survey effort.
Myriophyllum echinatum		P3	Winter-wet clay-based depression, record from Kenwick Swamp.	2010	Unlikely. No suitable habitat present. One record nearby from Kenwick swamp.
Pithocarpa corymbulosa		P3	Gravelly or sandy loam. Amongst granite outcrops.	1996	Unlikely. No suitable habitat in survey area, associated with Darling Scarp.
Ptilotus pyramidatus	CE	CR	Known from Kenwick area and Greater Brixton Street Wetlands. Inhabits seasonally inundated flat floodplain underlain by pale grey muddy-sand to sandy-mud alluvium of the Pinjarra Plain. Despite being known from the Brixton Street Wetlands in close proximity to the survey area, no known records were identified in the DBCA database.	NA	Unlikely. No suitable habitat present and no records in vicinity.
Senecio leucoglossus		P4	Gravelly lateritic or granitic soils. Granite outcrops, slopes.	1992	Unlikely. No suitable habitat in survey area. Records on Darling Scarp.
Stylidium striatum		P4	Brown clay loam over laterite. Hillslopes. Jarrah/Marri forest, Wandoo woodland.	1967	Unlikely. No suitable habitat in survey area. Records on Darling Scarp.
Styphelia filifolia		P3	No habitat information available. Record near survey area from flats on brown-grey sand adjacent to Hartfield Golf Club.	2006	May. Suitable habitat may be present.

Species	Cons. Code		Habitat[1]	Count Date	Likelihood of Occurrence
	EPBC	WA			
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	CE	CR	Endemic to Pinjarra Plain of WA, known from five subpopulations south of Perth from Serpentine to Dardanup. Occurs on grey, clayey sand with lateritic pebbles in low woodland near winter-wet flats. Associated with Kenwick Swamp.	2010	May. Suitable habitat may be present, DBCA population 7 is located in Kenwick Swamp.
Synaphea sp. Serpentine (G.R. Brand 103)	CE	CR	Flat terrain on grey-brown sandy loams to clay in seasonally wet areas.	NA	Unlikely. No known records despite significant survey effort at Kenwick Swamp nearby.
Thelymitra dedmaniarum	E	CR	Recorded near Gidgegannup in Darling Range on granite slopes and in open Wandoo woodland.	NA	Unlikely. No suitable habitat in survey area.
Thelymitra magnifica		P1	Stony ridges. Recorded on edge of Darling Scarp amongst dense heath in rocky soils surrounding exposed granite outcrops (Brown *et al.*, 2013). DBCA population 1, 3, 4, 5 and 8 are in close proximity.	2017	May. Unlikely to be suitable habitat (associated with Darling Scarp), however two populations in close proximity so outliers may be possible.
Thelymitra stellata	E	EN	Sand, gravel, lateritic loam. Grows in *Eucalyptus marginata* forests or in low heath on rocky tops of small hills (Brown *et al.*, 2013). DBCA population 4 and 24 in close proximity.	1994	May. Unlikely to be suitable habitat (associated with Darling Scarp), however two populations in close proximity so outliers may be possible.
Thysanotus anceps		P3	White or grey sand, lateritic gravel, laterite.	1993	Unlikely. No suitable habitat, associated with Darling Scarp. The database record locations unlikely to be correct.
Verticordia lindleyi subsp. *lindleyi*		P4	Grows in white to grey and yellow sand, often with or over clay and gravel, usually low-lying and winter-wet (George, 2002). Frequently in association with a few other verticordias in heath, shrubland and open woodland (George, 2002). Records from 1990 and 1994.	2006	Likely. Suitable habitat present, several records in close proximity.

1. Sourced from Florabase (WAH, 1998-) and/or DotEE (2019) unless otherwise referenced

Appendix A3: Fauna Desktop Results

Scientific Name	Common Name	Cons. Status		Last Record	Total Records	PMST	Ecology	Likelihood
		WA	EPBC					
Apus pacificus	Fork-tailed Swift	IA	Marine / Migratory			+	The Fork-tailed Swift is almost exclusively aerial, and a non-breeding visitor to Australia (DotE, 2015). They are rarely seen roosting on land.	Unlikely to occur within the survey area - no recent records.
Actitis hypoleucos	Common Sandpiper	IA	Marine / Migratory			+	The Common Sandpiper is widespread throughout Australia, with few important sites on the continent. They visit Australia during the non-breeding season. Preferred habitat is coastal wetlands with muddy margins or rocky shores but has also been recorded in inland wetlands and dams (DotE, 2015).	Unlikely to occur - no recent records and no preferred habitat likely to be present
Bettongia penicillata ogilbyi	Woylie	CR	E	1988	1	+	The Woylie is a small marsupial with grey to greyish brown fur on the back and flanks, and pale greyish on the undersides. The tail is dark and has a distinctive black brush at the end. The Woylie previously occurred over large areas of western, central and eastern Australia, however naturally occurring extant populations are now restricted to three small reserves in the Western Australian wheatbelt (Van Dyck & Strahan, 2008). They inhabit woodlands and adjacent heaths with a dense understorey of shrubs, particularly *Gastrolobium sp.* (poison pea).	Unlikely to occur - no recent records and no preferred habitat likely to be present
Botaurus poiciloptilus	Australasian Bittern	EN	E	-	-	+	The Australasian Bittern is a large thick-necked bird, growing to a length of 66 to 76 cm. Upper parts are brown and black and mottled to aid in camouflage. It grows to a length of 66–76 cm and has a wingspan of 1050–1180 cm. The Australasian Bittern has a straw yellow bill and the legs and feet are pale green to olive (Marchant & Higgins, 1990; Pizzey & Knight, 1997). In Western Australia the species was formerly widespread in the south-west however is now thought to only occur on the western coastal plain, southern coastal region and inland to some wetlands in the Jarrah forests (DSEWPaC, 2011). The Australasian Bittern's preferred habitat is comprised of wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water (Marchant & Higgins, 1990).	Unlikely to occur - no records and no preferred habitat likely to be present
Calidris acuminata	Sharp-tailed Sandpiper	IA	Marine / Migratory			+	The Sharp-tailed Sandpiper is a small to medium sized wader with a length of 17 to 22 cm and weighing 65g. They are widespread in Western Australia from the Pilbara region to the south-west.	Unlikely to occur - no recent records and no preferred habitat likely to be present

Appendix A3: Fauna Desktop Results

Scientific Name	Common Name	Cons. Status		Last Record	Total Records	PMST	Ecology	Likelihood
		WA	EPBC					
Calidris ferruginea	Curlew Sandpiper	CR	CE			+	The Curlew Sandpiper is a small, slim weighing 57 g. In Australia, Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. In Western Australia, they are widespread around coastal and sub coastal plains from Cape Arid to the south-west Kimberley.	Unlikely to occur - no records in close proximity to survey area
Calidris melanotos	Pectoral Sandpiper	IA	Marine / Migratory			+	The Pectoral Sandpiper occupies shallow, fresh waters often containing low grass or other small herbs. It is also observed in swamp margins, flooded pastures and saltmarshes. This species breeds in the northern hemisphere and is a regular though uncommon summer visitor to Australia (Pizzey & Knight, 2007). Rarely recorded in Western Australia (DotE, 2015).	Unlikely to occur - no recent records in close proximity to survey area
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	VU	V	2018	264	+	The Forest Red-tailed Black Cockatoo is 55-60 cm in length, and are mostly glossy black with a pair of black central tail feathers, a crest, robust bill and bright red, orange or yellow barring in the tail (Higgins, 1999). Males are distinguished by broad red tail panels that are only visible when taking off or alighting (Higgins 1999). Requires tree hollows to nest and breed, occurs in forests of Karri (*Eucalyptus diversicolor*), Jarrah (*E. marginata*) and Marri (*Corymbia calophylla*), with flocks moving out onto the Swan Coastal Plain in search of food from exotic trees such as White Cedar (Johnstone *et al.*, 2010). Foraging habitat for the species consists of Jarrah and Marri woodlands and forest throughout its range. Has become more common in the Metropolitan area in the past few years.	Likely to occur - abundant recent observations and suitable habitat likely to present

Appendix A3: Fauna Desktop Results

Scientific Name	Common Name	Cons. Status		Last Record	Total Records	PMST	Ecology	Likelihood
		WA	EPBC					
Calyptorhynchus baudinii	Baudin's Cockatoo	EN	E	-	-	+	Baudin's Cockatoo is a large cockatoo that measures 50–57 cm in length, with a wingspan of approximately 110 cm. Mostly dull black in colour, with pale whitish margins on the feathers (Higgins, 1999). Habitat critical to the survival of this species includes forests of Karri (*Eucalyptus diversicolor*), Jarrah (E. *marginata*) and Marri (*Corymbia calophylla*), in areas of 600 mm average rainfall per year. Individuals typically move north through the Perth region from March to May and south through the Perth region from August to October. This species ranges north to Gidgegannup and Hoddy Well and west to the Eastern Strip of the Swan Coastal Plain including West Midland in the north, heading south through Armadale, Byford and south and towards the coast until Lake Clifton where it continues to hug the coastline to east of Albany (Johnstone *et al.,* 2010). Breeding has been recorded to the south-west of the area bounded by Leschenault, Collie and Albany (DSEWPaC, 2012), with the most northerly record at Lowden, near Donnybrook (Johnstone & Storr, 1998). Breeding has also been recorded at Serpentine (hills area), and east to Kojonup and near Albany (Johnstone & Kirkby, 2008).	May occur - no DBCA records in close proximity in DBCA supplied search, but other records in close proximity.
Calyptorhynchus latirostris	Carnaby's Cockatoo	EN	E	2013	193	+	Carnaby's Cockatoo is a white-tailed black cockatoo endemic to the south-west of Western Australia. It is a postnuptial nomad and typically moves west soon after breeding. Breeding occurs mainly from early July to mid-December. There has been an apparent shift in its breeding range further west and south since the middle of last century (Johnstone *et al* ., 2010). The species nests in hollows in eucalypts, particularly Salmon Gum (*Eucalyptus salmonophloia*) and Wandoo (*E. Wandoo*), but nests have been found in other eucalypts including York Gum (*E. loxophleba*), Flooded Gum (*E. rudis*), Tuart (*E. gomphocephala*) and Marri (Corymbia calophylla) (Johnstone *et al* ., 2010). Breeding success is largely dependent on suitable feeding habitat adjacent to the nest site to provide the necessary food for the survival of the chick (Johnstone *et al* ., 2010). Diet consists of an array of Proteaceous and *Eucalyptus* species. Foraging habitat, including *Banksia* woodlands, is considered to be habitat critical to the survival of the species (Johnstone *et al* ., 2010).	Likely to occur - abundant recent observations and suitable habitat likely to present

Appendix A3: Fauna Desktop Results

Scientific Name	Common Name	Cons. Status		Last Record	Total Records	PMST	Ecology	Likelihood
		WA	EPBC					
Leipoa ocellata	Malleefowl	VU	V	-	-	+	The Malleefowl is a large, ground-dwellin gbird with strong feet and a short bill. It is found principally in the semi-arid to arid zone in shrublands and low woodlands dominated by mallee and associated habitats such as such as Broombush (*Melaleuca uncinata*) and Scrub Pine (*Callitris verrucosa*). In WA Malleefowl distribution was associated with landscapes that had lower rainfall, greater amounts of mallee and shrubland that occur as large remnants, and lighter soil surface textures (Benshemesh, 2007).	Unlikely to occur - no DBCA records and limited available habitat
Dasyurus geoffroii	Chuditch	VU	V	1994	14	+	At maturity the Chuditch is the size of a small domestic cat with white spotted brown pelage,, large rounded ears, pointed muzzle, large dark eyes and non-hopping gait. Following European settlement the range of this species contracted dramatically, from much of the continent to a small area in the south west. It currently only occurs in areas dominated by sclerophyll forest or drier woodland, heath and mallee shrubland (Van Dyck & Strahan, 2008). The Chuditch requires adequate numbers of suitable den and refuge sites (horizontal hollow logs or earth burrows) and sufficient prey biomass (large invertebrates, reptiles and small mammals) to survive.	Unlikely to occur - limited available habitat and no close records in the last 25 years
Isoodon fusciventer	Quenda	P4	-	2018	78	-	The Quenda or Southern Brown Bandicoot exists only in a fragmented distribution to its former range in southern south western and eastern Australia. It is found in forest, woodland, heath and shrub communities in these regions. Preferred habitat usually consists of a combination of sandy soils and dense heathy vegetation (Van Dyck & Strahan, 2008).	Likely to occur - abundant recent observations and suitable habitat likely to present
Leioproctus douglasiellus	Sort-tongued Bee	EN	CE	-	-	+	This species of native bee is a small black bee known from the SCP (Kenwick wetlands, Cannington and Forestdale Lake) and near Lithgow in the Blue Mountains of NSW (ALA, 2019) and has an association with *Goodenia filiformis* and *Anthotium junciforme* (South Metro Connect, 2011).	Unlikely to occur - no DBCA records or plant associations in survey area
Motacilla cinerea	Grey Wagtail	IA	Marine / Migratory	-	-	+	The Grey Wagtail is a scarce but regular visitor to northern Australia, typically arriving in October and leaving in March. The species is most commonly associated with water and are found across a wide variety of wetlands, watercourses and on the banks of lakes and marshes (DotE, 2015)	Unlikely to occur - no records and preferred habitat unlikely to be present
Myrmecobius fasciatus	Numbat	EN		1974	1		Originally widespread, the Numbat now only persists in two remnant populations at Dryandra and Perup in Western Australia with several reintroduced populations in the Western Australian wheatbelt (DotEE, 2019).	Unlikely to occur - no recent records and no preferred habitat likely to be present

Appendix A3: Fauna Desktop Results

Scientific Name	Common Name	Cons. Status		Last Record	Total Records	PMST	Ecology	Likelihood
		WA	EPBC					
Neelaps calonotos	Black-striped Snake	P3	-	1975	4	-	The Black-striped Snake is mostly confined to the Swan Coastal Plain between Mandurah and Lancelin. It takes shelter in upper layers of loose soil beneath leaf litter in *Eucalyptus / Banksia* woodlands, typically at the base of trees and shrubs (Bush *et al.,* 2010).	Unlikely to occur - no recent records in or adjacent survey area
Notamacropus irma	Western Brush Wallaby	P4	-	1963	1	-	The Western Brush-wallaby occurs in the south-west of Western Australia. Its preferred habitat consists of open sclerophyll forest or woodland and favours open flats over scrub thickets. It is also found in larger areas of mallee and heathland in the wheat belt and is uncommon in wet sclerophyll forest (Van Dyck & Strahan, 2008).	Unlikely to occur - no recent records in or adjacent survey area
Numenius madagascariensis	Eastern Curlew	CR	CE			+	The Eastern Curlew is Australia's largest shorebird and a long-haul flyer. It is easily recognisable, with its long, down-curved bill. The Eastern Curlew takes an annual migratory flight to Russia and north-eastern China to breed, arriving back home to Australia in August to feed on crabs and molluscs in intertidal mudflats. It is extremely shy and will take flight at the first sign of danger (DotEE, 2019). The southern most important international site in Western Australia is Eightly Mile Beach (Bamford *et al* ., 2008).	Unlikely to occur - no recent records and no preferred habitat likely to be present
Pachyptila turtur subantarctica	Fairy Prion (southern)	-	V			+	The fairy prion (southern) breeds on Macquarie Island and a number of other subantarctic islands outside of Australia, with the species a visitor to the south-west coast of Western Australia (DotEE, 2019).	Unlikely to occur - no recent records in or adjacent survey area
Pandion haliaetus	Osprey	IA	Marine / Migratory			+	The breeding range of the Osprey includes the northern coast of Australia from Albany in WA to Lake Macquirie in NSW. This bird is moderately common in Australia, mostly in northern Australia. It is rare to uncommon in southern WA. The Osprey inhabits littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. Found mostly in coastal areas but can travel inland along major rivers. Areas of open fresh, brackish or saline water for foraging is essential for their habitat, visiting various wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps and broad rivers, reservoirs and large lakes. They can also occur over atypical habitats such as heath, woodland or forest when travelling between foraging sites (DotEE, 2018).	Unlikely to occur - no recent records and no preferred habitat likely to be present

Appendix A3: Fauna Desktop Results

Scientific Name	Common Name	Cons. Status		Last Record	Total Records	PMST	Ecology	Likelihood
		WA	EPBC					
Pseudocheirus occidentalis	Western Ringtail Possum	CR	CE	-	-	+	This species is restricted to the south-west corner of Western Australia. Closer to the coast it is closely associated with Peppermint (*Agonis flexuosa*) forest and woodland and Tuart (*Eucalyptus gomphocephala*) with a peppermint mid-story. Further from the coast the species is found in Jarrah (*Eucalyptus marginata*), Wandoo (*Eucalyptus wandoo*) and Marri (*Corymbia calophylla*) forest (Van Dyck & Strahan, 2008).	Unlikely to occur - no recent records in or adjacent survey area
Rostratula australis	Australian Painted Snipe	-	E			+	The Australian Painted Snipe is a stocky wading bird around 220–250 mm in length with a long pinkish bill). This species is a very rare summer visitor to the south-west of Western Australia. Breeding habitat in Western Australia is not quite known however a nest located near Moora was located in a tussock beside a swamp (Johnstone & Storr, 1998). The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (DotEE, 2019).	Unlikely to occur - no recent records and no preferred habitat likely to be present
Setonix brachyurus	Quokka	VU	V	-	-	+	The Quokka is distributed from Jarrah forest south-east of Perth, extending south through southern Jarrah, Marri and Karri forests onward to the south coast. It is now thought to be absent from the Swan Coastal Plain. Habitat use varies and includes thickets of Acacia, Melaleuca and is sometimes found in conjunction with tea-tree (Van Dyck & Strahan, 2008).	Unlikely to occur - no recent records and is now thought to be absent from the SCP
Tringa stagnatilis	Marsh Sandpiper	IA	Marine / Migratory			-	This species breeds from Austria to Mongolia and moves to Australia for summer and is found in mostly coastal areas (Pizzey & Knight, 2007). Scattered records exist in Western Australia and are found mainly near the coast (DotE, 2015). This species occupies wetlands of varying salinity including fresh, sewage ponds and estuaries (Pizzey & Knight, 2007).	Unlikely to occur - no recent records in or adjacent survey area
Westralunio carteri	Carter's Freshwater Mussel	VU	V	-	-	-	The only reasonably large bivalve in freshwaters of south-west Western Australia. Occurs in greatest abundance in slower flowing waters with stable sediments that are soft enough for burrowing. Salinity tolerance is quite low (>3 g /L is lethal) (Klunzinger *et al.,* 2012).	May occur - no DBCA records in close proximity in DBCA supplied search, but other records in close proximity.

