APPENDIX C

BORR Southern Section Vegetation and Flora Study (BORR IPT 2020)

BORR Team

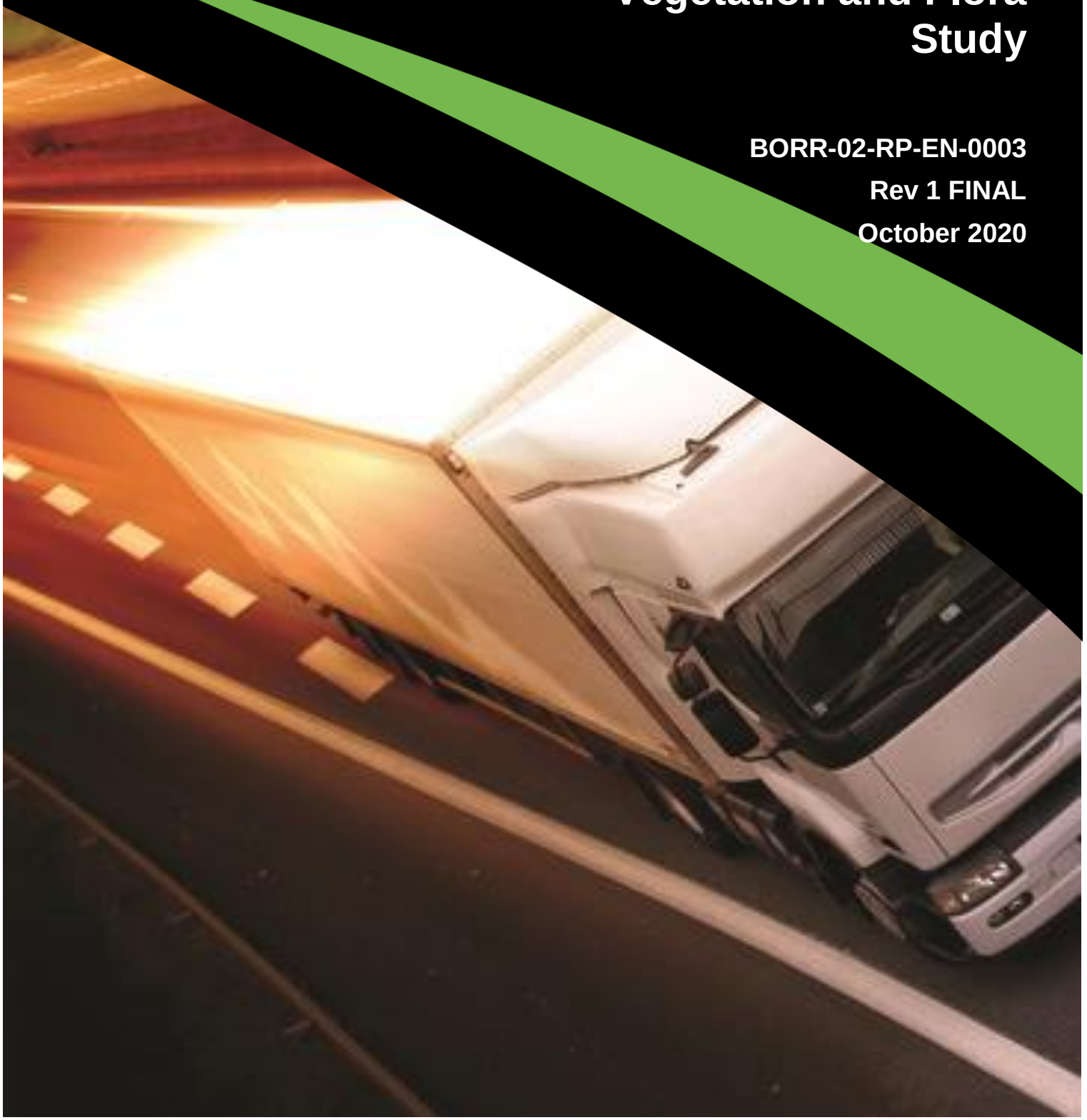
Bunbury Outer Ring Road Southern Section

Vegetation and Flora Study

BORR-02-RP-EN-0003

Rev 1 FINAL

October 2020



EXECUTIVE SUMMARY

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to construct and operate the Southern Section of the Bunbury Outer Ring Road (BORR) project. BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway (Figure 1**,** Appendix A). The completed project will provide a high standard route for access to the Bunbury Port, improve road user safety and facilitate proposed development to the east of the City of Bunbury. BORR also provides an effective bypass of Bunbury for inter-regional traffic. The proposed BORR comprises three sections:

- 'BORR Northern Section' – Forrest Highway to Boyanup-Picton Road
- 'BORR Central Section' – Boyanup-Picton Road to South Western Highway
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

Main Roads commissioned the BORR IPT to undertake a vegetation and flora study during the 2018 spring season, for BORR Southern Section (the Project). The purpose of the assessment was to delineate key flora and vegetation values within the survey area.

The 2018 assessment encompassed a survey area that was planned to include and extend beyond the proposed alignment of the BORR Southern Section. Subsequent refinement of the alignment resulted in some areas being included in the proposed alignment that were not contained within the 2018 survey area. In addition to this, in 2019, the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community (Tuart TEC) was listed as a threatened ecological community (TEC) (at the level of critically endangered) by the then Department of the Environment and Energy (DotEE). The Approved Conservation Advice (DotEE, 2019a) specified criteria and thresholds for determining occurrences of the TEC that had not been considered in the 2018 survey methodology. Separate to this, targeted surveys for vegetation representing the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed Clay Pans of the Swan Coastal Plain TEC (Claypan TEC) (and associated State-listed TECs and floristic community types), and Threatened flora taxa listed under the EPBC Act were deemed necessary to provide a comprehensive and complete assessment.

In response to the factors listed above, the following additional surveys wereconducted:

- Detailed and targeted assessment over previously unsurveyed gaps (September 2019)
- Targeted survey for occurrences of TECs and Priority ecological communities (PECs), including the Tuart TEC (September 2019)
- Targeted survey for occurrences of Claypan TEC within and surrounding the revised proposed alignment (September 2019)
- Targeted surveys for the Threatened orchid species *Diuris drummondii* (30 November 2019) and *Drakaea* spp (August and September 2019)
- Targeted surveys for other Threatened orchid species, including *Caladenia huegelii, Diuris micrantha* and *Caladenia speciosa*, was undertaken in suitable Jarrah / Banksia and wetland habitat. Listed Threatened species *Eleocharis keigheryi, Austrostipa jacobsiana* and *Austrostipa bronwenae* were also searched for in wetland / dampland habitat (August and September 2019)

This report presents the results of the initial 2018 survey and additional surveys as listed above. Also included is an analysis of survey (quadrat) data from GHD (2014; GHD, 2015) and Biota (2016; Biota, 2018) where these surveys overlap with the 2018 survey area.

This report is subject to, and must be read in conjunction with, the limitations and assumptions contained throughout the report.

Key findings

Vegetation

The survey area contains a combination of native vegetation and highly disturbed areas, including roads, road reserve and paddocks. A total of ten vegetation types comprising remnant native vegetation were identified and described from the survey area. A further three types, comprising highly disturbed areas, revegetation and planted vegetation were also identified and described.

The survey area occurs on the Bassendean and Spearwood Dunes and Pinjarra Plain. The sandy low dunes and plains that characterise the survey area were dominated by *Eucalyptus / Banksia* forests, in particular *Eucalyptus / Agonis* and *Banksia* woodlands / forests. Creek lines, swamps and low relief / seasonally inundated areas were dominated by *Eucalyptus rudis / Melaleuca preissiana / Melaleuca rhaphiophylla* woodlands. These were generally disturbed and dominated by introduced grasses and herbs in the ground-layer. In the agricultural areas and some road reserves, native vegetation occurred as scattered remnant trees or stands over introduced grasses. The survey area included approximately 163.8 ha (53.2%) of native vegetation.

The vegetation condition of the survey area ranged from Excellent to Completely Degraded. Over half of the survey area was cleared/highly modified (186.1 ha or 53.2 %). Historical clearing and aggressive weed species have influenced the structure and composition of the remaining native vegetation. There was 43.5 ha of vegetation in Good or better condition (approximately 12.4 % of the survey area) and 119.7 ha in Good to Degraded or worse condition (approximately 34.2 % of the survey area).

Five conservation significant ecological communities were identified (based on results of desktop and field assessments) within the survey area:

- Banksia Woodlands of the Swan Coastal Plain – listed as a Threatened Ecological Community (TEC) at the level of Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Also listed as a Priority 3 Ecological Community (PEC) by Department of Biodiversity, Conservation and Attractions (DBCA)
- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain (SCP) - listed as a TEC at the level of Critically Endangered under the EPBC Act. Also l isted as a Priority 3 Ecological Community (PEC) by DBCA
- Southern SCP *Eucalyptus gomphocephala – Agonis flexuosa* woodlands (floristic community type 25) – listed as Priority 3 by DBCA.

Flora

The floristic diversity of the survey area has been assessed by combining survey data from GHD (2014 and 2015), Biota (2016 and 2018) and the current survey (Appendix E). A total of 428 species have been recorded across these surveys including 119 introduced or planted species (28 %).

During the 2018 survey, 289 plant species (including subspecies and varieties) representing 227 genera and 71 plant families were recorded within the survey area. This total included 198 (68.5 %) native species and 91 introduced (exotic / planted) (31.5 %) species.

The likelihood of occurrence assessment post-field survey concluded that three species are known to occur, 11 species may possibly occur and the remaining 40 species are unlikely or highly unlikely to occur within the survey area. Three DBCA Priority-listed flora species were recorded within the survey area during the various field surveys; *Lasiopetalum membranaceum* (P3) (2018 and 2019 surveys), *Caladenia speciosa* (P4) (GHD, 2015) and *Acacia semitrullata* (P4) (GHD, 2014).

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Document *Control*

Revision	Date	Description	Prepared	Reviewed	Approved
1	October 2020	Final revised	BORR Team	MP	FH
0	June 2020	Final	BORR Team	MP	FH
A	July 2019	Draft for Main Roads Review	BORR Team	MB	FH
B	September 2019	Final Draft for Main Roads review	BORR Team	MB, MP	FH
C	September 2019	Final Draft	BORR Team	MB	FH
D	February 2020	Final Draft	BORR Team	SH	FH
E	May 2020	Final Draft	BORR Team	MP	FH
F	May 2020	Final Draft	BORR Team	MP	FH

1 INTRODUCTION

1.1 Project background

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to construct and operate the Southern Section of the Bunbury Outer Ring Road (BORR) project. BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway (Figure 1**,** Appendix A). The completed project will provide a high standard route for access to the Bunbury Port, improve road user safety and facilitate proposed development to the east of the City of Bunbury. BORR also provides an effective bypass of Bunbury for inter-regional traffic. The proposed BORR comprises three sections:

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- 'BORR Central Section' – Boyanup-Picton Road to South Western Highway
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

This document refers to BORR Southern Section only.

Main Roads commissioned the BORR IPT to undertake a vegetation and flora study during the 2018 spring season, for BORR Southern Section (the Project). The purpose of the assessment was to delineate key flora and vegetation values within the survey area.

The 2018 assessment encompassed a survey area that was planned to include and extend beyond the proposed alignment of the BORR Southern Section. Subsequent refinement of the alignment resulted in some areas being included in the proposed alignment that were not contained within the 2018 survey area. In addition to this, in 2019, the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community (Tuart TEC) was listed as a threatened ecological community (TEC) (at the level of critically endangered) by the then Department of the Environment and Energy (DotEE). The Approved Conservation Advice (DotEE, 2019a) specified criteria and thresholds for determining occurrences of the TEC that had not been considered in the 2018 survey methodology. Separate to this, targeted surveys for vegetation representing the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed Clay Pans of the Swan Coastal Plain TEC (Claypan TEC) (and associated State-listed TECs and floristic community types), and Threatened flora taxa listed under the EPBC Act were deemed necessary to provide a comprehensive and complete assessment.

In response to the factors listed above, the following additional surveys wereconducted:

- Detailed and targeted assessment over previously unsurveyed gaps (September 2019)
- Targeted survey for occurrences of TECs and Priority ecological communities (PECs), including the Tuart TEC (September 2019)
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This report presents the results of the initial 2018 survey and additional surveys as listed above. Also included is an analysis of survey (quadrat) data from GHD (2014; GHD, 2015) and Biota (2016; Biota, 2018) where these surveys overlap with the 2018 survey area.

1.2 Purpose of this report

The purpose of this study is to identify the vegetation and flora within the survey area in order to inform project design and environmental approvals.

The aim of the study was to:

- Identify, map and describe vegetation types
- Assess and map the condition of vegetation
- Identify and map the location of Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs)
- Identify areas of high floristic value including those that provide habitat for conservation significant flora, wetland / riparian vegetation, vegetation types that are poorly represented and those with high diversity
- Identify and map the location of conservation significant flora species.

1.3 Project location

1.3.1 Survey area

The survey area assessed in this flora and vegetation study covers approximately 349.91 hectares (ha) and includes existing road reserves, agricultural land and native vegetation. The Proposal Area is approximately 200 ha and entirely contained within the survey area.

As described in Section 1.1, the study commenced with a vegetation and flora study conducted during the 2018 spring season. In 2019, additional targeted surveys were completed within the Proposal Area for TECs and PECs as well as Threatened flora. This included those areas contained within the 2018 survey area and additional areas not previously surveyed.

The survey area is mapped in Figure 2, Appendix A. Combined survey effort, including the past, 2018 and additional survey areas is shown in Figure 3, Appendix A.

1.3.2 Study area

A study area was defined for the desktop based searches of the assessment and includes a 5 kilometre (km) buffer of the survey area for the purpose of flora and vegetation database searches.

1.4 Scope of works

The scope of works for the flora and vegetation survey included:

- A desktop review of publically available information and relevant reports to determine the environmental values of the survey area
- A biological survey to identify:
    - Vegetation community types present, including the presence of any TECs or PECs or other significant vegetation
    - Vegetation condition, including the location of any Weeds of National Significance (WONS) or Declared Weeds

  - Flora species present including introduced species
  - The presence or potential presence of any Threatened or Priority flora
- Preparation of a biological survey report (this document) that:
  - Documents the results of the desktop assessment and field survey, including mapping
  - Identifies and discusses potentially occurring significant flora and vegetation communities
- Provision of spatial files in GIS format.

1.5 Relevant legislation

In Western Australia (WA), significant communities and flora are protected under both Federal and State Government legislation. In addition, regulatory bodies provide a range of guidance and information on expected standards and protocols for environmental surveys.

An overview of key legislation and guidelines, conservation codes and background information relevant to this project are provided in Appendix B.

1.6 Limitations and assumptions

This report has been prepared by BORR IPT for Main Roads and may only be used and relied on by Main Roads for the purpose agreed between BORR IPT and the Main Roads as set out in section 1.2 of this report.

BORR IPT otherwise disclaims responsibility to any person other than Main Roads arising in connection with this report. BORR IPT also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by BORR IPT in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. BORR IPT has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by BORR IPT described in this report. BORR IPT disclaims liability arising from any of the assumptions being incorrect.

BORR IPT has prepared this report on the basis of information provided by Main Roads and others who provided information to BORR IPT (including Government authorities), which BORR IPT has not independently verified or checked beyond the agreed scope of work. BORR IPT does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of infrastructure, services and vegetation, and access. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this Report. BORR IPT does not accept responsibility arising from, or in connection with, any change to the site conditions. BORR IPT is also not responsible for updating this report if the site conditions change.

This report has assessed the flora values within the survey area, as shown in Figure 1, Appendix A.

2 METHODOLOGY

2.1 Desktop assessment

Prior to the commencement of the field survey, a desktop assessment was undertaken to identify relevant environmental information pertaining to both the survey area and study area and to assist in survey design. The desktop assessment involved a review of:

- GHD (2014) – Lot 1 Ducane Road Environmental Values Assessment
- GHD (2015) – Vegetation and Flora survey of the BORR South Alignment
- Biota (2016) – Bunbury Outer Ring Road Southern Section – Reassessment of Floristic Communities
- Biota (2018) – Bunbury Outer Ring Road Southern Section – Banksia Woodlands TEC Assessment
- Ecoedge (2017) – Report of a Targeted Rare Flora Survey for *Diuris drummondii* along four sections of the Bunbury Outer Ring Road proposed alignment

The desktop assessment also involved a review of:

- The Department of the Environment and Energy (DotEE) Protected Matters Search Tool (PMST) to identify communities and species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) potentially occurring within the study area (DotEE, 2019b) (Appendix C)
- The Department of Biodiversity, Conservation and Attractions (DBCA) TEC and PEC database to determine the potential for significant ecological communities to be present within the study area (provided by Main Roads)
- The DBCA NatureMap database for flora species previously recorded within the study area (DBCA, 2007-)(Appendix C)
- The DBCA Threatened (Declared Rare) and Priority Flora database (TPFL) and the WA Herbarium database (WAHERB) for Threatened and Priority flora species listed under the *Biodiversity Conservation Act 2016* (BC Act) (which replaced the *Wildlife Conservation Act 1950*) and listed as Priority by DBCA, previously recorded within the study area (provided by Main Roads) (DBCA, 2019c)
- Existing datasets including previous vegetation mapping of the survey area, aerial photography, geology/soils and hydrology information to provide background information on the variability of the environment, likely vegetation units and to identify areas with potential to contain TECs, PECs, and Threatened and Priority listed flora species
- Consultation with DBCA flora officer also identified additional conservation significant flora taxa not identified in desktop searches that are potentially present / have been recorded near the survey area.

Data from previous flora and vegetation investigations completed within the survey area were considered in the desktop assessment and included in the flora inventory. As shown in Table 2-2, flora assessments have been carried out within the survey area in September 2011, June 2013, June 2014, October 2016, November 2016, November 2017 and November 2019. These surveys include 34 quadrats / releves within the the survey area that were additional to those sampled in the 2018 and 2019 surveys. Data from these quadrats / releves have also been used to describe the vegetation types and / or included in the floristic community type (FCT) analysis for this report.

The location of the previous survey areas is shown in Figure 3, Appendix A.

Table 2-1 Data collected from previous and related field surveys

SOURCE	MEASUREMENT
GHD (2014)	Survey of Lot 1 Ducane Road. GHD completed a flora and vegetation assessment of Lot 1 Ducane Road on the 13 June 2013. This included nine quadrats, all of which are within the current survey area.
GHD (2015)	The survey was considered to be a level 2 assessment (as per the now superseded EPA guidelines). Phase 1 was carried out on the 21 to 23 September 2011 and Phase 2 from the 16 to 18 June 2014. A total of 21 quadrats (20 within the current survey area) were assessed and the vegetation types / condition described.
Biota (2016)	Survey from the 25 to 26 October 2016 by two Biota botanists targeting areas identified in GHD (2015) as likely to correspond with FCT 8 and FCT21b. Seven sites were sampled, of which five quadrats (three of which were re-sampled from GHD 2015) are within the current survey area.
Biota (2018)	The survey was carried out from the 4 to 6 November 2017 by two Biota botanists. Twenty-four target areas were sampled, using either quadrats (10 x 10 m) or mapping notes. Five quadrats and one relevé were sampled (two quadrats and one relevé within the current survey area).
Ecoedge (2017; 2019a)	Ecoedge completed a targeted assessment on the 19 and 30 November 2016 and 30 November 2019 of portions of the BORR South proposed alignment that provide suitable habitat for *Diuris drummondii* and adjacent areas. Three areas were searched as part of these assessments.
Ecoedge (2019b)	Ecoedge completed a desktop review for the location of potential claypan wetlands, which identified one potential claypan wetland. A field survey determined that the wetland was not to be a claypan community.

2.2 Field assessment

BORR IPT botanists with assistance from Ecoedge botanists completed a detailed vegetation and flora assessment of the survey area in August (late winter/ early spring) and September 2018 (spring). A targeted orchid survey of selected sites was completed in August and September 2019. A targeted *Diuris drummondii* (Tall Donkey Orchid) survey was also completed on 19 November and 30 November 2016 and 30 November 2019. In addition, a targeted survey for TECs/PECs and confirmation of vegetation types in previously unsurveyed gaps in the survey area was undertaken in September 2019. A review of potential conservation listed claypan occurrences was also undertaken. A summary of the field assessments undertaken is presented in Table 2-2.

Table 2-2 Flora and vegetation survey timing and effort

DATE	SURVEY EFFORT	FIELD TEAM AND EXPERIENCE
21 August 2018	Late winter / early spring assessment of wetland areas within the survey area / reconnaissance survey. 16 person hours were spent on these surveys.	Two GHD senior botanists, one with over 13 years' experience undertaking surveys in the South-West of Western Australia, including the Swan Coastal Plain, and one with ten years' experience undertaking flora surveys on the Swan Coastal Plain.
22 October, 30 October – 1 November 2018	Spring detailed survey within the survey area. 64 person hours were spent on these surveys.	One GHD senior botanist with over 12 years' experience undertaking flora surveys on the Swan Coastal Plain, and one GHD graduate ecologist with one year's experience undertaking flora and vegetation surveys.
23 – 30 August 2019	*Drakaea* targeted search of two locations. 130 person hours were spent on these surveys.	One BORR IPT senior botanist with over 16 years' experience in undertaking flora surveys and assessments on the Swan Coastal Plain, and one Ecoedge botanist with 10 years' experience undertaking flora surveys, in particular in the Bunbury region.
23 September – 9 October 2019	*Drakaea* targeted search of two locations. Targeted surveys for orchids and TECs across suitable habitats. Confirm vegetation types in previously unsurveyed gaps in the survey area. 300 person hours were spent on these surveys.	One BORR IPT senior botanist with over 16 years' experience in undertaking flora surveys and assessments on the Swan Coastal Plain, and one Ecoedge botanist with 10 years' experience undertaking flora surveys, in particular in the Bunbury region.
19 and 30 November 2016 and 30 November 2019	*Diuris drummondii* targeted search of three locations (Ecoedge, 2019a). 16 person hours were spent on these surveys. In addition four surveys areas were targeted in 2016 (Ecoedge, 2017). 32 person hours were spent on these surveys.	One Ecoedge senior botanist over 25 years' experience undertaking flora surveys in the South West of Western Australia, including the Swan Coastal Plain, and one Ecoedge botanist with 10 years' experience undertaking flora surveys, in particular in the Bunbury region.
1 August 2019	Review of potential conservation listed claypan occurrences (Ecoedge, 2019b). 16 person hours were spent on these surveys.	One Ecoedge senior botanist over 25 years' experience undertaking flora surveys in the South West of Western Australia, including the Swan Coastal Plain, and one Ecoedge botanist with 10 years' experience undertaking flora surveys, in particular in the Bunbury region, and one DBCA Senior Botanist (Andrew Webb).

The field surveys listed above were undertaken to verify the results of the desktop assessment, identify and describe the dominant vegetation units, assess vegetation condition, and identify and record vascular flora species present at the time of survey. Searches for significant ecological communities and flora species were also undertaken during the field survey. The survey personnel, survey timing and survey effort were appropriate to record the environmental values present within the survey area, and consistent with the standard required for environmental assessment of the Proposal.

The survey methodology employed by BORR IPT was undertaken with reference to the Environmental Protection Authority (EPA) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016).

2.2.1 Data collection

Field survey methods involved a combination of sampling quadrats, relevés and photographic reference points located in identified vegetation units and traversing the survey area by foot / vehicle. In total, 20 non-permanent quadrats, three relevés and 109 photographic reference points (PPs) were described throughout the survey area (Figure 2, Appendix A). Copies of the quadrat and relevé data and PPs are provided in Appendix D.

Quadrats (measuring 10 m x 10 m – area of 100 m^2) were located within each identified vegetation unit. A minimum of three quadrats were located within each identified vegetation unit, except for those that were largely in a Degraded to Completely Degraded condition / represented by scattered trees over introduced understorey species. Relevés were used to supplement quadrat data. At each PP, the vegetation type / condition was noted and searches for native flora via walking traverses were undertaken.

Field data at each quadrat were recorded on a pro-forma data sheet and included the parameters detailed in Table 2-3.

Table 2-3 Data collected during the field survey

ASPECT	MEASUREMENT
Collection attributes	Site code, personnel/recorder; date, quadrat dimensions, photograph of the quadrat
Physical features	Aspect, slope, landform, soil attributes, ground surface cover, leaf and wood litter
Location	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS) tool to accuracy approximately ± 5 metres (m)
Vegetation condition	Vegetation condition was assessed using the condition rating scale adapted by EPA (2016) for the South West Botanical Province
Disturbance	Level and nature of disturbances (e.g. weed presence, fire and time since last fire, impacts from grazing, exploration activities)
Flora	List of dominant flora from each structural layer. List of all species within the quadrat including stratum, average height and cover (using National Vegetation Information System (NVIS)).

A flora inventory was compiled from species listed in described quadrats, relevés, PPs and from opportunistic floristic records throughout the survey area.

2.2.2 Vegetation units

Vegetation units were identified and boundaries delineated in GHD (2015). During the 2018 and 2019 surveys, the previous mapping was ground-truthed to detect any changes since the previous surveys. Areas not previously surveyed were mapped using a combination of aerial photography, topographical features, field data/observations and statistical analyses.

Vegetation units were described based on structure, dominant species and cover characteristics as defined by quadrat data and field observations. Vegetation unit descriptions follow NVIS and are consistent with

NVIS Level V (Association). At Level V up to three species per stratum are used to describe the association (ESCAVI, 2003).

2.2.3 Statistical analyses

PRIMER v6 (Clarke, K.R. and Gorley, R.N., 2006) was used to examine the similarity between sites using collected data. A presence / absence matrix was created of all species (including perennials and annuals) present in BORR IPT quadrats and quadrats from GHD (2014; GHD, 2015) and Biota (2016; Biota, 2018) that are within the current survey area. The dissimilarity between quadrats was determined using the Bray-Curtis measure and the Resemblance function in PRIMER. A Cluster analysis (using Agglomerative Hierarchical Clustering technique) based on group average was undertaken using the Bray-Curtis similarity matrix and results presented as a dendrogram. In addition, a nonmetric multi-dimensional scaling analysis (MDS) was undertaken using the Bray-Curtis similarity matrix and results presented as a two dimensional scatter plot. Analysis was run using two scenarios:

- All species (base quadrat data)
- Native species only (weed species removed from each quadrat).

The outputs of the PRIMER analysis were used to inform decisions on vegetation units.

2.2.4 Comparison of vegetation units with regional datasets

Statistical analysis

The Swan Coastal Plain dataset (SWA) (accessed through *NatureMap*) is derived from a database compiled and maintained over many years, combining the results of a number of floristic studies (conducted between 1990 and 1996) on plant communities of the SWA bioregion, south of Moore River. The SWA dataset includes sampling site details, the flora collected at these sampling sites and the FCT assigned to these sampling sites. The taxonomy of the flora in the SWA dataset used is current as of December 2018 updated by BORR IPT.

PRIMER v6 (Clarke, K.R. and Gorley, R.N., 2006) was used to compare the BORR IPT quadrats to existing data (where available) for FCTs described on the SWA. SWA site locations within a 5 km buffer of the survey area were located and the FCTs represented by these sites were identified. All site locations for these FCTs from the SWA dataset were extracted, along with those identified in the desktop searches (e.g. TEC and PEC searches). Representative quadrats from each FCT selected for the analysis are shown in Table 2-4.

The BORR IPT and SWA dataset quadrat data was combined, reconciled to align nomenclature and a presence/absence matrix created of all species (including perennials and annuals). Singleton species (those occurring in only one quadrat) were removed from the matrix as well as species that were only identified to family or genus level. The dissimilarity between quadrats was determined using the Bray-Curtis measure and the Resemblance function in PRIMER. A Cluster analysis (using Agglomerative Hierarchical Clustering technique) based on group average was undertaken using the Bray-Curtis similarity matrix and results presented as a dendrogram. In addition, a nonmetric multi-dimensional analysis (MDS) was undertaken using the Bray-Curtis similarity matrix and results presented as a two dimensional scatter plot. A factor was added to the output to define sample groups by FCT. The outputs of the PRIMER analysis were used to inform decisions on vegetation units.

It is noted that PRIMER can be limited in use for this purpose as analysis is based on all species recorded in quadrats and does not take into account dominance of species. Further interpretation of statistical results, coupled with multiple field surveys and desktop information is needed to determine whether the vegetation units are representative of a certain FCT.

Table 2-4 List of SWA quadrats used in PRIMER analysis within a 5 km buffer of the survey area

FLORISTIC COMMUNITY TYPE NAME AND ID	STATUS	QUADRATS
Southern *Corymbia calophylla* woodlands on heavy soils (1b)	TEC	AMBR-1, AMBR-4, AMBR-6, AMBR-9, AMBRAL-1, CAPEL-5, CARB-1, CARB-2, CARB-4, R116703, YALLIN-1, YOON-1
***Corymbia calophylla* – *Xanthorrhoea preissii* woodlands and shrublands (3c)**	TEC	DUCK-1, DUCK-2, ELLEN-6, PEARCE-2, talb1, talb12, talb13, talb4, WATER-3, yarl01
***Melaleuca preissiana* damplands (4)**		AMBR-3, C58-1, CAPEL-3, dian02, FL-1, FL-9, GUTHR-1, Hamp01, kailis03, low14a, LYONS-1, MELA-1, Plant02, R116701, rowe02
Mixed shrub damplands (5)		AUSTB-5, GUTHR-4, jand06, low08, Mill01, MILT-1, PLINE-5, Swamp01
Weed dominated wetlands on heavy soils (6)		card10, card11, much02, PEARCE -1, Sunday01, TWIN-1, TWIN-2,
Herb rich saline shrublands in clay flats (7)	TEC ^	AUSTB-1, BAMBUN-1, BAMBUN-3, BULL-6, CARAB-2, FISH-1, gosn10, mrnp01, MUCK-2, Punr01, RUAB-4, Swamp02, YOON-3
Herb rich shrublands in clay pans (8)	TEC ^	C58-3, FL-3, FL-7, gosn08, Hay01, MEELON-1, MEELON-2, MUD-2, MUD-3, MUD-6, MUD-7, MUD-9, waro 03, waro 04, WATER-4
Dense shrublands on clay flats (9)	TEC ^	brick4, BYRD-1, DUCK-3, MANEA-1, Pind02, welr02, WONN-3, yarl02
Shrublands on dry clay flats (10a)	TEC ^	C58-4, FISH-3, FISH-4, FL-2, gosn11, KOOLJ-6, KOOLJ-7, pinj10, Plant01, Punr03, waro 05
Wet forests and woodlands (11)		AUSTB-3, beel03, BULL-12, C71-1, CARAB-3, HARRY-6, hymus01, hymus02, low10b, MODO-3, rowe01, TWIN-11, yuri04
***Melaleuca rhaphiophylla* – *Gahnia trifida* seasonal wetlands (17)**		Chid056, cool 01, cool 04, cool 11, ELLIS-1, Hay02, Ieda03, Ieda04, LESCH-6, MTB-5, PAGA-5, Possum5
Shrublands on calcareous silts (18)	TEC	boot01, boot03, ELE13, ELLIS-2, ELLIS-3, Hay05, xbeer02
Central *Banksia attenuata* – *Eucalyptus marginata* woodlands (21a)		AUSTRA-1, BULLER-1, C71-2, CAPEL-7, CLIFT01, CORON-1, FL-4, gelor02, Hamp03, KEME-2, KOOLI-2, MANEA-2, MGK01, MILT-6, NINE-2, REDL-1, RIVD-2, Sunday02
Southern *Banksia attenuata* woodlands (21b)	PEC *	boyan01, buffer01, CAPEL-1, CARB-3, dard02, gibson01, kelly02, MANEA-3, MGK03, R116702, RUAB-1, RUAB-2
Low lying *Banksia attenuata* woodlands or shrublands (21c)	PEC *	5C07, BULLER-3, DEJONG02, dillo01, FL-6, KEME-3, low07, MODO-2, PLINE-7, raven03, SF03, TWIN-7, white05

FLORISTIC COMMUNITY TYPE NAME AND ID	STATUS	QUADRATS
Southern *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands (25)	PEC **	bunb01, C71-4, colriv01, CORON-2, gelro01, GMaid01, GMaid02, GMaid03, GMaid04, KEME-1, MEAL-1, MINN-2, MYALUP-2, NMaid05, tokyu01, yela03
Coastal shrublands on shallow sands (29a)		BMaid02, BU01, BU04, MI21, NAVB-2, NMaid01, NMaid03, Pinn02, PRES-1, rich02
Quindalup *Eucalyptus gomphocephala* and / or *Agonis flexuosa* woodlands (30b)	PEC ***	LESCH-1, LESCH-2, LESCH-3, LESCH-4, LESCH-5, NMaid04, PEPB-1, pip01, Possum3
***Astartea* aff. *fascicularis*/ *Melaleuca* species dense shrublands (S01)**		Cavs07, Della01, gosn06, pinj15, raven04, Swamp03, yang03
***Acacia saligna* wetlands (S05)**		ELE09, ELE10, ELE36, Hay03

^ A component of the Critically Endangered Clay Pans of the Swan Coastal Plain EPBC listed TEC.

* A component of the Endangered Banksia Woodlands of the Swan Coastal Plain EPBC listed TEC.

** Can be a component of the Endangered Banksia Woodlands of the Swan Coastal Plain EPBC listed TEC or Tuart Woodlands of the SCP PEC.

*** Can be a component of the Tuart Woodlands of the Swan Coastal Plain EPBC listed TEC.

2.2.5 Vegetation condition

The vegetation condition was assessed and mapped in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces of Western Australia (devised by Keighery (1994) and adapted by EPA (2016)). The scale recognises the intactness of vegetation and consists of six rating levels. The vegetation condition rating scale is located in Appendix B.

2.2.6 Flora identification and nomenclature

Species well known to the survey botanists were identified in the field; all other species were collected and assigned a unique collection number to facilitate tracking. All specimens collected during the field assessment were dried and processed in accordance with the requirements of the WA Herbarium. Species were identified by a qualified taxonomist using taxonomic literature, electronic keys and online electronic databases.

The conservation status of all recorded flora was compared against the current lists available on FloraBase (WA Herbarium, 1998-) and the EPBC Act Threatened species database provided by DotEE (2019c).

Nomenclature used in this report follows that used by the WA Herbarium as reported on FloraBase (WA Herbarium, 1998-).

2.2.7 Targeted surveys for Threatened and Priority Ecological Communities (TEC/PEC)

Targeted surveys for the presence of TECs / PECs were undertaken by identifying vegetation units and delineating boundaries using a combination of aerial photography, topographical features, field data/observations and statistical analyses (multivariate analyses). Vegetation units were described based on structure, dominant species and cover characteristics as defined by quadrat data and field observations.

Banksia woodlands of the Swan Coastal Plain (TEC)

Targeted surveys for the presence of the Banksia Woodlands of the Swan Coastal Plain, listed as an Endangered TEC under the EPBC Act, were undertaken in 2019. Potential occurrences were described based on structure, dominant species, condition and cover characteristics by using quadrat sampling and field observations. To determine extent and boundaries, key diagnostic characteristics and condition thresholds were used to determine the Banksia Woodlands TEC as outlined in Threatened Species Scientific Community (TSSC) Approved Conservation Advice (TSSC, 2016). The TSSC (2016) provides guidance for determining whether the TEC is present. These criteria are summarised in Table 2-5.

Table 2-5 Diagnostic characteristics and condition thresholds for Banksia Woodlands TEC (TSSC, 2016)

DIAGNOSTIC CHARACTERISTICS / CONDITION THRESHOLDS	CRITERIA
Floristic Community Type	Location and physical environment: • Occurs on the Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (IBRA) bioregion Soil and landform: • Typically occurs on well drained, low nutrient soils on sandplain landforms, particularly in deep Bassendean and Spearwood sands and occasionally on Quindalup sands. Structure: • The community is a low woodland to forest, but may also include shrubland, open woodland or forest under some classification systems. The percentage canopy cover is more than 2% and typically less than 50%. The structure and appearance may also vary due to disturbance history. Composition: • The canopy is commonly dominated by *Banksia attenuata* and or *B. menziesii*. Other *Banksia* species that dominate include *B. prionotes* or *B. ilicifolia*. The patch must include at least one of these diagnostic species.
Vegetation condition[1] and minimum patch size	• Pristine – no minimum • Excellent – 0.5 ha • Very Good – 1 ha • Good – 2 ha
Surrounding context	A patch is a discrete and mostly continuous area of ecological community. A patch may include small scale (<30 m) variations, gaps and disturbances, such as tracks, that do not significantly alter the overall functionality of the ecological community. Such breaks are generally included in patch size calculations. The landscape and position of the patch including its position relative to surrounding vegetation also influences how important it is in the broader landscape.

[1] As per the Keighery (1994) condition scale presented in Bush Forever (Government of Western Australia 2000).

Banksia Woodlands of the SCP (PEC)

The field assessment confirmed the presence of the Banksia Woodlands of the SCP PEC, listed as Priority 3 by DBCA. Potential occurrences were described based on structure, dominant species, condition and cover characteristics by using quadrat sampling and field observations. This PEC aligns with the Banksia Woodlands TEC key diagnostic characteristics and condition thresholds (TSSC, 2016).

Tuart woodlands and forests of the SCP (TEC)

Targeted surveys for the presence of the Tuart (*Eucalyptus gomphocephala*) woodland and forests of the SCP TEC, listed in July 2019 as a Critically Endangered TEC under the EPBC Act were undertaken. Potential occurrences were described based on number of trees (including stags), distance between trees and their canopies, vegetation structure and composition, condition and patch size using a combination of quadrat sampling and field observations. Four Tuart quadrats (JENO01, JENO02, Tuart01 and Tuart02) were assessed across three potential TEC Tuart patches (Figure 11, Appendix A). To determine the extent and boundaries of the potential TEC occurrences, key diagnostic characteristics and condition thresholds were used as outlined in Approved Conservation Advice (DotEE, 2019a) and Main Roads draft Tuart Guidance Factsheet version 9th July 2019 (Main Roads, 2019). To calculate distance between trees and their canopies, the Arc GIS Collector app was utilised in the field which displayed aerial imagery on field tablets to allow the measure tool to be used. This approach allowed the patch to be determined, including determining gaps between potential patches.

The key diagnostic characteristics of this community include, but are not limited to:

- Occurs on the SCP bioregion
- Primarily occurs on the Spearwood and Quindalup dune systems
- The primary defining feature is the presence of at least two living established (> 15 centimetre (cm) diameter at breast height) Tuart trees in the uppermost canopy layer, although they may co-occur with trees of other species
- There is a gap of no more than 60 metres (m) between the outer edges of the canopies of adjacent Tuart trees
- Biotic and patch size thresholds.

These criteria are summarised in Table 2-6.

