

Flora and Vegetation Survey Report (v0.2)

LOT 7 RUNNYMEDE ROAD, WELLESLEY



REPORT PREPARED BY
LUNDSTROM ENVIRONMENTAL CONSULTANTS PTY LTD

Lot 7 Runnymede Rd, Wellesley

Flora and Vegetation Survey Report

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Front cover image: *Eucalyptus marginata*, *Agonis flexuosa* and *Banksia attenuata* over *Hibbertia hypericoides*, *Melaleuca thymoides* and *Dasyopogon bromeliifolius*

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GLOSSARY

BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i> (Western Australian Government)
BC Act	<i>Biodiversity Conservation Act 2016</i> (Western Australian Government)
BoM	Bureau of Meteorology
DAFWA	Department of Agriculture and Food Western Australia – superseded, now DPIRD (Western Australian Government)
DBCA	Department of Biodiversity, Conservation and Attractions (Western Australian Government)
DEC	Department of Environment and Conservation – superseded, now DBCA (Western Australian Government)
DEE	Department of the Environment and Energy (Australian Government)
DMIRS	Department of Mines, Industry Regulation and Safety (Western Australian Government)
DoW	Department of Water - superseded, now DWER (Western Australian Government)
DPIRD	Department of Primary Industries and Regional Development (Western Australian Government)
DRF	Declared Rare Flora
DWER	Department of Water and Environmental Regulation (Western Australian Government)
EPA	Environmental Protection Authority (Western Australian Government)
EP Act	<i>Environmental Protection Act 1986</i> (Western Australian Government)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Australian Government)
ESA	Environmentally Sensitive Area
LEC	Lundstrom Environmental Consultants
MNES	Matters of National Environmental Significance
PEC	Priority Ecological Community
TEC	Threatened Ecological Community
TPF	Threatened and Priority Flora
WALGA	Western Australian Local Government Association
WC Act	<i>Wildlife Conservation Act 1950</i> (Western Australian Government) superseded, now BC Act (Western Australian Government)
WONS	Weeds of National Significance

EXECUTIVE SUMMARY

B&J Catalano Pty Ltd (Catalano) is proposing to extract sand at Lot 7 Runnymede Road, Wellesley. Lundstrom Environmental Consultants (LEC) was commissioned by Catalano to undertake a detailed flora and vegetation assessment of the proposal area.

Lot 7 Runnymede Rd, an 80.2ha property currently zoned as 'General Farming', is located approximately 130km south of Perth and 24km north of Bunbury, within the Shire of Harvey, Western Australia (WA).

A single-phase detailed (formally level 2) flora and vegetation assessment was carried out by a team of botanists, taxonomists and field technicians between the 18th and 20th of September 2018. A targeted search for threatened and priority flora, such as *Caladenia speciosa*, was also conducted during this time.

The assessments for flora and vegetation (including Banksia woodland TEC) were recorded and reported in accordance with relevant technical guidelines and standards. Key findings of the assessments within the study area are as follows:

The key findings, conclusions and recommendations arising from the flora and vegetation assessment within the Survey Area are as follows:

- A total of 81 taxa from 63 genera and 34 families were identified in the Survey Area.
- Of the 81 taxa recorded, nine taxa were introduced flora (weeds) and 72 were native species (88.9% of taxa recorded).
- The commonly occurring families were Fabaceae and Myrtaceae (with 5 taxa each), Orchidaceae (7 taxa), as well as Asparagaceae and Asteraceae (with 8 taxa each).
- No Threatened flora under the BC Act or under the EPBC Act were recorded.
- Three Priority flora as listed by DBCA (2018a) were recorded in the Survey Area: *Millotia tenuifolia* ?var. *laevis* (P2); *Lasiopetalum* ?*membranaceum* (P3); and *Acacia semitrullata* (P4). The *Millotia* and *Lasiopetalum* species could not be identified with certainty, as they were either sterile or the flowering material was immature, but the identifications provided are the most likely outcome.
- No weed species recorded are listed as Declared Pests under the BAM Act or WONS.
- One vegetation type, mainly in 'Excellent' condition, was described and mapped within the Survey Area: *Banksia attenuata* - *Eucalyptus marginata* open woodland over a *Hibbertia hypericoides* – *Melaleuca thymoides* low open shrubland over a herbland of *Dasypogon bromeliifolius*.
- The vegetation of the Survey Area was consistent with FCT 21a, which although not listed as a PEC under WA State Policy (DBCA 2019), is consistent with the Commonwealth EPBC Act listed Banksia Woodlands TEC.

1 INTRODUCTION

1.1 BACKGROUND

B&J Catalano Pty Ltd (Catalano) is proposing to extract sand at Lot 7 Runnymede Road, Wellesley. Lundstrom Environmental Consultants (LEC) was commissioned by Catalano to undertake a detailed flora and vegetation assessment of the proposal area.

1.1.1 Location, Ownership and Tenure

Lot 7 Runnymede Road is located approximately 130km south of Perth within the Shire of Harvey (Figure 1), Western Australia (WA). The property is situated 2.5km east of Forrest Highway, 6km east of the coast at Binningup and approximately 24km north of Bunbury.

The 80.2ha property is owned by B, C & S Catalano and is currently zoned as 'General Farming' under the Shire of Harvey Town Planning Scheme No. 1.

The cleared western portion of the property was most recently used for sand extraction. The majority of properties surrounding Lot 7 are used for grazing, however Lot 4 (on the southern boundary of Lot 7) is currently operated by B&J Catalano for sand extraction.

1.1.2 Survey Area

The eastern portion of Lot 7 contains a continuous patch of remnant vegetation (approximately 50ha). The 16ha Survey Area is located on the western edge of this remnant vegetation patch, immediately adjacent to the partially cleared portion of Lot 7 (Figure 2).

Remnant vegetation is located directly north, west and south of the Survey Area, and the previous extraction area (currently under rehabilitation) lies to the west.

1.2 OBJECTIVE AND SCOPE

The objective of this report was to describe the vegetation and flora, provide information on the occurrence of conservation significant flora and to map and assess the environmental values of the vegetation within the Survey Area at Lot 7 Runnymede Road, Wellesley.

The scope of work included the following tasks:

- Review relevant literature and data for species and communities listed within Commonwealth and State Legislations and departmental databases.
- Conduct field surveys, including the use of quadrats and targeted searches, at a suitable time to locate species and vegetation identified through literature reviews and database searches.
- Identify and map all potential occurrences of conservation significant species and communities within the Survey Area.
- Delineate and characterise the flora and range of vegetation types in the Survey Area; and
- Assess and map the vegetation condition in the Survey Area

1.3 GUIDANCE AND LEGISLATION

1.3.1 Survey Guidance

The Environmental Protection Authority (EPA) provides guidance on flora and vegetation surveys to ensure that adequate data are obtained to an appropriate standard: *Technical Guidance - Flora and Vegetation surveys for Environmental Impact Assessment* (EPA 2016).

The guidance document provides advice on:

- survey preparation and desktop study;
- determining the type of survey required;
- sampling techniques and survey design; and
- data analysis and reporting.

1.3.2 Flora and Vegetation Protection

Flora and vegetation are protected by a range of legislative and non-legislative instruments. A short description of these is provided in Table 1. Definitions for categories of conservation significant species and ecological communities are provided in Section 2.3 and Section 2.4 respectively.

Table 1. Flora and vegetation protection - Legislation and Guidance

Legislation and Guidance	Description
COMMONWEALTH	
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	<p>The EPBC Act aims to protect Matters of National Environmental Significance (MNES), which includes Threatened Ecological Communities (TECs) and Threatened Species (DEE 2018a, DEE 2018d). Under the EPBC Act, the Commonwealth Department of the Environment and Energy (DEE) lists threatened species and communities in categories determined by criteria set out in the Act (www.environment.gov.au/epbc/index.html).</p> <p>Projects likely to cause a significant impact on MNES should be referred to the DEE for assessment under the EPBC Act.</p>
Weeds of National Significance (WONS)	<p>The Australian Government along with the State and Territory governments has endorsed 32 WONS, each of which has a national strategy. WONS must be reported and are regarded the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts.</p>
WA STATE	
<i>Biodiversity Conservation Act 2016</i> (BC Act)	<p>The BC Act came into effect in January 2019 to provide for the conservation and protection of biodiversity and biodiversity components in WA; replacing the <i>Wildlife Conservation Act 1950</i> (WC Act).</p> <p>The Department of Biodiversity, Conservation and Attractions (DBCA) lists flora and ecological communities under the provisions of the BC Act as protected according to their need for protection (DBCA 2018a).</p> <p>Flora may be Declared Rare when populations are geographically restricted or are threatened by local processes. The BC Act also provides</p>

Legislation and Guidance	Description
	<p>for the statutory listing of WA Threatened Ecological Communities (TECs) by the Minister for Environment (DBCAB).</p> <p>Under the BC Act, by Notice in the WA Government Gazette of 9 October 1987 (WC Act), all native flora (spermatophytes, pteridophytes, bryophytes and thallophytes) are also protected throughout the State.</p>
<p><i>Environmental Protection Act 1986 (EP Act)</i></p>	<p>Threatened Flora and TECs are given special consideration in environmental impact assessments and have special status as Environmentally Sensitive Areas (ESAs) under the EP Act and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.</p> <p>Exemptions for a clearing permit do not apply in an ESA.</p> <p>Refer to Section 2.3.2 for further information on Threatened Flora and Section 2.4.4. for more information on TECs.</p>
<p><i>Biosecurity and Agriculture Management Act 2007 (BAM Act)</i></p>	<p>Pests may be 'Declared' by the Minister for Agriculture under the BAM Act. The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under BAM Act. A declaration may apply to the whole State, to districts, individual properties or even to single paddocks.</p> <p>If a plant is 'Declared', landholders are obliged to control that plant on their properties (DAFWA 2015).</p> <p>Refer to Section 2.3.3 for further information on Declared Pest Plants.</p>
<p>DBCAs Priority Lists</p>	<p>The DBCA lists 'Priority' flora that have not been assigned statutory protection as Declared Rare or 'Scheduled' under the BC Act (DBCAs 2018a). Flora assessed as Priority 1-3 are in urgent need of further survey. Priority 4 flora require monitoring every 5-10 years and Priority 5 flora are subject to a specific conservation programme (Section 2.4).</p> <p>The DBCA also maintains a list of Priority Ecological Communities (PECs) which identifies ecologically valuable communities that need further investigation before possible nomination for TEC status (DBCAs 2019).</p> <p>Refer to Section 2.3.2 for further information on Priority Flora and Section 2.4.4. for more information on PECs.</p>
<p>Informal Recognition of Flora</p>	<p>Certain populations or communities of flora may be of local significance or interest because of their patterns of distribution and abundance (i.e. range extensions or unusual species composition).</p> <p>Many species are also in decline because of threatening processes (land clearing, grazing, changed fire regimes), and relict populations of such species assume local importance for the DBCA.</p>

2 METHODS

2.1 DESKTOP ASSESSMENT

The purpose of the desktop assessment is to gather contextual information and to identify potential flora and vegetation prior to the field survey.

2.1.1 Physical environment

A desktop assessment was undertaken of the physical factors of the region and the local area, including climate; geology; land systems; soils; hydrology and hydrogeology. Unusual or restricted geological features (e.g. outcropping, distinctive soil types or hydrological features) were identified and targeted during the survey as they may support significant/unique flora and vegetation to the area.

Database searches included GeoVIEW (Geology 1:50,000, DMIRS 2018), Bureau of Meteorology (Climate Data Online, BoM 2019), Acid Sulphate Soil Risk Map (DWER-055), Soil Landscape Mapping (DPIRD-027), Soil Landscape Mapping - Systems (DPIRD-064), as well as aerial photography and satellite imagery.

2.1.2 Flora

An evaluation of flora known within the area was undertaken to help develop an understanding of dominant flora species, typical families and potential diversity. The desktop flora assessment output consisted of an inventory of known and/or expected flora species within the Survey Area based on the following database searches:

- EPBC Act listed Threatened Flora (DEE 2018a)
- DBCA's threatened and priority flora databases (DBCA 2018c)
- NatureMap custom reports of recorded species in the locality (DBCA 2018d)
- FloraBase (Western Australian Herbarium 2018)
- Survey reports or references in the region or locality.

2.1.3 Vegetation

An evaluation of known and likely vegetation within the Survey Area was based on an assessment of regional and local mapping and databases, including:

- Statewide Vegetation Mapping (Beard 1968-1981, Beard 1972-1980 and Beard *et al.* 2005)
- Regional vegetation mapping (Hedde *et al.* 1980)
- EPBC Act List of Threatened Ecological Communities (Protected Matters Search Tool, DEE 2018b)
- DBCA threatened and priority ecological communities' databases (DBCA 2018e)
- Recovery Plans and other reports/documents containing information on the preferred habitats and distributions of TECs of relevance to the Study Area (i.e. DEE 2016 – a guide on Banksia Woodlands of the Swan Coastal Plain)
- Survey reports or references in the region or locality.
- General environmental databases to identify environmental values of the area and further site characteristics:
 - GeoVIEW to identified geology types for the Survey Area (DMIRS 2018)
 - National Map (Commonwealth of Australia 2018)

- o Environmental Planning Tool (WALGA 2018)
- o Locate (via SLIP and Landgate) (Government of Western Australia 2018a)

2.2 FIELD ASSESSMENT

EPA (2016) describes three survey types for Environmental Impact Assessment:

- *Reconnaissance Survey*: A reconnaissance survey provides context and gathers broad information about a Survey Area. Generally, a reconnaissance survey is required where flora and vegetation values are well defined, the area is not likely to support significant flora or vegetation and the scale and nature of potential impacts are not likely to be significant.
- *Targeted Survey*: A targeted survey gathers comprehensive information on significant flora and/or vegetation. A targeted survey aims to determine the size and extent of all significant flora populations or vegetation in the Survey Area and to place any impacts into context.
- *Detailed Survey*: A detailed survey provides adequate local and regional context relative to the values of the flora and vegetation within the Survey Area. A detailed survey requires comprehensive survey design that considers optimal survey timing, disturbance events and supplementary survey requirements. Multiple sampling events may also be necessary.

The Detailed Survey was considered the most appropriate survey type this assessment, as the Survey Area supports a relatively high biodiversity and it may contain significant flora or vegetation. The Detailed Survey includes a series of sampling techniques, as described in Sections 2.2.2 – 2.2.5 below.

2.2.1 Timing and expertise

Field surveys were undertaken between the 18th and the 20th of September 2018. This period was selected to coincide with the optimum flowering period for many of the species of the region, in particular the targeted conservation significant orchids such as *Caladenia speciosa*.

Field assessments were undertaken by a team comprising of botanists, taxonomists and field technicians, all with botanical survey experience across WA. A summary of the team is provided in Table 2.

Table 2. Experience and Competence

Shane Chalwell (Plant Ecology)	
Qualifications	PhD (Plant Ecology)
Scientific Licence	SL012223
Experience	Shane Chalwell is a highly qualified and skilled consulting botanist with extensive experience in vegetation surveys and monitoring throughout Western Australia. His expertise in plant community ecology includes the design of broad and fine scale vegetation mapping, vegetation health and rehabilitation monitoring programs, wetland condition assessments, and searches for Threatened and Priority flora. Shane was team leader during the field assessment, coordinated field surveys, and undertook data analysis.
Frank Obbens (Bushtech Consultancy)	
Qualifications	BSc Honours (1 ST) (Biology/Plant Science)
Scientific Licence	SL012278
Experience	Frank, a research associate with the WA Herbarium, has provided botanical services for over 20 years, including botanical identification, taxonomic investigation services and field support. He has been involved with many detailed flora and vegetation surveys, threatened and priority flora searches, vegetation mapping surveys, rehabilitation monitoring as well as flora identifications and specific

taxonomic investigations. Frank is also an expert on the genus *Calandrinia* and has published several papers.

Frank was a field botanist during surveys and undertook plant identification of the collected plant specimens.

Sharna Yates (Thomson)

Qualifications BSc (Botany/Plant Science)

Scientific Licence SLO12477

Experience Sharnya Yates (Thomson) is a specialised plant taxonomist and field botanist with over 15 years' experience in the field and an extensive knowledge WA's vascular plants. She has undertaken a wide variety of ecology related projects such as detailed flora surveys, targeted threatened, rare and priority flora surveys, base line flora and vegetation assessments, vegetation monitoring, plant taxonomy and arid region ecology projects.