An additional five only Marine listed species omitted due to survey area not containing commonwealth land

References

Appendix A3: Fauna Desktop Results

Scientific Name	Common Name	Cons. Status		Last Record	Total Records	PMST	Ecology	Likelihood
		WA	EPBC					

Atlas of Living Australia (ALA), 2019. *Leioproctus douglasiellus* . Accessed August 2019.

Benshemesh, J (2007). National Recovery Plan for Malleefowl. Department for Environment and Heritage, South Australia.

Bush B, Maryan B, Browne-Cooper R and Robinson D (2010). Field Guide to Reptiles and Frogs of the Perth Region. Western Australian Museum, Welshpool. 183pp.

Department of the Environment, 2015. Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act. Department of the Environment and Energy, Can

Department of the Environment and Energy (DotEE), 2019. Species Profile and Threats Database. Available online at http://www.environment.gov.au/cgi-bin/sprat/public/sprat

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2012. Referral guidelines for three species of Western Australian black cockatoo

Higgins, PJ, ed. 1999. *Handbook of Australian, New Zealand and Antarctic Birds Volume 4: Parrots to Dollarbird* . Melbourne: Oxford University Press.

Johnstone RE, & Storr GM, 1998. Ha*ndbook of Western Australian Birds, Volume 1 Non-passerines* . Western Australian Museum, Perth.

Johnstone, RE. & Kirkby T, 2008. Distribution, status, social organisation, movements and conservation of Baudin's Cockatoo *(Calyptorhynchus baudinii)* in South-west Weste

Johnstone RE, Johnstone C, & Kirkby T, 2010. Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo on the Swan Coastal Plain, Western Austra

Van Dyck S, & Strahan R, 2008. *The Mammals of Australia Third Edition* . Reed New Holland: Chatswood, New South Wales.

Appendix B

Banksia Woodlands of the SCP Assessment

Appendix C – Banksia Woodlands of the SCP Assessment

1.0 Methods

1.1 Introduction

The Banksia woodlands of the Swan Coastal Plain encompasses a large natural variation across its range. Furthermore it is subject to varying degrees of disturbance and degradation that have influenced the quality of patches.

The Threatened Species Scientific Committee (TSSC) published the approved Conservation Advice for this community in September 2016. This document details the key diagnostic features applicable for determining the presence of this TEC. Patches must meet the following kei diagnostic characteristics, condition thresholds, and minimum patch sizes:

- Step 1: use key diagnostic characteristics to determine if TEC is present
- Step 2: determine condition of patch
- Step 3: consider if patch meets minimum size threshold
- Step 4: surrounding context of a patch must be taken into account when considering factors that add to the importance of a patch that meets the condition thresholds.

1.2 Condition

The condition of vegetation of each patch needs to be determined in accordance with the following:

- The condition assessment of a patch should be centred on the area of highest native floristic diversity and/or cover of the patch.
- Timing of surveys and recent disturbance should be taken into account
- Surrounding context of a patch should be considered
- Certain vegetation components of Banksia Woodlands community merit consideration as critical elements to protect. Three components are recognised as threatened in their own right i.e. Priority Ecological Communities
- A relevant expert may be useful to help identify the ecological community and its condition.
- Vegetation must be in 'Good' or better condition in accordance with Table 1.

Table 1 Condition Table

Keighery (1994) Vegetation Condition Scale	Indicative condition measures/thresholds	
	Typical native vegetation composition	Typical weed cover
Pristine No obvious signs of disturbance	Native plant species diversity fully retained or almost so[1]	Zero or almost no weed cover/abundance
Excellent Vegetation structure intact, disturbance only affecting individual species, weeds are non-aggressive species.	High native plant species diversity[1]	Less than 10%
Very Good Vegetation structure altered, obvious signs of disturbance (e.g. repeated fires, dieback, logging,	Moderate native plant species diversity[1]	5 – 20%

Keighery (1994) Vegetation Condition Scale	Indicative condition measures/thresholds	
grazing). Aggressive weeds present.		
Good Vegetation structure altered but retains basic vegetation structure or ability to regenerate it. Obvious signs of disturbance (from partial clearing, dieback, logging, grazing). Presence of very aggressive weeds.	Low native plant species diversity[1]	5 – 50%
Degraded Basic vegetation structure severely impacted by disturbance. Requires intensive management. Disturbance evident such as partial clearing, dieback, logging and grazing. Presence of very aggressive weeds at high density.	Very low native plant species diversity[1]	20 – 70%
Completely Degraded Vegetation structure is no longer intact and the area is completely or almost completely without native flora. Equivalent to 'Parkland Cleared'.	Very low to no native species diversity[1]	Greater than 70%

1. relative to expected natural range of diversity for that vegetation unit e.g. Floristic Community Type where comparative data exists.

1.3 Minimum Patch Size

Different minimum patch sizes apply to different levels of condition, as outlined below:

- Pristine – no minimum patch size
- Excellent – 0.5 ha or 5,000 m^2 (50 x 100 m)
- Very Good – 1 ha or 10,000 m^2 (100 x 100 m)
- Good – 2 ha or 20,000 m^2 (200 x 100 m)

1.4 Further Information

The following information should be taken into consideration when applying the key diagnostic criteria and condition thresholds:

- Land use history and landscape position of patch including position relative to surrounding vegetation
- A patch is a discreet and mostly continuous area of the ecological community and may include small-scale variations (<30 m), gaps and disturbances such as tracks paths or breaks that do not significantly alter the overall functionality of the ecological community.
- Variation in canopy cover, quality or condition of vegetation across a patch should not be considered evidence of multiple patches
- A buffer zone is a contiguous area immediately adjacent to a patch of the ecological community. The recommended minimum buffer zone is 20-50 m. larger buffer zones should be considered for patches of particularly high conservation value, or if patches are down slope of drainage lines or a source of nutrient enrichment, or groundwater drawdown.
- Restored vegetation is not excluded provided it meets the key diagnostic criteria, condition threshold and patch size.
- Sampling protocols includes developing a quick map of the vegetation, landscape qualities and management history. Following this, a thorough sampling exercise must be undertaken to represent the range of variation. At least one hour per plot in early to mid-spring and a second

survey in late spring may be required to detect the majority of species. plots to be at least 100 m^2 (10 x 10 m). Search effort (number of person hours per plot across entire patch) and surveyor's level of expertise can be useful for future reference.

- Timing of surveys should allow a reasonable interval after a disturbance. Surveys at least one year post fire may be required to assess a site against the key diagnostic characteristics and minimum condition thresholds.
- Surrounding environment, landscape context and other significance considerations:
  - patches that are more species rich and less disturbed are likely to provide greater biodiversity value.
  - Patches that provide corridors or linkages within a largely modified landscape are particularly important.

The Conservation Advice provides an additional ten indicators to be considered when assessing impacts of actions or proposed actions under the EPBC Act. These are not further listed here.

2.0 Assessment

Patches are defined as a discreet and mostly continuous area of the ecological community. All native vegetation in Good or better condition were considered for an assessment against the key diagnostic criteria for the TEC. A preliminary review of Banksia species present was undertaken. Patches that had no Banksia overstorey species were excluded for further consideration.

The native vegetation has been separated into five patches:

- Patch 1 = quadrats 4 and 6
- Patch 2 = quadrats 12 and 13
- Patch 3 = quadrats 18 and 19
- Patch 4 = releve 08 and quadrat 09
- Patch 5 = releve 14

The key diagnostic features have been assessed using quadrats from each patch .

Table 2 key diagnostic features for xx patches

Key diagnostic characteristics Patch	1	2	3	4	5
Location and physical environment					
The Banksia Woodlands ecological community primarily occurs on the Swan Coastal Plain IBRA bioregion. Pockets of the community also extent into the adjacent lower parts of the Darling and Whicher escarpments that lie within the Jarrah Forest IBRA bioregion to the immediate east and south of the Swan Coastal Plain.	Y	Y	Y	Y	Y
Soils and landform					
Typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands. Is also common on sandy colluvium and Aeolian sands of the Ridge Hill Shelf, Whicher Scarp and Dandaragan Plateau In other less common scenarios (transitional substrates, sandflats)	Y	Interzone of Pinjarra Plain and Bassendean Sands.	Ridge Hill Shelf	Y	Y
Structure					
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; AND	Y sparse low woodland	Y low open woodland	Y	Y low open woodland	Y mid open woodland
Emergent trees of medium or tall (<10 m) height *Eucalyptus* or *Allocasuarina* species may sometimes be present above the *Banksia* canopy; AND	Y – *A. fraseriana, Nuytsia floribunda*	Y – *A fraseriana, E. todtiana*	Y – *E. marginata, A. fraseriana*	Y – *E. todtiana, A. fraseriana*	Y – *E. gomphocephala*

Key diagnostic characteristics Patch	1	2	3	4	5
A often highly species-rich understorey that consists of: • A layer of sclerophyllous shrubs of various heights • A herbaceous ground layer of cord rushes, sedges and perennial and ephemeral forbs that sometimes includes grasses. The development of a ground layer may vary depending on the density of the shrub layer and disturbance history.	Y – 31 sclerophyllous shrubs, 12 sedges and rushes, and 26 forbs.	Average – 19 sclerophyllous shrubs, 5 rushes and sedges, and 21 forbs.	Average - 21 sclerophyllous shrubs, 5 rushes and sedges, and 26 forbs.	Average (due to poor condition) – 14 sclerophyllous shrubs, 4 rushes and sedges, 15 forbs.	Average (due to poor condition) – 17 sclerophyllous shrubs, 3 rushes and sedges, 6 forbs.
Composition					
Canopy is most commonly dominated or co-dominated by *Banksia attenuata* and/or *Banksia menziesii.* Other *Banksia* species that dominate in some examples of the ecological community are *B. prionotes* or *B. ilicifolia*; AND	Y – 5% *B. attenuata*	Y – 3-8% *B. attenuata, 10-15% B. menziesii*	Y – 8% *B. menziesii*	Y – 5% *B. menziesii*	Co-dominated by *B. menziesii* at 2%
Patch must include at least one of the following diagnostic species: • *Banksia attenuata* • *Banksia menziesii* • *Banksia prionotes* • *Banksia ilicifolia*	Y	Y	Y	Y	Y
If present, the emergent tree layer often includes *Corymbia calophylla, E. marginata,* or less commonly *E. gomphocephala*; AND	Not present	Not present	Isolated trees.	Not present	Overstorey dominated by Eucalypt trees.
Other trees of a medium height may be present and may be co-dominant with the *Banksia* species across a patch, include *E. todtiana, Nuytsia floribunda, Allocasuarina fraseriana, Callitris arenaria, Callitris pyramidalis* and *Xylomelum occidentale*; AND	Sparse *A. fraseriana*	Y – 0-15% *A. fraseriana,* isolated *E. todtiana*	Y – 2% *A. fraseriana*	Y – 5% *E. todtiana*	*E. gomphocephala* and introduced Eucalypts at 20%

Key diagnostic characteristics Patch	1	2	3	4	5
Understorey typically contains high to very high diversity of shrub and herb species that often vary from patch to patch.	Y – 76 total species richness (n=2)	Average – 53 total species richness (n=2)	Average – 57 total species richness (n=2)	Average – 42 total species richness (n=2)	Low – 31 total species richness (n=1)
Contra-indicators					
Patches clearly dominated by *Banksia littoralis* are not part of the TEC	N	N	N	N	N
Patches clearly dominated by *Banksia burdettii* are not the TEC	N	N	N	N	N
FCT 20c – Eastern shrublands and woodlands, corresponds with a separate EPBC ecological community listing, Shrublands and Woodlands of the eastern Swan Coastal Plain. Occurrences of this FCT should be considered under that separate listing.	N	N	N	N	N

2.1 Patch 1 – 79 Victoria Road

Patch 1 incorporates native vegetation at 79 Victoria Road. This patch meets all the key diagnostic features, size and condition thresholds as published in the approved conservation advice (TSSC, 2016).

It is likely that the patch extends beyond this cadastral boundary however adjacent properties were excluded from the survey. The patch is mapped as Banksia woodland with an isolated pocket of Jarrah woodland on the southern tip. The patch also represents the WA TEC SCP20a *B. attenuata* over species rich dense shrublands. Vegetation condition is excellent.

Location	79 Victoria Road, Wattle Grove
Key diagnostic characteristics	Meets all key diagnostic characteristics. Very open overstorey of *Banksia* trees over species-rich dense shrublands.
Condition	Excellent
Patch size	0.94 ha
Additional features	Represents FCT20a *B. attenuata* over species rich dense shrublands. Potential to re-establish connection with adjacent Banksia woodlands beyond survey area. Supports populations of threatened *Conospermum undulatum* and Priority 3 *Isopogon drummondii*.
Land use history	Rural to urban development.
Any variations in patch	Patch has been resilient to significant weed invasion (<1m from edge excluded).
Buffer zone present	Limited buffer present for approximately 25% of patch.
Sampling protocol	Single scoring event of two non-permanent quadrats 10x10 delineated by measuring tape.
Disturbance history	Represents remnant native vegetation.
Surrounding environment	Predominantly cleared for lawn, houses and various private estate use.

Plate 1 Patch 1 photographs

2.2 Patch 2 – 58 Victoria Road

Patch 2 is isolated to remnant native vegetation on 58 Victoria Road. This patch meets all key diagnostic criteria, condition and size thresholds.

The patch is likely to extend beyond this cadastral boundary, particularly northwest. The patch includes two discreet areas separated by planted and native trees and a house. Due to the connection of canopies of trees along both sides of the house these two areas are considered representative of the same patch.

The patch represents two vegetation communities, both broadly described as Banksia woodlands. Vegetation condition varied between Degraded to Excellent which reflects historical clearing. In particular, the patch at the front of the house has been subject to partial clearing of the understorey. It falls outside the required 0.5 ha by such a minute amount which relies on precise mapping. The precautionary principle has been applied.

Location	58 Victoria Road, Wattle Grove
Key diagnostic characteristics	Meets all key diagnostic characteristics. Overstorey of Banksia trees over species-rich dense shrublands.
Condition	Excellent
Patch size	0.49 ha
Additional features	Patch represents two occurrences on 58 Victoria Road separated by planted trees and a house. Has the potential to be linked to larger remnant native vegetation on adjacent property. Continues to support high species richness and be resilient to weed invasion. Supports small population of threatened *Conospermum undulatum* flora.
Land use history	Rural to urban development.
Any variations in patch	The northwest section of the patch has been resilient to significant weed invasion (<1m from edge excluded). The area in front of the house has been partially cleared (understorey only) and weeds have displaced some native vegetation.
Buffer zone present	Buffer of native and introduced trees (no hardstand) present around entire patch.
Sampling protocol	Single scoring event of one non-permanent quadrat 10x10 delineated by measuring tape and one releve.
Disturbance history	Represents remnant native vegetation.
Surrounding environment	Predominantly cleared for lawn, houses and various private estate use.

Plate 2 Patch 2 vegetation

2.3 Patch 3 – 30 Ridley Road

Patch 3 represents native vegetation at 30 Ridley Road, Wattle Grove and adjacent roadside vegetation. Not all native vegetation on this property is considered representative of the Banksia Woodlands TEC, with approximately 30% supporting *E. marginata* woodland devoid of any Banksia species.

Patch 3 meets the key diagnostic criteria, size and condition thresholds. Species richness was potentially lower than other areas (57 species total). This may be attributed to its proximity to *E. marginata* woodland and isolation from other Banksia woodlands. Despite this, the patch is still considered representative of the Banksia Woodlands of the SCP.

Location	30 Ridley Road, Wattle Grove
Key diagnostic characteristics	Meets all key diagnostic characteristics. Overstorey of Banksia trees over mixed shrubs, sedges and forbs.
Condition	Excellent
Patch size	0.97 ha
Additional features	One of the few occurrences of Banksia woodland on Ridge Hill Shelf. Forms part of a corridor from waterway (south) to larger areas of remnant vegetation (north). The two quadrats infer FCT20b eastern *B. attenuata* and/or *E. marginata* woodlands which is listed in WA as a TEC.
Land use history	Rural to urban development.
Any variations in patch	The patch has been resilient to significant weed invasion (<1m from edge excluded). Small cleared area in centre of patch.
Buffer zone present	75% surrounded by road and gardens with remaining 25% buffered by *E. marginata* woodland.
Sampling protocol	Single scoring event of two non-permanent 10x10 quadrat delineated by measuring tape.
Disturbance history	Represents remnant native vegetation.
Surrounding environment	Predominantly cleared for lawn, houses and various private estate

	use.

**Plate 3 Patch 3 vegetation **

2.4 Patch 4 – 30 & 38 Brentwood Road

Patch 4 is restricted to the southeast corner of 30 and 38 Brentwood Road, separated by a cleared track approximately 15m wide. The northern area of this patch (represented by releve 08) is significantly disturbed with understorey species displaced by weeds and suffering from considerable edge effects. The southern area represented by quadrat 09 was in better condition.

This patch is not representative of the EPBC TEC Banksia Woodlands of the SCP due to degradation and size of the patch.

Location	30 and 38 Brentwood Road, Wattle Grove
Key diagnostic characteristics	Arguably could meet the key diagnostic characteristics despite low diversity due to degraded condition.
Condition	Good to Very Good
Patch size	0.17 ha
Additional features	Isolated from other patches of native vegetation with the exception of native and introduced trees. The quadrat infers FCT23a central *B. attenuata-B. menziesii* woodlands.
Land use history	Rural to urban development.
Any variations in patch	Weeds affect 50% of the patch. Edge effects are significant.
Buffer zone present	Surrounded by gardens, road and cleared areas.
Sampling protocol	Single scoring event of one non-permanent 10x10 quadrat delineated by measuring tape and one releve.
Disturbance history	Unsure, the area in better condition is likely to represent remnant native vegetation. The other area may represent regrowth or has been significantly cleared.

Surrounding environment	Cleared for lawn, houses and various private estate use.