Table 2-6 Diagnostic characteristics and condition thresholds for Tuart forests and woodlands TEC (DotEE, 2019a)

DIAGNOSTICS CHARACTERISTICS / CONDITION THRESHOLDS	CRITERIA
Floristic Community Type	Location and physical environment: • Occurs on the SCP IBRA bioregion Soil and landform: • Primarily occurs on the Spearwood and Quindalup dune systems, but can also occur on the Bassendean dunes and Pinjarra Plain. It can also occur on the banks of rivers and wetlands Structure:

DIAGNOSTICS CHARACTERISTICS / CONDITION THRESHOLDS	CRITERIA
	• The presence of at least two living established *Eucalyptus gomphocephala* (Tuart) trees in the uppermost canopy layer, although they may co-occur with trees of other species. There is a gap of no more than 60 m between the outer edges of the canopies of adjacent Tuart trees • Most often occurs as a woodland but can occur in other structural forms, (e.g. forest, open forest, woodland, open woodland, and various mallee forms). Composition: • Other tree species may be present in the canopy or sub-canopy. They commonly include *Agonis flexuosa* (Peppermint), *Banksia grandis* (Bull Banksia), *Banksia attenuata* (Candlestick Banksia), *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (Marri), *Banksia menziesii* (Firewood Banksia) and *Banksia prionotes* (Acorn Banksia) • An understorey of native plants is typically present, which may include grasses, herbs and shrubs, although this is often modified by disturbance.
Vegetation condition and minimum patch size	• If the patch is < 0.5 ha, it is not part of the TEC • For patches 0.5 ha to 2 ha in area or 2 ha to 5 ha, specific criteria will need to be met to be considered the TEC • All patches >5 ha that meet the key diagnostic characteristics and patch definition are part of the TEC with no condition thresholds required • Revegetated sites that meet the key diagnostics and minimum condition thresholds for the Tuart Woodlands and Forests are considered as part of the TEC. Sites outside of the described natural range of Tuart woodlands and forests are not part of the TEC.
Defining a patch	• A patch is a discrete and mostly continuous area of vegetation that meets the key diagnostic characteristics • Patch boundaries can extend beyond a site or property boundary • The patch boundary is 30 m beyond the outer canopy of established Tuart trees (< 15 cm DBH), including dead Tuart trees (stags) • Stags considered for inclusion in a patch, the vertical projection of its outermost branches is used to define the edge of its canopy. If the stag species is unclear, and its canopy is within 60 m of an identified Tuart tree, the stag is presumed to be a Tuart • Patches may vary in structural or biological complexity (e.g. patch may vary in number of mature trees / ecological diversity, to other parts of the same patch with fewer mature trees / less groundcover). Patches may also contain exposed soil and/or plant litter areas. Patches vary spatially; higher condition areas may intersperse with lower condition areas • Patches may include small areas without understorey vegetation. Small areas do not break up a patch as long there are some parts of the

DIAGNOSTICS CHARACTERISTICS / CONDITION THRESHOLDS	CRITERIA
	canopy within 60 m of the outer edges of the canopies of adjacent Tuart trees • Existing buildings and other human-made structures and gardens are not part of the TEC and should be excluded, even if there are some parts of the canopy within 60 m of the outer edges of the canopies of adjacent Tuart trees.
Minimum condition threshold for 0.5 ha to 2 ha patches of the Tuart Woodlands and Forests TEC	• High condition (needs to meet a minimum of high) • ≥60 % of all understorey vegetation cover is native OR • At least eight native understorey species per 0.01 ha AND • Have an important landscape role (≤100 m to native vegetation) (refer to indicators of important landscape features below) OR • Have a habitat role (≥2 very large trees per 0.5 ha) (refer to indictors of habitat features below) OR • Show regeneration (≥15 seedlings and / or saplings per 0.5 ha).
Minimum condition threshold for 2 ha to 5 ha patches of the Tuart Woodlands and Forests TEC	• Moderate condition • ≥50 % of all understorey vegetation cover is native OR • At least four native understorey species per 0.01 ha AND • Have an important landscape role (≤100 m to native vegetation) OR • Have a habitat role (≥2 very large trees per 0.5 ha) OR • Show regeneration (≥15 seedlings and / or saplings per 0.5 ha).
Indicators of Important Landscape, Habitat or Regeneration Features	• Show regeneration (≥15 seedlings and / or saplings per 0.5 ha) • Landscape: patch occurs ≤100 m to another patch of native vegetation ≥1 ha in size. This vegetation can be the TEC and / or other vegetation where ≥50 % of the vegetation cover across all layers is comprised of native plant species OR • Habitat: patch contains a mean of ≥2 very large trees (≥50 cm DBH) per half ha of any native plant species OR • Regeneration: patch displays evidence of natural regeneration of native eucalypts (Corymbia or Eucalyptus), represented by seedlings, saplings or other sub-mature stages (<15 cm DBH) with at least a mean of 15 individuals per half ha.

Southern SCP *Eucalyptus gomphocephala – Agonis flexuosa* woodlands (SCP25) / Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain

The field assessment also confirmed the presence of the Southern SCP *Eucalyptus gomphocephala – Agonis flexuosa* woodlands (SCP25) and Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain PECs, both listed as Priority 3 by DBCA. Potential occurrences were described based on number of trees, structure and composition, condition and patch size by using quadrat sampling / statistical analysis and field observations. The Tuart PEC aligns with the Tuart TEC key diagnostic characteristics and condition thresholds as outlined in the Approved Conservation Advice (DotEE, 2019a). The Quindalup *Eucalyptus gomphocephala* and / or *Agonis flexuosa* woodlands (30b) PEC was also assessed for potential occurrences.

2.2.8 Surveys for conservation significant flora

Prior to the field survey, information obtained from the desktop assessments (e.g. previous flora and vegetation investigations, aerial photography, geology, soils and topography data, EPBC Act PMST, TPFL, NatureMap and the WAHERB databases search results) was reviewed to determine conservation significant flora species potentially present within the study area and locations. Additionally, ecological information (e.g. habitat, associated flora species and phenology) was sourced from FloraBase (WA Herbarium, 1998-) to provide further details.

Potential habitats and locations of previous records were searched by opportunistic sampling. Where individuals were identified, the location and number of plants present were recorded using handheld GPS units.

Drakaea survey

A targeted survey was completed for *Drakaea elastica* and *D. micrantha*. The field survey was undertaken in reference to the Commonwealth of Australia *Draft Orchid Survey Guidelines* (2013) and the methodology was discussed with Mr Andrew Webb (DBCA Flora Officer) prior to commencing the field work. The methodology employed involved:

- Identification of potential habitat – this was based on the vegetation mapping and field observations during the spring surveys. Sites selected were nearby swamps / dampland areas and contained *Kunzea* thickets with *Banksia* woodlands within the survey area and adjacent areas (Figure 1, Appendix A). Areas that had been completely cleared, heavily grazed paddocks that did not contain remnant vegetation, were excluded from the survey
- Surveys were undertaken in mid to late August to coincide with the presence of *D. elastica* (and *D. micrantha*) leaf being conspicuous and detectable in the field
- Surveys involved one senior botanist and a one botanist, sites were traversed on foot with:
    - Higher quality habitat – sites that retained structure (had a upper / mid or ground layer that comprised native species) traversed on a parallel grid (at 10 m intervals)
    - Lower quality sites – sites that were almost completed cleared / or contained scattered native species but were grazed and had high visibility through the ground layer were traversed via meander surveys
- In total, 100 person hours were spent surveying for *D. elastica* and *D. micrantha*.

Figure 2, Appendix A shows the two survey sites assessed.

Diuris drummondii survey

A targeted survey was completed for *Diuris drummondii* (Ecoedge, 2019a). The field survey was undertaken in reference to the Commonwealth of Australia *Draft Orchid Survey Guidelines* (2013) and the methodology was discussed with Mr Andrew Webb (DBCA Flora Officer) prior to commencing the field work. The methodology employed involved:

- Identification of potential habitat – this was based on the vegetation mapping and field observations during the spring surveys. Sites selected were within swamps / dampland areas within the survey area and adjacent areas (Figure 2, Appendix A). Areas that had been completely cleared, heavily grazed paddocks that did not contain remnant vegetation, were excluded from the survey
- Prior to the field survey, Mr Andrew Webb confirmed that *D. drummondii* was flowering in the Bunbury region and one of the known sites (outside of the survey area) was visited to confirm that the species was in flower
- Surveys involved two senior botanists, three sites were traversed on foot with:
    - Higher quality habitat – sites that retained structure (had a upper / mid or ground layer that comprised native species) traversed on a parallel grid (at a 5-10 m intervals)

  - Lower quality sites – sites that were almost completed cleared / or contained scattered native sedges (such as *Juncus pallidus*) but were grazed and had high visibility through the ground layer were traversed via meander surveys
- In total, 16 person hours were spent surveying for *D. drummondii*.

Figure 2, Appendix A shows the three survey sites assessed.

Other conservation listed species survey

A targeted survey for other Threatened orchid species, including *Caladenia huegelii, Diuris micrantha* and *Caladenia speciosa*, was undertaken in suitable Jarrah / Banksia and wetland habitat. Listed Threatened species *Eleocharis keigheryi, Austrostipa jacobsiana* and *Austrostipa bronwenae* were also searched for in wetland / dampland habitat.

The methodology employed involved:

- Surveys involved two senior botanists, vegetation types VT1, VT2, VT3 and VT4 (Jarrah / Banksia) and VT6, VT7, VT8 (wetland habitat) were traversed on foot with:
  - Higher quality habitat – sites that retained structure (had a upper / mid or ground layer that comprised native species) traversed on a parallel grid (at a 5-10 m intervals)
  - Lower quality sites – sites that were almost completed cleared / or contained scattered native sedges (such as *Juncus pallidus*) but were grazed and had high visibility through the ground layer were traversed via meander surveys
- In total, 100 person hours were spent surveying for conservation listed orchid species.

2.3 Desktop and field assessment limitations

2.3.1 Desktop

The EPBC Act PMST is based on bioclimatic modelling for the potential presence of species. As such, this does not represent actual records of the species within the area. The records from the DBCA searches of Threatened and Priority flora provide more accurate information for the general area. However, some records of collections cannot be dated or are plain text interpretations of locations which can misrepresent the current range of Threatened or Priority species.

2.3.2 Field

The EPA (2016) Technical Guide states flora survey reports for environmental impact assessment in WA should contain a section describing the limitations of the survey methods used. The limitations and constraints associated with this field survey are discussed in Table 2-7. Based on this assessment, the present survey effort has not been subject to any constraints which affect the thoroughness of the assessment and the conclusions which have been formed.

Table 2-7 Field survey limitations

ASPECT	CONSTRAINT	COMMENT
Sources of information and availability of contextual information	Nil	Adequate information is available for the survey area, this includes: • Broad scale (1:250,000) mapping by Beard (1979), Heddle *et al*. (1980) and Webb *et al*. (2016) Regional biogeography Mitchell *et al*. (2002). Previous flora surveys within and adjacent to the survey area including GHD (2015); Ecoedge (2017) and Biota (2016; 2018) (see Section 4).

ASPECT	CONSTRAINT	COMMENT
Scope (what life forms were sampled etc.)	Nil	Vascular flora was sampled during the survey. Non-vascular flora were not surveyed.
Proportion of flora collected and identified (based on sampling, timing and intensity)	Minor	A reconnaissance survey was undertaken on the 21 August and a single season detailed vegetation and flora survey was undertaken on the 22 October and 30 October to 1 November 2018 (four days), 23 to 30 August 2019, 23 September to 9 October 2019 (13 days). Targeted orchid survey on 30 November 2019. The surveys included late winter, early spring and late spring. The flora recorded from the field survey is detailed in Section 5.5 and a full flora species list is provided in Appendix E. The portion of flora collected and identified was considered high, based on survey effort and timing. The species accumulation curve for the survey area, based on flora recorded within quadrats, is approaching an asymptote, which suggests that the current survey effort is sufficient. Furthermore, the bootstrap estimate of species richness generated from this data indicates that 289 species could be expected from the survey area based on the diversity recorded within quadrats. The total species recorded from the survey area was 428 flora species (267 recorded in the current survey), which is substantially above the predicted species diversity estimate.
Flora determination	Moderate	Flora determination was undertaken by the BORR IPT botanists in the field and at the WA Herbarium by a consulting taxonomist. During the 2018 surveys over 94 % of species were identified to a species level. 17 specimens could be identified to genera / tentative species only of which five were weeds. It is unlikely these un-identified species are conservation significant, with the exception of the orchid (*Caladenia* species) which contained basal leaves only. Later surveys in 2019 recorded all *Caladenia* species within the survey area. The taxonomy and conservation status of the WA flora is dynamic. This report was prepared with reliance on taxonomy and conservation status current at the time of report development, but it should be noted this may change in response to ongoing research and review of International Union for Conservation Nature (IUCN) criteria.

ASPECT	CONSTRAINT	COMMENT
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed)	Moderate	The survey area has previously been surveyed (see Section 4). Some areas that were previously assessed were also re-surveyed to determine change over time. Access to the survey area was made by vehicle tracks which extended along the site. Information gained from the survey was extrapolated across those sections of the survey area not accessed on foot during the field survey to assist with determining the vegetation units and condition. A total of approximately 560 person hours were spent on the various field surveys.
Mapping reliability	Minor	The vegetation was mapped using high-resolution ESRI aerial imagery obtained from Landgate, topographical features, previous broad scale mapping, previous vegetation mapping and field data. Data were recorded in the field using hand-held GPS tools (e.g. Samsung Tablet with ArcGIS Collector and Garmin GPS). Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers. The Garmin GPS units used for this survey are accurate to within ±5 m on average. Therefore the data points consisting of coordinates recorded from the GPS may contain inaccuracies. Mapping was completed to a scale of 1:10,000.
Timing/weather/ season/cycle	Nil	The field surveys were conducted from 20 August to 1 November 2018 and 23 to 30 August 2019, 23 September to 9 October 2019 (13 days). The closest Bureau of Meteorology (BoM) weather recording station to the survey area is Bunbury (No. 9965) (BoM, 2019). As shown in Plate 1, Section 3.1, the long-term averages (LTA) rainfall are slightly lower than the 2018 period for June and July, with the 2018 period recording lower rainfall averages in September, November and December. The temperature statistics indicate that the 2018 minimum and maximum temperatures were consistent with the LTAs. During 2019 higher rainfall was recorded in June 2019, compared with the long-term average (LTA) (Plate 2), where July and August total rainfall was lower than the LTA. Rainfall received was adequate for the flowering of flora species. The temperature statistics indicate that the 2019 minimum and maximum temperatures were consistent with the LTAs, except for the maximum temperatures during November and December 2019 were higher than the LTA. The weather conditions recorded during the survey periods are considered unlikely to have impacted upon the vegetation and flora survey. The survey timing was considered appropriate for the flora field survey.
Disturbances (e.g. fire, flood, accidental human intervention)	Nil	The survey area is largely located in an agricultural setting and as such has had previous land clearing. At the time of the survey one small area was burnt, no other disturbance such as fire / flooding etc. were present.

ASPECT	CONSTRAINT	COMMENT
Intensity (in retrospect, was the intensity adequate)	Minor	The vascular flora of the survey area was sampled in accordance with EPA (2016); a minimum of three quadrats per vegetation type were established (where possible) along with relevés and photographic reference points to supplement the data. The survey area was sufficiently covered by the botanists during the survey.
Resources	Minor	Adequate resources were employed during the field survey. Field survey teams consisted of one senior botanist (more than 10-17 years' experience) and a field ecologist (2+ years' field experience). In total, 500 person hours were spent undertaking vegetation and flora surveys.
Access restrictions	Nil	The survey area included private properties; the BORR IPT arranged site access. However, not all properties where accessed for the survey. In some instances, access within and across properties was restricted due to biosecurity, electric fences and cattle. In these instances vegetation types and conditions were extrapolated from aerial photography / soil and landscape information and nearby survey points.
Experience levels	Nil	The botanists who executed the survey are practitioners suitably qualified and experienced in their respective fields. The detailed survey team consisted of senior botanists and support personnel. The senior botanists have previously undertaken targeted Threatened orchid surveys on the Swan Coastal Plain and are highly familiar with the species taxonomy and habitat requirements. The reconnaissance survey was carried out by two senior botanists. The senior botanists have more than 12 years' experience conducting flora surveys in WA, including the south-west. Field ecologists/ field support staff have 1 – 4 years' field experience.

3 DESKTOP ASSESSMENT

3.1 Climate

The Bunbury area experiences a Mediterranean climate and is characterised by hot, dry summers and cool, wet winters. Rainfall is largely received during the winter months as a result of cold fronts that regularly cross the South West coast. The closest BoM weather station is Bunbury (site number 009965) (BoM, 2019). Climate statistics for the Bunbury weather station are presented in Plate 1 (2018) and Plate 2 (2019).

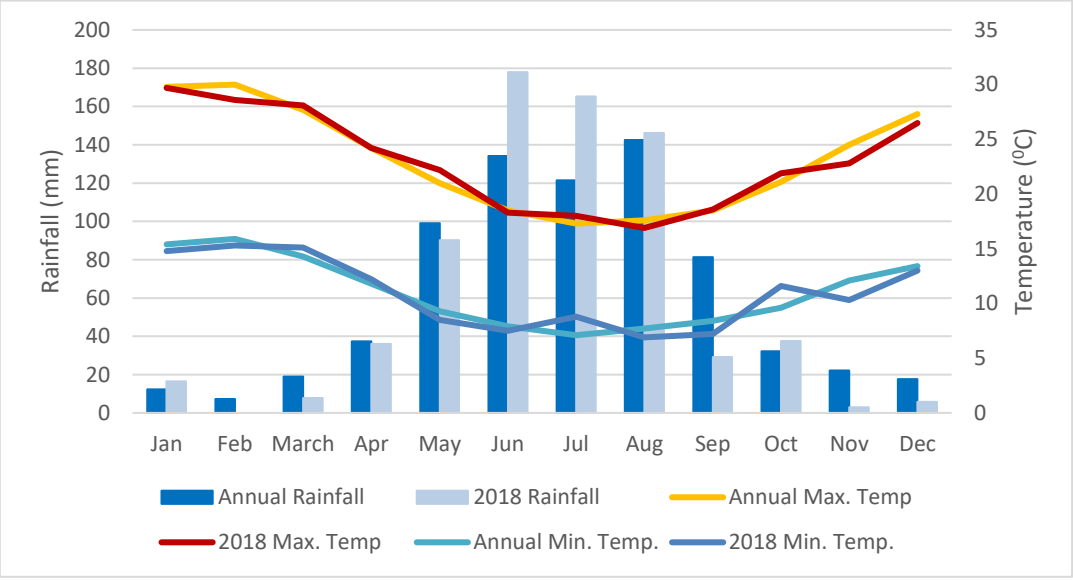

Plate 1 Climate statistics for Bunbury Weather Station (No. 9965) Annual and 2018

Note: April and May data for Bunbury Weather Station were not available at time of writing therefore data from Australind weather station (No. 9273) have been used instead for these two months. Annual climate statistics are from November 1995 to current.

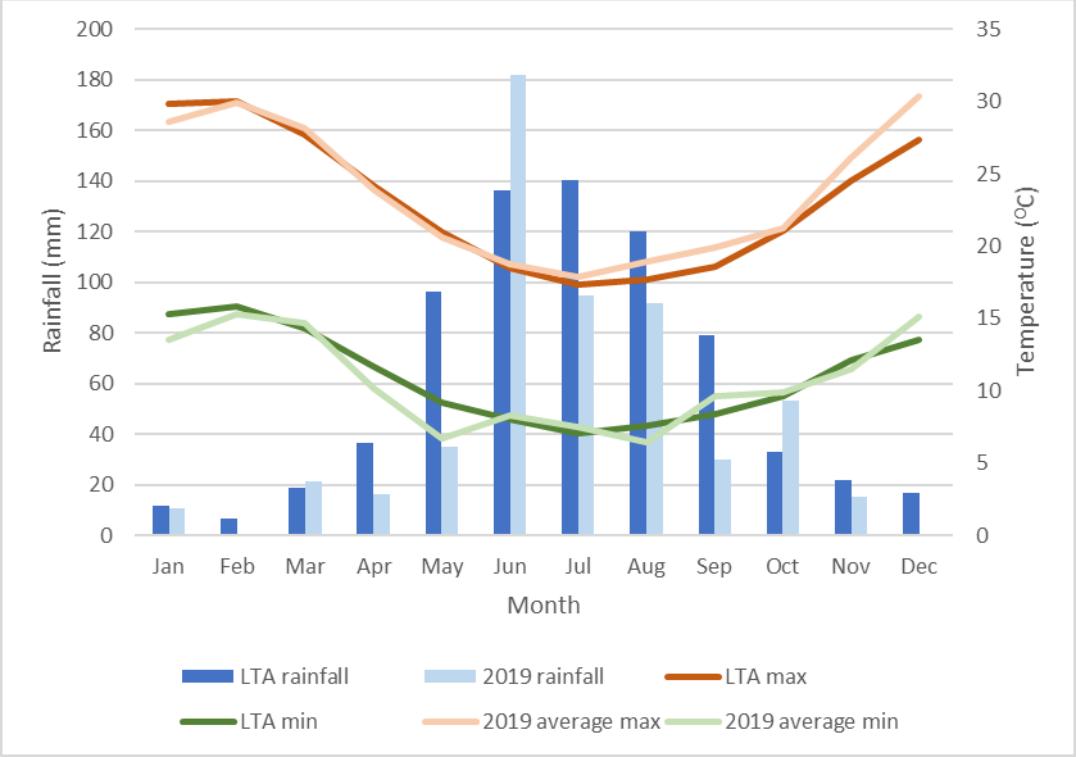

Plate 2 Climate statistics for Bunbury Weather Station (No. 9965) Annual and 2019

3.2 Province

The study area is located in the South West Botanical Province of WA (1980), the Swan Coastal Plain (SCP) bioregion and Perth (SWA2) subregion as described by the Interim Biogeographic Region of Western Australia (Department of the Environment, 2012).

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

3.3 Landform and soils

The SCP is comprised of five major geomorphological units, which lie more or less parallel to the coast, being the Quindalup, Spearwood and Bassendean Dunes, the Pinjarra Plain and the Ridge Hill Shelf (McArthur, W.M. and Bettenay, E., 1960; Churchward, H. and McArthur W.M. , 1980). The survey area lies within the Spearwood and Bassendean Dunes and Pinjarra Plain elements, which are broadly described as:

- Spearwood dune system: Pleistocene and aeolian sands overlying Tamala limestone. Low dunes and swales of shallow pale grey sands over yellow sands are characteristic of the Spearwood system. Wetlands are associated with peats and carbonate sands, occasionally with clay overlaying sands.
- Bassendean dune and sandplain system: Pleistocene sand dunes with very low relief, leached grey siliceous sand intervening sandy and clayey swamps and gently undulating plains. These occur immediately west of, and partly overlie, the Pinjarra Plain.
- Pinjarra Plain: Broad low relief plain west of the foothills, comprising predominantly Pleistocene fluvial sediments and some Holocene alluvium associated with major current drainage systems. Major soils are naturally poorly drained with many swamps.

Desktop assessment of broad geological formations indicates that the survey area occurs within three broad formations in addition to rivers and wetland areas, which are outlined in Table 3-1.

Table 3-1 Geology and landform information for the survey area (Geological Survey of WA, 2009)

FORMATION	GEOLOGICAL TYPE	GEOLOGICAL DESCRIPTION/ LANDFORM
Tamala Limestone	Qts	Sand associated with Tamala Limestone, high dunes
Guildford Formation	Qpa	Mainly alluvial sandy clay
Bassendean Sand	Qpb	Low rounded dunes
	Qpb/Qpa	Thin Bassendean Sand over Guildford Formation
Rivers	Qha	Alluvium
Wetlands	Qhw	Swamp deposits, mainly peaty sand

Department of Primary Industries and Regional Development (DPIRD) soil-landscape mapping of the South West of WA (Government of Western Australia (GoWA) (2019c)) provides soil and landform data compiled from various sources. This mapping identified 23 different soil types within the survey area. In total, approximately 56 % of the mapped soil types occur within the Bassendean dune system, 24 % within the Spearwood dune system and 20 % within the Pinjarra Plain. The dominant soil types (greater than 20 ha / more than 7 % of the survey area each) are the:

- Spearwood S1b Phase (211Sp__S1b): Dune ridges with deep siliceous yellow brown sands or pale sands with yellow-brown subsoil and slopes up to 15%.
- Spearwood S2c Phase (211Sp__S2c): Lower slopes (1-5%) of dune ridge with bleached or pale sands with a yellow-brown or pale brown subsoil (like S1c). Usually occurs on the eastern edge of the Spearwood Dunes.
- Bassendean B1b Phase (212Bs_B1b): Very low relief dunes of undulating sand plain with deep bleached grey sandy A2 horizons and pale yellow B horizons.
- Bassendean B2 Phase (212Bs_B2): Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.
- Pinjarra P1b Phase (213Pj_P1b): Flat to very gently undulating plain with deep acidic mottled yellow duplex soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas.

Soil landscape types are illustrated in Figure 4 (Appendix A).

3.4 Hydrology

3.4.1 Watercourses

The survey area intersects Five Mile Brook and a number of small drainage lines and constructed drains (Figure 5, Appendix A). Large parts of the survey area have been extensively modified for agricultural irrigation / drainage. For the purposes of this report, these irrigation channels are considered part of the agricultural areas and are not mapped as waterways.

3.4.2 Wetlands

Large sections of the survey area are low-lying palusplain, which is seasonally waterlogged or has a high water table during winter. A search of the EPBC Protected Matters Database (DotEE, 2019b) did not identify any Ramsar listed, Directory of Important Wetlands in Australia or National Heritage Listed wetlands within or in a 5 km buffer of the survey area.

The Geomorphic Wetlands dataset (Hill, A.L., Semeniuk, C.A., Seneniuk, V. and del Marco, A., 1996) identified 27 wetlands within the survey area (Figure 5, Appendix A). These include one Conservation Category Wetland (CCW), 20 Multiple Use Wetlands (MUW), five Resource Enhancement Wetlands (REW) and one Not Assessed wetland. Approximately 24 % of the survey area is mapped as geomorphic wetlands.

A separate wetland assessment has been completed (BORR IPT, 2019) which provides further information on the geomorphic wetlands and an evaluation against their classification.

3.5 Vegetation and flora

3.5.1 Broad vegetation mapping and extents

Broad scale (1:250,000) pre-European vegetation mapping of the area has been completed by Beard (1979) at an association level. The mapping indicates that the survey area intersects three vegetation associations (Figure 6, Appendix A):

- Medium woodland; Tuart and Jarrah (association 6)
- Medium woodland; Tuart (association 998)
- Mosaic: Medium forest; Jarrah-Marri / Low woodland; Banksia / Low forest; Teatree (*Melaleuca spp*.) (association 1000).

The pre-European mapping has been adapted and digitised by Shepherd *et al.* (2002). The extent of vegetation associations has been determined by the state-wide vegetation remaining extent calculations maintained by DBCA (latest update March 2019 (GoWA, 2019b)). As shown in Table 3-2, the current extent of vegetation associations 6 and 1000 are less than 30 % of their pre-European extent at the IBRA bioregion and subregion. Less than 30 % of association 1000 remains at the Local Government Authority (LGA) level for both the Shires of Capel and the City of Bunbury (latest update March 2019) (GoWA, 2019b). Association 998 has more than 30 % remaining at the IBRA bioregion and subregion levels but less than 30 % at the LGA level for both LGAs listed above.

Table 3-2 Extents of vegetation associations mapped within the survey area (GoWA, 2019b)

VEGETATION ASSOCIATION	SCALE		PRE-EUROPEAN EXTENT (HA)	CURRENT EXTENT (HA)	REMAINING (%)	REMAINING WITHIN DBCA MANAGED LANDS (%)
Swan Coastal Plain IBRA bioregion			1,501,221.93	579,813.47	38.62	38.45
6	State: WA		56,343.01	13,362.25	23.72	39.83
	IBRA bioregion: Swan Coastal Plain		56,343.01	13,362.25	23.72	39.83
	Sub-region: Perth		56,343.01	13,362.25	23.72	39.83
	LGA	City of Bunbury	712.97	281.18	39.44	NA
		Shire of Capel	5,245.29	2,301.14	43.87	16.51
998	State: WA		51,015.33	18,492.63	36.25	48.68
	IBRA bioregion: Swan Coastal Plain		50,867.50	18,492.32	36.35	48.68
	Sub-region: Perth		50,867.50	18,492.32	36.35	48.68
	LGA	City of Bunbury	1,405.24	150.28	10.69	NA
		Shire of Capel	234.63	24.28	10.35	NA
1000	State: WA		99,835.86	27,768.84	27.81	18.64
	IBRA bioregion: Swan Coastal Plain		94,175.31	24,869.20	26.41	19.18
	Sub-region: Perth		94,175.31	24,869.20	26.41	19.18
	LGA	City of Bunbury	2,171.67	621.00	28.60	2.12
		Shire of Capel	15,173.76	3,189.87	21.02	7.27

Note: orange indicates that less than 30 % of the pre-European extent remains.

Regional vegetation has been mapped by Heddle *et al*. (1980) and updated by Webb *et al.* (2016) based on major geomorphic units on the SCP. The mapping indicates that four vegetation complexes on Aeolian deposits of the SCP are present within the survey area (Figure 7, Appendix A):

- Bassendean Complex – Central and South: Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) – *Allocasuarina fraseriana* (Sheoak) – *Banksia* species to low woodland of *Melaleuca* species, and sedgelands on the moister sites. This area includes the transition of *Eucalyptus marginata* to *Eucalyptus todtiana* (Pricklybark) in the vicinity of Perth.
- Karrakatta Complex – Central and South: Predominantly open forest of *Eucalyptus gomphocephala* (Tuart) – *Eucalyptus marginata* – *Corymbia calophylla* (Marri) and woodland of *Eucalyptus marginata* – *Banksia* species. *Agonis flexuosa* (Peppermint) is co-dominant south of the Capel River.
- Southern River Complex – Open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - *Banksia* species with fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark) along creek beds.
- Yoongarillup Complex – Woodland to tall woodland of *Eucalyptus gomphocephala* (Tuart) with *Agonis flexuosa* in the second storey. Less consistently an open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri). South of Bunbury is characterised by *Eucalyptus rudis* (Flooded Gum)-*Melaleuca* species open forests.

GoWA (2019a) has assessed the current extent of vegetation complexes against predicted pre-European extents within the SWA IBRA bioregion (Table 3-3) and LGA levels (table 3-4). The current extents of the Bassendean Complex – Central and South, Karrakatta Complex – Central and South and Southern River Complex are less than 30 % of their pre-European extents within the IBRA bioregion. The current extents of the Bassendean Complex – Central and South, Southern River Complex and Yoongarillup Complex are also less than 30 % of their pre-European extents within the City of Bunbury and Shire of Capel LGAs.

Table 3-3 Extent of Heddle *et al.* (1980) vegetation complex on the SCP within the survey area (GoWA, 2019a)

VEGETATION COMPLEX	PRE-EUROPEAN EXTENT (HA)	CURRENT EXTENT (HA)	REMAINING EXTENT (%)	CURRENT EXTENT REMAINING WITHIN ALL DBCA MANAGED LAND (%)
Bassendean Complex – Central and South	87,476.26	23,508.66	26.87	5.00
Karrakatta Complex - Central and South	53,080.99	12,467.20	23.49	8.07
Southern River Complex	58,781.48	10,832.18	18.43	1.60
Yoongarillup Complex	27,977.93	10,018.14	35.81	18.41

Note: orange indicates that less than 30 % of the pre-European extent remains.

Table 3-4 Extent of Heddle *et al*. (1980) vegetation complex within Local Government Areas within the survey area (GoWA, 2019a)

VEGETATION COMPLEX	LGA	PRE-EUROPEAN EXTENT (HA)	CURRENT EXTENT (%)	REMAINING EXTENT (%)	PROPORTION OF COMPLEX WITHIN THE LGA (%)
Bassendean Complex – Central and South	City of Bunbury	0.0	0.0	0.0	0.0
	Shire of Capel	4,946.61	1,162.16	23.49	5.65
Karrakatta Complex - Central and South	City of Bunbury	756.61	283.96	37.53	1.43
	Shire of Capel	6,902.27	3,400.62	49.27	13.00
Southern River Complex	City of Bunbury	2,205.16	635.67	28.83	3.75
	Shire of Capel	7,876.12	1,794.33	22.78	13.40
Yoongarillup Complex	City of Bunbury	1,435.65	156.36	10.89	5.13
	Shire of Capel	1,022.21	233.64	22.86	3.65

Note: orange indicates that less than 30 % of the pre-European extent remains.

3.5.2 Swan Coastal Plain Floristic Studies

Floristic studies on the SCP include those completed by Gibson *et al.* (1994) and other unpublished data collected as part of the System 6 and Part System 1 Update program and from various sources (Weston A.S., Griffin E.A. and Trudgen M., 1993; Griffin, E.A., 1994; Department of Environmental Protection, 1996; Keighery G. , 1996). This data has been compiled into a dataset, referred to in this report as the SWA dataset. A search of the SWA dataset identified 17 FCTs that are known to occur within a 5 km buffer of the survey area (Table 3-5).

Table 3-5 SWA dataset FCTs within 5 km of the survey area

FCT	DESCRIPTION AND STATUS
Foothills / Pinjarra Plain	
1b	Southern *Corymbia calophylla* woodlands on heavy soils.
Seasonal wetlands	
4	*Melaleuca preissiana* damplands
5	Mixed shrub damplands
6	Weed dominated wetlands on heavy soils
8	Herb rich shrublands in clay pans
9	Dense shrublands on clay flats
11	Wet forests and woodlands
17	*Melaleuca rhaphiophylla – Gahnia trifida* seasonal wetlands
18	Shrublands on calcareous silts
S01	*Astartea* aff. *fascicularis* / *Melaleuca* species dense shrublands
S05	*Acacia saligna* wetlands
Uplands centred on Bassendean dunes and Dandaragan Plateau	
21a	Central *Banksia attenuata – Eucalyptus marginata* woodlands
21b	Southern *Banksia attenuata* woodlands
21c	Low lying *Banksia attenuata* woodlands and shrublands
Uplands centred on Spearwood and Quindalup Dunes	
25	Southern *Eucalyptus gomphocephala – Agonis flexuosa* woodlands
29a	Coastal shrubland on shallow sands
30b	Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands

3.5.3 Conservation significant ecological communities

A search of the EPBC Act PMST (DotEE, 2019b) and the DBCA TEC/PEC database identified 13 TEC / PECs that occur within the study area. A summary of the database findings is presented in Table 3-6 and the DBCA database results are shown in Figure 8, Appendix A.

Table 3-6 Threatened and Priority Ecological Communities identified in the desktop searches

COMMUNITY TYPE	EPBC ACT	DBCA	DESCRIPTION	LOCATION[2]
TECs / PECs within the survey area				
Banksia woodlands of the SCP (TEC, PEC)	Endangered	Priority 3	The ecological community is a woodland associated with the SWA. A key diagnostic feature is a prominent tree layer of *Banksia*, with scattered eucalypts and other tree species often present among or emerging above the *Banksia* canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. The ecological community is characterised by a high endemism and considerable localised variation in species composition across its range (TSSC, 2016).	89 occurrences mapped within the survey area 702 occurrences within the 5 km buffer of the survey area
Shrublands on dry clay flats (SCP10a)	Critically Endangered	Endangered	This ecological community forms a component of the Critically Endangered Clay Pans of the SWA TEC. This is the most rapidly drying of the clay flats vegetation community types. This vegetation community type has a high species richness and includes the aquatic annuals and geophytes typical of other clay pan and clay flat vegetation community types. The shrub layer is dominated by species of *Hakea* (*H. varia* and *H. sulcata*) which, along with *Pericalymma ellipticum,* is indicative of a short inundation period (TSSC, 2012)	One occurrence mapped within the survey area One occurrence within the 5 km buffer of the survey area
Tuart (*Eucalyptus gomphocephala*) Woodland and Forests of the SCP TEC, PEC **Southern SCP *Eucalyptus gomphocephala – Agonis flexuosa* woodlands (SCP25)**	Critically Endangered	Priority 3	Tuart (*Eucalyptus gomphocephala*) woodland and forests of the SCP TEC, listed in July 2019 as a Critically Endangered TEC under the EPBC Act and Priority 3 listed by DBCA. Mostly confined to Quindalup Dunes and Spearwood Dunes from Jurien Bay to the Sabina River, with outliers along some rivers. Tuart is the key dominant canopy species however Tuart communities comprise a variety of flora and fauna assemblages.	121 occurrences within 5 km buffer of the survey area

[2] Some TECs and PECs identified occur further than the study area. However since they were identified in the DBCA database searches they have been included.

COMMUNITY TYPE	EPBC ACT	DBCA	DESCRIPTION	LOCATION[2]
TECs / PECs within the 5 km buffer of the survey area				
Herb rich saline shrublands in clay pans (SCP07)	Critically Endangered	Vulnerable	This ecological community forms a component of the Critically Endangered Clay Pans of the SCP TEC. This vegetation community type occurs on heavy clay soils that are generally inundated from winter to mid-summer. Structurally this vegetation community type is quite variable ranging from woodlands to herblands, the most common overstorey species being *Melaleuca viminea, M. uncinata, M. cuticularis* or *Casuarina obesa*. Typical species in the understorey include the common herbs *Brachyscome bellidioides, Centrolepis polygyna, Pogonolepis stricta* and *Cotula coronopifolia*. In addition, species such as *Angianthus* aff. *drummondii*, *Eryngium pinnatifidum* subsp. Palustre (G.J. Keighery 13459) and *Blennospora drummondii* occur in low frequency (<50%) and are absent from the other four vegetation community types (SCP08, SCP09, SCP10a and 117) (TSSC, 2012).	Two occurrences mapped within the 5 km buffer of the survey area
Herb rich shrublands in clay pans (FCT - SCP08)	Critically Endangered	Vulnerable	This ecological community forms a component of the Critically Endangered Clay Pans of the SCP TEC. This vegetation community type occurs in low lying flats with a clay impeding layer allowing seasonal inundation. This vegetation community type is dominated by one or more of the shrubs: *Viminaria juncea, Melaleuca viminea, M. lateritia*, *Kunzea micrantha* or *K. recurva* with occasional emergent of *Eucalyptus wandoo*. Species such as *Hypocalymma angustifolium*, *Acacia lasiocarpa* var. bracteolata long peduncle variant (G. J. Keighery 5026) (P1) and *Verticordia huegelii* occur at moderate frequencies. This vegetation community type has a high percentage of weeds and appears to be the clay pan vegetation community type that has the greatest disturbance (TSSC, 2012).	Four occurrences mapped within the 5 km buffer of the survey area

COMMUNITY TYPE	EPBC ACT	DBCA	DESCRIPTION	LOCATION[2]
Dense shrublands on clay flats (FCT – SCP09)	Critically Endangered	Vulnerable	This ecological community forms a component of the Critically Endangered Clay Pans of the SCP TEC. This vegetation community type is shrublands or low open woodlands on clay flats that are inundated for long periods because it usually occurs very low in the landscape. Sedges are more apparent in this ecological community and include *Chorizandra enodis*, *Cyathochaeta avenacea, Lepidosperma longitudinale* and *Meeboldina coangustata*. Shrubs include *Hakea varia* and *Melaleuca viminea* and occasionally *Xanthorrhoea preissii, X. drummondii* and *Kingia australis*. This vegetation community type has a lower species richness and weed frequency than in the other clay pan community types, presumably because of the longer inundation times (TSSC, 2012).	Two occurrences mapped within the 5 km buffer of the survey area
Shrublands on calcareous silts of the SCP (SCP18)		Vulnerable	This ecological community is a very species rich community with a restricted distribution on calcareous silt flats. Common species are *Acacia saligna, Leptomeria lehmannii, Xanthorrhoea preissii, Gahnia trifida* and *Melaleuca teretifolia* (Gibson *et al.* (1994)).	One occurrence within the 5 km buffer of the survey area
***Corymbia calophylla* woodlands on heavy soils of the southern SCP (SCP1b)**		Vulnerable	This ecological community consists largely of *C. calophylla* forests and woodlands of bushland remnants on the plain south of Capel (Gibson *et al.* (1994)).	One occurrence within the 5 km buffer of the survey area

COMMUNITY TYPE	EPBC ACT	DBCA	DESCRIPTION	LOCATION[2]
Southern *Banksia attenuata* woodlands (SCP21b)	Endangered	Priority 3	This ecological community forms a component of the Endangered Banksia Woodland TEC. This community is restricted to the sand sheets at the base of the Whicher Scarp, the sand sheets on elevated ridges or the sand plain south of Bunbury. Structurally, this community type is normally *Banksia attenuata* or *Eucalyptus marginata – B. attenuata* woodlands. Common species include *Acacia extensa*, *Jacksonia* sp. Busselton, *Laxmannia sessiliflora*, *Lysinema ciliatum* and *Johnsonia acaulis* (DBCA, 2019a)	Four occurrences mapped within the 5 km buffer of the survey area
Low lying *Banksia attenuata* woodlands or shrublands (SCP21c) **Banksia woodlands of the SCP (TEC)**	Endangered	Priority 3	This ecological community forms a component of the Banksia Woodlands TEC. This type occurs sporadically between Gingin and Bunbury, and is largely restricted to the Bassendean system. The type tends to occupy lower lying wetter sites and is variously dominated by *Melaleuca preissiana*, *Banksia attenuata*, *B. menziesii*, *Regalia ciliata*, *Eucalyptus marginata* or *Corymbia calophylla*. Structurally, this community type may either be a woodland or occasionally shrubland (DBCA, 2019a)	One occurrence within the 5 km buffer of the survey area
Coastal shrublands on shallow sands (SCP29a)		Priority 3	Coastal shrublands on shallow sands are largely restricted to the Quindalup system, mostly heaths on shallow sands over limestone close to the coast.	Four occurrences mapped within the 5 km buffer of the survey area

COMMUNITY TYPE	EPBC ACT	DBCA	DESCRIPTION	LOCATION[2]
Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands (SCP30b)	Critically endangered	Priority 3	This ecological community can form a component of the 'Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC and the Tuart Woodlands of the SCP PEC. This community is dominated by either Tuart or *Agonis flexuosa*. The presence of *Hibbertia cuneiformis*, *Geranium retrorsum* and *Dichondra repens* differentiate this group from other Quindalup community types. This type is found from the Leschenault Peninsular south to Busselton (DBCA, 2019a).	One occurrence within the 5 km buffer of the survey area
***Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the SCP (SCP3c)**	Endangered	Priority 3	The *Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the SCP ecological community is one of three *Corymbia calophylla* dominated plant communities, which were historically probably some of the most common vegetation types on heavy soils on the eastern side of the SCP. Gibson *et al.* (1994) recognised three distinct communities in this group. The floristic composition of these communities varies with water regime, with this driest type dominated by *Corymbia calophylla* and *Xanthorrhoea preissii*. This ecological community aligns with the Gibson *et al*. (1994) community type 3c (DotEE, 2017)	Three occurrences mapped within the 5 km buffer of the survey area

3.5.4 Flora diversity

The NatureMap database search (DBCA, 2007-) identified 568 plant species, representing 92 families recorded within the study area. This total comprised 469 native flora species and 99 introduced flora species. Dominant families recorded within the study area included Fabaceae (70 species), Orchidaceae (50), Cyperaceae (39), Poaceae (39 species), and Asteraceae (32 species). The NatureMap database search is provided in Appendix C.