Sharnya was a field botanist during surveys and undertook plant identification of the collected plant specimens.

Daniel Marsh

Qualification BSc (Biological Science)

Scientific Licence SLO12308

Experience Daniel is an experienced ecologist and field botanist working in all aspects of flora and vegetation surveys throughout WA.

Daniel was a field botanist during surveys.

Michelle Carey (Lundstrom Environmental)

Qualifications PhD (Environmental Science)

Scientific Licence SLO12385

Experience Michelle has over 20 years' experience in environmental monitoring and investigations across WA. She has experience with field assessments, project planning, data analysis and reporting.

Michelle assisted Shane with field logistics, provided field support during targeted searches and prepared the survey report.

2.2.2 Quadrats

Quadrat sampling is the most appropriate technique for determining and describing vegetation during detailed vegetation surveys. Eight 10m x 10m quadrats were installed across one single vegetation type, based on desktop assessment and field reconnaissance. A full description of each quadrat is presented in Appendix 1. Information collected in each quadrat included:

- site code;
- location, with GPS coordinates (estimate of their accuracy) and datum;
- size and shape of quadrat;
- photograph/s from north-west corner;
- landform and soil description;
- dominant growth form, height, cover and species for the three traditional strata (upper, mid and ground) compatible with NVIS Level V (NVIS Technical Working Group, 2017);
- any other location information that might be useful in vegetation classification including slope, aspect, litter, fire history, vegetation/landform/soil correlations;
- assessment of vegetation condition and description of disturbances;

- a comprehensive species list, including weeds; and
- quadrat marking method.

2.2.3 Targeted search

A search was undertaken to target significant flora and vegetation with the potential to occur in the Survey Area, based on findings from the desktop study.

A transect width of 10m (equating to a 5m search area either side of the walked transect) was traversed throughout the entire Survey Area.

The following data was recorded along the traverse:

- a descriptive location;
- GPS coordinates and datum;
- targeted species or community data per vegetation type boundary/potential quadrat location (dependant on purpose of traverse);
- landform; aspect;
- soils;
- vegetation condition;
- period since the last fire;
- description of disturbances; and
- any apparent correlation between vegetation and landform features.

2.2.4 Opportunistic sampling

Flora not recorded in quadrats were recorded and collected opportunistically as the Survey Area was traversed. When a potentially unrecorded species was found, the location was noted using a GPS waypoint and a reference photograph was recorded. The general site conditions were also noted (i.e. soil type, associated flora, cover, distribution and other general notes).

2.2.5 Vegetation condition rating

The condition of vegetation was assessed and mapped across the Survey Area using the vegetation condition scales outlined in Keighery (1994). A description of the condition scale is summarised in Table 3.

Table 3. Vegetation Condition Scale (adapted from Keighery 1994)

Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.

Condition	Description
	Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact, and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

2.3 FLORA ANALYSIS

2.3.1 Identification of specimens

Identification of specimens was undertaken using taxonomic keys, comparison with herbarium reference specimens and consultation with taxonomic experts in the field and via external contacts (WA State Herbarium).

2.3.2 Conservation significant flora

Flora within WA that is under threat may be classed as either Threatened Flora or Priority Flora. Where flora has been gazetted as Threatened Flora under the BC Act, it is an offence "to take" such flora without the written consent of the Minister. The BC Act states that "to take" flora includes 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.

Priority Flora constitute species considered to be 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. Such species are considered to potentially be under threat, but do not have legislative protection afforded under the BC Act. The DBCA categorises Priority Flora according to their conservation priority using four categories as described in. Table 4 sets out definitions of both Threatened and Priority Flora.

At the Commonwealth level, under the EPBC Act, Threatened Flora can also be listed as Vulnerable, Endangered, Critically Endangered, Conservation Dependent, Extinct in the Wild, or Extinct by the Minister for the Environment. Under the EPBC Act, a person must not take an action that has or will have a significant impact on a listed threatened species without approval from the Commonwealth Minister for the Environment.

Table 4. Conservation Codes for WA Flora (DBCA 2018a)

Conservation Code	Description and rating
THREATENED FLORA	
T (Threatened Flora)	Specially protected under the BC Act, listed under Schedules 1, 2 and 3 of the Wildlife Conservation (Rare Flora) Notice (which may also be referred to as Declared Rare Flora). Taxa which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such

	The assessment of the conservation status of these species is based on their national extent.
CR - Schedule 1	taxa that are extant and considered likely to become extinct or rare, as critically endangered flora, and therefore in need of special protection.
EN --Schedule 2	taxa that are extant and considered likely to become extinct or rare, as endangered flora, and therefore in need of special protection.
VU - Schedule 3	taxa that are extant and considered likely to become extinct or rare, as vulnerable flora, and therefore in need of special protection.
EX (Presumed Extinct Flora)	Specially protected under the BC Act, listed under Schedule 4 of the Wildlife Conservation (Rare Flora) Notice (which may also be referred to as Declared Rare Flora). Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died and have been gazetted as such. Threatened flora are ranked according to their level of threat using IUCN Red List categories and criteria. For example, <i>Acacia splendens</i> is specially protected as Declared Rare Flora under the BC Act and is a threatened species with a ranking of Critically Endangered
EX - Schedule 4	taxa that are presumed to be extinct in the wild and therefore in need of special protection.
PRIORITY FLORA	
P1 (Priority One): Poorly known species	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations, but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2 (Priority Two): Poorly known species	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations, but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3 (Priority Three): Poorly known species	Species that are known from several locations, and the species do not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations, but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4 (Priority Four): Rare, Near Threatened and other species in need of monitoring	(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.

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

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

2.3.3 Declared (Plant) Pest Organisms

Section 22 of the BAM Act makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (Section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under section 26 (1) of the BAM Act, a person who finds a declared plant pest must report, in accordance with subsection (2), the presence or suspected presence of the declared pest to the Director General or an inspector of the DPIRD.

Under the Biosecurity and Agriculture Management Regulations (2013), declared plant pests are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Appendix 2). According to Section 30 (3) of the BAM Act, the owner or occupier of land, or a person who is conducting an activity on the land, must take the prescribed control measures to control the declared pest if it is present on the land.

2.4 VEGETATION ANALYSIS

2.4.1 Vegetation description

The National Vegetation Information System (NVIS) (NVIS Technical Working Group, 2017) is the nationally adopted classification system used for vegetation description for EIA in Western Australia.

The description of each vegetation unit represents the entire area and the level of variability within and between vegetation units has been assessed and described.

Broadly, the vegetation classification uses vegetation structure and dominant species to describe differences between vegetation units. Structural vegetation classification provides information on height of strata, foliar cover and dominant species.

Local scale vegetation units have been described at NVIS Level V. The term “Vegetation Type” should be used to describe local scale vegetation units and “Vegetation Association” and “Vegetation Complex” are used to describe vegetation at the state and regional scale respectively. The hierarchy and scale of vegetation classification systems as described in this report is:

- Vegetation Association (NVIS III)- Structural form and dominant species (1:1,000,000 -to 250,000)
- Vegetation Complex (NVIS IV)– structural and floristic description linked to geomorphology (1:250 000 to 1:100 000)
- Vegetation Type (NVIS V)- Floristic definition by strata with structural detail. Often represented with a code and floristic description (1:100 000 to 1:10 000).

2.4.2 Floristic community type analysis

The remnant vegetation of the southern Swan Coastal Plain was surveyed by Gibson *et al.* (1994) to provide an understanding of the major floristic gradients across the region. The major plant communities (or Floristic Community Types, FCTs) were defined by classifying the data according to the similarities in species composition between plots. When determining the FCT of a new record, a floristic analysis of species composition provides the most robust method that is consistent with the original classification.

Presently, a single consistent method for the determination of FCTs for vegetation data in the Swan Coastal Plain is not available. Therefore, it is preferable to use multiple methods and compare the output for the most likely result. All analyses described below were undertaken using 'R' environmental software, specifically its packages 'Cluster', 'Vegclust' and 'Vegan' (<https://www.r-project.org/>).

2.4.2.1 Hierarchical Clustering

Hierarchical agglomerative clustering is the usual first stage in classifying vegetation data into community types. This involves calculating the similarity (or more often, the dissimilarity) between plots within the dataset and then sequentially fusing the plots into groups according to their similarity. This type of method was used in the analysis of the original Swan Coastal Plain dataset (Gibson *et al.* 1994), but its use as the basis for assigning new plot data to the regional classification has some drawbacks.

Firstly, a hierarchical clustering only applies to the relationships between plots, and the relative distances between them, within that particular dataset. The addition of new data often alters the relative distances and disrupts the clustering output. Secondly, as an unsupervised method, hierarchical clustering does not define rules for the membership of the defined groups, and so the addition of new plots requires the rebuilding of the entire hierarchy (De Cáceres and Wiser 2012).

The data for the Swan Coastal Plain regional survey (Gibson *et al.* 1994) was downloaded from the NatureMap website. This is largely similar to the original survey except for one site (OATES-1), which has now been excluded. The species nomenclature of the original dataset was updated to be consistent with current usage. Where original names could not be matched clearly to the updated usage, those taxa were removed from the analysis. The data from the plots of Lot 7 and Lot 4 Runnymede Rd surveys (undertaken concurrently) was added to the matrix both together and also one plot a time, which served to remove any effect of spatial correlation between the new plots. Each new dataset was then analysed calculating the Bray-Curtis distance coefficient (or resemblance measure) and the flexible beta linkage method ($\beta = -0.1$). Assignment of the Runnymede Rd plots was to the nearest distinct group by inspection of the resulting dendrogram.

2.4.2.2 Non-hierarchical clustering

Non-hierarchical clustering methods often allow new plot data to be added to previous classifications because they are based on the concept that each group or cluster is represented by a prototype i.e. either a centroid or a medoid (a 'type' plot) (De Cáceres and Wiser 2012). Therefore, new observations can be assigned to an existing classification by calculating the distance to the nearest prototype (which may be considered a membership criterion). This approach is to be preferred to the hierarchical reconstruction approach because it defines numerical rules that can be consistently applied. However, it also means the original classification needs to be re-analysed using a different method, which can be problematic because not all sites from the original classification may be diagnostic for their respective clusters.

For the analysis of the Runnymede Rd data, the same updated Swan Coastal Plain dataset was used as for the hierarchical clustering analysis. After calculating a Bray-Curtis distance matrix, the dataset was then analysed using Fuzzy C-Means clustering in the R package 'Vegclust'. A fuzziness coefficient of 1.1 was chosen to minimise influence from noisy data points. FCTs with too few plots to reliably define determine a prototype (e.g. FCT 14 with two plots) were removed from the analysis. Similarly, some plots that were regularly being misclassified (such as those from clusters with large internal heterogeneity) were also removed. The final dataset consisted of 344 plots with 1316 taxa representing 38 FCTs. Each site of the Runnymede Rd data was then assigned a FCT using function 'vegclass' in the Vegclust package.

It should be noted that this approach for FCT assignment is preliminary and will need to be refined further before it can be used consistently. For example, the assignment of sites to dryland FCTs gives robust and consistent results. Sampling of seasonally-inundated wetlands, however, often gives problematic results as these floristic types show a greater degree of floristic overlap between groups and/or require additional sampling to provide a clearer differentiation between such groups. Also, disturbed sites with a high proportion of introduced taxa often give spurious results.

2.4.3 Conservation significant vegetation

An ecological community is defined as a naturally occurring biological assemblage that occurs in a particular type of habitat composed of specific abiotic and biotic factors.

At the State level, ecological communities may be considered Threatened once they have been identified as such by the WA Threatened Ecological Communities Scientific Advisory Committee. 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 Commonwealth as threatened, endangered or vulnerable. There are four categories of TEC, as described in Table 5. Some State TECs are also listed as Threatened under the Commonwealth EPBC Act.

Ecological communities identified as threatened, but not listed as TECs, can be 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. DBCA uses five categories of PEC according to their conservation priority, as described in Table 5.

Table 5. Conservation Codes for WA Vegetation (DEC 2013)

Conservation Code	Description and rating
Threatened Ecological Community (TEC)	A community is one which is found to fit into one of the following categories; “presumed totally destroyed”, “critically endangered”, “endangered” or “vulnerable”.
presumed totally destroyed	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.
critically endangered	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated
endangered	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
vulnerable	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.
Priority Ecological Community (PEC)	Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Conservation Code	Description and rating
Priority One	Poorly-known ecological communities. Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100 ha).
Priority Two	Poorly-known ecological communities. Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200 ha).
Priority Three	<p>Poorly known ecological communities</p> <ul style="list-style-type: none"> (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc.
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.
Priority Five	Conservation Dependent ecological communities

3 DESKTOP ASSESSMENT RESULTS

3.1 PHYSICAL ENVIRONMENT

3.1.1 Climate

The Survey Area is in the south-west of WA and experiences a temperate climate with dry, hot summers and cool, wet winters.

The Bureau of Meteorology (BoM) Wokalup Station (Site No.9642), is within 12km of the Survey Area and has up to 65 years of records (1951-2019) (Table 6). Data from the Wokalup station indicates the mean maximum temperature ranges from 16.7°C in July to 31.0°C in January, and the mean minimum temperature ranges from 7.9°C in July to 16.1°C in February. The mean annual rainfall is 936.2mm (BoM 2019).

Table 6. Climate statistics. Bureau of Meteorology, Wokalup Station (Site No. 9642).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature (°C)													
Mean max.	31.0	30.8	28.3	24.2	20.2	17.5	16.7	17.1	18.7	21.1	24.0	28.1	23.1
Mean min.	15.5	16.1	14.8	12.7	10.6	9.0	8.0	7.9	8.5	9.4	11.4	13.7	11.5
Rainfall (mm)													
Mean	14.5	15.3	20.7	51.4	134.6	180.5	182.6	134.3	95.8	57.7	35.7	15.3	936.2

3.1.2 Geology, landforms and soils

The Survey Area is located within the Swan Coastal Plain (SCP). The SCP represents the Quaternary surface of the Perth Basin and lies in a 30km wide band between the coast and the Darling Scarp, extending approximately 600km from Geraldton to Dunsborough (Playford *et al.* 1976).

The landform of the SCP is characterised as low-lying coastal plains, often swampy, with sand hills consisting mainly sandy, yellow soils (Beard 1990).

The Survey Area lies within the Spearwood dune geomorphic unit of the SCP (Figure 3). The Spearwood system is described as dune ridges with deep siliceous yellow brown sands or pale sands with yellow-brown subsoil.

The sand reaches a maximum thickness of 20 metres and is underlain by sandy clays of the Guildford Formation and limestone of the Tamala Formation.

A search of the Acid Sulphate Soil (ASS) risk map for the Swan Coastal Plain identified the area to be outside any mapped risk polygons.

3.1.3 Hydrology

The Survey Areas lies within the Coastal Catchment of the Harvey River Basin and does not fall within a Public Drinking Water Source Area (Western Australian Land Information System [WALIS] 2017).

The Site is within the Rights in Water and Irrigation Act (RIWI) Groundwater Proclamation Area (South West Coastal Groundwater Area), but outside any RIWI Act Surface Water Management Areas.

Locally, there are no defined drainage lines within the extraction area as drainage occurs by infiltration into the porous sand surface. There is no expression of surface water within the Survey Area.

3.1.4 Hydrogeology

The Survey Area is within the Bunbury trough of the Southern Perth Basin (DoW 2009).

Based on an evaluation of information provided by the Department of Water, together with data on static water elevation obtained from the drill log of a private bore sited on the adjoining Lot 4, groundwater occurs at an average of 7mAHD, with an annual variation of approximately 1 meter. Groundwater flow is towards the Mialla Swamp to the west.

3.2 VEGETATION

3.2.1 Regional Vegetation Mapping

The Survey Area lies within the Drummond Botanical Sub-district of the Darling Botanical District, which falls within the Southwest Botanical Province (Beard 1980) and is recognised as having a very high degree of species diversity.

The Drummond Botanical Sub-district is characterised by Banksia woodland on leached sands with Melaleuca swamps; woodlands of tuart (*Eucalyptus gomphocephala*), jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) (Beard, 1990). Dominant plant families of the Drummond Botanical Sub-district include Proteaceae, Myrtaceae and Fabaceae.

