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Lot 1 Thomas Road, Oakford

Flora, vegetation and black
cockatoo habitat survey

DRAFT

Prepared for
Urban Resources
by Strategen

October 2018

Lot 1 Thomas Road, Oakford

**Flora, vegetation and black
cockatoo habitat survey**

DRAFT

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October 2018

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Client: Urban Resources

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Table of contents

1. Introduction	1
1.1 Purpose	1
1.2 Scope	1
2. Context	3
2.1 Legislative context	3
2.1.1 Conservation significant flora and ecological communities	3
2.1.2 Environmentally Sensitive Areas	4
2.1.3 Protection of native vegetation	4
2.1.4 Introduced species	5
2.2 Overview of existing environment	5
2.2.1 Geology, landform and soils	5
2.2.2 Climate	5
2.2.3 Hydrology	6
2.2.4 Regional vegetation	6
2.2.5 Black cockatoo habitat	7
3. Methods	10
3.1 Desktop assessment	10
3.2 Field assessment	10
3.2.1 Data analysis and vegetation mapping	11
3.2.2 Survey limitations and constraints	12
4. Results	14
4.1 Desktop assessment	14
4.1.1 Threatened and Priority flora	14
4.1.2 Threatened and Priority Ecological Communities	18
4.1.3 Wetlands	18
4.1.4 Bush Forever	18
4.2 Field assessment results	21
4.2.1 Threatened and Priority flora	21
4.2.2 Introduced (exotic) taxa	21
4.2.3 Accumulated species – sites surveyed (species-area curve)	21
4.2.4 Vegetation types	22
4.2.5 Threatened and Priority Ecological Communities	24
4.2.6 Vegetation condition	25
4.3 Black cockatoo habitat	28
5. Discussion	31
6. Assessment against the ten clearing principles	32
7. References	35

List of tables

Table 1: Personnel	10
Table 2: Vegetation condition scale (Keighery 1994)	11
Table 3: Flora and vegetation survey potential limitations and constraints	13
Table 4: Threatened and Priority flora potentially occurring within the Survey Area	15
Table 5: Threatened and Priority flora species potentially occurring within survey area	21
Table 6: Vegetation type and condition within Survey Area	22
Table 7: Results of hierarchical analysis for plots from the Survey Area	24
Table 8: Characteristics of the Banksia woodland within the Subject Site compared to the key diagnostic criteria as per TSSC (2016)	24
Table 9: Area (ha) covered by each vegetation condition category within the project area	25
Table 10: Definitions of black cockatoo foraging habitat quality	28
Table 11: Vegetation types and black cockatoo foraging species within the project area	28
Table 12: Total area of foraging habitat for each black cockatoo species	29
Table 13: Assessment against the ten clearing principles	32

List of figures

Figure 1: Project area	2
Figure 2: Mean monthly climatic data (temperature and rainfall) for Medina Research Centre	6
Figure 3: Regional vegetation mapping	9
Figure 4: Location of TECs and PECs within 5 km of the survey area	19
Figure 5: Wetlands and Bush Forever sites within 5 km of survey area	20
Figure 6: Averaged randomised Species Accumulation Curve	22
Figure 7: Vegetation types	23
Figure 8: FCTs, PECs and TECs mapped within the survey area	26
Figure 9: Vegetation condition within the survey area	27
Figure 10: Black cockatoo habitat	30

List of appendices

Appendix 1 Conservation significant flora and ecological community definitions
Appendix 2 Desktop assessment results (Parks and Wildlife 2007-, DEE 2017c)
Appendix 3 Vascular plant species recorded within quadrats
Appendix 4 FCT analysis results
Appendix 5 Photographic record of vegetation types and condition
Appendix 6 Vascular plant taxa recorded by site and vegetation type

1. Introduction

1.1 Purpose

This report presents the findings of a detailed flora, vegetation and black cockatoo habitat survey undertaken to support a proposed sand mine within Lot 1 Thomas Road, Oakford (the project area, Figure 1).

The proposed works will require clearing of native vegetation and as such, a flora, vegetation and black cockatoo survey was deemed necessary to determine the environmental values of the potential clearing area.

1.2 Scope

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

The objectives were to:

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

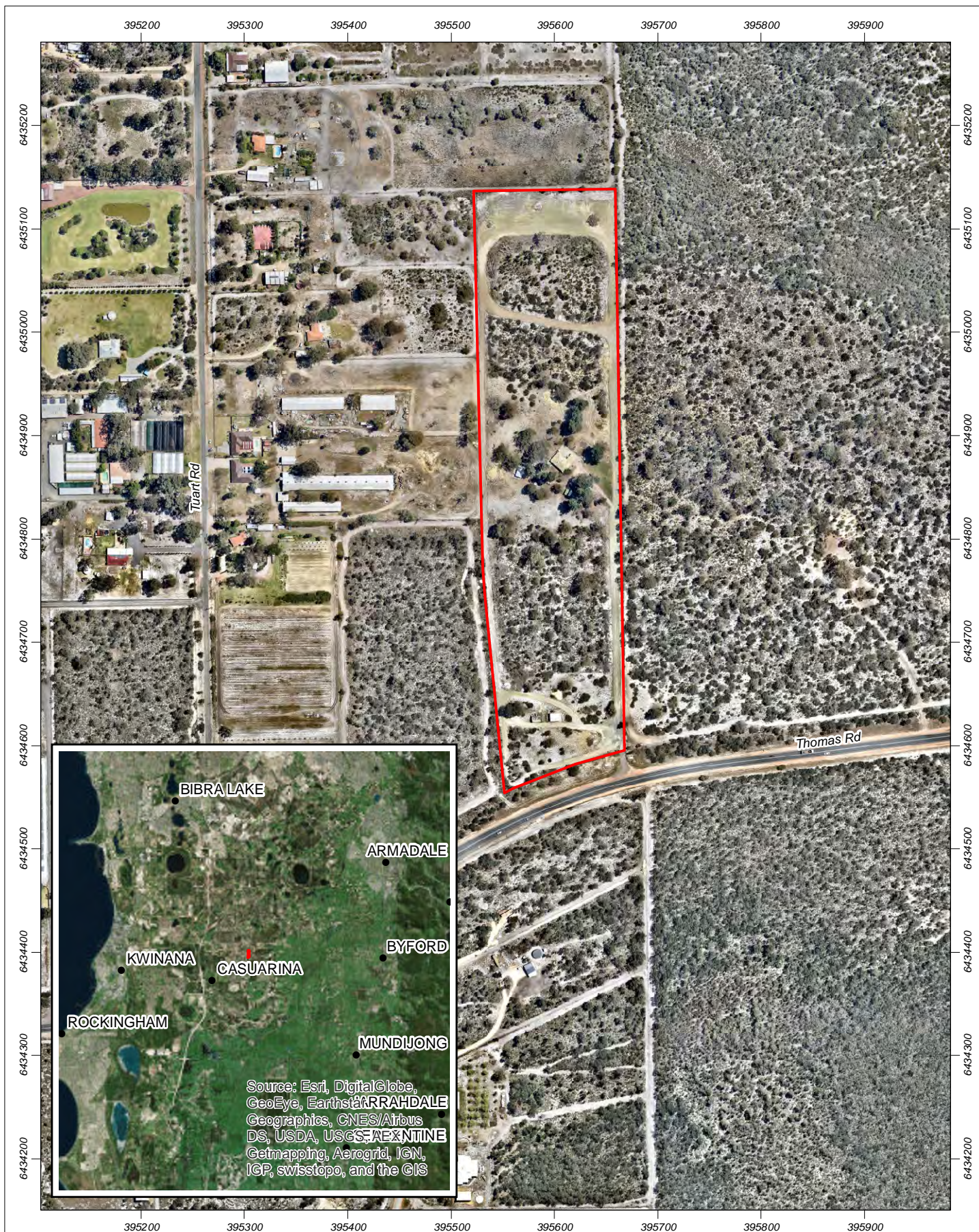
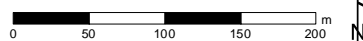


Figure 1: Survey Area

Scale 1:5,000 at A4



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 7/12/2017

Author: jcrute

Source: Aerial: Nearmap, flown 10/2017.



Legend

Survey area

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2. Context

2.1 Legislative context

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

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

2.1.1 Conservation significant flora and ecological communities

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

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

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

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

A TEC is defined under the EP Act as an ecological community listed, designated or declared under a written law or a law of the Australian Government as Threatened, Endangered or Vulnerable. There are four State categories of TECs (DEC 2010)¹:

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

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

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

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

Ecological communities identified as Threatened, but not listed as TECs, are classified as Priority Ecological Communities (PECs). These communities are under threat, but there is insufficient information available concerning their distribution to make a proper evaluation of their conservation status. Parks and Wildlife categorises PECs according to their conservation priority, using five categories, P1 (highest conservation significance) to P5 (lowest conservation significance), to denote the conservation priority status of such ecological communities. Appendix 1 defines PECs (DEC 2010). DBCA (2017b) contains a list of current PECs.

2.1.2 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are protected under the EP Act, and include the following:

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

2.1.3 Protection of native vegetation

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

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

- (a) the vegetation was sown, planted or propagated as required under the EP Act or another written law
- (b) the vegetation is declared to be native under Regulation 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

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

- (a) planting that was funded (fully or partly)
 - i. by a person who was not the owner of the land
 - ii. for the purpose of biodiversity conservation or land conservation
- (b) intentionally planted vegetation that has one of the following:
 - i. a conservation covenant or agreement to reserve under section 30B of the *Soil and Land Conservation Act 1945*
 - ii. a covenant to conserve under section 21A of the *National Trust of Australia (WA) Act 1964*
 - iii. restrictive covenant to conserve under section 129B of the *Transfer of Land Act 1983*
 - iv. some other form of binding or undertaking to establish and maintain, or maintain, the vegetation.

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

2.1.4 Introduced species

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

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

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

2.2 Overview of existing environment

2.2.1 Geology, landform and soils

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

2.2.2 Climate

The Oakford locality experiences a Mediterranean climate characterised by mild, wet winters and warm to hot, dry summers. The nearest Bureau of Meteorology (BoM) weather station at Medina Research Centre (Station No. 009194) provides average monthly climate statistics for the Oakford locality (Figure 2). Average annual rainfall recorded at Medina Research Centre since 1983 is 745.5 mm (BoM 2017). Rainfall may occur at any time of year; however, most occurs in winter in association with cold fronts from the southwest. Highest temperatures occur between January and February, with average monthly maximums ranging from 18°C in July to 31.5°C in February (BoM 2017). Lowest temperatures occur in July and August, with average monthly minimums ranging from 8.2°C in July and August to 17.6°C in February (BoM 2017).

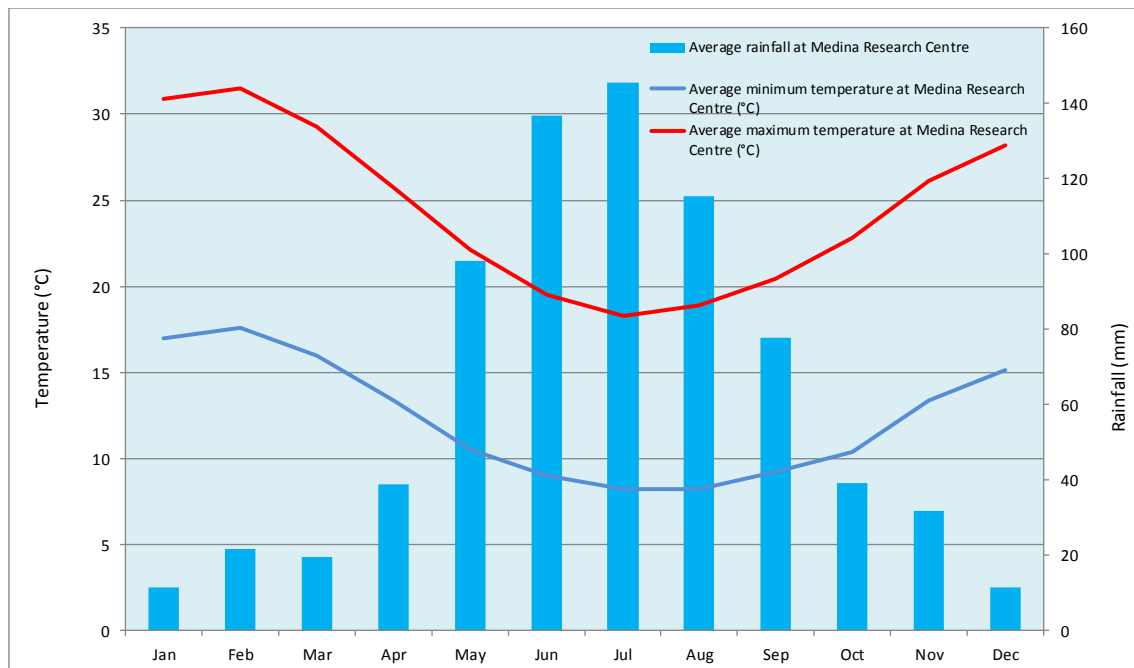


Figure 2: Mean monthly climatic data (temperature and rainfall) for Medina Research Centre

2.2.3 Hydrology

Surface water

Mapping of the geomorphic wetlands of the Swan Coastal Plain (Figure 5) identifies a small area in the northern portion of the Survey Area as a Multiple Use Wetland (UFI 6950). No other wetlands are mapped within the lot boundary.

A Conservation Category Wetland (CCW) (UFI 14740) is mapped immediately north and adjacent to the north-east corner of the Survey Area. The CCW abuts the lot boundary for approximately 180 m.

Groundwater

The *Perth Groundwater Atlas 2004* (DWER 2017) shows the May 2003 groundwater level to be approximately 24 mAHD which equates to a depth to groundwater within the site of approximately near surface in the northern portion of the site, up to 12 m beneath the central sandy rise.

2.2.4 Regional vegetation

Beard (1990) Botanical Subdistrict

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

IBRA subregion

The Interim Biogeographic Regionalisation for Australia (IBRA) divides Western Australia into 26 biogeographic regions and 53 subregions based on dominant landscape characteristics of climate, lithology, geology, landform and vegetation (McKenzie et al. 2003).

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

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

System 6 and vegetation system association mapping

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

The project area is situated within vegetation association Bassendean 1001 – *Medium very sparse woodland; jarrah, with low woodland; banksia & casuarina* (Beard 1990), of which 21.6% remains in the IBRA bioregion (GoWA 2017a).

Based on regional vegetation complex mapping (Heddle et al. 1980) the Survey Area contains the 'Bassendean Complex Central and South' vegetation complex, as illustrated in Figure 3, of which 26.9% remains in the IBRA bioregion (GoWA 2017b)..

Conservation areas

The project area is located directly west of Bush Forever (BF) site 348 which abuts the eastern project area boundary. This BF site is mapped as managed by Parks and Wildlife.