Plate 4 Patch 4 vegetation

2.5 Patch 5 – 45 Ridley Road

Patch 5 represents Good to Degraded native vegetation on 45 Ridley Road. This patch has low species diversity and vegetation is degraded as a result of partial clearing, weed invasion and potentially historical grazing. There is a horse arena in the centre of the patch.

This patch does not meet the condition and size thresholds to represent the Banksia Woodlands TEC.

Location	45 Ridley Road, Wattle Grove
Key diagnostic characteristics	Arguably could meet the key diagnostic characteristics despite low diversity due to degraded condition.
Condition	Good to Degraded
Patch size	0.54 ha
Additional features	Is separated from large area of SCP20a mapped community which is north of the highway. Also forms part of a roadside corridor in east and west direction. Targeted surveys did not identify any T or P flora.
Land use history	Rural to urban development.
Any variations in patch	Weeds represent up to 30% foliage cover. There is partial clearing and presence of garden escapees present.
Buffer zone present	Surrounded by native and planted trees and road corridor.
Sampling protocol	Single scoring event of one releve.
Disturbance history	Partial clearing in the area.
Surrounding environment	Cleared for lawn, houses and various private estate use.

Plate 5 Patch 5 vegetation

Appendix C

Flora Species by Family by Community Matrix

Appendix C Flora Species by Family by Community Matrix

Family	Taxon	Community					
		BaEpPf	BmXpEc	CcHaEc	EmCaFa	EmMpLp	EmPcAh
Anarthriaceae							
	Lyginia imberbis	x	x				
Apiaceae							
	Platysace tenuissima				x		
	Xanthosia atkinsoniana				x		
	Xanthosia candida				x		x
	Xanthosia huegelii						x
Araliaceae							
	Trachymene pilosa	x	x			x	
Asparagaceae							
	Acanthocarpus preissii	x					
	Asparagus asparagoides			x			
	Lomandra caespitosa		x				x
	Lomandra drummondii	x					
	Lomandra hermaphrodita	x	x				x
	Lomandra micrantha	x	x				x
	Lomandra preissii	x	x		x	x	x
	Lomandra sonderi	x	x		x	x	x
	Lomandra sp.	x					
	Thysanotus multiflorus					x	
	Thysanotus patersonii	x	x	x		x	x
	Thysanotus thyrsoideus	x					
	Thysanotus triandrus				x		
Asteraceae							
*	*Arctotheca calendula*	x	x				
*	*Hypochaeris glabra*	x	x		x	x	x
	Podolepis gracilis		x				
*	*Sonchus oleraceus*						x
*	*Ursinia anthemoides*	x	x		x		x
Campanulaceae							
	?Lobelia anceps	x		x	x		x
Casuarinaceae							
	Allocasuarina fraseriana	x	x		x	x	
	Allocasuarina humilis	x	x			x	
Celastraceae							
	Tripterococcus brunonis				x		
Colchicaceae							
	Burchardia congesta	x	x		x	x	x
Cyperaceae							
	Cyathochaeta avenacea		x	x	x		
	Lepidosperma leptostachyum	x				x	x
	Lepidosperma pubisquameum				x		
	Lepidosperma sp.				x		
	Lepidosperma tenue		x		x	x	
	Mesomelaena pseudostygia	x	x		x	x	
	Mesomelaena tetragona	x	x		x		
	Phlebocarya filifolia	x	x				
	Schoenus clandestinus	x					
	Schoenus pedicellatus	x	x				
	Tetraria capillaris						x
	Tetraria octandra	x	x	x	x	x	x
Dasypogonaceae							
	Calectasia narragara		x				
	Dasypogon bromeliifolius	x	x			x	
Dillenaceae							
	Hibbertia aurea	x					
	Hibbertia huegellii	x					

Appendix C Flora Species by Family by Community Matrix

Family		Taxon	Community					
			BaEpPf	BmXpEc	CcHaEc	EmCaFa	EmMpLp	EmPcAh
Dillenaceae		*Hibbertia hypericoides*	x	x		x	x	x
		Hibbertia subvaginata			x			
Droseraceae								
		Drosera erythrorhiza	x			x		x
		Drosera gigantea				x		
		Drosera porrecta	x	x			x	x
Ericaceae								
		Conostephium preissii		x			x	
		Leucopogon capitellatus						x
		Lysinema pentapetalum	x					
Euphorbiaceae								
		Monotaxis grandiflora var. *grandiflora*	x					
Fabaceae								
		Acacia alata var. *alata*		x				
		Acacia lasiocarpa var. *lasiocarpa*		x		x	x	x
	*	*Acacia longifolia*					x	
		Acacia nervosa				x		
		Acacia pulchella var. *pulchella*			x	x	x	x
		Acacia sp.		x			x	x
		Bossiaea aquifolium				x		
		Bossiaea eriocarpa	x	x		x	x	
		Bossiaea ornata				x		
	*	*Chamaecytisus palmensis*					x	x
		Daviesia decurrens subsp. *decurrens*	x			x		
		Daviesia divaricata subsp. *divaricata*		x		x		
		Daviesia nudiflora subsp. *nudiflora*	x	x				
		Gompholobium confertum	x					
		Gompholobium knightianum		x		x		x
		Gompholobium tomentosum				x		x
		Hovea chorizemifolia			x			
		Hovea pungens	x	x				
		Hovea trisperma	x	x		x		x
		Isotropis cuneifolia subsp. *cuneifolia*				x		x
		Jacksonia floribunda		x		x		
		Jacksonia furcellata				x	x	
		Jacksonia lehmannii	x					
		Kennedia coccinea				x		x
		Labichea punctata	x	x		x	x	x
	*	*Lotus angustissimus*		x		x	x	
	*	*Lupinus angustifolius*						x
		Sphaerolobium medium	x					
Goodeniaceae								
		Dampiera alata		x				
		Dampiera linearis	x	x			x	x
		Lechenaultia biloba				x	x	x
		Scaevola canescens						x
		Scaevola repens var. *repens*	x	x				
Haemodoraceae								
		Anigozanthos manglesii subsp. *manglesii*		x		x		
		Conostylis aculeata		x				
		Conostylis aurea	x					

Appendix C Flora Species by Family by Community Matrix

Family		Taxon	Community					
			BaEpPf	BmXpEc	CcHaEc	EmCaFa	EmMpLp	EmPcAh
Haemodorum		*Conostylis setigera*	x			x		
		Conostylis setigera subsp. *setigera*		x				
		Haemodorum laxum	x	x		x	x	x
		Haemodorum sp.		x		x	x	
		Haemodorum spicatum	x			x		
Haloragaceae								
		Gonocarpus pithyoides				x	x	
Hemerocallidaceae								
		Agrostocrinum hirsutum	x			x		x
		Caesia micrantha		x		x	x	
		Tricoryne elatior	x	x		x	x	
Iridaceae								
	*	*Freesia alba x leichtlinii*		x		x	x	x
	*	*Gladiolus caryophyllaceus*	x	x		x	x	
		Patersonia juncea				x		
		Patersonia occidentalis	x	x				
		Patersonia pygmaea	x					
	*	*Romulea rosea*				x		
	*	*Watsonia meriana*			x			
Lamiaceae								
		Hemiandra pungens	x	x				
		Hemiphora bartlingii	x					
Lauraceae								
		Cassytha glabella	x			x		
Loranthaceae								
		Nuytsia floribunda	x					
Myrtaceae								
		Agonis flexuosa		x				
		Babingtonia camphorosmae		x				x
		Calytrix glutinosa				x		
		Chamelaucium uncinatum		x				
		Conothamnus trinervis	x					
		Corymbia calophylla			x	x		x
		Darwinia citriodora			x			
		Eremaea pauciflora var. *pauciflora*	x	x		x	x	
		Eucalyptus gomphocephala		x				
		Eucalyptus marginata subsp. *marginata*		x		x	x	x
		Eucalyptus sp.		x		x		
		Eucalyptus todtiana	x	x				
		Hovea chorizemifolia				x		
		Hypocalymma angustifolium			x			
		Hypocalymma robustum		x		x	x	
		Melaleuca systena		x			x	
		Melaleuca trichophylla	x					
		Pericalymma ellipticum	x					
Orchidaceae								
		Caladenia flava	x					
		Prasophyllum sp.				x		
		Pterostylis sanguinea				x		
		Thelymitra graminea	x			x		x
Oxalidaceae								
	*	*Oxalis pes-caprae*		x				

Appendix C Flora Species by Family by Community Matrix

Family		Taxon	Community					
			BaEpPf	BmXpEc	CcHaEc	EmCaFa	EmMpLp	EmPcAh
Phyllanthaceae								
		Phyllanthus calycinus				x		x
		Pittosporaceae				x		
		Billardiera fraseri				x		
Poaceae								
		Austrostipa compressa		x				x
	*	*Avena barbata*		x	x			
	*	*Briza maxima*	x	x		x	x	x
	*	*Briza minor*			x	x		
	*	*Ehrharta calycina*	x	x	x	x	x	x
	*	*Eragrostis curvula*	x			x		
		Neurachne alopecuroidea	x			x		
		Tetrarrhena laevis	x					x
Primulaceae								
	*	*Lysimachia arvensis*				x		x
Proteaceae								
		Adenanthos cygnorum subsp. *cygnorum*	x	x				
		Banksia armata var. *armata*	x			x		
		Banksia attenuata	x	x				
		Banksia dallanneyi	x			x	x	
		Banksia menziesii	x	x				
		Banksia sessilis var. *sessilis*		x				x
		Conospermum undulatum	x					
		Grevillea bipinnatifida subsp. *bipinnatifida*		x		x	x	
		Hakea amplexicaulis		x				
		Hakea conchifolia	x					
		Hakea lissocarpha						x
		Hakea prostrata	x					
		Hakea ruscifolia		x				
		Hakea stenophylla				x		
		Hakea trifurcata		x	x	x	x	
		Hakea undulata		x		x		
		Isopogon drummondii	x	x				
		Isopogon dubius	x			x	x	
		Lambertia multiflora var. *darlingensis*	x	x		x	x	
		Persoonia angustiflora	x					
		Petrophile linearis	x					
		Petrophile macrostachya	x			x		
		Petrophile seminuda	x					
		Stirlingia latifolia	x	x			x	
		Synaphea spinulosa subsp. *spinulosa*		x			x	
Restionaceae								
		Alexgeorgea nitens	x	x				
		Desmocladus fasciculatus	x	x		x	x	x
		Hypolaena exsulca	x					
		Loxocarya cinerea	x			x		
Rhamnaceae								
		Spyridium globulosum			x			
Rubiaceae								
		Opercularia vaginata		x				
Rutaceae								
		Philotheca spicata	x	x		x	x	

Appendix C Flora Species by Family by Community Matrix

Family	Taxon	Community					
		BaEpPf	BmXpEc	CcHaEc	EmCaFa	EmMpLp	EmPcAh
Solanaceae							
	* *Solanum nigrum*						x
Stylidiaceae							
	Stylidium amoenum	x					
	Stylidium brunonianum		x		x		
	Stylidium hispidum				x		
	Stylidium piliferum				x		x
	Stylidium schoenoides	x	x				x
Violaceae							
	Hybanthus calycinus	x	x				
Xanthorrhoeaceae							
	Chamaescilla corymbosa var. *corymbosa*		x				x
	Xanthorrhoea acanthostachya	x	x				
	Xanthorrhoea gracilis		x				x
	Xanthorrhoea preissii	x	x		x	x	x

Appendix D

Flora Quadrat Data

Appendix D Quadrat Data

Site: 1	**Location:** 116.01621 -32.01444	**Date:** 01-10-2019
Type: Quadrat	Size: 10x10	Community: EmCaFa
Topography: undulating	Soils: sandy loam gravels	Colour:
Bare Ground: 10% litter	Fire: 10+	
Vegetation significance: None		
Condition: very good, weeds		

*	Taxon	Height cm	Foliage %
	Burchardia congesta	20	0.1
	Caesia micrantha	30	0.1
	Cassytha glabella		0.1
	Haemodorum spicatum	60	0.1
	Labichea punctata	10	0.1
	Lechenaultia biloba	5	0.1
	Lomandra preissii	20	0.1

*	Taxon	Height cm	Foliage %
*	*Lotus angustissimus*	1	0.1
	Platysace tenuissima	30	0.1
	Prasophyllum sp.	5	0.1
	?Lobelia anceps	20	0.2
	Conostylis setigera	10	0.2
	Gompholobium tomentosum	20	0.2
	Gonocarpus pithyoides	20	0.2
	Hakea undulata	60	0.2
	Hovea chorizemifolia	20	0.2
	Lambertia multiflora var. darlingensis	20	0.2
	Patersonia juncea	40	0.2
	Stylidium hispidum	5	0.2
	Tetraria octandra	20	0.2
	Bossiaea ornata	40	0.4
	Banksia dallanneyi	5	0.5
*	*Briza maxima*	10	0.5
	Gompholobium knightianum	10	0.5
	Labichea punctata	10	0.5
	Lomandra sonderi	20	0.5
	Loxocarya cinerea	10	0.5
	Thelymitra graminea	50	0.5
*	*Ursinia anthemoides*	10	0.5
	Acacia nervosa	30	1
	Agrostocrinum hirsutum	10	1
	Banksia armata var. armata	20	1
	Drosera gigantea	15	1
	Lepidosperma sp.	20	1
	Mesomelaena pseudostygia	20	1
	Petrophile macrostachya	50	1
	Thysanotus triandrus	15	1
	Daviesia decurrens subsp. decurrens	50	1.5
Pl	*Eucalyptus sp.*	300	2
	Hakea stenophylla	50	2
	Hibbertia hypericoides	50	2
	Corymbia calophylla	3000	3
	Xanthorrhoea preissii	40	3
	Cyathochaeta avenacea	25	5

*	Taxon	Height cm	Foliage %
*	*Ehrharta calycina*	80	5
	Eucalyptus marginata subsp. marginata	1500	8
*	*Freesia alba x leichtlinii*	10	8
	Kennedia coccinea		
	Philotheca spicata	60	
	Stylidium piliferum		

Note: * depicts an introduced (weed) species

Site: 2	**Location:** 116.01690 -32.01376	**Date:** 01-10-2019
Type: Releve	Size:	Community: EmPcAh
Topography: undulating	Soils: sandy loam gravel	Colour:
Bare Ground: 80% litter	Fire: 10+	
Vegetation significance: WA TEC C. calophylla-E. marginata Woodlands on Sandy Clay Soils (FCT3b)		
Condition: degraded better in SE corner		

*	Taxon	Height cm	Foliage %
	?Lobelia anceps		
	Agrostocrinum hirsutum		
	Austrostipa compressa		
	Corymbia calophylla		
*	*Ehrharta calycina*		
	Eucalyptus marginata subsp. marginata		
*	*Freesia alba x leichtlinii*		
	Gompholobium knightianum		
	Gompholobium knightianum		

*	Taxon	Height cm	Foliage %
	Gompholobium tomentosum		
*	*Hypochaeris glabra*		
	Lechenaultia biloba		
*	*Lupinus angustifolius*		
*	*Lysimachia arvensis*		
	Solanum nigrum		
	Stylidium piliferum		
*	*Ursinia anthemoides*		
	Xanthorrhoea preissii		

Note: * depicts an introduced (weed) species

Site: 3	**Location:** 116.00806 -32.00412	**Date:** 02-10-2019
Type: Releve	Size:	Community: CcHaEc
Topography: drainage line	Soils: sandy loam	Colour:
Bare Ground: 60% litter	Fire: 10+	
Vegetation significance: None		
Condition: degraded		

*	Taxon	Height cm	Foliage %
	?Lobelia anceps	20	0.1
*	*Briza minor*	10	0.1
	Tetraria octandra	30	0.1
	Thysanotus patersonii		0.1
	Hovea chorizemifolia	40	0.3
DP *	*Asparagus asparagoides*	cl	0.5
	Hibbertia subvaginata	50	0.5
	Acacia pulchella var. pulchella	100	1

*	Taxon	Height cm	Foliage %
	Cyathochaeta avenacea	30	1
	Darwinia citriodora	50	1
	Hakea trifurcata	200	1
	Hypocalymma angustifolium	40	1
*	*Watsonia meriana*	60	2
*	*Avena barbata*	60	5
	Corymbia calophylla	1500	10
*	*Ehrharta calycina*	60	10
	Spyridium globulosum	200	60

Note: * depicts an introduced (weed) species

Site: 4	**Location:** 116.00887 -32.01774	**Date:** 02-10-2019
Type: Quadrat	Size: 10x10	Community: BaEpPf
Topography: flat	Soils: sand grey	Colour:
Bare Ground: 5% litter	Fire: 10+	
Vegetation significance: EPBC TEC Banksia Woodlands of the SCP; WA TEC B. attenuata over species rich dense shrublands		
Condition: excellent		

*	Taxon	Height cm	Foliage %
*	*Briza maxima*	10	0.1
	Burchardia congesta	20	0.1
	Cassytha glabella		0.1
	Conostylis setigera	5	0.1
	Conothamnus trinervis	30	0.1
	Desmocladus fasciculatus	10	0.1
	Drosera erythrorhiza		0.1
*	*Ehrharta calycina*	30	0.1

*	Taxon	Height cm	Foliage %
*	*Gladiolus caryophyllaceus*	50	0.1
	Haemodorum spicatum	40	0.1
	Hovea pungens	20	0.1
*	*Hypochaeris glabra*	2	0.1
	Hypolaena exsulca	20	0.1
	Jacksonia lehmannii	20	0.1
	Lomandra hermaphrodita	10	0.1
	Loxocarya cinerea	5	0.1
	Neurachne alopecuroidea	10	0.1
	Patersonia pygmaea	10	0.1
	Persoonia angustiflora	5	0.1
	Sphaerolobium medium	20	0.1
	Stylidium amoenum	50	0.1
	Thysanotus thyrsoideus	20	0.1
	Trachymene pilosa	5	0.1
	Tricoryne elatior	20	0.1
*	*Ursinia anthemoides*	10	0.1
	Banksia dallanneyi	10	0.2
	Haemodorum laxum	30	0.2
	Hemiphora bartlingii	40	0.2
	Philotheca spicata	60	0.2
	Conospermum undulatum	70	0.5
	Hibbertia aurea	30	0.5
	Hibbertia huegellii	20	0.5
	Labichea punctata	20	0.5
	Lepidosperma leptostachyum	30	0.5
	Lomandra sp.	15	0.5
	Lyginia imberbis	30	0.5
	Melaleuca trichophylla	20	0.5
	Mesomelaena pseudostygia	30	0.5
	Patersonia occidentalis	20	0.5
	Schoenus pedicellatus	40	0.5
*	*Arctotheca calendula*	5	1
	Daviesia decurrens subsp. decurrens	50	1
	Daviesia nudiflora subsp. nudiflora	50	1
	Isopogon drummondii	30	1
	Isopogon dubius	30	1