3.2.2 Biogeographic Regionalisation (IBRA 7)

The Biogeographic Regionalisation of Australia (IBRA) divides Australia into 89 bioregions based on major biological and geographical/geological attributes. These bioregions are subdivided into 419 subregions, as part of a refinement of the IBRA framework. The Survey Area is situated in the Perth subregion (SWA02) of the Swan Coastal Plain IBRA bioregion (DEE 2018; Thackway and Cresswell 1995) (Figure 4).

The Perth subregion (SWA02) is composed of colluvial and aeolian sands, alluvial river flats, coastal limestone. It comprises of Heath and/or Tuart woodlands on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages, and Marri on colluvial and alluvials and also includes a complex series of seasonal wetlands (Mitchell *et al.* 2002).

3.2.3 Pre-European vegetation

As discussed in Section 2.4.1, state and regional scale vegetation classification systems are described in terms of “Vegetation Association” and “Vegetation Complex”:

- Vegetation Association (NVIS III)- Structural form and dominant species (1:1,000,000 -to 250,000)
- Vegetation Complex (NVIS IV)– structural and floristic description linked to geomorphology (1:250 000 to 1:100 000)

In Western Australia, the datasets that map native vegetation occurring prior to European settlement at both a Vegetation Association and Vegetation Complex scale are described below:

- State wide Vegetation Association mapping is based on published and unpublished mapping of J. S. Beard at 1:250,000 scale (Beard 1990 and Beard *et al.* 2005).
- Vegetation Complex mapping for the south-west of Western Australia:
 - 1:250,000 Swan Coastal Plain Vegetation Complexes (Hedde *et al.* 1980) as updated by Webb *et al.* (2016)
 - 1:50,000 Mapping of vegetation complexes in the South West Forest Region of Western Australia (Mattiske and Havel 1998) as updated by Webb *et al.* (2016).

3.2.3.1 Vegetation Association

The Survey Area is supported by the Spearwood_6 vegetation association, which is broadly described as a medium woodland; tuart and jarrah (Beard *et al.* 2005; Government of Western Australia 2018b). The vegetation association of the Survey Area (within the Swan Coastal Plain) and its remaining extent in WA and the Swan Coastal Plain is presented in Table 7 and Figure 5.

Table 7. Pre-European Vegetation Extent (Source: Beard *et al.* 2005, Government of Western Australia 2018b)

Veg. Association and Ref No.	Extent Context	Pre-European Extent (ha)	Current Extent (ha)	% Pre European Extent Remaining	% Current Extent Protected (IUCN I–IV)
Spearwood_6	Swan Coastal Plain	56,343ha	14,579ha	25.8%	12.9%

Source: Government of Western Australia (2018b)

3.2.3.2 Vegetation Complex

Vegetation complexes are patterns of vegetation at a regional scale, and are based on factors such as landform, soil and climate.

The vegetation complex of the Survey Area is part of the “Karrakatta Complex – Central and South”, which is described as ‘predominantly open forest of *Eucalyptus gomphocephala* – *E. marginata*– *E. calophylla* and woodland of *E. marginata* – *Banksia* spp.’ (Webb *et. al* 2016).

The remaining extent of the vegetation complex of the Survey Area is presented in Table 8 and Figure 6.

Table 8. Vegetation Complex extent summary

Veg. Complex	Extent Context	Pre-European Extent (ha)	Current Extent (ha)	% Pre European Extent Remaining
Karrakatta Complex – Central and South	Swan Coastal Plain	2,178.42ha	2,143.61ha	98.4%

Source: Webb *et. al* (2016)

3.2.4 Threatened and Priority Ecological Communities:

According to various databases, the entire Survey Area has been mapped as a community that is likely to contain Banksia Woodlands of the Swan Coastal Plain ecological community, an Endangered TEC listed as under the EPBC Act. A summary of the database search results, including the likely presence of TECs, is presented in Appendix 3.

Field assessments were used to confirm the presence of the TEC within the Study area.

3.2.5 Environmentally Sensitive Areas and Wetlands

There are no Environmentally Sensitive Areas (ESA) as defined by the Native Vegetation Clearing Regulations within the Survey Area. The two closest ESAs are located approximately 1.8km west and 1km east of the Survey Area and are both associated with conservation category wetlands.

The nearest Ramsar Wetland, the Peel-Yalgorup System (Australian Ramsar Site No. 36), is approximately 5.8km north west of the Survey Area.

3.3 FLORA

3.3.1 Conservation Significant Flora

Database searches of NatureMap (DBCA 2018d), the DBCA Threatened and Priority Flora (DBCA 2018c), and the WA Herbarium Threatened Flora Databases Florabase (WA Herbarium 2018) as well as the DEE protected matters database (DEE 2018b) were undertaken to determine whether any Threatened or Priority flora are known from within a 5 km radius of the Survey Area. The literature review and database searches identified 21 conservation significant species in proximity of the Survey Area, representing ten Threatened Flora, nine Priority Flora and two species undetermined (*Caladenia georgei* x *speciosa*; *Caladenia paludosa* x *speciosa*) (Figure 7). Of the 21 conservation significant species recorded, six (two Threatened Flora; and four Priority Flora) were recorded within approximately 2km from the Survey Area:

- *Acacia semitrullata* (P4)
- *Boronia juncea* subsp. *Juncea* (P1)
- *Dillwynia dillwynioides* (P3)
- *Drakaea elastica* (T)
- *Drakaea micrantha* (T); and
- *Lasiopetalum membranaceum* (P3).

The list of previously recorded conservation significant species, their habitat preference and likelihood of occurrence within the Survey Area is summarised in Table 9. Analysis of the preferred habitat and soil type found that two Priority 4 species had the potential to occur within the Survey Area (*Caladenia speciosa* and *Acacia semitrullata*), with the remaining species preferring seasonally wet habitats or soil types not found in the Survey Area.

A summary of the database search results, including conservation significant flora, is presented in Appendix 3.

Table 9. Conservation significant flora occurring in proximity to the Survey Area.

Species	EPBC Act	BC Act /DBCA *	Description	Potential to occur (soil type/habitat within Survey Area)
<i>Acacia flagelliformis</i>		P4	Rush-like, erect or sprawling shrub, 0.3-0.75(-1.6) m high. Fl. yellow, May to Sep. Sandy soils. Winter-wet areas.	Unlikely
<i>Acacia semitrullata</i>		P4	A slender, erect, pungent shrub to 1.5m tall. Flowers are cream- white and visible in May to October. Habitat for this species is in white/grey sand sometimes over laterite or clay. This species occurs in sandplains and swampy areas.	Possible
<i>Andersonia gracilis</i>	Endangered	T	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple, Sep to Nov. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Unlikely
<i>Austrostipa bronwenae</i>	Endangered	T	Perennial, rhizomatous grass to 1.5m tall (including flower spikes). The inflorescence is 10 to 20cm long. Flowering occurs in October through November. Fruit matures in November to December. Grows in calcareous, winter-wet grey-brown sandy-loam or dark brown loam over clay	Unlikely
<i>Boronia capitata subsp. gracilis</i>		P3	Slender shrub, 0.3-0.6(-3) m high, branches pilose. Fl. pink, Jun to Nov. White/grey or black sand. Winter-wet swamps, hillslopes.	Unlikely
<i>Boronia juncea subsp. juncea</i>		P1	Slender or straggly shrub, pedicels and sepals glabrous. Fl. pink, Apr. Sand. Low scrub.	Unlikely
<i>Caladenia georgei x speciosa</i>			Insufficient information available	Unlikely
<i>Caladenia huegelii</i>	Endangered	T	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey or brown sand, clay loam.	Unlikely
<i>Caladenia paludosa x speciosa</i>			Insufficient information available	Unlikely
<i>Caladenia procera</i>	Critically Endangered	T	Tuberous, perennial, herb, 0.35-0.9 m high. Fl. yellow, Sep to Oct. Rich clay loam. Alluvial loamy flats, jarrah/marri/peppermint woodland, dense heath, sedges.	Unlikely
<i>Caladenia speciosa</i>		P4	Tuberous, perennial, herb, 0.35-0.6m high. Flowers Sep-Oct. Occurs in white, grey or black sand.	Possible
<i>Cyathochaeta teretifolia</i>		P3	Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. brown. Grey sand, sandy clay. Swamps, creek edges.	Unlikely
<i>Dillwynia dillwynioides</i>		P3	Decumbent or erect, slender shrub, 0.3-1.2 m high. Fl. red & yellow/orange, Aug to Dec. Sandy soils. Winter-wet depressions.	Unlikely

Species	EPBC Act	BC Act /DBCA *	Description	Potential to occur (soil type/habitat within Survey Area)
<i>Diuris drummondii</i>		T	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow, Nov to Dec or Jan. Low-lying depressions, swamps.	Unlikely
<i>Diuris micrantha</i>	Vulnerable	T	Basal tuft of narrow, linear leaves and a loose, slender inflorescence up to 60 cm high. The yellow flowers have reddish-brown markings and are up to 1.3 cm across. Flowers appear from August to early October. It is found in small populations, on dark, grey to blackish, sandy clay-loam substrates in winter wet depressions or swamps.	Unlikely
<i>Drakaea elastica</i>	E	T	A slender orchid to 30 cm tall with a prostrate, round to heart shaped leaf. Singular, bright green, glossy flower. Habitat for this species is within bare patches of white sand over dark sandy loams on damp areas.	Unlikely
<i>Drakaea micrantha</i>	Vulnerable	T	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct. Brown loamy clay. Winter-wet swamps, in shallow water.	Unlikely
<i>Lasiopetalum membranaceum</i>		P3	Multi-stemmed shrub, 0.2-1 m high. Fl. pink-blue-purple, Sep to Dec. Sand over limestone.	Unlikely
<i>Synaphea</i> sp. Fairbridge Farm	Critically Endangered	T	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Fl. yellow, Oct. Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	Unlikely
<i>Synaphea</i> sp. <i>Serpentine</i>	Critically Endangered	T	Plants clumped, Spikes long, undulating, Flowers small, openly spaced, Sparsely hairy to hairless in upper 1/3 of fruit body. Occurs predominantly on flat terrain on grey-brown sandy loams to clay in seasonally wet areas.	Unlikely
<i>Tripterococcus</i> sp. Brachylobus		P4	Perennial herb to 0.6m with yellow flowers. Sand overlay	Unlikely

*DBCA 2018a

3.3.2 Introduced Flora

The Shire of Harvey has 47 Declared Pests listed under Section 22(2) of the BAM Act, six of which have the strongest level of control category (C2 Eradication):

- *Chondrilla juncea* (skeleton weed);
- *Pistia stratiotes* (water lettuce);
- *Prosopis glandulosa* x *Prosopis velutina* (mesquite);
- *Ulex europaeus* (gorse);
- *Xanthium spinosum* (thorny burweed); and
- *Xanthium strumarium* (sheepbur).

3.4 SOCIAL ENVIRONMENT

3.4.1 Heritage

An Aboriginal Heritage Inquiry System (Department of Planning Lands and Heritage <https://maps.daa.wa.gov.au/AHIS/>) identified five heritage surveys conducted over the entire (or part of the) Survey Area:

- Heritage Survey Area 104608 (1): Bunbury-Wellington Regional Planning Study: Aboriginal Heritage & Planning Survey: working paper no. 6
- Heritage Survey Area 23321 (1): Report of an archaeological and ethnographic Aboriginal Heritage Survey of Lot 4 Runnymede Road, Wellesley, Western Australia
- Heritage Survey Area 103801 (1): Report of a Survey for Aboriginal Sites, Korijekup Seismic Program. Jan.1991.
- Heritage Survey Area 104079 (1): Bunbury-Wellington Regional Planning Study: Working Paper no.6, Aboriginal Heritage and Planning Survey. [Open] Released for Public Comment July 1992.
- Heritage Survey Area 102190 (1): Report on Aboriginal Sites of the Lake Peel-Preston Lakelands.

According to the Aboriginal Heritage Inquiry System, no Registered Aboriginal Sites or other Heritage Places have been recorded in the Survey Area. The nearest site is “Registered Aboriginal Site 15371 – Australind: Buffalo Rd Burial”, and “Registered Aboriginal Site 16713 – Collie River Waugal” located approximately 8.2km south west of the Survey Area.

3.5 LOCAL STUDIES

Environmental studies (incorporating flora and vegetation assessments) near the Survey Area include:

- Mattiske Consulting (2003). Flora and Vegetation Survey of the Proposed Kwinana to Australind Gas Pipeline Infrastructure Corridor. Prepared for BBG and Department of Mineral and Petroleum Resources. November 2003.
- GHD (2017) Additional Area Assessment – Biological Assessment within the Kemerton Strategic Industrial Area. Memo for Albemarle Lithium Pty Ltd. October 2017.
- Ecological Australia (2017) Kemerton Industrial Area Spring Flora and Fauna Survey. Report prepared for S2V Consulting. September 2017.

4 FIELD ASSESSMENT RESULTS

4.1 LIMITATIONS AND CONSTRAINTS

There were very few constraints for this survey and all potential limitations are outlined in Table 10.

Table 10. Survey limitations

Potential limitation	Constraint	How this was addressed
Availability of contextual information at a regional and local scale	Not a constraint	Large range of reference resources was available, including vegetation association and complex information, DBCA conservation significant flora and ecological community databases (DBCA 2018c; 2018f; 2018g) as well as other studies within or near the Survey Area.
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed	Not a constraint	All botanists had extensive experience working in the south west. Refer to Section 2.2.1.
Proportion of flora recorded and/or collected, any identification issues	Not a constraint	The survey intensity was considered thorough with adequate replication of survey sites selected via pre-planned quadrat locations and opportunistic field reconnaissance. The Survey Area was easily accessible by car and the entire site could be traversed on foot.
Appropriate area fully surveyed (effort and extent)	Not a constraint	Coverage of the Survey Area is good. Site is relatively small and easy to traverse, and so entire Survey Area was mapped. High quality aerial maps were used during the survey and desktop mapping.
Access restrictions within the Survey Area	Not a constraint	Vehicle access to the Survey Area via Stanley Road and internal tracks provided no restrictions. Some foot traverse required to access southern boundary of Survey Area.
Survey timing, rainfall, season of survey	Not a constraint	Optimum flowering period following good winter rainfall in 2018. Appropriate survey time for targeted orchid species was confirmed with DBCA prior to field visit.
Disturbance that may have affected the results of survey such as fire, flood or clearing	Not a constraint	No recent major disturbance event has occurred within the Survey Area. The site was very degraded due to heavy grazing and the understory was limited.

4.2 FLORA

4.2.1 Overview

A total of 81 taxa from 63 genera and 34 families were identified in the Survey Area. Of the 81 taxa recorded, nine taxa were introduced flora and 72 were native species (88.9% of taxa recorded). The commonly occurring families were Fabaceae and Myrtaceae (with 5 taxa each), Orchidaceae (7 taxa), as well as Asparagaceae and Asteraceae (with 8 taxa each).

A flora inventory is provided in Appendix 4.

4.2.2 Threatened and Priority Flora

No Threatened species listed under the EPBC Act or gazetted as Declared Rare Flora (Threatened) pursuant to the BC Act were recorded in the Survey Area.

Three Priority flora, as listed by DBCA (2018a) were recorded in the Survey Area. The recorded Priority species included one P4 species (*Acacia semitrullata*), one P2 species (*Millotia tenuifolia* ?var. *laevis*); one P3 species (*Lasiopetalum ?membranaceum*) (Figure 8). The last two taxa (*Millotia* and *Lasiopetalum*) could not be identified with certainty as they were either sterile or the flowering material was immature, but the identifications provided are the most likely outcome.

4.2.3 Range extensions

The Survey Area did not represent a range extension for any of the flora recorded.

4.2.4 Introduced Flora

A total of nine introduced species, representing 11% of the total taxa, were recorded during the survey and are listed in Table 11. No species recorded are listed as Declared Pests under the BAM Act or WONS.