An environmentally sensitive area (ESA) is located within the northern portion of the site, which is associated with a 50 m buffer to the adjacent CCW to the north of the project area (as shown in Figure 5).

2.2.5 Black cockatoo habitat

Carnaby's Black-Cockatoos, listed as Endangered under the EPBC Act, feed on the seeds, nuts and flowers, of a variety of native and introduced plant species and insect larvae (DEE 2017b). Food plants generally occur within proteaceous genera such as *Banksia*, *Hakea* and *Grevillea*, though are known to forage on eucalypt species in woodland areas. Carnaby's black cockatoos have also adapted to feeding on exotic species such as pines and cape lilac and weeds such as wild radish and wild geranium (DEE 2017b). Carnaby's black cockatoos usually breed between July and December in the hollows of live or dead eucalypts; primarily in Salmon Gum and Wandoo, but also within Jarrah, Marri and other eucalypt species (Johnstone 2010a). Hollows are usually at least 2 m above ground, sometimes over 10 m and the depth of the hollow varies from 0.25 m to 6 m (DEE 2017b). Mapping of Carnaby's Black Cockatoo distribution (Johnstone and Kirkby undated) identifies the Survey Area as occurring within the range of the species.

Forest Red-tailed Black-Cockatoos, listed as Vulnerable under the EPBC Act, depend primarily on Marri and Jarrah trees for both foraging and nesting. The seeds of both eucalypts are the favoured food source of the birds and hollows within live or dead individual trees are utilised for nesting purposes (Johnstone 2010b). Breeding varies between years and occurs at times of Jarrah and Marri fruiting. These black cockatoos breed in woodland, forest or artificial nest boxes, but may also breed in former woodland or forest that has been reduced to isolated trees (DEE 2017b). Mapping of the Forest Red-tailed Black Cockatoo distribution (Johnstone and Kirkby undated) identifies the species as likely to occur within the Survey Area.

Baudin's Black-Cockatoos primarily occur in eucalypt forests and forage at all strata levels within the forests with a tendency to favour areas containing Marri (Johnstone and Kirkby 2008, DEE 2017b). Breeding generally occurs in the Jarrah, Marri and Karri forests of the southwest of Western Australia in areas averaging more than 750 mm of rainfall annually (DEE 2017b). As with the other two species of Threatened black cockatoos in Western Australia, breeding habitat also occurs in former woodland or forest that has been reduced to isolated trees (DEE 2017b). Mapping of the Baudin's Black-Cockatoos distribution (Johnstone and Kirkby undated) identifies the species as potentially occurring within the Survey Area.



Figure 3: Regional vegetation mapping

Scale 1:5,000 at A4



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 7/12/2017

Author: jcrute

Source: Aerial: Nearmap, flown 10/2017. Vegetation: Beard, DAFWA 2017. Vegetation: Hedde, DEC 2012. Lot boundary: Lot2ThomasRD40mbuffer Client 02/2017.

Path: Q:\Consult\2017\URE\URE17457\01_GIS_documents\ArcMap_documents\URE17457_G003_RevA.mxd

Legend

Survey area

Vegetation system association (Beard 1990)

BASSENDEAN_1001

Vegetation class, System 6 ID (Hedde et al. 1980)

Bassendean complex - central and south, 1357

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3. Methods

3.1 Desktop assessment

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

A database search request was also submitted to the Threatened Communities Branch of DBCA to identify any potential TECs or PECs within 5 km of the survey area.

Desktop surveys were undertaken prior to the field survey which involved querying NatureMap (Parks and Wildlife 2007-) and the Commonwealth Protected Matters Search Tool (DEE 2017) as well as requesting data from the Threatened Species and Communities branches of Parks and Wildlife.

3.2 Field assessment

A field survey was conducted by a Senior Ecologist from Strategen on 12 September 2018, and comprised the following elements:

- Detailed Survey fulfilling the requirements of the Environmental Protection Authority (EPA) (2016), *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*
- Black Cockatoo foraging and nesting habitat survey.

Table 1 identifies staff involved in the field surveys, their role and qualifications. The survey area was traversed on foot to record changes in vegetation structure and type and five vegetation quadrats were surveyed to identify vegetation types.

Table 1: Personnel

Name	Role	Flora collection permit
R Chesney Strategen (Senior Ecologist)	Fieldwork, plant identification, data interpretation and report preparation	SL012076

Site selection for vegetation mapping was based on differences in structure and species composition of the communities present within the survey area. Vegetation mapping sites were determined from aerial photographs and confirmed on site. The survey area was traversed on foot, allowing for opportunistic sites to be placed where a change in vegetation structure or composition was observed.

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

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

For each vascular plant species, the average height, number of plants and percent cover were recorded. Vegetation condition was rated according to the scale of Keighery (1994) (Table 2).

Table 2: Vegetation condition scale (Keighery 1994)

Condition rating	Description
Pristine (1)	Pristine or nearly so, no obvious sign of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback, grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

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

3.2.1 Data analysis and vegetation mapping

Vegetation types were delineated using a combination of results from the cluster analysis (see below), combined with site observations. Aerial photography interpretation and field notes taken during the survey, were then used to develop VT mapping polygon boundaries over the survey area. These polygon boundaries were then digitised using Geographic Information System (GIS) software.

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

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

To identify possible TECs and PECs in the survey area, vegetation quadrats (and subsequently, Vegetation Types) were compared to Floristic Community Types (FCTs) defined by Gibson et al. (1994). An association matrix was prepared using the Bray-Curtis coefficient, resulting in pairwise coefficients of similarities between quadrats (both recorded during the survey and from the SCP dataset). Agglomerative hierarchical clustering, using flexible UPGMA ($\beta = -0.1$) was used to generate quadrat classification dendrograms for each quadrat within the survey area.

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

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

3.2.2 Survey limitations and constraints

Table 3 displays the evaluation of the flora and vegetation assessment against a range of potential limitations that may have an effect on that assessment. Based on this evaluation, the assessment has not been subject to constraints that would affect the thoroughness of the assessment and the conclusions reached.

Table 3: Flora and vegetation survey potential limitations and constraints

Potential limitation	Impact on assessment	Comment
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	Not a constraint.	The survey has been undertaken in the Drummond Botanical Subdistrict on the Swan Coastal Plain which has been well studied and documented with ample literature available (Beard 1990).
Scope (i.e. what life forms, etc., were sampled).	Not a constraint.	Number of species recorded, number of quadrats sampled and timing of the survey (i.e. spring) were adequate for this level of survey.
Proportion of flora/fauna collected and identified (based on sampling, timing and intensity).	Not a constraint.	The proportion of flora surveyed was adequate. The entire survey area was traversed and flora species were recorded systematically.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	Not a constraint.	The information collected during the survey was sufficient to assess the vegetation that was present during the time of the survey.
Mapping reliability.	Not a constraint.	Aerial photography of a suitable scale was used to map the survey area. Sites were chosen from these aerials to reflect changes in community structure. Opportunistic sites were also used if differences were observed during on ground reconnaissance. Vegetation types were assigned to each site based on topography, soil type and presence/absence and percent foliage cover of vegetation.
Timing, weather, season, cycle.	Possible constraint.	Flora and vegetation surveys are normally conducted following winter rainfall in the South-West Province, ideally during spring (EPA 2016). The field assessment was conducted in November (i.e. spring) in fine weather conditions and therefore these factors are not deemed to be constraints for the spring survey. However, the survey was conducted outside the flowering time for the Threatened and Priority flora species assessed as possibly occurring within the Survey Area; as such, this could potentially be a constraint.
Disturbances (fire flood, accidental human intervention, etc.).	Not a constraint.	The survey area and regional surrounds have been subject to disturbance over a significant period of time. Given the wide range of this disturbance, this is not considered to be a limitation within the survey area.
Intensity (in retrospect, was the intensity adequate).	Not a constraint.	The survey area was traversed on foot and all differences in vegetation structure were recorded appropriately.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	Not a constraint.	The available resources were adequate to complete the survey.
Access problems (i.e. ability to access survey area).	Not a constraint.	Existing tracks enabled adequate access to survey the vegetation within the survey area. Where access was not available by car, the area was easily traversed by foot.
Experience levels (e.g. degree of expertise in species identification to taxon level).	Not a constraint.	All survey personnel have the appropriate training in sampling and identifying the flora of the region.

4. Results

4.1 Desktop assessment

4.1.1 Threatened and Priority flora

A desktop survey for Threatened and Priority flora that may potentially occur within the survey area was undertaken using NatureMap (Parks and Wildlife 2007-), the Western Australian Herbarium (Western Australian Herbarium 1998-), and the DEE Protected Matters Search Tool (DEE 2017c).

Table 4 shows the Threatened and Priority flora potentially occurring within the survey area based on the desktop assessment. The desktop assessment identified eight Threatened flora and 20 Priority flora species that have been recorded in the local area. Of these, based on general habitat requirements (Table 4), two Threatened and one Priority flora species were considered to have the potential to occur within the survey area; as follows:

- *Caladenia huegelii* (T)
- *Dodonaea hackettiana* (P4)
- *Drakaea micrantha* (T).

Table 4: Threatened and Priority flora potentially occurring within the Survey Area

Species	Conservation status		Description	Potential to occur
	EPBC Act	WC Act		
<i>Andersonia gracilis</i>	Endangered	P4	A slender, erect or open straggly shrub, 10 to 100 cm high. Flowers are white to pink to purple from September to November. Habitat for this species occurs in white/grey sand, sandy clay, gravelly loam within winter-wet areas and near swamps (Western Australian Herbarium 1998-). The species occurs in damp black, sandy clay flats near swamps in open low heath with <i>Calothamnus hirsutus</i> (hairy clawflower), <i>Verticordia densiflora</i> (compact featherflower), <i>Kunzea recurva</i> (recurved kunzea) and <i>Banksia telmatiaea</i> over sedges. Vegetation within the proposed action area is dominated by Open Woodland of <i>Eucalyptus marginata</i> (Jarrah), <i>Corymbia calophylla</i> (Marri), <i>Pinus pinaster</i> (pines), <i>Eucalyptus gomphocephala</i> (tuart) over <i>Kunzea glabrescens</i> and mixed native/non-native shrubs and grasses on predominantly light grey sand (DEE 2017b, Western Australian Herbarium 1998-).	Unlikely due to absence of preferred habitat.
<i>Aponogeton hexatepalus</i>	Not listed	P4	A rhizomatous aquatic perennial herb. Flowers are green-white and visible between July to October. Habitat for this species occurs in mud and freshwater ponds, rivers and claypans (Western Australian Herbarium 1998-).	Unlikely due to absence of preferred habitat.
<i>Caladenia huegelii</i>	Endangered	T	A slender orchid 30 to 50 cm tall. One or two striking flowers characterised by a greenish-cream lower petal with a maroon tip. Other petals are cream with red or pink suffusions. Habitat for this species occurs within well-drained, deep sandy soils in low mixed <i>Banksia</i> , <i>Allocasuarina</i> and Jarrah woodlands (Western Australian Herbarium 1998-, DEE 2017b).	Possible in VT2 due to presence of preferred habitat.
<i>Cyathochaeta teretifolia</i>	Not listed	P3	A rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high and to 1.0 m wide. Flowers are brown. Habitat for this species includes grey sand or sandy clay within swamps or creek edges (Western Australian Herbarium 1998-).	Unlikely due to absence of preferred habitat.
<i>Diuris micrantha</i>	Vulnerable	T	A slender orchid to 60 cm tall. Flowers are yellow with reddish-brown markings and visible from September to October. Habitat for this species occurs within clay-loam substrates in winter-wet depressions or swamps (DEE 2017b).	Unlikely due to absence of preferred habitat.
<i>Diuris purdiei</i>	Endangered	T	A slender orchid to 0.35 m tall. Flowers are yellow and visible from September to October. Habitat for this species is grey-black sand substrates in winter-wet swamps which have high moisture (Western Australian Herbarium 1998-). <i>Diuris purdiei</i> occurs from Perth south to near the Whicher Range, within the Swan (Western Australia) Natural Resource Management Region. It grows on sand to sandy clay soils, in areas subject to winter inundation, and amongst native sedges and dense heath with scattered emergent <i>Melaleuca preissiana</i> , <i>Corymbia calophylla</i> , <i>Eucalyptus marginata</i> and <i>Nuytsia floribunda</i> (DEE 2017b).	Unlikely due to absence of preferred habitat.

Species	Conservation status		Description	Potential to occur
	EPBC Act	WC Act		
<i>Dodonaea hackettiana</i>	Not listed	P4	An erect shrub or tree, 100 to 500 cm tall. Flowers are yellow to green/red and occur mainly from July to October. Habitat for this species occurs in sand and outcropping limestone (Western Australian Herbarium 1998-).	Possible in VT2 due to presence of preferred habitat.
<i>Drakaea elastica</i>	Endangered	T	A slender orchid to 30 cm tall with a prostrate, round to heart shaped leaf. Singular, bright green, glossy flower. <i>Drakaea elastica</i> is currently known only from the Swan Coastal Plain over a range of approximately 350 km between Cataby in the north and Busselton in the south. The species is known to grow on bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps (DEE 2017b). The species typically grows in Banksia (<i>Banksia menziesii</i> , <i>B. attenuata</i> and <i>B. ilicifolia</i>) woodland or Spearwood (<i>Kunzea glabrescens</i>) thicket vegetation.	Unlikely due to absence of preferred habitat.
<i>Drakaea micrantha</i>	Vulnerable	T	A tuberous, terrestrial herb which has a diminutive red and yellow flower, 1.2–2.5 cm long, on a stem that grows to 30 cm. Flowering occurs from September to October. Its heart-shaped leaf, about 1.5 cm long, is silvery grey with prominent green veins. Habitat for this species occurs within cleared firebreaks or open sandy patches that have been disturbed, where competition from other plants has been removed (Western Australian Herbarium 1998-, DEE 2017b).	Possible in VT1 and VT2 due to presence of preferred habitat.
<i>Eucalyptus x balanites</i>	Endangered	T	Species known to occur in sandy soils with lateritic gravel (Western Australian Herbarium 1998-).	Unlikely due to absence of preferred habitat.
<i>Jacksonia gracillima</i>	Not listed	P3	A spreading, compact shrub 100 cm tall and 100 cm wide. Flower buds are very angular and wings are orange with a darker orange keel. Habitat for this species occurs within winter wet Bassendean sands and littered, grey, peaty, loamy sand (Western Australian Herbarium 1998-).	Unlikely due to absence of preferred habitat.
<i>Lepidosperma rostratum</i>	Endangered	P4	A rhizomatous, tufted perennial, grass-like or herb (sedge), 50 cm tall. Flowers are brown and flowering occurs from May to June. Habitat for this species occurs in peaty sand or clay and within seasonally wet swamps (Western Australian Herbarium 1998-, DEE 2017b).	Unlikely due to absence of preferred habitat.
<i>Pithocarpa corymbulosa</i>	Not listed	P3	An erect to scrambling perennial herb 50 to 100 cm tall. Flowers are white and are present from January to April. Habitat for this species occurs within gravelly or sandy loam and amongst granite outcrops (Western Australian Herbarium 1998-, DEE 2017b).	Unlikely due to absence of preferred habitat.
<i>Stylidium paludicola</i>	Not listed	P4	Reed-like perennial, herb, 35 to 100 cm tall. Leaves are tufted, linear or subulate or narrowly oblanceolate. Flowers are pink and occur in October to December. Habitat for this species occurs in peaty sand over clay and winter wet areas, often in Marri and <i>Melaleuca</i> woodland or <i>Melaleuca</i> shrubland (Western Australian Herbarium 1998-).	Unlikely due to absence of preferred habitat.