3.5.5 Conservation significant flora

Desktop searches of the EPBC Act PMST, NatureMap, DBCA TPFL and WAHERB databases identified the presence / potential presence of 39 conservation significant flora species within the study area, which includes two species that were identified by DBCA Flora Officer, Andrew Webb, as potentially occurring.

The desktop searches and consultation with DBCA identified 13 species listed under the EPBC Act and / or as Threatened under the BC Act and 26 listed as Priority species by the DBCA.

The locations of conservation significant flora registered on the DBCA databases are mapped in Figure 8, Appendix A.

4 SUMMARY OF PREVIOUS VEGETATION AND FLORA SURVEYS

A number of studies have been undertaken over sections of the survey area. An overview of previous survey effort is provided in Table 4-1 and the location of these surveys is illustrated in Figure 3, Appendix A.

Table 4-1 Summary of previous surveys

STUDY NAME	LOCATION/ EXTENT IN SURVEY AREA	COMMENTS
Lot 1 Ducane Road Environmental Values Assessment (GHD, 2014)	GHD completed a flora and vegetation assessment of Lot 1 Ducane Road on the 13 June 2013. The assessment described the vegetation types present and their conditions and also searched for conservation significant flora. A total of 40.49 ha of this study is within the survey area.	The survey assessed vegetation types and floristic diversity for Lot 1 Ducane Road, which is located within the current survey area
Vegetation and Flora survey of the BORR South Alignment (GHD, 2015)	The GHD (2015) survey area was 112 ha in size and the report included a review of previous flora surveys for the alignment including: Bennett Environmental Consulting (2003) Vegetation and Flora of Selected Areas – Bunbury Outer Ring Road and Port Access Road for Main Roads Western Australia. Bennett Environmental Consulting (2008) Significant Flora Along Proposed Bunbury Ring Road for Main Roads Western Australia. GHD (2002) Bunbury Outer Ring Road and Port Access Road – Wetlands and Threatened Community Survey for Main Roads Western Australia. GHD (2009) Flora and Vegetation Survey for Main Roads Western Australia. GHD (2012) Flora and Vegetation Survey for Main Roads Western Australia. The survey was considered to be a level 2 assessment (as per the now superseded EPA guidelines). Phase 1 was carried out on the 21 – 23 September 2011 and Phase 2 from the 16 – 18 June 2014. A total of 21 quadrats were assessed and the vegetation types / their condition described. A total of 86.38 ha of this study is within the survey area.	This report has been used as the basis for the current assessment, including information on vegetation types and condition and species composition
Bunbury Outer Ring Road Southern Section – Reassessment of Floristic	Biota completed a targeted flora survey to further resolve the conservation status of vegetation types identified in the GHD (2012; 2015) flora surveys for BORR South. Two Biota botanists completed an additional seven quadrats on the 25 to 26 October 2016 and re-ran statistical analysis against both Biota and GHD quadrats to align vegetation types with	Re-assessment of FCTs within the current survey area and assessment of an additional seven quadrats (four within

STUDY NAME	LOCATION/ EXTENT IN SURVEY AREA	COMMENTS
Communities (Biota, 2016)	Gibson *et al.* (1994) FCTs. The focus on this assessment was those vegetation types that were potentially TECs / PECs.	the current survey area)
Bunbury Outer Ring Road Southern Section – Banksia Woodlands TEC Assessment (Biota, 2018)	This assessment included a desktop component to identify potential areas of Banksia woodland TEC that were then targeted in the field survey. The field survey was carried out to determine the extent of Banksia Woodland TEC within the BORR South area and surrounds. The survey was carried out between 4 and 6 November 2017 by two Biota botanists. 24 target areas were sampled, using either quadrats (10 x 10 m) or mapping notes. A floristic analysis using PATN v3.1 was carried out to compare quadrats within the study area with those from the existing SCP vegetation data set arising from Gibson *et al.* (1994). A total of 25.58 ha of this study is within the survey area.	The area assessed provides the location of Banksia Woodland TEC within the survey area and surrounding vegetation
Report of a Targeted Rare Flora Survey for *Diuris drummondii* along four sections of the Bunbury Outer Ring Road proposed alignment (Ecoedge, 2017)	Ecoedge completed a targeted assessment on the 19 November and 30 November 2016 of portions of the BORR South proposed alignment that provide suitable habitat for *Diuris drummondii*. The survey was completed in accordance with the Commonwealths Draft Survey Guidelines for Australia's Threatened Orchids (Commonwealth of Australia, 2013). A known population of the species nearby was used as a reference to determine when flowering had commenced and optimal timing for the survey. A total of 18.6 ha was searched, however no *D. drummondii* plants were found. A total of 15.50 ha of this study is within the survey area.	Provides information on the targeted survey for *D. drummondii* within the current survey area
Memorandum. Review of Potential Claypan Occurrences in the BORR Southern Section (Ecoedge, 2019b)	Ecoedge completed desktop review for the location of potential claypan wetlands, which identified one potential claypan wetland. The field survey determined that the wetland was not to be a claypan community.	Assessment for Claypan TEC within the Proposal Area that confirmed the TEC is not present

5 VEGETATION AND FLORA FIELD SURVEY RESULTS

5.1 Vegetation types

The survey area contains a combination of native vegetation and highly disturbed areas, including roads, road reserve and paddocks. A total of ten vegetation types comprising remnant native vegetation were identified and described from the survey area. A further three types, comprising highly disturbed areas, revegetation and planted vegetation were also identified and described.

The survey area occurs on the Bassendean and Spearwood Dunes and Pinjarra Plain. The sandy low dunes and plains were dominated by *Eucalyptus / Banksia* forests, in particular *Eucalyptus* / *Agonis* and *Banksia* woodlands / forests. The creeklines, swamps and low relief / seasonally inundated areas were dominated by *Eucalyptus rudis / Melaleuca preissiana* / *M. rhaphiophylla* woodlands. These were generally disturbed and the ground layer was dominated by introduced grasses and herbs. In the agricultural areas and some road reserves, native vegetation occurred as scattered remnant trees or stands over introduced grasses. The survey area included approximately 163.81 ha (53.18%) of native vegetation.

The survey identified ten vegetation types comprising remnant native vegetation. These include *Eucalyptus* and *Melaleuca* swamps / damplands, riverine / creekline vegetation, shrublands, *Eucalyptus* woodlands and *Eucalyptus* / *Banksia* woodlands as well as scattered remnant trees within agricultural areas and road reserves. A summary of these vegetation types, along with those comprising highly disturbed areas, revegetation or planted vegetation, is presented in Table 5-1 and they are mapped in Figure 9, Appendix A.

5.1.1 Floristic analysis

The similarity between all quadrats sampled within the survey area (BORR IPT, which includes GHD and Biota) sites was examined using PRIMER. Analysis was run using two scenarios:

- All species (base quadrat data)
- Native species only (weed species removed from each quadrat).

Of these two scenarios, the native species only scenario had the lowest stress value (0.13) indicating a reasonable representation. Using this scenario, the cluster analysis and resulting dendrogram (Appendix F) and two dimensional MDS scatter plot (Plate 3) showed general groupings of quadrats that broadly aligned with vegetation types.

Those vegetation units that most closely grouped were:

- VT6 – Closed tall scrub of *Melaleuca preissiana*, *Astartea scoparia* and *Kunzea glabrescens* over sedgeland: all four quadrats grouped together
- VT7 - Low open forest of *Melaleuca preissiana* and *M. rhaphiophylla* over sedgeland: four of the five quadrats grouped together.

The three *Eucalyptus / Agonis / Banksia* forest vegetation types (VT1, VT2 and VT4) generally grouped together across multiple clades. These vegetation types had 41 quadrats sampled from September 2011 to November 2018. They also occurred in varying degrees of condition (ranging from Degraded to Excellent). These vegetation types were very similar, with their differences in the field identified by changes in dominance of key species.

Those vegetation types that largely occurred in Degraded or worse condition and have experienced historical disturbance, occurred on multiple clades and showed limited similarity.

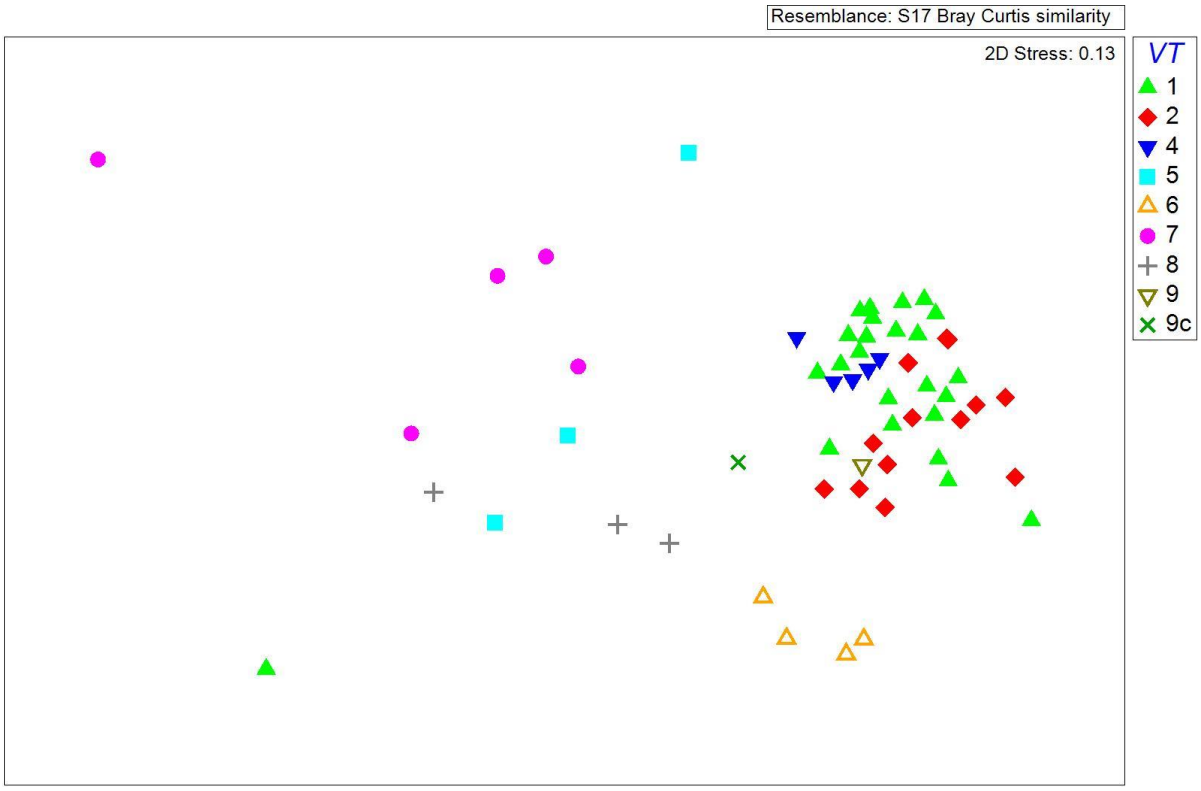

Plate 3 MDS showing general clustering of quadrats

All quadrats sampled within the survey area (BORR IPT, which includes GHD and Biota) and the SWA dataset for sites within the 5 km buffer (see section 2.2) were compared to assist in FCT assignment. The cluster analysis and resulting dendrogram (Appendix F) showed some similarities between the BORR IPT quadrats (which include GHD and Biota quadrats) and the SWA FCTs with some quadrats having affinities to:

- FCT 5
- FCT 21a and 21c
- FCT 6
- FCT 11

A two dimensional MDS scatter plot was also produced (Plate 4) and indicated that the survey quadrats (BORR IPT quadrats, which include GHD and Biota quadrats) plot near the following FCTs:

- FCT 17
- FCT 11
- FCT S05
- FCT 6
- FCT 25
- FCT 21c
- FCT 21a

However, there is no strong statistical alignment with any of the FCTs, and the stress value of 0.22 indicated a poor / random representation. Given the degraded nature of much of the survey area it was difficult to make firm conclusions regarding the appropriate FCT to assign to each vegetation type. Best matches were drawn from a combination of the statistical analysis and FCT descriptions.

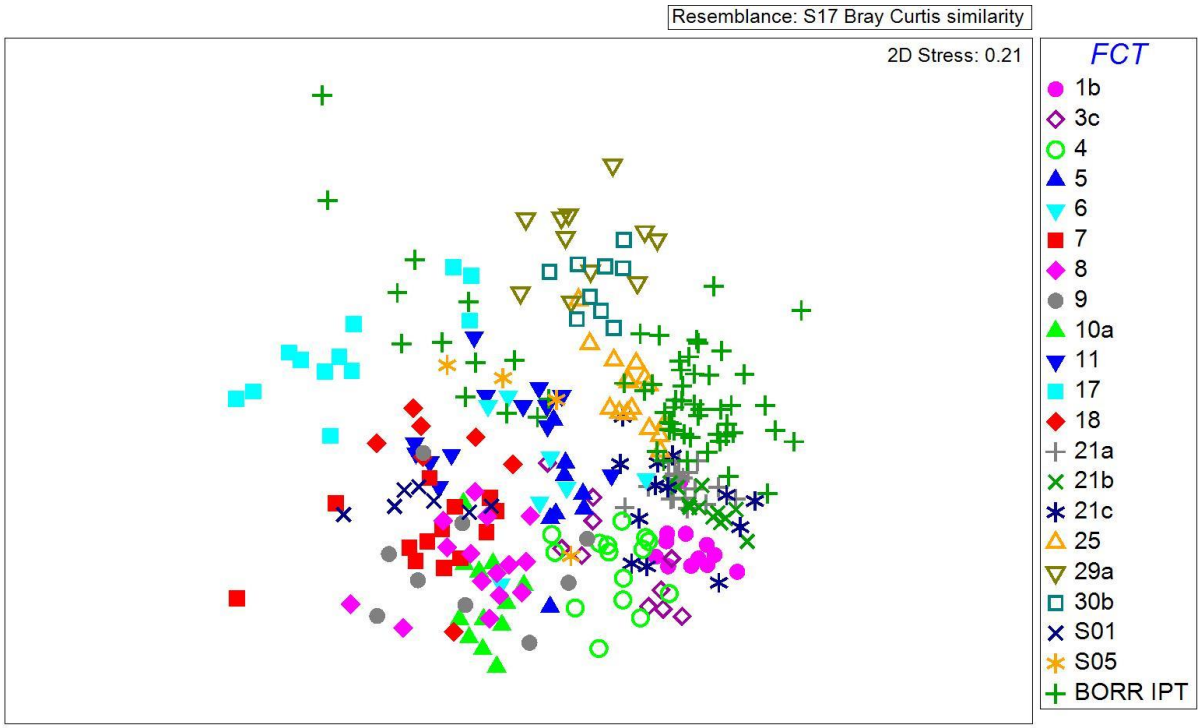

Plate 4 MDS showing showing BORR IPT quadrats compared to the SWA dataset

A species accumulation curve was generated using PRIMER to assess adequacy of sampling effort within the survey area (Plate 5). The species accumulation curve for the survey area, based on flora recorded within quadrats, is approaching an asymptote, which suggests that the current survey effort is sufficient. Furthermore, the bootstrap estimate of species richness generated from this data indicates that 289 species could be expected from the survey area based on the diversity recorded within quadrats. The total species recorded from the survey area was 428 flora species (267 recorded in the current survey), which is substantially above the predicted species diversity estimate. The survey area is considered representative of the floristic diversity in the area.

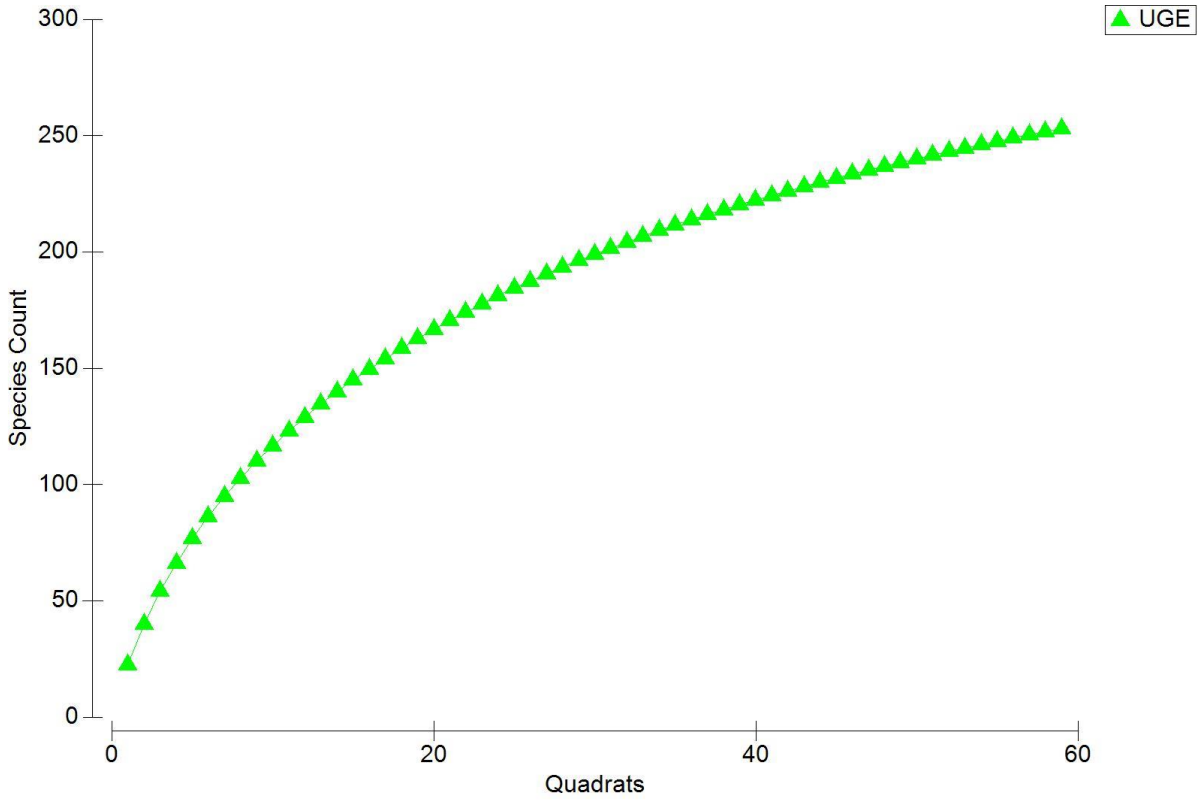

Plate 5 Species accumulation curve for quadrats within the survey area

5.1.2 Biota 2016

Biota (2016) completed additional floristic surveys (seven quadrats) and analysis of the combined GHD (2015) and Biota (2016) quadrat data against the SWA dataset. This assessment was targeted at the areas that were identified by GHD (2015) as potentially corresponding to SCP FCT 08 and SCP FCT 21b.

Biota (2016) concluded that floristic classification and analysis did not demonstrate that any of the quadrats sampled in the survey area should be assigned to either FCT 8 or FCT 21b. The most appropriate assignments for the vegetation types sampled comprise:

1. VT5 - Tall shrubland *Kunzea micrantha* subsp. *micrantha* and *Melaleuca viminea* over weeds: FCT 11, 'Wet forests and woodlands'.

2. VT2 'Open forest of *Eucalyptus marginata, Corymbia calophylla, Banksia attenuata* and *Agonis flexuosa* on Bassendean dunes': FCT 21a, 'Central *Banksia attenuata-Eucalyptus marginata* woodlands'.

Best matches were drawn from a combination of the statistical analysis and FCT descriptions (using dominant species and landform). FCT assignment to the BORR ITP vegetation types are shown in Table 5-1.

Table 5-1 Recorded vegetation types

VEGETATION DESCRIPTION	PHOTOGRAPH	LOCATION, CONDITION AND EXTENT WITHIN THE SURVEY AREA	SAMPLE LOCATIONS AND FLORISTIC COMMUNITY TYPES (FCT) COMPARISON
***Eucalyptus / Banksia* forests on sand dunes and plains**			
VT1 – Open forest of *Eucalyptus marginata*, *Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands Open forest of *Eucalyptus marginata* and *Corymbia calophylla +/- Agonis flexuosa* over low open forest of *Banksia attenuata* over shrubland of *Hibbertia hypericoides*, *Macrozamia riedlei* and *Xanthorrhoea brunonis* over grassland over **Ehrharta* spp., **Briza maxima* over herbland of *Dasypogon bromeliifolius*, *Lomandra* species and *Phlebocarya ciliata* over open sedgeland of *Lepidosperma pubisquameum*.		27.1 ha 5.8 ha Excellent to Very Good 4 ha Very Good 0.6 ha Good / Very Good 3.7 ha Good 11.7 ha Good to Degraded 0.7 ha Degraded 0.5 ha Degraded – Completely Degraded 0.02 ha Completely Degraded	**Quadrats:** GHD (2015a): Q1, Q2, Q3, Q4, Q5, Q6, Q9, Q10, Q18, Q20, T1, T2, T5, T8, T9 Biota (2018) : GEL01 and GELREL01, 2018 : Quadrats GBRS01, GBRS02, GBRS05, GBRS08, GBRS11, GBRS13, GBRS14, GBRS15, GBRS16, GBRS17, GBRS18, GBRS19 **Photo points:** GB01, GB04 - GB06, GB08 - GB10, GB22 - GB25, GB38, GB49 - GB51, GB58, GB75 - GB93 **FCT:** Affinity to Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT 25), however, Tuart did not form part of the overstorey. Represents occurrence of Banksia Woodlands TEC/PEC

VEGETATION DESCRIPTION	PHOTOGRAPH	LOCATION, CONDITION AND EXTENT WITHIN THE SURVEY AREA	SAMPLE LOCATIONS AND FLORISTIC COMMUNITY TYPES (FCT) COMPARISON
VT1b – Open forest of *Eucalyptus gomphocephala* with occasional *Eucalyptus marginata* over *Agonis flexuosa* and *Banksia attenuata* on yellow sand over limestone Open forest of *Eucalyptus gomphocephala* with occasional *Eucalyptus marginata* over *Agonis flexuosa* and *Banksia attenuata* scattered trees over **Ehrharta* spp. and **Briza maxima* grassland and mixed introduced herbs on yellow sand over limestone with some limestone outcropping at the surface. Some areas contain revegetation in the understorey.		7.4 ha 3.7 ha Very Good 2.9 ha Good to Degraded 0.10 ha Degraded – Completely Degraded 0.7 ha Completely Degraded	**Quadrats:** GBQ11 **Photo points:** GB76, GB77, GB75 **FCT:** Considered to be aligned with Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT 25) and Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain TEC
VT2 – Open forest of *Eucalyptus marginata, Corymbia calophylla, Banksia attenuata* and *Agonis flexuosa* on Bassendean dunes Open forest of *Eucalyptus marginata, Corymbia calophylla* and *Agonis flexuosa* over low forest of *Banksia attenuata* and *B. ilicifolia* over tall shrubland of *Kunzea glabrescens, Jacksonia furcellata* and *Xylomelum occidentale* over shrubland of *Hibbertia hypericoides*, *Acacia* spp. and *Xanthorrhoea brunonis* over grassland / Sedgeland of *Tetraria octandra*, *Desmocladus fascicularis* and introduced grasses.		44.4 ha 0.5 ha Excellent 1.4 ha Excellent – Very Good 0.5 ha Good 36.8 ha Good to Degraded 4.7 ha Degraded 0.2 ha Degraded / Completely Degraded 0.2 ha Completely Degraded	**Quadrats:** GHD (2014): Q2, Q3, Q6, Q4 and Q9. GHD (2015a): Q11, Q12, Q17, T6 Biota (2016) : BOR05, BOR06 and BOR07 2018: Quadrat GBRS20 **Photo points:** WPP53, WPP54, WPP57, WPP59 – WPP61, WPP63 – WPP65 **FCT:** Central *Banksia attenuata – Eucalyptus marginata* woodland (FCT 21a) Represents occurrence of Banksia Woodlands TEC/PEC

VEGETATION DESCRIPTION	PHOTOGRAPH	LOCATION, CONDITION AND EXTENT WITHIN THE SURVEY AREA	SAMPLE LOCATIONS AND FLORISTIC COMMUNITY TYPES (FCT) COMPARISON
VT3 – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Banksia* spp. Scattered *Eucalyptus marginata, Corymbia calophylla and +/- Agonis flexuosa* over a tall very open shrubland of *Banksia attenuata, B. ilicifolia, Xylomelum occidentale* and *Kunzea glabrescens* over a grassland of introduced species. Occurs in paddocks and road reserves. In the road reserve along South West Highway the shrubland is largely devoid and *Agonis flexuosa* is present in the tree layer.		4.0 ha 3.8 Degraded 0.10 ha Degraded to Completely Degraded 0.10 ha Completely Degraded	**Photo-points:** GB18, GB26, GB27, GB35, GB36, GB43 – GB46, GB71 **FCT:** Likely to be a degraded from of Central *Banksia attenuata – Eucalyptus marginata* woodland (FCT 21a) but as it only occurs in Degraded or worse condition, alignment with an FCT has not been confirmed.
VT4 – Open forest of *Banksia attenuata* and *Agonis flexuosa* Open forest of *Banksia attenuata* and *Agonis flexuosa* over shrubland of *Hibbertia hypericoides*, *Macrozamia riedlei* and *Leucopogon propinquus* over open grassland of **Ehrharta* spp. and **Briza maxima* over herbland of *Dichopogon capillipes, Phlebocarya ciliata* and *Conostylis aculeata.* Scattered *Eucalyptus marginata* as an emergent. Occurs in one location on grey sands on a rounded hill slope.		3.5 ha 0.7 ha in Very Good 2.7 ha Very Good to Good	**Quadrats:** GHD (2015a): Q7, Q8 Biota (2018): GEL03 2018: Quadrats: GBRS04 and GBRS06 **Photo points:** GB11, GB12, GB15, GB16 **FTC:** Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT 25) Represents occurrence of Banksia Woodlands TEC/PEC

VEGETATION DESCRIPTION	PHOTOGRAPH	LOCATION, CONDITION AND EXTENT WITHIN THE SURVEY AREA	SAMPLE LOCATIONS AND FLORISTIC COMMUNITY TYPES (FCT) COMPARISON
***Eucalyptus / Me*laleuca Woodlands and Shrublands in creeklines / swamps and seasonally wet areas**			
VT5 - Tall shrubland of *Kunzea micrantha* subsp. *micrantha* and *Melaleuca viminea* over weeds Tall open shrubland of *Kunzea micrantha* subsp. *micrantha* and *Melaleuca viminea* over open sedgeland of *Lepidosperma longitudinale* and *Juncus subsecundus* over grassland of **Briza maxima, *B. minor* and **Ehrharta calycina.*		0.05 ha All Completely Degraded	**Quadrats:** GHD (2015a): Q13 Biota (2016): BOR03 and BOR04 **FCT:** Wet forests and woodlands (FCT 11)
VT6 - Closed tall scrub of *Melaleuca preissiana*, *Astartea scoparia* and *Kunzea glabrescens* over sedgeland Closed tall scrub of *Melaleuca preissiana*, *Kunzea glabrescens* and *Astartea scoparia* over a sedgeland of *Baumea juncea, Lyginia imberbis* and **Cyperus tenellus* with introduced grass species over open herbland of **Hypochaeris* sp., **Ornithopus compressus* and **Ursinia anthemoides.*		4.5 ha 0.6 ha Excellent – Good 2.6 ha Very Good to Good 0.3 ha Good 0.6 ha Good to Degraded 0.4 ha Completely Degraded	**Quadrats:** GHD (2014): Q5, Q8 GHD (2015a): Q14 2018: Quadrat GBRS10 **Photo points:** GB68 - GB70, PP16, WPP58, WPP62. **FCT:** *Melaleuca preissiana* damplands (FCT 4)

VEGETATION DESCRIPTION	PHOTOGRAPH	LOCATION, CONDITION AND EXTENT WITHIN THE SURVEY AREA	SAMPLE LOCATIONS AND FLORISTIC COMMUNITY TYPES (FCT) COMPARISON
VT7 – Low open forest of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over sedgeland Low open forest of *Melaleuca preissiana, M. rhaphiophylla* and *M. viminea* over sedgeland of *Lepidosperma longitudinale*, *Juncus pallidus* and **Carex divisa* with introduced grasses and herbs including **Cynodon dactylon*, **Lotus subbiflorus* and **Cotula* species. Attached and floating aquatic species were present including: *Lemna disperma*, *Cycnogeton lineare* and **Callitriche stagnalis*.		31.3 ha 15.2 ha Good 3.6 ha Good to Degraded 3.5 ha Degraded 7.6 ha Degraded / Completely Degraded 1.5 ha Completely Degraded	**Quadrats:** GHD (2015a): Q15, Q16, T7 2018: Releve and Quadrats GBRel01, GBRel02, GBRel03 and GBRS09 **Photo points:** GB56, GB57, GB61, GB64, GB67, GB73, PP14, PP19, PP22 **FCT:** *Melaleuca preissiana* damplands (FCT 4) / Wet forests and woodlands (FCT 11)
VT8 – Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over grassland of **Ehrharta longiflora* and **Avena* species over sedgeland of *Lepidosperma longitudinale* over herbland of **Rumex* species. In Lot 1 Ducane Road an open tall shrubland of *Kunzea glabrescens* and *Melaleuca teretifolia* over open heath of *Astartea scoparia* over a sedgeland of *Hypolaena exsulca* and *Lepidosperma longitudinale* was present. This was the only occurrence of the vegetation in Very Good condition. Occurs along drainage lines and seasonally inundated areas.		3.4 ha 1.1 ha Excellent to Very Good 1.7 ha Degraded 0.7 ha Degraded to Completely Degraded	**Quadrats:** GHD (2014): Q7 GHD (2015a): Q19, T3 2018: Quadrat GBRS03 **Photo points:** GB02, GB03, GB07, GB28, GB42, WPP55, WPP56, WPP42 **FCT:** Wet forests and woodlands (FCT 11)

VEGETATION DESCRIPTION	PHOTOGRAPH	LOCATION, CONDITION AND EXTENT WITHIN THE SURVEY AREA	SAMPLE LOCATIONS AND FLORISTIC COMMUNITY TYPES (FCT) COMPARISON
Scattered remnant vegetation / Highly modified vegetation types			
VT9 - Scattered remnant vegetation present in agricultural areas and along road reserves: • **VT09a** - *Corymbia calophylla* and *Eucalyptus marginata +/- Agonis flexuosa* with very occasional *E. gomphocephala* • **VT09b** – *Melaleuca rhaphiophylla* • **VT09c** – *Corymbia calophylla* and *Eucalyptus marginata* with *Agonis flexuosa* over introduced grasses • **VT09d**: *Eucalyptus rudis* and *Corymbia calophylla +/- M. rhaphiophylla, M. preissiana*		VT9a: 19.1 ha (Degraded 1.6 ha, 12.7 ha Degraded to Completely Degraded, 4.8 Completely Degraded) VT9b: 1.6 ha (0.2 ha Degraded to Completely Degraded, 1.4 Completely Degraded) VT9c: 6.6 ha (Degraded 5.4 ha, 1.2 ha Degraded to Completely Degraded, 0.01 Completely Degraded) VT9d: 1.7 ha (Good to Degraded 0.02 ha, 0.6 ha Degraded, 0.4 ha Degraded to Completely Degraded, 0.7 Completely Degraded)	**Quadrats:** GHD (2015a): T1, T4 2018: Quadrats : GBRS07 **Photo points:** GB29 – GB31, GB40, GB53 – GB55, GB59, GB60, GB74, GB14, GB21, GB66, PP52, PP53 **FCT:** N/A

VEGETATION DESCRIPTION	PHOTOGRAPH	LOCATION, CONDITION AND EXTENT WITHIN THE SURVEY AREA	SAMPLE LOCATIONS AND FLORISTIC COMMUNITY TYPES (FCT) COMPARISON
VT10 – Parkland cleared with scattered native / planted species Parkland cleared with occasional *Corymbia calophylla, Eucalyptus gomphocephala, E. marginata* and *Agonis flexuosa* trees with planted tree species over an understorey of weedy herbs and grasses.		7.4 ha 0.5 ha Degraded 0.1 ha Degraded to Completely Degraded 6.8 ha Completely Degraded	**Photo points:** 2018: GB48, GB19, GB20, GB41, GB47 **FCT:** N/A
VT10b - Revegetation in road reserves This includes revegetation as well as areas planted with a mixture of native and non-native vegetation. There are scattered remnant trees occasionally present (including *Corymbia calophylla, Eucalyptus marginata, E. utilis* (planted), *E. rudis*, *Agonis flexuosa* and *Casuarina obesa).* Common shrubs include *Melaleuca nesophila, M. lanceolata*, *Kunzea glabrescens* and *Acacia saligna*. The understorey was mostly dominated by introduced grasses and herbs. This vegetation unit occurred within the median strip of Bussell Highway.		1.7 ha 0.9 ha Degraded 0.2 ha Degraded to Completely Degraded 0.5 ha Completely Degraded	**Photo points:** 2018: GB45, GB42 **FCT:** N/A

VEGETATION DESCRIPTION	PHOTOGRAPH	LOCATION, CONDITION AND EXTENT WITHIN THE SURVEY AREA	SAMPLE LOCATIONS AND FLORISTIC COMMUNITY TYPES (FCT) COMPARISON
Cleared / highly modified Areas where clearing or other activities have fundamentally altered the composition of native vegetation and are not in a condition of self-sustaining. These areas are completely without native species.		186.1 ha	**Photo points:** 2018 GB13, GB37, GB39, GB62, GB63, GB65, PP13, PP17, WPP43 **FCT:** N/A

5.2 Vegetation condition

The vegetation condition of the survey area ranged from Excellent to Completely Degraded. Over half of the survey areas was cleared / highly modified (186.1 ha or 53.2 %). Historical clearing and aggressive weed species have influenced the structure and composition of the remaining native vegetation. There was 43.5 ha of vegetation in Good or better condition (approximately 12.4 % of the survey area) and 119.7 ha in Good to Degraded or worse condition (approximately 34.2 % of the survey area).

Through the southern section of the survey area, the vegetation condition predominantly was rated between Very Good to Degraded. Native vegetation within this section has been severely impacted by partial clearing and weed invasion.

The northern section of the survey area was largely rated between Degraded to Completely Degraded. These areas were highly disturbed for agricultural purposes and comprised scattered native trees over weedy herbs and grasses.

The majority of vegetation within the survey area has not been burnt in the last five to 20 years. A section of recently burnt bushland located within the median strip along Bussell Highway has been burnt in the last year and was observed to be regenerating. Within the survey area, small patches of vegetation have been burnt in the last 5- 10 years, however, this has not significantly impacted the vegetation condition.

A summary of the vegetation condition is provided in Table 5-2 and vegetation condition mapping is shown in Figure 10, Appendix A.

Table 5-2 Extent of vegetation condition ratings mapped within the survey area

VEGETATION CONDITION	EXTENT IN SURVEY AREA (HA) (%)
Excellent	0.5 ha (0.1 %)
Excellent – Very Good	9.0 ha (2.6 %)
Very Good	8.4 ha (2.4 %)
Very Good – Good	5.9 ha (1.7 %)
Good	19.7 ha (5.6 %)
Good – Degraded	56.3 ha (15.9 %)
Degraded	22.9 ha (6.5 %)
Degraded – Completely Degraded	24.0 ha (6.9 %)
Completely Degraded	17.2 ha (4.9 %)
Cleared / highly modified	186.1 ha (53.2 %)
Total	**349.9 ha**

5.3 Threatened and Priority Ecological Communities

Threatened and Priority Ecological Communities were identified by assessing the vegetation types, landform features and field observations, coupled with the statistical analyses. Two TECs and three PECs were identified within the survey area Table 5-3.

Table 5-3 Extent of TECs and PECs mapped within the survey area

TEC / PEC	STATUS	EXTENT IN SURVEY AREA
Banksia Woodlands of the SCP TEC	Endangered TEC – EPBC Act	33.9 ha
Banksia Woodlands of the SCP PEC	Priority 3 PEC – DBCA	33.9 ha
Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the SCP TEC	Critically Endangered TEC – EPBC Act	7.3 ha
Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the SCP PEC	Priority 3 PEC – DBCA	7.3 ha
Southern SCP *Eucalyptus gomphocephala* – *Agonis flexuosa* woodlands (FCT25)*	Priority 3 PEC – DBCA	7.4 ha

* can be a component of the Endangered Banksia Woodlands of the Swan Coastal Plain EPBC listed TEC, or the Tuart woodlands of the Swan Coastal Plain PEC

A discussion is also provided on other TECs / PECs considered to show affinities to vegetation but were deemed to not meet the descriptions / criteria for the TEC or PEC determination.

The spatial distribution of these communities are presented in Figure 11, Appendix A.

5.3.1 Banksia Woodlands of the Swan Coastal Plain (TEC / PEC)

The Banksia Woodlands were assessed by Biota (2018) during the 2018 and 2019 flora and vegetation surveys. Vegetation types 1, 2 and 4 were considered to contain patches that represent the Banksia Woodland TEC. In total, 33.9 ha of vegetation types 1, 2 and 4 met the criteria for the Banksia TEC over five patches. The spatial distribution of these TECs patches is presented in Figure 11, Appendix A. Table 5-4 outlines the TEC assessment and patch sampling details.

Table 5-4 Summary of patch field assessment for Banksia Woodland TEC/PEC

PATCH	MAPPED VT AND SURVEY SITES	CONDITION AND SIZE	TEC/PEC NOTES	PHOTOGRAPH	OUTCOME
Patch 1 - Bussell Highway road reserve from Calinup and Lakes road intersection extending north of Woods road.	VT1 – Open forest of *Eucalyptus marginata, Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands and VT4 - Open forest of *Banksia attenuata* and *Agonis flexuosa* Quadrats GBQ18, GBQ17, GBQ16, GBQ14, GBQ15, GBQ13, GBQ5, GBQ4, GBQ6	Very Good to Completely Degraded (24.0 ha) within the survey area: • 1.2 ha Excellent to Very Good • 4.7 ha Very Good • 3.3 ha Very Good to Good • 1.6 ha Good • 11.7 ha Good to Degraded • 0.7 ha Degraded • 0.5 ha Degraded to Completely Degraded • 0.07 ha Completely Degraded	*B. attenuata* present in patch at 2 – 20 % cover. Patch size outside survey area to the west is approximately > 200 ha in size of similar *Eucalyptus / Banksia* open forest vegetation type in Very Good condition.		23.9 ha Banksia Woodlands of the SCP TEC/PEC Patch extends outside the survey area > 200 ha in size in total.

PATCH	MAPPED VT AND SURVEY SITES	CONDITION AND SIZE	TEC/PEC NOTES	PHOTOGRAPH	OUTCOME
Patch 2 – North of Jilly Road	VT1 – Open forest of *Eucalyptus marginata, Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands Quadrats GBQ2	Excellent to Very Good (4.6 ha) within the survey area. Not mapped in the adjacent land, visual assessment only ranged from Very Good to Degraded.	*B. attenuata* present in patch at 2 – 20 % cover. Patch size outside of the survey area to the north is continuous and contains similar *Eucalyptus / Banksia* open forest vegetation type with areas in Very Good to Degraded condition.		4.6 ha Banksia Woodlands of the SCP TEC/PEC Patch extends outside the survey area.
Patch 3 – Marchetti Road	VT2 - Open forest of *Eucalyptus marginata, Corymbia calophylla, Banksia attenuata* and *Agonis flexuosa* on Bassendean dunes. Visual assessment.	Excellent within the survey area (0.5 ha). Not mapped in the adjacent land, visual assessment only ranged from Excellent to Degraded.	*B. attenuata* present in patch at 2 – 20 % cover. Patch size outside survey area to the north is continuous and contains similar *Eucalyptus / Banksia* open forest vegetation type with areas in Very Good condition.		0.5 ha Banksia Woodlands of the SCP TEC/PEC Patch extends outside the survey area.

PATCH	MAPPED VT AND SURVEY SITES	CONDITION AND SIZE	TEC/PEC NOTES	PHOTOGRAPH	OUTCOME
Patch 4 - South of Ducane Road	VT2 Open forest of *Eucalyptus marginata, Corymbia calophylla, Banksia attenuata* and *Agonis flexuosa* on Bassendean dunes. Visual assessment.	Degraded to Completely Degraded (0.7 ha) within the survey area.	*B. attenuata* is present in patch at 2-5 % cover. Does not meet patch size and condition criteria for the TEC/PEC.		Does not meet Banksia Woodlands TEC/PEC due to small size and condition.
Patch 5	VT2 Open forest of *Eucalyptus marginata, Corymbia calophylla, Banksia attenuata* and *Agonis flexuosa* on Bassendean dunes. Visual assessment.	Very-Good to Excellent to Completely Degraded (39 ha) within the survey area: • 1.5 ha Very-Good to Excellent • 0.5 ha Good • 36.8 ha Good to Degraded • 0.02 ha Degraded • 0.04 ha Degraded to Completely Degraded • 0.2 ha Completely Degraded	*B. attenuata* present in patch at 2 – 20 % cover. Patch size outside of the survey area to the north and west is continuous and contains similar *Eucalyptus / Banksia* open forest vegetation type with areas in Good to Completely Degraded condition. Patch		2.8 ha Banksia Woodlands of the SCP TEC/PEC.