Table 11. Introduced flora records from the Survey Area

Species	Common name	No. of quadrats with records
<i>Arctotheca calendula</i>	capeweed	1
<i>Asphodelus fistulosus</i>	onion weed	1
<i>Briza maxima</i>	blowfly grass; quaking grass	4
<i>Cotula turbinata</i>	mayweed	1
<i>Ehrharta longiflora</i>	annual veld grass	2
<i>Hypochaeris glabra</i>	smooth cats-ear	7
<i>Petrorhagia dubia</i>	velvety pink	1
<i>Ursinia anthemoides</i>	ursinia	4
<i>Vulpia bromoides</i>	squirrel-tail fescue	1

4.3 VEGETATION

4.3.1 Overview

One vegetation type was described for the entire Survey Area:

Banksia attenuata - *Eucalyptus marginata* open woodland over a *Hibbertia hypericoides* – *Melaleuca thymoides* low open shrubland over a herbland of *Dasypogon bromeliifolius*.

The extent of this vegetation type is mapped in Figure 8. A matrix showing species per site is also presented in Appendix 5.

4.3.2 Hierarchical analysis

The results of the hierarchical analysis show that plots either assigned themselves to FCT 21a – ‘Central *Banksia attenuata* – *Eucalyptus marginata* woodlands’ or FCT 21c – ‘Low-lying *Banksia attenuata* woodlands or shrublands’ (Table 12). The results are consistent with similarities in the presence of dominant species, however once landscape position is also considered/assessed, it is less likely that the Survey Area is consistent with FCT 21c, given the site’s relatively high landscape position.

Dendrogram outputs from the analysis are shown in Appendix 6.

The plots that could not be assigned an FCT were first fused with PAGA – 6, which as a member of FCT 25 – ‘Southern *Eucalyptus gomphocephala* – *Agonis flexuosa* woodlands’. This similarity is likely due to the presence of *Agonis flexuosa* within the site, but PAGA – 6 is a transitional plot with similarities to plots within FCTs 11, and hence has led to a misleading assignment.

Table 12. Hierarchical analysis for plots from the Lot 7 Runnymede Rd Survey Area

Site	FCT First fusion	FCT of nearest main group fusion	Possible FCT
Plot 8	25	21a	21a
Plot 9	21a	21a	21a
Plot 10	21a	21a	21a
Plot 11	21c	21c	21c
Plot 109	21c	5	21c
Plot 110	21c	5	21c
Plot 111	25	11	undetermined
Plot 112	21c	5	21c

4.3.3 Non-hierarchical analysis

The results of the FCT assignment by non-hierarchical analysis were inconclusive and are shown in Table 13. The results show the highest similarity to either a deeper wetland group (FCTs 13, 15, 16, 17) or FCT 6 for each plot, although the strengths of membership (similar to a probability) are not strong and not much greater than to other groups. This result is often due to fewer native species present within the site than those plots sampled in the Swan Coastal Plain survey. This can occur in otherwise ‘Excellent’ condition vegetation that has been exposed to disturbances such as increased fire regimes, altered hydrological conditions, recreational usage or grazing that may not degrade the structure of the vegetation but allow a higher degree of weed infestation and suppress some native species.

Table 13. Non-hierarchical analysis for plots from the Lot 7 Runnymede Rd Survey Area.

Plot	FCT of nearest group*	FCT of 2 nd nearest group	FCT of 3 rd nearest group
Plot 8	6 (32.7%)	13,15,16,17 (26.4%)	5 (10.1%)
Plot 9	6 (37.3%)	13,15,16,17 (18.8%)	5 (12.3%)
Plot 10	6 (28.5%)	5 (16.0%)	21c (13.0%)
Plot 11	6 (35.8%)	13,15,16,17 (13.2%)	21c (13.1%)
Plot 109	13,15,16,17 (29.3%)	6 (23.4%)	29/30 (19.2%)
Plot 110	13,15,16,17 (37.5%)	6 (28.0%)	29/30 (14.7%)
Plot 111	6 (41.9%)	13,15,16,17 (35.4%)	29/30 (14.9%)
Plot 112	13,15,16,17 (50.5%)	6 (28.6%)	29/30 (13.5%)

* Strength of membership shown in brackets

4.3.4 Threatened and Priority Ecological Communities

The Survey Area is considered to be consistent with FCT 21a, which is not listed as a PEC under WA State Policy (DBCA 2019).

The vegetation type within the site was also assessed for consideration as part of the Commonwealth’s EPBC Act-listed TEC ‘Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region’ (Banksia Woodlands TEC). This TEC was gazetted in September 2016 (Commonwealth of Australia 2016).

To be considered as part of the Banksia Woodlands TEC, a patch of banksia woodland needs to meet a number of criteria:

- occurrence on the Swan Coastal Plain and immediately adjacent areas of the Whicher Scarp, Ridge Hill Shelf and Dandaragan Plateau in well-drained, low nutrient soils on sandplain landforms;
- the structure is that of a low woodland to forest;
- the canopy is commonly dominated by or co-dominated by *Banksia attenuata* and/or *Banksia menziesii*;
- the patch must include at least one of *Banksia attenuata*, *Banksia menziesii*, *Banksia ilicifolia* or *Banksia prionotes*; and
- the canopy may include emergent trees of *Eucalyptus marginata* or *Corymbia calophylla*.

The condition of the patch is also important in determining the presence of the Banksia Woodlands TEC. A patch must meet the criteria for 'Good' condition or better according to the Keighery (1994) Condition Scale (see Table 3 in Section 2.2.5). If a patch is rated as being in 'Good' condition, then it must also be at least 2 ha in size.

4.3.5 Vegetation Condition

The vegetation of the Survey Area ranged from 'Excellent' to 'Degraded', with the majority of the site in an 'Excellent' condition. An area in the west varied from 'Good' to 'Very Good' where more weeds were present and thin pockets along the northern and western boundary were in a 'Degraded' condition as they directly adjoined cleared areas.

As the majority of the vegetation of the site is in a 'Good' or better condition, it meets the criteria for inclusion within the EPBC Act listed Banksia Woodlands TEC (as described above).

Vegetation condition mapping is presented in Figure 9 and the extent described in Table 14. The average fire age of the vegetation was considered greater than three years (at least three years since last fire).

Table 14. Vegetation condition extent in the Survey Area

Condition	Quadrat records	Area (ha)	Area (%)
Excellent	6	11.3	70.8%
Very Good	1	2.6	16.3%
Good	1	1.0	6.4%
Degraded	0	1.0	6.5%

5 DISCUSSION

5.1 FLORA

Database searches identified 21 local conservation significant species, of which two Priority 4 species (*Caladenia speciosa* and *Acacia semitrullata*) were considered as potentially occurring within the Survey Area, based on location of previous records, preferred habitat and soil type.

Field surveys recorded a total of 81 taxa, 63 genera and 34 families. Nine (11%) of these taxa were weeds, none of which are WONS or Declared Pests under the BAM Act.

No Threatened species listed under the EPBC Act or gazetted as Declared Rare Flora (Threatened) pursuant to the BC Act were recorded in the Survey Area, despite targeted searches during optimum flowering times over the entire Survey Area.

Three Priority flora, as listed by DBCA (2018a) were recorded in the Survey Area: *Acacia semitrullata* (P4); *Millotia tenuifolia* ?var. *laevis* (P2); *Lasiopetalum ?membranaceum* (P3). Although the *Millotia* and *Lasiopetalum* species could not be identified with certainty (considered either sterile or the flowering material was immature) the identifications provided are the most likely outcome.

5.2 VEGETATION

One vegetation type was described for the Survey Area:

Banksia attenuata - *Eucalyptus marginata* open woodland over a *Hibbertia hypericoides* – *Melaleuca thymoides* low open shrubland over a herbland of *Dasypogon bromeliifolius*.

The vegetation described was most similar to FCT21a, which is part of the EPBC Act Banksia Woodland TEC. The vegetation of the Survey Area ranged from 'Excellent' to 'Degraded', with the majority of the site in an 'Excellent' condition, which also meets the criteria for inclusion within the EPBC Act listed Banksia Woodlands TEC.

5.3 CONCLUSION

The key findings, conclusions and recommendations arising from the flora and vegetation assessment within the Survey Area are as follows:

- No Threatened flora under the BC Act or under the EPBC Act were recorded.
- Three Priority flora (one P2; one P3; and one P4), as listed by DBCA (2018a) were recorded in the Survey Area
- One vegetation type, mainly in 'Excellent' condition, was described and mapped within the Survey Area: *Banksia attenuata* - *Eucalyptus marginata* open woodland over a *Hibbertia hypericoides* – *Melaleuca thymoides* low open shrubland over a herbland of *Dasypogon bromeliifolius*.
- The vegetation of the Survey Area was consistent with FCT 21a, which although not listed as a PEC under WA State Policy (DBCA 2019), is consistent with the Commonwealth EPBC Act listed Banksia Woodlands TEC.

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7 FIGURES

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- Figure 2. Sites and Surrounds
- Figure 3. Soil Landscape System
- Figure 4. Biogeographical Regionalisation of Australia (IBRA)
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- Figure 7. Environmental Values
- Figure 8. Recorded Vegetation Type and Significant Flora
- Figure 9. Vegetation Condition



Lot 7 Runnymede Road

Indian Ocean

0 10 km









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Projection: Australia MGA94 (50)

Client: B & J Catalano
Project: Flora and Vegetation
Assessment
Location: Lot 7 Runnymede Rd
Wellesley

**Figure 1:
Locality Plan**

-  Survey Area
-  Property Boundary
-  Roads
-  Conservation Wetland
-  Multiple Use Wetland
-  Resource Enhancement Wetland

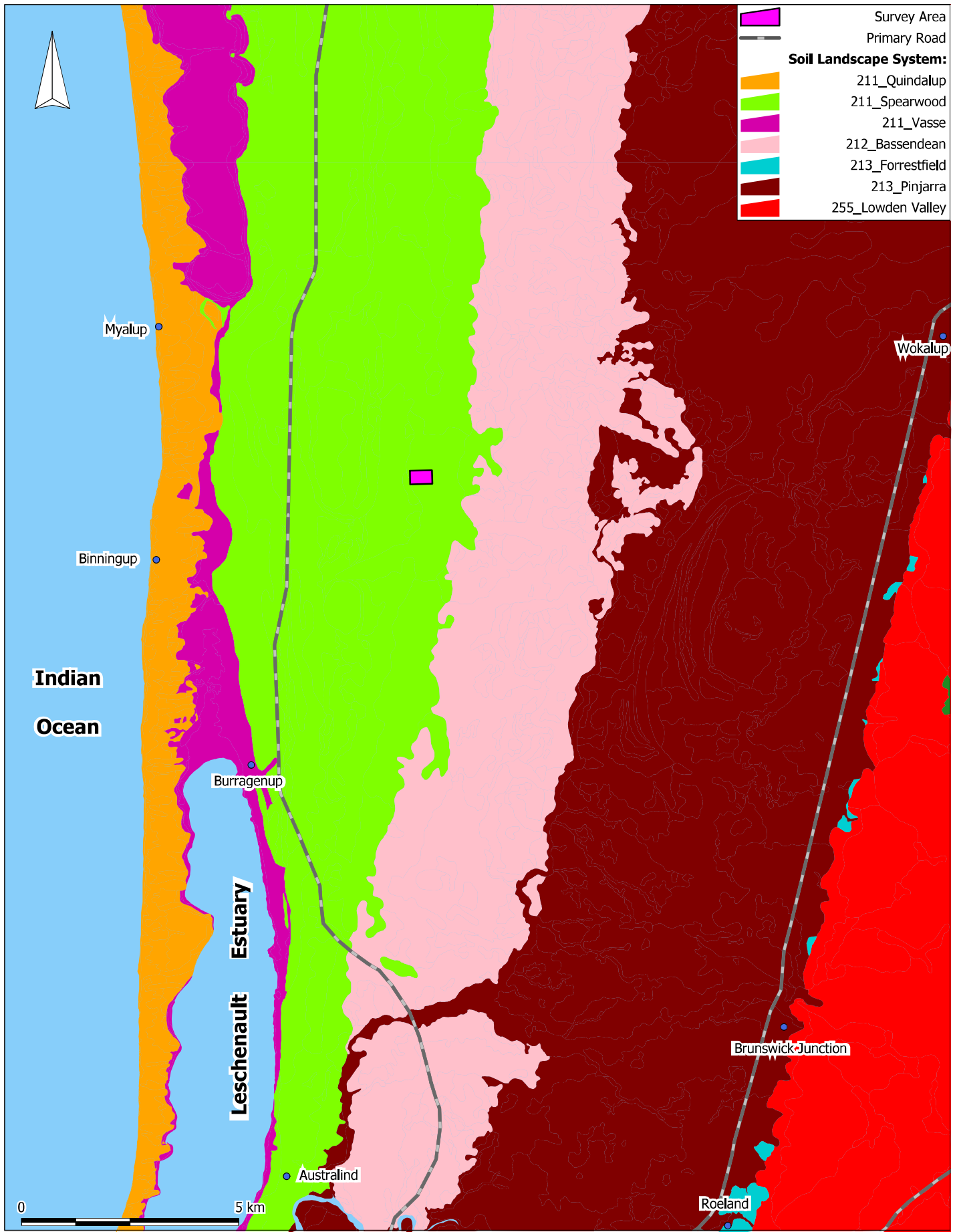


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**Figure 2:
Site and
Surrounds**