Species	Conservation status		Description	Potential to occur
	EPBC Act	WC Act		
<i>Synaphea</i> sp. Fairbridge Farm	Critically Endangered	T	A dense, clumped sub-shrub 25–65 cm tall by 20–80 cm wide. Habitat for the species occurs on grey, clayey sand with lateritic pebbles in low woodland areas near winter-wet flats. Associated species include Running Postman (<i>Kennedia prostrata</i>), Grass Tree (<i>Xanthorrhoea preissii</i>), Cone Flowers (<i>Conostylis</i> sp.) and Dwellingup Synaphea (<i>Synaphea stenoloba</i>). Two subpopulations occur in seasonally wet Swamp Teatree (<i>Pericalymma ellipticum</i>) dominated shrubland, with Teatrees (<i>Leptospermum</i> sp.), Blue Lechenaultia (<i>Lechenaultia biloba</i>), Semaphore Sedge (<i>Mesomelaena tetragona</i>), <i>Adenanthos meisneri</i> , White Myrtle (<i>Hypocalymma angustifolium</i>) and Dwarf Sheoak (<i>Allocasuarina humilis</i>).	Unlikely due to absence of preferred habitat.

4.1.2 Threatened and Priority Ecological Communities

One TEC was identified as occurring within or near the Survey Area, namely, Banksia woodlands of the Swan Coastal Plain (Figure 4).

4.1.3 Wetlands

A small area in the northern portion of the site is mapped as a Multiple Use Wetland (UFI 6950).

The nearest CCW (UFI 14740) is mapped immediately north and adjacent to the north-east corner of the Survey Area. The CCW abuts the northern boundary of the Survey Area.

4.1.4 Bush Forever

There are no Bush Forever sites located within the Survey Area.

Bush Forever site 348 (Modong Nature Reserve and Adjacent Bushland, Oakford) is directly adjacent to the Survey Area, separated by fencing and cleared areas (firebreaks and a driveway within the Survey Area).

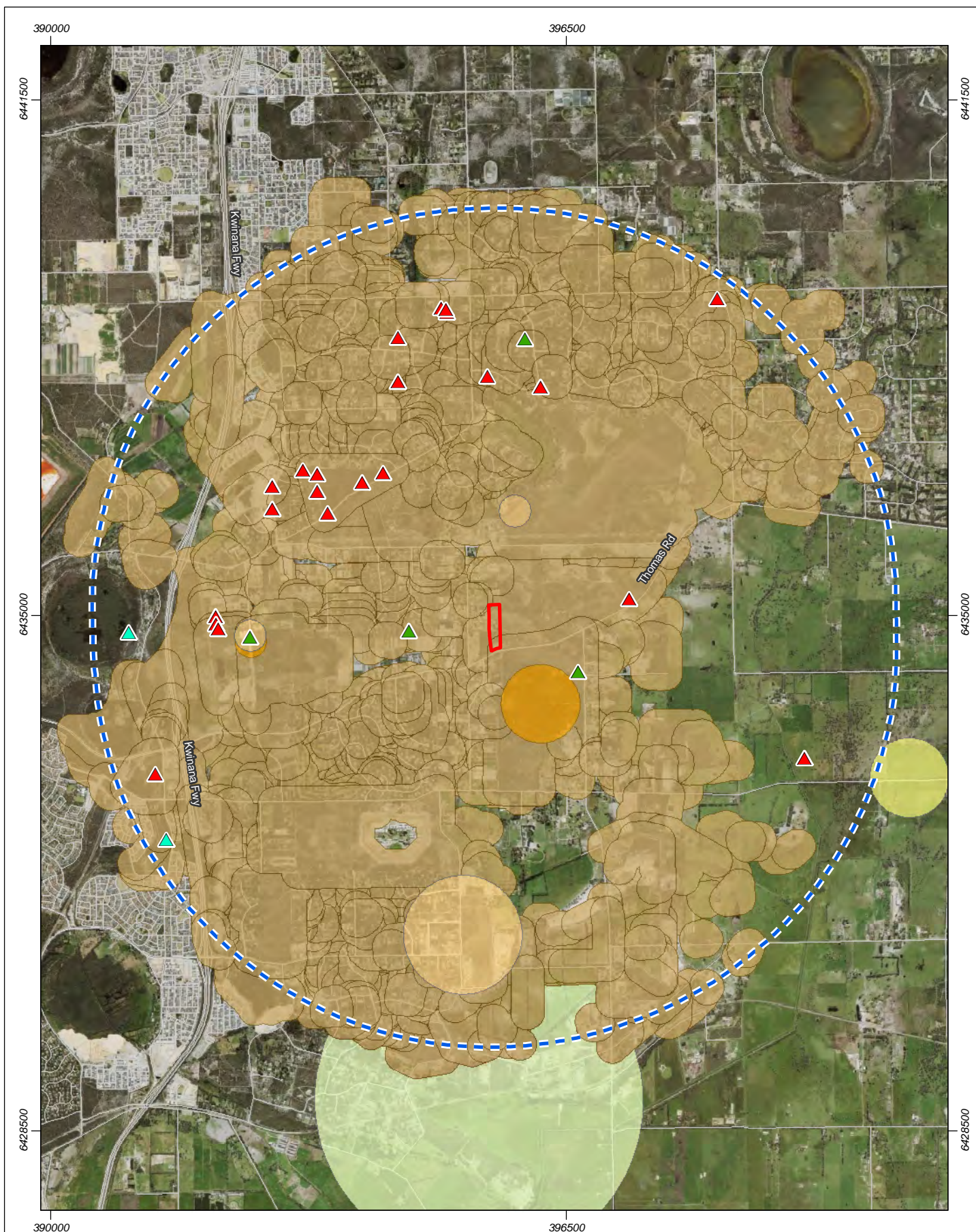


Figure 4: Location of Threatened and Priority Flora and Ecological Communities within 5 km of Survey Area

Scale 1:65,000 at A4

0 500 1,000 1,500 2,000 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 21/12/2017

Author: jcrute

Source: Landgate: Aerial imagery - 2017.

TEC/PEC: DBCA, 2017.

Path: Q:\Consult\2017\URE\URE17457\01_GIS_documents\ArcMap_documents\URE17457_G004_RevC.mxd

Legend

Threatened & Priority Flora

▲ (T) Threatened Rare Flora - Extant Taxa; T

▲ Priority 3 - Poorly Known Taxa

▲ Priority 4 - Rare Taxa

--- 5km survey area buffer

▭ Survey area

Threatened & priority ecological communities

■ Banksia Woodlands of the Swan Coastal Plain

■ Casuarina obesa association

■ Mound Springs SCP

■ SCP21c

■ SCP22

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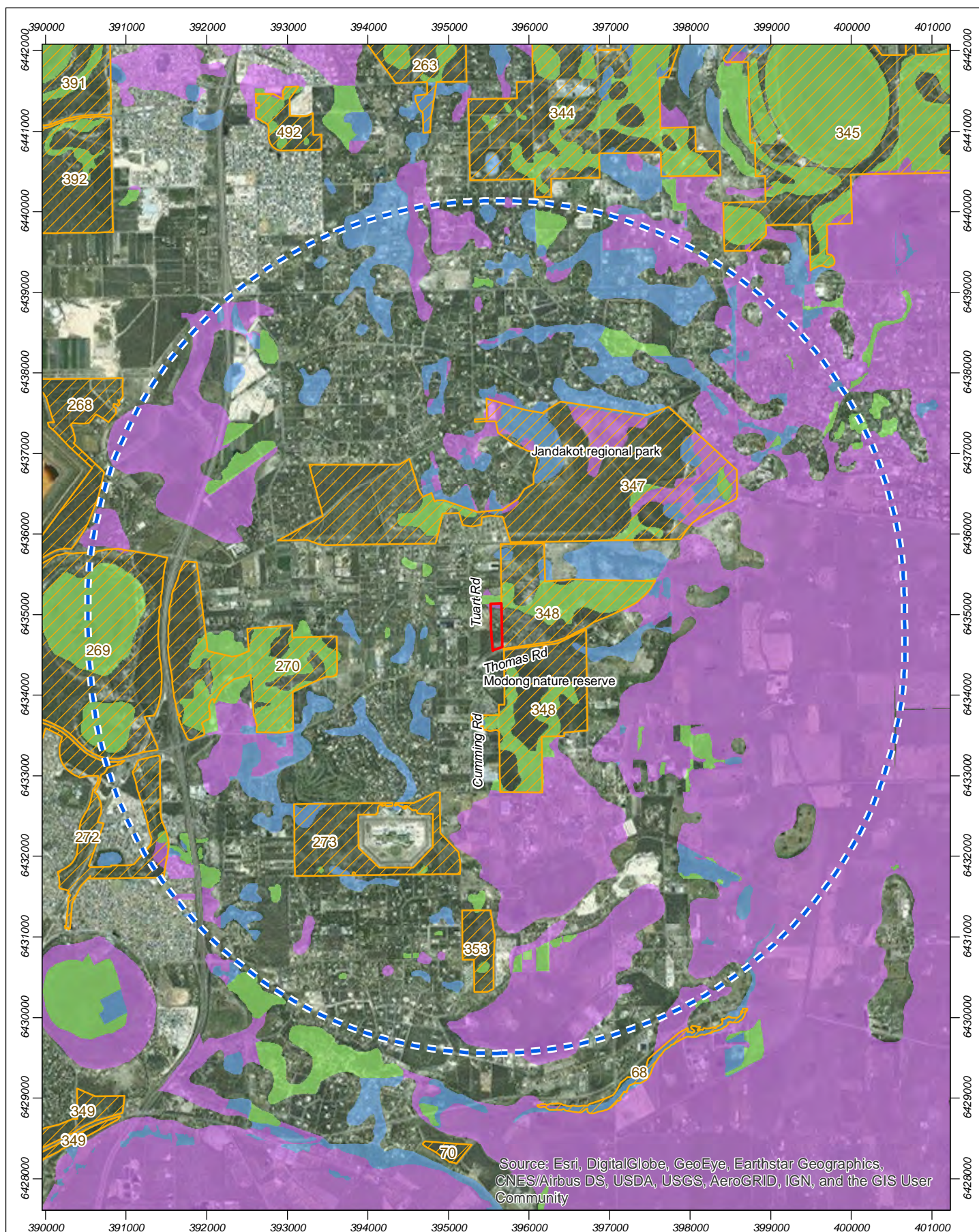


Figure 5: Wetlands and Bush Forever sites within 5 km of survey area

Scale 1:64,039 at A4
 0 500 1,000 1,500 2,000 m

Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas
 Date: 21/12/2017

Author: jcrute
 Source: Aerial: ESRI, approx. 2014. Bush Forever: DoP, 2017. Wetlands: DPAW, 2017.

Legend

- Survey area
- 5km survey area buffer
- Bush Forever sites

Wetlands

- Conservation
- Multiple Use
- Resource Enhancement

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4.2 Field assessment results

A total of 48 native vascular plant taxa from 21 plant families were recorded within the project area. The majority of taxa were recorded within the Proteaceae, Myrtaceae and Fabaceae families (Appendix 3).

4.2.1 Threatened and Priority flora

No flora species listed as Threatened under the WC Act or EPBC Act, or Priority Flora species as listed by the DBCA were recorded during the field survey.

The survey was conducted during the main flowering season for flora of the southwest botanical region (i.e. spring); however, this was outside the flowering season for the Threatened and Priority flora species identified as potentially present within the Survey Area.

Table 5: Threatened and Priority flora species potentially occurring within survey area

Species	Habitat	Flowering time	Potential habitat location within survey area
<i>Caladenia huegelii</i>	Banksia woodland	September – October	VT2
<i>Dodonaea hackettiana</i>	Sand and outcropping limestone	July – October	VT2
<i>Drakaea micrantha</i>	Sandy soils over limestone.	September – October	VT1, VT2

4.2.2 Introduced (exotic) taxa

The following six exotic taxa were also recorded within the Survey Area:

- *Avena barbata*
- *Briza maxima*
- *Carpobrotus edulis*
- *Corymbia citriodora* (planted)
- *Ehrharta calycina*
- *Gladiolus* sp.
- *Pinus* sp. (planted)
- *Ursinia anthemoides*.

Due to the degraded nature of the Survey Area, it is likely that other introduced species occur away from survey quadrats and transects.

None of the introduced species recorded were Declared Plant species in Western Australia pursuant to section 22 of the BAM Act according to the Western Australian Department of Agriculture and Food (DAFWA 2017).

4.2.3 Accumulated species – sites surveyed (species-area curve)

The species-area curve (Figure 6), based on a species accumulation analysis, was used to evaluate the adequacy of sampling (Colwell 2013). The asymptotic value was determined using Michaelis-Menten modelling. Using this analysis, the incidence based coverage estimator of species richness (ICE) was calculated to be 95.29 (Chao 2005). Based on this value, and the total of 55 species recorded during the survey, approximately 57.7% of the flora species potentially present within the survey area were recorded.

The relatively low percentage of flora species potentially present is expected due to the low number of quadrats sampled, which was appropriate for the small amount of vegetation present within the Survey Area.