*	Taxon	Height cm	Foliage %
	Lomandra sonderi	30	1
	Tetraria octandra	30	1
	Banksia attenuata	600	2
	Hibbertia hypericoides	30	2
	Petrophile macrostachya	50	2
	Banksia armata var. armata	60	3
	Schoenus clandestinus	5	3
	Xanthorrhoea acanthostachya	50	3
	Xanthorrhoea preissii	50	3
	Allocasuarina humilis	100	5
	Hakea conchifolia	60	5
	Phlebocarya filifolia	20	5
	Hakea prostrata	50	6
	Eremaea pauciflora var. pauciflora	40	7
	Lambertia multiflora var. darlingensis	60	8
	Allocasuarina fraseriana	600	opp
	Stylidium schoenoides		

Note: * depicts an introduced (weed) species

Site: 5	**Location:** 116.00843 -32.01840	**Date:** 02-10-2019
Type: Releve	Size:	Community: EmMpLp
Topography: flat	Soils: sandy	Colour:
Bare Ground: 50% litter	Fire: 10+	
Vegetation significance: None		
Condition: very good weed incursion, isolated patch of trees		

*	Taxon	Height cm	Foliage %
	Burchardia congesta	40	0.1
	Drosera porrecta	10	0.1
*	*Gladiolus caryophyllaceus*	40	0.1
	Labichea punctata	20	0.5
	Lambertia multiflora var. darlingensis	50	0.5
	Dampiera linearis	10	1
	Desmocladus fasciculatus	20	1
	Tricoryne elatior	10	1

*	Taxon	Height cm	Foliage %
	Xanthorrhoea preissii	60	1
*	*Ehrharta calycina*	50	2
	Tetraria octandra	30	2
	Banksia dallanneyi	10	3
	Lomandra preissii	20	10
	Allocasuarina fraseriana	1300	20
	Mesomelaena pseudostygia	30	30
	Eucalyptus marginata subsp. marginata	1500	50
Pl	*Acacia longifolia*	300	
*	*Briza maxima*		
*	*Chamaecytisus palmensis*	200	
	Philotheca spicata		

Note: * depicts an introduced (weed) species

Site: 6	**Location:** 116.00805 -32.01803	**Date:** 02-10-2019
Type: Quadrat	Size: 10x10	Community: BaEpPf
Topography: flat	Soils: sand grey	Colour:
Bare Ground: 20% litter	Fire: 10+	
Vegetation significance: EPBC TEC Banksia Woodlands of the SCP; WA TEC B. attenuata over species rich dense shrublands		
Condition: excellent weed encroachment		

*	Taxon	Height cm	Foliage %
	Burchardia congesta	20	0.1
	Conostylis setigera	10	0.1
	Dasypogon bromeliifolius	10	0.1
	Hemiphora bartlingii	40	0.1
*	*Hypochaeris glabra*	1	0.1
	Lomandra hermaphrodita	20	0.1
	Lomandra sonderi	30	0.1
	Melaleuca trichophylla	30	0.1

*	Taxon	Height cm	Foliage %
	Mesomelaena tetragona	30	0.1
	Persoonia angustiflora	10	0.1
	Stirlingia latifolia	30	0.1
	Stylidium amoenum	3	0.1
	Thysanotus patersonii		0.1
	Thysanotus thyrsoideus	10	0.1
	Trachymene pilosa	5	0.1
	Banksia dallanneyi	10	0.2
	Cassytha glabella		0.2
	Conospermum undulatum	80	0.2
	Hibbertia huegellii	20	0.2
	Philotheca spicata	80	0.2
*	*Ursinia anthemoides*	10	0.2
*	*Gladiolus caryophyllaceus*	60	0.3
	Isopogon drummondii	40	0.3
*	*Briza maxima*	30	0.5
	Drosera porrecta	10	0.5
*	*Ehrharta calycina*	80	0.5
	Hovea trisperma	30	0.5
	Lomandra preissii	40	0.5
	Alexgeorgea nitens	10	1
	Hakea prostrata	80	1
	Scaevola repens var. repens	5	1
	Phlebocarya filifolia	10	1
	Schoenus pedicellatus	40	1
	Tetraria octandra	20	1
	Banksia armata var. armata	70	2
	Eremaea pauciflora var. pauciflora	30	2
	Hemiandra pungens	10	2
	Lambertia multiflora var. darlingensis	100	2
	Lyginia imberbis	40	2
	Xanthorrhoea preissii	100	2
	Patersonia occidentalis	30	3
	Tricoryne elatior	20	4
	Banksia attenuata	600	5
	Allocasuarina humilis	150	8
	Mesomelaena pseudostygia	30	8

*	Taxon	Height cm	Foliage %
	Hibbertia hypericoides	50	10
	Banksia menziesii	600	
	Gompholobium confertum		
	Lepidosperma leptostachyum		
	Nuytsia floribunda		
	Petrophile linearis		
	Stylidium schoenoides		

Note: * depicts an introduced (weed) species

Site: 7	**Location:** 116.01142 -32.01586	**Date:** 02-10-2019
Type: Quadrat	Size: 10x10	Community: EmCaFa
Topography: flat	Soils: sand	Colour:
Bare Ground: 60% litter	Fire:	
Vegetation significance: WA TEC C. calophylla-E. marginata woodlands on sandy clay soils		
Condition: excellent		

*	Taxon	Height cm	Foliage %
	?Lobelia anceps	15	0.1
	Acacia lasiocarpa var. lasiocarpa	5	0.1
	Acacia lasiocarpa var. lasiocarpa	5	0.1
	Burchardia congesta	30	0.1
	Hovea trisperma	10	0.1
	Pterostylis sanguinea	20	0.1
	Xanthosia atkinsoniana	2	0.1
	Tripterococcus brunonis	20	0.2

*	Taxon	Height cm	Foliage %
	Billardiera fraseri	10	0.5
	Gompholobium knightianum	10	0.5
	Hovea chorizemifolia	10	0.5
	Acacia pulchella var. pulchella	20	1
	Bossiaea ornata	40	1
	Cyathochaeta avenacea	20	1
*	*Ehrharta calycina*	50	1
	Lomandra preissii	20	1
	Stylidium piliferum	10	1
	Drosera erythrorhiza		2
	Lomandra preissii	20	2
	Neurachne alopecuroidea	20	2
	Lechenaultia biloba	30	4
	Lepidosperma pubisquameum	30	4
	Eucalyptus marginata subsp. marginata	1400	35
	Haemodorum spicatum	60	.
	Isopogon dubius		opp
	Calytrix glutinosa	40	opp
	Stylidium brunonianum		opp
	Thelymitra graminea	50	opp
	Daviesia decurrens subsp. decurrens		opp
	Desmocladus fasciculatus		opp
	Isotropis cuneifolia subsp. cuneifolia		opp
	Lomandra preissii		opp
	Lomandra sonderi		opp

Note: * depicts an introduced (weed) species

Site: 8	**Location:** 116.00046 -32.01188	**Date:** 03-10-2019
Type: Releve	Size:	Community: BmXpEc
Topography: flat	Soils: sand grey	Colour:
Bare Ground: 70% litter	Fire: 10+	
Vegetation significance: None		
Condition: degraded partial clearing, weeds		

*	Taxon	Height cm	Foliage %
	Burchardia congesta	30	0.1
	Dasypogon bromeliifolius	30	0.1
*	*Gladiolus caryophyllaceus*	50	0.1
	Patersonia occidentalis	20	0.1
	Stirlingia latifolia	30	0.1
	Bossiaea eriocarpa	30	0.2
*	*Freesia alba x leichtlinii*	10	0.5
	Hakea amplexicaulis	30	0.5

*	Taxon	Height cm	Foliage %
*	*Ursinia anthemoides*	10	0.5
	Cyathochaeta avenacea	40	1
	Eremaea pauciflora var. pauciflora	30	1
	Mesomelaena pseudostygia	30	1
	Xanthorrhoea gracilis	40	1
	Xanthorrhoea preissii	40	4
*	*Briza maxima*	10	5
*	*Ehrharta calycina*	50	5
	Eucalyptus todtiana	600	5
	Agonis flexuosa	800	20
	Hibbertia hypericoides		
	Lambertia multiflora var. darlingensis		

Note: * depicts an introduced (weed) species

Site: 9	**Location:** 116.00003 -32.01200	**Date:** 03-10-2019
Type: Quadrat	Size: 10x10	Community: BmXpEc
Topography: flat	Soils: grey sand	Colour:
Bare Ground: 20% litter	Fire: 10+	
Vegetation significance: None		
Condition: very good		

*	Taxon	Height cm	Foliage %
*	*Avena barbata*	30	0.1
	Burchardia congesta	20	0.1
	Conostylis aculeata	5	0.1
	Dampiera alata	10	0.1
	Dampiera linearis	20	0.1
*	*Gladiolus caryophyllaceus*	40	0.1
	Hovea trisperma	20	0.1
*	*Hypochaeris glabra*	1	0.1

*	Taxon	Height cm	Foliage %
	Thysanotus patersonii		0.1
	Trachymene pilosa	5	0.1
	Calectasia narragara	20	0.2
	Cyathochaeta avenacea	40	0.2
	Jacksonia floribunda	20	0.2
	Lyginia imberbis	30	0.2
	Dasypogon bromeliifolius	10	0.5
	Hemiandra pungens	5	0.5
	Mesomelaena tetragona	30	0.5
	Stirlingia latifolia	40	0.5
	Agonis flexuosa	800	1
	Allocasuarina fraseriana	200	1
	Allocasuarina humilis	100	1
	Austrostipa compressa	40	1
*	*Briza maxima*	20	1
	Hemiandra pungens	10	1
	Mesomelaena pseudostygia	30	1
	Patersonia occidentalis	20	1
	Scaevola repens var. repens	5	1
	Lambertia multiflora var. darlingensis	100	1.5
	Alexgeorgea nitens	5	2
*	*Ursinia anthemoides*	10	2
	Xanthorrhoea preissii	80	2
	Adenanthos cygnorum subsp. cygnorum	300	3
	Hibbertia hypericoides	30	3
	Banksia menziesii	600	5
*	*Ehrharta calycina*	70	5
	Eremaea pauciflora var. pauciflora	30	10
	Lomandra micrantha		
	Melaleuca systena		

Note: * depicts an introduced (weed) species

Site: 10	**Location:** 116.02012 -32.01215	**Date:** 03-10-2019
Type: Quadrat	Size: 10x10	Community: EmPcAh
Topography: slope	Soils: sandy loam gravel, gravel on surface	Colour:
Bare Ground: 60% litter	Fire: 10+	
Vegetation significance: WA TEC C. calophylla-E. marginata woodlands on sandy clay soils		
Condition: good		

*	Taxon	Height cm	Foliage %
	Banksia sessilis var. sessilis	20	0.1
	Hovea trisperma	20	0.1
	Sonchus oleraceus	3	0.1
	Stylidium schoenoides	15	0.1
	Thelymitra graminea	40	0.1
	Kennedia coccinea		0.2
	Stylidium piliferum	10	0.2
	Leucopogon capitellatus	15	0.3

*	Taxon	Height cm	Foliage %
	Agrostocrinum hirsutum	20	0.5
	Drosera porrecta	20	0.5
	Gompholobium knightianum	15	0.5
	Hibbertia hypericoides		0.5
	Labichea punctata	20	0.5
	Lepidosperma leptostachyum	20	0.5
	Tetraria capillaris	20	0.5
	Thysanotus patersonii		0.5
	Desmocladus fasciculatus	15	1
*	*Hypochaeris glabra*	1	1
	Lomandra sonderi	20	1
	Tetraria octandra	20	1
*	*Ursinia anthemoides*	10	1
*	*Briza maxima*	10	3
	Xanthorrhoea preissii	60	3
*	*Ehrharta calycina*	40	4
	Phyllanthus calycinus	30	10
	Corymbia calophylla	2000	15
	Eucalyptus marginata subsp. marginata	1500	20
	Burchardia congesta		
	Lechenaultia biloba		
	Scaevola canescens		

Note: * depicts an introduced (weed) species

Site: 11	**Location:** 116.02073 -32.01122	**Date:** 03-10-2019
Type: Quadrat	Size: 10x10	Community: EmPcAh
Topography: slopes	Soils: sandy loam gravel	Colour:
Bare Ground: 30% litter	Fire: 10+	
Vegetation significance: WA TEC C. calophylla-E. marginata woodlands on sandy clay soils		
Condition: very good		

*	Taxon	Height cm	Foliage %
	Acacia lasiocarpa var. lasiocarpa	20	0.1
	Babingtonia camphorosmae	15	0.1
	Burchardia congesta	30	0.1
	Chamaescilla corymbosa var. corymbosa	1	0.1
	Drosera porrecta	15	0.1
	Haemodorum laxum	60	0.1
	Isotropis cuneifolia subsp. cuneifolia	10	0.1
	Lomandra hermaphrodita	10	0.1
	Lomandra micrantha	15	0.1

*	Taxon	Height cm	Foliage %
	Lomandra preissii	20	0.1
	Thelymitra graminea	30	0.1
	Thysanotus patersonii		0.1
	Xanthosia huegelii	15	0.1
Pl	*Acacia sp.*	50	0.2
*	*Chamaecytisus palmensis*	50	0.2
	Dampiera linearis	15	0.2
	Lechenaultia biloba	20	0.2
	Tetrarrhena laevis	20	0.2
	Labichea punctata	20	0.3
	Stylidium piliferum	10	0.3
	Acacia pulchella var. pulchella	40	0.5
	Gompholobium knightianum	15	0.5
	Hovea trisperma	20	0.5
	Lomandra caespitosa	20	0.5
*	*Lysimachia arvensis*	2	0.5
	Tetraria octandra	30	0.5
	Xanthosia candida	5	0.5
	Desmocladus fasciculatus	10	1
	Drosera erythrorhiza	1	1
	Hakea lissocarpha	30	1
	Hibbertia hypericoides	30	1
	Lepidosperma leptostachyum	40	1
	Lomandra sonderi	20	1
	Tetraria octandra	20	2
*	*Briza maxima*	20	3
	Xanthorrhoea gracilis	70	3
	Agrostocrinum hirsutum	40	4
*	*Ehrharta calycina*	80	5
	Corymbia calophylla	2000	8
	Phyllanthus calycinus	30	12
	Eucalyptus marginata subsp. marginata	1800	25

Note: * depicts an introduced (weed) species

Site: 12	**Location:** 116.00606 -32.01366	**Date:** 03-10-2019
Type: Releve	Size:	Community: BmXpEc
Topography: flat	Soils: sandy loam	Colour:
Bare Ground: 80% litter	Fire: 10+	
Vegetation significance: EPBC TEC Banksia Woodlands of the SCP		
Condition: degraded		

*	Taxon	Height cm	Foliage %
	Calectasia narragara	20	0.1
	Eremaea pauciflora var. pauciflora	20	0.1
*	*Gladiolus caryophyllaceus*	100	0.1
	Gompholobium knightianum	20	0.1
	Hovea trisperma	10	0.1
	Hibbertia hypericoides	20	0.2
	Lambertia multiflora var. darlingensis	80	0.2
	Lomandra sonderi	20	0.2

*	Taxon	Height cm	Foliage %
	Anigozanthos manglesii subsp. manglesii	100	1
	Isopogon drummondii	60	1
	Xanthorrhoea gracilis	80	1
	Xanthorrhoea preissii	120	3
	Banksia attenuata	500	8
	Banksia menziesii	500	10
Pl	*Eucalyptus sp.*	1800	10
	Allocasuarina fraseriana	500	15
*	*Ehrharta calycina*	80	20

Note: * depicts an introduced (weed) species

Site: 13	**Location:** 116.00524 -32.01307	**Date:** 03-10-2019
Type: Quadrat	Size: 10x10	Community: BaEpPf
Topography: flat	Soils: grey sand	Colour:
Bare Ground: 20% litter	Fire: 10+	
Vegetation significance: EPBC TEC Banksia Woodlands of the SCP; WA TEC eastern B. attenuata and/or E. marginata woodlands		
Condition: excellent		

*	Taxon	Height cm	Foliage %
	?Lobelia anceps	20	0.1
	Burchardia congesta	40	0.1
	Conostylis aurea	10	0.1
	Conostylis setigera	15	0.1
	Drosera porrecta	15	0.1
*	*Gladiolus caryophyllaceus*	60	0.1
	Gompholobium confertum	20	0.1
	Haemodorum laxum	100	0.1

*	Taxon	Height cm	Foliage %
*	*Hypochaeris glabra*	1	0.1
	Monotaxis grandiflora var. grandiflora	20	0.1
	Pericalymma ellipticum	40	0.1
	Petrophile linearis	30	0.1
	Tetraria octandra	30	0.1
	Trachymene pilosa	2	0.1
	Tricoryne elatior	30	0.1
	Agrostocrinum hirsutum	50	0.2
	Dampiera linearis	20	0.2
	Desmocladus fasciculatus	10	0.2
	Hovea trisperma	20	0.2
	Patersonia occidentalis	30	0.2
	Tetrarrhena laevis	30	0.2
*	*Ursinia anthemoides*	10	0.2
	Bossiaea eriocarpa	30	0.5
*	*Briza maxima*	30	0.5
	Conospermum undulatum	130	0.5
	Drosera erythrorhiza	1	0.5
	Lomandra sonderi	30	0.5
	Stirlingia latifolia	40	0.5
	Acanthocarpus preissii	40	1
	Lomandra drummondii	30	1
	Philotheca spicata	60	1
	Schoenus pedicellatus	50	1
	Banksia dallanneyi	10	2
	Melaleuca trichophylla	50	2
	Banksia attenuata	300	3
	Lepidosperma leptostachyum	50	3
	Lomandra micrantha	20	3
	Petrophile macrostachya	80	3
	Xanthorrhoea preissii	100	3
	Isopogon drummondii	60	6
	Hibbertia hypericoides	40	8
	Eremaea pauciflora var. pauciflora	50	12
	Banksia menziesii	600	15
	Mesomelaena pseudostygia	40	15
	Eucalyptus todtiana		