PATCH	MAPPED VT AND SURVEY SITES	CONDITION AND SIZE	TEC/PEC NOTES	PHOTOGRAPH	OUTCOME
			condition is mostly Degraded.		
Patch 6	VT3 Scattered *Eucalyptus marginata, Corymbia calophylla* and +/- *Agonis flexuosa* over a tall open Shrubland of *Banksia attenuata, Banksia ilicifolia, Xylomelum occidentale* and *Kunzea glabrescens* over grassland over introduced grasses. Larger *B. attenuata* trees present. Visual assessment	Degraded to Completely Degraded (2.1 ha) within the survey area.	*B. attenuata* is present in patch at 2-5 % cover. Does not meet patch size and condition criteria for the TEC/PEC.		Does not meet Banksia Woodlands TEC/PEC due to condition.
Patch 7 – Lot 161	VT3 Scattered *Eucalyptus marginata, Corymbia calophylla* and +/- *Agonis flexuosa* over a tall open shrubland of *Banksia attenuata, Banksia ilicifolia, Xylomelum occidentale* and *Kunzea glabrescens* over grassland over introduced grasses. Larger *B. attenuata* trees present.	Degraded to Completely Degraded (0.2 ha) within the survey area. Extends outside the survey area.	*B. attenuata* is present in patch at 2-20 % cover. Does not meet patch size and condition criteria for the TEC/PEC.		Does not meet Banksia Woodlands TEC/PEC due to condition.

PATCH	MAPPED VT AND SURVEY SITES	CONDITION AND SIZE	TEC/PEC NOTES	PHOTOGRAPH	OUTCOME
	Visual assessment				
Patch 8 – Centenary road	VT1 – Open forest of *Eucalyptus marginata, Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands Quadrat GBQ08	Good (2.11 ha) within the survey area. Extends outside the survey area.	*B. attenuata* is present in patch at 2-20 % cover. Patch size outside survey area to the north is continuous and contains similar *Eucalyptus / Banksia* open forest vegetation type with areas in Excellent to Very Good condition.		2.11 ha Banksia Woodlands of the SCP TEC/PEC (part of larger patch) Patch extends outside the survey area.
Patch 9 - Bussell highway near Golf course	VT3 Scattered *Eucalyptus marginata, Corymbia calophylla* and +/- *Agonis flexuosa* over a tall open shrubland of *Banksia attenuata, Banksia ilicifolia, Xylomelum occidentale* and *Kunzea glabrescens* over grassland over introduced grasses. Larger *B. attenuata* trees present.	Degraded (0.9 ha) within the survey area.	*B. attenuata* is present in patch at 2-5 % cover. Does not meet patch size and condition criteria for the TEC/PEC.	Photo unavailable	Does not meet Banksia Woodlands TEC/PEC due to condition.

PATCH	MAPPED VT AND SURVEY SITES	CONDITION AND SIZE	TEC/PEC NOTES	PHOTOGRAPH	OUTCOME
	Visual assessment				
Patch 10 – Bussell Highway at junction with Hasties Road	VT3 Scattered *Eucalyptus marginata, Corymbia calophylla* and +/- *Agonis flexuosa* over a tall open shrubland of *Banksia attenuata, Banksia ilicifolia, Xylomelum occidentale* and *Kunzea glabrescens* over grassland over introduced grasses. Larger *B. attenuata* trees present. Visual assessment	Degraded to Completely Degraded (0.8 ha) within the survey area.	*B. attenuata* is present in patch at 2-5 % cover. Does not meet patch size and condition criteria for the TEC/PEC.	Photo unavailable	Does not meet Banksia Woodlands TEC/PEC due to condition.

5.3.2 Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain (TEC/PEC)

Areas of potential Tuart TEC were identified through the desktop review (including soils mapping), previous surveys in the area (GHD, 2015; Biota, 2018), initial site reconnaissance visit and aerial photography. These areas were assessed (using quadrats and traverses) during the 2018 and 2019 surveys. In addition, Ecoedge sampled two Tuart quadrats (JENO01 and JENO02) during the 2019 surveys. Tuart assessment quadrats were assessed across potential Tuart TEC patches. The Tuart TEC assessment was undertaken in accordance with the Approved Conservation Advice (DotEE, 2019a) and Main Roads draft Tuart Guidance Factsheet version 9th July 2019 (Main Roads, 2019).

Part of VT1b is considered to be representative of the Tuart TEC. VT1b contained two separate Tuart patches, patch 1 and patch 2. Patch 1 was assessed and determined to meet the key diagnostic characteristics of the Tuart TEC as the patch is > 5 ha and therefore no condition thresholds are required to be met. The Tuart quadrats assessed had between 18-20 native species (< 3 m) in the understorey which is classed as Very High Tuart condition. In total, 7.3 ha of Tuart TEC occurs within the survey area (patch 1). Patch 1 extends outside the survey area to the north and south with an approximate area of 25 ha. Total patch 1 size is approximately 32.3 ha.

Patch 2 was assessed and determined not to meet the key diagnostic characteristics of the Tuart TEC as the patch is between 0.5 – 2 ha (0.52 ha in total with 0.10 ha inside survey area) and therefore must have at least eight native understorey species per 0.01 ha (10 x 10 m) to qualify as the TEC. The Tuart01 quadrat has only seven native understorey species (10 x 10 m).

Patch 3, which occurs as part of vegetation type VT9a *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* was assessed and determined that it does not meet key diagnostic characteristics of the Tuart TEC as the patch is < 0.5 ha (0.4 ha). The patch is predominately parkland cleared.

The spatial distribution of Tuart survey quadrats and patches 1- 3 are presented in Figure 11, Appendix A. Detailed patch assessment information is presented in Appendix I. A summary of the patch assessment is presented in Table 5-5.

5.3.3 Southern SCP *Eucalyptus gomphocephala – Agonis flexuosa* woodlands (FCT 25) PEC

The field assessment also confirmed the presence of the Southern SCP *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT25) PEC listed as Priority 3 by DBCA. Vegetation type 1b (patches 1 and 2) are considered to be representative of the PEC. VT9a patch 3 is not considered to be representative of the PEC as VT9a is dominated by Jarrah (*E. marginata*) and Marri (*C. calophylla*) and is not dominated by Tuart trees across the vegetation type extent. In total, 7.3 ha of the Southern SCP *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT25) PEC occurs within the survey area. The spatial distribution of Tuart survey quadrats and patches 1- 3 are presented in Figure 11, (Appendix A). Detailed patch assessment information is presented in Appendix H. A summary of the patch assessment is presented in Table 5-5.

FCT 25 - Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands has been mapped by DBCA within the survey area. Consultation with Mr. Andrew Webb from DBCA (pers. comm. 2011 and 2015) has confirmed that the vegetation types in this area represent FCT 25.

Table 5-5 Summary of patch field assessments for Tuart Woodland TEC/PEC

PATCH	MAPPED VT AND SURVEY SITES	CONDITION AND SIZE	TEC/PEC NOTES	PHOTOGRAPH	OUTCOME
Patch 1	VT1b – Open forest of *Eucalyptus gomphocephala* with occasional *Eucalyptus marginata* over *Agonis flexuosa* and *Banksia attenuata* on yellow sand over limestone. Quadrats JENO01, JENO02	Very Good to Completely Degraded (7.3 ha) within the survey area: • 3.7 ha Very Good • 2.9 ha Good to Degraded • 0.008 ha Degraded – Completely Degraded • 0.7 ha Completely Degraded	Patch contains numerous mature trees within the patch. There are >200 Tuart trees in the patch over 15 cm DBH. Patch extends outside the survey area. Patch size outside of the survey area is approximately 25 ha. Total is 32.3 ha	 JENO01  JENO02	7.3 ha Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain TEC/PEC 7.3 ha Southern SCP *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT25) PEC Patch extends outside the survey area > 32 ha in size in total.

PATCH	MAPPED VT AND SURVEY SITES	CONDITION AND SIZE	TEC/PEC NOTES	PHOTOGRAPH	OUTCOME
Patch 2	VT1b – Open forest of *Eucalyptus gomphocephala* with occasional *Eucalyptus marginata* over *Agonis flexuosa* and *Banksia attenuata*. Quadrat Tuart01	Degraded to Completely Degraded (0.1 ha) within the survey area • 0.10 ha Degraded – Completely Degraded	Patch contains 10 mature Tuart trees within the patch. Patch extends outside the survey area. Patch size outside of the survey area is approximately 0.42 ha. Total is 0.52 ha.	 Tuart01	Does not meet Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the SCP TEC/PEC due to small size and lack of understorey species diversity. 0.1 ha Southern SCP *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT25) PEC
Patch 3	VT9a – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala*. Quadrat Tuart02	Degraded to Completely Degraded (0.4 ha) within the survey area • 0.13 ha Degraded • 0.24 ha Degraded – Completely Degraded	Patch contains 4 mature Tuart trees within the patch. Patch extends outside the survey area. Patch size outside of the survey area is approximately 0.1 ha. Total is 0.46 ha.	 Tuart02	Does not meet Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the SCP TEC/PEC due to small size and lack of understorey species diversity, and due to VT9a being dominated by Jarrah (*E. marginata*) and Marri (*C. calophylla*) and not dominated by Tuart trees across the vegetation type extent. Does not meet Southern SCP *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT25) PEC.

5.3.4 Herb rich shrublands in clay pans (TEC)

The clay pan communities occur where clay substrate is low in the landscape and form an impermeable layer close to the surface. These wetlands rely on rainfall and local surface drainage to fill and are unlikely to be connected to groundwater. A suite of perennial plants and annual herbs flower as the clay pans dry out (DBCA, 2019b).

Herb rich shrublands in clay pans (FCT 8), which is a State (Vulnerable) and Federally listed (Critically Endangered) TEC (as a component of the Claypans of the SCP TEC), is located within 2.8 km of the survey area. GHD (2015) quadrat 13, which is located within vegetation type 5 shares some similarities in dominant overstorey species and annual weed species to that of FCT 8. Biota (2016) assessed two quadrats at this location and determined that the most appropriate assignment for this vegetation type is 'FCT 11 - Wet forests and woodlands' and VT5 is therefore not considered to be consistent with the FCT 8 TEC.

Ecoedge (2019b) (Appendix G) completed desktop review for the location of potential claypan wetlands, which identified one potential claypan wetland on lots 5 and 160 south of Centenary Road. The site was visited on 1 August 2019 by two Ecoedge botanists, DBCA Senior Botanist (Andrew Webb) and a MRWA representative, Senior Environmental Officer (Dr. Freea Itzstein-Davey).

The wetland was found not to be a claypan community, the soil being a sandy-loam at the surface. The vegetation was dominated by *Melaleuca rhaphiophylla* and *M. viminea*, with an open sedgeland of *Lepidosperma longitudinale* over a grassland of *Sporobolus virginicus*. A copy of the memorandum on the site visit is included at Appendix G.

5.4 Other significant vegetation

The survey area traverses a number of creeklines, small drainage lines, as well as seasonally inundated areas (wetlands) that support riparian vegetation. Vegetation associated with the riverine and wetland areas includes remnant trees and shrubs (e.g. *E. rudis, Melaleuca preissiana* and *Melaleuca rhaphiophylla*) over introduced grasses and herbs, with mixed sedges present. Vegetation types 5, 6, 7 and 8 are all associated with riparian vegetation.

There is approximately 39.2 ha of vegetation within the survey area that grows in association with a watercourse and/or wetland. This vegetation has a restricted distribution and has been historically impacted by extensive clearing throughout the local and broad areas. Riparian and wetland vegetation in Good or better condition (approximately half of the riparian vegetation) is considered to be other locally significant vegetation, not listed as a TEC / PEC:

- 19.8 ha in Good to Very Good condition – other significant vegetation
- 19.5 ha in Good – Degraded to Completely Degraded condition – mostly occurs as scattered trees over introduced grasses and herbs, not considered to be other significant vegetation.

5.5 Flora diversity

The floristic diversity of the survey area has been assessed by combining survey data from GHD (2014; 2015), Biota (2016; 2018) and the current survey (Appendix E). A total of 428[3] species have been recorded across these surveys including 119 introduced or planted species (28 %).

During the recent survey, 289 plant species (including subspecies and varieties) representing 227 genera and 71 plant families were recorded within the survey area. This total included 198 (68.5 %) native species and 91 introduced (exotic/planted) (31.5 %) species.

[3] Some of these surveys extended outside the current survey area.

Table 5-6 provides a summary of the records of previous flora surveys and the current survey.

Table 5-6 Floristic diversity of the survey area

SURVEY	TOTAL SPECIES	TOTAL NATIVE: WEED	COMMENTS
Current survey (2018 and 2019)	289	198: 91	Survey over multiple sites, August, September and October survey with over 30 % introduced species.
GHD 2014	101	81: 23	Smaller survey area with few vegetation types, winter survey only.
GHD 2015	194	145: 53	Similar survey area as the current survey, September and June survey period.
Biota 2016	96	62: 34	Restricted to small survey area with only few vegetation types.
Biota 2018	115	92: 20	Survey of potential Banksia woodland TEC only.

5.6 Conservation significant flora

No EPBC Act or BC Act listed flora were recorded within the survey area. Furthermore, the previous surveys in November 2007 (Bennett Environmental Consulting , 2008), October 2008 (GHD, 2009), November 2011 and June 2014 (GHD, 2015), June 2013 (GHD, 2014), October 2016 (Biota, 2016) and November 2017 (Biota, 2018) did not record any EPBC Act or BC Act listed flora. Ecoedge (2017; 2019a) completed a targeted assessment for *Diuris drummondii* (an EPBC Act and BC Act listed species), and did not identify any *D. drummondii* plants (further details on this assessment are provided below).

5.6.1 Species recorded during field surveys

Three DBCA Priority-listed flora species were recorded within the survey area during the field surveys.

The location of the three priority flora is shown in Figure 11 (Appendix A). Species location data and number of plants recorded is presented in Appendix E.

Lasiopetalum membranaceum (Priority 3)

Lasiopetalum membranaceum is a shrub to 1 m high with pink-purple flowers, and flowers during September to December. The species grows in sand over limestone and is recorded from the SCP bioregion, with outliers in the Jarrah Forest and Warren bioregions (WA Herbarium, 1998-). This species is known locally from nine records within 5 km of the survey area (WA Herbarium, 1998-), with the closest record 0.23 km from the survey area. Regionally the species is known from 73 records (DBCA, 2007-) across its full distribution.

Lasiopetalum membranaceum was recorded from one location with one individual that has been impacted by stock grazing (Plate 6). It was recorded in degraded habitat in open forest of *Eucalyptus gomphocephala* with occasional *Eucalyptus marginata* (VT1b). The record is from the northern extent of the survey area.

Caladenia speciosa (Priority 4)

The Sandplain White Spider Orchid (*Caladenia speciosa*) (Plate 7) is a tuberous, perennial herb approximately 0.35 to 0.6 m high, with white to pink flowers. This species is reported to flower in September to October. It grows in white, grey or black sands and is recorded from the Jarrah Forest and Swan Coastal Plain IBRA bioregions (WA Herbarium, 1998-). This species is known locally from 19 records

within 5 km of the survey area (WA Herbarium, 1998-). Regionally the species is known from 84 records (DBCA, 2007-) across its full distribution.

C. speciosa was recorded from 30 locations (45 individuals) within the survey area in *Eucalyptus* / *Banksia* woodland in the southern end of the alignment beside Bussell Highway and adjoining Woods Road.

Acacia semitrullata (Priority 4)

Acacia semitrullata (Plate 8) is an erect, pungent shrub to about 0.5 m high with cream-white flowers. The species grows in white to grey sand on sand plains and is recorded from the Jarrah Forrest, SCP and Warren IBRA bioregions (WA Herbarium, 1998-). This species is known locally from 15 records within 5 km of the survey area (WA Herbarium, 1998-). Regionally the species is known from 116 records (DBCA, 2007-) across its full distribution.

Acacia semitrullata was recorded from six locations (six plants) within the survey area. It was recorded from *Eucalyptus* woodlands and *Eucalyptus / Banksia* woodlands.

Plate 6 *Lasiopetalum membranaceum* (Priority 3)

Plate 7 *Caladenia speciosa* (Priority 4)

Plate 8 *Acacia semitrullata* (Priority 4)

5.6.2 Targeted search results

Desktop searches have identified several EPBC Act / BC Act listed flora that may have the potential to occur based on the results of field surveys in the local area and/or the presence of potentially suitable habitat. Further information on the likelihood of occurrence for these species is provided below post survey:

- *Caladenia huegelii* (King Spider Orchid) EPBC Act – Endangered / BC Act – Critically Endangered
- *Diuris drummondii* (Tall Donkey orchid) EPBC Act/ BC Act – Vulnerable
- *Diuris micrantha* (Dwarf bee-orchid) EPBC Act/ BC Act – Vulnerable
- *Drakaea elastica* (Glossy-leaved hammer orchid) EPBC Act – Endangered / BC Act – Critically Endangered
- *Drakaea micrantha* (Dwarf hammer orchid) EPBC Act – Vulnerable / BC Act – Endangered
- *Eleocharis keigheryi* (Keighery's Eleocharis) EPBC Act/ BC Act – Vulnerable
- *Synaphea* sp. Fairbridge Farm (D. Papenfus 696) EPBC Act/ BC Act – Critically Endangered
- *Austrostipa jacobsiana* EPBC Act/ BC Act – Critically Endangered
- *Austrostipa bronwenae* EPBC Act/ BC Act – Endangered

Drakaea elastica and *Drakaea micrantha*

Targeted surveys for *Drakaea* were undertaken by Senior Botanist/Botanist between 23 and 30 August and 23 September to 9 October, 2019. Two Drakaea survey areas were searched as well as all potential habitat (VT1, 2, 3 and 4). These searches did not locate any *Drakaea elastica* or *D. micrantha*. Mapping showing the location of the search sites is shown in Figure 2 (Appendix A).

The post survey likelihood for both *Drakaea elastica* and *D. micrantha* concludes that these species are unlikely to occur in the survey area when considering that suitable survey effort covering all potential habitats over multiple surveys has been undertaken during the preferred survey timing for species detection. While suitable habitat exists within the survey area, disturbances such as weed invasion, grazing, edge effects, tracks, clearing and rubbish dumping have led to the habitat being disturbed and reducing the habitat condition. Known locations of *Drakaea elastica* and *D. micrantha* outside of the survey area that have been previously surveyed by a GHD Senior Botanist in the Kemerton area are typically in larger continuous patches containing suitable habitat that is in Very Good to Excellent condition. The preferred habitat for the species consists of thickets of *Kunzea glabrescens* with open patches of white sand, often shaded, near damplands. This specific habitat was not commonly recorded in the survey area, and when targeted the habitat was often degraded by one or a number of disturbances listed above. While the species may not flower each year, targeted surveys for the presence of the *Drakaea* leaf were undertaken early in the season to ensure that if *Drakaea* species were present it would have been detected through

adequate survey effort. The common species *Drakaea livida* was recorded within the survey area, showing that the survey timing was appropriate for *Drakaea* species detection.

Diuris drummondii

Ecoedge (2017) completed a targeted survey over four areas within the survey area and adjacent that were identified by Mr. Andrew Webb (Flora Conservation Officer, Department of Biodiversity Conservation and Attractions) as potential habitat for *Diuris drummondii*. A two day survey of potential habitat was completed on the 19 November and 30 November 2016. No *D. drummondii* plants were found within the area. Ecoedge concluded that the majority of the potential habitat was too disturbed by many years of grazing by livestock for *D. drummondii* to be present. Other areas within the survey extent were considered by Ecoedge to be too dry for the orchid and likely too deeply inundated over winter and early spring for the orchid to be able to survive. Ecoedge (2019a) completed a follow up targeted survey for *D. drummondii* over three locations on 30 November 2019 (Figure 3, Appendix A). No *D. drummondii* plants were recorded. The potential habitat on Lots 4 and 5 had been searched twice previously in a wetter year (Ecoedge, 2017) without any plants being found, and together with the result of the 2019 survey, it can be concluded that it is very unlikely that *D. drummondii* occurs within these Lots (which are subject to livestock grazing). There were parts of Lot 5 which could not be accessed because of the depth of water. These areas are unlikely to support the growth of *D. drummondii* as the area is mostly grazed pasture.

Diuris micrantha

It is considered that *D. micrantha* is unlikely to occur in the survey area when considering that suitable survey effort covered all potential habitats, such as *Kunzea* thickets in *Banksia* woodlands near wetlands. Targeted surveys were undertaken over multiple trips during the preferred survey timing for species detection. Suitable small areas of habitat exists within the survey area, however disturbances such as weed invasion, edge effects, tracks, clearing and rubbish dumping have led to the habitat being disturbed and reducing the habitat condition. Areas in better condition were adequately surveyed.

Caladenia huegelii

The post survey likelihood for *Caladenia huegelii* is considered unlikely to occur in the survey area when considering that suitable survey effort using systematic transects covering all potential habitats over multiple surveys has been undertaken during the preferred survey timing for species detection. These surveys were undertaken during the targeted searches for *Drakaea* species in *Banksia* woodland habitat. Mapping showing the location of the search sites (*Drakaea* species search areas) is shown in Figure 2 (Appendix A). Suitable habitat exists within the survey area, however disturbances such as weed invasion, grazing, edge effects, tracks, clearing and rubbish dumping have led to the habitat being disturbed and reducing the habitat condition.

Eleocharis keigheryi

The post survey likelihood for *Eleocharis keigheryi* is considered unlikely to occur in the survey area when considering that suitable survey effort covering all potential specific claypan habitats has been undertaken during the preferred survey timing for species detection. Suitable small areas of claypan habitat exists within the survey area. Disturbances such as weed invasion, edge effects, tracks, clearing and rubbish dumping have led to the habitat being disturbed and reducing the habitat condition. Areas in better condition, were adequately surveyed. The closest known record is near St Helena Road, this location is considered unreliable as the point is located in a cleared paddock. Suitable survey effort in this area in potential habitat did not record the species and it is considered unlikely to occur in the survey area.

Synaphea sp. Fairbridge Farm (D. Papenfus 696)

The post survey likelihood for *Synaphea* sp. Fairbridge Farm (D. Papenfus 696) is considered unlikely to occur in the survey area. This species is endemic to the Pinjarra Plains and grows on grey clayey sand with lateritic pebbles soils, near winter-wet flats in low woodlands of *Corymbia calophylla* with *Viminaria juncea,*

Xanthorrhoea preissii, Adenthos meisneri, Hypocalymma angustifolia and *Allocasuarina humilis* shrubs (WA Herbarium, 1998-). The survey area does not contain suitable habitat on the Pinjarra Plain landform. Suitable search effort did not record the species.

Austrostipa jacobsiana

The post survey likelihood for *Austrostipa jacobsiana* is considered unlikely to occur in the survey area after suitable survey effort covering all wetland habitats has been undertaken during the preferred survey timing for species detection. The species was also targeted during the surveys for *Diuris drummondii* as both share similar habitat. Wetland habitat exists within the survey area, however disturbances such as weed invasion, edge effects, tracks, clearing and rubbish dumping have led to the habitat being disturbed causing a reduction in the habitat condition. Areas in better condition, were adequately surveyed. The closest recorded occurrence is approximately 1.06 km from the survey area in protected habitat that is in Excellent-Very Good condition. Suitable search effort did not record the species in the survey area.

Austrostipa bronwenae

The post survey likelihood for *Austrostipa bronwenae* is considered unlikely to occur in the survey area after suitable survey effort covering all wetland habitats has been undertaken during the preferred survey timing for species detection. The species was also targeted during the surveys for *Diuris drummondii* as both share similar habitat. Wetland habitat exists within the survey area, however disturbances such as weed invasion, edge effects, tracks, clearing and rubbish dumping have led to the habitat being disturbed causing a reduction in the habitat condition. Areas in better condition, were adequately surveyed. The closest recorded occurrence is approximately 2.73 km from the survey area in protected habitat that is in Excellent-Very Good condition. Suitable search effort did not record the species in the survey area.

5.6.3 Likelihood of occurrence

A likelihood of occurrence assessment was conducted post-field survey for all conservation significant flora species identified in the desktop assessment, including TPFL and WAHERB database records (Appendix I). This assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of the species.

The likelihood of occurrence assessment post-field survey concluded that three species are known to occur (recorded), 11 species may possibly occur and the remaining 40 species are unlikely or highly unlikely to occur within the survey area. The species listed as may potentially occur are typically cryptic species that are small, such as the annuals and small *Schoenus* species. A summary of conservation significant species which are known, likely or possibly occur within the survey area has been included in Table 5-7.

Table 5-7 Summary of conservation significant species recorded as occuring or potentially occuring within or near the survey area

SPECIES	EPBC ACT STATUS	BC ACT/ DBCA STATUS	LIKELIHOOD OF OCCURRENCE
Acacia semitrullata	-	P4	Recorded
Angianthus drummondii	-	P3	Possible
Blennospora doliiformis		P3	Possible
Caladenia speciosa	-	P4	Recorded
Chamaescilla gibsonii	-	P3	Possible
Eucalyptus rudis* subsp. *cratyantha	-	P4	Possible
Lasiopetalum membranaceum	-	P3	Recorded
Leptomeria furtiva	-	P2	Possible
Schoenus benthamii	-	P3	Possible
Schoenus loliaceus	-	P2	Possible
Schoenus natans	-	P4	Possible
Stylidium longitubum	-	P4	Possible
Stylidium paludicola	-	P3	Possible
Verticordia attenuata	-	P3	Possible

Note: P: Priority.

5.7 Other significant flora

None of the flora identified within the survey area are considered to be other significant flora i.e. they are not locally endemic, new species, range extensions, unusual species or relictual status.

5.8 Introduced flora

One-hundred and nineteen (119) introduced flora species were recorded in the survey area. Of the introduced species, five are listed as Declared Pests under the *Biosecurity and Management Act 2007* and / or as a WONS:

- **Asparagus asparagoides* (Bridal Creeper) – Declared Pest and WONS
- **Lantana camara* – Declared Pest and WONS
- **Moraea flaccida* (One-leaf Cape Tulip) – Declared Pest
- **Opuntia stricta* (Common Prickly Pear) – Declared Pest and WONS
- **Zantedeschia aethiopica* (Arum lily) – Declared Pest.

The remaining introduced species are considered environmental weeds and all have been previously recorded on the SWA. The locations of the declared weeds is shown in Figure 10, Appendix A and the co-ordinates for these species is provided in Appendix E.

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APPENDIX A

Figures

30,000 32,000 34,000 36,000

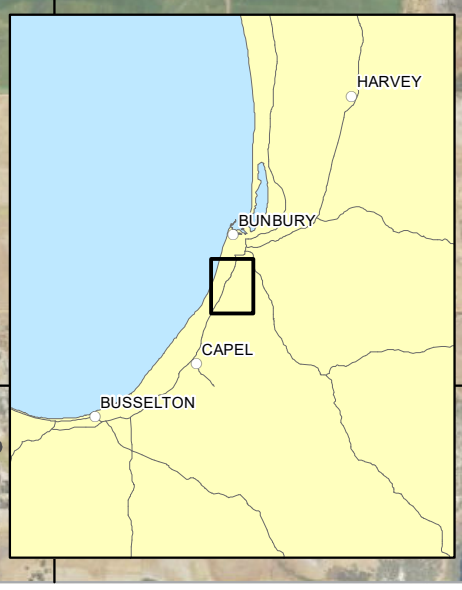
106,000 104,000 102,000 100,000 98,000 96,000

WITHERS
USHER
COLLEGE GROVE
DALYELLUP
NORTH BOYANUP
GELORUP
STRATHAM
BOYANUP

Centenary Rd
Ducane Rd
Lakes Rd
Bussell Hwy

LEGEND

- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 200 400 600 800

Metres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Bunbury Outer Ring Road

Project Locality

Project No. **61-37041**
Revision No. **2**
Date **06 May 2020**

FIGURE 1

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_001_ProjectLocality_Rev2.mxd
Print date: 06 May 2020 - 15:52

Data source: BORR team: South environmental survey area - 20200214; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200506. Created by: slei

35,000 36,000 37,000

104,000 103,000 102,000 101,000

COLLEGE GROVE

DAVENPORT

GELORUP

NORTH BOYANUP

GBQ11 GB75 GBQ08 GB59 GB58 GB57 GB74 GB60 GB56 GB55 GB54 PP53 PP52 GBRel01 GB61 GBQ12 GB62 GB63 GB73 PP22 PP19 RelGB05 GBRel02 GB64 GB65 PP17 GBQ09 GB66 GB67 GB68 GBQ10 GB69 PP16 RelGB04 GB70 GB71 PP13 PP14 GBRel03 GB30 WPP43 WPP53 WPP54 WPP55 WPP42 WPP65 WPP56 WPP64 WPP63 WPP57 WPP62 WPP61 WPP59 WPP58 WPP60

LEGEND

- Quadrat
- Relevé
- Photo point
- Transect Survey Effort
- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary
- *Drakaea elastica* and *Drakaea micrantha* Survey Areas
- *Diuris drummondii* Survey Sites

SLIP POWERED BY LANDGATE

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Revision No. **2**
Date **08 Jun 2020**

Survey Area and Sample Locations

FIGURE 2

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_002_SurveyAreaSampleLocations_Rev2.mxd
Print date: 08 Jun 2020 - 14:34

Data source: BORR team: South environmental survey area - 20200214, Quadrats,Releves, Photo points, *Drakaea elastica* survey areas - 2019; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200608. Created by: slei

33,000 34,000 35,000

104,000 103,000 102,000

LEGEND

- Quadrat
- Relevé
- Photo point
- Transect Survey Effort
- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary
- *Drakaea elastica* and *Drakaea micrantha* Survey Areas
- *Diuris drummondii* Survey Sites

USHER
COLLEGE GROVE
DALYELLUP
GELORUP
NORTH BOYANUP
Bussell Hwy

GB76 GB77 GBQ11 GB75 GBQ08 GB59 GB58 GB57 GB60 GB74 GB56 GB55 GB54 PP53 PP52 GBRel01 GB61 GBQ12 GB62 GB63 GB73 GBQ09 GB66 GB67 PP13 PP14 GBRel03 GB26 GB35 GB36 GB27 GB28 GB29 GB29 GB30 WPP43 WPP42 WPP65

SLIP POWERED BY LANDGATE

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Date	**08 Jun 2020**

Survey Area and Sample Locations

FIGURE 2

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_002_SurveyAreaSampleLocations_Rev2.mxd
Print date: 08 Jun 2020 - 14:35

Data source: BORR team: South environmental survey area - 20200214, Quadrats,Releves, Photo points, *Drakaea elastica* survey areas - 2019; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200608. Created by: slei

33,000 34,000 35,000

101,000 100,000 99,000

LEGEND

- Quadrat
- Photo point
- Transect Survey Effort
- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary
- *Drakaea elastica* and *Drakaea micrantha* Survey Areas

WPP43 WPP53 WPP42 WPP65 NORTH BOYANUP WPP64 GBQ20 GELORUP GB25 GB24 GB23 GB15 GB13 GBQ07 GB14 GB18 GB06 GB06 GB05 GBQ2 GB07 GB04 GBQ3 GB02 GB03

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Bunbury Outer Ring Road

Project No. **61-37041**
Revision No. **2**
Date **08 Jun 2020**

Survey Area and Sample Locations

FIGURE 2

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_002_SurveyAreaSampleLocations_Rev2.mxd
Print date: 08 Jun 2020 - 14:34

Data source: BORR team: South environmental survey area - 20200214, Quadrats,Releves, Photo points, *Drakaea elastica* survey areas - 2019; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200608. Created by: slei

31,000

32,000

100,000

99,000

98,000

97,000

LEGEND

- Quadrat
- Photo point
- Transect Survey Effort
- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

DALYELLUP

GELORUP

STRATHAM

Bussell Hwy

GB25 GB24 GB23 GB15 GB13 GBQ06 GB11 GB10 GB22 GBQ05 GB08 GB16 GBQ4 GB09 GB81 GB18 GB21 GB12 GB19 GB20 GBQ13 GB93 GB37 GB80 GB88 GB87 GBQ15 GB92 GBQ14 GB38 GB91 GB81 GB90 GB83 GB79 GB51 GBQ16 GB78 GBQ17 GB84 GB85 GBQ18 GB50 GB86 GB49 GB39 GB01 GBQ19 GBQ01 GB48 GB40 GB47 GB41 GB46 GB45 GB42 GB44 GB43

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Bunbury Outer Ring Road

Project No.	**61-37041**
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Date	**08 Jun 2020**

Survey Area and Sample Locations

FIGURE 2

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_002_SurveyAreaSampleLocations_Rev2.mxd
Print date: 08 Jun 2020 - 14:34

Data source: BORR team: South environmental survey area - 20200214, Quadrats,Releves, Photo points, *Drakaea elastica* survey areas - 2019; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200608. Created by: slei

30,000 32,000 34,000 36,000

104,000 102,000 100,000 98,000 96,000

LEGEND

Major road

GHD 2014
- Quadrat
- 2014 Survey area

GHD 2015
- Quadrat
- 2015 Survey area

Biota 2016
- Quadrat

EcoEdge 2017
- 2017 Survey area

Biota 2018
- 2018 Survey area

GHD 2018
- Quadrat
- Relevé
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

EcoEdge 2019
- 2019a Survey area
- 2019b Survey Area

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Bunbury Outer Ring Road

Combined Survey Effort

Project No. **61-37041**
Revision No. **3**
Date **08 May 2020**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_003_PreviousSurveyLocations_Rev3.mxd
Print date: 08 May 2020 - 16:53

Data source: BORR team: South Section Referral Boundary - 20191212, South environmental survey area - 20200214; GHD: Quadrats and extents - 2014, 2015, 2016, 2017, 2018; Landgate: Roads - 201805, Imagery accessed on 20200508. Created by: slei

30,000 32,000 34,000 36,000

104,000 102,000 100,000 98,000 96,000

WITHERS
USHER
COLLEGE GROVE
DAVENPORT
DALYELLUP
GELORUP
NORTH BOYANUP
STRATHAM
BOYAN

Bussell Hwy

211Qu__Qb
211Qu__Qd
211Qu__Qf1
211Qu__Qp2
211Qu__Qp3
211Qu__Qqp
211QuU_BEACH
211QuX_SEWERAGE
211SpW_SWAMP
211Sp__S1a
211Sp__S1b
211Sp__S2a
211Sp__S2b
211Sp__S2c
211Sp__S3
211Sp__S3a
211Sp__S4a
211Sp__S4c
212BsW_SWAMP
212Bs__B1
212Bs__B1a
212Bs__B1b
212Bs__B2
212Bs__B3
212Bs__B3a
212Bs__B4
212Bs__B5
212Bs__B6
213PjW_SWAMP
213PjX_MINE
213Pj__B1
213Pj__B2
213Pj__B3
213Pj__B3a
213Pj__B6
213Pj__P1a
213Pj__P1b
213Pj__P1d
213Pj__P3a
213Pj__P7
213Pj__P7a
213Pj__P8
213Pj__P9

LEGEND

- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

Soil Landscape System

211QuU_BEACH
211QuX_SEWERAGE
211Qu__Qb
211Qu__Qd
211Qu__Qf1
211Qu__Qp2
211Qu__Qp3
211Qu__Qqp
211SpW_SWAMP
211Sp__S1a
211Sp__S1b
211Sp__S2a
211Sp__S2b
211Sp__S2c
211Sp__S3
211Sp__S3a
211Sp__S4a
211Sp__S4c
212BsW_SWAMP
212Bs__B1
212Bs__B1a
212Bs__B1b
212Bs__B2
212Bs__B3
212Bs__B3a
212Bs__B4
212Bs__B5
212Bs__B6
213PjW_SWAMP
213PjX_MINE
213Pj__B1
213Pj__B2
213Pj__B3
213Pj__B3a
213Pj__B6
213Pj__P1a
213Pj__P1b
213Pj__P1d
213Pj__P3a
213Pj__P7
213Pj__P7a
213Pj__P8
213Pj__P9

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Soil Landscape Types

Project No. **61-37041**
Revision No. **2**
Date **06 May 2020**

FIGURE 4

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_004_SoilLandscapeTypes_Rev2.mxd
Print date: 06 May 2020 - 15:57

Data source: BORR team: South environmental survey area - 20200214, Referral Boundary - 20191212; DPIRD: Soil landscape types - 20180618; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200506. Created by: slei

30,000 32,000 34,000 36,000

104,000 102,000 100,000 98,000 96,000

WITHERS
USHER
COLLEGE GROVE
DAVENPORT
DALYELLUP
5 MILE BROOK
Bussell Hwy
NORTH BOYANUP
GELORUP
STRATHAM
BOYANUP

LEGEND

- Major road
- Watercourse
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary
- Waterbody

Geomorphic Wetland Category

- Conservation
- Multiple Use
- Resource Enhancement

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Paper Size ISO A3

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Main Roads Western Australia
Bunbury Outer Ring Road

Hydrological Aspects

Project No.	**61-37041**
Revision No.	**1**
Date	**28 Feb 2020**

FIGURE 5

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_005_HydrologicalAspects_Rev1.mxd
Print date: 28 Feb 2020 - 16:19

Data source: BORR team: South Section Referral Boundary - 20191212, South environmental survey area - 20200214; DPAW: Geomorphic wetlands - 20190604; Landgate: Roads - 201805, Watercourses - 2018, Imagery - WA Now accessed: 20200226. Created by: slei

30,000
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36,000

104,000
102,000
100,000
98,000
96,000

WITHERS
USHER
COLLEGE GROVE
DAVENPORT
DALYELLUP
Bussell Hwy
NORTH BOYANUP
GELORUP
STRATHAM

LEGEND

- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

Beard Vegetation

- Association 1000
- Association 998
- Association 968
- Association 3
- Association 37
- Association 6

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 200 400 600 800

Metres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Bunbury Outer Ring Road

Vegetation Association Mapping

Project No. **61-37041**
Revision No. **1**
Date **28 Feb 2020**

FIGURE 6

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_006_BeardMapping_Rev1.mxd
Print date: 28 Feb 2020 - 16:08

Data source: BORR team: BORR team: South Section Referral Boundary - 20191212, South environmental survey area - 20200214; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200226; DBCA: Beard mapping - 1979. Created by: slei

30,000 32,000 34,000 36,000

104,000 102,000 100,000 98,000 96,000

WITHERS
USHER
COLLEGE GROVE
DAVENPORT
DALYELLUP
Bussell Hwy
GELORUP
NORTH BOYANUP
STRATHAM

LEGEND

- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

Heddle Vegetation

- Bassendean Complex-Central and South
- Guildford Complex
- Karrakatta Complex-Central and South
- Quindalup Complex
- Serpentine River Complex
- Southern River Complex
- Vasse Complex
- Yoongarillup Complex

SLIP POWERED BY LANDGATE

Paper Size ISO A3
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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Vegetation Complex Mapping

Project No. **61-37041**
Revision No. **1**
Date **28 Feb 2020**

FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_007_HeddleMapping_Rev1.mxd
Print date: 28 Feb 2020 - 16:06

Data source: BORR team: South Section Referral Boundary - 20191212, South environmental survey area - 20200214; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200226; DBCA: Heddle vegetation - 1998. Created by: slei

30,000 35,000 40,000

110,000 105,000 100,000 95,000 90,000

LEGEND

Conservation Significant Flora

- Critically Endangered
- Endangered
- Vulnerable
- Priority 1
- Priority 2
- Priority 3
- Priority 4
- Threatened Flora (Declared Rare Flora — Extant)
- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

TEC/PEC

- Critically Endangered
- Endangered
- Vulnerable
- Priority 1
- Priority 3

Forrest Hwy
Willinge Dr
South Western Hwy
Robertson Dr
Bunbury Outer Ring Rd
Bussell H.Wy

Paper Size ISO A3

0 0.5 1 1.5 2

Kilometres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

SLIP POWERED BY LANDGATE

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Main Roads Western Australia
Bunbury Outer Ring Road

Biological Constraints

Project No. **61-37041**
Revision No. **1**
Date **28 Feb 2020**

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_008_BiologicalConstraints_Rev1.mxd
Print date: 28 Feb 2020 - 16:02

Data source: BORR team: South Section Referral Boundary - 20191212, South environmental survey area - 20200214; MRWA: Conservation significant flora - 20180605; DBCA: TEC/PEC - 20180605; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200226. Created by: slei

30,000 32,000 34,000 36,000

106,000 104,000 102,000 100,000 98,000 96,000

LEGEND

- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary
- Map sheet

WITHERS
USHER
COLLEGE GROVE
DAVENPORT
DALYELLUP
Bussell Hwy
NORTH BOYANUP
GELORUP
STRATHAM
BOYANUP

Map 1
Map 2
Map 3
Map 4

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road

Vegetation Types

Project No. **61-37041**
Revision No. **1**
Date **23 May 2020**

OVERVIEW

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_009_VegetationTypesOverview_Rev1.mxd
Print date: 23 May 2020 - 22:21