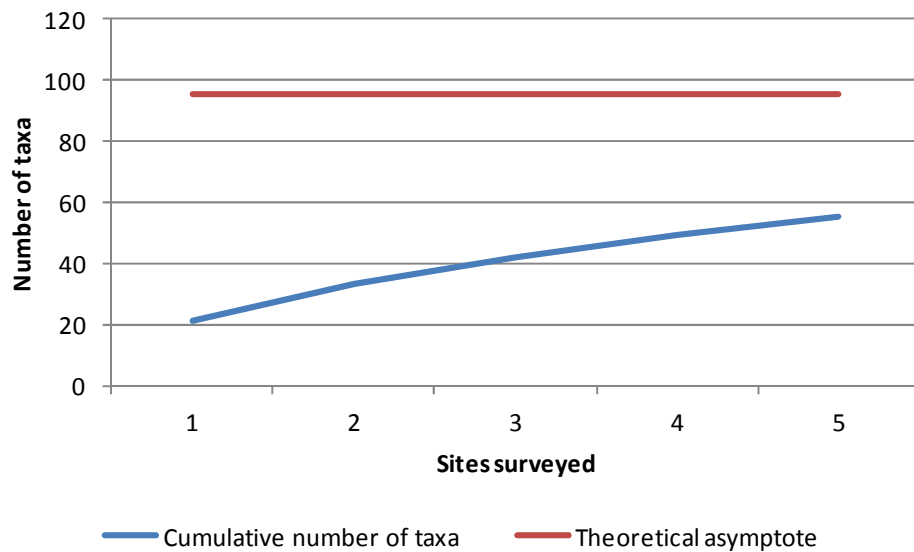


Figure 6: Averaged randomised Species Accumulation Curve

4.2.4 Vegetation types

Two native vegetation types were recorded within the Survey Area (Table 6, Figure 7). Cleared and/or developed areas were also observed and have been included in Table 6 below.

Table 6: Vegetation type and condition within Survey Area

Vegetation type	Description	Condition	Area (ha) within project area
VT1	Open shrubland of <i>Adenanthos cygnorum</i> and <i>Banksia ilicifolia</i> over <i>Xanthorrhoea preissii</i> and <i>Kunzea glabrescens</i> over closed herbland of <i>Dasypogon bromeliifolius</i> , * <i>Ehrharta calycina</i> , and * <i>Ursinia anthemoides</i>	Good - Degraded	1.46
VT2	Open low woodland of <i>Banksia attenuata</i> , <i>Banksia menziesii</i> and <i>Banksia ilicifolia</i> over <i>Xanthorrhoea preissii</i> and <i>Adenanthos cygnorum</i> over closed herbland of <i>Phlebocarya ciliata</i> , <i>Stirlingia latifolia</i> and <i>Patersonia occidentalis</i>	Very Good	1.69
C	Cleared and / or developed	Completely Degraded	4.28
Total			7.44

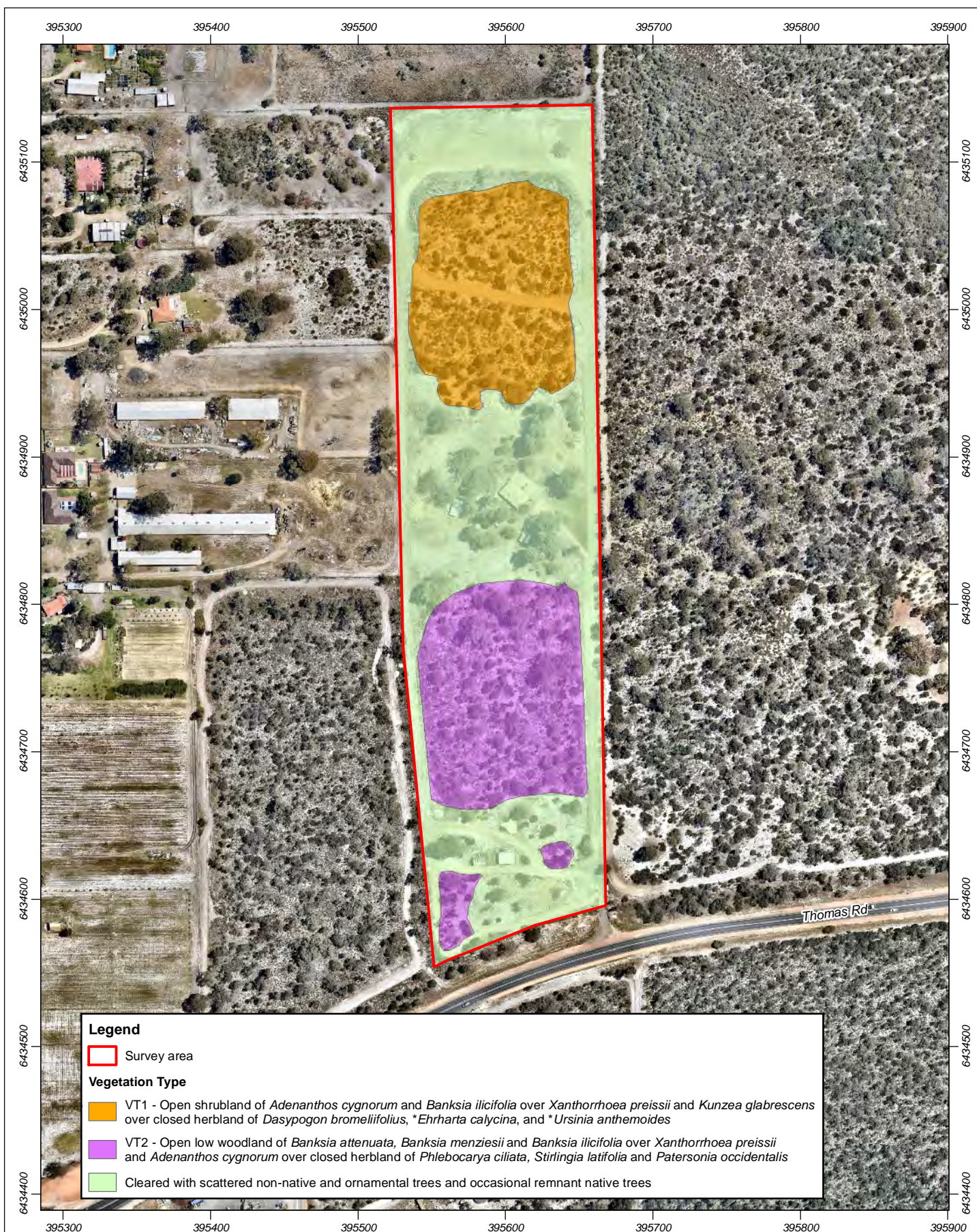


Figure 7: Vegetation Types (VTs) mapped within the survey area

Scale 1:3,500 at A4



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 19/12/2017

Author: jcrute

Source: Aerial; Nearmap, flown 10/2017.

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4.2.5 Threatened and Priority Ecological Communities

The results of the hierarchical clustering provided limited results for VT1 (quadrats 1 and 2). Quadrat 2 of VT1 showed affiliation with SCP 21c based on species composition; however, field observations indicated that this vegetation type was severely disturbed, with overstorey comprising regrowth of *Banksia ilicifolia*, and heavy weed infestation in the understorey. Historical aerial imagery also indicates disturbance to this portion of the Survey Area.

Results indicated affiliation of all quadrats (quadrats 3, 4 and 5) within VT2 to FCT 21c, as shown in Table 7 and the partial dendrograms in Appendix 4. As such, vegetation within VT2 can unequivocally be assigned to FCT 21c, which is described as 'low lying *Banksia attenuata* woodlands or shrublands' (Gibson et al. 1994).

Table 7: Results of hierarchical analysis for plots from the Survey Area

Quadrat	First Fusion	First Group Fusion	Likely FCT
1	6	6	undetermined (weedy)
2	21c	21c	undetermined (regrowth, weedy)
3	4	21c	?21c
4	21c	21c	21c
5	21c	21c	21c

Community type 21c occurs sporadically between Gingin and Bunbury, and has a mean species richness of 40.5. Largely restricted to the Bassendean systems, this subgroup tends to occupy lower lying sites and occurs either a woodland or shrubland, and is variously dominated by *Melaleuca preissiana*, *Banksia attenuata*, *B. menziesii*, *Regelia ciliata*, *Eucalyptus marginata* or *Corymbia calophylla*, either singly or in combination.

Vegetation within VT2 also met diagnostic criteria provided in the approved conservation advice for the *Banksia woodlands of the Swan Coastal Plain* TEC (Table 8).

Table 8: Characteristics of the Banksia woodland within the Subject Site compared to the key diagnostic criteria as per TSSC (2016)

Key diagnostic criteria (TSSC 2016)	Banksia woodlands within the survey area
<u>Location:</u> Occurs in the Swan Coastal Plain or Jarrah Forest IBRA bioregions.	Yes. Banksia woodlands within the Survey Area occur on the Swan Coastal Plain.
<u>Soils and landform:</u> Occurs on: <ul style="list-style-type: none"> well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands sandy colluviums and aeolian sands of the Ridge Hill Shelf, Whicher Scarp and Dandaragan Plateau transitional substrates and sandflats. 	Yes. Banksia woodlands within the survey area occur on Bassendean sands.
<u>Structure:</u> Low woodland to forest with: <ul style="list-style-type: none"> a distinctive upper sclerophyllous layer of low trees (occasionally large shrubs more than 2 m tall), typically dominated or co-dominated by one or more of the banksia species identified below emergent trees of medium or tall (>10 m) height. <i>Eucalyptus</i> or <i>Allocasuarina</i> species may sometimes be present above the banksia canopy an often highly species-rich understorey. 	Yes. Banksia woodlands within the survey area represent a low woodland-woodland structure.

Key diagnostic criteria (TSSC 2016)	Banksia woodlands within the survey area
<u>Composition:</u> Contains at least one of the following species: <ul style="list-style-type: none"> • <i>Banksia attenuata</i> • <i>Banksia menziesii</i> • <i>Banksia prionotes</i> • <i>Banksia ilicifolia</i>. 	Yes. Banksia woodlands within the survey area contain <i>Banksia attenuata</i> and <i>B. menziesii</i> .
<u>Condition (Keighery 1994):</u> 'Pristine': no minimum patch size 'Excellent': 0.5 ha 'Very Good': 1 ha 'Good': 2 ha.	Yes. Banksia woodlands within the Survey Area are predominantly in Very Good condition, with smaller areas in Degraded condition. The patch of Banksia woodland in Very Good condition comprises 1.56 ha.

4.2.6 Vegetation condition

Vegetation condition ranged from Completely Degraded throughout the cleared and developed areas, to Very Good in the largest section of VT2. (Keighery 1994, Figure 9).

Table 9: Area (ha) covered by each vegetation condition category within the project area

Condition rating	Area (ha)
Very Good	1.56
Good – Degraded	1.46
Degraded	0.14
Completely Degraded (Cleared)	4.28
Total	7.44



Figure 8: FCTs, PECs and TECs mapped within the survey area

Scale 1:3,500 at A4

0 25 50 75 100 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 19/12/2017

Author: jcrute

Source: Aerial: Nearmap, flown 10/2017.

Legend

Survey area

Vegetation type

FCT undetermined

SCP 21c: Low lying *Banksia attenuata* woodlands or shrublands

no FCT

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Figure 9: Vegetation condition within the survey area

Scale 1:3,500 at A4

0 25 50 75 100 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 8/12/2017

Author: jcrute

Source: Aerial: Nearmap, flown 10/2017.

Legend

Survey area

Vegetation condition

VG: Very Good

G-D: Good to Degraded

D: Degraded

CD: Completely Degraded

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4.3 Black cockatoo habitat

Based on the location of the Survey Area, Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo are considered likely to utilise the site. Distribution mapping of Baudin's Black Cockatoo indicates this species also potentially uses the site; however, the Survey Area is located at the western margins of the distribution mapping (DEE 2017b).

Twelve potential nesting habitat trees were recorded within the project area (*Eucalyptus marginata*). Of these, three trees contained visible hollows of at least 10 cm diameter.

Habitat foraging quality of each vegetation type is shown in Table 11 and was determined using the scale described in Table 10. Habitat foraging quality and location of potential nesting habitat trees is illustrated in Figure 10.

Table 10: Definitions of black cockatoo foraging habitat quality

Foraging quality	Justification
Excellent	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) and presence of food sources at several strata (i.e. canopy, midstorey and understorey).
Good	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) but food sources only present at one or two strata (i.e. canopy and midstorey).
Moderate	Moderate foraging value density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 20-40%) and food sources only present at one or two strata (i.e. canopy and midstorey).
Poor	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy).
Very poor	Very low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species <10%) and presence of food sources at only one stratum (i.e. canopy).
Nil	Cleared areas - no suitable vegetation present.

Table 11: Vegetation types and black cockatoo foraging species within the project area

Vegetation type	Black cockatoo foraging species	Foraging quality	Area (ha)
VT1	<u>BBC</u> – Nil <u>CBC</u> – <i>Jacksonia furcellata</i> <u>FRTBC</u> - Nil	<ul style="list-style-type: none"> • Nil (BBC) • Very poor (CBC) • Nil (FRTBC) 	1.46
VT2	<u>BBC</u> – <i>Allocasuarina fraseriana</i> , <i>Eucalyptus marginata</i> <u>CBC</u> – <i>Allocasuarina fraseriana</i> , <i>Banksia attenuata</i> , <i>Banksia menziesii</i> , <i>Eucalyptus marginata</i> , <i>Eucalyptus tottiana</i> , <i>Xanthorrhoea preissii</i> <u>FRTBC</u> – <i>Allocasuarina fraseriana</i> , <i>Eucalyptus marginata</i> .	<ul style="list-style-type: none"> • Very poor (BBC) • Moderate (CBC) • Very poor (FRTBC) 	1.69
C	<u>BBC</u> – <i>Eucalyptus marginata</i> , ^ <i>Pinus</i> sp. <u>CBC</u> – <i>Eucalyptus marginata</i> , ^ <i>Corymbia citriodora</i> , ^ <i>Pinus</i> sp. <u>FRTBC</u> - <i>Eucalyptus marginata</i>	<ul style="list-style-type: none"> • Very poor (BBC) • Very poor (CBC) • Very poor (FRTBC) 	4.28
TOTAL			7.44

A breakdown of each foraging habitat quality rating is shown in Table 12.

Table 12: Total area of foraging habitat for each black cockatoo species

Species	Habitat quality (ha)	
	Very poor	Moderate
Baudin's Black Cockatoo	5.97	-
Carnaby's Black Cockatoo	5.74	1.69
Forest Red-tailed Black Cockatoo	5.97	-



Figure 10: Black cockatoo habitat

Scale 1:3,500 at A4

0 25 50 75 100 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 19/12/2017

Author: jcrute

Source: Aerial: Nearmap, flown 10/2017.

Legend

- Significant trees
- Survey area

Black Cockatoo habitat quality

- Very poor quality (CBC, FRTBC, BBC)
- Very poor quality (FRTBC, BBC), moderate quality (CBC)
- Very poor quality (CBC only)

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5. Discussion

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

The Survey Area falls within one broad-scale vegetation type, Bassendean 1001 Figure 3), of which 21.6% of the pre-European extent remains, as at the most recent assessment in 2016 (Government of Western Australia 2016). Two native VTs were mapped within the Survey Area, as well as cleared and developed areas containing deliberately planted vegetation, as follows:

- one area of remnant native vegetation in the southern portion of the Survey Area, described as open low woodland of *Banksia attenuata*, *Banksia menziesii* and *Banksia ilicifolia* over *Xanthorrhoea preissii* and *Adenanthos cygnorum* over closed herbland of *Phlebocarya ciliata*, *Stirlingia latifolia* and *Patersonia occidentalis*. Smaller, more highly degraded patches of this vegetation type were also present in the southern section of the Survey Area
- an area of native vegetation regrowth in the north of the Survey Area. This vegetation appeared to have revegetated after historical disturbance and was described as open shrubland of *Adenanthos cygnorum* and *Banksia ilicifolia* over *Xanthorrhoea preissii* and *Kunzea glabrescens* over closed herbland of *Dasypogon bromeliifolius*, **Ehrharta calycina*, and **Ursinia anthemoides*.