*	Taxon	Height cm	Foliage %
	Adenanthos cygnorum subsp. cygnorum		
	Caladenia flava		
	Daviesia nudiflora subsp. nudiflora		
*	*Eragrostis curvula*		
	Hakea prostrata		
	Hemiphora bartlingii		
	Hybanthus calycinus		
	Jacksonia lehmannii		
	Lysinema pentapetalum		
	Petrophile seminuda		
	Scaevola repens var. repens		
	Thelymitra graminea		

Note: * depicts an introduced (weed) species

Site: 14	**Location:** 116.01633 -32.00499	**Date:** 04-10-2019
Type: Releve	Size:	Community: BmXpEc
Topography: flat	Soils: sand loam	Colour:
Bare Ground: 60% litter	Fire: 10+	
Vegetation significance: None		
Condition: degraded to good		

*	Taxon	Height cm	Foliage %
	Bossiaea eriocarpa	30	0.1
	Daviesia nudiflora subsp. nudiflora	30	0.1
	Gompholobium knightianum	20	0.1
	Labichea punctata	20	0.1
	Scaevola repens var. repens	5	0.1
	Stirlingia latifolia	40	0.1
	Hypocalymma robustum	80	0.2
	Eremaea pauciflora var. pauciflora	60	0.5
	Chamelaucium uncinatum	200	1

*	Taxon	Height cm	Foliage %
	Dasypogon bromeliifolius	20	1
	Mesomelaena pseudostygia	40	1
	Mesomelaena tetragona	40	1
	Xanthorrhoea preissii	100	1
	Banksia menziesii	200	2
*	*Lotus angustissimus*	5	2
	Eucalyptus gomphocephala	1600	5
*	*Ursinia anthemoides*	10	5
Pl	*Eucalyptus sp.*	1800	15
*	*Ehrharta calycina*	80	20
	Banksia sessilis var. sessilis	200	
	Daviesia divaricata subsp. divaricata	80	
	Lomandra hermaphrodita	15	
	Acacia alata var. alata	15	
	Acacia lasiocarpa var. lasiocarpa		
	Babingtonia camphorosmae		
*	*Briza maxima*	10	
	Grevillea bipinnatifida subsp. bipinnatifida	40	
	Hovea pungens	50	
	Lomandra preissii	30	
	Phlebocarya filifolia	20	
	Synaphea spinulosa subsp. spinulosa	20	

Note: * depicts an introduced (weed) species

Site: 15	**Location:** 116.02106 -32.00571	**Date:** 04-10-2019
Type: Quadrat	Size: 10x10	Community: EmCaFa
Topography: lower slope	Soils: sandy loam	Colour:
Bare Ground: 20% litter	Fire: 10+	
Vegetation significance: None		
Condition: very good horse grazing, weeds		

*	Taxon	Height cm	Foliage %
*	*Briza minor*	10	0.1
	Eremaea pauciflora var. pauciflora	1	0.1
*	*Gladiolus caryophyllaceus*	80	0.1
	Haemodorum sp.	20	0.1
*	*Hypochaeris glabra*	1	0.1
*	*Lysimachia arvensis*	5	0.1
*	*Romulea rosea*	10	0.1
	Stylidium brunonianum	15	0.1
	Tricoryne elatior	15	0.1

*	Taxon	Height cm	Foliage %
	Tripterococcus brunonis	10	0.1
	Xanthosia candida	5	0.1
	Anigozanthos manglesii subsp. manglesii	50	0.2
	Haemodorum laxum	110	0.2
	Bossiaea eriocarpa	30	0.3
*	*Briza maxima*	15	0.5
	Daviesia divaricata subsp. divaricata	50	0.5
*	*Ehrharta calycina*	100	1
	Hibbertia hypericoides	30	1
	Jacksonia furcellata	100	1
	Lomandra preissii	30	1
	Neurachne alopecuroidea	10	1
	Hakea undulata	200	1.5
	Xanthorrhoea preissii	130	2
	Labichea punctata	30	4
*	*Freesia alba x leichtlinii*	5	5
	Mesomelaena tetragona	40	5
	Phyllanthus calycinus	30	5
	Allocasuarina fraseriana	500	8
	Eucalyptus marginata subsp. marginata	700	10
*	*Eragrostis curvula*	100	opp
	Grevillea bipinnatifida subsp. bipinnatifida	40	
	Acacia lasiocarpa var. lasiocarpa		
	Bossiaea aquifolium		
	Desmocladus fasciculatus		
	Hypocalymma robustum		
	Jacksonia floribunda		
	Lechenaultia biloba		

Note: * depicts an introduced (weed) species

Site: 16	**Location:** 116.02074 -32.00544	**Date:** 04-10-2019
Type: Releve	Size:	Community: EmCaFa
Topography: sloped	Soils: loam	Colour:
Bare Ground: 70% litter	Fire: 10+	
Vegetation significance: None		
Condition: degraded		

*	Taxon	Height cm	Foliage %
	Mesomelaena pseudostygia	40	0.1
	Stylidium brunonianum	15	0.1
	Agrostocrinum hirsutum	30	0.5
	Lepidosperma tenue	30	0.5
	Daviesia decurrens subsp. decurrens	50	1
*	*Eragrostis curvula*	120	2
Pl	*Eucalyptus sp.*	800	2
	Allocasuarina fraseriana	500	3

*	Taxon	Height cm	Foliage %
	Neurachne alopecuroidea	15	5
	Eucalyptus marginata subsp. marginata	1500	15
*	*Freesia alba x leichtlinii*	5	15

Note: * depicts an introduced (weed) species

Site: 17	**Location:** 116.02133 -32.00513	**Date:** 04-10-2019
Type: Releve	Size:	Community: EmCaFa
Topography:	Soils: gravely loam. Gravel on surface	Colour:
Bare Ground:	Fire:	
Vegetation significance: None		
Condition:		

*	Taxon	Height cm	Foliage %
	Agrostocrinum hirsutum		
	Banksia armata var. armata		
	Bossiaea aquifolium		
	Hakea trifurcata		
	Lechenaultia biloba		
	Xanthorrhoea preissii		

Note: * depicts an introduced (weed) species

Site: 18	**Location:** 116.02119 -32.00715	**Date:** 04-10-2019
Type: Quadrat	Size: 10x10	Community: BmXpEc
Topography: lower slope	Soils: loamy	Colour:
Bare Ground: 8% litter, 5% bare	Fire: 10+	
Vegetation significance: EPBC TEC Banksia Woodlands of the SCP		
Condition: excellent		

*	Taxon	Height cm	Foliage %
	Burchardia congesta	30	0.1
	Chamaescilla corymbosa var. corymbosa	10	0.1
	Drosera porrecta	10	0.1
*	*Gladiolus caryophyllaceus*	60	0.1
	Stylidium brunonianum	10	0.1
	Trachymene pilosa	5	0.1
	Daviesia divaricata subsp. divaricata	120	0.5
*	*Ehrharta calycina*	80	0.5
	Haemodorum sp.	20	0.5

*	Taxon	Height cm	Foliage %
	Hypocalymma robustum	50	0.5
	Lomandra sonderi	20	0.5
*	*Ursinia anthemoides*	15	0.5
Pl	*Acacia sp.*	200	1
	Bossiaea eriocarpa	20	1
*	*Briza maxima*	20	1
	Dasypogon bromeliifolius	30	1
	Hakea ruscifolia	180	1
*	*Hypochaeris glabra*	1	1
	Lepidosperma tenue	20	1
	Lomandra caespitosa	20	1
	Synaphea spinulosa subsp. spinulosa	30	1
	Tetraria octandra	30	1
	Tricoryne elatior	30	1
	Podolepis gracilis	10	1.5
	Anigozanthos manglesii subsp. manglesii	50	2
	Desmocladus fasciculatus	10	2
	Stirlingia latifolia	50	3
	Xanthorrhoea preissii	100	5
	Hibbertia hypericoides	30	6
	Mesomelaena pseudostygia	30	6
	Labichea punctata	20	7
	Banksia menziesii	400	8
	Eremaea pauciflora var. pauciflora	40	12
	Babingtonia camphorosmae		
	Caesia micrantha		
	Dampiera linearis		
	Eucalyptus marginata subsp. marginata		
	Hakea trifurcata		
	Hakea undulata		
	Jacksonia floribunda		
	Opercularia vaginata		

Note: * depicts an introduced (weed) species

Site: 19	**Location:** 116.02058 -32.00685	**Date:** 04-10-2019
Type: Quadrat	Size: 10x10	Community: BmXpEc
Topography: lower slope	Soils: sandy loam	Colour:
Bare Ground: 5% litter, 7% bare	Fire: 10+	
Vegetation significance: EPBC TEC Banksia Woodlands of the SCP; WA TEC eastern B. attenuata and/or E. marginata woodlands		
Condition: excellent to very go		

*	Taxon	Height cm	Foliage %
	Anigozanthos manglesii subsp. manglesii	20	0.1
	Caesia micrantha	40	0.1
	Conostephium preissii	20	0.1
	Drosera porrecta	15	0.1
	Haemodorum laxum	150	0.1
	Hybanthus calycinus	20	0.1
	Stylidium brunonianum	10	0.1
	Stylidium schoenoides	20	0.1
	Babingtonia camphorosmae	20	0.2

*	Taxon	Height cm	Foliage %
	Bossiaea eriocarpa	30	0.2
	Conostylis setigera subsp. setigera	10	0.2
*	*Gladiolus caryophyllaceus*	80	0.2
	Lomandra hermaphrodita	10	0.2
*	*Oxalis pes-caprae*	20	0.2
	Philotheca spicata	30	0.2
*	*Arctotheca calendula*	5	0.5
	Desmocladus fasciculatus	10	0.5
	Haemodorum sp.	20	0.5
	Hypocalymma robustum	50	0.5
	Lepidosperma tenue	30	0.5
	Lomandra preissii	20	0.5
	Podolepis gracilis	10	0.5
	Tricoryne elatior	30	0.5
*	*Briza maxima*	20	1
	Dasypogon bromeliifolius	30	1
*	*Ehrharta calycina*	80	1
	Grevillea bipinnatifida subsp. bipinnatifida	40	1
*	*Hypochaeris glabra*	5	1
	Labichea punctata	20	1
	Lambertia multiflora var. darlingensis	150	1
	Lomandra caespitosa	20	1
	Schoenus pedicellatus	30	1
	Trachymene pilosa	5	1
	Synaphea spinulosa subsp. spinulosa	40	1.5
	Allocasuarina fraseriana	400	2
	Tetraria octandra	30	2
	Xanthorrhoea acanthostachya	50	2
	Banksia menziesii	600	3
	Daviesia nudiflora subsp. nudiflora	100	3
	Hibbertia hypericoides	50	4
	Eremaea pauciflora var. pauciflora	50	5
	Mesomelaena pseudostygia	30	5
	Xanthorrhoea preissii	100	5
	Jacksonia floribunda	60	6
	Stirlingia latifolia	80	7

Note: * depicts an introduced (weed) species

Site: 20	**Location:** 116.02006 -32.00628	**Date:** 04-10-2019
Type: Quadrat	Size: 10x10	Community: EmMpLp
Topography: lower slope	Soils: loam	Colour:
Bare Ground: 60% litter	Fire:	
Vegetation significance: Tentative WA TEC Banksia attenuata and/or Eucalyptus marginata woodlands of the eastern side of the Swan Coastal Plain (SCP20b)		
Condition: excellent		

*	Taxon	Height cm	Foliage %
	Acacia lasiocarpa var. lasiocarpa	40	0.1
	Bossiaea eriocarpa	10	0.1
	Burchardia congesta	50	0.1
	Conostephium preissii	30	0.1
*	*Gladiolus caryophyllaceus*	80	0.1
	Gonocarpus pithyoides	20	0.1
	Haemodorum laxum	120	0.1
	Melaleuca systena	50	0.1
	Thysanotus multiflorus	15	0.1

*	Taxon	Height cm	Foliage %
	Thysanotus patersonii		0.1
	Caesia micrantha	30	0.2
	Dampiera linearis	10	0.2
	Grevillea bipinnatifida subsp. bipinnatifida	30	0.2
	Acacia pulchella var. pulchella	120	0.5
Pl	*Acacia sp.*	200	0.5
	Allocasuarina humilis	50	0.5
	Banksia dallanneyi	10	0.5
	Desmocladus fasciculatus	10	0.5
*	*Ehrharta calycina*	80	0.5
*	*Freesia alba x leichtlinii*	10	0.5
	Haemodorum sp.	20	0.5
	Hypocalymma robustum	50	0.5
	Lechenaultia biloba	30	0.5
	Lomandra sonderi	20	0.5
*	*Lotus angustissimus*	5	0.5
	Stirlingia latifolia	40	0.5
	Synaphea spinulosa subsp. spinulosa	40	0.5
	Trachymene pilosa	5	0.5
*	*Briza maxima*	30	1
	Eucalyptus marginata subsp. marginata	600	1
	Hibbertia hypericoides	50	1
	Jacksonia furcellata	200	1
	Labichea punctata	30	1
	Xanthorrhoea preissii	100	1
*	*Hypochaeris glabra*	1	2
	Lepidosperma tenue	20	2
	Tetraria octandra	20	3
	Dasypogon bromeliifolius	30	4
	Eremaea pauciflora var. pauciflora	40	5
	Lepidosperma leptostachyum	40	5
	Allocasuarina fraseriana	800	8
	Mesomelaena pseudostygia	40	10
	Hakea trifurcata		
	Isopogon dubius		

Note: * depicts an introduced (weed) species

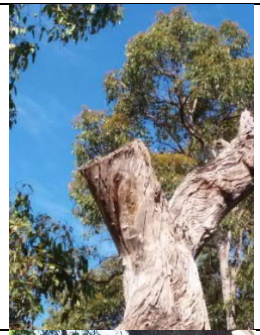
Site: 21	**Location:** 116.01963 -32.01613	**Date:** 18-11-2019
Type: Quadrat	Size: 10x10	Community:
Topography: lower slope	Soils: grey sand over gravel	Colour:
Bare Ground: 0% bare, 35% leaf	Fire: 10+	
Vegetation significance:		
Condition: very partial clearing, weeds		

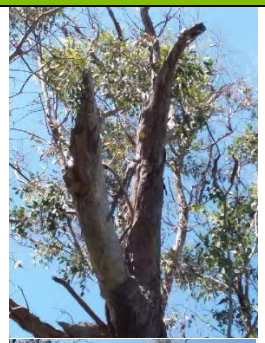
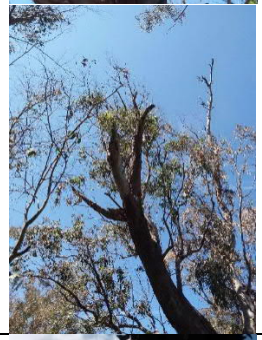
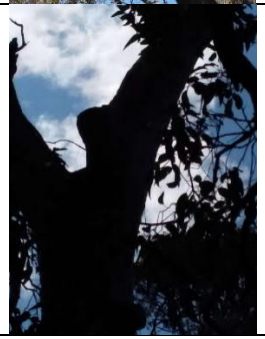
Note: * depicts an introduced (weed) species

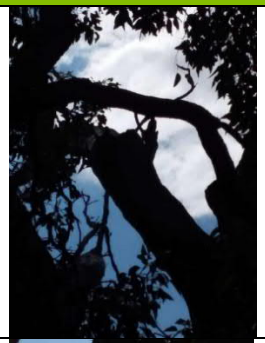
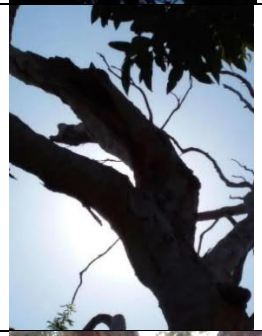
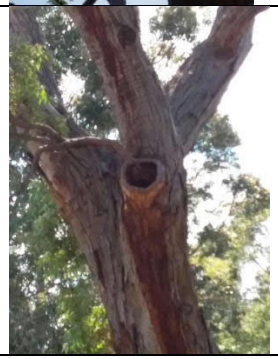
Appendix E

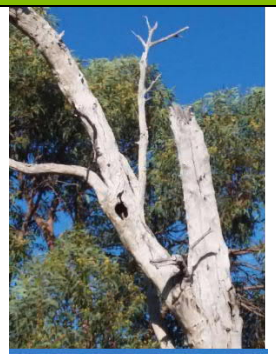
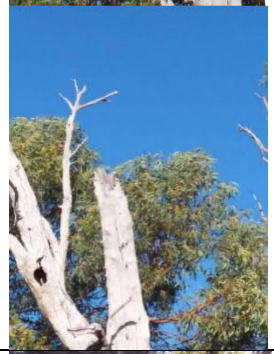
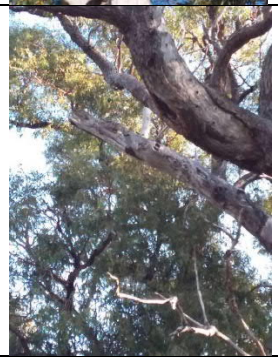
Black Cockatoo Breeding Tree Data

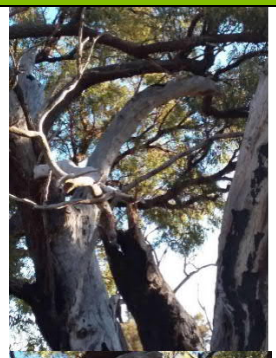
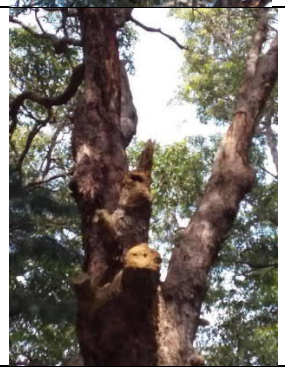
Appendix E Breeding Trees with Hollows

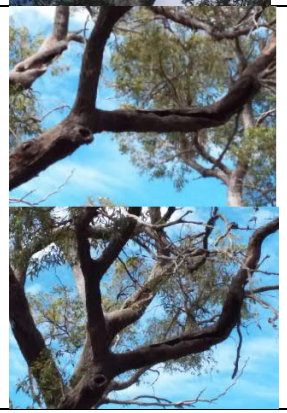
ID	Species	Ht (m)	DBH (cm)	No. Potentially Suitable Hollows	Hollow comments	Hollow Photos
173	Jarrah	14	90	1	East facing spout hollow on branch, vertical, 40x40 cm entrance, 10 m above ground, assumed deep enough floor space, no evidence of use	n/a
181	Jarrah	13	58	1	East facing hollow, 20x20 cm entrance, at 45 degrees, 5 m above ground on trunk, unable to assess depth and chamber size. Possible recent evidence of use	n/a
214	Stag	4	75	1	Hollow 5 m above ground, facing north on branch, at 45 degrees, 20x20 cm entrance, currently utilised by bees	
233	Marri	25	200	1	West facing branch hollow, 3 m above ground, 20x20 cm entrance, at 45 degrees, recent evidence of use.	