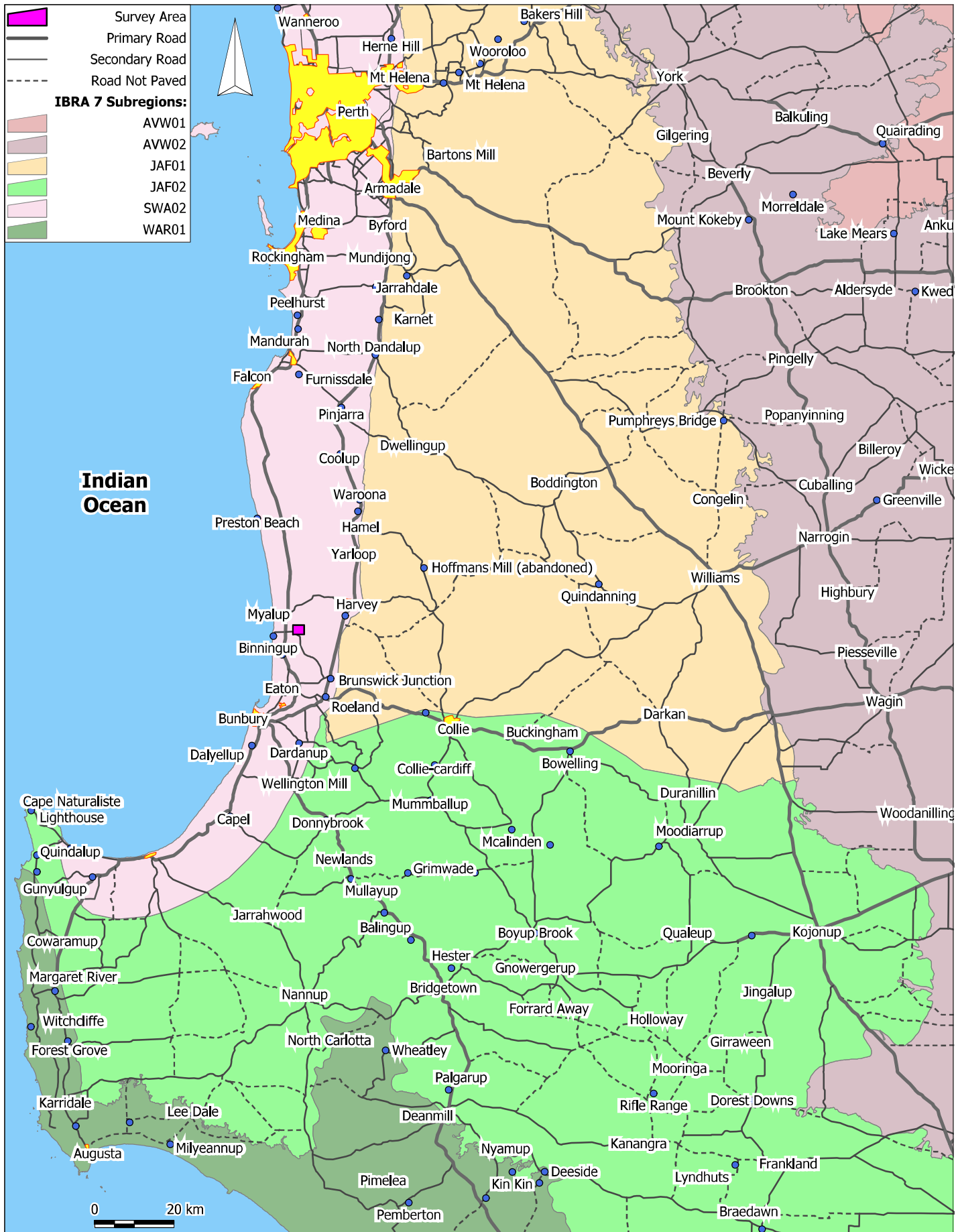


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Figure 3:
Soil Landscape

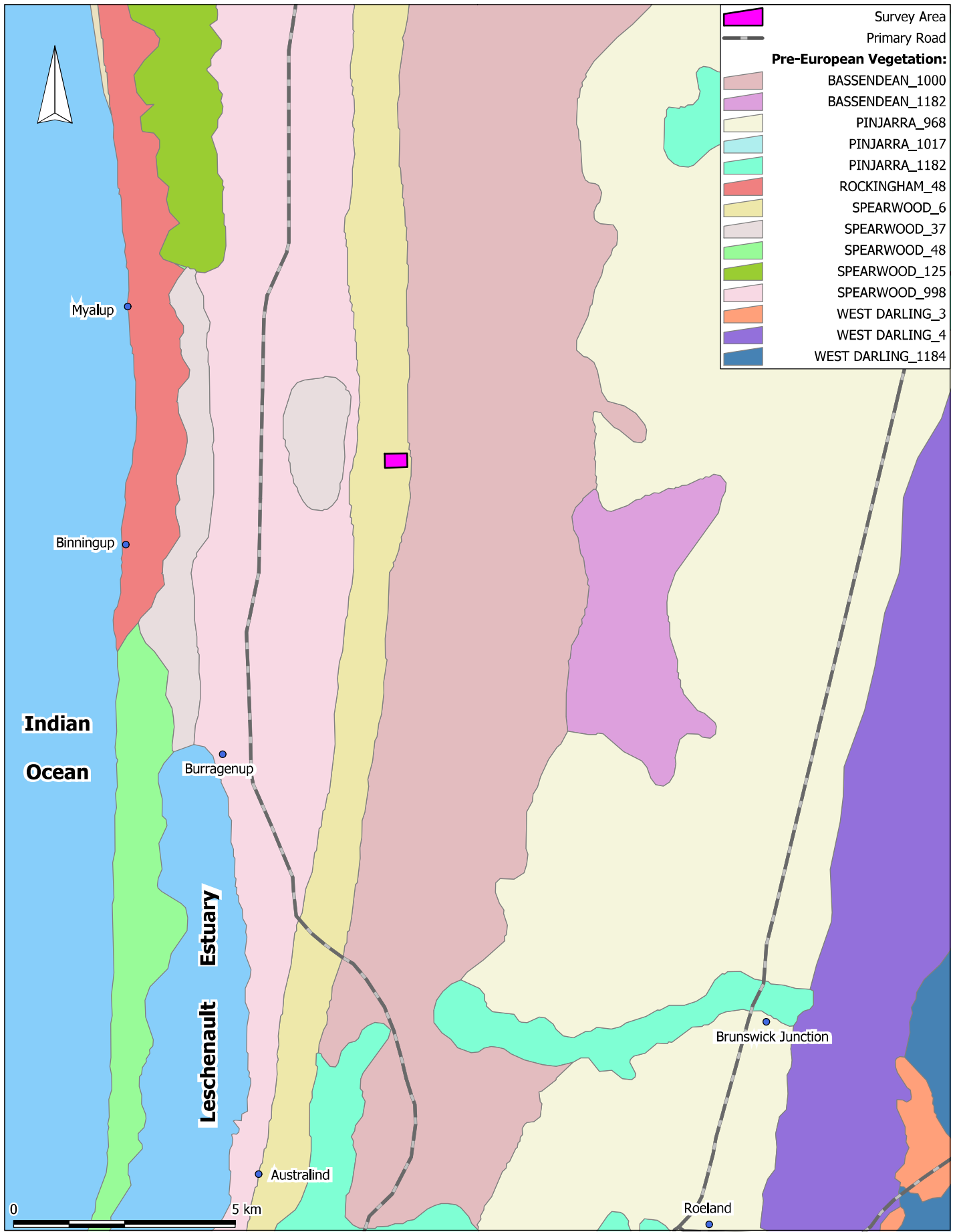


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**Figure 4:
IBRA
Subregions**



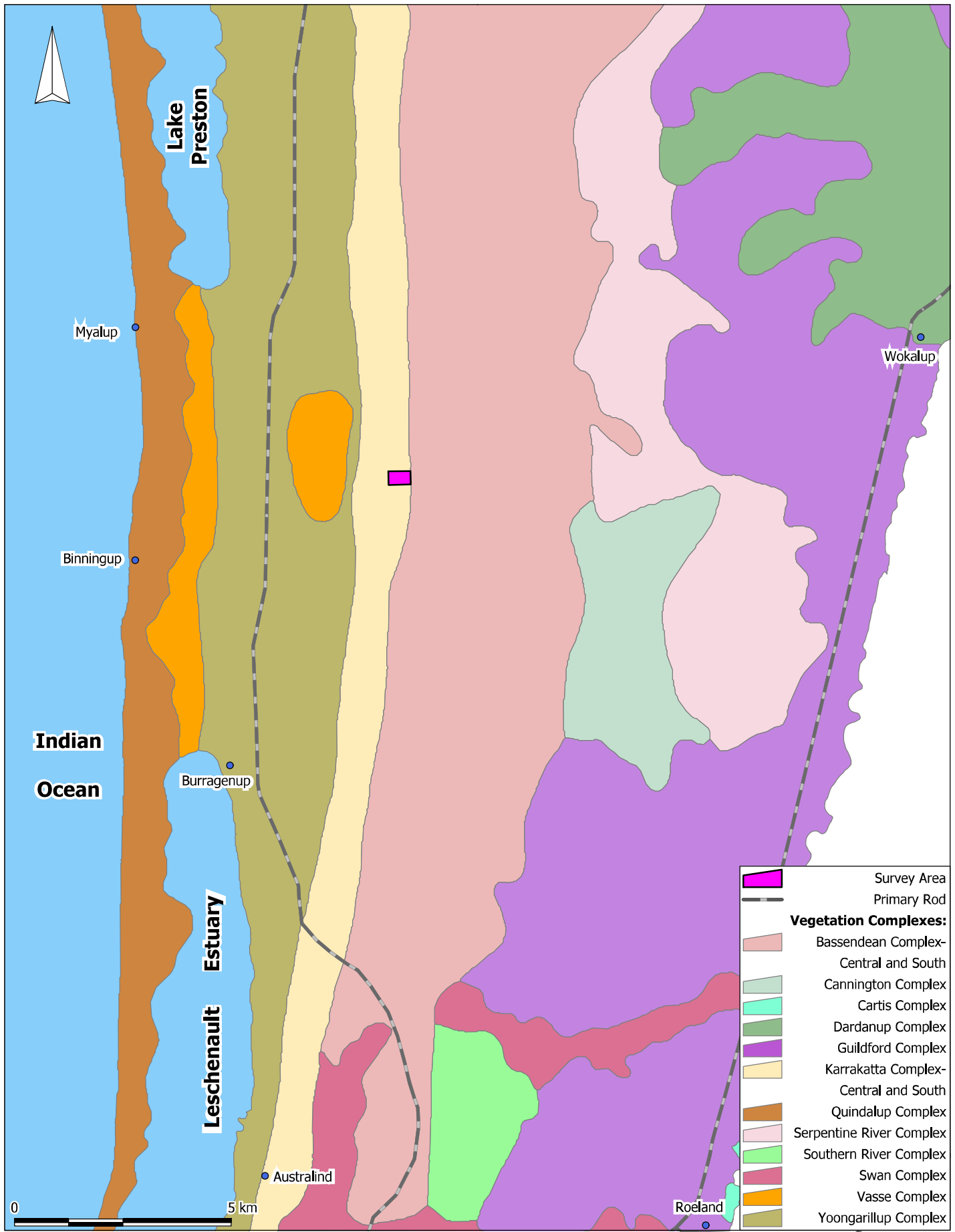
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**Figure 5:
Pre-European
Vegetation**



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**Figure 6:
 Vegetation Complexes**



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Scale: 1:2100
 Original Size: A4
 Air Photo Source: Nearmap May 2017
 Datum: GDA94
 Projection: Australia MGA94 (50)

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Project: Flora and Vegetation Assessment
Location: Lot 7 Runnymede Rd, Wellesley

Figure 8:
Vegetation Type & Significant Flora



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Air Photo Source: Nearmap May 2017
Datum: GDA94
Projection: Australia MGA94 (50)

Client: B & J Catalano
Project: Flora and Vegetation Assessment
Location: Lot 7 Runnymede Rd, Wellesley


**Figure 9:
Vegetation Condition**

8 APPENDICES

- Appendix 1. Sampling Site Description
- Appendix 2. Declared Pest Plant Categories and Requirements
- Appendix 3. Summary of Database Search Results
- Appendix 4. Complete Species List (Family grouping)
- Appendix 5. Matrix: Species x Quadrat
- Appendix 6. Dendrogram outputs from FCT Analysis

APPENDIX 1.

QUADRAT DESCRIPTIONS

Plot 8	
Easting / Longitude	-33.1416338
Northing / Latitude	115.755286
Landform	midslope
Soil colour	Grey
Soil text	Clayey sand
Soil depth	>50 cm
Surface gravel	0
Bare ground %	10
Aspect	W
Fire Interval	>3 years
Slope	0-5
Impact	Low
Grazing	Low
Vegetation Condition	Excellent
Weed cover	0
Strata 1 Height	Trees
Strata 1 Cover	10-30%
Strata 1 Dominance	<i>Eucalyptus marginata</i> , <i>Agonis flexuosa</i> , <i>Banksia attenuata</i>
Strata 2 Height	Shrubs <1m
Strata 2 Cover	2-10%
Strata 2 Dominance	<i>Xanthorrhoea gracilis</i> , <i>Hibbertia hypericoides</i> , <i>Melaleuca thymoides</i>
Strata 3 Height	Herbs
Strata 3 Cover	10-30%
Strata 3 Dominance	<i>Lepidosperma squamatum</i>
	

Plot 9	
Easting / Longitude	-33.1415214
Northing / Latitude	115.7545775
Landform	Midslope
Soil colour	Grey
Soil text	Clayey sand
Soil depth	>50 cm
Surface gravel	0
Bare ground %	5
Aspect	W
Fire Interval	>3 years
Slope	0-5
Impact	Low
Grazing	Low
Vegetation Condition	Excellent
Weed cover	0
Strata 1 Height	Trees
Strata 1 Cover	10-30%
Strata 1 Dominance	<i>Eucalyptus marginata</i> , <i>Agonis flexuosa</i> , <i>Banksia attenuata</i>
Strata 2 Height	Shrubs <1m
Strata 2 Cover	2-10%
Strata 2 Dominance	<i>Xanthorrhoea gracilis</i> , <i>Hibbertia hypericoides</i> , <i>Melaleuca thymoides</i>
Strata 3 Height	Herbs
Strata 3 Cover	30-70%
Strata 3 Dominance	<i>Dasypogon bromeliifolius</i>



Plot 10	
Easting / Longitude	-33.1416705
Northing / Latitude	115.7521935
Landform	midslope
Soil colour	Grey
Soil text	Clayey sand
Soil depth	>50 cm
Surface gravel	0
Bare ground %	10
Aspect	W
Fire Interval	>3 years
Slope	0-5
Impact	Low
Grazing	Low
Vegetation Condition	Excellent
Weed cover	0
Strata 1 Height	Trees
Strata 1 Cover	10-30%
Strata 1 Dominance	<i>Eucalyptus marginata</i> , <i>Banksia attenuata</i> , <i>Corymbia calophylla</i>
Strata 2 Height	Shrubs <1m
Strata 2 Cover	10-30%
Strata 2 Dominance	<i>Xanthorrhoea gracilis</i> , <i>Hibbertia hypericoides</i> , <i>Melaleuca thymoides</i>
Strata 3 Height	Herbs
Strata 3 Cover	10-30%
Strata 3 Dominance	<i>Dasypogon bromeliifolius</i>



Plot 11	
Easting / Longitude	-33.1414014
Northing / Latitude	115.7511388
Landform	midslope
Soil colour	Grey
Soil text	Clayey sand
Soil depth	>50 cm
Surface gravel	0
Bare ground %	5
Aspect	W
Fire Interval	>3 years
Slope	0-5
Impact	Low
Grazing	Low
Vegetation Condition	Very good
Weed cover	0
Strata 1 Height	Trees
Strata 1 Cover	10-30%
Strata 1 Dominance	<i>Eucalyptus marginata</i> , <i>Banksia attenuata</i> , <i>Corymbia calophylla</i> , <i>Agonis flexuosa</i>
Strata 2 Height	Shrubs <1m
Strata 2 Cover	2-10%
Strata 2 Dominance	<i>Xanthorrhoea gracilis</i> , <i>Hibbertia hypericoides</i> , <i>Melaleuca thymoides</i>
Strata 3 Height	Herbs
Strata 3 Cover	2-10%
Strata 3 Dominance	<i>Dasyogon bromeliifolius</i>



Plot 109	
Easting / Longitude	383889
Northing / Latitude	6332504
Landform	Mid slope
Soil colour	Grey
Soil text	Clayey Sand
Soil depth	>50 cm
Surface gravel	0
Bare ground %	1
Aspect	N
Fire Interval	>3 years
Slope	5-15
Impact	Low
Grazing	Low
Vegetation Condition	Excellent
Weed cover	0
Strata 1 Height	Trees
Strata 1 Cover	30-70%
Strata 1 Dominance	<i>Eucalyptus marginata</i> , <i>Agonis flexuosa</i> , <i>Banksia attenuata</i>
Strata 2 Height	Shrubs <1m
Strata 2 Cover	2-10%
Strata 2 Dominance	<i>Hibbertia hypericoides</i> , <i>Melaleuca thymoides</i>
Strata 3 Height	Herbs
Strata 3 Cover	2-10%
Strata 3 Dominance	<i>Dasyogon bromeliifolius</i>



Plot 110	
Easting / Longitude	383740
Northing / Latitude	6332495
Landform	Mid slope
Soil colour	Grey
Soil text	Clayey Sand
Soil depth	>50 cm
Surface gravel	0
Bare ground %	4
Aspect	NW
Fire Interval	>3 years
Slope	5-15
Impact	Low
Grazing	Low
Vegetation Condition	Excellent
Weed cover	0
Strata 1 Height	Trees
Strata 1 Cover	30-70%
Strata 1 Dominance	<i>Eucalyptus marginata</i> , <i>Agonis flexuosa</i> , <i>Banksia attenuata</i> , <i>Corymbia calophylla</i>
Strata 2 Height	Shrubs <1m
Strata 2 Cover	<2%
Strata 2 Dominance	<i>Hibbertia hypericoides</i>
Strata 3 Height	Herbs
Strata 3 Cover	10-30%
Strata 3 Dominance	<i>Dasyogon bromeliifolius</i> , <i>Xanthorhea gracillis</i>



Plot 111	
Easting / Longitude	383551
Northing / Latitude	6332442
Landform	Upper slope
Soil colour	Grey
Soil text	Clayey Sand
Soil depth	>50 cm
Surface gravel	0
Bare ground %	4
Aspect	W
Fire Interval	>3 years
Slope	5-15
Impact	Low
Grazing	Low
Vegetation Condition	Excellent
Weed cover	0
Strata 1 Height	Trees
Strata 1 Cover	30-70%
Strata 1 Dominance	<i>Eucalyptus marginata</i> , <i>Banksia attenuata</i> , <i>Corymbia calophylla</i>
Strata 2 Height	Shrubs <1m
Strata 2 Cover	2-10%
Strata 2 Dominance	<i>Melaleuca thymoides</i>
Strata 3 Height	Herbs
Strata 3 Cover	10-30%
Strata 3 Dominance	<i>Dasyopogon bromeliifolius</i> , <i>Xanthorrhoea gracillis</i>



Plot 112	
Easting / Longitude	383458
Northing / Latitude	6332420
Landform	Mid slope
Soil colour	Grey
Soil text	Clayey Sand
Soil depth	>50 cm
Surface gravel	0
Bare ground %	4
Aspect	W
Fire Interval	>3 years
Slope	5-15
Impact	Moderate
Grazing	Moderate
Vegetation Condition	Good
Weed cover	1
Strata 1 Height	Trees
Strata 1 Cover	30-70%
Strata 1 Dominance	<i>Eucalyptus marginata</i> , <i>Banksia attenuata</i> , <i>Corymbia calophylla</i>
Strata 2 Height	Shrubs <1m
Strata 2 Cover	<2%
Strata 2 Dominance	<i>Leucopogon propinquus</i>
Strata 3 Height	Herbs
Strata 3 Cover	10-30%
Strata 3 Dominance	<i>Dasypogon bromeliifolius</i>



APPENDIX 2.