The remainder of the Survey Area had been cleared and contained ornamental plants and occasional remnant native trees around the dwelling.

Forty-eight native vascular plant taxa from 21 plant families as well as six exotic taxa were recorded within quadrats in the Survey Area. No Declared Plant species pursuant to section 22 of the BAM Act were recorded within the survey area.

The following Threatened and Priority Flora species have the potential to occur within the survey area (Table 4 and Table 5) based on habitat requirements:

- *Caladenia huegelii* (T)
- *Dodonaea hackettiana* (P4)
- *Drakaea micrantha* (T).

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) were recorded within the Survey Area. Additionally, no Priority flora species as listed by Western Australian Herbarium (1998-), including those listed above, were recorded.

Statistical analyses of vegetation data from the survey area determined that FCT 21c was present within VT2. This FCT is included as one of the FCTs constituting the *Banksia woodlands of the Swan Coastal Plain* TEC, which is listed as Endangered under the EPBC Act (TSSC 2016).

Vegetation condition within the survey area ranged from Completely Degraded to Very Good (Keighery 1994). Generally, the areas rated as Completely Degraded corresponded with cleared tracks, firebreaks, and the area surrounding the dwelling. Vegetation in Very Good condition occurred in the southern portion of the Survey Area (VT2), which was the only area containing remnant native vegetation. VT2 was similar in composition to the section of Bush Forever site 348 directly adjacent to the Survey Area, as well as vegetation in the lot directly to the west of the Survey Area.

Twelve potential nesting habitat trees (*Eucalyptus marginata*) were recorded within the Survey Area, of which three contained hollows >10 cm in diameter. The Survey Area contained 7.44 ha of potential foraging habitat for Carnaby's Black Cockatoo (rated largely as very poor quality), of which 5.97 ha was also potential foraging habitat for Forest Red-tailed Black Cockatoo (very poor quality) and Baudin's Black Cockatoo (very poor quality).

6. Assessment against the ten clearing principles

An assessment of the proposed clearing against the ten clearing principles outlined in Schedule 5 of the EP Act is provided in Table 13. This assessment demonstrates that the proposed removal of 2.66 ha of native vegetation in the Survey Area (Proposed Clearing Area) is not at variance with any of the ten clearing principles. As such, Urban Resources anticipates that the proposed clearing of 2.66 ha of native vegetation can occur.

Table 13: Assessment against the ten clearing principles

Principle	Assessment	Conclusion
Native vegetation should not be cleared if it comprises a high level of biological diversity.	<p>No Threatened or Priority flora species were recorded in the Proposed Clearing Area.</p> <p>Two vegetation types were identified in the Proposed Clearing Area (2.66 ha), a description and its extent in the Proposed Clearing Area includes the following:</p> <ul style="list-style-type: none"> VT1: 1.34 ha of open shrubland of <i>Adenanthos cygnorum</i> and <i>Banksia ilicifolia</i> over <i>Xanthorrhoea preissii</i> and <i>Kunzea glabrescens</i> over closed herbland of <i>Dasypogon bromeliifolius</i>, <i>Ehrharta calycina</i>, and <i>Ursinia anthemoides</i> VT2: 1.32 ha of open low woodland of <i>Banksia attenuata</i>, <i>Banksia menziesii</i> and <i>Banksia ilicifolia</i> over <i>Xanthorrhoea preissii</i> and <i>Adenanthos cygnorum</i> over closed herbland of <i>Phlebocarya ciliata</i>, <i>Stirlingia latifolia</i> and <i>Patersonia occidentalis</i> <p>VT2 was rated as Very Good condition and met the diagnostic criteria for the <i>Banksia woodlands of the Swan Coastal Plain</i> TEC (Table 8).</p> <p>Given that the vegetation in the survey area constitutes the Banksia Woodland TEC, the proposed clearing may be at variance to this principle. However, due to the small size of the area of clearing alongside an already cleared areas, the impacts can be considered to be minimal.</p>	The proposed clearing is unlikely to be at variance with this principle. The vegetation does not contain a high level of biological diversity and is well represented locally.
Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	<p>Although the Proposed Clearing Area contains potential habitat for conservation listed species, removal of this habitat is not expected to result in a significant impact to any of the species, given the availability of continuous areas of protected habitat in the Mariginiup area.</p> <p>The proposed clearing of up to 2.66 ha of vegetation will result in some level of impact to fauna species potentially occurring in the area, however the clearing will not greatly restrict the habitat available for these species and due to the mobile nature of the species that may occur, any impacts are not expected to be significant.</p> <p>The habitat proposed to be removed is not considered to be habitat critical for the survival of any of the conservation significant species occurring or potentially occurring in the clearing area. The Proposed Clearing Area is located in Mariginiup where there are large continuous areas of protected habitat.</p>	Removal of vegetation within the Proposed Clearing Area is not considered to be at variance with this principle.
Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No Threatened flora species were recorded in the Proposed Clearing Area during the April survey, or have previously been identified within the Proposed Clearing Area (DBCA 2018).	Removal of vegetation within the Proposed Clearing Area is not considered to be at variance with this principle.

Principle	Assessment	Conclusion
Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	<p>Vegetation in the proposed clearing area was assessed against the key diagnostic criteria for the <i>Banksia Woodlands of the Swan Coastal Plain</i> TEC (TSSC 2016). VT1 and VT3 met the diagnostic criteria for this TEC.</p> <p>Therefore, the Proposed Clearing Area comprises 1.32 ha of vegetation (VT2) that forms part of the <i>Banksia Woodlands of the Swan Coastal Plain</i> TEC.</p> <p>Due to the small area of clearing (2.66 ha) alongside an already cleared track of vegetation that is representative of the <i>Banksia Woodlands of the Swan Coastal Plain</i> TEC, it is not likely that clearing of this vegetation will have a major impact on the ongoing maintenance of this TEC.</p> <p>A referral under the EPBC Act was undertaken for the proposed clearing (2017/8136). The Department of Energy and Environment determined the proposed action to be 'Not a Controlled Action' with no further assessment required.</p>	The proposed clearing is unlikely to be at variance with this principle.
Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	<p>A total of up to 2.66 ha of remnant vegetation ranging from Very Good to Degraded is proposed to be permanently cleared.</p> <p>Based on regional vegetation complex mapping (Hedde et al. 1980) the Survey Area contains the 'Bassendean Complex Central and South' vegetation complex, as illustrated in Figure 3, of which 25.7% remains in the IBRA bioregion. Locally, within the Shire of Serpentine-Jarrahdale 31.3% remains. The clearing of 2.66 ha of vegetation represents <0.01% of the current extent and would not significantly reduce the remaining extent of this vegetation complex.</p> <p>The 2.66 ha of vegetation proposed to be cleared is has been subject to partial clearing and degradation. Vegetation adjacent to the proposed clearing area remains intact. Given this, the proposed clearing area is not considered to be a significant remnant of vegetation</p>	Removal of vegetation within the survey area is not considered to be at variance with this principle.
Native vegetation should not be cleared if it is growing in or in association with a watercourse or wetland.	No wetlands occur within the proposed clearing area.	Removal of vegetation within the Proposed clearing area is not considered to be at variance with this principle.
Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The proposed clearing will affect vegetation previously subject to partial clearing. The proposed clearing will facilitate proposed sand extraction activities on the site. Extraction will occur to a suitable depth above the groundwater table (as determined by the Shire of Serpentine- Jarrahdale), to allow future use of the site for rural residential purposes.	Removal of vegetation within the Proposed Clearing Area is not considered to be at variance with this principle.
Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	The proposed clearing area directly west of Bush Forever (BF) site 348 which abuts the eastern project area boundary. Given the partial clearing and disturbance of the remaining vegetation, no new impacts to the environmental values of the adjacent conservation area are likely to occur as a result of the proposed clearing.	Removal of vegetation within the Proposed Clearing Area is not considered to be at variance with this principle.

Principle	Assessment	Conclusion
Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	No surface water features exist within the Proposed Clearing Area. Due to the small extent of the proposed clearing, it is unlikely that the clearing of vegetation will contribute to an increase in groundwater salinity or cause deterioration in groundwater quality.	Removal of vegetation within the Proposed Clearing Area is not considered to be at variance with this principle, as the proposed clearing of native vegetation will affect a relatively small area (2.66 ha). Furthermore, the proposed clearing is unlikely to have any impact on the quality of surface water or groundwater.
Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the intensity of flooding.	The proposed clearing will affect a small amount of existing vegetation and is not part of, or associated with, a flood management zone, a drainage basin or creek line.	Removal of vegetation within the Proposed Clearing Area is not considered to be at variance with this principle, as the area to be cleared is relatively small, and is not expected to cause or exacerbate flooding in the area.

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Appendix 1
Conservation significant flora and
ecological community definitions

Conservation Codes for Western Australia (Western Australian Herbarium 1998-)

Under the *Wildlife Conservation Act* (1950), 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. Schedules 1 and 2 deal with those that are threatened and those that are presumed extinct, respectively.

T: Threatened Flora (Declared Rare Flora – Extant)

Species which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*).

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List Criteria:

- CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild
- EN: Endangered – considered to be facing a very high risk of extinction in the wild
- VU: Vulnerable – considered to be facing a high risk of extinction in the wild
- X: Presumed Extinct Flora (Declared Rare Flora – Extinct).

Species that have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the *Wildlife Conservation Act 1950*).

Priority Flora

Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Species that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.

Priority One: Poorly-known Species

Species that are known from one or a few collections or sight records (generally less than 5), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority Two: Poorly-known Species

Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority Three: Poorly-known Species

Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities 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 localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.

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

- 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
- Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable
- Species that have been removed from the list of threatened species during the past 5 years for reasons other than taxonomy.

Definition of Threatened Ecological Communities (DEC 2010)

Presumed Totally Destroyed (PD)

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

- records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
- all occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

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

1. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply:
 - (a) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years)
 - (b) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.
2. Current distribution is limited, and one or more of the following apply:
 - (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years)
 - (b) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
 - (c) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.
3. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

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

1. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply:
 - (a) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years)
 - (b) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

2. Current distribution is limited, and one or more of the following apply"
 - (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years)
 - (b) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes
 - (c) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.
3. The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

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

1. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
2. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
3. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definition of Priority Ecological Communities (DEC 2010)

Priority One: Poorly-known ecological communities

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

Priority Two: Poorly-known ecological communities

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

Priority Three: Poorly known ecological communities

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

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

Priority Four

Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. These include:

1. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.
2. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
3. Ecological communities that have been removed from the list of threatened communities during the past five years.

Appendix 2
Desktop assessment results (Parks and
Wildlife 2007-, DEE 2017c)

NatureMap Species Report

Created By Guest user on 30/11/2017

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 53' 31" E, 32° 13' 04" S
Buffer 5km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	346	1637
Priority 3	4	11
Priority 4	2	2
Rare or likely to become extinct	3	22
TOTAL	355	1672