Data source: BORR team: South environmental survey area - 20200214, Vegetation types - 20200219; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200523. Created by: slei

35,000 36,000 37,000

104,000 103,000 102,000 101,000

COLLEGE GROVE

DAVENPORT

GELORUP

NORTH BOYANUP

LEGEND

- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

Vegetation Type

- VT1 - Open forest of *Eucalyptus marginata, Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands
- VT1b - Open forest of *Eucalyptus gomphocephala* with occasional *Eucalyptus marginata* over *Agonis flexuosa* and *Banksia attenuata* on yellow sand over limestone
- VT2 - Open forest of *Eucalyptus marginata, Corymbia calophylla, Banksia attenuata* and *Agonis flexuosa* on Bassendean dunes
- VT3 - *Corymbia calophylla* and *Eucalyptus marginata* +/- *Banksia* spp.
- VT5 - Tall shrubland *Kunzea micrantha* subsp. *micrantha* and *Melaleuca viminea* over weeds
- VT6 - Closed tall scrub of *Melaleuca preissiana, Astartea scoparia* and *Kunzea glabrescens* over sedgeland
- VT7 - Low open forest of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over sedgeland
- VT8 - Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland
- VT9a - *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala*
- VT9b - *Melaleuca rhaphiophylla*
- VT9c - *Corymbia calophylla* and *Eucalyptus marginata* with *Agonis flexuosa* over introduced grasses
- VT9d - *Eucalyptus rudis* and *Corymbia calophylla* +/- *M. rhaphiophylla*
- VT10 - Parkland cleared with scattered native / planted species
- VT10b - Revegetation / Regrowth in road reserves
- Cleared / highly modified

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road

Vegetation Types

Project No. **61-37041**
Revision No. **2**
Date **23 May 2020**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_009_VegetationTypes_Rev2.mxd
Print date: 23 May 2020 - 22:12

Data source: BORR team: South environmental survey area - 20200214, Vegetation types - 20200219; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200523. Created by: slei

33,000 34,000 35,000

104,000 103,000 102,000

LEGEND

- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

Vegetation Type

- VT1 - Open forest of *Eucalyptus marginata, Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands
- VT1b - Open forest of *Eucalyptus gomphocephala* with occasional *Eucalyptus marginata* over *Agonis flexuosa* and *Banksia attenuata* on yellow sand over limestone
- VT2 - Open forest of *Eucalyptus marginata, Corymbia calophylla, Banksia attenuata* and *Agonis flexuosa* on Bassendean dunes
- VT3 - *Corymbia calophylla* and *Eucalyptus marginata +/- Banksia* spp.
- VT5 - Tall shrubland *Kunzea micrantha* subsp. *micrantha* and *Melaleuca viminea* over weeds
- VT7 - Low open forest of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over sedgeland
- VT8 - Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland
- VT9a - *Corymbia calophylla* and *Eucalyptus marginata +/- Agonis flexuosa* with very occasional *E. gomphocephala*
- VT9b - *Melaleuca rhaphiophylla*
- VT9c - *Corymbia calophylla* and *Eucalyptus marginata* with *Agonis flexuosa* over introduced grasses
- VT9d - *Eucalyptus rudis* and *Corymbia calophylla +/- M. rhaphiophylla*
- VT10 - Parkland cleared with scattered native / planted species
- VT10b - Revegetation / Regrowth in road reserves
- Cleared / highly modified

COLLEGE GROVE
NORTH BOYANUP
DALYELLUP
GELORUP
Bussell Hwy

Paper Size ISO A3
0 50 100 150 200
Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUILDING OUR FUTURE
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road

Vegetation Types

Project No. **61-37041**
Revision No. **2**
Date **23 May 2020**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_009_VegetationTypes_Rev2.mxd
Print date: 23 May 2020 - 22:13

Data source: BORR team: South environmental survey area - 20200214, Vegetation types - 20200219; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200523. Created by: slei

33,000 34,000 35,000

101,000 100,000 99,000

LEGEND

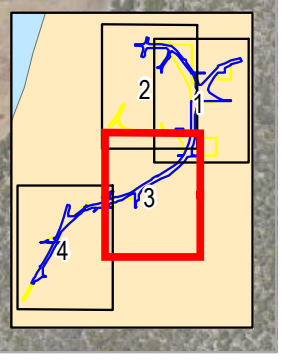
- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

Vegetation Type

- VT1 - Open forest of *Eucalyptus marginata, Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands
- VT2 - Open forest of *Eucalyptus marginata, Corymbia calophylla, Banksia attenuata* and *Agonis flexuosa* on Bassendean dunes
- VT5 - Tall shrubland *Kunzea micrantha* subsp. *micrantha* and *Melaleuca viminea* over weeds
- VT7 - Low open forest of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over sedgeland
- VT8 - Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland
- VT9a - *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala*
- VT9c - *Corymbia calophylla* and *Eucalyptus marginata* with *Agonis flexuosa* over introduced grasses
- VT9d - *Eucalyptus rudis* and *Corymbia calophylla* +/- *M. rhaphiophylla*
- VT10 - Parkland cleared with scattered native / planted species
- Cleared / highly modified

NORTH BOYANUP

GELORUP



Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road

Vegetation Types

Project No. **61-37041**
Revision No. **2**
Date **23 May 2020**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_009_VegetationTypes_Rev2.mxd
Print date: 23 May 2020 - 22:15

Data source: BORR team: South environmental survey area - 20200214, Vegetation types - 20200219; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200523. Created by: slei

LEGEND

- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

Vegetation Type

- VT1 - Open forest of *Eucalyptus marginata, Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands
- VT3 - *Corymbia calophylla* and *Eucalyptus marginata +/- Banksia* spp.
- VT4 - Open forest of *Banksia attenuata* and *Agonis flexuosa*
- VT8 - Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland
- VT9a - *Corymbia calophylla* and *Eucalyptus marginata +/- Agonis flexuosa* with very occasional *E. gomphocephala*
- VT9c - *Corymbia calophylla* and *Eucalyptus marginata* with *Agonis flexuosa* over introduced grasses
- VT10 - Parkland cleared with scattered native / planted species
- VT10b - Revegetation / Regrowth in road reserves
- Cleared / highly modified

31,000 32,000 100,000 99,000 98,000 97,000

YELLUP GELORUP STRATHAM Bussell Hwy

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road

Vegetation Types

Project No. **61-37041**
Revision No. **2**
Date **23 May 2020**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_009_VegetationTypes_Rev2.mxd
Print date: 23 May 2020 - 22:15

Data source: BORR team: South environmental survey area - 20200214, Vegetation types - 20200219; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200523. Created by: slei

30,000 32,000 34,000 36,000

106,000 104,000 102,000 100,000 98,000 96,000

LEGEND

Significant Weeds

- * *Asparagus asparagoides* (Bridal Creeper) - Declared Pest and WONS
- * *Lantana camara* - Declared Pest and WONS
- * *Leptospermum laevigatum*
- * *Moraea flaccida* (One-leaf Cape Tulip) - Declared Pest
- * *Opuntia stricta* (Common Prickly Pear) - Declared Pest and WONS
- * *Zantedeschia aethiopica* (Arum lily) - Declared Pest
- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary
- Map sheet

WITHERS
USHER
COLLEGE GROVE
DAVENPORT
DALYELLUP
Bussell Hwy
NORTH BOYANUP
GELORUP
STRATHAM
BOYANUP

Map 1
Map 2
Map 3
Map 4

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road

Vegetation Condition and Significant Weeds

Project No. **61-37041**
Revision No. **1**
Date **23 May 2020**

OVERVIEW

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_010_VegetationConditionOverview_Rev1.mxd
Print date: 23 May 2020 - 22:31

Data source: BORR team: South environmental survey area - 20200214, Vegetation condition - 20200219, Significant weeds - 20190215; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200523.
Created by: slei

35,000 36,000 37,000

104,000 103,000 102,000 101,000

COLLEGE GROVE

DAVENPORT

GELORUP

NORTH BOYANUP

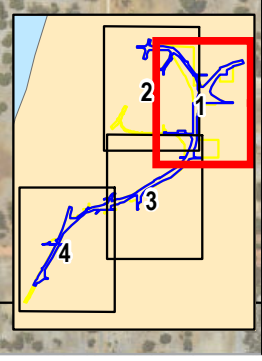
LEGEND

Significant Weeds

- * *Asparagus asparagoides* (Bridal Creeper) - Declared Pest and WONS
- * *Moraea flaccida* (One-leaf Cape Tulip) - Declared Pest
- * *Zantedeschia aethiopica* (Arum lily) - Declared Pest
- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

Vegetation Condition

- Excellent - Very Good
- Very Good
- Very Good - Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Completely Degraded
- Highly modified / Cleared



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 50 100 150 200

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road

Vegetation Condition and Significant Weeds

Project No. **61-37041**
Revision No. **3**
Date **27 May 2020**

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_010_VegetationCondition_Rev3.mxd
Print date: 27 May 2020 - 23:31

Data source: BORR team: South environmental survey area - 20200214, Vegetation condition - 20200219, Significant weeds - 20190215; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200527.
Created by: slei

33,000 34,000 35,000

104,000 103,000 102,000

LEGEND

Significant Weeds

- * *Asparagus asparagoides* (Bridal Creeper) - Declared Pest and WONS
- * *Lantana camara* - Declared Pest and WONS
- * *Zantedeschia aethiopica* (Arum lily) - Declared Pest
- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

Vegetation Condition

- Very Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Completely Degraded
- Highly modified / Cleared

USHER
COLLEGE GROVE
NORTH BOYANUP
DALYELLUP
GELORUP
Bussell Hwy

1 2 3 4

SLIP POWERED BY LANDGATE

Paper Size ISO A3
0 50 100 150 200
Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUILDING OUR FUTURE
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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road

Vegetation Condition and Significant Weeds

Project No. **61-37041**
Revision No. **3**
Date **27 May 2020**

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_010_VegetationCondition_Rev3.mxd
Print date: 27 May 2020 - 23:32

Data source: BORR team: South environmental survey area - 20200214, Vegetation condition - 20200219, Significant weeds - 20190215; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200527.
Created by: slei

33,000 34,000 35,000

101,000 100,000 99,000

LEGEND

Significant Weeds

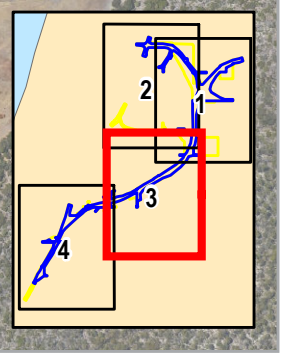
- * *Asparagus asparagoides* (Bridal Creeper) - Declared Pest and WONS
- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

Vegetation Condition

- Excellent
- Excellent - Very Good
- Very Good - Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Completely Degraded
- Highly modified / Cleared

NORTH BOYANUP

GELORUP



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road

Vegetation Condition and Significant Weeds

Project No. **61-37041**
Revision No. **3**
Date **27 May 2020**

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_010_VegetationCondition_Rev3.mxd
Print date: 27 May 2020 - 16:36

Data source: BORR team: South environmental survey area - 20200214, Vegetation condition - 20200219, Significant weeds - 20190215; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200527.
Created by: slei

31,000

32,000

100,000

99,000

98,000

97,000

DALYELLUP

GELORUP

STRATHAM

Bussell Hwy

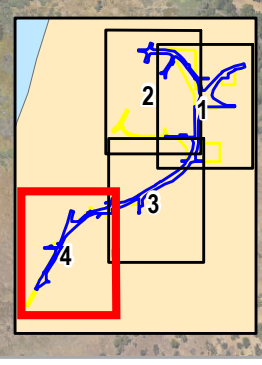
LEGEND

Significant Weeds

- * *Asparagus asparagoides* (Bridal Creeper) - Declared Pest and WONS
- * *Leptospermum laevigatum*
- * *Moraea flaccida* (One-leaf Cape Tulip) - Declared Pest
- * *Opuntia stricta* (Common Prickly Pear) - Declared Pest and WONS
- * *Zantedeschia aethiopica* (Arum lily) - Declared Pest
- Major road
- BORR Southern Section Environmental Survey Area
- BORR Southern Section Referral Boundary

Vegetation Condition

- Excellent - Very Good
- Very Good
- Very Good - Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Completely Degraded
- Highly modified / Cleared



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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Main Roads Western Australia
Bunbury Outer Ring Road

Vegetation Condition and Significant Weeds

Project No. **61-37041**
Revision No. **3**
Date **27 May 2020**

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_010_VegetationCondition_Rev3.mxd
Print date: 27 May 2020 - 16:39

Data source: BORR team: South environmental survey area - 20200214, Vegetation condition - 20200219, Significant weeds - 20190215; Landgate: Roads - 201805, Imagery - WA Now accessed: 20200527.
Created by: slei

30,000 32,000 34,000 36,000

106,000 104,000 102,000 100,000 98,000 96,000

LEGEND

- Tuart Quadrat

Conservation Significant Flora

- *Lasiopetalum membranaceum* (DBCA-P3) (2019)
- *Acacia semitrullata* (DBCA-P4) (2019)
- *Caladenia speciosa* (DBCA-P4) (2015, 2019)
- Map sheet
- BORR Southern Section Referral Boundary
- BORR Southern Section Environmental Survey Area
- Tuart Patches
- Major road

WITHERS
USHER
COLLEGE GROVE
DAVENPORT
DALYELLUP
Bussell Hwy
NORTH BOYANUP
GELORUP
STRATHAM
BOYANUP

Patch 2
Tuart01
Patch 1
JENO2
JENO1
Patch 1
Patch 3
Tuart02

Map 1
Map 2
Map 3
Map 4

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 150 300 450 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road

Conservation and Other Significant Ecological Communities and Flora

Project No. **61-37041**
Revision No. **2**
Date **23 May 2020**

OVERVIEW

FIGURE 11

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_011_ConservationAndSignificantEcologicalCommunitiesOverview_Rev2.mxd
Print date: 23 May 2020 - 22:07

Data source: BORR team: South environmental survey area - 20200214, TEC/PEC - 20190219; EcoEdge: Tuart Location - 20190926; Landgate: Roads - 201805, Imagery accessed on 20200523. Created by: slei

35,000
36,000
37,000
104,000
103,000
102,000
101,000

Patch 1
Patch 8
JENO2
JENO1
Patch 1
Patch 1
Patch 5

LEGEND

- Tuart Quadrat

Conservation Significant Flora

- *Lasiopetalum membranaceum* (DBCA-P3) (2019)
- *Acacia semitrullata* (DBCA-P4) (2019)
- BORR Southern Section Environmental Survey Area
- Banksia Woodland TEC/PEC
- Tuart Woodland TEC/PEC
- Tuart-Peppermint Woodland PEC

1
2
3
4

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road

Conservation and Other Significant Ecological Communities and Flora

Project No. 61-37041
Revision No. 4
Date 08 Jul 2020

FIGURE 11

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_011_ConservationAndSignificantEcologicalCommunities_Rev4.mxd
Print date: 08 Jul 2020 - 13:54

Data source: BORR team: South environmental survey area - 20200214, TEC/PEC - 20190219; EcoEdge: Tuart Location - 20190926; Landgate: Roads - 201805, Imagery accessed on 20200708. Created by: slei

33,000
34,000
35,000
104,000
103,000
102,000

LEGEND

- Tuart Quadrat

Conservation Significant Flora

- *Lasiopetalum membranaceum* (DBCA-P3) (2019)
- BORR Southern Section Environmental Survey Area
- Banksia Woodland TEC/PEC
- Tuart Woodland TEC/PEC
- Tuart-Peppermint Woodland PEC

Tuart01
Patch 2
Patch 1
Patch 1
Patch 8
JENO2
JENO1
Patch 1
Patch 1

1
2
3
4

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

N

SLIP POWERED BY LANDGATE

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT
mainroads WESTERN AUSTRALIA

Main Roads Western Australia
Bunbury Outer Ring Road

Conservation and Other Significant Ecological Communities and Flora

Project No. 61-37041
Revision No. 4
Date 08 Jul 2020

FIGURE 11

G:\61\37041\19_0_GIS\Maps\Working\BORR GBRS Flora and Vegetation Report\6137041_011_ConservationAndSignificantEcologicalCommunities_Rev4.mxd
Print date: 08 Jul 2020 - 13:52

Data source: BORR team: South environmental survey area - 20200214, TEC/PEC - 20190219; EcoEdge: Tuart Location - 20190926; Landgate: Roads - 201805, Imagery accessed on 20200708. Created by: slei

33,000
34,000
35,000
101,000
100,000
99,000

LEGEND

- Tuart Quadrat

Conservation Significant Flora

- *Acacia semitrullata* (DBCA-P4) (2019)
- *Caladenia speciosa* (DBCA-P4) (2015, 2019)
- BORR Southern Section Environmental Survey Area
- Banksia Woodland TEC/PEC

Patch 1
Patch 2
Patch 3
Tuart02

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Main Roads Western Australia
Bunbury Outer Ring Road

Conservation and Other Significant Ecological Communities and Flora

Project No. 61-37041
Revision No. 4
Date 08 Jul 2020

FIGURE 11

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Print date: 08 Jul 2020 - 13:58

Data source: BORR team: South environmental survey area - 20200214, TEC/PEC - 20190219; EcoEdge: Tuart Location - 20190926; Landgate: Roads - 201805, Imagery accessed on 20200708. Created by: slei

31,000
32,000
100,000
99,000
98,000
97,000

LEGEND

Conservation Significant Flora

Caladenia speciosa (DBCA-P4)
(2015, 2019)

BORR Southern Section Environmental Survey Area

Banksia Woodland TEC/PEC

Patch 1
Patch 1
Patch 1
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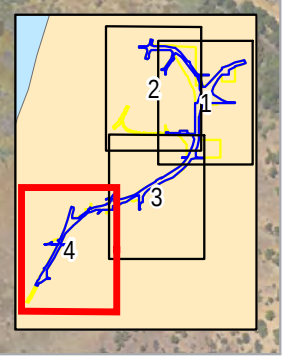
Patch 1



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Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BORR Team

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Main Roads Western Australia
Bunbury Outer Ring Road

Conservation and Other Significant Ecological Communities and Flora

Project No. 61-37041
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FIGURE 11

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Print date: 08 Jul 2020 - 13:50

Data source: BORR team: South environmental survey area - 20200214, TEC/PEC - 20190219; EcoEdge: Tuart Location - 20190926; Landgate: Roads - 201805, Imagery accessed on 20200708. Created by: slei

APPENDIX B

Conservation codes

Relevant legislation

Federal *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The biological aspects listed as MNES include:

- Nationally threatened flora and fauna species and ecological communities
- Migratory species

A person must not undertake an action that has, will have, or is likely to have a significant impact (direct or indirect) on MNES, without approval from the Federal Minister for the Environment.

The EPBC Act is administered by the Department of the Environment and Energy (DEE).

State *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. The Act allows the Environmental Protection Authority (EPA), to prevent, control and abate pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing. Part IV of the EP Act is administered by the EPA and makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals and land use planning schemes.

The Department of Water and Environment Regulation (DWER) is responsible for administering the clearing provisions of the EP Act (Part V). Clearing of native vegetation in Western Australia requires a permit from the DWER, unless exemptions apply. Applications for clearing permits are assessed by the Department and decisions are made to grant or refuse the application in accordance with the Act. When making a decision the assessment considers clearing against the ten clearing principles as specified in Schedule 5 of the EP Act:

a) Native vegetation should not be cleared if it comprises a high level of biodiversity.

b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significance habitat for fauna indigenous to Western Australia.

c) Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora.

d) Native vegetation should not be cleared if it comprises the whole or part of native vegetation in an area that has been extensively cleared.

e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

g) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

h) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

Exemptions for clearing include clearing that is a requirement of a written law or authorised under certain statutory processes (listed in Schedule 6 of the EP Act) and exemptions for prescribed low impact day-to-day activities (prescribed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004); these exemptions do not apply in environmentally sensitive areas (ESAs).

State *Biodiversity and Conservation Act 2016*

The *Biodiversity Conservation Act 2016* (BC Act) provides for the conservation and protection of biodiversity and biodiversity components, as well as the promotion of the ecologically sustainable use of biodiversity components in Western Australia. The BC Act replaces both the repealed *Wildlife Conservation Act 1950* (WC Act) and the *Sandalwood Act 1929* (Sandalwood Act), as well as their associated regulations. To attain the objectives of the BC Act, principles of ecological sustainable development have been established:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
- If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
- The conservation of biodiversity and ecological integrity should be a fundamental consideration indecision-making
- Improved valuation, pricing and incentive mechanisms should be promoted.

The BC Act is administered by the Department of Biodiversity Conservation and Attractions (DBCA).

State *Biosecurity and Agriculture Management Act 2007*

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) and associated regulations are administered by the Department of Primary Industries and Regional Development (DPIRD) and replace the repealed *Agriculture and Related Resources Protection Act 1976.* The main purposes of the BAM Act and its regulations are to:

- Prevent new animal and plant pests (vermin and weeds) and diseases from entering WA
- Manage the impact and spread of those pests already present in the state
- Safely manage the use of agricultural and veterinary chemicals
- Increased control over the sale of agricultural products that contain violative chemical residues.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act. A Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) of the Act is in force. Declared Pests may be assigned a control category including: C1 (exclusion), C2 (eradication) and C3 (management). The category may apply to the whole of the State, LGAs, districts, individual properties or even paddocks, and all landholders are obliged to comply with the specific category of control. Categories of control are defined below.

DPIRD Categories for Declared Pests under the BAM Act

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

Background information

Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under Section 51B of the EP Act. The Table below outlines the aspects of areas declared as ESA in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005.

Aspects of ESAs

Aspects of Environmentally Sensitive Areas
A declared World Heritage property as defined in Section 13 of the EPBC Act.
An area that is included on the Register of the National Estate (RNE), because of its natural values, under the *Australian Heritage Commission Act 1975* of the Commonwealth (the RNE was closed in 2007 and is no longer a statutory list – all references to the RNE were removed from the EPBC Act on 19 February 2012).
A defined wetland and the area within 50 m of the wetland. Defined wetlands include Ramsar wetlands, conservation category wetlands and nationally important wetlands.
The area covered by vegetation within 50 m of rare flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located.
The area covered by a Threatened Ecological Community.
A Bush Forever Site listed in “Bush Forever” Volumes 1 and 2 (2000), published by the Western Australia Planning Commission, except to the extent to which the site is approved to be developed by the Western Australia Planning Commission.
The areas covered by the *Environmental Protection (Gnangara Mound Crown Land) Policy 1992*.
The areas covered by the *Environmental Protection (Western Swamp Tortoise Habitat) Policy 2002*.
The areas covered by the lakes to which the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (EPP Lakes) applies.
Protected wetlands as defined in the *Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998*.

Reserves and conservation areas

Department of Biodiversity, Conservation and Attractions managed lands and waters

DBCA manages lands and waters throughout Western Australia to conserve ecosystems and species, and to provide for recreation and appreciation of the natural environment. DBCA managed lands and waters include national parks, conservation parks and reserves, marine parks and reserves, regional parks, nature reserves, State forest and timber reserves. DBCA managed conservation estate, is vested with the Conservation Commission of Western Australia. Access to, or through, some areas of DBCA managed lands may require a permit or could be restricted due to management activities. Proposed land use changes and development proposals that abut DBCA managed lands will generally be referred to DBCA throughout the assessment process.

Wetlands

Wetlands include not only lakes with open water, but areas of seasonally, intermittently or permanently waterlogged soil.

Ramsar Listed Wetlands

The Convention of Wetlands of International Importance was signed in 1971 at the Iranian town of Ramsar. The Convention has since been referred to as the Ramsar Convention. Ramsar Listed wetlands are “sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity … because of their ecological, botanical, zoological, limnological or hydrological importance” (DEE 2019b). Once a Ramsar Listed Wetland is designated, the country agrees to manage its conservation and ensure its wise use. Under the Convention, wise use is broadly defined as “maintaining the ecological character of a wetland” (DEE 2019b).

Nationally important wetlands

Wetlands of national significance are listed under the Directory of Important Wetlands in Australia. Nationally important wetlands are wetlands which meet at least one of the following criteria (DEE 2019a):

- It is a good example of a wetland type occurring within a biogeographic region in Australia
- It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex
- It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail
- The wetland supports one percent or more of the national populations of any native plant or animal taxa
- The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level
- The wetland is of outstanding historical or cultural significance

Geomorphic wetlands

Categorisation of wetlands has been conducted by Hill et al. (1996), delineating Swan Coastal Plain wetlands into levels of protection and management categories. Conservation Category Wetlands are wetlands that support high levels of attributes and functions. Resource Enhancement Wetlands are those that have been partly modified but still support substantial functions and attributes. Multiple Use Wetlands are classified as those wetlands with few attributes that still provide important wetland functions. Multiple Use wetlands have few important ecological attributes and functions remaining.

The Geomorphic Wetlands Swan Coastal Plain dataset displays the location, boundary, geomorphic classification (wetland type) and management category of wetlands on the Swan Coastal Plain.

Vegetation extent and status

The National Objectives and Targets for Biodiversity Conservation 2001–2005 (Commonwealth of Australia 2001) recognise that the retention of 30 percent or more of the pre-clearing extent of each ecological community is necessary if Australia’s biological diversity is to be protected. This is the threshold level below which species loss appears to accelerate exponentially and loss below this level should not be permitted. This level of recognition is in keeping with the targets recommended in the review of the National Strategy for the Conservation of Australia’s Biological Diversity (ANZECC 2000).

The extent of remnant native vegetation in WA has been assessed by Shepherd et al. (2002) and the GoWA (2018), based on broadscale vegetation association mapping by Beard (various publications). The GoWA produces Statewide Vegetation Statistics Reports that are used for a number of purposes including conservation planning, land use planning and when assessing development applications. The reports are updated at least every two years.

Vegetation condition

The vegetation condition can be assessed in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces (EPA 2016a). The scale recognises the intactness of vegetation and consists of six rating levels as outlined below.

Vegetation condition rating scale for the South West and Interzone Botanical Provinces

Condition	South West and Interzone Botanical Provinces description
Pristine	Pristine or nearly so, no obvious signs of 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. 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 vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as ‘parkland cleared’ with the flora comprising weed or crop species with isolated native trees or shrubs.

Vegetation condition rating scale for the Eremaean and Northern Botanical Provinces

Condition	Eremaean and Northern Botanical Provinces description
Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds

Condition	Eremaean and Northern Botanical Provinces description
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds..
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or ‘parkland cleared’ with their flora comprising weed or crop species with isolated native trees or shrubs.

Conservation codes

Species of significant flora, fauna and communities are protected under both Federal and State Acts. The Federal EPBC Act provides a legal framework to protect and manage nationally important flora and communities. The State BC Act is the primary wildlife conservation legislation in Western Australia. Information on the conservation codes is summarised in the following sections.

Ecological communities

Conservation significant communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blyth 1997). Federally listed Threatened Ecological Communities (TECs) are protected under the EPBC Act. The BC Act provides for the Minister to list an ecological community as a TEC (section 27), or as a collapsed ecological community (section 31) statutory listing of State TECs by the Minister. The legislation also describes statutory processes for preparing recovery plans for TECs, the registration of their critical habitat, and penalties for unauthorised modification of TECs.

Possible TECs that do not meet survey criteria are added to the DBCA Priority Ecological Community (PEC) List under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs 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. PECs are not listed under any formal Federal or State legislation, however, may be listed as TECs under the EPBC Act.

Conservation codes and definitions for TECs listed under the EPBC Act and/ or BC Act

Categories	Definition
Federal Government Conservation Categories (EPBC Act)	
Critically Endangered (CR)	An ecological community if, at that time, is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Endangered (EN)	An ecological community if, at that time: A) is not critically endangered; and B) is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Vulnerable (VU)	An ecological community if, at that time: A) is not critically endangered or endangered; and B) is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Western Australia Conservation Categories (BC Act)	
Threatened Ecological Communities	

Categories	Definition
Critically Endangered (CR)	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 (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.
Collapsed ecological communities	
An ecological community is eligible for listing as a collapsed ecological community at a particular time if, at that time – (a) there is no reasonable doubt that the last occurrence of the ecological community has collapsed); or (b) the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover – (i) its species composition or structure; or (ii) its species composition and structure. Section 33 of the BC Act provides for a collapsed ecological community to be regarded as a threatened ecological community if it is discovered in a state that no longer makes it eligible for listing as a collapsed ecological community.	

Conservation categories and definitions for PECS as listed by the DBCA

Category	Description
Priority 1	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). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2	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). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Category	Description
Priority 3	Poorly known ecological communities. (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, 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, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority 4	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. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority 5	Conservation Dependent ecological communities. Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Other significant vegetation

Vegetation may be significant for a range of reasons other than a statutory listing. The EPA (2016b) states that significant vegetation may include vegetation that includes the following:

- Restricted distribution
- Degree of historical impact from threatening processes
- Local endemism in restricted habitats
- Novel combinations of taxa
- A role as a refuge
- A role as a key habitat for Threatened species or large population representing a significant proportion of the local to regional total population of a species
- Being representative of a vegetation unit in ‘pristine’ condition in a highly cleared landscape, recently discovered range extensions, or isolated outliers of the main range)
- Being poorly reserved.

This may apply at a number of levels, so the unit may be significant when considered at the fine-scale (intra-locality), intermediate-scale (locality or inter-locality) or broad-scale (local to region).

Flora

Conservation significant flora

Species of significant flora are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the BC Act can warrant referral to the DEE and/or the EPA.

The Federal conservation level of flora and fauna species and their significance status is assessed under the EPBC Act. The significance levels for flora and fauna used in the EPBC Act align with the International Union for Conservation of Nature (IUCN) Red List criteria, which are internationally recognised as providing best practice for assigning the conservation status of species.

The State conservation level of flora and fauna species and their significance status also follows the IUCN Red List criteria. Under the BC Act flora and fauna can be listed as Threatened, Extinct and as Specially Protected species.

Threatened species are those are species which have been adequately searched for and are deemed to be, in the wild, either rare, under identifiable threat of extinction, or otherwise in need of special protection, and have been gazetted as such. The assessment of the conservation status of Threatened species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria. Specially protected species meet one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as Threatened or Extinct species under the BC Act cannot also be listed as Specially Protected species.

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

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

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

For the purposes of this assessment, all species listed under the EPBC Act, BC Act and DBCA Priority species are considered conservation significant.

Conservation categories and definitions for EPBC Act and BC Act listed flora and fauna species

Conservation category	Definition
Threatened species	
Critically Endangered (CR)	Threatened species considered to be “facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines”. Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
Endangered (EN)	Threatened species considered to be “facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines”. Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines
Vulnerable (VU)	Threatened species considered to be “facing a high risk of extinction in the wild in the medium term future, as determined in accordance with criteria set out in the ministerial guidelines”. Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines.
Extinct species	
Extinct (EX)	Species where “there is no reasonable doubt that the last member of the species has died”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
Extinct in the Wild (EW)	Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Conservation codes for DBCA listed Priority flora and fauna

Priority category	Definition
Priority 1	Poorly-known taxa 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.
Priority 2	Poorly-known taxa 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,

Priority category	Definition
	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.
Priority 3	Poorly-known taxa Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4	Rare, Near Threatened and other taxa in need of monitoring A. Rare: Taxa 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 taxa are usually represented on conservation lands. B. Near Threatened. Taxa 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. Taxa that have been removed from the list of threatened taxa during the past five years for reasons other than taxonomy.

Other significant flora

Flora species, subspecies, varieties, hybrids and ecotypes may be significant for a range of reasons, other than a statutory listing. The EPA (2016b) states that significant flora may include taxa that have:

- A keystone role in a particular habitat for threatened or Priority flora or fauna species, or large populations representing a considerable proportion of the local or regional total population of a species
- Relictual status, being representation of taxonomic or physiognomic groups that no longer occur widely in the broader landscape
- Anomalous features that indicate a potential new discovery
- Being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- The presence of restricted subspecies, varieties, or naturally occurring hybrids
- Local endemism (a restricted distribution) or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
- Being poorly reserved

Introduced plants (weeds)

Declared Pests

Information on species considered to be Declared Pests is provided under *State Biosecurity and Agriculture Management Act 2007.*

Weeds of National Significance

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WoNS) is based on four major criteria:

- Invasiveness
- Impacts
- Potential for spread
- Socio-economic and environmental values

Australian state and territory governments have identified thirty-two Weeds of National Significance (WoNS); a list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012.

References

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APPENDIX C

Desktop Searches

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 18/10/2018

Kingdom	Plantae
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Line'
Vertices	33° 24' 36" S,115° 39' 04" E 33° 26' 49" S,115° 38' 29" E 33° 28' 48" S,115° 36' 53" E 33° 29' 25" S,115° 34' 60" E
Group By	Family

Family	Species	Records
Aizoaceae	2	2
Amaranthaceae	2	2
Amaryllidaceae	1	1
Anarthriaceae	3	6
Apiaceae	8	29
Apocynaceae	1	2
Apodanthaceae	1	1
Aponogetonaceae	1	12
Araceae	1	1
Araliaceae	5	18
Asparagaceae	22	68
Asphodelaceae	2	3
Asteraceae	34	72
Boryaceae	1	2
Brassicaceae	3	4
Bryaceae	1	1
Campanulaceae	6	12
Caprifoliaceae	1	2
Caryophyllaceae	6	9
Casuarinaceae	1	2
Celastraceae	2	2
Centrolepidaceae	6	17
Chenopodiaceae	5	5
Colchicaceae	3	8
Commelinaceae	1	2
Convolvulaceae	1	1
Crassulaceae	2	3
Cyperaceae	45	82
Dasypogonaceae	1	5
Dennstaedtiaceae	1	1
Dicranaceae	1	1
Dilleniaceae	10	42
Droseraceae	14	22
Elaeocarpaceae	3	10
Ericaceae	12	27
Euphorbiaceae	4	8
Fabaceae	66	177
Funariaceae	1	1
Geraniaceae	4	7
Goodeniaceae	16	25
Haemodoraceae	14	26
Haloragaceae	3	4
Hemerocallidaceae	9	21
Hydatellaceae	3	6
Hypoxidaceae	4	4
Iridaceae	10	26
Isoetaceae	1	2
Juncaceae	4	7
Juncaginaceae	5	5
Lamiaceae	1	6
Lauraceae	3	6
Lentibulariaceae	1	1
Loganiaceae	2	2
Loranthaceae	1	2
Malvaceae	1	7
Marsileaceae	1	2
Menyanthaceae	3	5
Montiaceae	1	1
Myrtaceae	26	52
Onagraceae	1	1
Orchidaceae	49	121
Orobanchaceae	3	7
Oxalidaceae	4	8
Phrymaceae	1	1
Phyllanthaceae	1	8
Plantaginaceae	2	3
Poaceae	40	102
Podocarpaceae	1	1
Polygalaceae	1	1
Polygonaceae	1	1
Pottiaceae	2	2
Primulaceae	3	4
Proteaceae	27	88
Ranunculaceae	2	4
Restionaceae	13	23