SUMMARY OF PEST PLANT CATEGORIES AND REQUIREMENTS

Source: <https://www.agric.wa.gov.au/declared-plants/declared-plant-requirements>

Declared pest category

The Western Australian Organism List (WAOL) contains information on the area(s) in which a pest is declared and the control and keeping categories to which it has been assigned in Western Australia (WA). Use the external links on this page to reach WAOL.

Requirements for land owners/occupiers and other persons

Species	Common name	Records
Requirements for organisms in Category 1 (C1, Exclusion) and Category 2 (C2, Eradication)	Introduction of the plant or its seeds into, or movement within this area is prohibited.	Mark the location of the pest in such a way that it can be found again.
	Report the presence or suspected presence of this pest in this area (1800 084 881).	C1 and C2 category pests are of high importance to WA and must be reported as a priority. Please report sightings to the Pest and Disease Information Service (1800 084 881).
	Supply or advertising supply of this pest into this area is prohibited.	-
	If the declared pest is found in this area control measures must be taken to destroy, prevent or eradicate it.	Treat to destroy all plants, prevent seed set and prevent the spread of seed or plant parts within and from the area on or in livestock, fodder, grain, vehicles and/or machinery. Treat prior to seed set each year.
	Ensure that any person conducting an activity on the land is aware that measures are required to be taken to control the declared pest.	Erect a biosecurity sign for persons conducting an activity on the land.
Requirements for organisms in Category 3 (C3, Management)	Introduction of the plant or its seeds into this area is prohibited.	—
	Supply or advertising supply of this pest into this area is prohibited.	—
	The infested area must be managed in such a way that alleviates the impact, reduces the number or distribution or prevents or contains the spread of the declared pest in this area.	Treat to destroy all plants, prevent seed set and prevent the spread of seed or plant parts within and from the area on or in livestock, fodder, grain, vehicles and/or machinery. Treat prior to seed set each year.
	Ensure that any person conducting an activity on the land is aware that measures are required to be taken to control the declared pest.	Erect a biosecurity sign for persons conducting an activity on the land.

APPENDIX 3.

DATABASE SEARCH RESULTS SUMMARY



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: 13/09/18 13:58:35

[Summary](#)

[Details](#)

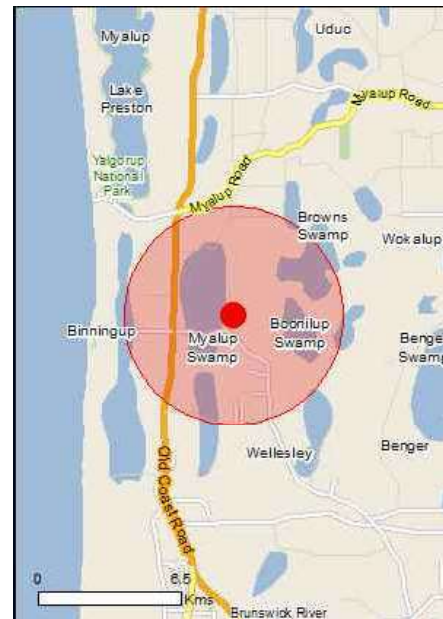
[Matters of NES](#)

[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:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	25
Listed Migratory Species:	12

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:	18
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	26
Nationally Important Wetlands:	None
Key Ecological Features (Marine):	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Peel-ylgorup system	Within 10km of Ramsar

Listed Threatened Ecological Communities [Resource Information]

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

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

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii		
Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding likely to occur within area
Calyptorhynchus latirostris		
Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri		
Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri		
Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Fish		
Galaxiella nigrostriata Blackstriped Dwarf Galaxias, Black-stripe Minnow [88677]	Endangered	Species or species habitat known to occur within area
Mammals		
Dasyurus geoffroi Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat known to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Austrostipa bronwenae [87808]	Endangered	Species or species habitat known to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Caladenia procera Carbunup King Spider Orchid [68679]	Critically 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 likely 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 known to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat may 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

Name	Threatened	Type of Presence
Ardenna carneipes Flesh-footed Shearwater, Fleishy-footed Shearwater [82404]		within area 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 may 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 may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

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

Name	Threatened	Type of Presence 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 may 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 may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to 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
NTWA Bushland covenant (0004)	WA
NTWA Bushland covenant (0095)	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		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
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
Feral deer Feral deer species in Australia [85733]		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 rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species

Name	Status	Type of Presence
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area

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

-33.14257 115.74497

Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact Us](#) page.

NatureMap Species Report

Created By Guest user on 23/08/2018

Current Names Only Yes
 Core Datasets Only Yes
 Method 'By Circle'
 Centre 115° 44' 54" E, 33° 08' 43" S
 Buffer 5km
 Group By Kingdom

Kingdom	Species	Records
Animalia	147	1044
Fungi	4	9
Plantae	150	219
TOTAL	301	1272

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Animalia				
1.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
2.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
3.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
4.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
5.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
6.	42368 <i>Acritoscincus trilineatus</i> (Western Three-lined Skink)			
7.	25544 <i>Aegotheles cristatus</i> (Australian Owlet-nightjar)			
8.	<i>Aname tepperi</i>			
9.	24312 <i>Anas gracilis</i> (Grey Teal)			
10.	24315 <i>Anas rhynchos</i> (Australasian Shoveler)			
11.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
12.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
13.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
14.	25670 <i>Anthus australis</i> (Australian Pipit)			
15.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
16.	25558 <i>Ardea ibis</i> (Cattle Egret)			
17.	41324 <i>Ardea modesta</i> (great egret, white egret)			
18.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
19.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
20.	24318 <i>Aythya australis</i> (Hardhead)			
21.	<i>Barnardius zonarius</i>			
22.	24319 <i>Biziura lobata</i> (Musk Duck)			
23.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
24.	25598 <i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
25.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
26.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
27.	24731 <i>Calyptorhynchus banksii subsp. naso</i> (Forest Red-tailed Black Cockatoo)		T	
28.	24734 <i>Calyptorhynchus latirostris</i> (Camaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		T	
29.	48400 <i>Calyptorhynchus sp.</i> (white-tailed black cockatoo)		T	
30.	24086 <i>Cercartetus concinnus</i> (Western Pygmy-possum, Mundarda)			
31.	24186 <i>Chalinolobus gouldii</i> (Gould's Wattle Bat)			
32.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
33.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
34.	25601 <i>Chrysococcyx lucidus</i> (Shining Bronze Cuckoo)			
35.	24288 <i>Circus approximans</i> (Swamp Harrier)			
36.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
37.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
38.	25592 <i>Corvus coronoides</i> (Australian Raven)			
39.	24671 <i>Coturnix pectoralis</i> (Stubble Quail)			
40.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
41.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
42.	25398 <i>Crinia georgiana</i> (Quacking Frog)			

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43.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
44.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
45.	30893 <i>Cryptoblepharus buchananii</i>			
46.	25047 <i>Ctenopus impar</i>			
47.	25049 <i>Ctenopus labillardieri</i>			
48.	24322 <i>Cygnus atratus</i> (Black Swan)			
49.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
50.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
51.	24092 <i>Dasyurus geoffroyi</i> (Chuditch, Western Quoll)		T	
52.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
53.	25100 <i>Egernia napoleonis</i>			
54.	<i>Egretta novaehollandiae</i>			
55.	<i>Elanus axillaris</i>			
56.	<i>Eolophus roseicapillus</i>			
57.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
58.	25623 <i>Falco longipennis</i> (Australian Hobby)			
59.	24189 <i>Falsistrellus mackenziei</i> (Western False Pipistrelle, Western Falsistrelle)		P4	
60.	24041 <i>Felis catus</i> (Cat)	Y		
61.	25727 <i>Fulica atra</i> (Eurasian Coot)			
62.	24761 <i>Fulica atra</i> subsp. <i>australis</i> (Eurasian Coot)			
63.	34027 <i>Galaxiella nigrostriata</i> (Black-stripe Minnow, black-striped dwarf galaxias)		T	
64.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
65.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
66.	24487 <i>Haematopus longirostris</i> (Pied Oystercatcher)			
67.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
68.	24296 <i>Hamirostra isura</i> (Square-tailed Kite)			
69.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
70.	25119 <i>Hemiergis quadrilineata</i>			
71.	47965 <i>Hieraetus morphnoides</i> (Little Eagle)			
72.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
73.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
74.	25133 <i>Lerista elegans</i>			
75.	25147 <i>Lerista lineata</i> (Perth Slider, Lined Skink)		P3	
76.	25005 <i>Lialis burtonis</i>			
77.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
78.	25415 <i>Limodynastes dorsalis</i> (Western Banjo Frog)			
79.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
80.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
81.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
82.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
83.	25184 <i>Menetia greyii</i>			
84.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
85.	<i>Microcarbo melanoleucos</i>			
86.	<i>Missulena granulosa</i>			
87.	25191 <i>Morethia lineocellata</i>			
88.	24223 <i>Mus musculus</i> (House Mouse)	Y		
89.	25248 <i>Neelaps bimaculatus</i> (Black-naped Snake)			
90.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
91.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
92.	24194 <i>Nyctophilus geoffroyi</i> (Lesser Long-eared Bat)			
93.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
94.	24085 <i>Oryctolagus cuniculus</i> (Rabbit)	Y		
95.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
96.	24693 <i>Pachyptila desolata</i> (Antarctic Prion)			
97.	25253 <i>Parasuta gouldii</i>			
98.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
99.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
100.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
101.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
102.	48066 <i>Petroica boodang</i> (Scarlet Robin)			
103.	25698 <i>Phalacrocorax melanoleucos</i> (Little Pied Cormorant)			
104.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
105.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
106.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
107.	48070 <i>Phascogale tapoatafa</i> subsp. <i>wambenger</i> (South-western Brush-tailed Phascogale, Wambenger)		S	
108.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
109.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
110.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
111.	24747 <i>Platycercus spurius</i> (Red-capped Parrot)			

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112.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
113.	25703 <i>Podargus stingoides</i> (Tawny Frogmouth)			
114.	24907 <i>Pogona minor</i> subsp. <i>minor</i> (Dwarf Bearded Dragon)			
115.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
116.	25722 <i>Polytelis anthopeplus</i> (Regent Parrot)			
117.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
118.	24767 <i>Porphyrio porphyrio</i> subsp. <i>bellus</i> (Purple Swamphen)			
119.	24166 <i>Pseudocheirus occidentalis</i> (Western Ringtail Possum, ngwayir)		T	
120.	25511 <i>Pseudonaja affinis</i> (Dugite)			
121.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
122.	<i>Purpurecephalus spurius</i>			
123.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
124.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
125.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
126.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
127.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
128.	30948 <i>Smicromis brevirostris</i> (Weebill)			
129.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
130.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
131.	24259 <i>Sus scrofa</i> (Pig)	Y		
132.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
133.	24682 <i>Tachybaptus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
134.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
135.	48135 <i>Thinornis rubricollis</i> (Hooded Plover, Hooded Dotterel)		P4	
136.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
137.	25519 <i>Tiliqua rugosa</i>			
138.	25207 <i>Tiliqua rugosa</i> subsp. <i>rugosa</i>			
139.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
140.	24158 <i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i> (Common Brushtail Possum)			
141.	48147 <i>Turnix varius</i> (Painted Button-quail)			
142.	24386 <i>Vanellus tricolor</i> (Banded Lapwing)			
143.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			
144.	25225 <i>Varanus rosenbergi</i> (Heath Monitor)			
145.	24206 <i>Vespadelus regulus</i> (Southern Forest Bat)			
146.	24040 <i>Vulpes vulpes</i> (Red Fox)	Y		
147.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silveryeye)			
Fungi				
148.	27691 <i>Cladonia ramulosa</i>			
149.	27748 <i>Flavoparmelia rutidota</i>			
150.	<i>Phytophthora cinnamomi</i>			
151.	28087 <i>Usnea inermis</i>			
Plantae				
152.	15466 <i>Acacia applanata</i>			
153.	3339 <i>Acacia flagelliformis</i>		P4	
154.	11611 <i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i>			
155.	3482 <i>Acacia paradoxa</i> (Kangaroo Thorn)	Y		
156.	15481 <i>Acacia pulchella</i> var. <i>glaberrima</i>			
157.	15482 <i>Acacia pulchella</i> var. <i>goadbyi</i>			
158.	30036 <i>Acacia saligna</i> subsp. <i>stolonifera</i>			
159.	3537 <i>Acacia semitrullata</i>		P4	
160.	3557 <i>Acacia stenoptera</i> (Narrow Winged Wattle)			
161.	1790 <i>Adenanthos meisneri</i>			
162.	1791 <i>Adenanthos obovatus</i> (Basket Flower)			
163.	7820 <i>Ambrosia artemisiifolia</i> (Annual Ragweed, Bitterweed, Hay-feverweed, Hog-weed)	Y		
164.	3688 <i>Aotus gracillima</i>			
165.	7851 <i>Asteridea pulverulenta</i> (Common Bristle Daisy)			
166.	6323 <i>Astroloma ciliatum</i> (Candle Cranberry)			
167.	38480 <i>Austrostipa bronwenae</i>		T	
168.	17233 <i>Austrostipa campylachne</i>			
169.	1800 <i>Banksia attenuata</i> (Slender Banksia, Piara)			
170.	1822 <i>Banksia ilicifolia</i> (Holly-leaved Banksia)			
171.	3165 <i>Billardiera variifolia</i>			
172.	11612 <i>Boronia capitata</i> subsp. <i>gracilis</i>		P3	
173.	16633 <i>Boronia juncea</i> subsp. <i>juncea</i>		P1	
174.	4438 <i>Boronia ramosa</i>			
175.	3710 <i>Bossiaea eriocarpa</i> (Common Brown Pea)			
176.	244 <i>Briza maxima</i> (Blowfly Grass)	Y		
177.	12770 <i>Burchardia congesta</i>			