ID	Species	Ht (m)	DBH (cm)	No. Potentially Suitable Hollows	Hollow comments	Hollow Photos
270	Flooded Gum	15	90	2	Hollow 1: West facing on branch at 45 degrees, 8 m above ground, 15x15 cm entrance, no evidence of use Hollow 2: West facing on branch at 45 degrees, 8 m above ground, 10x15 cm entrance, no evidence of use	 
275	Stag	18	110	2	Hollow 1: South-west facing hollow on branch, vertical, 8 m above ground, 15x15 cm entrance, unable to assess depth, old evidence of use Hollow 2: South facing hollow on branch, at 45 degrees, 9 m above ground, 20x20 cm entrance, unable to assess depth, recent evidence of use	

ID	Species	Ht (m)	DBH (cm)	No. Potentially Suitable Hollows	Hollow comments	Hollow Photos
						
294	Jarrah	20	150	2	Hollow 1: South facing hollow, 10 m above ground on branch, at 45 degrees, 15x20 cm entrance, unable to assess depth, no evidence of use, currently occupied by bees Hollow 2: North-west facing hollow, 8 m above ground on branch, vertical, 10x10 cm entrance, unable to assess depth, no evidence of use, currently occupied by bees	
295	Jarrah	18	150	1	South-west facing hollow, on trunk, vertical, 20x20 cm entrance, 5 m above ground, unable to assess depth, no evidence of use, currently occupied by bees	

ID	Species	Ht (m)	DBH (cm)	No. Potentially Suitable Hollows	Hollow comments	Hollow Photos
357	Stag	12	60	2	Hollow 1: 15x20 cm entrance, west facing hollow, vertical on trunk, 6 m above ground, unable to assess depth, no evidence of use Hollow 2: 30x30 cm entrance, facing upward/vertical on spout, 7 m above ground	 
372	Jarrah	14	120	3	Hollow 1: East facing branch hollow, 8 m above ground, 10x40 cm entrance, unable to assess depth and floor space, tree utilised by Lorikeets Hollow 2: West facing branch hollow, 6 m above ground, 15x50 cm entrance, at 45 degrees, unable to assess chamber size Hollow 3: South facing branch hollow 7 m above ground, 15x20 cm entrance, at 45 degrees, hard to assess chamber from ground	

ID	Species	Ht (m)	DBH (cm)	No. Potentially Suitable Hollows	Hollow comments	Hollow Photos
						 
522	Marri	30	100	1	North-west facing hollow, 8 m above ground, 15x15 cm entrance, 45 degrees, on branch, recent evidence of use, Kookaburra observed on branch	
615	Jarrah	15	80	2	Hollow 1: Vertical hollow on spout, 13 m above ground, 30x30 cm entrance,	

ID	Species	Ht (m)	DBH (cm)	No. Potentially Suitable Hollows	Hollow comments	Hollow Photos
					unable to assess depth, no evidence of use Hollow 2: South-west facing trunk hollow, 10 m above ground, 20x20 cm entrance, horizontal angle, unable to assess depth	
653	Stag	16	150	5	Tree has 5 branch and spout hollows. All hollows are above 8 m and have openings greater than 10x10 cm. Unable to assess chamber sizes.	
753	Jarrah	20	90	2	Hollow 1: West facing branch hollow, 11 m above ground, 50x10 cm entrance at 45 degrees, unable to assess chamber size, hollow occupied by pink and grey galahs Hollow 2: North-west facing branch hollow 10 m above ground, 10x100 cm entrance at 45 degrees, old evidence of use, currently occupied by bees	

Appendix F

Black Cockatoo Foraging Habitat Assessments

Appendix F Black Cockatoo Breeding Tree Data

ID	Species	Coordinates		Tree Height (m)	DBH (cm)	DBH Comments	No. of Potentially Suitable Hollows	Hollow Comments
6	Marri	116.0173	-32.0139	20	65		0	
7	Jarrah	116.019	-32.0126	14	65		0	
10	Marri	116.0224	-32.0065	18	70		0	
11	Marri	116.0192	-32.0093	16	58		0	
12	Marri	116.0184	-32.0099	18	55		0	
13	Marri	116.0184	-32.0099	18	65		0	
14	Marri	116.0182	-32.01	16	54		0	
15	Marri	116.0182	-32.0101	18	60		0	
16	Marri	116.018	-32.0102	18	60		0	
17	Marri	116.0177	-32.0105	14	60		0	
18	Marri	116.0224	-32.0129	14	65		0	
19	Stag	116.0222	-32.0129	12	80		0	
20	Marri	116.0216	-32.013	12	62		0	
21	Stag	116.0208	-32.0129	15	90		0	
22	Marri	116.0207	-32.0128	18	64		0	
23	Marri	116.0207	-32.0128	18	85		0	
24	Marri	116.0216	-32.012	18	90		0	
25	Marri	116.0202	-32.0127	20	54		0	
26	Marri	116.0201	-32.0127	17	80		0	
27	Marri	116.02	-32.0127	18	51		0	
28	Marri	116.02	-32.0127	17	55		0	
29	Marri	116.0199	-32.0127	15	85	DBH measured below fork	0	
30	Jarrah	116.0198	-32.0127	16	54		0	
31	Marri	116.0197	-32.0126	10	52		0	
32	Marri	116.0197	-32.0126	20	110		0	
33	Marri	116.0195	-32.0126	15	51		0	
34	Marri	116.0189	-32.0125	13	51		0	
35	Marri	116.0185	-32.0124	12	80		0	
36	Marri	116.0183	-32.0122	17	150	DBH measured below fork	0	
37	Marri	116.0181	-32.0122	15	85		0	
38	Marri	116.018	-32.0122	17	90		0	
39	Marri	116.0179	-32.0122	16	85		0	
40	Marri	116.0176	-32.0122	18	70		0	
41	Marri	116.0175	-32.0122	12	63		0	
42	Marri	116.0175	-32.0122	14	63		0	
43	Marri	116.0174	-32.0122	14	70		0	
44	other	116.017	-32.0121	18	150		0	
45	Jarrah	116.017	-32.0121	13	60		0	
46	Flooded Gum	116.0018	-32.0198	8	59	Tree is regularly trimmed	0	
47	Introduced	116.0017	-32.02	20	90		0	
48	Introduced	116.0016	-32.02	16	52		0	
49	E. todtiana	116.0055	-32.0166	8	55		0	
50	Jarrah	116.0085	-32.0142	15	100		0	
51	Jarrah	116.0083	-32.0144	17	60		0	
52	Jarrah	116.0088	-32.014	16	60	Largest trunk measured of the two. Fork below DBH	0	
53	Tuart	116.0098	-32.0146	16	59	DBH measured above fork	0	
54	Tuart	116.0099	-32.0148	18	150		0	
55	Tuart	116.0098	-32.0147	14	80	DBH measured below fork	0	
56	Tuart	116.0099	-32.0148	16	50		0	
57	Tuart	116.0099	-32.0148	18	52		0	
58	Tuart	116.0098	-32.0148	15	51		0	
59	Jarrah	116.0093	-32.0135	12	61		0	
60	Jarrah	116.0111	-32.0109	10	110		0	
61	Jarrah	116.0104	-32.0108	12	110		0	
62	Jarrah	116.0082	-32.0103	20	90		0	
63	Jarrah	116.0104	-32.0108	10	54	DBH measured above fork	0	
64	Marri	116.0097	-32.0106	12	53		0	
65	Jarrah	116.0098	-32.0105	14	58		0	
66	Marri	116.0045	-32.0096	16	54		0	
67	Marri	116.0095	-32.0106	20	200	Possible roost tree. Some broken branches at base, no scat	0	
68	Marri	116.0094	-32.0106	18	55		0	
69	Marri	116.0093	-32.0106	12	52		0	
70	Marri	116.0093	-32.0106	15	54		0	
71	Marri	116.0023	-32.0093	18	70		0	
72	Marri	116.0092	-32.0106	17	52		0	
73	Marri	116.0091	-32.0105	20	75		0	
74	Marri	116.0021	-32.0092	25	53		0	
75	Jarrah	116.0085	-32.0104	12	75		0	
76	Marri	116.0088	-32.004	18	120		0	
77	Marri	116.0091	-32.004	14	59		0	
78	Introduced	116.0027	-32.0086	15	80	Unidentified species, photos of fruit taken.	0	
79	Marri	116.0096	-32.0038	10	51		0	
80	Marri	116.0088	-32.0039	13	52		0	
81	Marri	116.0038	-32.0081	20	80		0	
82	Marri	116.0038	-32.008	20	56		0	

Appendix F Black Cockatoo Breeding Tree Data

ID	Species	Coordinates		Tree Height (m)	DBH (cm)	DBH Comments	No. of Potentially Suitable Hollows	Hollow Comments
83	Marri	116.009	-32.0037	14	65		0	
84	Marri	116.0039	-32.008	18	68		0	
85	Marri	116.009	-32.0037	14	110	DBH measured below fork	0	
86	Marri	116.0041	-32.0078	18	55		0	
87	Marri	116.0043	-32.0076	18	85		0	
88		116.0093	-32.0032	0	59	DBH taken below fork. Unlikely to provide hollows for some time	0	
89	Marri	116.0095	-32.0032	20	55		0	
90	Marri	116.0047	-32.0072	15	56		0	
91	Marri	116.0094	-32.0032	10	67		0	
92	Marri	116.005	-32.007	16	100	Two trunks, too close together to be measured separately	0	
93	Marri	116.0051	-32.007	17	59		0	
94	Jarrah	116.0088	-32.0034	18	65		0	
95	Marri	116.0051	-32.0069	20	70	Termite damage to trunk	0	
96	Marri	116.0052	-32.0068	22	80		0	
97	Marri	116.0053	-32.0067	16	59		0	
98	Marri	116.0054	-32.0067	20	60		0	
99	Marri	116.0055	-32.0066	17	65		0	
100	Marri	116.0086	-32.0037	18	100		0	
101	Marri	116.0063	-32.0058	18	60		0	
102	Marri	116.0085	-32.0036	18	150			
103	Marri	116.0064	-32.0058	16	59		0	
104	Marri	116.0065	-32.0057	14	53		0	
105	Marri	116.0083	-32.004	15	70		0	
106	Marri	116.0066	-32.0056	14	55		0	
107	Marri	116.0077	-32.0043	18	51		0	
108	Marri	116.0068	-32.0054	20	80		0	
109	Marri	116.0069	-32.0054	22	120		0	
110	Marri	116.007	-32.0052	16	62		0	
111	Marri	116.024	-32.0073	22	53		0	
112	Marri	116.0231	-32.0078	20	58		0	
113	Marri	116.0238	-32.0074	24	55		0	
114	Marri	116.0232	-32.0078	22	130		0	
115	Marri	116.0238	-32.0074	25	51		0	
116	Marri	116.0232	-32.0077	18	55		0	
117	Marri	116.0232	-32.0078	18	52		0	
118	Introduced	116.0015	-32.0201	12	52		0	
119	Marri	116.0053	-32.0088	14	65	Approx.	0	
120	Marri	116.0059	-32.0084	16	65	Approx.	0	
121		116.0064	-32.0103	0	0	Poss. breeding trees		
122	Marri	116.006	-32.0084	12	60		0	
123		116.0016	-32.0089	0	0	Native eucs		
124		116.0057	-32.0066	0	0	Possible breeding trees		
125		116.0024	-32.0094	0	0	Group of marri tree, unable to access		
126	Marri	116.0053	-32.0095	15	68		0	
127	Marri	116.0052	-32.0095	15	65		0	
128	Marri	116.0052	-32.0094	15	65		0	
129	Marri	116.0053	-32.0094	18	62		0	
130	Marri	116.0054	-32.0094	20	66		0	
131	Marri	116.0054	-32.0094	18	70		0	
132	Marri	116.0055	-32.0094	18	56		0	
133	Marri	116.0055	-32.0094	18	56		0	
134	Marri	116.0055	-32.0092	15	56		0	
135	Flooded Gum	116.0111	-32.0065	18	60		0	
136	Flooded Gum	116.0111	-32.0065	25	100	Approx.	0	
137	Jarrah	116.0165	-32.0146	20	54		0	
138	Jarrah	116.0167	-32.0135	15	80		0	
139	Marri	116.0168	-32.0138	15	53		0	
140	Jarrah	116.0169	-32.0141	10	63		0	
141	Jarrah	116.0161	-32.0142	18	51		0	
142	Marri	116.0055	-32.0097	25	60		0	
143	Marri	116.0055	-32.0096	18	75		0	
144	Marri	116.0054	-32.0096	20	60		0	
145	Marri	116.0062	-32.0086	22	70		0	
146	Marri	116.0066	-32.0088	20	58		0	
147	Marri	116.0066	-32.0086	15	54		0	
148	Marri	116.0068	-32.0086	15	53		0	
149	Marri	116.0067	-32.0085	18	76		0	
150	Marri	116.0069	-32.0084	16	55		0	
151	Marri	116.007	-32.0082	14	57		0	
152	Marri	116.0053	-32.009	20	70		0	
153	Flooded Gum	116.0113	-32.0064	16	75		0	

Appendix F Black Cockatoo Breeding Tree Data

ID	Species	Coordinates		Tree Height (m)	DBH (cm)	DBH Comments	No. of Potentially Suitable Hollows	Hollow Comments
154	Flooded Gum	116.0111	-32.0061	18	90	Approx.	0	
155	Flooded Gum	116.0108	-32.0057	16	70	Approx.	0	
156	Marri	116.0107	-32.0057	18	5	Approx.	0	
157	Flooded Gum	116.0105	-32.0057	10	78	Approx.	0	
160	Flooded Gum	116.0105	-32.0059	8	52		0	
161	Flooded Gum	116.0103	-32.0059	18	150	Approx.	0	
162	Marri	116.0132	-32.0069	12	56		0	
163	Flooded Gum	116.0123	-32.0068	18	55		0	
164	Tuart	116.0121	-32.0064	22	68		0	
165	Tuart	116.0109	-32.0057	16	60		0	
166	Marri	116.0109	-32.0054	18	65		0	
167	Marri	116.011	-32.0053	16	56		0	
168	Marri	116.0113	-32.0051	16	52		0	
169	Marri	116.0114	-32.005	18	63		0	
170	Jarrah	116.0118	-32.005	14	82	DBH measured below branches	0	
171	Jarrah	116.012	-32.0049	18	52		0	
172	Jarrah	116.0123	-32.0049	15	51		0	
173	Jarrah	116.0124	-32.005	14	90	Approx.	1	East facing spout hollow on branch, vertical, 40x40 cm entrance, 10 m above ground, assumed deep enough floor space, no evidence of use
174	Marri	116.0127	-32.0055	20	60		0	
175	Jarrah	116.0127	-32.0055	20	75		0	
176	Marri	116.0126	-32.0055	16	58		0	
177	Marri	116.0126	-32.0055	20	75		0	
178	Marri	116.0125	-32.0054	20	65		0	
179	Jarrah	116.0124	-32.0054	20	60		0	
180	Marri	116.0088	-32.0089	20	60		0	
181	Jarrah	116.0089	-32.0089	13	58		1	East facing hollow, 20x20 cm entrance, at 45 degrees, 5 m above ground on trunk, unable to assess depth and chamber size. Possible recent evidence of use
182	Marri	116.009	-32.0089	18	70		0	
183	Jarrah	116.009	-32.0089	20	70		0	
184	Jarrah	116.0091	-32.0088	20	65		0	
185	Marri	116.0093	-32.0088	15	55		0	
186	Jarrah	116.0094	-32.0092	15	53		0	
187	Jarrah	116.0094	-32.0092	15	58		0	
188	Jarrah	116.0093	-32.0093	15	53		0	
189	Tuart	116.0091	-32.0096	30	65		0	
190	Jarrah	116.0086	-32.0092	18	58		0	
191	Marri	116.0086	-32.0092	15	52		0	
192	Marri	116.0086	-32.009	18	60		0	
193	Jarrah	116.01	-32.0088	14	80		0	
194	Marri	116.0102	-32.0085	12	52		0	
195	Marri	116.0102	-32.0086	20	66		0	
196	Marri	116.0102	-32.0085	20	54		0	
197	Marri	116.0102	-32.0085	20	60	Two trunks, similar size	0	
198	Marri	116.0104	-32.0085	20	65		0	
199	Marri	116.0104	-32.0084	16	51		0	
200	Marri	116.0105	-32.0084	18	51		0	
201	Marri	116.0105	-32.0084	16	55		0	
202	Marri	116.0102	-32.0084	17	55		0	
203	Marri	116.0101	-32.0078	16	56		0	
204	Marri	116.0113	-32.0077	15	54		0	
205	Marri	116.0113	-32.0075	18	70		0	
206	Marri	116.0112	-32.0076	12	76		0	
207	Marri	116.0109	-32.0074	15	52		0	
208	Marri	116.011	-32.0072	18	55	DBH measured above fork	0	
209	Marri	116.0109	-32.0072	16	52		0	
210	Marri	116.0109	-32.0073	17	140		0	
211	Marri	116.0108	-32.0072	18	55		0	
212	Marri	116.0107	-32.0075	16	52	Multiple trunks on tree	0	
213	Marri	116.0103	-32.0075	16	70		0	
214	Stag	116.0094	-32.0083	4	75		1	Hollow 5 m above ground, facing north on branch, at 45 degrees, 20x20 cm entrance, currently utilised by bees
215	Marri	116.0101	-32.0083	16	65		0	
216	Marri	116.0198	-32.0121	18	75		0	
217	Marri	116.0104	-32.0083	16	58		0	
218	Marri	116.0103	-32.0083	20	52		0	
219	Marri	116.0201	-32.013	20	55		0	
220	Marri	116.0101	-32.0081	20	130		0	
221	Marri	116.01	-32.0079	18	55		0	