Rhamnaceae	2	3
Rubiaceae	7	11
Rutaceae	6	15
Santalaceae	5	7
Scrophulariaceae	2	2
Selaginellaceae	1	1
Solanaceae	3	4
Stylidiaceae	17	32
Thymelaeaceae	3	3
Urticaceae	1	5
Xanthorrhoeaceae	4	11
Zamiaceae	1	7
Zygophyllaceae	1	1
TOTAL	**597**	**1357**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Aizoaceae					
1.	2798	*Carpobrotus virescens (Coastal Pigface, Kolboko, Bain)*			
2.	2820	*Tetragonia decumbens (Sea Spinach)*	Y		
Amaranthaceae					
3.	25840	*Amaranthus blitum*	Y		
4.	2668	*Amaranthus powellii (Powell's Amaranth)*	Y		
Amaryllidaceae					
5.	1489	*Amaryllis belladonna (Belladonna Lily)*	Y		
Anarthriaceae					
6.	1062	*Anarthria prolifera*			
7.	1097	*Lyginia barbata*			
8.	18049	*Lyginia imberbis*			
Apiaceae					
9.	6203	*Actinotus glomeratus*			
10.	6218	*Daucus glochidiatus (Australian Carrot)*			
11.	6219	*Eryngium pinnatifidum (Blue Devils)*			
12.	15446	*Eryngium pinnatifidum subsp. pinnatifidum*			
13.	6222	*Homalosciadium homalocarpum*			
14.	6249	*Platysace compressa (Tapeworm Plant)*			
15.	11132	*Platysace ramosissima*		P3	
16.	6289	*Xanthosia huegelii*			
Apocynaceae					
17.	6565	*Alyxia buxifolia (Dysentery Bush)*			
Apodanthaceae					
18.	2408	*Pilostyles hamiltonii*			
Aponogetonaceae					
19.	141	*Aponogeton hexatepalus (Stalked Water Ribbons)*		P4	
Araceae					
20.	1049	*Zantedeschia aethiopica (Arum Lily)*	Y		
Araliaceae					
21.	6223	*Hydrocotyle alata*			
22.	6225	*Hydrocotyle bonariensis*	Y		
23.	6229	*Hydrocotyle diantha*			
24.	11546	*Hydrocotyle pilifera var. glabrata*			
25.	6280	*Trachymene pilosa (Native Parsnip)*			
Asparagaceae					
26.	1208	*Acanthocarpus preissii*			
27.	1287	*Dichopogon capillipes*			
28.	1289	*Dichopogon preissii*			
29.	1304	*Laxmannia minor*			
30.	11464	*Laxmannia sessiliflora subsp. australis*			
31.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
32.	1228	*Lomandra hermaphrodita*			
33.	1232	*Lomandra micrantha (Small-flower Mat-rush)*			
34.	1234	*Lomandra nigricans*			
35.	1236	*Lomandra odora (Tiered Matrush)*			
36.	1239	*Lomandra preissii*			
37.	1240	*Lomandra purpurea (Purple Mat Rush)*			
38.	1243	*Lomandra sericea (Silky Mat Rush)*			
39.	1246	*Lomandra suaveolens*			
40.	20664	*Ornithogalum longebracteatum*	Y		
41.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
42.	1319	*Thysanotus arenarius*			
43.	1339	*Thysanotus multiflorus (Many-flowered Fringe Lily)*			
44.	1343	*Thysanotus patersonii*			
45.	1351	*Thysanotus sparteus*			
46.	1354	*Thysanotus tenellus*			
47.	1357	*Thysanotus thyrsoideus*			
Asphodelaceae					
48.	1366	*Bulbine semibarbata (Leek Lily)*			
49.	1368	*Trachyandra divaricata*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Asteraceae					
50.	7829	*Angianthus drummondii*		P3	
51.	7833	*Angianthus preissianus*			
52.	7851	*Asteridea pulverulenta (Common Bristle Daisy)*			
53.	7925	*Chondrilla juncea (Skeleton Weed)*	Y		
54.	20074	*Conyza sumatrensis*	Y		
55.	7943	*Cotula australis (Common Cotula)*			
56.	7944	*Cotula bipinnata (Ferny Cotula)*	Y		
57.	7947	*Cotula turbinata (Funnel Weed)*	Y		
58.	13354	*Craspedia variabilis*			
59.	15137	*Euchiton sphaericus*			
60.	12016	*Helianthus debilis subsp. cucumerifolius*	Y		
61.	16759	*Hyalosperma simplex subsp. simplex*			
62.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
63.	9356	*Logfia gallica*			
64.	8105	*Millotia myosotidifolia*			
65.	8127	*Olearia axillaris (Coastal Daisybush)*			
66.	8133	*Olearia elaeophila*			
67.	14371	*Picris angustifolia*			
68.	8160	*Picris squarrosa*			
69.	42281	*Pithocarpa cordata*			
70.	8175	*Podolepis gracilis (Slender Podolepis)*			
71.	8189	*Pseudognaphalium luteoalbum (Jersey Cudweed)*			
72.	8195	*Quinetia urvillei*			
73.	13300	*Rhodanthe citrina*			
74.	20663	*Senecio multicaulis subsp. multicaulis*			
75.	20161	*Senecio pinnatifolius*			
76.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
77.	9367	*Sonchus hydrophilus (Native Sowthistle)*			
78.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
79.	8251	*Trichocline spathulata (Native Gerbera)*			
80.	8255	*Ursinia anthemoides (Ursinia)*	Y		
81.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
82.	8257	*Vellereophyton dealbatum (White Cudweed)*	Y		
83.	8282	*Waitzia suaveolens (Fragrant Waitzia)*			
Boryaceae					
84.	1272	*Borya scirpoidea*			
Brassicaceae					
85.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
86.	3002	*Cakile maritima (Sea Rocket)*	Y		
87.	19403	*Stenopetalum gracile*			
Bryaceae					
88.		*Bryum sp.*			
Campanulaceae					
89.	7399	*Isotoma scapigera (Long-scaped Isotome)*			
90.	7407	*Lobelia rhytidosperma (Wrinkled-seeded Lobelia)*			
91.	7408	*Lobelia tenuior (Slender Lobelia)*			
92.	37440	*Monopsis debilis var. depressa*	Y		
93.	7384	*Wahlenbergia capensis (Cape Bluebell)*	Y		
94.	7389	*Wahlenbergia preissii*			
Caprifoliaceae					
95.	7366	*Centranthus macrosiphon*	Y		
Caryophyllaceae					
96.	2889	*Cerastium glomeratum (Mouse Ear Chickweed)*	Y		
97.	2891	*Corrigiola litoralis (Strapwort)*	Y		
98.	2894	*Moenchia erecta (Erect Chickweed)*	Y		
99.	19825	*Petrorhagia dubia*	Y		
100.	2909	*Silene gallica (French Catchfly)*	Y		
101.	15972	*Silene gallica var. gallica*	Y		
Casuarinaceae					
102.	1732	*Allocasuarina humilis (Dwarf Sheoak)*			
Celastraceae					
103.	4733	*Stackhousia monogyna*			
104.	4737	*Tripterococcus brunonis (Winged Stackhousia)*			
Centrolepidaceae					
105.	1117	*Aphelia cyperoides*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
106.	1118	*Aphelia drummondii*			
107.	1121	*Centrolepis aristata (Pointed Centrolepis)*			
108.	1125	*Centrolepis drummondiana*			
109.	1129	*Centrolepis glabra (Smooth Centrolepis)*			
110.	1134	*Centrolepis polygyna (Wiry Centrolepis)*			
Chenopodiaceae					
111.	2491	*Chenopodium macrospermum*	Y		
112.	2578	*Rhagodia baccata (Berry Saltbush)*			
113.	11341	*Rhagodia baccata subsp. baccata*			
114.	11930	*Rhagodia baccata subsp. dioica (Sea Berry Saltbush)*			
115.	2644	*Threlkeldia diffusa (Coast Bonefruit)*			
Colchicaceae					
116.	12770	*Burchardia congesta*			
117.	1385	*Burchardia multiflora (Dwarf Burchardia)*			
118.	12072	*Wurmbea dioica subsp. alba*			
Commelinaceae					
119.	1162	*Cartonema philydroides*			
Convolvulaceae					
120.	6616	*Dichondra repens (Kidney Weed)*			
Crassulaceae					
121.	3137	*Crassula colorata (Dense Stonecrop)*			
122.	11563	*Crassula colorata var. colorata*			
Cyperaceae					
123.	743	*Baumea juncea (Bare Twigrush)*			
124.	747	*Baumea rubiginosa*			
125.	748	*Baumea vaginalis (Sheath Twigrush)*			
126.	43241	*Carex thecata*			
127.	763	*Chorizandra enodis (Black Bristlerush)*			
128.	768	*Cyathochaeta avenacea*			
129.	792	*Cyperus eragrostis (Umbrella Sedge)*	Y		
130.	822	*Eleocharis acuta (Common Spikerush)*			
131.	17605	*Eleocharis keigheryi*		T	
132.	835	*Evandra pauciflora*			
133.	20216	*Ficinia nodosa (Knotted Club Rush)*			
134.	902	*Gahnia decomposita*			
135.	907	*Gahnia trifida (Coast Saw-sedge)*			
136.	20200	*Isolepis cernua var. setiformis*			
137.	912	*Isolepis cyperoides*			
138.	20198	*Isolepis fluitans var. fluitans*			
139.	917	*Isolepis marginata (Coarse Club-rush)*			
140.	919	*Isolepis oldfieldiana*			
141.	925	*Lepidosperma angustatum*			
142.	42742	*Lepidosperma calcicola*			
143.	930	*Lepidosperma costale*			
144.	932	*Lepidosperma effusum (Spreading Sword-sedge)*			
145.	933	*Lepidosperma gladiatum (Coast Sword-sedge, Kerbin)*			
146.	937	*Lepidosperma longitudinale (Pithy Sword-sedge)*			
147.	940	*Lepidosperma pubisquameum*			
148.		*Lepidosperma sp.*			
149.	20398	*Lepidosperma sp. Blackwood (R. Davis 7696)*			
150.	29150	*Lepidosperma sp. Margaret River (B.J. Lepschi 1841)*			
151.	945	*Lepidosperma squamatum*			
152.	946	*Lepidosperma striatum*			
153.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
154.	973	*Schoenus asperocarpus (Poison Sedge)*			
155.	974	*Schoenus benthamii*		P3	
156.	975	*Schoenus bifidus*			
157.	986	*Schoenus efoliatus*			
158.	992	*Schoenus grandiflorus (Large Flowered Bogrush)*			
159.	996	*Schoenus laevigatus*			
160.	999	*Schoenus loliaceus*		P2	
161.	17614	*Schoenus plumosus*			
162.	1011	*Schoenus rigens*			
163.	1013	*Schoenus sculptus (Gimlet Bog-rush)*			
164.	1020	*Schoenus sublateralis*			
165.	1023	*Schoenus tenellus*			
166.	17409	*Schoenus variicellae*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
167.	1036	*Tetraria octandra*			
Dasypogonaceae					
168.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
Dennstaedtiaceae					
169.	41651	*Pteridium esculentum subsp. esculentum*			
Dicranaceae					
170.	32338	*Campylopus introflexus*	Y		
Dilleniaceae					
171.	5109	*Hibbertia amplexicaulis*			
172.	5117	*Hibbertia cuneiformis (Cutleaf Hibbertia)*			
173.	5118	*Hibbertia cunninghamii*			
174.	20051	*Hibbertia diamesogenos*			
175.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
176.	45534	*Hibbertia hypericoides subsp. hypericoides*			
177.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
178.	5172	*Hibbertia stellaris (Orange Stars)*			
179.	5173	*Hibbertia subvaginata*			
180.	5176	*Hibbertia vaginata*			
Droseraceae					
181.	3091	*Drosera bulbigena (Midget Sundew)*			
182.	3095	*Drosera erythrorhiza (Red Ink Sundew)*			
183.	13217	*Drosera erythrorhiza subsp. erythrorhiza*			
184.	3097	*Drosera gigantea (Giant Sundew)*			
185.	14298	*Drosera macrantha subsp. macrantha*			
186.	3108	*Drosera marchantii*			
187.	13209	*Drosera marchantii subsp. marchantii*			
188.	48710	*Drosera micrantha*			
189.	13189	*Drosera oreopodion*			
190.	3118	*Drosera pallida (Pale Rainbow)*			
191.	8911	*Drosera rosulata*			
192.	13385	*Drosera stelliflora*			
193.	3131	*Drosera stolonifera (Leafy Sundew)*			
194.	13205	*Drosera tubaestylis*			
Elaeocarpaceae					
195.	4524	*Platytheca galioides*			
196.	4535	*Tetratheca hirsuta (Black Eyed Susan)*			
197.	48341	*Tetratheca hirsuta subsp. viminea*			
Ericaceae					
198.	6306	*Andersonia caerulea (Foxtails)*			
199.	6323	*Astroloma ciliatum (Candle Cranberry)*			
200.	6334	*Astroloma pallidum (Kick Bush)*			
201.	6348	*Conostephium pendulum (Pearl Flower)*			
202.	6360	*Leucopogon australis (Spiked Beard-heath)*			
203.	6374	*Leucopogon conostephioides*			
204.	6375	*Leucopogon cordatus*			
205.	6427	*Leucopogon parviflorus (Coast Beard-heath)*			
206.	6436	*Leucopogon propinquus*			
207.	6440	*Leucopogon racemulosus*			
208.	29492	*Leucopogon sp. Busselton (D. Cooper 243)*		P2	
209.	34736	*Lysinema pentapetalum*			
Euphorbiaceae					
210.	4585	*Amperea ericoides*			
211.	4636	*Euphorbia paralias (Sea Spurge)*	Y		
212.	4666	*Monotaxis occidentalis*			
213.	20537	*Stachystemon virgatus*			
Fabaceae					
214.	3207	*Acacia alata (Winged Wattle)*			
215.	15466	*Acacia applanata*			
216.	3262	*Acacia cochlearis (Rigid Wattle)*			
217.	3282	*Acacia cyclops (Coastal Wattle)*			
218.	3331	*Acacia extensa (Wiry Wattle)*			
219.	3339	*Acacia flagelliformis*		P4	
220.	3374	*Acacia huegelii*			
221.	3383	*Acacia incurva*			
222.	3502	*Acacia pulchella (Prickly Moses)*			
223.	15481	*Acacia pulchella var. glaberrima*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
224.	15482	*Acacia pulchella var. goadbyi*			
225.	3504	*Acacia pycnantha (Golden Wattle)*	Y		
226.	3527	*Acacia saligna (Orange Wattle, Kudjong)*			
227.	30036	*Acacia saligna subsp. stolonifera*			
228.	3537	*Acacia semitrullata*		P4	
229.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
230.	3576	*Acacia tetragonocarpa*			
231.	3602	*Acacia willdenowiana (Grass Wattle)*			
232.	3688	*Aotus gracillima*			
233.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
234.	18497	*Bossiaea sp. Waroona (B.J. Keighery & N. Gibson 229)*			
235.	3793	*Daviesia angulata*			
236.	3807	*Daviesia divaricata (Marno)*			
237.	18560	*Daviesia divaricata subsp. divaricata*			
238.	3832	*Daviesia physodes*			
239.	3835	*Daviesia preissii*			
240.	3872	*Euchilopsis linearis (Swamp Pea)*			
241.	3876	*Eutaxia epacridoides*			
242.	3880	*Eutaxia virgata*			
243.	20475	*Gastrolobium capitatum*			
244.	20512	*Gastrolobium praemorsum*			
245.	3948	*Gompholobium capitatum*			
246.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
247.	3961	*Hardenbergia comptoniana (Native Wisteria)*			
248.	3964	*Hovea chorizemifolia (Holly-leaved Hovea)*			
249.	3968	*Hovea trisperma (Common Hovea)*			
250.	12859	*Hovea trisperma var. trisperma*			
251.	3992	*Isotropis cuneifolia (Granny Bonnets)*			
252.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
253.	20462	*Jacksonia gracillima*		P3	
254.	4017	*Jacksonia horrida*			
255.	4029	*Jacksonia sternbergiana (Stinkwood, Kapur)*			
256.	4037	*Kennedia coccinea (Coral Vine)*			
257.	37960	*Kennedia coccinea subsp. calcaria*			
258.	4044	*Kennedia prostrata (Scarlet Runner)*			
259.		*Kennedia rubicunda*			
260.	4052	*Latrobea tenella*			
261.	4059	*Lotus angustissimus (Narrowleaf Trefoil)*	Y		
262.	8564	*Lotus subbiflorus*	Y		
263.	4065	*Lupinus angustifolius (Narrowleaf Lupin)*	Y		
264.	4079	*Medicago polymorpha (Burr Medic)*	Y		
265.	4085	*Melilotus indicus*	Y		
266.	4113	*Ornithopus compressus (Yellow Serradella)*	Y		
267.	3618	*Paraserianthes lophantha (Albizia)*			
268.	4177	*Pultenaea ochreata*			
269.	4183	*Pultenaea skinneri (Skinner's Pea)*		P4	
270.	4205	*Sphaerolobium linophyllum*			
271.	4292	*Trifolium campestre (Hop Clover)*	Y		
272.	17763	*Trifolium campestre var. campestre (Hop Clover)*	Y		
273.	4293	*Trifolium cernuum (Drooping Flower Clover)*	Y		
274.	4297	*Trifolium glomeratum (Cluster Clover)*	Y		
275.	4298	*Trifolium hirtum (Rose Clover)*	Y		
276.	4313	*Trifolium subterraneum (Subterranean Clover)*	Y		
277.	4320	*Vicia hirsuta (Hairy Vetch)*	Y		
278.	4322	*Vicia sativa (Common Vetch)*	Y		
279.	11474	*Vicia sativa subsp. nigra*	Y		
Funariaceae					
280.	32370	*Funaria hygrometrica*			
Geraniaceae					
281.	4332	*Erodium botrys (Long Storksbill)*	Y		
282.	4333	*Erodium cicutarium (Common Storksbill)*	Y		
283.	4339	*Geranium molle (Dove's Foot Cranesbill)*	Y		
284.	4340	*Geranium retrorsum*			
Goodeniaceae					
285.	12724	*Anthotium junciforme*			
286.	7428	*Dampiera coronata (Wedge-leaved Dampiera)*			
287.	7454	*Dampiera linearis (Common Dampiera)*			
288.	7462	*Dampiera pedunculata*			
289.	7487	*Diaspasis filifolia (Thread-leaved Diaspasis)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
290.	7505	*Goodenia eatoniana*			
291.	7517	*Goodenia incana (Hoary Goodenia)*			
292.	12551	*Goodenia micrantha*			
293.	7538	*Goodenia pulchella*			
294.	19284	*Goodenia pulchella subsp. Coastal Plain B (L.W. Sage 2336)*			
295.	7568	*Lechenaultia biloba (Blue Leschenaultia)*			
296.	7572	*Lechenaultia expansa*			
297.	7595	*Scaevola anchusifolia*			
298.	7602	*Scaevola calliptera*			
299.	7606	*Scaevola crassifolia (Thick-leaved Fan-flower)*			
300.	7619	*Scaevola lanceolata (Long-leaved Scaevola)*			
Haemodoraceae					
301.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw, Kurulbrang)*			
302.	1416	*Anigozanthos viridis (Green Kangaroo Paw, Kurulbardang)*			
303.	1418	*Conostylis aculeata (Prickly Conostylis)*			
304.	11826	*Conostylis aculeata subsp. aculeata*			
305.	12118	*Conostylis aculeata subsp. gracilis*			
306.	12109	*Conostylis aculeata subsp. preissii*			
307.	1438	*Conostylis laxiflora*			
308.	1453	*Conostylis serrulata*			
309.	11597	*Conostylis setigera subsp. setigera*			
310.	1474	*Haemodorum sparsiflorum*			
311.	1478	*Phlebocarya ciliata*			
312.	1481	*Tribonanthes australis*			
313.	1482	*Tribonanthes brachypetala*			
314.	1483	*Tribonanthes longipetala*			
Haloragaceae					
315.	6159	*Gonocarpus nodulosus*			
316.	6189	*Myriophyllum crispatum*			
317.	6199	*Myriophyllum tillaeoides*			
Hemerocallidaceae					
318.	23474	*Agrostocrinum hirsutum*			
319.	1261	*Agrostocrinum scabrum (Blue Grass Lily)*			
320.	1276	*Caesia micrantha (Pale Grass Lily)*			
321.	1277	*Caesia occidentalis*			
322.	1285	*Corynotheca micrantha (Sand Lily)*			
323.	16326	*Dianella brevicaulis*			
324.	1259	*Dianella revoluta (Blueberry Lily)*			
325.	1295	*Johnsonia acaulis*			
326.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			
Hydatellaceae					
327.	33019	*Trithuria australis*		P4	
328.	1139	*Trithuria bibracteata*			
329.	1141	*Trithuria submersa*			
Hypoxidaceae					
330.	43763	*Pauridia glabella*			
331.	43760	*Pauridia occidentalis*			
332.	43761	*Pauridia occidentalis var. occidentalis*			
333.	43782	*Pauridia vaginata var. vaginata*			
Iridaceae					
334.	18392	*Freesia alba x leichtlinii*	Y		
335.	19179	*Moraea flaccida (One-leaf Cape Tulip)*	Y		
336.	19438	*Moraea ochroleuca*	Y		
337.	1537	*Orthrosanthus laxus (Morning Iris)*			
338.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
339.	11550	*Patersonia umbrosa var. xanthina (Yellow Flags)*			
340.	1556	*Romulea rosea (Guildford Grass)*	Y		
341.	14924	*Romulea rosea var. communis*	Y		
342.	1557	*Sisyrinchium exile*	Y		
343.	1561	*Tritonia crocata*	Y		
Isoetaceae					
344.	11	*Isoetes drummondii (Quillwort)*			
Juncaceae					
345.	1178	*Juncus bufonius (Toad Rush)*	Y		
346.	1179	*Juncus caespiticius (Grassy Rush)*			
347.	1180	*Juncus capitatus (Capitate Rush)*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
348.	1198	*Luzula meridionalis (Field Woodrush)*			
Juncaginaceae					
349.	40661	*Cycnogeton lineare*			
350.	33276	*Triglochin isingiana*			
351.	147	*Triglochin mucronata*			
352.	18587	*Triglochin nana*			
353.	152	*Triglochin trichophora*			
Lamiaceae					
354.	6839	*Hemiandra pungens (Snakebush)*			
Lauraceae					
355.	11501	*Cassytha glabella forma casuarinae*			
356.	2957	*Cassytha racemosa (Dodder Laurel)*			
357.	11799	*Cassytha racemosa forma racemosa*			
Lentibulariaceae					
358.	7145	*Utricularia menziesii (Redcoats)*			
Loganiaceae					
359.	43201	*Adelphacme minima*		P3	
360.	16825	*Phyllangium divergens*			
Loranthaceae					
361.	2401	*Nuytsia floribunda (Christmas Tree, Mudja)*			
Malvaceae					
362.	5038	*Lasiopetalum membranaceum*		P3	
Marsileaceae					
363.	78	*Pilularia novae-hollandiae (Austral Pillwort)*			
Menyanthaceae					
364.	36160	*Liparophyllum capitatum*			
365.	36181	*Ornduffia parnassifolia*			
366.	36200	*Ornduffia submersa*		P4	
Montiaceae					
367.	2845	*Calandrinia brevipedata (Short-stalked Purslane)*			
Myrtaceae					
368.	5316	*Agonis flexuosa (Peppermint, Wonil)*			
369.	17202	*Agonis flexuosa var. flexuosa*			
370.	20283	*Astartea scoparia (Common Astartea)*			
371.	5415	*Calothamnus lateralis*			
372.	5458	*Calytrix flavescens (Summer Starflower)*			
373.	5460	*Calytrix fraseri (Pink Summer Calytrix)*			
374.	5519	*Darwinia oederoides*			
375.	5625	*Eucalyptus diversicolor (Karri)*			
376.	5659	*Eucalyptus gomphocephala (Tuart, Duart)*			
377.	5708	*Eucalyptus marginata (Jarrah, Djara)*			
378.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
379.	35070	*Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)*			
380.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
381.	5832	*Kunzea ericifolia (Spearwood, Pondil)*			
382.	17461	*Kunzea micrantha subsp. micrantha*			
383.	5841	*Kunzea recurva*			
384.	37580	*Melaleuca acutifolia*			
385.	5946	*Melaleuca pauciflora*			
386.	5952	*Melaleuca preissiana (Moonah)*			
387.	5959	*Melaleuca rhaphiophylla (Swamp Paperbark)*			
388.	5978	*Melaleuca teretifolia (Banbar)*			
389.	5980	*Melaleuca thymoides*			
390.	13280	*Melaleuca viminea subsp. viminea*			
391.	6006	*Pericalymma ellipticum (Swamp Teatree)*			
392.	12392	*Verticordia attenuata*		P3	
393.	15432	*Verticordia densiflora var. densiflora*			
Onagraceae					
394.	6140	*Oenothera mollissima*	Y		
Orchidaceae					
395.	15332	*Caladenia attingens subsp. attingens*			
396.	15579	*Caladenia chapmanii*			
397.	1586	*Caladenia discoidea (Dancing Orchid)*			
398.	1592	*Caladenia flava (Cowslip Orchid)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
399.	15348	*Caladenia flava subsp. flava*			
400.	15352	*Caladenia georgei*			
401.	15354	*Caladenia hirta subsp. hirta*			
402.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
403.	1599	*Caladenia latifolia (Pink Fairy Orchid)*			
404.	1602	*Caladenia longicauda (Common White Spider Orchid)*			
405.	13859	*Caladenia longicauda subsp. clivicola*			
406.	17760	*Caladenia nobilis*			
407.	15503	*Caladenia paludosa*			
408.	15377	*Caladenia reptans subsp. reptans*			
409.	13862	*Caladenia speciosa*		P4	
410.	18019	*Caladenia vulgata*			
411.	15114	*Cyanicula gemmata*			
412.	15404	*Cyanicula sericea*			
413.	10916	*Cyrtostylis huegelii*			
414.	19649	*Disa bracteata*	Y		
415.	10796	*Diuris drummondii (Tall Donkey Orchid)*		T	
416.	48253	*Diuris porphyrochila*			
417.	1639	*Drakaea elastica (Glossy-leaved Hammer Orchid)*		T	
418.	11156	*Drakaea livida*			
419.	1643	*Elythranthera brunonis (Purple Enamel Orchid)*			
420.	1646	*Eriochilus dilatatus (White Bunny Orchid)*			
421.	15411	*Eriochilus dilatatus subsp. magnus*			
422.	15412	*Eriochilus dilatatus subsp. multiflorus*			
423.	1653	*Leporella fimbriata (Hare Orchid)*			
424.	10954	*Microtis media (Tall Mignonette Orchid)*			
425.	15419	*Microtis media subsp. media*			
426.	1660	*Microtis orbicularis (Dark Mignonette Orchid)*			
427.	1674	*Prasophyllum giganteum (Bronze Leek Orchid)*			
428.	10853	*Prasophyllum plumiforme*			
429.	44084	*Prasophyllum sp. early (G. Brockman GBB 1626)*			
430.		*Pterostylis aff. nana*			
431.	1685	*Pterostylis angusta*			
432.	15426	*Pterostylis aspera*			
433.	17267	*Pterostylis brevisepala*			
434.	11054	*Pterostylis hamiltonii (Red-veined Shell Orchid)*			
435.	1693	*Pterostylis recurva (Jug Orchid)*			
436.	1694	*Pterostylis rogersii (Curled-tongue Shell Orchid)*			
437.	18655	*Pterostylis sp. crinkled leaf (G.J. Keighery 13426)*			
438.	1698	*Pterostylis vittata (Banded Greenhood)*			
439.	1705	*Thelymitra crinita (Blue Lady Orchid)*			
440.	1707	*Thelymitra flexuosa (Twisted Sun Orchid)*			
441.	1708	*Thelymitra fuscolutea (Chestnut Sun Orchid)*			
442.	20730	*Thelymitra paludosa*			
443.	1717	*Thelymitra variegata (Queen of Sheba)*		P2	
Orobanchaceae					
444.	7122	*Orobanche minor (Lesser Broomrape)*	Y		
445.	7089	*Parentucellia latifolia (Common Bartsia)*	Y		
446.	7090	*Parentucellia viscosa (Sticky Bartsia)*	Y		
Oxalidaceae					
447.	4352	*Oxalis glabra*	Y		
448.	4354	*Oxalis incarnata*	Y		
449.	4355	*Oxalis perennans*			
450.	4356	*Oxalis pes-caprae (Soursob)*	Y		
Phrymaceae					
451.	7060	*Glossostigma diandrum*			
Phyllanthaceae					
452.	4675	*Phyllanthus calycinus (False Boronia)*			
Plantaginaceae					
453.	14282	*Gratiola pubescens*			
454.	7108	*Veronica arvensis (Wall Speedwell)*	Y		
Poaceae					
455.	184	*Aira caryophyllea (Silvery Hairgrass)*	Y		
456.	186	*Aira elegantissima*	Y		
457.	13380	*Amphibromus nervosus*			
458.	200	*Amphipogon turbinatus*			
459.	202	*Anthoxanthum odoratum (Sweet Vernal Grass)*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
460.	17233	*Austrostipa campylachne*			
461.	17234	*Austrostipa compressa*			
462.	17240	*Austrostipa flavescens*			
463.	38481	*Austrostipa jacobsiana*		T	
464.	17253	*Austrostipa semibarbata*			
465.	231	*Avellinia michelii*	Y		
466.	233	*Avena barbata (Bearded Oat)*	Y		
467.	234	*Avena fatua (Wild Oat)*	Y		
468.	244	*Briza maxima (Blowfly Grass)*	Y		
469.	245	*Briza minor (Shivery Grass)*	Y		
470.	247	*Bromus arenarius (Sand Brome)*			
471.	249	*Bromus diandrus (Great Brome)*	Y		
472.	48259	*Cortaderia selloana subsp. selloana*	Y		
473.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
474.	306	*Dichelachne crinita (Longhair Plumegrass)*			
475.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
476.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
477.	376	*Eragrostis curvula (African Lovegrass)*	Y		
478.	444	*Holcus lanatus (Yorkshire Fog)*	Y		
479.	19955	*Lachnagrostis plebeia*			
480.	467	*Lagurus ovatus (Hare's Tail Grass)*	Y		
481.	476	*Lolium perenne (Perennial Ryegrass)*	Y		
482.	478	*Lolium rigidum (Wimmera Ryegrass)*	Y		
483.	11073	*Lolium x hybridum*	Y		
484.	485	*Microlaena stipoides (Weeping Grass)*			
485.	547	*Phalaris angusta*	Y		
486.	573	*Poa drummondiana (Knotted Poa)*			
487.	577	*Poa poiformis (Coastal Poa)*			
488.	583	*Polypogon tenellus*			
489.	40425	*Rytidosperma caespitosum*			
490.	40426	*Rytidosperma occidentale*			
491.	625	*Spinifex longifolius (Beach Spinifex)*			
492.	722	*Vulpia bromoides (Squirrel Tail Fescue)*	Y		
493.	11137	*Vulpia fasciculata*	Y		
494.	724	*Vulpia myuros (Rat's Tail Fescue)*	Y		
Podocarpaceae					
495.	86	*Podocarpus drouynianus (Wild Plum, Kula)*			
Polygalaceae					
496.	4564	*Comesperma virgatum (Milkwort)*			
Polygonaceae					
497.	13911	*Persicaria decipiens*			
Pottiaceae					
498.	32315	*Barbula calycina*			
499.	32439	*Syntrichia papillosa*			
Primulaceae					
500.	36375	*Lysimachia arvensis (Pimpernel)*	Y		
501.	6483	*Samolus junceus*			
502.	6484	*Samolus repens (Creeping Brookweed)*			
Proteaceae					
503.	14970	*Adenanthos barbiger*			
504.	1790	*Adenanthos meisneri*			
505.	1791	*Adenanthos obovatus (Basket Flower)*			
506.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
507.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
508.	1830	*Banksia littoralis (Swamp Banksia, Pungura)*			
509.	1863	*Conospermum capitatum*			
510.	1945	*Franklandia triaristata (Lanoline Bush)*		P4	
511.	19628	*Grevillea bipinnatifida subsp. bipinnatifida*			
512.	2119	*Grevillea vestita*			
513.	12824	*Grevillea vestita subsp. vestita*			
514.	2216	*Hakea varia (Variable-leaved Hakea)*			
515.	16522	*Isopogon formosus subsp. dasylepis*		P3	
516.	2267	*Persoonia longifolia (Snottygobble)*			
517.	2273	*Persoonia saccata (Snottygobble)*			
518.	2299	*Petrophile linearis (Pixie Mops)*			
519.	2316	*Stirlingia latifolia (Blueboy)*			
520.	16769	*Synaphea hians*		P3	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
521.	16865	*Synaphea odocoileops*		P1	
522.	2324	*Synaphea petiolaris (Synaphea)*			
523.	16862	*Synaphea petiolaris subsp. simplex*		P3	
524.	2326	*Synaphea polymorpha (Albany Synaphea, Pinda)*			
525.	18590	*Synaphea sp. Fairbridge Farm (D. Papenfus 696)*		T	
526.	30751	*Synaphea sp. Pinjarra Plain (A.S. George 17182)*		T	
527.	28354	*Synaphea sp. Serpentine (G.R. Brand 103)*		T	
528.	16749	*Synaphea stenoloba*		T	
529.	2331	*Xylomelum occidentale (Woody Pear, Djandin)*			
Ranunculaceae					
530.	2932	*Ranunculus colonorum (Common Buttercup)*			
531.	2935	*Ranunculus pumilio (Smallflower Buttercup)*			
Restionaceae					
532.	17685	*Chaetanthus aristatus*			
533.	17691	*Desmocladus fasciculatus*			
534.	16595	*Desmocladus flexuosus*			
535.	1070	*Hypolaena exsulca*			
536.	17841	*Hypolaena pubescens*			
537.	1077	*Leptocarpus canus (Hoary Twine-rush)*			
538.	19833	*Leptocarpus laxus*			
539.	46382	*Leptocarpus roycei*			
540.	1080	*Leptocarpus scariosus*			
541.	46377	*Leptocarpus scoparius*			
542.	1082	*Leptocarpus tenax (Slender Twine Rush)*			
543.	46379	*Leptocarpus thysananthus*			
544.	1088	*Lepyrodia macra (Large Scale Rush)*			
Rhamnaceae					
545.	13484	*Cryptandra arbutiflora var. tubulosa*			
546.	4828	*Spyridium globulosum (Basket Bush)*			
Rubiaceae					
547.	7321	*Galium divaricatum*	Y		
548.	7323	*Galium murale (Small Goosegrass)*	Y		
549.	25797	*Galium spurium*	Y		
550.	18254	*Opercularia apiciflora*			
551.	7348	*Opercularia hispidula (Hispid Stinkweed)*			
552.	18255	*Opercularia vaginata (Dog Weed)*			
553.	7362	*Sherardia arvensis (Field Madder)*	Y		
Rutaceae					
554.	4417	*Boronia dichotoma*			
555.	4420	*Boronia fastigiata (Bushy Boronia)*			
556.	4441	*Boronia spathulata (Boronia)*			
557.	17804	*Boronia tetragona*		P3	
558.	4454	*Diplolaena dampieri (Southern Diplolaena)*			
559.	18529	*Philotheca spicata (Pepper and Salt)*			
Santalaceae					
560.	10907	*Exocarpos odoratus (Scented Ballart)*			
561.	10765	*Exocarpos sparteus (Broom Ballart, Djuk)*			
562.	2342	*Leptomeria cunninghamii*			
563.	17702	*Leptomeria furtiva*		P2	
564.	2353	*Leptomeria scrobiculata*			
Scrophulariaceae					
565.	7054	*Dischisma arenarium*	Y		
566.	17175	*Eremophila glabra subsp. albicans*			
Selaginellaceae					
567.	6	*Selaginella gracillima (Tiny Clubmoss)*			
Solanaceae					
568.	6949	*Anthocercis littorea (Yellow Tailflower)*			
569.	6983	*Physalis peruviana (Cape Gooseberry)*	Y		
570.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
Stylidiaceae					
571.	7677	*Levenhookia stipitata (Common Stylewort)*			
572.	30278	*Stylidium androsaceum*			
573.	25831	*Stylidium araeophyllum (Stilt Walker)*			
574.	7693	*Stylidium brunonianum (Pink Fountain Triggerplant)*			
575.	25801	*Stylidium hesperium*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
576.	7745	*Stylidium junceum (Reed Triggerplant)*			
577.	13083	*Stylidium lateriticola*			
578.	7756	*Stylidium longitubum (Jumping Jacks)*		P4	
579.	19248	*Stylidium megacarpum*			
580.	25829	*Stylidium neurophyllum (Coastal Plain Triggerplant)*			
581.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
582.	7785	*Stylidium repens (Matted Triggerplant)*			
583.	7798	*Stylidium schoenoides (Cow Kicks)*			
584.		*Stylidium sp.*			
585.	23511	*Stylidium thesioides (Delicate Triggerplant)*			
586.	7806	*Stylidium utricularioides (Pink Fan Triggerplant)*			
587.	7808	*Stylidium violaceum (Violet Triggerplant)*			
Thymelaeaceae					
588.	5231	*Pimelea angustifolia (Narrow-leaved Pimelea)*			
589.	11928	*Pimelea ciliata subsp. ciliata*			
590.	11402	*Pimelea imbricata var. piligera*			
Urticaceae					
591.	1762	*Parietaria debilis (Pellitory)*			
Xanthorrhoeaceae					
592.	1280	*Chamaescilla corymbosa (Blue Squill)*			
593.	19338	*Chamaescilla gibsonii*		P3	
594.	1251	*Xanthorrhoea brunonis*			
595.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
Zamiaceae					
596.	85	*Macrozamia riedlei (Zamia, Djiridji)*			
Zygophyllaceae					
597.	4390	*Zygophyllum fruticulosum (Shrubby Twinleaf)*			

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

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

Australian Government
Department of the Environment and Energy

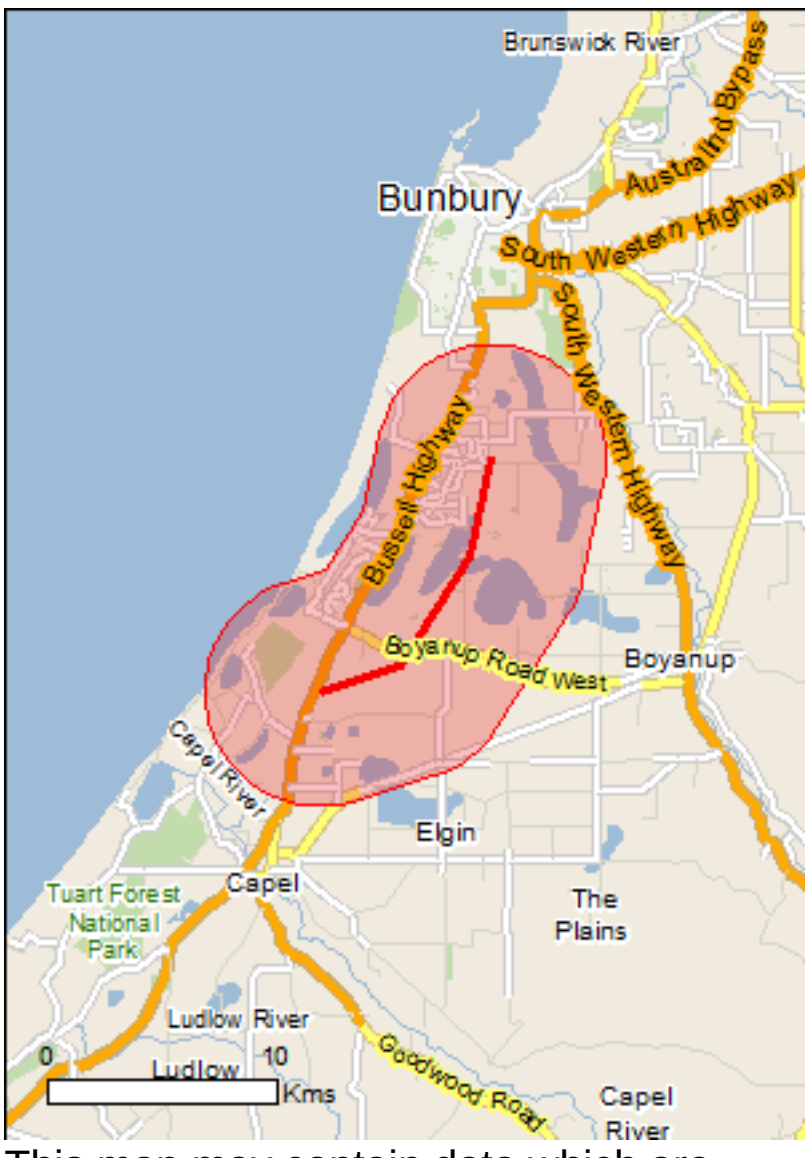
EPBC Act Protected Matters Report

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

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

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

Report created: 19/10/18 13:11:54



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Coordinates
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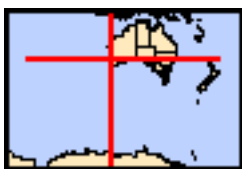

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	60
Listed Migratory Species:	41

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:	63
Whales and Other Cetaceans:	13
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:	1
Regional Forest Agreements:	None
Invasive Species:	31
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

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

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

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or

Name	Status	Type of Presence
		related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour 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
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	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
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding likely to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
[Pseudocheirus occidentalis](#) Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Breeding known to occur within area
[Setonix brachyurus](#) Quokka [229]	Vulnerable	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 likely to occur within area
[Austrostipa jacobsiana](#) [87809]	Critically Endangered	Species or species habitat known to occur within area
[Banksia nivea subsp. uliginosa](#) Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area
[Banksia squarrosa subsp. argillacea](#) Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
[Brachyscias verecundus](#) Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
[Caladenia huegelii](#) King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
[Chamelaucium sp. S coastal plain (R.D.Royce 4872)](#) Royce's Waxflower [87814]	Vulnerable	Species or species habitat may occur within area
[Diuris drummondii](#) Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
[Diuris micrantha](#) Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
[Diuris purdiei](#) Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
[Drakaea elastica](#) Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
[Drakaea micrantha](#) Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
[Eleocharis keigheryi](#) Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area
[Gastrolobium papilio](#) Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat may occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat known to occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat known to occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	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 within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
[Diomedea epomophora](#) Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Diomedea exulans](#) Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Diomedea sanfordi](#) Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
[Hydroprogne caspia](#) Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
[Macronectes giganteus](#) Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
[Macronectes halli](#) Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
[Onychoprion anaethetus](#) Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
[Phoebetria fusca](#) Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
[Thalassarche cauta](#) Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
[Thalassarche impavida](#) Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
[Thalassarche melanophris](#) Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
[Thalassarche steadi](#) White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
[Balaena glacialis australis](#) Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
[Balaenoptera edeni](#) Bryde's Whale [35]		Species or species habitat may occur within area
[Balaenoptera musculus](#) Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
[Caperea marginata](#) Pygmy Right Whale [39]		Species or species habitat may occur within area
[Carcharodon carcharias](#) White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur

Name	Threatened	Type of Presence within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
[Lagenorhynchus obscurus](#) Dusky Dolphin [43]		Species or species habitat may occur within area
[Manta alfredi](#) Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
[Manta birostris](#) Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
[Megaptera novaeangliae](#) Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
[Orcinus orca](#) Killer Whale, Orca [46]		Species or species habitat may occur within area
[Rhincodon typus](#) Whale Shark [66680]	Vulnerable	Species or species habitat may 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 known to occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat 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

Name	Threatened	Type of Presence 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
[Anous tenuirostris melanops](#) Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area
[Ardea alba](#) Great Egret, White Egret [59541]		Breeding known to occur within area
[Ardea ibis](#) Cattle Egret [59542]		Species or species habitat may occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
[Calidris canutus](#) Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area
[Diomedea amsterdamensis](#) Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
[Diomedea dabbenena](#) Tristan Albatross [66471]	Endangered	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may 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
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Tuart Forest	WA

Invasive Species [Resource Information]

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

Name	Status	Type of Presence

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
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
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 habitat likely to occur within area
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,		Species or species

Name	Status	Type of Presence
Florist's Smilax, Smilax Asparagus [22473]		habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
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
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		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

-33.415691 115.651124,-33.447495 115.642884,-33.483868 115.615075,-33.491886 115.583833

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.