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178.	1276 <i>Caesia micrantha</i> (Pale Grass Lily)			
179.	1592 <i>Caladenia flava</i> (Cowslip Orchid)			
180.	15348 <i>Caladenia flava</i> subsp. <i>flava</i>			
181.	18038 <i>Caladenia procera</i>		T	
182.	13862 <i>Caladenia speciosa</i>		P4	
183.	5460 <i>Calytrix fraseri</i> (Pink Summer Calytrix)			
184.	1162 <i>Cartonema philydroides</i>			
185.	13489 <i>Cerastium pumilum</i>	Y		
186.	1280 <i>Chamaescilla corymbosa</i> (Blue Squill)			
187.	10804 <i>Clematis linearifolia</i>			
188.	6348 <i>Conostephium pendulum</i> (Pearl Flower)			
189.	1418 <i>Conostylis aculeata</i> (Prickly Conostylis)			
190.	1436 <i>Conostylis juncea</i>			
191.	1438 <i>Conostylis laxiflora</i>			
192.	13354 <i>Craspedia variabilis</i>			
193.	16245 <i>Cyathochaeta teretifolia</i>		P3	
194.	7454 <i>Dampiera linearis</i> (Common Dampiera)			
195.	1218 <i>Dasyopogon bromeliifolius</i> (Pineapple Bush)			
196.	3834 <i>Daviesia polyphylla</i>			
197.	3863 <i>Dillwynia dillwynioides</i>		P3	
198.	19649 <i>Disa bracteata</i>	Y		
199.	11049 <i>Diuris corymbosa</i>			
200.	10796 <i>Diuris drummondii</i> (Tall Donkey Orchid)		T	
201.	48253 <i>Diuris porphyrochila</i>			
202.	46858 <i>Diuris tinctoria</i>			Y
203.	1639 <i>Drakaea elastica</i> (Glossy-leaved Hammer Orchid)		T	
204.	13635 <i>Drakaea micrantha</i>		T	
205.	13209 <i>Drosera marchantii</i> subsp. <i>marchantii</i>			
206.	3112 <i>Drosera myriantha</i> (Star Rainbow)			
207.	3118 <i>Drosera pallida</i> (Pale Rainbow)			
208.	3131 <i>Drosera stolonifera</i> (Leafy Sundew)			
209.	11105 <i>Echinochloa crus-galli</i>	Y		
210.	332 <i>Echinochloa frumentacea</i> (Siberian Millet)	Y		
211.	1643 <i>Elythranthera brunonis</i> (Purple Enamel Orchid)			
212.	1644 <i>Elythranthera emarginata</i> (Pink Enamel Orchid)			
213.	5708 <i>Eucalyptus marginata</i> (Jarrah, Djara)			
214.	13547 <i>Eucalyptus marginata</i> subsp. <i>marginata</i> (Jarrah)			
215.	835 <i>Evandra pauciflora</i>			
216.	894 <i>Fimbristylis velata</i>			
217.	3957 <i>Gompholobium tomentosum</i> (Hairy Yellow Pea)			
218.	5135 <i>Hibbertia hypericoides</i> (Yellow Buttercups)			
219.	45534 <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i>			
220.	5162 <i>Hibbertia racemosa</i> (Stalked Guinea Flower)			
221.	5176 <i>Hibbertia vaginata</i>			
222.	6222 <i>Homalosciadium homalocarpum</i>			
223.	3968 <i>Hovea trisperma</i> (Common Hovea)			
224.	12859 <i>Hovea trisperma</i> var. <i>trisperma</i>			
225.	12741 <i>Hyalosperma cotula</i>			
226.	5216 <i>Hybanthus calycinus</i> (Wild Violet)			
227.	8086 <i>Hypochaeris glabra</i> (Smooth Catsear)	Y		
228.	1070 <i>Hypolaena exsulca</i>			
229.	16836 <i>Hypolaena viridis</i>			
230.	917 <i>Isolepis marginata</i> (Coarse Club-rush)			
231.	5832 <i>Kunzea ericifolia</i> (Spearwood, Pondil)			
232.	5038 <i>Lasiopetalum membranaceum</i>		P3	
233.	1309 <i>Laxmannia squarrosa</i>			
234.	925 <i>Lepidosperma angustatum</i>			
235.	1653 <i>Leporella fimbriata</i> (Hare Orchid)			
236.	46375 <i>Leptocarpus decipiens</i>			
237.	46382 <i>Leptocarpus roycei</i>			
238.	6445 <i>Leucopogon squarrosus</i>			
239.	6454 <i>Leucopogon verticillatus</i> (Tassel Flower)			
240.	1223 <i>Lomandra caespitosa</i> (Tufted Mat Rush)			
241.	1228 <i>Lomandra hermaphrodita</i>			
242.	1232 <i>Lomandra micrantha</i> (Small-flower Mat-rush)			
243.	1234 <i>Lomandra nigricans</i>			
244.	1243 <i>Lomandra sericea</i> (Silky Mat Rush)			
245.	1246 <i>Lomandra suaveolens</i>			
246.	1198 <i>Luzula meridionalis</i> (Field Woodrush)			
247.	1097 <i>Lyginia barbata</i>			

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248.	5281 <i>Lythrum hyssopifolia</i> (Lesser Loosestrife)	Y		
249.	85 <i>Macrozamia riedlei</i> (Zamia, Djindji)			
250.	18598 <i>Melaleuca systema</i>			
251.	5978 <i>Melaleuca teretifolia</i> (Banbar)			
252.	5980 <i>Melaleuca thymoides</i>			
253.	485 <i>Microlaena stipoides</i> (Weeping Grass)			
254.	15419 <i>Microtis media</i> subsp. <i>media</i>			
255.	8106 <i>Millotia tenuifolia</i> (Soft Millotia)			
256.	6201 <i>Myriophyllum verrucosum</i> (Red Water Milfoil)			
257.	8133 <i>Oleania elaeophila</i>			
258.	46316 <i>Orianthera serpyllifolia</i> subsp. <i>angustifolia</i>			
259.	1762 <i>Parietaria debilis</i> (Pellitory)			
260.	533 <i>Paspalum vaginatum</i> (Salt Water Couch)			
261.	1550 <i>Patersonia occidentalis</i> (Purple Flag, Koma)			
262.	4346 <i>Pelargonium littorale</i>			
263.	6006 <i>Pericalymma ellipticum</i> (Swamp Teatree)			
264.	2299 <i>Petrophile linearis</i> (Pixie Mops)			
265.	18529 <i>Philothea spicata</i> (Pepper and Salt)			
266.	1478 <i>Phlebocarya ciliata</i>			
267.	6249 <i>Platysace compressa</i> (Tapeworm Plant)			
268.	4524 <i>Platytheca galioides</i>			
269.	8175 <i>Podolepis gracilis</i> (Slender Podolepis)			
270.	4691 <i>Poranthera microphylla</i> (Small Poranthera)			
271.	<i>Pterostylis</i> aff. <i>nana</i>			
272.	10875 <i>Pterostylis concava</i>			
273.	1693 <i>Pterostylis recurva</i> (Jug Orchid)			
274.	12217 <i>Pterostylis sanguinea</i>			
275.	1698 <i>Pterostylis vittata</i> (Banded Greenhood)			
276.	2440 <i>Rumex pulcher</i> (Fiddle Dock)	Y		
277.	40426 <i>Rytidosperma occidentale</i>			
278.	20063 <i>Salix babylonica</i>	Y		
279.	7595 <i>Scaevola anchusifolia</i>			
280.	7602 <i>Scaevola calliptera</i>			
281.	1020 <i>Schoenus sublateralis</i>			
282.	7037 <i>Solanum symonii</i>			
283.	1312 <i>Sowerbaea laxiflora</i> (Purple Tassels)			
284.	2316 <i>Stirlingia latifolia</i> (Blueboy)			
285.	7693 <i>Stylidium brunonianum</i> (Pink Fountain Triggerplant)			
286.	7798 <i>Stylidium schoenoides</i> (Cow Kicks)			
287.	7799 <i>Stylidium spathulatum</i> (Creamy Triggerplant)			
288.	48341 <i>Tetralochea hirsuta</i> subsp. <i>viminea</i>			
289.	10856 <i>Thelymitra benthamiana</i> (Leopard Orchid)			
290.	1338 <i>Thysanotus manglesianus</i> (Fringed Lily)			
291.	1343 <i>Thysanotus patersonii</i>			
292.	6280 <i>Trachymene pilosa</i> (Native Parsnip)			
293.	1361 <i>Tricoryne elatior</i> (Yellow Autumn Lily)			
294.	4292 <i>Trifolium campestre</i> (Hop Clover)	Y		
295.	44444 <i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S. George 14234)		P4	
296.	8255 <i>Ursinia anthemoides</i> (Ursinia)	Y		
297.	33537 <i>Vallisneria australis</i>	Y		
298.	6101 <i>Verticordia nitens</i> (Morrison Featherflower, Kodjeningara)			
299.	7389 <i>Wahlenbergia preissii</i>			
300.	8282 <i>Waitzia suaveolens</i> (Fragrant Waitzia)			
301.	6289 <i>Xanthosia huegelii</i>			

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.

APPENDIX 4.

VASCULAR PLANT SPECIES RECORDED DURING FIELD SURVEY

(*represents weed species)

Family	Taxon	Conservation Status
Anarthriaceae	<i>Lyginia imberbis</i>	
Apiaceae	<i>Platysace filiformis</i>	
	<i>Daucus glochidiatus</i>	
Araliaceae	<i>Trachymene pilosa</i>	
Asparagaceae	<i>Lomandra caespitosa</i>	
	<i>Lomandra hermaphrodita</i>	
	<i>Lomandra micrantha</i> subsp. <i>micrantha</i>	
	<i>Lomandra nigricans</i>	
	<i>Lomandra sericea</i>	
	<i>Lomandra suaveolens</i>	
	<i>Sowerbaea laxiflora</i>	
	<i>Thysanotus manglesianus</i>	
Asphodelaceae	* <i>Asphodelus fistulosus</i>	
Asteraceae	* <i>Arctotheca calendula</i>	
	* <i>Cotula turbinata</i>	
	* <i>Hypochaeris glabra</i>	
	<i>Lagenophora huegelii</i>	
	<i>Millotia tenuifolia</i> ?var. <i>laevis</i>	P2
	<i>Quinetia urvillei</i>	
	<i>Rhodanthe citrina</i>	
	* <i>Ursinia anthemoides</i>	
Caryophyllaceae	* <i>Petrorhagia dubia</i>	
Colchicaceae	<i>Burchardia congesta</i>	
Cyperaceae	<i>Isolepis marginata</i>	
	<i>Isotropis cuneifolia</i>	
	<i>Lepidosperma pubisquameum</i>	
	<i>Lepidosperma squamatum</i>	
Dasypogonaceae	<i>Dasypogon bromeliifolius</i>	
Dilleniaceae	<i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i>	
	<i>Hibbertia racemosa</i>	
Droseraceae	<i>Drosera</i> ? <i>macrantha</i>	
	<i>Drosera bulbosa</i>	

Family	Taxon	Conservation Status
	<i>Drosera menziesii</i>	
	<i>Drosera stolonifera</i>	
Elaeocarpaceae	<i>Tetradlea hirsuta</i> subsp. <i>viminea</i>	
Ericaceae	<i>Brachyloma preissii</i>	
	<i>Leucopogon propinquus</i>	
	<i>Leucopogon racemosus</i>	
Fabaceae	<i>Acacia semitrullata</i>	P4
	<i>Bossiaea eriocarpa</i>	
	<i>Gompholobium tomentosum</i>	
	<i>Jacksonia furcellata</i>	
	<i>Kennedia prostrata</i>	
Haemodoraceae	<i>Conostylis aculeata</i> subsp. <i>preissii</i>	
	<i>Conostylis juncea</i>	
	<i>Conostylis setigera</i>	
	<i>Caesia micrantha</i>	
	<i>Dianella revoluta</i> var. <i>divaricata</i>	
	<i>Tricoryne elatior</i>	
Iridaceae	<i>Patersonia occidentalis</i>	
Lamiaceae	<i>Hemiandra pungens</i>	
Malvaceae	<i>Lasiopetalum ?membranaceum</i>	P3
Myrtaceae	<i>Agonis flexuosa</i>	
	<i>Corymbia calophylla</i>	
	<i>Eucalyptus marginata</i>	
	<i>Kunzea glabrescens</i>	
	<i>Melaleuca thymoides</i>	
Orchidaceae	<i>Caladenia arenicola</i>	
	<i>Caladenia flava</i>	
	<i>Elythranthera brunonis</i>	
	<i>Pterostylis nana</i>	
	<i>Pterostylis</i> sp.	
	<i>Pyrorchis nigricans</i>	
Phyllanthaceae	<i>Phyllanthus calycinus</i>	
Poaceae	* <i>Briza maxima</i>	
	* <i>Ehrharta longiflora</i>	
	<i>Tetrarrhena laevis</i>	
	* <i>Vulpia bromoides</i>	

Family	Taxon	Conservation Status
Proteaceae	<i>Banksia attenuata</i>	
	<i>Banksia grandis</i>	
	<i>Petrophile linearis</i>	
Restionaceae	<i>Desmocladus fasciculatus</i>	
	<i>Desmocladus flexuosus</i>	
	<i>Hypolaena exsulca</i>	
Rubiaceae	<i>Opercularia hispidula</i>	
Rutaceae	<i>Philotheca spicata</i>	
Stylidiaceae	<i>Stylidium brunonianum</i>	
	<i>Stylidium piliferum</i>	
Xanthorrhoeaceae	<i>Chamaescilla corymbosa</i>	
	<i>Xanthorrhoea gracilis</i>	
Zamiaceae	<i>Macrozamia riedlei</i>	

APPENDIX 5.

MATRIX: SPECIES x QUADRAT

(+ represents presence)

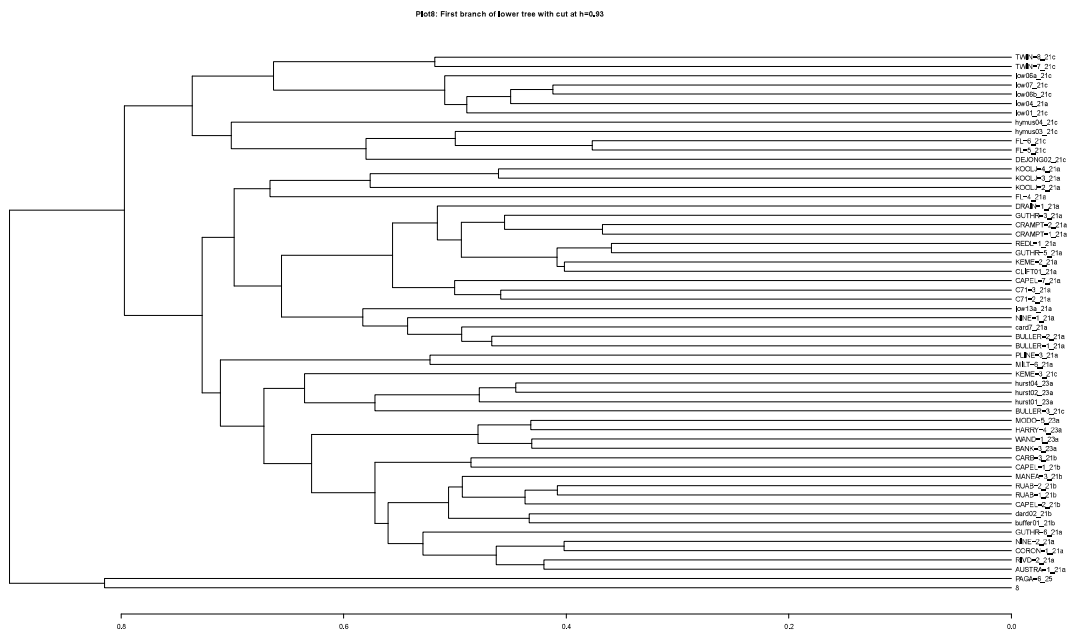
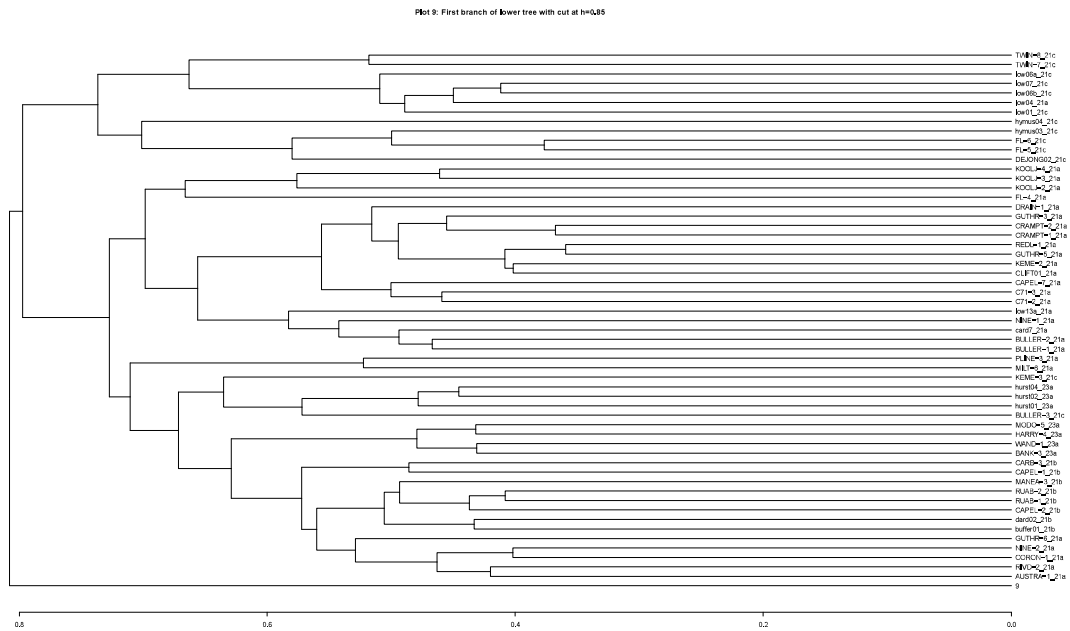
Name	Plot 8	Plot 9	Plot 10	Plot 11	Plot 109	Plot 110	Plot 111	Plot 112
<i>Acacia semitrullata</i> (P4)						+		
<i>Agonis flexuosa</i>	+	+		+	+	+		
<i>Arctotheca calendula</i>								+
<i>Asphodelus fistulosus</i>								+
<i>Banksia attenuata</i>	+	+	+	+	+	+	+	+
<i>Banksia grandis</i>			+			+		
<i>Bossiaea eriocarpa</i>	+	+	+		+	+		
<i>Brachyloma preissii</i>					+	+		
<i>Briza maxima</i>		+	+	+		+		
<i>Burchardia congesta</i>		+	+	+	+	+	+	
<i>Caesia micrantha</i>							+	
<i>Caladenia flava</i>	+	+	+	+	+	+	+	+
<i>Chamaescilla corymbosa</i>	+			+	+	+	+	+
+ <i>Conostylis aculeata</i> subsp. <i>preissii</i>	+	+			+		+	+
<i>Conostylis juncea</i>					+	+		
<i>Conostylis setigera</i>	+	+	+					
<i>Corymbia calophylla</i>			+	+		+	+	+
<i>Cotula turbinata</i>								+
+ <i>Dasyopogon bromeliifolius</i>		+	+	+	+	+	+	+
<i>Daucus glochidiatus</i>				+				
<i>Desmocladus fasciculatus</i>							+	
<i>Desmocladus flexuosus</i>				+	+	+	+	+
<i>Dianella revoluta</i> var. <i>divaricata</i>			+		+			
<i>Drosera ?macrantha</i>						+	+	