Appendix F Black Cockatoo Breeding Tree Data

ID	Species	Coordinates		Tree Height (m)	DBH (cm)	DBH Comments	No. of Potentially Suitable Hollows	Hollow Comments
222	Marri	116.0096	-32.0082	14	50		0	
223	Marri	116.0098	-32.0082	16	60		0	
224	Marri	116.0086	-32.009	20	55		0	
225	Marri	116.0085	-32.0091	20	55		0	
226	Marri	116.0085	-32.0092	20	52		0	
227	Tuart	116.0088	-32.0093	22	55		0	
228	Tuart	116.009	-32.0096	25	55		0	
229	Jarrah	116.0093	-32.0092	18	55		0	
230	Jarrah	116.0092	-32.0092	20	60		0	
231	Jarrah	116.0093	-32.0091	20	75		0	
232	Marri	116.0092	-32.0088	20	60		0	
233	Marri	116.0092	-32.0087	25	200		1	West facing branch hollow, 3 m above ground, 20x20 cm entrance, at 45 degrees, recent evidence of use.
234	Marri	116.0091	-32.0086	18	55		0	
235	Marri	116.009	-32.0086	18	52		0	
236	Marri	116.009	-32.0087	20	65		0	
237	Marri	116.009	-32.009	20	55		0	
238	Marri	116.0118	-32.0057	18	130		0	
239	Marri	116.0117	-32.0054	15	52		0	
240	Jarrah	116.0119	-32.0053	14	100		0	
241	Marri	116.0118	-32.0053	20	55		0	
242	Marri	116.0119	-32.0052	12	70		0	
243	Jarrah	116.0121	-32.0052	15	55		0	
244	Jarrah	116.0123	-32.0053	16	55		0	
245	Jarrah	116.0123	-32.0053	20	90		0	
246	Marri	116.0125	-32.0053	20	70		0	
247	Jarrah	116.0124	-32.0051	22	52		0	
249	Marri	116.0116	-32.0048	10	52		0	
250	Marri	116.0115	-32.0048	20	70		0	
251	Marri	116.0116	-32.0048	18	50		0	
252	Marri	116.0115	-32.0048	18	50		0	
253	Marri	116.0115	-32.0049	18	90		0	
254	Marri	116.0114	-32.0049	18	55		0	
256	Marri	116.0112	-32.0053	18	120		0	
257	Marri	116.0112	-32.0056	22	110	DBH measured above fork	0	
258	Marri	116.0114	-32.0059	22	110		0	
259	Introduced	116.0118	-32.0065	18	55		0	
260	Flooded Gum	116.0126	-32.0073	14	52		0	
262	Marri	116.0129	-32.0068	20	140		0	
263	Flooded Gum	116.0109	-32.0061	20	60		0	
264	Flooded Gum	116.0105	-32.006	18	60		0	
265	Flooded Gum	116.0104	-32.0061	20	55		0	
266	Flooded Gum	116.0103	-32.0061	22	60		0	
267	Flooded Gum	116.0103	-32.0062	20	52		0	
268	Flooded Gum	116.0101	-32.0062	18	75		0	
270	Flooded Gum	116.0099	-32.0062	15	90		2	Hollow 1: West facing on branch at 45 degrees, 8 m above ground, 15x15 cm entrance, no evidence of use Hollow 2: West facing on branch at 45 degrees, 8 m above ground, 10x15 cm entrance, no evidence of use
271	Jarrah	116.0165	-32.0146	14	55		0	
272	Jarrah	116.0167	-32.0135	14	65		0	
273	Stag	116.0166	-32.0138	14	65		0	
274	Jarrah	116.0169	-32.0138	16	100		0	
275	Stag	116.0171	-32.0139	18	110		2	Hollow 1: South-west facing hollow on branch, vertical, 8 m above ground, 15x15 cm entrance, unable to assess depth, old evidence of use Hollow 2: South facing hollow on branch, at 45 degrees, 9 m above ground, 20x20 cm entrance, unable to assess depth, recent evidence of use
277	Jarrah	116.0157	-32.0141	14	50		0	
278	Jarrah	116.0157	-32.014	12	55		0	
279	Marri	116.0153	-32.0139	18	60		0	
280	Jarrah	116.0156	-32.0137	10	60		0	
281	Jarrah	116.0154	-32.0136	8	55		0	
283	Jarrah	116.0172	-32.0133	14	55		0	
284	Jarrah	116.015	-32.0139	12	50		0	
285	Jarrah	116.015	-32.0139	12	55		0	
286	Marri	116.0154	-32.0143	18	60		0	

Appendix F Black Cockatoo Breeding Tree Data

ID	Species	Coordinates		Tree Height (m)	DBH (cm)	DBH Comments	No. of Potentially Suitable Hollows	Hollow Comments
287	Jarrah	116.0156	-32.0145	20	75		0	
288	Marri	116.0157	-32.0145	18	60		0	
289	Jarrah	116.0163	-32.0145	16	50		0	
290	Jarrah	116.016	-32.0145	10	55		0	
291	Stag	116.0172	-32.0133	15	55		0	
292	Marri	116.0161	-32.0145	18	65		0	
293	Marri	116.0161	-32.0146	18	65		0	
294	Jarrah	116.0163	-32.0146	20	150		2	Hollow 1: South facing hollow, 10 m above ground on branch, at 45 degrees, 15x20 cm entrance, unable to assess depth, no evidence of use, currently occupied by bees Hollow 2: North-west facing hollow, 8 m above ground on branch, vertical, 10x10 cm entrance, unable to assess depth, no evidence of use, currently occupied by bees
295	Jarrah	116.0165	-32.0145	18	150		1	South-west facing hollow, on trunk, vertical, 20x20 cm entrance, 5 m above ground, unable to assess depth, no evidence of use, currently occupied by bees
297	Introduced	116.0062	-32.0088	18	300	Unsure of species, but appears introduced and hollow bearing	0	
298	Marri	116.0062	-32.0087	18	20		0	
299	Marri	116.0063	-32.0087	16	55		0	
300	Marri	116.0065	-32.0088	16	55		0	
301	Marri	116.0066	-32.0087	16	60		0	
302	Marri	116.0071	-32.0085	14	53		0	
303	Marri	116.0071	-32.0086	14	55		0	
304	Marri	116.0071	-32.0085	14	52		0	
305	Marri	116.0071	-32.0084	14	55		0	
306	Marri	116.0071	-32.0084	14	53		0	
307	Marri	116.0073	-32.0083	12	54		0	
308	Marri	116.0072	-32.0082	12	55		0	
309	Marri	116.0059	-32.0086	12	53		0	
310	Marri	116.0054	-32.009	12	52		0	
311	Marri	116.0052	-32.0094	16	55	DBH measured below fork	0	
312	Marri	116.0052	-32.0094	16	52			
313	Marri	116.0051	-32.0094	16	52		0	
314	Marri	116.0051	-32.0095	18	52		0	
315	Marri	116.005	-32.0095	16	60		0	
323	Jarrah	116.0076	-32.0102	15	60		0	
325	Marri	116.0044	-32.0051	20	82		0	
326	Marri	116.0044	-32.005	20	90		0	
327	Marri	116.0044	-32.0051	12	60		0	
328	Marri	116.0048	-32.0049	16	70		0	
329	Marri	116.005	-32.0046	16	90		0	
330	Marri	116.007	-32.0058	25	110		0	
331	Marri	116.007	-32.0058	18	70		0	
332	Marri	116.007	-32.0059	20	70		0	
333	Marri	116.0071	-32.0059	16	60		0	
334	Flooded Gum	116.0071	-32.0059	20	60		0	
335	Marri	116.0072	-32.006	20	55	Two main trunks	0	
336	Flooded Gum	116.0073	-32.0061	18	56		0	
337	Flooded Gum	116.0073	-32.0062	20	56		0	
338	Flooded Gum	116.0074	-32.0062	18	60		0	
339	Flooded Gum	116.0071	-32.0063	17	58		0	
340	Marri	116.0107	-32.0052	16	58		0	
341	Marri	116.0104	-32.0036	20	55		0	
342	Marri	116.0099	-32.0032	18	55		0	
343	Marri	116.01	-32.0034	20	90		0	
344	Tuart	116.0023	-32.0192	25	70		0	
345	Jarrah	116.007	-32.0145	12	51		0	
346	Jarrah	116.0069	-32.0145	16	52		0	
347	Jarrah	116.0059	-32.0141	15	55		0	
348	Jarrah	116.0116	-32.0157	15	60		0	
349	Marri	116.0117	-32.0156	17	70		0	
350	Jarrah	116.0116	-32.0154	20	56		0	
351	Tuart	116.0041	-32.0182	25	100		0	
352	E. todtiana	116.003	-32.0206	10	60		0	
353	E. todtiana	116.0029	-32.0205	12	60		0	
354	Jarrah	116.0024	-32.0207	15	55		0	
355	E. todtiana	116.0024	-32.0208	15	60		0	
356	E. todtiana	116.0023	-32.0208	15	55		0	

Appendix F Black Cockatoo Breeding Tree Data

ID	Species	Coordinates		Tree Height (m)	DBH (cm)	DBH Comments	No. of Potentially Suitable Hollows	Hollow Comments
357	Stag	116.0023	-32.0212	12	60		2	Hollow 1: 15x20 cm entrance, west facing hollow, vertical on trunk, 6 m above ground, unable to assess depth, no evidence of use Hollow 2: 30x30 cm entrance, facing upward/vertical on spout, 7 m above ground
358	E. todtiana	116.0024	-32.0213	14	65		0	
359	E. todtiana	116.0027	-32.021	15	60		0	
360	E. todtiana	116.0028	-32.021	18	100		0	
361	E. todtiana	116.0029	-32.021	14	55		0	
362	Jarrah	116.0038	-32.0222	18	80		0	
363	Marri	116.0038	-32.0223	20	70		0	
364	Marri	116.0037	-32.0225	20	80		0	
365	Jarrah	116.0033	-32.0224	20	55		0	
366	Marri	116.0033	-32.0225	20	70		0	
367	Marri	116.0033	-32.0226	18	70		0	
368	Jarrah	116.0032	-32.0223	15	65		0	
369	Jarrah	116.0033	-32.022	18	60		0	
370	E. todtiana	116.0025	-32.0202	10	80		0	
371	Jarrah	116.004	-32.0219	14	90		0	
372	Jarrah	116.0036	-32.0212	14	120	Tree split into two	3	Hollow 1: East facing branch hollow, 8 m above ground, 10x40 cm entrance, unable to assess depth and floor space, tree utilised by Lorikeets Hollow 2: West facing branch hollow, 6 m above ground, 15x50 cm entrance, at 45 degrees, unable to assess chamber size Hollow 3: South facing branch hollow 7 m above ground, 15x20 cm entrance, at 45 degrees, hard to assess chamber from ground
373	Jarrah	116.0036	-32.0213	14	55		0	
374	Jarrah	116.004	-32.0213	15	55		0	
375	Jarrah	116.0035	-32.021	16	65		0	
376	Jarrah	116.0037	-32.0211	18	110		0	
377	E. todtiana	116.0037	-32.0209	10	75		0	
378	E. todtiana	116.0039	-32.021	8	60		0	
379	E. todtiana	116.0033	-32.0207	8	70		0	
380	E. todtiana	116.0033	-32.0204	10	65		0	
381	Marri	116.0117	-32.0156	18	70		0	
382	Marri	116.0115	-32.0155	18	50		0	
383	Marri	116.0114	-32.0155	16	52		0	
384	Jarrah	116.0172	-32.0133	14	52		0	
385	Marri	116.0112	-32.0157	20	52		0	
386	Marri	116.011	-32.0158	20	65	Multiple trunks	0	
387	Jarrah	116.0108	-32.0156	17	52	Multiple trunks	0	
388	Jarrah	116.0106	-32.0153	8	70	Multiple trunks	0	
389	Jarrah	116.0106	-32.0153	10	60	Multiple trunks	0	
390	Marri	116.0108	-32.0154	16	55		0	
391	Marri	116.0109	-32.0154	20	70		0	
392	Marri	116.0109	-32.0154	20	54		0	
393	Marri	116.011	-32.0155	20	55		0	
394	Marri	116.011	-32.0155	20	60		0	
395	Marri	116.011	-32.0154	20	65		0	
396	Jarrah	116.0111	-32.0153	17	58		0	
397	Marri	116.0111	-32.0154	20	55		0	
398	Marri	116.0112	-32.0154	20	60		0	
399	Marri	116.0111	-32.0154	18	55		0	
400	Jarrah	116.0112	-32.0153	14	52		0	
401	Jarrah	116.011	-32.0153	15	52		0	
402	Jarrah	116.0109	-32.0152	15	55		0	
403	Jarrah	116.0111	-32.0151	15	60	DBH measured below fork	0	
405	Jarrah	116.0068	-32.0144	15	60		0	
406	Jarrah	116.0071	-32.0145	18	110		0	
407	Tuart	116.0006	-32.0175	10	60		0	
408	Tuart	116.0025	-32.019	22	110		0	
409	Tuart	116.0025	-32.019	22	60		0	
410	Tuart	116.002	-32.019	20	70		0	
411	Tuart	116.0013	-32.0186	18	60		0	
412	Tuart	116.0012	-32.0185	20	65	DBH measured above fork	0	
413	Tuart	116.0012	-32.0185	20	65		0	
414	Tuart	116.0011	-32.0185	20	100		0	
415	Tuart	116.0011	-32.0184	22	130		0	
416	Tuart	116.0011	-32.0184	16	120		0	
417	Tuart	116.001	-32.0184	16	65		0	
418	Tuart	116.001	-32.0184	14	60		0	
419	Tuart	116.001	-32.0183	12	120		0	
420	Tuart	116.001	-32.0183	22	65		0	
422	Tuart	116.0015	-32.0187	22	100		0	
423	Tuart	116.0016	-32.0187	22	90		0	

Appendix F Black Cockatoo Breeding Tree Data

ID	Species	Coordinates		Tree Height (m)	DBH (cm)	DBH Comments	No. of Potentially Suitable Hollows	Hollow Comments
424	Jarrah	116.0123	-32.0097	8	50		0	
425	Marri	116.0134	-32.0095	18	58		0	
426	Marri	116.0135	-32.0094	18	70		0	
427	Marri	116.0134	-32.0095	18	52		0	
428	Marri	116.0136	-32.0095	15	52		0	
433	Jarrah	116.0091	-32.018	10	70		0	
434	Jarrah	116.0092	-32.0179	10	80		0	
435	Jarrah	116.0085	-32.0185	13	60		0	
436	Jarrah	116.0085	-32.0184	13	60		0	
437	Jarrah	116.0085	-32.0185	12	55		0	
438	Jarrah	116.0084	-32.0184	14	65		0	
439	Jarrah	116.0083	-32.0184	12	55	Two trunks on tree	0	
440	Marri	116.0093	-32.0036	20	65		0	
441	Marri	116.0093	-32.0036	22	55		0	
442	Marri	116.0096	-32.0035	22	100	DBH measured below fork	0	
444	Marri	116.0114	-32.0048	15	80		0	
445	Flooded Gum	116.007	-32.0064	18	120		0	
450	Marri	116.0043	-32.0044	18	50		0	
451	Marri	116.0043	-32.0045	14	55		0	
452	Marri	116.004	-32.0047	17	60	DBH measured above fork	0	
453	Marri	116.004	-32.0048	17	60		0	
454	Marri	116.0043	-32.0049	14	60		0	
455	Tuart	116.0047	-32.0064	18	52		0	
456	Tuart	116.0048	-32.0064	22	60		0	
457	Marri	116.0041	-32.0052	15	55		0	
458	Marri	116.004	-32.005	18	80		0	
459	Marri	116.0039	-32.0051	15	52		0	
460	Marri	116.0038	-32.005	15	65		0	
461	Stag	116.0037	-32.0049	16	75		0	
462	Marri	116.0037	-32.0052	15	52		0	
463	Marri	116.0036	-32.0051	15	65		0	
464	Flooded Gum	116.0035	-32.0054	14	55		0	
465	Flooded Gum	116.0034	-32.0056	8	65	Tree cut down	0	
466	Tuart	115.999	-32.0083	20	120		0	
468	Marri	115.9989	-32.0083	18	65		0	
469	Marri	116.0133	-32.0091	16	52		0	
470	Marri	116.0045	-32.0044	18	100		0	
471	Jarrah	116.0048	-32.0097	15	58		0	
472	Marri	116.0083	-32.0077	18	80		0	
473	Marri	116.0082	-32.0077	18	70	Tree contains artificial nest box	0	
474	Marri	116.0084	-32.0076	18	55		0	
475	Marri	116.0085	-32.0077	18	70		0	
476	Marri	116.0085	-32.0076	20	70		0	
477	Marri	116.0087	-32.0079	20	75		0	
478	Marri	116.0088	-32.0081	20	65		0	
479	Stag	116.0085	-32.0085	18	70		0	
480	Stag	116.0082	-32.0083	12	60		0	
481	Tuart	116.003	-32.0186	20	65	Three main trunks	0	
482	Tuart	116.0029	-32.0186	20	65	Three main trunks	0	
483	Tuart	116.0029	-32.0185	25	80		0	
484	Jarrah	116.0079	-32.0124	17	80		0	
485	Jarrah	116.0077	-32.0126	15	65	Tree has multiple large trunks	0	
486	Jarrah	116.0074	-32.0129	18	80		0	
487	Jarrah	116.0073	-32.0128	15	75		0	
488	Jarrah	116.0073	-32.0126	17	62		0	
490	Jarrah	116.0097	-32.0133	16	75		0	
491	Jarrah	116.0081	-32.0112	10	52		0	
492	Jarrah	116.0075	-32.0117	15	75		0	
493	Jarrah	116.0076	-32.0118	18	85		0	
494	Jarrah	116.0072	-32.0119	15	60	Multiple trunks on tree	0	
495	Jarrah	116.0069	-32.0123	16	75		0	
496	Jarrah	116.007	-32.0124	12	51		0	
497	Jarrah	116.0067	-32.0122	18	70		0	
498	Jarrah	116.0066	-32.0122	16	60		0	
499	Jarrah	116.0074	-32.0115	16	90		0	
500	Jarrah	116.0075	-32.0115	16	65		0	
501	Jarrah	116.0086	-32.0109	18	70		0	
502	Jarrah	116.0087	-32.011	10	56		0	
503	Jarrah	116.0084	-32.0118	14	53		0	
504	Jarrah	116.0079	-32.0127	15	60		0	
505	Marri	116.0232	-32.0082	15	55		0	
506	Marri	116.0232	-32.0082	20	57		0	
507	Marri	116.0233	-32.0084	20	58		0	
508	Flooded Gum	116.0235	-32.0092	22	70		0	