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APPENDIX D

Quadrat and Photo Point Data

Quadrat Species List

Row Labels	Status	GB 01	GB 02	GB 03	GB 04	GB 05	GB 06	GB 07	GB 08	GB 09	GB 10	GB 11	GB 12	GB 13	GB 14	GB 15	GB 16	GB 17	GB 18	GB 19	GB 20
Acacia applanata									1					1	1						
Acacia extensa			1																		
Acacia huegelii									1												
Acacia longifolia	*		1																		
Acacia pulchella var. *pulchella*			1												1						
Acacia pulchella var. *glaberrima*																			1	1	1
Agonis flexuosa					1		2	1				1	1	1			1				1
Agrostocrinum scabrum			1			1															
Alyxia buxifolia															1						
Anthoxanthum odoratum	*										1										
Astartea scoparia											1										
Asteridea pulverulenta					1	1															
Astroloma pallidum						1															
Austrostipa campylachne		1											1		1		1		1		
Austrostipa flavescens																				1	
Austrostipa semibarbata																					1
Avena barbata	*	1						1									1	1			
Avena fatua	*			1			1														
Banksia attenuata		1	1		1	1	1	1	1			1	1	1	1	1	1	1	1	1	1
Banksia grandis		1					1		1						1					1	
Banksia ilicifolia									1												1
Baumea juncea											1										
Billardiera variifolia															1						
Bossiaea eriocarpa		1			1	1			1										1		1
Briza maxima	*	1	1	1	1	1	1	1	1		1	1	1	1		1	1	1	1	1	1
Briza minor	*												1								

BORR Team

Row Labels	Status	GB 01	GB 02	GB 03	GB 04	GB 05	GB 06	GB 07	GB 08	GB 09	GB 10	GB 11	GB 12	GB 13	GB 14	GB 15	GB 16	GB 17	GB 18	GB 19	GB 20
Bromus diandrus	*															1					
Burchardia congesta		1	1		1	1			1						1		1	1	1		
Caladenia flava subsp. *flava*		1	1			1									1				1		
Callitriche stagnalis	*																				
Carex divisa	*									1											
Cassytha sp.																					
Chamaescilla corymbosa		1					1					1									
Conostylis aculeata																				1	
Conostylis aculeata subsp. *preissii*		1	1		1	1						1	1	1	1	1	1	1	1		1
Conostylis juncea							1														
Conyza bonariensis	*			1																	
Corymbia calophylla			1						1			1		1	1	1	1	1	1	1	
Cotula coronopifolia	*			1						1											
Cotula turbinata	*			1				1		1											
Crassula colorata var. *colorata*																1					
Crassula natans var. *minus*	*			1												1					
Cryptostylis ovata (leaf only)			1																		
Cyathochaeta avenacea											1										
Cycnogeton lineare																					
Cynodon dactylon	*									1											
Cyperus tenellus	*										1										
Dasypogon bromeliifolius			1						1					1							
Daucus glochidiatus														1				1			
Daviesia physodes			1																		
Desmocladus fascicularis		1	1		1	1			1			1		1		1		1		1	1
Desmocladus flexuosa												1						1			
Dianella revoluta							1					1		1			1	1	1		

Row Labels	Status	GB 01	GB 02	GB 03	GB 04	GB 05	GB 06	GB 07	GB 08	GB 09	GB 10	GB 11	GB 12	GB 13	GB 14	GB 15	GB 16	GB 17	GB 18	GB 19	GB 20
Dichopogon capillipes		2			1	1	1					1			1		1	1	2	1	
Disa bracteata	*										1					1		1			
Drosera erythrorhiza		1																			
Drosera glanduligera											1										
Drosera sp. climbing (nf)									1						1						
Drosera stolonifera						1						1				1			1		
Ehrharta calycina	*				1	1	1	1				1	1	1	1	1	1	1	1		1
Ehrharta longiflora	*	1		1	1			1													
Eriochilus dilatatus (leaf only)																			1		
Eryngium pinnatifidum							1														
Eucalyptus marginata subsp. *marginata*		1	1		1								1							1	
Eucalyptus rudis				1																	
Euphorbia peplus	*							1													
Ficinia nodosa				1																	
Geranium molle	*			1																	
Gladiolus caryophyllaceus															1				1		
Gompholobium polymorphum			1																		
Gompholobium tomentosum		1	1		1	1													1		1
Hardenbergia comptoniana		1	1		1	1	1					1	1	1	1	1					1
Hibbertia cuneiformis								1						1	1		1	1			
Hibbertia hypericoides																				1	
Hibbertia hypericoides subsp. *hypericoides*		1	1		1	1	1		1			1		1	1	1	1	1	1		1
Hibbertia racemosa							1										1			1	
Hibbertia vaginata									1												
Holcus lanatus	*									1											
Hordeum leporinum	*	1																			

Row Labels	Status	GB 01	GB 02	GB 03	GB 04	GB 05	GB 06	GB 07	GB 08	GB 09	GB 10	GB 11	GB 12	GB 13	GB 14	GB 15	GB 16	GB 17	GB 18	GB 19	GB 20
Hovea trisperma					1				1												
Hyalosperma cotula					1	1															
Hybanthus calycinus					1	1	1														
Hypocalymma robustum			1																		1
Hypochaeris glabra	*		1	1	1	1		1		1	1	1	1		1	1		1	1		1
Hypochaeris radicata	*	1		1																	
Hypolaena exsulca		1	1						1												1
Isolepis cernua var. *setiformis*										1											
Ixia sp.	*														1	1	1	1	1		
Jacksonia furcellata															1				1		1
Jacksonia horrida									1												
Juncus pallidus										1											
Kennedia prostrata					1				1					1		1	1	1			1
Kunzea glabrescens									1		2							1			
Lagenophora huegelii		1	1		1	1	1					1									1
Lemna disperma																					
Lepidosperma longitudinale				1																	
Lepidosperma pubisquameum		1	1		1	1	1		1			1			1	1	1		1		1
Lepidosperma sp. (nf)																				1	
Leptocarpus kraussii																					
Leucopogon propinquus		1			1	1	1					1	1	1	1		1		1		
Levenhookia pusilla		1			1	1	1												1		
Lobelia heterophylla							1														
Lolium rigidum	*							1		1											
Lomandra ?odora																					1
Lomandra caespitosa					1	1															1
Lomandra hermaphrodita		1													1		2				

Row Labels	Status	GB 01	GB 02	GB 03	GB 04	GB 05	GB 06	GB 07	GB 08	GB 09	GB 10	GB 11	GB 12	GB 13	GB 14	GB 15	GB 16	GB 17	GB 18	GB 19	GB 20
Lomandra odora							1							1			1				
Lomandra purpurea		1	1												1						
Lomandra sericea																					1
Lomandra sp.			1		1																
Lotus subbiflorus	*			1						1	1					1					
Lyginia barbata									1												
Lyperanthus serratus															1				1		
Lysimachia arvensis	*					1	1					1	1								
Macrozamia riedlei		1			1		1	1	1			1		1	1	1		1	1	1	
Melaleuca preissiana				1						1											
Melaleuca rhaphiophylla										1											
Melaleuca thymoides									1												
Mentha pulegium	*			1																	
Microtis media subsp. *media*			1							1				1	1		1		1		
Microtis sp. nf tall (45 cm)												1									
Moraea flaccida																1					
Nuytsia floribunda																				1	
Opercularia apiciflora		1																	1		
Opercularia hispidula			1									1									
Opercularia vaginata							1														
Ornithopus compressus											1							1			
Orthrosanthus laxus var. *laxus*															1		1	1	1		
Oxalis pes-caprae	*							1					1	1	1	1	1	1			
Patersonia occidentalis			1		1							1			1		1		1	1	
Persoonia longifolia															1						
Petrophile linearis			1									1			1						1
Petrorhagia dubia	*					1	1	1					1								

Row Labels	Status	GB 01	GB 02	GB 03	GB 04	GB 05	GB 06	GB 07	GB 08	GB 09	GB 10	GB 11	GB 12	GB 13	GB 14	GB 15	GB 16	GB 17	GB 18	GB 19	GB 20
Philotheca spicata		1													1						
Phlebocarya ciliata		1	1		1		1		1			1		1	1			1	1	1	
Phyllanthus calycinus		1			1		1													1	
Phytolacca octandra	*									1											
Pimelea rosea subsp. *rosea*							1														
Podolepis gracilis																				1	
Poranthera microcephala														1							
Ptilotus sericostachyus							1														
Pyrorchis nigricans		1	1			1			1						1						
Ranunculus muricatus	*			1																	
Rhodanthe citrina							1														
Romulea rosea	*		1		1	1				1	1	1				1					
Romulea rosea var. *communis*	*																				1
Rumex acetosella	*			2				1													
Rumex conglomeratus	*			1																	
Rumex crispus	*			1																	
Rytidosperma occidentale																					1
Scaevola calliptera		1	1																		
Schoenus grandiflorus																		1	1		
Sonchus oleraceus	*			1																	
Sonchus sp.	*			1																	
Sowerbaea laxiflora		1			1							1		1	1		1		1		
Spergula arvensis	*			1																	
Sporobolus africanus	*									1											
Spyridium globulosum															1			1	1		
Stirlingia latifolia									1												
Stylidium brunonianum									1												1

Row Labels	Status	GB 01	GB 02	GB 03	GB 04	GB 05	GB 06	GB 07	GB 08	GB 09	GB 10	GB 11	GB 12	GB 13	GB 14	GB 15	GB 16	GB 17	GB 18	GB 19	GB 20
Stylidium calcaratum						1															
Stylidium ciliatum									1												
Stylidium schoenoides		1			1	1															
Stypandra glauca												1									
Thelymitra benthamiana		2	1		1	1			1			1		1	1		1	1			
Thelymitra graminea									1										1		
Thelymitra macrophylla			2			1			1						1		1		1		
Thysanotus ? manglesianus		1			1				1						1		1	1	1		
Thysanotus multiflorus		1																			
Trachyandra divaricata																1					
Trachymene pilosa		1	1		1	1	1		1		1	1	1	1					1		
Tricoryne elatior							1						1								
Trifolium arvense var. *arvense*	*									1											
Trifolium campestre	*											1	1			1	1	1			
Trifolium repens	*			1						1								1			
Trifolium sp.	*					1		1													
Ursinia anthemoides	*	1	1		1	1	1				1			1		1	1	1			
Xanthorrhoea brunonis					1				1			1			1	1	1	1	1	1	1
Xanthorrhoea gracilis		1				1	1														
Xanthosia huegelii		1			1				1												1
Xylomelum occidentale		1	1										1							1	
Zantedeschia aethiopica	*									1						1	1				
Grand Total		**46**	**40**	**25**	**39**	**36**	**35**	**16**	**35**	**20**	**16**	**32**	**18**	**26**	**42**	**27**	**33**	**32**	**39**	**21**	**29**

APPENDIX E

Flora Data

Combined species list for BORR South

Family	*Genus*	*Species*	Status	BORR IPT 2018/2019	GHD 2015	GHD 2014	Biota 2016	Biota 2018
Alismataceae	*Alisma*	*lanceolatum*	*	X				
Amaranthaceae	*Ptilotus*	*sericostachyus*		X				
Anarthriaceae	*Anarthria*	*prolifera*				X		
Anarthriaceae	*Lyginia*	*barbata*		X				
Anarthriaceae	*Lyginia*	*imberbis*		X	X	X		
Anthericaceae	*Agrostocrinum*	sp.			X			
Apiaceae	*Centella*	*asiatica*		X				
Apiaceae	*Daucus*	*glochidiatus*		X				
Apiaceae	*Eryngium*	*pinnatifidum*		X				
Apiaceae	*Platysace*	*compressa*		X				
Apiaceae	*Platysace*	*filiformis*				X		
Apiaceae	*Xanthosia*	*huegelii*		X			X	X
Apocynaceae	*Alyxia*	*buxifolia*		X		X		
Araceae	*Lemna*	*disperma*		X				
Araceae	*Zantedeschia*	*aethiopica*	*DP/WoNS	X	X	X	X	X
Araliaceae	*Hydrocotyle*	sp.			X			
Araliaceae	*Trachymene*	*pilosa*		X	X		X	X
Asparagaceae	*Acanthocarpus*	*preissii*		X				
Asparagaceae	*Asparagus*	*asparagoides*	*DP/WoNS	X	X	X	X	
Asparagaceae	*Dichopogon*	*capillipes*		X				
Asparagaceae	*Lomandra*	*? preissii*			X			
Asparagaceae	*Lomandra*	*caespitosa*		X				X
Asparagaceae	*Lomandra*	*hermaphrodita*		X				X
Asparagaceae	*Lomandra*	*integra*						X
Asparagaceae	*Lomandra*	*micrantha* subsp. *micrantha*			X	X		
Asparagaceae	*Lomandra*	*nigricans*			X	X		X
Asparagaceae	*Lomandra*	*odora*		X				
Asparagaceae	*Lomandra*	*preissii*			X			
Asparagaceae	*Lomandra*	*purpurea*		X				
Asparagaceae	*Lomandra*	*sericea*						X
Asparagaceae	*Lomandra*	sp.		X	X			
Asparagaceae	*Sowerbaea*	*laxiflora*		X	X		X	X
Asparagaceae	*Thysanotus*	*? manglesianus*		X	X			
Asparagaceae	*Thysanotus*	*arbuscula*						X
Asparagaceae	*Thysanotus*	*arenarius*				X		
Asparagaceae	*Thysanotus*	*multiflorus*		X				X
Asparagaceae	*Thysanotus*	*patersonii*					X	X
Asparagaceae	*Thysanotus*	*tenellus*		X				
Asphodelaceae	*Trachyandra*	*divaricata*	*	X				
Asteraceae	*Arctotheca*	*calendula*	*	X	X	X	X	
Asteraceae	*Asteridea*	*pulverulenta*		X			X	X
Asteraceae	*Conyza*	*bonariensis*	*	X	X			

Family	*Genus*	*Species*	Status	BORR IPT 2018/2019	GHD 2015	GHD 2014	Biota 2016	Biota 2018
Asteraceae	*Conyza*	sp.	*	X			X	
Asteraceae	*Cotula*	*bipinnata*	*	X				
Asteraceae	*Cotula*	*coronopifolia*	*	X	X			
Asteraceae	*Cotula*	*turbinata*	*	X	X		X	
Asteraceae	*Craspedia*	*variabilis*		X	X			X
Asteraceae	*Hyalosperma*	*cotula*		X	X			
Asteraceae	*Hypochaeris*	*? glabra*	*		X			
Asteraceae	*Hypochaeris*	*glabra*	*	X	X	X	X	X
Asteraceae	*Hypochaeris*	*radicata*	*	X			X	
Asteraceae	*Hypochaeris*	sp.	*		X	X		
Asteraceae	*Lagenophora*	*huegelii*		X	X		X	X
Asteraceae	*Olearia*	*axillaris*			X			
Asteraceae	*Pithocarpa*	*cordata*		X				
Asteraceae	*Podolepis*	*gracilis*						X
Asteraceae	*Rhodanthe*	*citrina*		X				
Asteraceae	*Siloxerus*	*humifusus*		X				
Asteraceae	*Senecio*	*pinnatifolius* var *pinnatifolius*		X				
Asteraceae	*Sonchus*	*asper*	*		X			
Asteraceae	*Sonchus*	*oleraceus*	*	X			X	X
Asteraceae	*Sonchus*	sp.		X				
Asteraceae	sp.				X			
Asteraceae	*Taraxacum*	*officinale*	*		X			
Asteraceae	*Trichocline*	*spathulata*		X				X
Asteraceae	*Ursinia*	*anthemoides*	*	X	X	X	X	X
Asteraceae	*Waitzia*	*suaveolens* var. *suaveolens*		X				X
Brassicaceae	*Raphanus*	*raphanistrum*	*	X				
Campanulaceae	*Hybanthus*	*calycinus*		X				
Campanulaceae	*Lobelia*	*anceps*				X		
Campanulaceae	*Lobelia*	*heterophylla*		X				
Campanulaceae	*Lobelia*	*tenuior*						X
Campanulaceae	*Wahlenbergia*	*capensis*	*	X				
Caryophyllaceae	*Cerastium*	*glomeratum*	*	X				
Caryophyllaceae	*Petrorhagia*	*dubia*	*	X	X			X
Caryophyllaceae	*Silene*	*gallica*	*	X				
Caryophyllaceae	*Spergula*	*arvensis*	*	X				
Caryophyllaceae	*Stellaria*	*media*	*	X				
Casuarinaceae	*Allocasuarina*	*? humilis*			X			
Casuarinaceae	*Allocasuarina*	*humilis*		X				
Casuarinaceae	*Allocasuarina*	sp.			X			
Casuarinaceae	*Casuarina*	*obesa*		X				
Celastraceae	*Tripterococcus*	*brunonis*		X			X	
Centrolepidaceae	*Aphelia*	*cyperoides*		X				
Centrolepidaceae	*Centrolepis*	*aristata*		X				

Family	*Genus*	*Species*	Status	BORR IPT 2018/2019	GHD 2015	GHD 2014	Biota 2016	Biota 2018
Centrolepidaceae	*Centrolepis*	*polygyna*		X				
Chenopodiaceae	*Atriplex*	*prostrata*	*		X			
Colchicaceae	*Burchardia*	*congesta*		X	X	X	X	X
Colchicaceae	*Burchardia*	*multiflora*					X	
Colchicaceae	*Wurmbea*	*monantha*			X			
Crassulaceae	*Crassula*	*? glomerata*			X			
Crassulaceae	*Crassula*	*colorata* var. *colorata*		X	X			
Crassulaceae	*Crassula*	*decumbens*		X				
Crassulaceae	*Crassula*	*natans*		X				
Crassulaceae	*Crassula*	*natans* var. *minus*	*	X				
Cyperaceae	*? Caustis*	*dioica*			X			
Cyperaceae	*Baumea*	*articulata*		X				
Cyperaceae	*Baumea*	*juncea*		X				
Cyperaceae	*Baumea*	*vaginalis*		X				
Cyperaceae	*Carex*	*divisa*	*	X				
Cyperaceae	*Chorizandra*	*enodis*		X				
Cyperaceae	*Cyathochaeta*	*avenacea*		X			X	
Cyperaceae	*Cyperus*	*congestus*		X				
Cyperaceae	*Cyperus*	*eragrostis*	*	X				
Cyperaceae	*Cyperus*	*tenellus*	*	X			X	
Cyperaceae	*Ficinia*	*nodosa*		X			X	
Cyperaceae	*Isolepis*	*? cernua*			X			
Cyperaceae	*Isolepis*	*cernua* var. *setiformis*		X				
Cyperaceae	*Isolepis*	*marginata*	*	X	X			
Cyperaceae	*Isolepis*	*oldfieldiana*		X				
Cyperaceae	*Lepidosperma*	*? longitudinale*			X			
Cyperaceae	*Lepidosperma*	*? pubisquameum*			X			
Cyperaceae	*Lepidosperma*	*gladiatum*			X			
Cyperaceae	*Lepidosperma*	*longitudinale*		X	X	X	X	
Cyperaceae	*Lepidosperma*	*pubisquameum*		X	X	X		X
Cyperaceae	*Lepidosperma*	sp.		X	X			
Cyperaceae	*Lepidosperma*	*squamatum*			X	X	X	
Cyperaceae	*Mesomelaena*	*stygia*		X				
Cyperaceae	*Mesomelaena*	*tetragona*		X	X			
Cyperaceae	*Schoenus*	*curvifolius*		X				
Cyperaceae	*Schoenus*	*grandiflorus*		X	X			X
Cyperaceae	*Tetraria*	*octandra*		X			X	X
Dasypogonaceae	*Calectasia*	*narragara*		X				
Dasypogonaceae	*Dasypogon*	*bromeliifolius*		X	X	X	X	X
Dennstaedtiaceae	*Pteridium*	*esculentum* subsp. *esculentum*		X		X		
Dilleniaceae	*Hibbertia*	*cuneiformis*		X	X			X
Dilleniaceae	*Hibbertia*	*hypericoides subsp hypericoides*		X	X	X	X	X

Family	*Genus*	*Species*	Status	BORR IPT 2018/2019	GHD 2015	GHD 2014	Biota 2016	Biota 2018
Dilleniaceae	*Hibbertia*	*racemosa*		X	X	X	X	X
Dilleniaceae	*Hibbertia*	*vaginata*		X		X		X
Droseraceae	*Drosera*	*? erythrorhiza*			X			X
Droseraceae	*Drosera*	*? pallida*						X
Droseraceae	*Drosera*	*? porrecta*			X			
Droseraceae	*Drosera*	*? stolonifera*						X
Droseraceae	*Drosera*	*erythrorhiza*		X	X	X		
Droseraceae	*Drosera*	*glanduligera*		X		X		
Droseraceae	*Drosera*	*menziesii*		X				
Droseraceae	*Drosera*	*pallida*		X	X			
Droseraceae	*Drosera*	*porrecta*		X				
Droseraceae	*Drosera*	sp.			X	X		
Droseraceae	*Drosera*	*stolonifera*		X				
Droseraceae	*Drosera*	sp. climbing (nf)		X				
Elaeocarpaceae	*Platytheca*	*galioides*						X
Elaeocarpaceae	*Tetratheca*	*hirsuta*			X			
Ericaceae	*Astroloma*	*pallidum*		X				X
Ericaceae	*Conostephium*	*pendulum*				X		
Ericaceae	*Leucopogon*	*? conostephioides* s. lat			X			
Ericaceae	*Leucopogon*	*propinquus*		X	X	X	X	X
Ericaceae	*Leucopogon*	sp.			X			
Ericaceae	*Petrophile*	*linearis*		X				X
Ericaceae	*Styphelia*	*tenuiflora*				X		
Euphorbiaceae	*Euphorbia*	*peplus*	*	X			X	
Euphorbiaceae	*Ricinus*	*communis*	*	X				
Fabaceae	*? Daviesia*	*divaricata*			X			
Fabaceae	*Acacia*	*applanata*		X				
Fabaceae	*Acacia*	*baileyana*	*		X	X		
Fabaceae	*Acacia*	*cochlearis*		X				
Fabaceae	*Acacia*	*cyclops*			X			
Fabaceae	*Acacia*	*extensa*		X	X	X		
Fabaceae	*Acacia*	*huegelii*		X			X	
Fabaceae	*Acacia*	*incurva*			X			
Fabaceae	*Acacia*	*iteaphylla*	*	X	X	X		
Fabaceae	*Acacia*	*longifolia*	*	X		X		X
Fabaceae	*Acacia*	*podalyriifolia*	*	X		X		
Fabaceae	*Acacia*	*pulchella*			X	X	X	
Fabaceae	*Acacia*	*pulchella* var. *glaberrima*		X				
Fabaceae	*Acacia*	*pulchella* var. *pulchella*		X				X
Fabaceae	*Acacia*	*saligna*		X	X			
Fabaceae	*Acacia*	*semitrullata*	P4		X	X		
Fabaceae	*Acacia*	*stenoptera*		X				X

Family	*Genus*	*Species*	Status	BORR IPT 2018/2019	GHD 2015	GHD 2014	Biota 2016	Biota 2018
Fabaceae	*Aotus*	*gracillima*		X		X		
Fabaceae	*Aotus*	*intermedia*				X		
Fabaceae	*Bossiaea*	*? eriocarpa*			X			
Fabaceae	*Bossiaea*	*eriocarpa*		X	X	X		X
Fabaceae	*Chamaecytisus*	*palmensis*	*	X	X			
Fabaceae	*Chorizema*	*retrorsum*				X		
Fabaceae	*Daviesia*	*? divaricata*			X			
Fabaceae	*Daviesia*	*decurrens*			X			
Fabaceae	*Daviesia*	*divaricata* subsp. *divaricata*		X	X	X	X	
Fabaceae	*Daviesia*	*incrassata*		X		X		
Fabaceae	*Daviesia*	*physodes*		X	X			
Fabaceae	*Daviesia*	sp.			X			
Fabaceae	*Euchilopsis*	*linearis*				X		X
Fabaceae	*Gastrolobium*	*capitatum*			X			
Fabaceae	*Gompholobium*	*polymorphum*		X				X
Fabaceae	*Gompholobium*	*tomentosum*		X		X	X	X
Fabaceae	*Hardenbergia*	*comptoniana*		X	X	X	X	X
Fabaceae	*Hovea*	*trisperma*		X			X	X
Fabaceae	*Jacksonia*	*furcellata*		X	X	X		
Fabaceae	*Jacksonia*	*horrida*		X				
Fabaceae	*Jacksonia*	*sternbergiana*						X
Fabaceae	*Kennedia*	*prostrata*		X	X	X	X	X
Fabaceae	*Kennedia*	sp.				X		
Fabaceae	*Lotus*	*angustissimus*	*	X	X			
Fabaceae	*Lotus*	*subbiflorus*	*	X			X	X
Fabaceae	*Lupinus*	*angustifolius*	*	X	X			
Fabaceae	*Lupinus*	*cosentinii*	*		X			
Fabaceae	*Ornithopus*	*compressus*	*	X	X		X	
Fabaceae	*Ornithopus*	*sativus*	*	X				
Fabaceae	*Trifolium*	*arvense* var. *arvense*	*	X				
Fabaceae	*Trifolium*	*campestre*	*	X				X
Fabaceae	*Trifolium*	*repens*	*	X				X
Fabaceae	*Trifolium*	sp.	*	X	X			
Fabaceae	*Trifolium*	*subterraneum*	*		X			X
Fabaceae	*Vicia*	*sativa*	*	X			X	
Fabaceae	*Vicia*	sp.	*		X			
Fabaceae	*Viminaria*	*juncea*		X	X		X	
Geraniaceae	*Erodium*	*botrys*	*		X			
Geraniaceae	*Geranium*	*molle*	*	X				
Goodeniaceae	*Dampiera*	*lindleyi*			X			
Goodeniaceae	*Dampiera*	*linearis*		X		X		
Goodeniaceae	*Dampiera*	*pedunculata*		X				
Goodeniaceae	*Scaevola*	*calliptera*		X				X

Family	*Genus*	*Species*	Status	BORR IPT 2018/2019	GHD 2015	GHD 2014	Biota 2016	Biota 2018
Haemodoraceae	*Anigozanthos*	*manglesii*		X	X			
Haemodoraceae	*Conostylis*	*aculeata*			X	X		
Haemodoraceae	*Conostylis*	*aculeata* ? subsp. *preissii*		X				
Haemodoraceae	*Conostylis*	*aculeata* subsp. *gracilis*			X		X	X
Haemodoraceae	*Conostylis*	*aculeata* subsp. *preissii*		X	X		X	
Haemodoraceae	*Conostylis*	*juncea*		X				
Haemodoraceae	*Conostylis*	sp.		X				
Haemodoraceae	*Haemodorum*	sp.			X			X
Haemodoraceae	*Haemodorum*	*spicatum*		X	X	X		
Haemodoraceae	*Phlebocarya*	*ciliata*		X	X			X
Haemodoraceae	sp.				X			
Hemerocallidaceae	*Agrostocrinum*	*hirsutum*						X
Hemerocallidaceae	*Agrostocrinum*	*scabrum*		X				
Hemerocallidaceae	*Caesia*	*micrantha*			X		X	X
Hemerocallidaceae	*Dianella*	*revoluta*		X		X		X
Hemerocallidaceae	*Stypandra*	*glauca*		X	X			
Hemerocallidaceae	*Tricoryne*	*elatior*		X	X			X
Iridaceae	*Freesia*	*alba x leichtlinii*	*	X	X			
Iridaceae	*Gladiolus*	*caryophyllaceus*	*	X				
Iridaceae	*Ixia*	sp.	*	X				X
Iridaceae	*Moraea*	*flaccida*	* DP	X	X		X	
Iridaceae	*Orthrosanthus*	*laxus* var. *laxus*		X	X		X	X
Iridaceae	*Patersonia*	*occidentalis*		X	X		X	X
Iridaceae	*Patersonia*	*occidentalis* var. *angustifolia*		X				
Iridaceae	*Patersonia*	sp.				X		
Iridaceae	*Romulea*	*rosea*	*	X	X	X	X	
Iridaceae	*Sparaxis*	*bulbifera*	*	X				
Iridaceae	*Watsonia*	*meriana* var. *bulbifera*	*	X				
Juncaceae	*Juncus*	*articulatus*	*	X			X	
Juncaceae	*Juncus*	*bufonius*	*				X	
Juncaceae	*Juncus*	*kraussii*		X				
Juncaceae	*Juncus*	*microcephalus*	*			X		
Juncaceae	*Juncus*	*pallidus*		X	X	X		
Juncaceae	*Juncus*	sp.					X	
Juncaceae	*Juncus*	*subsecundus*			X			
Juncaceae	*Luzula*	*meridionalis*		X				
Juncaginaceae	*Cycnogeton*	*lineare*		X				
Lamiaceae	*Hemiandra*	*pungens*			X			X
Lamiaceae	*Mentha*	*pulegium*	*	X				
Lauraceae	*Cassytha*	*glabella*						X
Lauraceae	*Cassytha*	sp.		X	X	X		

Family	Genus	Species	Status	BORR IPT 2018/2019	GHD 2015	GHD 2014	Biota 2016	Biota 2018
Loganiaceae	*Orianthera*	*serpyllifolia* subsp. *angustifolia*			X			
Loranthaceae	*Nuytsia*	*floribunda*		X	X	X	X	X
Malvaceae	*Lasiopetalum*	*membranaceum*	P3	X				
Menyanthaceae	*Liparophyllum*	*? latifolium*		X				
Menyanthaceae	*Ornduffia*	*albiflora*				X		
Montiaceae	*Calandrinia*	*brevipedata*		X				
Myrtaceae	*Agonis*	*flexuosa*		X	X	X	X	X
Myrtaceae	*Astartea*	*? scoparia*				X		
Myrtaceae	*Astartea*	*scoparia*		X	X			X
Myrtaceae	*Callistemon*	*phoeniceus*	# planted	X	X			
Myrtaceae	*Calothamnus*	*quadrifidus*	# planted		X			
Myrtaceae	*Chamelaucium*	*uncinatum*	# planted	X				
Myrtaceae	*Corymbia*	*calophylla*		X	X	X	X	X
Myrtaceae	*Eucalyptus*	*globulus*	# planted		X			
Myrtaceae	*Eucalyptus*	*gomphocephala*		X	X			X
Myrtaceae	*Eucalyptus*	*marginata* subsp. *marginata*		X	X	X	X	X
Myrtaceae	*Eucalyptus*	*rudis*		X	X	X		X
Myrtaceae	*Eucalyptus*	sp.			X			
Myrtaceae	*Hypocalymma*	*robustum*		X	X		X	X
Myrtaceae	*Hypocalymma*	sp.			X			
Myrtaceae	*Kunzea*	*glabrescens*		X	X	X	X	X
Myrtaceae	*Kunzea*	*micrantha subsp micrantha*			X		X	
Myrtaceae	*Melaleuca*	*? huegelii*			X			
Myrtaceae	*Melaleuca*	*? lateritia*			X			
Myrtaceae	*Melaleuca*	*lanceolata*	# planted	X				
Myrtaceae	*Melaleuca*	*nesophila*	# planted	X				X
Myrtaceae	*Melaleuca*	*preissiana*		X	X	X		X
Myrtaceae	*Melaleuca*	*rhaphiophylla*		X	X			X
Myrtaceae	*Melaleuca*	sp.			X			
Myrtaceae	*Melaleuca*	*teretifolia*			X	X		
Myrtaceae	*Melaleuca*	*thymoides*		X	X	X	X	X
Myrtaceae	*Melaleuca*	*viminea*		X	X			
Myrtaceae	*Melaleuca*	*viminea* subsp. *Viminea*					X	
Myrtaceae	*Pericalymma*	*ellipticum*			X			
Myrtaceae	sp.				X			
Oleaceae	*Olea*	*europaea*	*		X	X		
Orchidaceae	*Caladenia*	*attingens* subsp. *attingens*		X				
Orchidaceae	*Caladenia*	*flava* subsp. *flava*		X	X		X	
Orchidaceae	*Caladenia*	*hirta* subsp. *hirta*			X			
Orchidaceae	*Caladenia*	*latifolia*		X	X			
Orchidaceae	*Caladenia*	sp. (leaf only)		X				

Family	*Genus*	*Species*	Status	BORR IPT 2018/2019	GHD 2015	GHD 2014	Biota 2016	Biota 2018
Orchidaceae	*Caladenia*	*speciosa*	P4		X			
Orchidaceae	*Cryptostylis*	*ovata*		X		X		X
Orchidaceae	*Cyrtostylis*	*huegelii*		X				
Orchidaceae	*Disa*	*bracteata*	*	X	X		X	
Orchidaceae	*Diuris*	*? longifolia*			X			
Orchidaceae	*Diuris*	*corymbosa*			X			
Orchidaceae	*Drakaea*	*livida*		X				
Orchidaceae	*Elythranthera*	*brunonis*		X				
Orchidaceae	*Eriochilus*	*dilatatus* (leaf only)		X				
Orchidaceae	*Lyperanthus*	*serratus*		X				
Orchidaceae	*Microtis*	*media* subsp. *media*		X			X	X
Orchidaceae	*Microtis*	sp. nf tall (45 cm)		X				
Orchidaceae	*Pterostylis*	? *recurva*			X			
Orchidaceae	*Pterostylis*	*erubescens*		X				
Orchidaceae	*Pterostylis*	*aspera*			X			
Orchidaceae	*Pterostylis*	*pyramidalis*		X				
Orchidaceae	*Pterostylis*	*sanguinea*				X		
Orchidaceae	*Pterostylis*	sp. crinkled leaf (G.J. Keighery 13426)		X				
Orchidaceae	*Pterostylis*	sp.		X	X	X		
Orchidaceae	*Pterostylis*	*vittata*		X	X	X		X
Orchidaceae	*Pyrorchis*	*nigricans*		X	X	X	X	X
Orchidaceae	sp.					X		
Orchidaceae	*Thelymitra*	*benthamiana*		X				X
Orchidaceae	*Thelymitra*	*graminea*		X			X	
Orchidaceae	*Thelymitra*	*macrophylla*		X				
Orchidaceae	*Thelymitra*	*paludosa*						X
Orobanchaceae	*Orobanche*	*minor*	*	X	X	X	X	X
Oxalidaceae	*Oxalis*	*pes-caprae*	*	X	X	X		
Oxalidaceae	*Oxalis*	*purpurea*	*		X			
Oxalidaceae	*Oxalis*	sp.			X	X	X	X
Papaveraceae	*Fumaria*	*capreolata*	*	X			X	
Phyllanthaceae	*Poranthera*	*microcephala*		X				
Phytolaccaceae	Phyllanthus	calycinus		X	X			X
Phytolaccaceae	*Phytolacca*	*octandra*	*	X				
Pittosporaceae	*Billardiera*	*variifolia*		X			X	X
Plantaginaceae	*Callitriche*	*stagnalis*	*	X	X			
Plantaginaceae	*Plantago*	*lanceolata*	*	X				
Poaceae	*Anthoxanthum*	*odoratum*	*	X			X	
Poaceae	Austrostipa	campylachne		X				
Poaceae	*Austrostipa*	*flavescens*			X			
Poaceae	*Avena*	*barbata*	*	X			X	X
Poaceae	*Avena*	*fatua*	*	X				
Poaceae	*Briza*	*maxima*	*	X	X	X	X	X

Family	*Genus*	*Species*	Status	BORR IPT 2018/2019	GHD 2015	GHD 2014	Biota 2016	Biota 2018
Poaceae	*Briza*	*minor*	*	X			X	
Poaceae	*Bromus*	*diandrus*	*	X		X	X	X
Poaceae	*Bromus*	*hordeaceus*	*				X	
Poaceae	*Cenchrus*	*clandestinus*	*	X	X			
Poaceae	*Cenchrus*	*longisetus*	*			X		
Poaceae	*Cynodon*	*dactylon*	*	X		X	X	
Poaceae	*Ehrharta*	*calycina*	*	X	X	X	X	X
Poaceae	*Ehrharta*	*longiflora*	*	X	X	X	X	
Poaceae	*Ehrharta*	sp.	*		X			
Poaceae	*Eragrostis*	*curvula*	*		X			
Poaceae	*Holcus*	*lanatus*	*	X				
Poaceae	*Hordeum*	*leporinum*	*	X				
Poaceae	*Hordeum*	*marinum*	*				X	
Poaceae	*Hordeum*	sp.	*		X			
Poaceae	*Lagurus*	*ovatus*	*	X				
Poaceae	*Lolium*	*perenne*	*				X	
Poaceae	*Lolium*	*rigidum*	*	X				
Poaceae	*Microlaena*	*stipoides* var. *stipoides*						X
Poaceae	*Paspalum*	*dilatatum*	*		X			
Poaceae	*Poa*	*annua*	*	X	X			
Poaceae	*Polypogon*	*monspeliensis*	*	X				
Poaceae	*Rytidosperma*	*caespitosum*						X
Poaceae	*Rytidosperma*	*occidentale*					X	X
Poaceae	sp.				X			
Poaceae	*Sporobolus*	*africanus*	*	X				
Poaceae	*Vulpia*	*bromoides*	*				X	
Polygonaceae	*? Rumex*	sp.	*		X			
Polygonaceae	*Polygonum*	*? arenastrum*	*	X				
Polygonaceae	*Rumex*	*acetosella*	*	X				
Polygonaceae	*Rumex*	*brownii*	*	X				
Polygonaceae	*Rumex*	*conglomeratus*	*	X				
Polygonaceae	*Rumex*	*crispus*	*	X				
Polygonaceae	*Rumex*	sp.	*		X			
Primulaceae	*Lysimachia*	*arvensis*	*	X				
Primulaceae	*Lysimachia*	*arvensis*	*		X			X
Proteaceae	*Adenanthos*	*meisneri*			X			
Proteaceae	*Banksia*	*attenuata*		X	X	X	X	X
Proteaceae	*Banksia*	*dallanneyi* var. *dallanneyi*					X	
Proteaceae	*Banksia*	*grandis*		X	X	X		X
Proteaceae	*Banksia*	*ilicifolia*		X	X	X	X	X
Proteaceae	*Calothamnus*	sp.	# planted	X				
Proteaceae	*Hakea*	*ruscifolia*				X		
Proteaceae	*Hakea*	*varia*			X		X	

Family	*Genus*	*Species*	Status	BORR IPT 2018/2019	GHD 2015	GHD 2014	Biota 2016	Biota 2018
Proteaceae	*Persoonia*	*longifolia*		X	X	X		
Proteaceae	*Petrophile*	*? brevifolia*			X			
Proteaceae	*Petrophile*	*linearis*					X	X
Proteaceae	*Petrophile*	*serruriae*				X		
Proteaceae	*Stirlingia*	*latifolia*		X	X	X	X	X
Proteaceae	*Synaphea*	*petiolaris* subsp. *triloba*		X				
Proteaceae	*Synaphea*	*spinulosa* subsp. *spinulosa*		X				
Proteaceae	*Xylomelum*	*occidentale*		X	X	X	X	X
Ranunculaceae	*Ranunculus*	*muricatus*	*	X				
Restionaceae	*Chaetanthus*	*tenellus*		X				
Restionaceae	*Desmocladus*	*fascicularis*		X	X		X	X
Restionaceae	*Desmocladus*	*flexuosa*		X				
Restionaceae	*Hypolaena*	*exsulca*		X	X	X		
Restionaceae	*Leptocarpus*	*decipiens*		X				
Restionaceae	*Leptocarpus*	*kraussii*		X				
Restionaceae	*Leptocarpus*	*laxus*		X				
Restionaceae	*Leptocarpus*	*royceii*		X				
Restionaceae	*Lepyrodia*	*glauca*		X				
Restionaceae	sp.				X	X		
Rhamnaceae	*Spyridium*	*globulosum*		X	X			X
Rubiaceae	*Galium*	*murale*	*	X	X		X	
Rubiaceae	*Opercularia*	*apiciflora*		X			X	X
Rubiaceae	*Opercularia*	*hispidula*		X		X		
Rubiaceae	*Opercularia*	*vaginata*		X	X			
Rutaceae	*Boronia*	*spathulata*		X				
Rutaceae	*Philotheca*	*spicata*		X	X	X		
Solanaceae	*Solanum*	*nigrum*	*	X	X	X		
Stylidiaceae	*Levenhookia*	*pusilla*		X				
Stylidiaceae	*Stylidium*	*? repens*				X		
Stylidiaceae	*Stylidium*	*araeophyllum*						X
Stylidiaceae	*Stylidium*	*brunonianum*		X			X	
Stylidiaceae	*Stylidium*	*calcaratum*		X				X
Stylidiaceae	*Stylidium*	*ciliatum*		X				
Stylidiaceae	*Stylidium*	*repens*					X	
Stylidiaceae	*Stylidium*	*schoenoides*		X			X	
Thymelaeaceae	*Pimelea*	*? rosea* subsp. *rosea*			X			
Thymelaeaceae	*Pimelea*	*rosea* subsp. *rosea*		X				
Typhaceae	*Typha*	*orientalis*				X		
Typhaceae	*Typha*	*orientalis*		X				
Urticaceae	*Parietaria*	*debilis*		X				
Verbenaceae	*Lantana*	*camara*	DP *	X				
Violaceae	*Hybanthus*	*calycinus*			X			X
Violaceae	*Hybanthus*	*floribundus*			X			

Family	*Genus*	*Species*	Status	BORR IPT 2018/2019	GHD 2015	GHD 2014	Biota 2016	Biota 2018
Xanthorrhoeaceae	*Chamaescilla*	*corymbosa*		X				
Xanthorrhoeaceae	*Xanthorrhoea*	*brunonis*		X	X	X	X	X
Xanthorrhoeaceae	*Xanthorrhoea*	*gracilis*		X				
Xanthorrhoeaceae	*Xanthorrhoea*	*preissii*			X			
Zamiaceae	*Macrozamia*	*riedlei*		X	X	X	X	X

Conservation listed species and weed location data

Species	Conservation status/weed ranking	Eastings	Northings	Number of plants
Acacia semitrullata	P4	35420	101317	1
Acacia semitrullata	P4	35391	101205	1
Acacia semitrullata	P4	35788	101255	1
Acacia semitrullata	P4	35892	101187	1
Acacia semitrullata	P4	35892	101168	1
Acacia semitrullata	P4	35333	101347	1
Caladenia speciosa	P4	31440	99048	1
Caladenia speciosa	P4	32060	99458	1
Caladenia speciosa	P4	32293	99511	1
Caladenia speciosa	P4	32162	99510	1
Caladenia speciosa	P4	32488	99535	1
Caladenia speciosa	P4	32502	99559	1
Caladenia speciosa	P4	32523	99558	1
Caladenia speciosa	P4	32545	99582	1
Caladenia speciosa	P4	32560	99588	1
Caladenia speciosa	P4	32581	99545	1
Caladenia speciosa	P4	32543	99567	1
Caladenia speciosa	P4	32501	99559	1
Caladenia speciosa	P4	34200	100374	1
Caladenia speciosa	P4	31474	99269	1
Caladenia speciosa	P4	33570	99955	2
Caladenia speciosa	P4	31460	99363	1
Caladenia speciosa	P4	31348	98997	1
Caladenia speciosa	P4	31303	98785	1
Caladenia speciosa	P4	31362	98947	2
Caladenia speciosa	P4	31377	98981	1
Caladenia speciosa	P4	31505	99379	1
Caladenia speciosa	P4	32178	99467	1
Caladenia speciosa	P4	32594	99569	3
Caladenia speciosa	P4	32533	99565	2