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Rare or likely to become extinct				
1.	1596 <i>Caladenia huegelii</i> (Grand Spider Orchid)		T	
2.	1637 <i>Diuris purdiei</i> (Purdie's Donkey Orchid)		T	
3.	1639 <i>Drakaea elastica</i> (Glossy-leaved Hammer Orchid)		T	
Priority 3				
4.	16245 <i>Cyathochaeta teretifolia</i>		P3	
5.	20462 <i>Jacksonia gracillima</i>		P3	
6.	8163 <i>Pithocarpa corymbulosa</i> (Corymbose Pithocarpa)		P3	
7.	25800 <i>Stylidium paludicola</i>		P3	
Priority 4				
8.	141 <i>Aponogeton hexatepalus</i> (Stalked Water Ribbons)		P4	
9.	4763 <i>Dodonaea hackettiana</i> (Hackett's Hopbush)		P4	
Non-conservation taxon				
10.	15466 <i>Acacia applanata</i>			
11.	3374 <i>Acacia huegelii</i>			
12.	3502 <i>Acacia pulchella</i> (Prickly Moses)			
13.	15481 <i>Acacia pulchella</i> var. <i>glaberrima</i>			
14.	3557 <i>Acacia stenoptera</i> (Narrow Winged Wattle)			
15.	3602 <i>Acacia willdenowiana</i> (Grass Wattle)			
16.	6203 <i>Actinotus glomeratus</i>			
17.	1775 <i>Adenanthos cygnorum</i> (Common Woollybush)			
18.	11837 <i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i> (Common Woollybush)			
19.	1791 <i>Adenanthos obovatus</i> (Basket Flower)			
20.	184 <i>Aira caryophyllea</i> (Silvery Hairgrass)	Y		
21.	<i>Aira caryophyllea/cupaniana</i> group			
22.	185 <i>Aira cupaniana</i> (Silvery Hairgrass)	Y		
23.	187 <i>Aira praecox</i> (Early Hairgrass)	Y		
24.	1728 <i>Allocasuarina fraseriana</i> (Sheoak, Kondil)			
25.	4585 <i>Amperea ericoides</i>			
26.	20184 <i>Amphipogon laguroides</i> subsp. <i>laguroides</i>			
27.	200 <i>Amphipogon turbinatus</i>			
28.	1060 <i>Anarthria laevis</i>			
29.	1411 <i>Anigozanthos manglesii</i> (Mangles Kangaroo Paw, Kurulbrang)			
30.	3686 <i>Aotus cordifolia</i>			
31.	3688 <i>Aotus gracillima</i>			
32.	3692 <i>Aotus procumbens</i>			
33.	1117 <i>Aphelia cyperoides</i>			
34.	7838 <i>Arctotheca calendula</i> (Cape Weed, African Marigold)	Y		
35.	1264 <i>Arnocrinum preissii</i>			
36.	8779 <i>Asparagus asparagoides</i> (Bridal Creeper)	Y		
37.	20283 <i>Astartea scoparia</i> (Common Astartea)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
38.	<i>Asteraceae</i> sp.			Y
39.	<i>Asterella drummondii</i>			
40.	6334 <i>Astroloma pallidum</i> (Kick Bush)			
41.	17234 <i>Austrostipa compressa</i>			
42.	17240 <i>Austrostipa flavesceus</i>			
43.	233 <i>Avena barbata</i> (Bearded Oat)	Y		
44.	235 <i>Avena sativa</i> (Common Oat)	Y		
45.	18280 <i>Babiana nana</i>	Y		
46.	36441 <i>Babingtonia camphorosmae</i> (Camphor Myrtle)			
47.	1800 <i>Banksia attenuata</i> (Slender Banksia, Piara)			
48.	1822 <i>Banksia ilicifolia</i> (Holly-leaved Banksia)			
49.	1834 <i>Banksia menziesii</i> (Firewood Banksia)			
50.	748 <i>Baumea vaginalis</i> (Sheath Twigrush)			
51.	749 <i>Bolboschoenus caldwellii</i> (Marsh Club-rush)			
52.	4413 <i>Boronia crenulata</i> (Aniseed Boronia)			
53.	16636 <i>Boronia crenulata</i> subsp. <i>viminea</i>			
54.	3710 <i>Bossiaea eriocarpa</i> (Common Brown Pea)			
55.	6341 <i>Brachyloma preissii</i> (Globe Heath)			
56.	7878 <i>Brachyscome iberidifolia</i>			
57.	3000 <i>Brassica tournefortii</i> (Mediterranean Turnip)	Y		
58.	244 <i>Briza maxima</i> (Blowfly Grass)	Y		
59.	245 <i>Briza minor</i> (Shivery Grass)	Y		
60.	1383 <i>Burchardia bairdiae</i>			
61.	12770 <i>Burchardia congesta</i>			
62.	1276 <i>Caesia micrantha</i> (Pale Grass Lily)			
63.	1277 <i>Caesia occidentalis</i>			
64.	<i>Caesia</i> sp.			
65.	1586 <i>Caladenia discoidea</i> (Dancing Orchid)			
66.	1592 <i>Caladenia flava</i> (Cowslip Orchid)			
67.	15348 <i>Caladenia flava</i> subsp. <i>flava</i>			
68.	1605 <i>Caladenia marginata</i> (White Fairy Orchid)			
69.	17760 <i>Caladenia nobilis</i>			
70.	<i>Caladenia</i> sp.			
71.	2848 <i>Calandrinia corrigioloides</i> (Strap Purslane)			
72.	19309 <i>Calectasia narragara</i>			
73.	5415 <i>Calothamnus lateralis</i>			
74.	5439 <i>Calytrix angulata</i> (Yellow Starflower)			
75.	5458 <i>Calytrix flavesceus</i> (Summer Starflower)			
76.	5460 <i>Calytrix fraseri</i> (Pink Summer Calytrix)			
77.	2795 <i>Carpobrotus edulis</i> (Hottentot Fig)	Y		
78.	1162 <i>Cartonema philydroides</i>			
79.	2952 <i>Cassytha glabella</i> (Tangled Dodder Laurel)			
80.	2954 <i>Cassytha micrantha</i>			
81.	2957 <i>Cassytha racemosa</i> (Dodder Laurel)			
82.	11799 <i>Cassytha racemosa</i> forma <i>racemosa</i>			
83.	1121 <i>Centrolepis aristata</i> (Pointed Centrolepis)			
84.	1125 <i>Centrolepis drummondiana</i>			
85.	1132 <i>Centrolepis mutica</i>			
86.	1280 <i>Chamaescilla corymbosa</i> (Blue Squill)			
87.	7937 <i>Cirsium vulgare</i> (Spear Thistle, Scotch Thistle)	Y		
88.	4550 <i>Comesperma calymega</i> (Blue-spike Milkwort)			
89.	4555 <i>Comesperma integerrimum</i>			
90.	4564 <i>Comesperma virgatum</i> (Milkwort)			
91.	15611 <i>Conospermum stoechadis</i> subsp. <i>stoechadis</i> (Common Smokebush)			
92.	6348 <i>Conostephium pendulum</i> (Pearl Flower)			
93.	6349 <i>Conostephium preissii</i>			
94.	1418 <i>Conostylis aculeata</i> (Prickly Conostylis)			
95.	11826 <i>Conostylis aculeata</i> subsp. <i>aculeata</i>			
96.	1436 <i>Conostylis juncea</i>			
97.	7941 <i>Conyza parva</i>	Y		
98.	<i>Conyza</i> sp.			
99.	1285 <i>Corynotheca micrantha</i> (Sand Lily)			
100.	3137 <i>Crassula colorata</i> (Dense Stonecrop)			
101.	11563 <i>Crassula colorata</i> var. <i>colorata</i>			
102.	7454 <i>Dampiera linearis</i> (Common Dampiera)			
103.	7462 <i>Dampiera pedunculata</i>			
104.	35618 <i>Darwinia</i> sp. <i>Karonie</i> (K. Newbey 8503)			
105.	1218 <i>Dasypogon bromeliifolius</i> (Pineapple Bush)			
106.	3807 <i>Daviesia divaricata</i> (Marno)			
107.	3832 <i>Daviesia physodes</i>			

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
108.	3845	<i>Daviesia triflora</i>			
109.	17691	<i>Desmocladius fasciculatus</i>			
110.	16595	<i>Desmocladius flexuosus</i>			
111.	1259	<i>Dianella revoluta</i> (Blueberry Lily)			
112.	17838	<i>Dielsia stenostachya</i>			
113.	19649	<i>Disa bracteata</i>	Y		
114.	7054	<i>Dischisma arenarium</i>	Y		
115.	7055	<i>Dischisma capitatum</i> (Woolly-headed Dischisma)	Y		
116.	11049	<i>Diuris corymbosa</i>			
117.		<i>Diuris corymbosa/magnifica</i>			
118.	12939	<i>Diuris magnifica</i>			
119.	3095	<i>Drosera erythrorhiza</i> (Red Ink Sundew)			
120.	3097	<i>Drosera gigantea</i> (Giant Sundew)			
121.	16244	<i>Drosera gigantea</i> subsp. <i>geniculata</i>			
122.	3098	<i>Drosera glanduligera</i> (Pimpernel Sundew)			
123.	3106	<i>Drosera macrantha</i> (Bridal Rainbow)			
124.	14298	<i>Drosera macrantha</i> subsp. <i>macrantha</i>			
125.	3109	<i>Drosera menziesii</i> (Pink Rainbow)			
126.	13216	<i>Drosera menziesii</i> subsp. <i>penicillaris</i>			
127.	13189	<i>Drosera oreopodion</i>			
128.	13188	<i>Drosera paleacea</i> subsp. <i>paleacea</i>			
129.	3118	<i>Drosera pallida</i> (Pale Rainbow)			
130.	29178	<i>Drosera porrecta</i>			
131.	3124	<i>Drosera pulchella</i> (Pretty Sundew)			
132.	8911	<i>Drosera rosulata</i>			
133.		<i>Drosera</i> sp. "climbing"			
134.	3135	<i>Drosera zonaria</i> (Painted Sundew)			
135.		<i>Ehrharta ?longiflora</i>			Y
136.	347	<i>Ehrharta calycina</i> (Perennial Veldt Grass)	Y		
137.	349	<i>Ehrharta longiflora</i> (Annual Veldt Grass)	Y		
138.		<i>Ehrharta</i> sp.			
139.	1643	<i>Elythranthera brunonis</i> (Purple Enamel Orchid)			
140.	11756	<i>Epilobium billardiareanum</i> subsp. <i>cinereum</i> (Variable Willow Herb)			
141.	6132	<i>Epilobium ciliatum</i>	Y		
142.	13950	<i>Eremaea asterocarpa</i> subsp. <i>asterocarpa</i>			
143.	6219	<i>Eryngium pinnatifidum</i> (Blue Devils)			
144.	5708	<i>Eucalyptus marginata</i> (Jarrah, Djara)			
145.	13547	<i>Eucalyptus marginata</i> subsp. <i>marginata</i> (Jarrah)			
146.	5763	<i>Eucalyptus rudis</i> (Flooded Gum, Kulurda)			
147.	5790	<i>Eucalyptus todtiana</i> (Coastal Blackbutt)			
148.	3872	<i>Euchilopsis linearis</i> (Swamp Pea)			
149.	15137	<i>Euchiton sphaericus</i>			
150.	20014	<i>Euphorbia hyssopifolia</i>	Y		
151.	4638	<i>Euphorbia peplus</i> (Petty Spurge)	Y		
152.	4648	<i>Euphorbia terracina</i> (Geraldton Carnation Weed)	Y		
153.	3880	<i>Eutaxia virgata</i>			
154.	835	<i>Evandra pauciflora</i>			
155.		<i>Fumaria</i> sp.			
156.	7323	<i>Galium murale</i> (Small Goosegrass)	Y		
157.	3936	<i>Genista linifolia</i> (Flaxleaf Broom)	Y		
158.	1520	<i>Gladiolus caryophyllaceus</i> (Wild Gladiolus)	Y		
159.	3957	<i>Gompholobium tomentosum</i> (Hairy Yellow Pea)			
160.	6161	<i>Gonocarpus pithyoides</i>			
161.	7538	<i>Goodenia pulchella</i>			
162.	2788	<i>Gyrostemon subnudus</i>			
163.		<i>Haemodorum</i> sp.			
164.	1475	<i>Haemodorum spicatum</i> (Mardja)			
165.	3961	<i>Hardenbergia comptoniana</i> (Native Wisteria)			
166.	6839	<i>Hemiandra pungens</i> (Snakebush)			
167.	1293	<i>Hensmania turbinata</i>			
168.	5135	<i>Hibbertia hypericoides</i> (Yellow Buttercups)			
169.	5162	<i>Hibbertia racemosa</i> (Stalked Guinea Flower)			
170.	5173	<i>Hibbertia subvaginata</i>			
171.	5176	<i>Hibbertia vaginata</i>			
172.	445	<i>Holcus setiger</i> (Annual Fog)	Y		
173.	6222	<i>Homaloscladium homalocarpum</i>			
174.	3966	<i>Hovea pungens</i> (Devil's Pins, Puyenak)			
175.	12859	<i>Hovea trisperma</i> var. <i>trisperma</i>			
176.	12741	<i>Hyalosperma cotula</i>			
177.	5216	<i>Hybanthus calycinus</i> (Wild Violet)			