Appendix F Black Cockatoo Breeding Tree Data

ID	Species	Coordinates		Tree Height (m)	DBH (cm)	DBH Comments	No. of Potentially Suitable Hollows	Hollow Comments
509	Marri	116.0235	-32.0092	20	65		0	
510	Marri	116.0236	-32.0092	20	60		0	
511	Marri	115.9997	-32.012	17	70		0	
512	Jarrah	116.0009	-32.0115	18	70			
513	Jarrah	116.0138	-32.0139	18	55		0	
514	Marri	116.0192	-32.0095	20	70		0	
515	Marri	116.0199	-32.0096	25	90		0	
516	Marri	116.02	-32.0099	20	90		0	
517	Marri	116.0204	-32.01	25	70		0	
518	Marri	116.0203	-32.01	25	80		0	
519	Marri	116.0205	-32.0101	25	70		0	
520	Marri	116.0205	-32.0101	25	70		0	
521	Marri	116.0205	-32.0102	25	80		0	
522	Marri	116.0206	-32.0101	30	100		1	North-west facing hollow, 8 m above ground, 15x15 cm entrance, 45 degrees, on branch, recent evidence of use, Kookaburra observed on branch
523	Marri	116.0206	-32.0101	22	70		0	
524	Marri	116.0207	-32.0103	20	70		0	
525	Marri	116.0207	-32.0103	25	70		0	
526	Marri	116.0208	-32.0103	25	65		0	
527	Marri	116.0205	-32.0103	20	51		0	
528	Marri	116.0205	-32.0103	30	75		0	
529	Marri	116.0205	-32.0104	25	65		0	
530	Marri	116.0204	-32.0103	25	70		0	
531	Jarrah	116.0209	-32.0104	16	55		0	
532	Jarrah	116.021	-32.0105	18	75		0	
533	Marri	116.0209	-32.0106	20	62		0	
534	Jarrah	116.0209	-32.0106	20	65		0	
535	Marri	116.0207	-32.0108	25	80		0	
536	Jarrah	116.0208	-32.0108	15	51		0	
537	Marri	116.0209	-32.0106	25	60		0	
538	E. todtiana	115.9984	-32.013	15	55		0	
539	Marri	116.0202	-32.0123	20	54		0	
540	Jarrah	116.0201	-32.0124	14	55		0	
541	Marri	116.0199	-32.0124	20	100		0	
542	Marri	116.0198	-32.0124	15	55		0	
543	Marri	116.0199	-32.0123	25	60		0	
544	Jarrah	116.0197	-32.0122	18	56		0	
545	Marri	116.0192	-32.0123	20	90		0	
546	Marri	116.0192	-32.0123	20	50		0	
547	Marri	116.0192	-32.0123	20	50		0	
548	Stag	116.0192	-32.0123	6	70		0	
549	Marri	116.0192	-32.0123	18	70		0	
550	Marri	116.0192	-32.0123	25	75		0	
551	Marri	116.0192	-32.0123	25	85		0	
552	Marri	116.0194	-32.0121	20	70		0	
553	Jarrah	116.0196	-32.0121	18	65		0	
554	Jarrah	116.02	-32.012	17	60		0	
555	Marri	116.0202	-32.012	20	65		0	
556	Marri	116.0202	-32.012	20	55		0	
557	Marri	116.0202	-32.012	25	80		0	
558	Marri	116.02	-32.0117	25	70		0	
559	Marri	116.02	-32.0117	20	70		0	
560	Jarrah	116.0201	-32.0115	16	55		0	
561	Marri	116.0201	-32.0114	17	54		0	
562	Jarrah	116.0203	-32.0114	22	60		0	
563	Marri	116.0206	-32.0112	25	65		0	
564	Jarrah	116.0102	-32.015	18	58		0	
565	Marri	116.0106	-32.0161	28	90		0	
566	Marri	116.0104	-32.0163	25	75		0	
567	Marri	116.0108	-32.016	30	100		0	
568	Marri	116.0107	-32.0159	26	70		0	
569	Jarrah	116.0105	-32.0157	18	59		0	
570	Marri	116.0106	-32.016	20	60		0	
572	Marri	116.0209	-32.0113	15	75		0	
573	Marri	116.0211	-32.0113	17	80		0	
574	Jarrah	116.0211	-32.0113	18	65		0	
575	Marri	116.0205	-32.0112	20	66		0	
576	Marri	116.0207	-32.011	20	56		0	
577	Marri	116.0207	-32.011	20	71		0	
578	Jarrah	116.0209	-32.011	16	52		0	
579	Jarrah	116.021	-32.011	17	60	Multiple large trunks, recently dead	0	
580	Marri	116.021	-32.0108	16	56		0	
581	Marri	116.021	-32.0107	25	75		0	
582	Marri	116.0215	-32.0103	25	70		0	
583	Marri	116.0204	-32.0119	18	59		0	
584	Marri	116.0204	-32.0119	17	58		0	
585	Marri	116.0203	-32.0121	18	62		0	

Appendix F Black Cockatoo Breeding Tree Data

ID	Species	Coordinates		Tree Height (m)	DBH (cm)	DBH Comments	No. of Potentially Suitable Hollows	Hollow Comments
586	Marri	116.0205	-32.0121	20	70		0	
587	Jarrah	116.0202	-32.0124	16	58		0	
588	Jarrah	116.0131	-32.0114	18	64		0	
589	Jarrah	116.0128	-32.0116	15	70		0	
590	Jarrah	116.0128	-32.0114	15	60		0	
591	Jarrah	116.0127	-32.0116	16	56		0	
592	Marri	116.014	-32.0104	25	90		0	
593	Marri	116.0142	-32.0105	25	80		0	
594	Marri	116.0143	-32.0105	10	60		0	
595	Jarrah	116.0131	-32.011	15	75		0	
596	Jarrah	116.0135	-32.0105	12	54		0	
597	Wandoo	116.0243	-32.0072	15	47		0	
598	Wandoo	116.0243	-32.0074	17	38		0	
599	Wandoo	116.0243	-32.0071	18	42		0	
600	Wandoo	116.0243	-32.0071	18	41		0	
601	Marri	116.0233	-32.0074	25	75		0	
602	Jarrah	116.0232	-32.0073	11	60		0	
603	Tuart	116.0242	-32.0101	30	70		0	
604	Marri	116.0225	-32.0076	22	70	Multiple large trunks	0	
605	Jarrah	116.0222	-32.0076	17	61		0	
606	Jarrah	116.0223	-32.0074	12	56		0	
607	Jarrah	116.0229	-32.007	17	65		0	
608	Marri	116.0204	-32.005	25	70		0	
609	Marri	116.0202	-32.0054	22	55		0	
610	Marri	116.0201	-32.0055	22	56		0	
611	Jarrah	116.0199	-32.0053	15	70		0	
612	Marri	116.0219	-32.0051	8	53		0	
613	Jarrah	116.0206	-32.0065	16	80		0	
614	Marri	116.0209	-32.0066	15	70		0	
615	Jarrah	116.0207	-32.0066	15	80		2	Hollow 1: Vertical hollow on spout, 13 m above ground, 30x30 cm entrance, unable to assess depth, no evidence of use Hollow 2: South-west facing trunk hollow, 10 m above ground, 20x20 cm entrance, horizontal angle, unable to assess depth
616	Jarrah	116.0212	-32.0073	18	58		0	
617	Jarrah	116.0208	-32.0071	16	80		0	
618	Jarrah	116.02	-32.0065	15	90		0	
619	Marri	116.0197	-32.0053	18	51		0	
620	Marri	116.0199	-32.0058	18	55		0	
621	Jarrah	116.0203	-32.0059	14	52		0	
622	Marri	116.02	-32.0084	14	90		0	
623	Marri	116.0198	-32.0085	18	65		0	
624	Marri	116.0198	-32.0085	12	52		0	
625	Marri	116.0196	-32.0084	16	50		0	
626	Marri	116.0191	-32.008	16	60		0	
627	Marri	116.0187	-32.0077	12	50	Multiple trunks	0	
628	Marri	116.0189	-32.0078	8	55		0	
629	Marri	116.0192	-32.0078	18	65		0	
630	Marri	116.0194	-32.0078	20	90		0	
631	Marri	116.0192	-32.0076	12	65		0	
632	Marri	116.0194	-32.0076	16	120		0	
633	Marri	116.0195	-32.0076	12	50		0	
634	Marri	116.0197	-32.0077	14	65		0	
635	Marri	116.0197	-32.0078	18	100		0	
636	Marri	116.0197	-32.0077	18	100		0	
637	Marri	116.0197	-32.0078	16	60		0	
638	Marri	116.0196	-32.0079	12	100		0	
640	Marri	116.0185	-32.0071	14	80		0	
641	Stag	116.0184	-32.0072	8	75		0	
642	Marri	116.0183	-32.0071	14	55		0	
643	Marri	116.0181	-32.0067	18	55		0	
644	Jarrah	116.0231	-32.0064	12	65		0	
645	Jarrah	116.0232	-32.0067	20	55		0	
646	Marri	116.0212	-32.0057	18	75		0	
648	Marri	116.0215	-32.0053	10	55		0	
649	Marri	116.0209	-32.005	10	50		0	
650	Marri	116.0206	-32.0051	18	90		0	
651	Marri	116.0204	-32.0053	18	60		0	
652	Marri	116.0205	-32.0054	16	55		0	
653	Stag	116.0207	-32.0052	16	150		5	Tree has 5 branch and spout hollows. All hollows are above 8 m and have openings greater than 10x10 cm. Unable to assess chamber sizes.
654	Marri	116.0206	-32.0054	16	55		0	
655	Marri	116.0206	-32.0056	10	60		0	
656	Marri	116.0208	-32.0057	14	52		0	
657	Marri	116.02	-32.0051	18	50		0	
658	Marri	116.0202	-32.0048	14	52		0	
659	Jarrah	116.0197	-32.0051	12	80		0	

Appendix F Black Cockatoo Breeding Tree Data

ID	Species	Coordinates		Tree Height (m)	DBH (cm)	DBH Comments	No. of Potentially Suitable Hollows	Hollow Comments
660	Jarrah	116.0197	-32.0052	8	50		0	
661	Jarrah	116.0219	-32.0075	12	60		0	
662	Jarrah	116.0218	-32.0072	14	80		0	
663	Jarrah	116.0216	-32.0076	14	52		0	
664	Jarrah	116.0218	-32.0078	10	60	DBH measured just below fork.	0	
665	Jarrah	116.0164	-32.0058	10	55		0	
668	Marri	116.0169	-32.0061	14	50		0	
669	Tuart	116.0174	-32.006	25	60		0	
670	Tuart	116.0177	-32.0061	25	55		0	
671	Marri	116.0174	-32.0066	18	55		0	
672	Marri	116.018	-32.0067	17	52		0	
673	Marri	116.0181	-32.0067	20	55		0	
675	Wandoo	116.0245	-32.0072	8	40		0	
676	Wandoo	116.0245	-32.0072	8	40		0	
677	Tuart	116.0134	-32.0104	16	100		0	
678	Jarrah	116.0132	-32.0102	12	100		0	
679	Marri	116.0138	-32.0102	16	60		0	
680	Marri	116.0137	-32.0102	14	50		0	
681	Jarrah	116.0138	-32.0105	10	50		0	
682	Jarrah	116.0138	-32.0105	10	50		0	
683	Jarrah	116.0139	-32.0105	10	55		0	
686	Jarrah	116.0124	-32.0117	10	140		0	
687	Jarrah	116.0124	-32.0118	8	55		0	
688	Jarrah	116.0125	-32.0118	14	52		0	
689	Marri	116.0207	-32.0122	18	52		0	
690	Marri	116.0206	-32.0125	18	55		0	
691	Marri	116.0208	-32.0126	18	80		0	
692	Marri	116.0208	-32.0126	22	60		0	
693	Marri	116.0209	-32.0126	20	55		0	
694	Marri	116.021	-32.0126	20	90		0	
695	Marri	116.0215	-32.0127	18	80		0	
696	Marri	116.0209	-32.0115	18	60		0	
697	Marri	116.0209	-32.0118	16	140		0	
698	Marri	116.0103	-32.016	14	55		0	
699	Jarrah	116.0107	-32.0156	18	60		0	
700	Marri	116.0108	-32.0157	20	55		0	
701	Marri	116.0109	-32.0158	25	90		0	
702	Marri	116.0111	-32.0162	20	80		0	
703	Jarrah	116.0109	-32.0162	15	60		0	
704	Marri	116.0106	-32.0161	22	70		0	
705	Marri	116.0104	-32.0151	20	65		0	
706	Jarrah	116.0104	-32.0149	12	55		0	
707	Jarrah	116.0105	-32.0148	12	65	Multiple trunks	0	
708	Tuart	116.0108	-32.0123	22	55		0	
709	Jarrah	116.011	-32.0121	12	55	Multiple trunks	0	
710	Jarrah	116.0085	-32.0143	14	52		0	
711	Jarrah	116.0087	-32.0142	10	55		0	
712	Jarrah	116.0088	-32.0146	20	70	Two trunks	0	
713	Jarrah	116.008	-32.0141	16	60		0	
714	E. todtiana	116.0049	-32.0132	12	80		0	
715	E. todtiana	116.005	-32.0131	8	70		0	
716	Jarrah	116.0054	-32.0132	8	55		0	
717	Marri	116.0212	-32.0133	20	55		0	
718	Jarrah	116.0214	-32.0141	8	55		0	
719	Marri	116.0211	-32.0141	16	55	Multiple trunks	0	
720	Marri	116.0206	-32.0139	16	52		0	
721	Marri	116.0206	-32.0136	18	55		0	
722	Marri	116.0207	-32.0138	18	55		0	
723	Jarrah	116.0211	-32.013	14	70		0	
725	Marri	116.0206	-32.0114	16	50		0	
726	Marri	116.0207	-32.0115	18	50		0	
727	Jarrah	116.0206	-32.0115	18	52		0	
728	E. todtiana	115.9983	-32.0125	8	55		0	
729	Tuart	115.9987	-32.0127	25	120		0	
730	Tuart	115.9986	-32.0126	20	100		0	
731	Tuart	116.0165	-32.0118	25	150		0	
732	Tuart	115.9985	-32.0125	25	75		0	
733	Tuart	115.9985	-32.0125	25	100		0	
736	Marri	116.0165	-32.0118	20	55		0	
737	Marri	116.0206	-32.0106	20	52		0	
738	Marri	116.0206	-32.0106	20	100		0	
739	Marri	116.0205	-32.0106	18	60		0	
740	Jarrah	116.0139	-32.0138	8	65		0	
742	E. todtiana	116.0001	-32.0111	7	50		0	
745	Marri	116.0235	-32.0085	16	160		0	
746	Marri	116.0235	-32.0083	0	140	Tree covered by ficus, unable to assess		
747	Stag	116.0234	-32.0082	7	90		0	
748	Marri	116.0234	-32.0082	20	65		0	

Appendix F Black Cockatoo Breeding Tree Data

ID	Species	Coordinates		Tree Height (m)	DBH (cm)	DBH Comments	No. of Potentially Suitable Hollows	Hollow Comments
749	Marri	116.0233	-32.0082	20	55		0	
751	Jarrah	116.0085	-32.0117	12	55	Multiple trunks	0	
752	Jarrah	116.0087	-32.0108	22	110		0	
753	Jarrah	116.0088	-32.0108	20	90		2	Hollow 1: West facing branch hollow, 11 m above ground, 50x10 cm entrance at 45 degrees, unable to assess chamber size, hollow occupied by pink and grey galahs Hollow 2: North-west facing branch hollow 10 m above ground, 10x100 cm entrance at 45 degrees, old evidence of use, currently occupied by bees
754	Jarrah	116.0089	-32.0108	14	60		0	
755	Jarrah	116.009	-32.0106	15	55		0	
756	Jarrah	116.009	-32.0106	3	52	Tree loped	0	
757	Jarrah	116.0089	-32.0107	14	90		0	
758	Jarrah	116.0088	-32.0107	16	110		0	
759	Jarrah	116.0084	-32.0107	14	65		0	
760	Jarrah	116.0083	-32.0108	18	110		0	
763	Jarrah	116.0104	-32.0136	14	55		0	
764	Jarrah	116.0073	-32.0125	14	50		0	
765	Jarrah	116.0073	-32.0124	18	50		0	
766	Jarrah	116.0116	-32.0056	20	52		0	
767	Jarrah	116.0078	-32.0118	14	80		0	
768	Jarrah	116.0078	-32.0119	17	52		0	
769	Jarrah	116.0075	-32.0123	16	52		0	
770	Jarrah	116.0075	-32.0124	18	60		0	
771	Tuart	116.0024	-32.0184	22	80	Two trunks	0	
772	Tuart	116.0025	-32.0188	18	120		0	
774	Marri	116.0082	-32.0087	14	70	DBH measured below fork.	0	
775	Marri	116.0081	-32.0087	14	52		0	
776	Marri	116.0078	-32.009	18	50		0	
777	Marri	116.0077	-32.009	20	80		0	
778	Marri	116.0079	-32.0088	16	50		0	
779	Marri	116.0081	-32.0083	25	100		0	
780	Marri	116.0079	-32.008	20	110		0	
781	Marri	116.0071	-32.0087	18	90		0	
782	Marri	116.0071	-32.0087	18	90		0	
783	Marri	116.007	-32.0088	15	60	Two trunks	0	
784	Marri	116.0069	-32.0088	18	55		0	
785	Marri	116.0193	-32.0081	16	60		0	