Name	Plot 8	Plot 9	Plot 10	Plot 11	Plot 109	Plot 110	Plot 111	Plot 112
<i>Drosera bulbosa</i>	+	+				+		
<i>Drosera menziesii</i>				+				
<i>Drosera stolonifera</i>	+	+	+	+	+	+	+	+
<i>Ehrharta longiflora</i>							+	+
<i>Elythranthera brunonis</i>		+	+	+				
<i>Eucalyptus marginata</i>	+	+	+	+	+	+	+	+
<i>Gompholobium tomentosum</i>					+	+		
<i>Hemiandra pungens</i>					+			
<i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i>	+	+	+	+	+	+	+	
<i>Hibbertia racemosa</i>	+				+	+	+	+
<i>Hypochaeris glabra</i>	+	+	+	+	+	+		+
<i>Hypolaena exsulca</i>	+		+		+		+	
<i>Isolepis marginata</i>				+				+
<i>Isotropis cuneifolia</i>	+	+			+		+	
<i>Jacksonia furcellata</i>			+					
<i>Kennedia prostrata</i>							+	
<i>Kunzea glabrescens</i>	+							
<i>Lagenophora huegelii</i>	+	+	+	+	+	+	+	
<i>Lasiopetalum ?membranaceum</i> (P3)					+			
<i>Lepidosperma pubisquameum</i>					+	+		
<i>Lepidosperma squamatum</i>	+		+					
<i>Leucopogon propinquus</i>							+	+
<i>Leucopogon racemulosus</i>				+		+	+	
<i>Lomandra caespitosa</i>								+
<i>Lomandra hermaphrodita</i>					+			
<i>Lomandra micrantha</i> subsp. <i>micrantha</i>								+
<i>Lomandra nigricans</i>					+			
<i>Lomandra sericea</i>							+	+

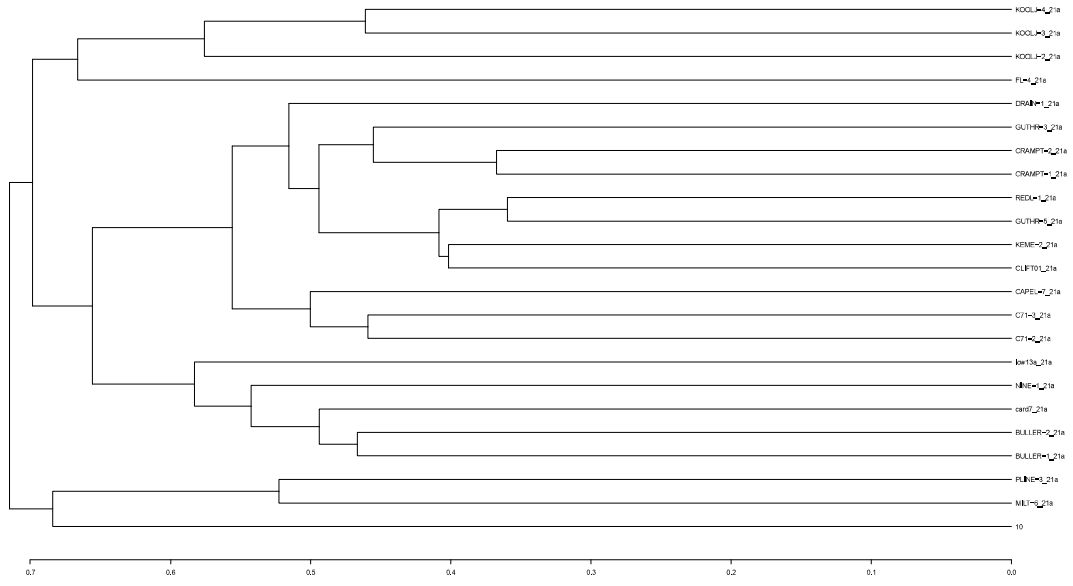
Name	Plot 8	Plot 9	Plot 10	Plot 11	Plot 109	Plot 110	Plot 111	Plot 112
<i>Lomandra suaveolens</i>	+		+		+	+		
<i>Lyginia imberbis</i>					+	+	+	+
<i>Macrozamia riedlei</i>			+				+	
<i>Melaleuca thymoides</i>	+	+	+	+	+	+	+	+
<i>Millotia tenuifolia ?var laevis (P2)</i>					+			
<i>Opercularia hispidula</i>	+	+	+		+	+	+	
<i>Patersonia occidentalis</i>				+	+			+
<i>Petrophile linearis</i>		+			+			
<i>Petrorhagia dubia</i>								+
<i>Philothea spicata</i>	+	+	+	+	+	+	+	
<i>Phyllanthus calycinus</i>		+	+	+	+		+	
<i>Platysace filiformis</i>				+				
<i>Pterostylis nana</i>							+	+
<i>Pterostylis sp</i>						+		
<i>Pyrorchis nigricans</i>					+		+	
<i>Quinetia urvillei</i>					+	+		+
<i>Rhodanthe sp</i>					+	+		
<i>Sowerbaea laxiflora</i>	+	+	+	+			+	+
<i>Stylidium brunonianum</i>	+	+	+		+			
<i>Stylidium piliferum</i>	+				+			
<i>Tetrarrhena laevis</i>							+	
<i>Tetrateca hirsuta subsp. viminea</i>			+			+		
<i>Thysanotus manglesianus</i>				+	+	+		
<i>Trachymene pilosa</i>		+	+	+	+	+	+	+
<i>Tricoryne elatior</i>							+	+
<i>Ursinia anthemoides</i>					+	+	+	+
<i>Vulpia bromoides</i>						+		
<i>Xanthorrhoea gracilis</i>	+	+	+	+	+	+	+	

APPENDIX 6.

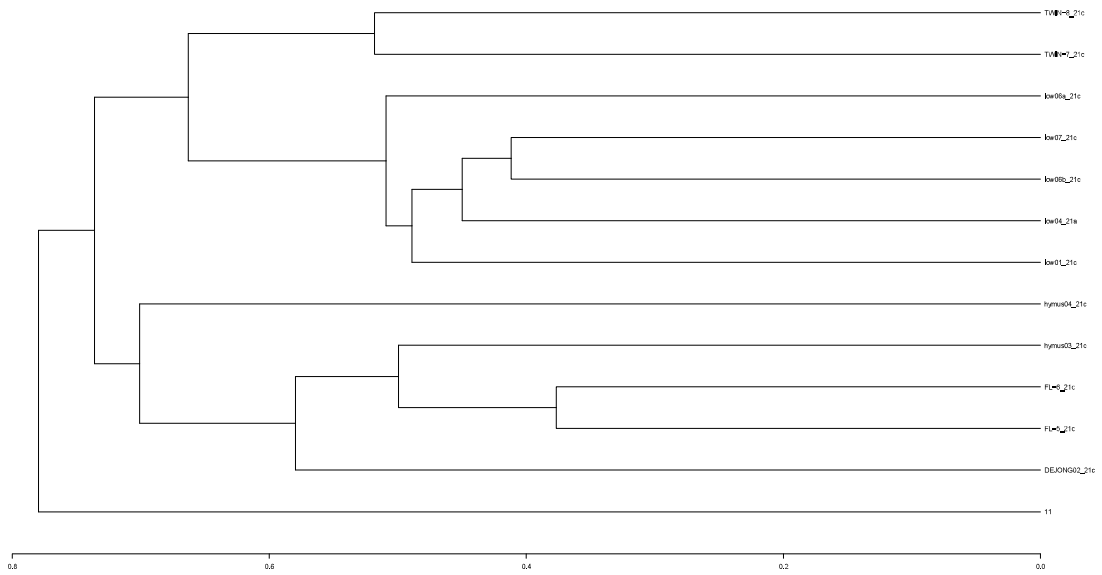
DENDROGRAM OUTPUT FROM FCT ANALYSIS



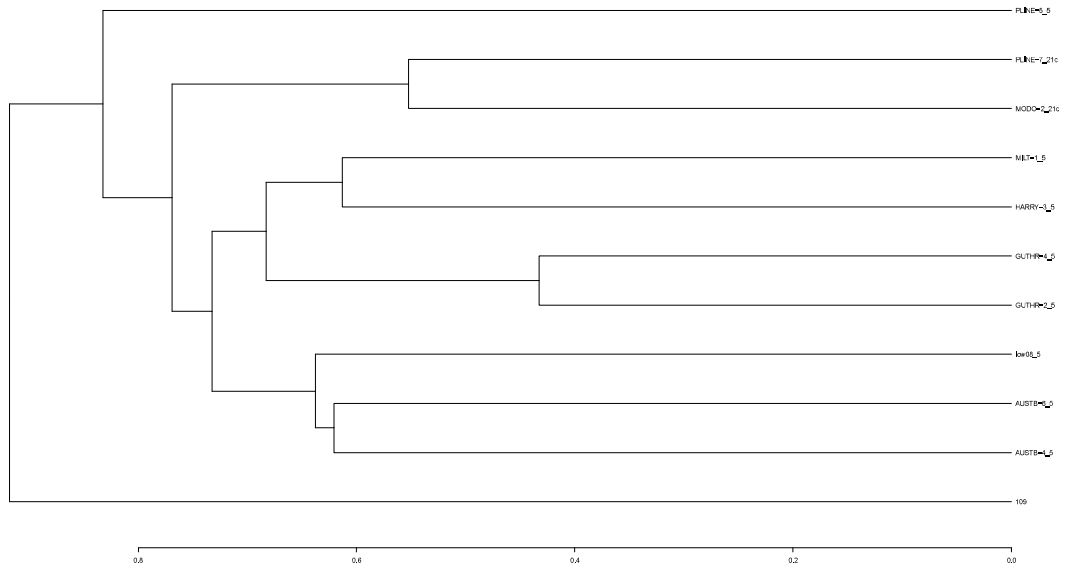
Plot 10: First branch of lower tree with cut at h=0.75



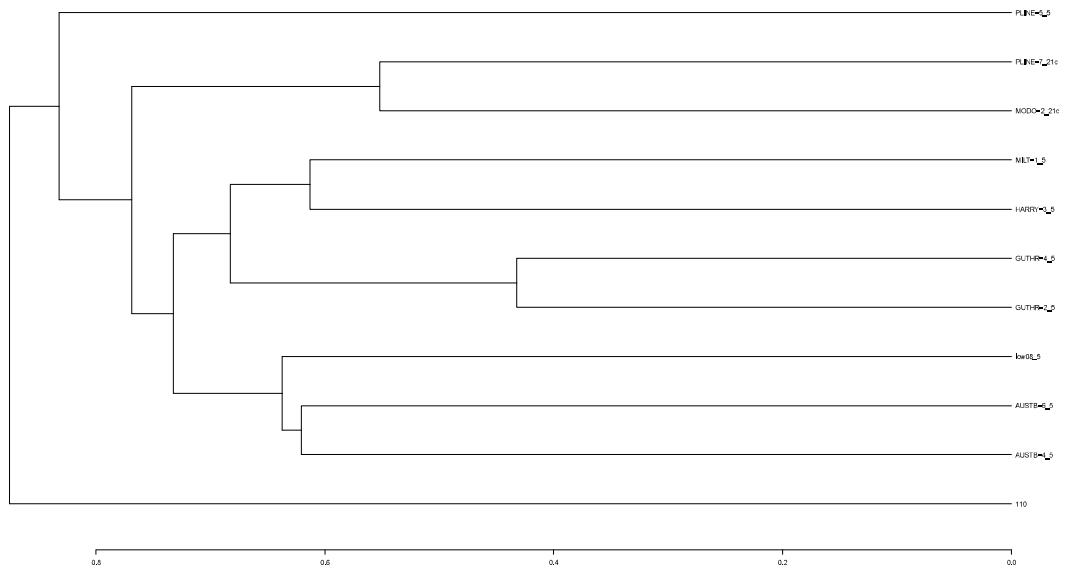
Plot 11: First branch of lower tree with cut at h=0.78



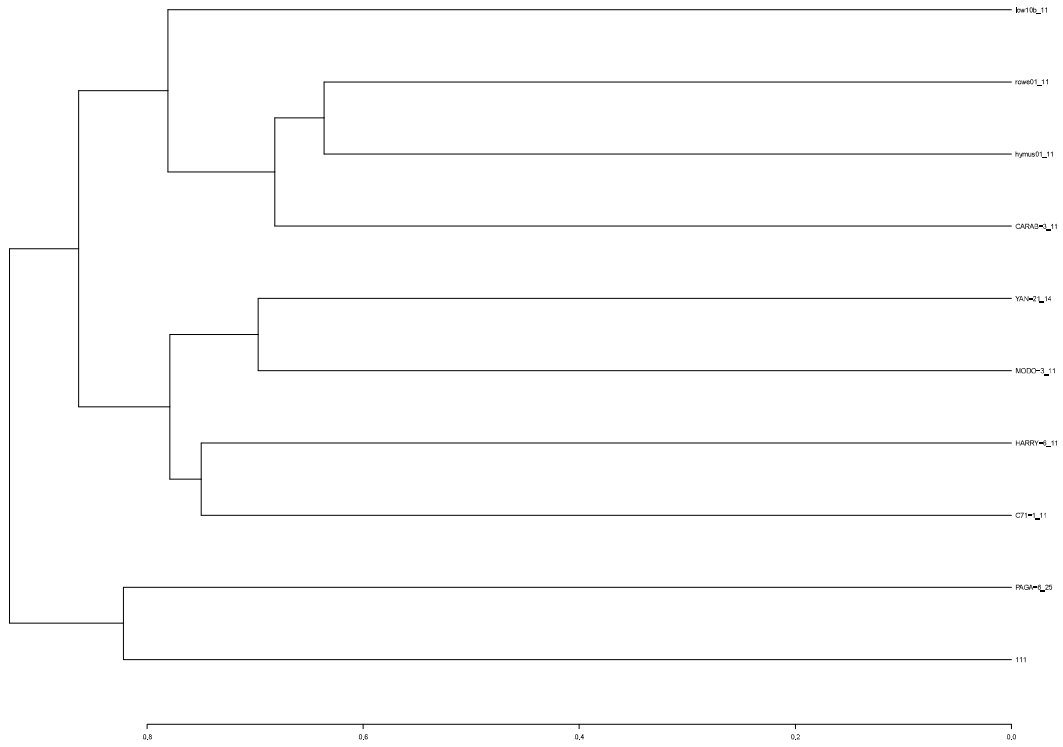
Plot 109: First branch of lower tree with cut at h=0.95



Plot 110: First branch of lower tree with cut at h=0.95



Plot 111: First branch of lower tree with cut at h=0.95



Plot 112: First branch of lower tree with cut at h=0.95