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178.	6224	<i>Hydrocotyle blepharocarpa</i>			
179.	6226	<i>Hydrocotyle callicarpa</i> (Small Pennywort)			
180.	6240	<i>Hydrocotyle scutellifera</i>			
181.	5817	<i>Hypocalymma angustifolium</i> (White Myrtle, Kudjid)			
182.	35070	<i>Hypocalymma angustifolium</i> subsp. Swan Coastal Plain (G.J. Keighery 16777)			
183.	5825	<i>Hypocalymma robustum</i> (Swan River Myrtle)			
184.	8086	<i>Hypochaeris glabra</i> (Smooth Catsear)	Y		
185.	1070	<i>Hypolaena exsulca</i>			
186.		<i>Iridaceae</i> sp.			Y
187.	917	<i>Isolepis marginata</i> (Coarse Club-rush)			
188.	919	<i>Isolepis oldfieldiana</i>			
189.	924	<i>Isolepis stellata</i> (Star Club-rush)			
190.	3992	<i>Isotropis cuneifolia</i> (Granny Bonnets)			
191.	4012	<i>Jacksonia furcellata</i> (Grey Stinkwood)			
192.	4029	<i>Jacksonia sternbergiana</i> (Stinkwood, Kapur)			
193.	4044	<i>Kennedia prostrata</i> (Scarlet Runner)			
194.	5832	<i>Kunzea ericifolia</i> (Spearwood, Pondil)			
195.	15498	<i>Kunzea glabrescens</i> (Spearwood)			
196.	8096	<i>Lactuca serriola</i> (Prickly Lettuce)	Y		
197.	4052	<i>Latrobea tenella</i>			
198.	1307	<i>Laxmannia ramosa</i> (Branching Lily)			
199.	1309	<i>Laxmannia squarrosa</i>			
200.	7574	<i>Lechenaultia floribunda</i> (Free-flowering Leschenaultia)			
201.	44490	<i>Leontodon rhagadioloides</i>	Y		
202.	925	<i>Lepidosperma angustatum</i>			
203.	937	<i>Lepidosperma longitudinale</i> (Pithy Sword-sedge)			
204.	944	<i>Lepidosperma scabrum</i>			
205.		<i>Lepidosperma</i> sp. <i>Baldivis</i>			Y
206.	29150	<i>Lepidosperma</i> sp. Margaret River (B.J. Lepschi 1841)			
207.	945	<i>Lepidosperma squamatum</i>			
208.	946	<i>Lepidosperma striatum</i>			
209.	1653	<i>Leporella fimbriata</i> (Hare Orchid)			
210.	1080	<i>Leptocarpus scariosus</i>			
211.	2344	<i>Leptomeria empetriformis</i>			
212.	1090	<i>Lepyrodia muirii</i>			
213.	6360	<i>Leucopogon australis</i> (Spiked Beard-heath)			
214.	6374	<i>Leucopogon conostephioides</i>			
215.	6436	<i>Leucopogon propinquus</i>			
216.		<i>Levenhookia pusilla</i> <i>stipitata</i>			
217.	7677	<i>Levenhookia stipitata</i> (Common Stylewort)			
218.	9289	<i>Lobelia anceps</i> (Angled Lobelia)			
219.	7408	<i>Lobelia tenuior</i> (Slender Lobelia)			
220.	476	<i>Lolium perenne</i> (Perennial Ryegrass)	Y		
221.		<i>Lomandra</i> ? <i>caespitosa</i>			
222.		<i>Lomandra</i> ? <i>preissii</i>			
223.	1223	<i>Lomandra caespitosa</i> (Tufted Mat Rush)			
224.	1228	<i>Lomandra hermaphrodita</i>			
225.	1232	<i>Lomandra micrantha</i> (Small-flower Mat-rush)			
226.	1234	<i>Lomandra nigricans</i>			
227.	1239	<i>Lomandra preissii</i>			
228.	1243	<i>Lomandra sericea</i> (Silky Mat Rush)			
229.	1246	<i>Lomandra suaveolens</i>			
230.	8564	<i>Lotus subbiflorus</i>	Y		
231.	1198	<i>Luzula meridionalis</i> (Field Woodrush)			
232.	1097	<i>Lyginia barbata</i>			
233.		<i>Lyginia barbata</i> <i>imberbis</i>			
234.	18049	<i>Lyginia imberbis</i>			
235.	36375	<i>Lysimachia arvensis</i> (Pimpernel)	Y		
236.	6456	<i>Lysinema ciliatum</i> (Curry Flower)			
237.	6458	<i>Lysinema elegans</i>			
238.	2839	<i>Macarthuria australis</i>			
239.	18119	<i>Macrozamia fraseri</i>			
240.	5926	<i>Melaleuca lateritia</i> (Robin Redbreast Bush)			
241.	5946	<i>Melaleuca pauciflora</i>			
242.	5952	<i>Melaleuca preissiana</i> (Moonah)			
243.	5964	<i>Melaleuca seriata</i>			
244.	5978	<i>Melaleuca teretifolia</i> (Banbar)			
245.	5980	<i>Melaleuca thymoides</i>			
246.	955	<i>Mesomelaena pseudostygia</i>			
247.	957	<i>Mesomelaena tetragona</i> (Semaphore Sedge)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
248.	485 <i>Microlaena stipoides</i> (Weeping Grass)			
249.	10954 <i>Microtis media</i> (Tall Mignonette Orchid)			
250.	15419 <i>Microtis media</i> subsp. <i>media</i>			
251.	4666 <i>Monotaxis occidentalis</i>			
252.	19179 <i>Moraea flaccida</i> (One-leaf Cape Tulip)	Y		
253.	492 <i>Neurachne alopecuroides</i> (Foxtail Mulga Grass)			
254.	2401 <i>Nuytsia floribunda</i> (Christmas Tree, Mudja)			
255.	18255 <i>Opercularia vaginata</i> (Dog Weed)			
256.	4358 <i>Oxalis purpurea</i> (Largeflower Wood Sorrel)	Y		
257.	7090 <i>Parentucellia viscosa</i> (Sticky Bartsia)	Y		
258.	1550 <i>Patersonia occidentalis</i> (Purple Flag, Koma)			
259.	30472 <i>Patersonia occidentalis</i> var. <i>occidentalis</i>			
260.	4343 <i>Pelargonium capitatum</i> (Rose Pelargonium)	Y		
261.	40423 <i>Pentameris airoides</i> (False Hairgrass)	Y		
262.	6006 <i>Pericalymma ellipticum</i> (Swamp Teatree)			
263.	16477 <i>Pericalymma ellipticum</i> var. <i>ellipticum</i>			
264.	2273 <i>Persoonia saccata</i> (Snottygobble)			
265.	2299 <i>Petrophile linearis</i> (Pixie Mops)			
266.	2301 <i>Petrophile macrostachya</i>			
267.	2312 <i>Petrophile striata</i>			
268.	18529 <i>Philothea spicata</i> (Pepper and Salt)			
269.	1478 <i>Phlebocarya ciliata</i>			
270.	16177 <i>Phyllangium paradoxum</i>			
271.	4675 <i>Phyllanthus calycinus</i> (False Boronia)			
272.	6249 <i>Platysace compressa</i> (Tapeworm Plant)			
273.	573 <i>Poa drummondiana</i> (Knotted Poa)			
274.	<i>Poaceae</i> sp.			
275.	8175 <i>Podolepis gracilis</i> (Slender Podolepis)			
276.	<i>Podotheca ?gnaphalioides</i>			
277.	8182 <i>Podotheca angustifolia</i> (Sticky Longheads)			
278.	8184 <i>Podotheca gnaphalioides</i> (Golden Long-heads)			
279.	4691 <i>Poranthera microphylla</i> (Small Poranthera)			
280.	<i>Poranthera microphylla</i> /moorokatta			
281.	1676 <i>Prasophyllum hians</i> (Yawning Leek Orchid)			
282.	10853 <i>Prasophyllum plumiforme</i>			
283.	<i>Pterostylis</i> aff. <i>nana</i>			
284.	<i>Pterostylis</i> aff. <i>nana</i> long sepal			Y
285.	1693 <i>Pterostylis recurva</i> (Jug Orchid)			
286.	12217 <i>Pterostylis sanguinea</i>			
287.	1698 <i>Pterostylis vittata</i> (Banded Greenhood)			
288.	11260 <i>Ptilotus drummondii</i> var. <i>drummondii</i> (Pussytail)			
289.	4177 <i>Pultenaea ochreatea</i>			
290.	4181 <i>Pultenaea reticulata</i>			
291.	16367 <i>Pyrorchis nigricans</i> (Red beaks, Elephants ears)			
292.	8195 <i>Quinetia urvillei</i>			
293.	13300 <i>Rhodanthe citrina</i>			
294.	1556 <i>Romulea rosea</i> (Guildford Grass)	Y		
295.	40426 <i>Rytidosperma occidentale</i>			
296.	7603 <i>Scaevola canescens</i> (Grey Scaevola)			
297.	982 <i>Schoenus clandestinus</i>			
298.	984 <i>Schoenus curvifolius</i>			
299.	986 <i>Schoenus efoliatus</i>			
300.	1007 <i>Schoenus pedicellatus</i>			
301.	1017 <i>Schoenus subbulbosus</i>			
302.	6033 <i>Scholtzia involucrata</i> (Spiked Scholtzia)			
303.	6 <i>Selaginella gracillima</i> (Tiny Clubmoss)			
304.	2909 <i>Silene gallica</i> (French Catchfly)	Y		
305.	8225 <i>Siloxerus humifusus</i> (Procumbent Siloxerus)			
306.	<i>Siloxerus humifusus</i> /filifolius			
307.	7022 <i>Solanum nigrum</i> (Black Berry Nightshade)	Y		
308.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
309.	1312 <i>Sowerbaea laxiflora</i> (Purple Tassels)			
310.	2316 <i>Stirlingia latifolia</i> (Blueboy)			
311.	25831 <i>Stylidium araeophyllum</i> (Stilt Walker)			
312.	<i>Stylidium araeophyllum</i> /neurophyllum			
313.	7693 <i>Stylidium brunonianum</i> (Pink Fountain Triggerplant)			
314.	7699 <i>Stylidium carnosum</i> (Fleshy-leaved Triggerplant)			
315.	7717 <i>Stylidium divaricatum</i> (Daddy-long-legs)			
316.	7718 <i>Stylidium diversifolium</i> (Touch-me-not)			
317.	7734 <i>Stylidium guttatum</i> (Dotted Triggerplant)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
318.	7774 <i>Stylidium piliferum</i> (Common Butterfly Triggerplant)			
319.	7785 <i>Stylidium repens</i> (Matted Triggerplant)			
320.	7798 <i>Stylidium schoenoides</i> (Cow Kicks)			
321.	15532 <i>Synaphea spinulosa</i> subsp. <i>spinulosa</i>			
322.	1702 <i>Thelymitra campanulata</i> (Shirt Orchid)			
323.	1705 <i>Thelymitra crinita</i> (Blue Lady Orchid)			
324.	11143 <i>Thelymitra graminea</i>			
325.	11053 <i>Thelymitra macrophylla</i>			
326.	20731 <i>Thelymitra vulgaris</i>			
327.	20728 <i>Thelymitra xanthotricha</i>			
328.	1318 <i>Thysanotus arbuscula</i>			
329.	1319 <i>Thysanotus arenarius</i>			
330.	1328 <i>Thysanotus dichotomus</i> (Branching Fringe Lily)			
331.	<i>Thysanotus manglesianus/patersonii</i> complex			
332.	1339 <i>Thysanotus multiflorus</i> (Many-flowered Fringe Lily)			
333.	1343 <i>Thysanotus patersonii</i>			
334.	1351 <i>Thysanotus sparteus</i>			
335.	1357 <i>Thysanotus thyrsoides</i>			
336.	6280 <i>Trachymene pilosa</i> (Native Parsnip)			
337.	1361 <i>Tricoryne elatior</i> (Yellow Autumn Lily)			
338.	1363 <i>Tricoryne tenella</i>			
339.	Unknown Annual Grasses			
340.	8254 <i>Urospermum picroides</i> (False Hawkbit)	Y		
341.	8255 <i>Ursinia anthemoides</i> (Ursinia)	Y		
342.	7107 <i>Verbascum virgatum</i> (Twiggy Mullein)	Y		
343.	724 <i>Vulpia myuros</i> (Rat's Tail Fescue)	Y		
344.	<i>Vulpia</i> sp.			
345.	7384 <i>Wahlenbergia capensis</i> (Cape Bluebell)	Y		
346.	7389 <i>Wahlenbergia preissii</i>			
347.	8282 <i>Waitzia suaveolens</i> (Fragrant Waitzia)			
348.	18118 <i>Watsonia meriana</i> var. <i>meriana</i>	Y		
349.	12072 <i>Wurmbea dioica</i> subsp. <i>alba</i>			
350.	1256 <i>Xanthorrhoea preissii</i> (Grass tree, Palga)			
351.	<i>Xanthorrhoea</i> sp.			
352.	<i>Xanthosia</i> ? <i>huegelii</i>			Y
353.	6289 <i>Xanthosia huegelii</i>			
354.	2331 <i>Xylomelum occidentale</i> (Woody Pear, Djandin)			
355.	1049 <i>Zantedeschia aethiopica</i> (Arum Lily)	Y		

Conservation Codes

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

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



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: 30/11/17 17:19:33

[Summary](#)

[Details](#)

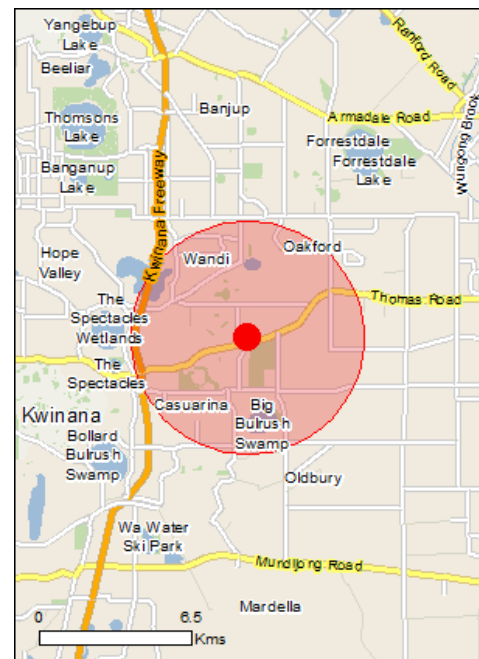
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[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

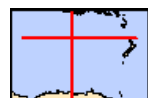
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 5.0Km



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:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	21
Listed Migratory Species:	10

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:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	38
Nationally Important Wetlands:	1
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
Peel-yalgorup system	30 - 40km upstream

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

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

Listed Threatened Species	[Resource Information]
---------------------------	--------------------------

Name	Status	Type of Presence
------	--------	------------------

Birds

Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area

Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area

Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo, Karraak [67034]	Vulnerable	Species or species habitat known to occur within area

Calyptorhynchus baudinii		
Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	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

Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area

Mammals

Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area

Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica Glossy-leaved 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 likely to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat likely to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area

Listed Migratory Species [\[Resource Information \]](#)

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to 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]		Species or species habitat may 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

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 likely 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 likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to 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 known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Banksia	WA
Modong	WA
Wandi	WA

Invasive Species	[Resource Information]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources 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
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur 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

Name	Status	Type of Presence area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		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] 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 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
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323] 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
Gibbs Road Swamp System		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

-32.21958 115.89157

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](#)
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- [-State Herbarium of South Australia](#)
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- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
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- [-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.

Appendix 3
Vascular plant species recorded within
quadrats

Family	Species
Asparagaceae	<i>Laxmannia squarrosa</i>
	<i>Lomandra ?caespitosa</i>
Asteraceae	<i>Podolepis gracilis</i>
	<i>Podotheca</i> sp.
Casuarinaceae	<i>Allocasuarina fraseriana</i>
Colchicaceae	<i>Burchardia congesta</i>
	<i>Burchardia</i> sp.
Cyperaceae	<i>Lepidosperma ?costale</i>
Dasypogonaceae	<i>Dasypogon bromeliifolius</i>
Dilleniaceae	<i>Hibbertia hypericoides</i>
	<i>Hibbertia subvaginata</i>
Ericaceae	<i>Conostephium pendulum</i>
	<i>Leucopogon</i> sp.
Fabaceae	<i>Bossiaea eriocarpa</i>
	<i>Daviesia triflora</i>
	<i>Gastrolobium calycinum</i>
	<i>Gompholobium tomentosum</i>
	<i>Hovea trisperma</i>
	<i>Jacksonia furcellata</i>
Goodeniaceae	<i>Lechenaultia floribunda</i>
Haemodoraceae	<i>Conostylis aculeata</i>
	<i>Conostylis setigera</i>
	<i>Haemodorum</i> sp.
	<i>Phlebocarya ciliata</i>
Iridaceae	<i>Patersonia occidentalis</i>
Loranthaceae	<i>Nuytsia floribunda</i>
Myrtaceae	<i>Calytrix flavescens</i>
	<i>Calytrix</i> sp.
	<i>Eucalyptus marginata</i>
	<i>Eucalyptus todiana</i>
	<i>Kunzea glabrescens</i>
	<i>Scholtzia involucrata</i>
Poaceae	<i>Austrodanthonia setacea</i>
	<i>Austrostipa compressa</i>
	<i>Neurachne alopecuroidea</i>
Proteaceae	<i>Adenanthos cygnorum</i>
	<i>Banksia attenuata</i>
	<i>Banksia ilicifolia</i>
	<i>Banksia menziesii</i>
	<i>Persoonia saccata</i>
	<i>Petrophile linearis</i>
	<i>Stirlingia latifolia</i>
Restionaceae	<i>Desmocladius flexuosus</i>
	<i>Hypolaena exsulca</i>
	<i>Lyginia barbata</i>
Rubiaceae	<i>Opercularia echinocephala</i>
Rutaceae	<i>Philotheca spicata</i>
Stylidiaceae	<i>Stylidium brunonianum</i>
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>

Appendix 4

FCT analysis results

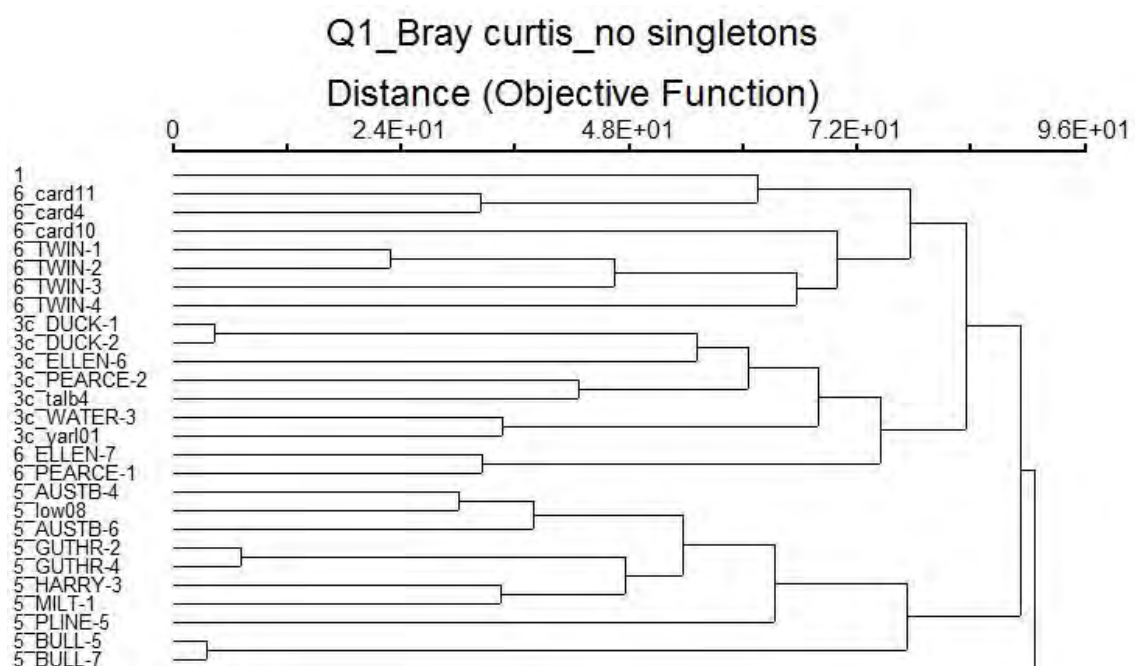


Plate 1: Partial dendrogram – Q1

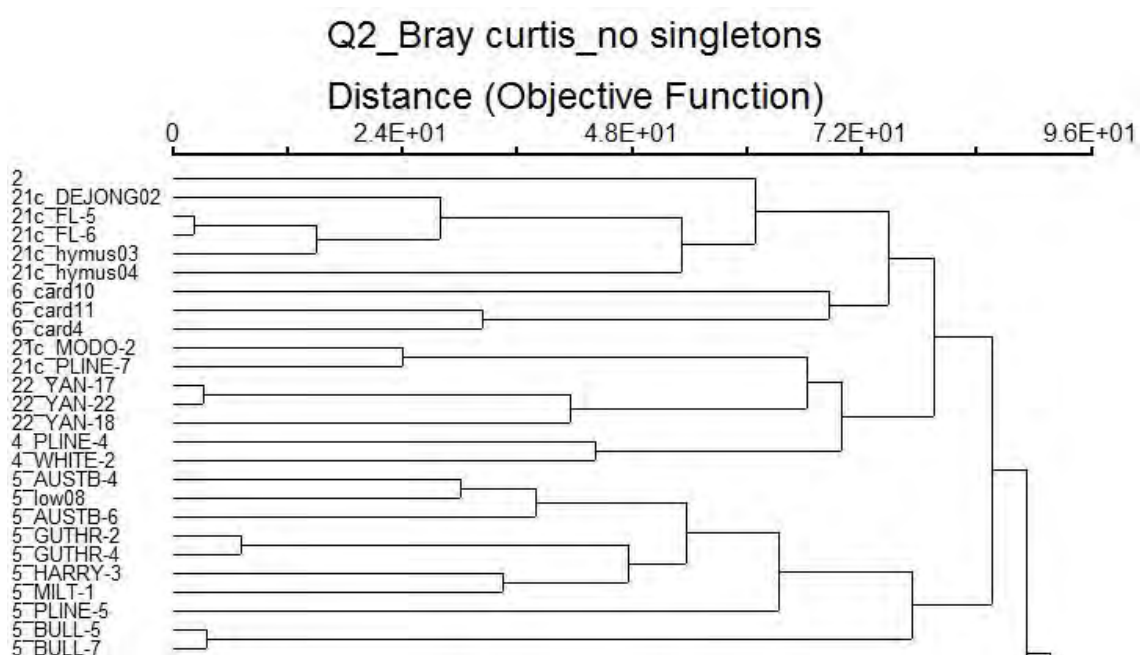


Plate 2: Partial dendrogram – Q2

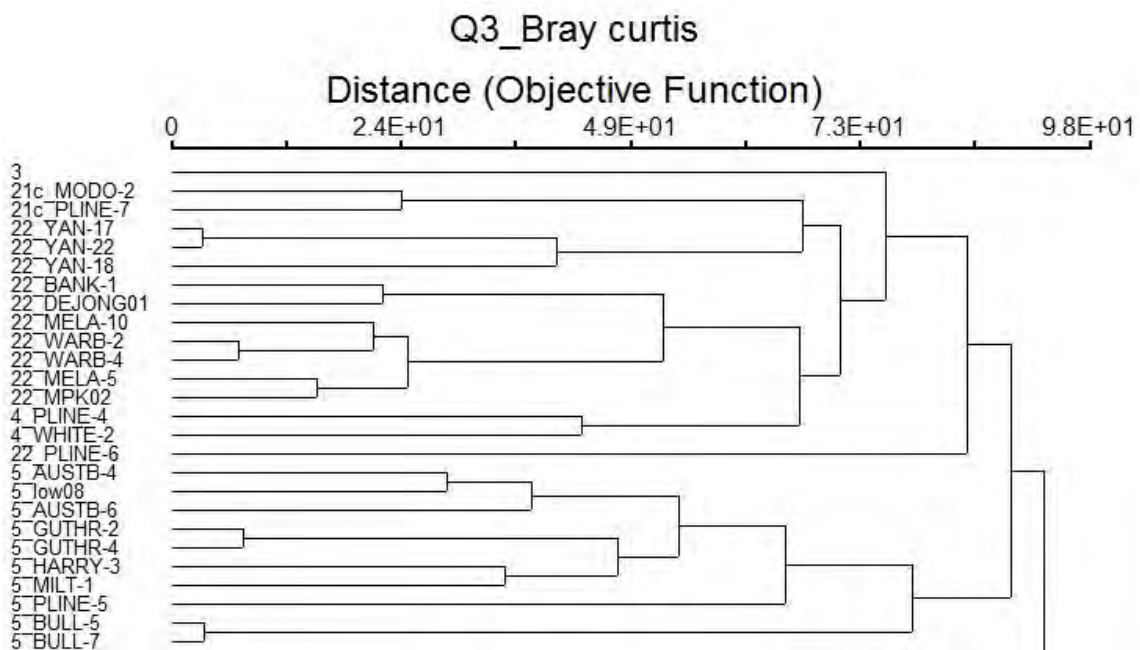


Plate 3: Partial dendrogram – Q3

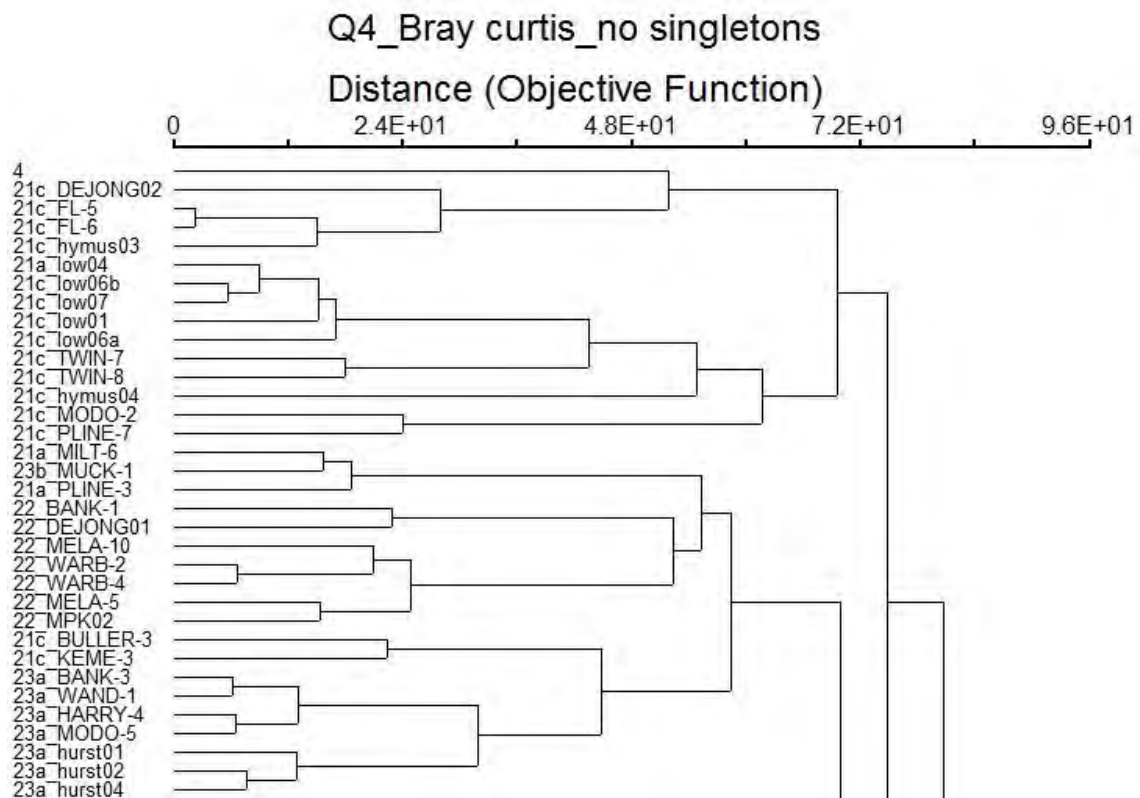


Plate 4: Partial dendrogram – Q4

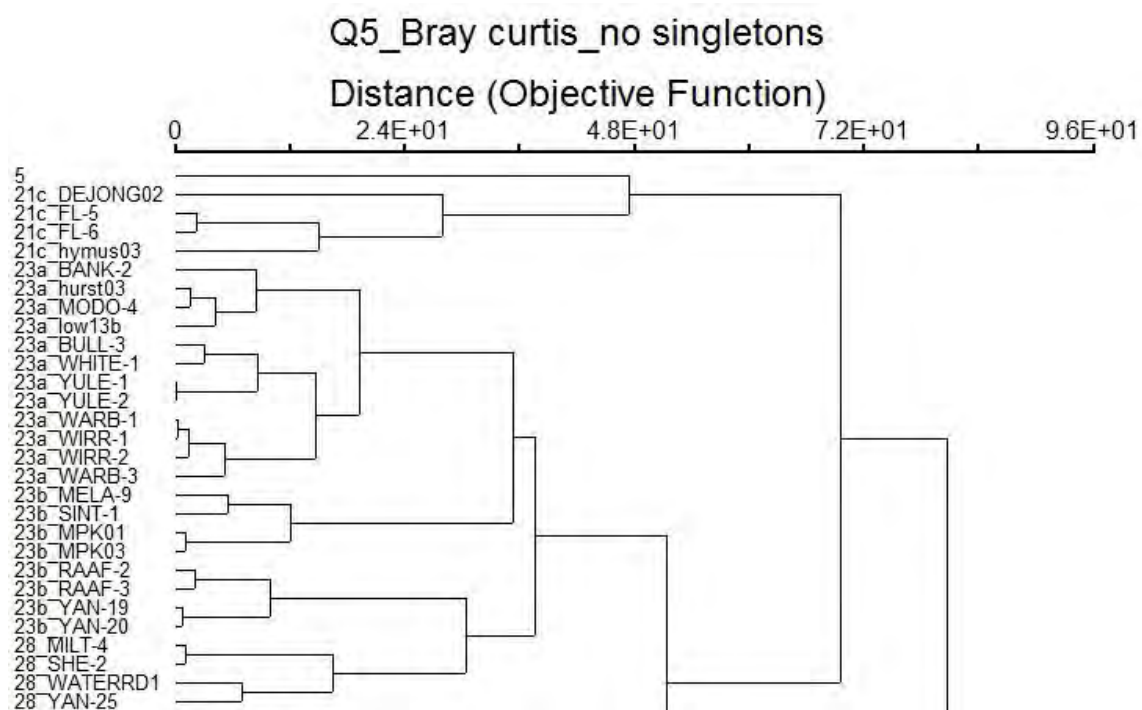


Plate 5: Partial dendrogram – Q5

Appendix 5
Photographic record of vegetation
types and condition



Plate 1: VT1 in Good – Degraded condition



Plate 2: VT2 in Very Good condition



Plate 3: Cleared area in Completely Degraded condition

Appendix 6
Vascular plant taxa recorded by site
and vegetation type

Species	Quadrat number				
	1	2	3	4	5
<i>Adenanthos cygnorum</i>			x	x	x
<i>Allocasuarina fraseriana</i>					x
<i>Austrodanthonia setacea</i>				x	
<i>Austrostipa compressa</i>		x		x	x
<i>Avena barbata</i>	x				
<i>Banksia attenuata</i>				x	
<i>Banksia ilicifolia</i>	x	x			
<i>Banksia menziesii</i>				x	x
<i>Bossiaea eriocarpa</i>			x	x	x
<i>Briza maxima</i>	x	x	x	x	x
<i>Burchardia congesta</i>					x
<i>Burchardia</i> sp.			x		
<i>Calytrix flavescens</i>		x			
<i>Calytrix</i> sp.					x
<i>Carpobrotus edulis</i>		x		x	
<i>Conostephium pendulum</i>				x	x
<i>Conostylis aculeata</i>		x	x		x
<i>Conostylis setigera</i>					x
<i>Dasypogon bromeliifolius</i>	x	x		x	
<i>Daviesia triflora</i>					x
<i>Desmocladus flexuosus</i>			x		
<i>Ehrharta calycina</i>	x	x	x	x	
<i>Eucalyptus marginata</i>			x		
<i>Eucalyptus todiana</i>					x
<i>Gastrolobium calycinum</i>				x	
<i>Gladiolus</i> sp.		x	x	x	x
<i>Gompholobium tomentosum</i>			x		
<i>Haemodorum</i> sp.		x			
<i>Hibbertia hypericoides</i>				x	x
<i>Hibbertia subvaginata</i>		x		x	
<i>Hovea trisperma</i>			x		
<i>Hypolaena exsulca</i>				x	x
<i>Jacksonia furcellata</i>		x			
<i>Kunzea glabrescens</i>	x		x	x	x
<i>Laxmannia squarrosa</i>					x
<i>Lechenaultia floribunda</i>		x			
<i>Lepidosperma ?costale</i>					x
<i>Leucopogon</i> sp.				x	x
<i>Lomandra ?caespitosa</i>			x		
<i>Lyginia barbata</i>			x		x
<i>Neurachne alopecuroidea</i>				x	
<i>Nuytsia floribunda</i>		x		x	
<i>Opercularia echinocephala</i>					x
<i>Patersonia occidentalis</i>	x	x	x	x	
<i>Persoonia saccata</i>			x		
<i>Petrophile linearis</i>					x
<i>Philothea spicata</i>				x	
<i>Phlebocarya ciliata</i>	x		x	x	x
<i>Podolepis gracilis</i>			x		

Species	Quadrat number				
	1	2	3	4	5
<i>Podotheca</i> sp.		x			
<i>Scholtzia involucrata</i>		x			x
<i>Stirlingia latifolia</i>				x	x
<i>Stylidium brunonianum</i>		x	x	x	x
<i>Ursinia anthemoides</i>	x	x	x	x	x
<i>Xanthorrhoea preissii</i>	x	x	x		