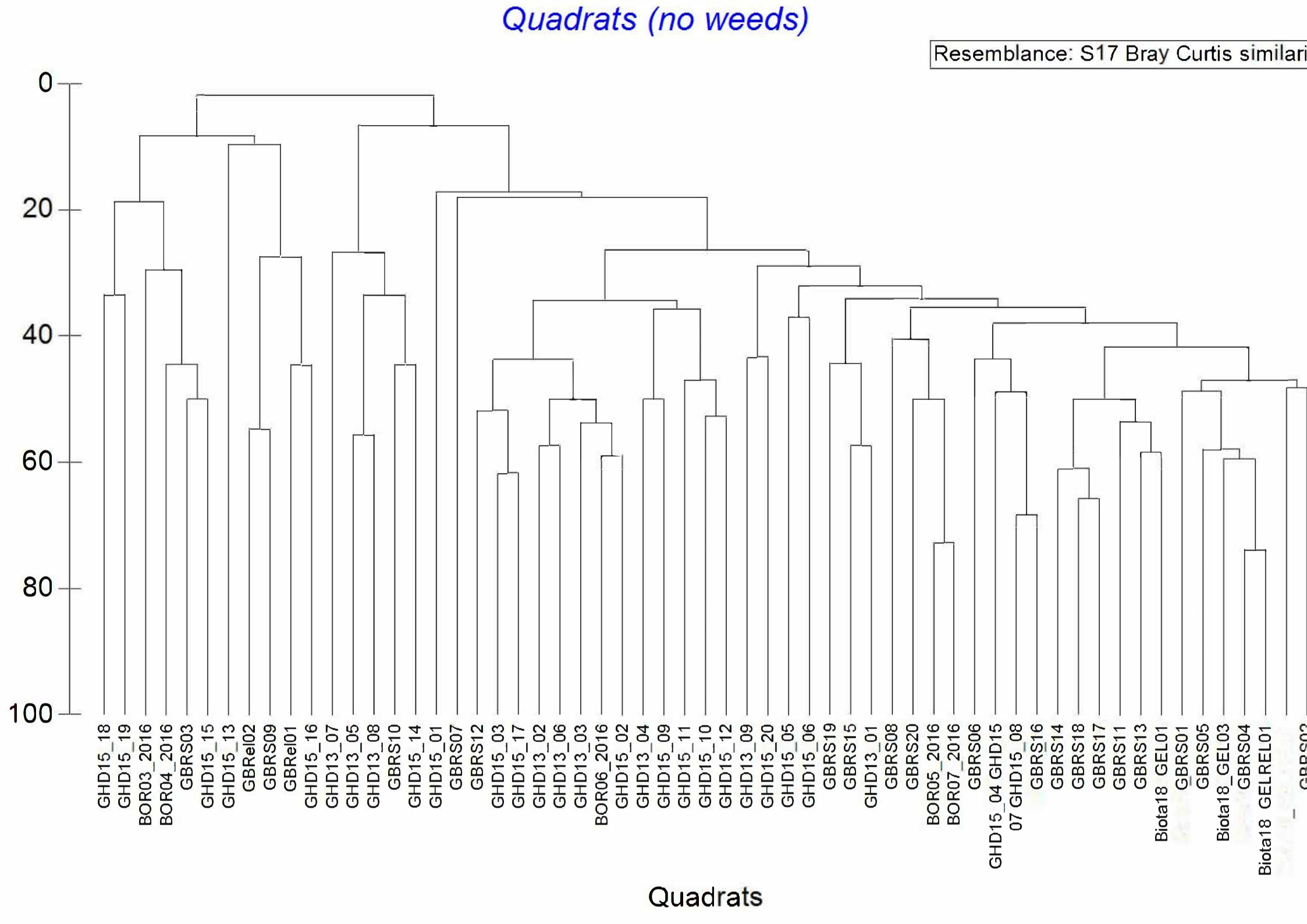
Species	Conservation status/weed ranking	Eastings	Northings	Number of plants
Caladenia speciosa	P4	32529	99569	1
Caladenia speciosa	P4	32528	99578	7
Caladenia speciosa	P4	32360	99490	2
Caladenia speciosa	P4	31336	98877	2
Caladenia speciosa	P4	32172	99471	1
Caladenia speciosa	P4	31494	99205	3
Lasiopetalum membranaceum	P3	34269	104408	1
**Asparagus asparagoides*	Declared Pest and WONS	35316	101656	1
**Asparagus asparagoides*	Declared Pest and WONS	31846	99276	1
**Asparagus asparagoides*	Declared Pest and WONS	33604	104480	25
**Asparagus asparagoides*	Declared Pest and WONS	33604	104480	25
**Asparagus asparagoides*	Declared Pest and WONS	35309	102533	1
**Lantana camara*	Declared Pest and WONS	32985	102205	1
**Moraea flaccida*	Declared Pest	36439	103774	1
**Moraea flaccida*	Declared Pest	36156	103524	1
**Moraea flaccida*	Declared Pest	32107	99559	1
**Moraea flaccida*	Declared Pest	36132	103681	1
**Opuntia stricta*	Declared Pest and WONS	32210	99510	1
**Zantedeschia aethiopica*	Declared Pest	35946	103536	18
**Zantedeschia aethiopica*	Declared Pest	36132	103681	19
**Zantedeschia aethiopica*	Declared Pest	36439	103774	22
**Zantedeschia aethiopica*	Declared Pest	35223	104264	0
**Zantedeschia aethiopica*	Declared Pest	35323	104371	0
**Zantedeschia aethiopica*	Declared Pest	36132	103504	0
**Zantedeschia aethiopica*	Declared Pest	35214	103465	0
**Zantedeschia aethiopica*	Declared Pest	35725	103121	0

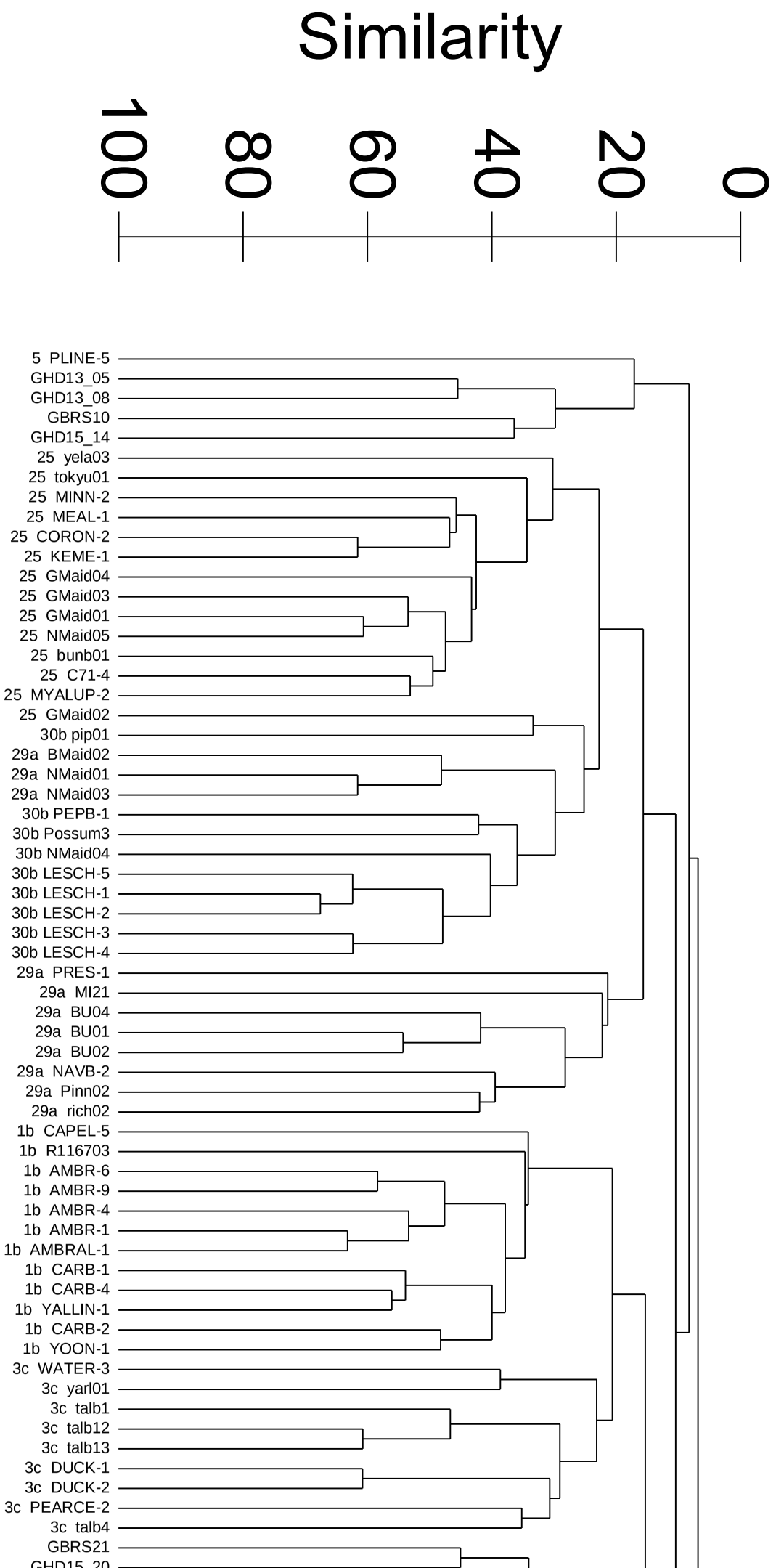
Species	Conservation status/weed ranking	Eastings	Northings	Number of plants
*Zantedeschia aethiopica	Declared Pest	31846	99276	0
*Zantedeschia aethiopica	Declared Pest	31607	99054	0
*Zantedeschia aethiopica	Declared Pest	31521	99001	0
*Zantedeschia aethiopica	Declared Pest	32107	99559	0
*Zantedeschia aethiopica	Declared Pest	35713	103303	50
*Zantedeschia aethiopica	Declared Pest	33775	104469	1
*Zantedeschia aethiopica	Declared Pest	35713	103303	50
*Zantedeschia aethiopica	Declared Pest	33775	104469	1
*Zantedeschia aethiopica	Declared Pest	32014	99368	1
*Zantedeschia aethiopica	Declared Pest	31961	99337	50
*Zantedeschia aethiopica	Declared Pest	31803	99233	1
*Zantedeschia aethiopica	Declared Pest	31943	99344	40

* Denotes introduced species

APPENDIX F

Vegetation Statistics


Quadrats (no weeds)
Resemblance: S17 Bray Curtis similari
0
20
40
60
80
100
GHD15_18
GHD15_19
BOR03_2016
BOR04_2016
GBRS03
GHD15_15
GHD15_13
GBRel02
GBRS09
GBRel01
GHD15_16
GHD13_07
GHD13_05
GHD13_08
GBRS10
GHD15_14
GHD15_01
GBRS07
GBRS12
GHD15_03
GHD15_17
GHD13_02
GHD13_06
GHD13_03
BOR06_2016
GHD15_02
GHD13_04
GHD15_09
GHD15_11
GHD15_10
GHD15_12
GHD13_09
GHD15_20
GHD15_05
GHD15_06
GBRS19
GBRS15
GHD13_01
GBRS08
GBRS20
BOR05_2016
BOR07_2016
GBRS06
GHD15_04 GHD15
07 GHD15_08
GBRS16
GBRS14
GBRS18
GBRS17
GBRS11
GBRS13
Biota18_GEL01
GBRS01
GBRS05
Biota18_GEL03
GBRS04
Biota18_GELREL01
Quadrats

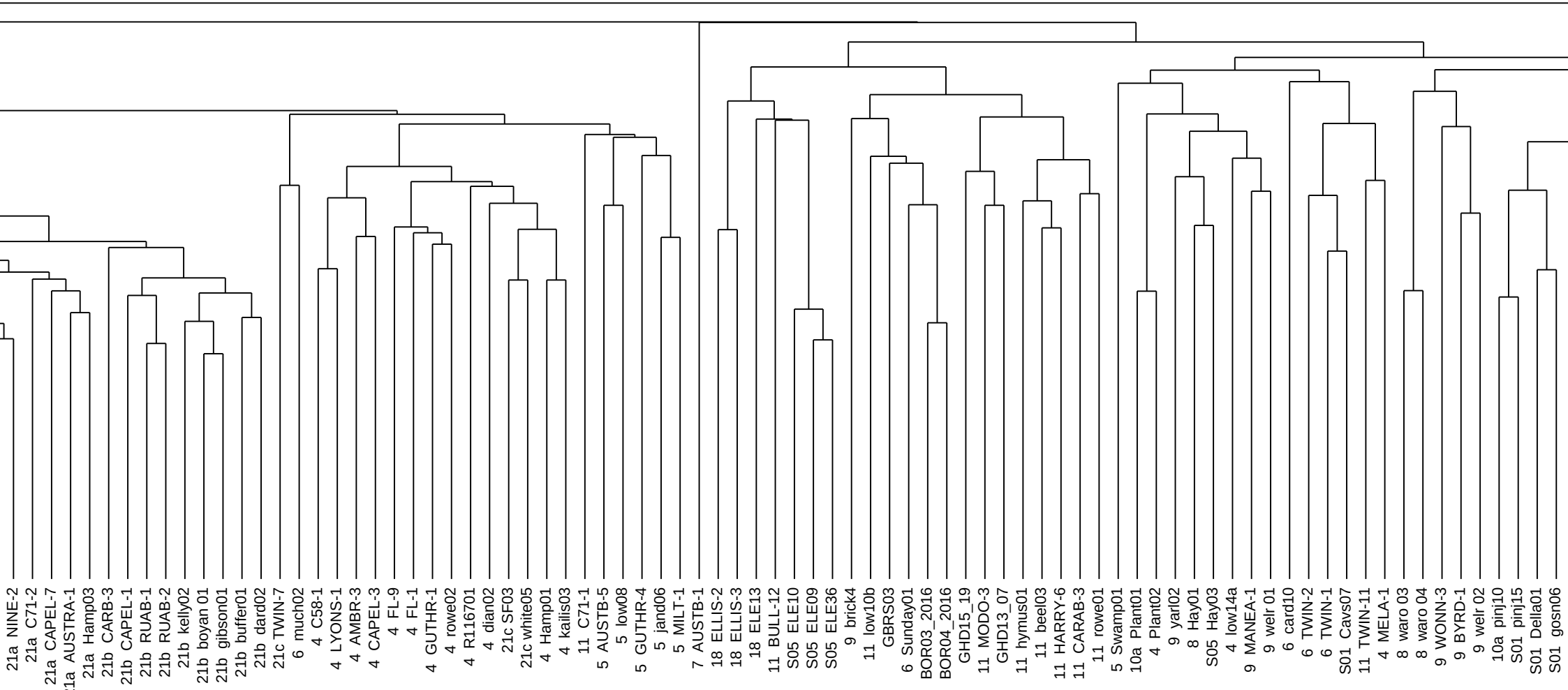

Similarity
100
80
60
40
20
0
5 PLINE-5
GHD13_05
GHD13_08
GBRS10
GHD15_14
25 yela03
25 tokyu01
25 MINN-2
25 MEAL-1
25 CORON-2
25 KEME-1
25 GMaid04
25 GMaid03
25 GMaid01
25 NMaid05
25 bunb01
25 C71-4
25 MYALUP-2
25 GMaid02
30b pip01
29a BMaid02
29a NMaid01
29a NMaid03
30b PEPB-1
30b Possum3
30b NMaid04
30b LESCH-5
30b LESCH-1
30b LESCH-2
30b LESCH-3
30b LESCH-4
29a PRES-1
29a MI21
29a BU04
29a BU01
29a BU02
29a NAVB-2
29a Pinn02
29a rich02
1b CAPEL-5
1b R116703
1b AMBR-6
1b AMBR-9
1b AMBR-4
1b AMBR-1
1b AMBRAL-1
1b CARB-1
1b CARB-4
1b YALLIN-1
1b CARB-2
1b YOON-1
3c WATER-3
3c yarl01
3c talb1
3c talb12
3c talb13
3c DUCK-1
3c DUCK-2
3c PEARCE-2
3c talb4
GBRS21

Group av

3c DUCK-1
3c DUCK-2
3c PEARCE-2
3c talb4
GBRS19
GHD15_20
GHD15_09
GHD15_10
GHD15_12
GHD15_05
GBRS06
GHD15_04
GHD15_06
GHD15_07
GHD15_08
Biota18_GEL01
GBRS14
GBRS18
GBRS15
GBRS11
GBRS13
GBRS16
GBRS17
GBRS20
BOR05_2016
BOR07_2016
Biota18_GELREL01
GBRS02
GBRS01
GBRS05
Biota18_GEL03
GBRS04
GHD15_01
GBRS07
GBRS12
GHD13_01
GHD13_04
GHD15_03
GHD15_17
BOR06_2016
GHD15_02
GHD13_03
GHD13_02
GHD13_06
6 card11
21c FL-6
21c 5C07
21c DEJONG02
21a FL-4
21c raven03
GHD13_09
GBRS08
GHD15_11
21c low07
21c MODO-2
21c PLINE-7
21c BULLER-3
21c KEME-3
21a MGK01
21a MANEA-2
21a Sunday02
25 colriv01
21a CLIFT01
21a KEME-2
21a gelor02
25 gelor01
21a NINE-1
21a BULLER-1
21a MILT-6
21a KOOLJ-2
21c dillo01
21b MANEA-3
21b MGK03
21a RIVD-2
21b R116702
21a REDL-1
21a CORON-1
21a NINE-2
21a C71-2
21a CAPEL-7
21a AUSTRA-1
21a Hamp03

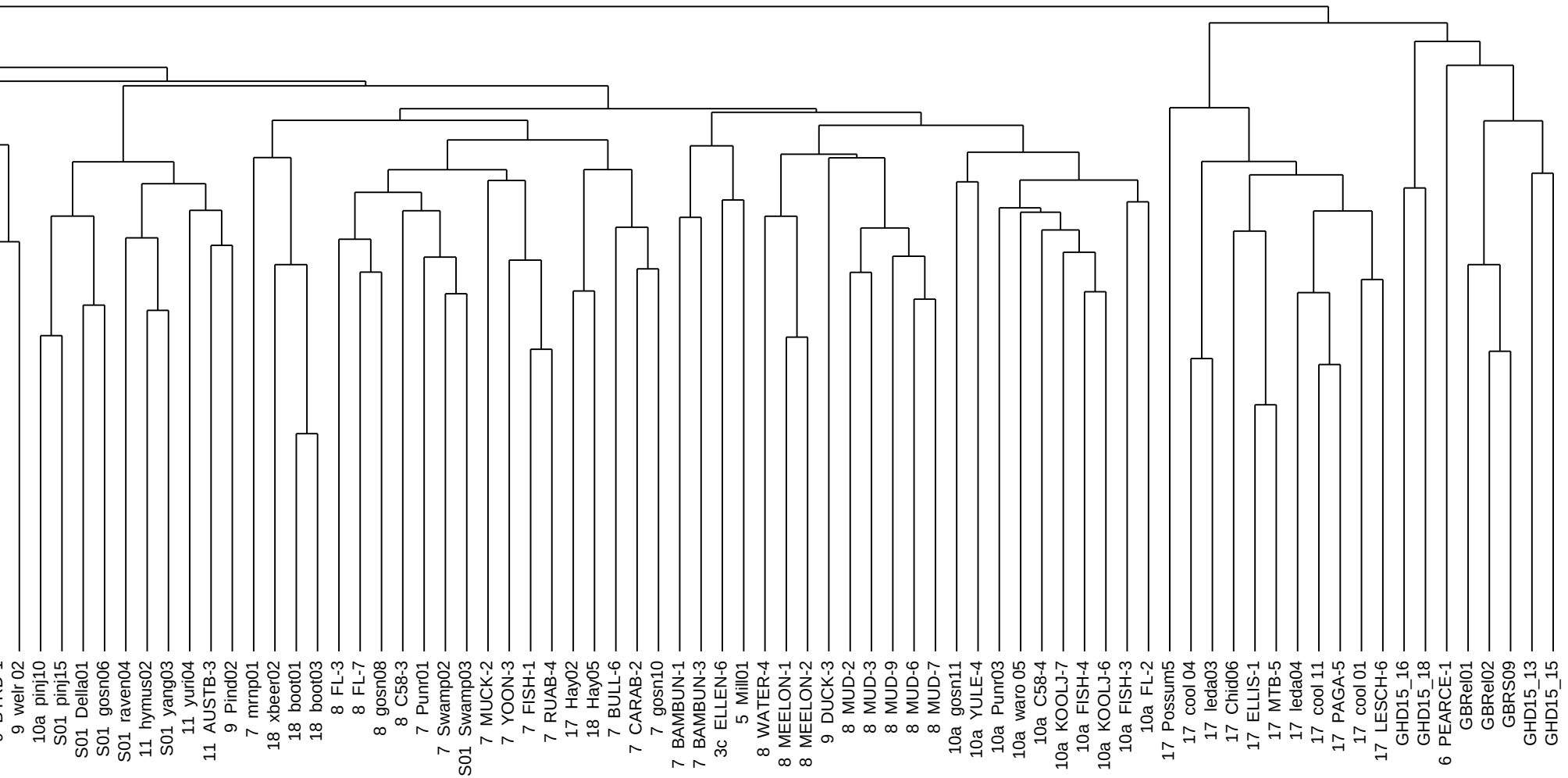
Sa

o average



Samples

Resemblance: S17 Bray Curtis similarity



APPENDIX G

Claypan TEC Assessment

Memorandum

Client:	GHD MRWA BORR team
Attention:	Fionnuala Hannon <Fionnuala.Hannon@ghd.com>
From:	Debbie Brace <debbie@ecoedge.com.au> debbie@ecoedge.com.au 0484 771 825
Date:	19 August 2019
Subject:	Review of Potential Claypan Occurrences in the BORR Southern Section

Background

In July 2019 Ecoedge was requested by the Bunbury Outer Ring Road (BORR) Integrated Planning Team to carry out a desktop review of the BORR Southern Referral Corridor for the location of potential claypan wetlands that could be occurrences of the Commonwealth-listed Threatened Ecological Community (TEC) 'Clay pans of the Swan Coastal Plain'. Any areas of potential claypan wetland would then be visited with Andrew Webb from Department of Conservation and Attractions (DBCA) and a Main Roads WA (MRWA) representative to verify its conservation status.

Methods and Results

Previous vegetation mapping of the BORR Southern Section GHD (2012), recent high quality aerial imagery together with mapping of soil-landscape phases (Schoknecht *et al*., 2004) was used to evaluate potential claypan areas within the BORR Southern Section. Only one potential claypan wetland was identified, situated on privately managed property lots 5 and 160 south of Centenary Road (**Figure 1**). This area had previously been mapped as 'Low open forest of *Melaleuca preissiana* and *Melaleuca viminea* over sedgeland' by GHD (2012) and was situated partly on Pinjarra Plain soil and partly on Bassendean sand.

The site was visited on 1 August 2019 by Ecoedge Botanists (Russell Smith & Colin Spencer), DBCA Senior Botanist (Andrew Webb) and a MRWA representative, Senior Environmental Officer (Freea Itzstein-Davey).

The wetland was found not to be a claypan community, the soil being a sandy-loam at the surface. The vegetation was dominated by *Melaleuca rhaphiophylla* and *M. viminea*, with an open sedgeland of *Lepidosperma longitudinale* over a grassland of *Sporobolus virginicus*. On Lot 160 *Opercularia hispidula* is one of the understorey species (**Figure 2**). With normal winter rains the wetland is inundated to a depth of 0.5-0.7 m.

Conclusion

The wetland visited on Lots 5 and 160 south of Centenary Road was found not to be a clay-based wetland, and therefore is not a potential occurrence of the 'Clay pans of the Swan Coastal Plain' TEC.

References

GHD (2012). Report for Bunbury Outer Ring Road - Southern Section (South Western Highway to Bussell Highway) Environmental Impact Assessment. Report for Main Roads WA.

Schoknecht, N., Tille, P., and Purdie, B. (2004). Soil-landscape mapping in south-western Australia. Resource Management Technical Report 280. Department of Agriculture and Food, 3 Baron-Hay Court, South Perth, Western Australia, 6155.

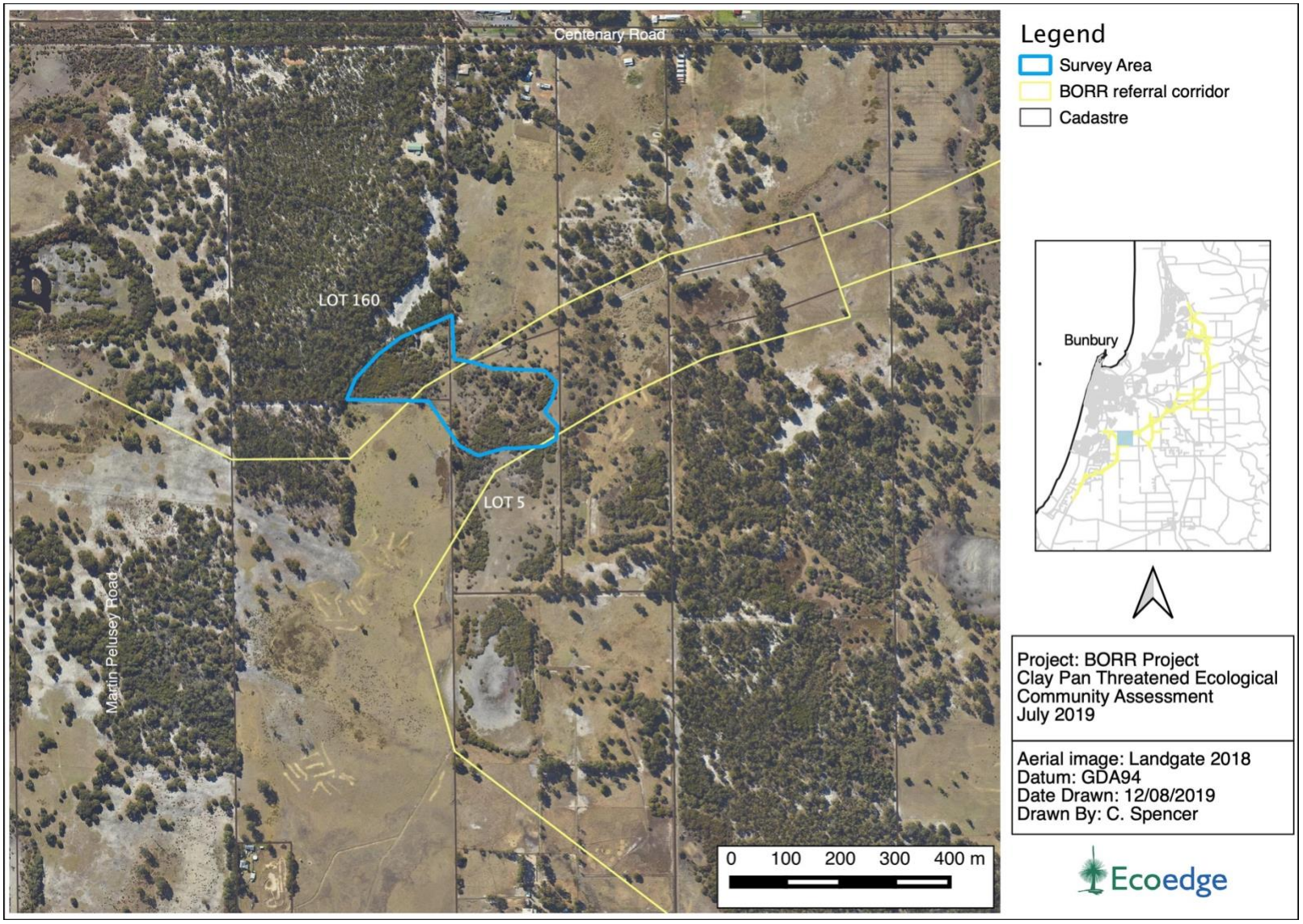


Figure 1. Location of the Survey Area, Lot 160 and Lot 5 with BORR footprint overlay.

Figure 2. Photograph of the wetland where it extends into Lot 160.

APPENDIX H

Tuart TEC/PEC Patch Assessment

Patch 1 Assessment

Site and location	Patch no. and quadrat ID	Survey date	Landform and soils	Vegetation type description	Condition	Approximate no. of Tuart trees in patch	Photographs and list of native understorey species present (<3m)
East of intersection of Bussell Highway and Centenary Road, Jenour property	Patch 1. Tuart Quadrat JENO01, JENO02	8 – 9 October 2019	Yellow sand over limestone ridges / slopes and sandplain	VT1b – Open forest of *Eucalyptus gomphocephala* with occasional *Eucalyptus marginata* over *Agonis flexuosa* and *Banksia attenuata* on yellow sand over limestone. Disturbances include presence of weeds, livestock grazing, previous clearing and edge effects	7.3 ha 3.7 ha Very Good 2.9 ha Good to Degraded 0.008 ha Degraded – Completely Degraded 0.7 ha Completely Degraded	Patch contains numerous mature trees within the patch. There are >200 Tuart trees in the patch over 15 cm DBH.	 JENO01 (20 taxa in total) *Acacia huegelii, Austrostipa flavescens, Caladenia flava, Calandrinia* sp. sterile, *Conostylis aculeata, Corynotheca micrantha, Dichopogon capillipes, Hardenbergia comptoniana, Homalosciadum homalocarpum, Hypolaena exsulca, Kennedia prostrata, Lagenophora huegelii, Lepidosperma squamatum, Lomandra caespitosa, Lomandra micrantha, Microlaena stipoides, Poranthera microphylla, Quinettia urvillei, Trachymene pilosa, Xylomelum occidentale*

JENO02 (18 taxa in total)

Billardiera variifolia, Conostylis aculeata, Corynotheca micrantha, Daucus glochidiatus, Daviesia divaricata, Desmocladus flexuosus, Dianella revoluta, Dichopogon capillipes, Drosera stolonifera, Hardenbergia comptoniana, Hibbertia hypericoides, Jacksonia gracillima/horrida, Lomandra micrantha, Macrozamia riedlei, Sowerbaea laxiflora, Tetraria octandra, Xanthorrhoea brunonis, Xylomelum occidentale

Structural form and size (DBH) of Tuarts	Percentage cover (%) of native understorey species	Size of patch (ha) within and outside survey area	Landscape, habitat and regeneration evidence	Weed cover (%) and dominant weed species	Outcome of patch assessment
Occurs as an open forest. Other tree species include *Agonis flexuosa* and *Eucalyptus marginata.* Tuart tree DBH ranges from 15 to > 150 cm DBH.	Cover of native species ranges from 5 – 20 % cover	The patch extends outside the survey area. The patch extends to the north and south of the survey area. Patch size within the survey area is 7.3 ha. Patch size outside of the survey area is approximately 25 ha. Total is 32.3 ha.	Provides a landscape function of being within 100 m of another patch of native vegetation. Evidence of a large number of smaller trees at 15 cm DBH that have recruited from a previous disturbance event	Weed cover ranges from 5 – 50 %. Weed species include: *Hypochaeris glabra, Trifolium campestre, Romulea rosea, Briza maxima, Ehrharta calycina, Ehrharta longiflora, Galium murale, Lagurus ovatus, Lysimachia arvensis, Oxalis pes-caprae, Ursinia anthemoides*	Meets the key diagnostic characteristics of the Tuart (*Eucalyptus gomphocephala*) woodland and forests of the SCP TEC as the patch is > 5 ha and therefore there is no condition thresholds required to be met. The Tuart quadrats assessed had between 18-20 native species (< 3 m) in the understorey which is classed as Very High Tuart condition. Patch 1 represents Tuart (*Eucalyptus gomphocephala*) woodland and forests of the SCP TEC/PEC. Patch 1 represents Southern SCP *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT25) PEC.

Patch 2 Assessment

Site and location	Patch no. and quadrat ID	Survey date	Landform and soils	Vegetation type description	Condition	Approximate no. of Tuart trees in patch	Photograph and list of native understorey species present (<3m)
North west of intersection of Bussell Highway and Centenary Road	Patch 2. Tuart Quadrat Tuart01	9 October 2019	Light grey sand on sandplain	VT1b – Open forest of *Eucalyptus gomphocephala* with occasional *Eucalyptus marginata* over *Agonis flexuosa* and *Banksia attenuata*. Disturbances include presence of low level weeds and previous ground disturbance	0.10 ha 0.10 ha Degraded – Completely Degraded	Patch contains 10 mature Tuart trees within the patch.	 Tuart01 (11 taxa in total, 7 species in total classed as understorey <3 m) *Acacia saligna, Kunzea grabrescens, Corymbia calophylla^, Hardenbergia comptoniana, Agonis flexuosa^, Crassula colorata* var. *colorata, Banksia grandis^, Patersonia occidentalis, Gastrolobium* sp., *Acacia pulchella, Melaleuca rhaphiophylla^.* ^Overstorey species that are juvenile and under <3 m, however, are not classed as understorey species.

Structural form and size (DBH) of Tuarts	Percentage cover (%) of native understorey species	Size of patch (ha) within and outside survey area	Landscape, habitat and regeneration evidence	Weed cover (%) and dominant weed species	Field notes	Outcome of patch assessment
Occurs as an open forest. Other tree species include *Eucalyptus rudis*, *Corymbia calophylla* and *Melaleuca preissiana.* Tuart tree DBH > 50 cm DBH.	Cover of native species ranges from 2 – 15 % cover	The patch extends outside the survey area. The patch extends to the north west of the survey area. Patch size within the survey area is 0.10 ha. Patch size outside of the survey area is approximately 0.42 ha. Total is 0.52 ha.	Provides a landscape function of being within 100 m of another patch of native vegetation and provides habitat.	Weed cover < 2 %. Weed species include: *Hypochaeris glabra, Ehrharta longiflora, Oxalis pes-caprae, Sonchus oleraceus*	Patch 2 has successful revegetation in the ground layer and is maintained with mulch and good weed control. Revegetated sites that meet the key diagnostics and minimum condition thresholds are considered part of the Tuart TEC.	Does not meet the key diagnostic characteristics of the Tuart (*Eucalyptus gomphocephala*) woodland and forests of the SCP TEC as the patch is between 0.5 – 2 ha (0.52 ha) therefore it must have at least eight native understorey species per 0.01 ha (10 x 10 m). The Tuart01 quadrat has seven native understorey species (10 x 10 m). These species have mostly been planted. Patch 2 does not represent Tuart (*Eucalyptus gomphocephala*) woodland and forests of the SCP TEC/PEC. Patch 2 represents Southern SCP *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT25) PEC.

BORR Team

Patch 3 Assessment

Site and location	Patch no. and quadrat ID	Survey date	Landform and soils	Vegetation type description	Condition	Approximate no. of Tuart trees in patch	Photographs and list of native understorey species present (<3m)
North of Woods Road, Gelorup	Patch 3. Tuart Quadrat Tuart02	9 October 2019	Light grey sand on slight undulating sandplain	VT9a – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala*. The patch is parkland cleared with a weed understorey and heavily grazed by kangaroos.	0.37 ha 0.13 ha Degraded 0.24 ha Degraded – Completely Degraded	Patch contains 4 mature Tuart trees within the patch.	 Tuart02 (2 taxa in total) *Hibbertia cuneata, Crassula colorata* var. *colorata.*
Structural form and size (DBH) of Tuarts	**Percentage cover (%) of native understorey species**	**Size of patch (ha) within and outside survey area**	**Landscape, habitat and regeneration evidence**	**Weed cover (%) and dominant weed species**	**Field notes**		**Outcome of patch assessment**
Occurs as an open forest dominated by *Eucalyptus marginata,*	Cover of native species 0.1 % cover.	The patch extends outside the survey area. The patch extends to the	Provides a landscape function of being within 100 m of	Weed cover < 2 %. Weed species include: *Hypochaeris glabra, Ehrharta*	Patch 3 contains a 'Vintage tuart' tree. The 'Vintage' Tuart tree represents an example of an old-growth specimen.		Does not meet the key diagnostic characteristics of the Tuart (*Eucalyptus gomphocephala*) woodland and forests of the SCP TEC/PEC as the patch is less than 0.5 ha therefore does not meet the

Cormbia calophylla and Agonis flexuosa. Tuart trees up to DBH > 350 cm.		south of the survey area. Patch size within the survey area is 0.37 ha. Patch size outside of the survey area is approximately 0.1 ha. Total is 0.46 ha.	another patch of native vegetation and provides habitat.	*longiflora, Oxalis pes-caprae, Sonchus oleraceus*		minimum patch size. The patch is predominately parkland cleared. Does not meet Southern SCP *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT25) PEC due to VT9a being dominated by Jarrah (*E. marginata*) and Marri (*C. calophylla*) and not dominated by Tuart trees across the vegetation type extent.

APPENDIX I

Flora Likelihood of Occurrence Assessment

Flora likelihood of occurrence assessment guidelines

Likelihood of occurrence	Guideline
Known	Species recorded within survey area from current and historical field survey results.
Likely	Species previously recorded within 5 km and large areas of suitable habitat occur in the survey area.
Possible	Species previously recorded within 5 km and areas of suitable habitat occur/may occur in the survey area.
Unlikely	Species previously recorded within 5 km, but suitable habitat does not occur in the survey area.
Highly unlikely	Species not previously recorded within 5 km, suitable habitat does not occur in the survey area and/or the survey area is outside the natural distribution of the species.
Other considerations	Intensity of survey, availability of access, growth form type, recorded flowering times, cryptic nature of species

Source information - desktop searches

PMST – DotEE Protected Matters Search Tool (PMST) to identify flora listed under the EPBC Act potentially occurring within the study area
TPFL and WAHERB – records of threatened flora from TPFL and WAHERB database searches within the study area
NM – DBCA *NatureMap* (accessed January 2019)
Species Profile and Threats Database (SPRAT) - DotEE (2019b)

Flora likelihood of Occurrence Assessment

FAMILY	TAXON	STATUS		DESCRIPTION AND CLOSEST RECORD INFORMATION (IF AVAILABLE) (WA HERBARIUM 1998-, DBCA 2018, SPRAT DATABASE (DOTEE 2019B))	LIKELIHOOD OF OCCURRENCE	SOURCE
		BC Act	EPBC Act			
Apiaceae	*Brachyscias verecundus*	T	CE	Annual (or ephemeral), herb, 0.012-0.022 m high, entirely glabrous. Fl. white/cream. In a moss sward. On a granite outcrop.	Unlikely – this species has not been recorded within 5 km of the survey area and suitable habitat is considered unlikely to be present within the survey area.	PMST
Apiaceae	*Platysace ramosissima*	P3	-	Perennial, herb, to 0.3 m high. Fl. white-cream, Oct to Nov. Sandy soils. Closest record is 2.53 km north.	Unlikely – this species has been recorded within 5 km of the survey area and suitable habitat is considered likely to be present. Suitable search effort did not record the species.	NatureMap, WA Herb, TPFL
Aponogetonaceae	*Aponogeton hexatepalus*	P4	-	Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green-white, Jul to Oct. Mud. Freshwater: ponds, rivers, claypans. Closest record is 2.29 km north	Unlikely – this species has been recorded within 5 km of the survey area and suitable habitat is considered likely to be present. Suitable search effort did not record the species.	NatureMap, WA Herb, TPFL
Asteraceae	*Angianthus drummondii*	P3	-	Erect annual, herb, to 0.1 m high. Fl. yellow, Oct to Dec. Grey or brown clay soils, ironstone. Seasonally wet flats. Closest record is 1.11 km south.	Possible – species occurs within 5 km of survey area and degraded habitat occurs within survey area. Suitable search effort did not record the species.	NatureMap, WA Herb
Asteraceae	*Blennospora doliiformis*	P3	-	Erect annual, herb, to 0.15 m high. Fl. yellow, Oct to Nov. Grey or red clay soils over ironstone. Seasonally-wet flats. Recorded within 500 m of survey area	Possible – species is also know from claypan wetlands in Manea Park. Similar habitat occurs within survey	DBCA Flora Officer, Ecoedge (2019b)

FAMILY	TAXON	STATUS		DESCRIPTION AND CLOSEST RECORD INFORMATION (IF AVAILABLE) (WA HERBARIUM 1998-, DBCA 2018, SPRAT DATABASE (DOTEE 2019B))	LIKELIHOOD OF OCCURRENCE	SOURCE
		BC Act	EPBC Act			
				(Ecoedge 2019b) in a claypan wetland that is in very good condition.	area, however, suitable search effort did not record the species.	
Cyperaceae	*Carex tereticaulis*	P3	-	Monoecious, rhizomatous, tufted perennial, grass-like or herb (sedge), 0.7 m high. Fl. brown, Sep to Oct. Black peaty sand. Closest record is 4.57 km north east.	Unlikely – this species has been recorded within 5 km of the survey area and suitable habitat is considered likely to be present. Suitable search effort did not record the species.	NatureMap, WA Herb, TPFL
Cyperaceae	*Eleocharis keigheryi*	T	V	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. green, Aug to Nov. Clay, sandy loam. Emergent in freshwater: creeks, claypans. Closest record is 6.03 km south east.	Unlikely – this species has been recorded within 5 km of the survey area. Suitable search effort did not record the species in restricted claypan habitat within the survey area.	PMST, Naturemap, WA Herb
Cyperaceae	*Schoenus benthamii*	P3	-	Tufted perennial, grass-like or herb (sedge), 0.15-0.45 m high. Fl. brown, Oct to Nov. White, grey sand, sandy clay. Winter-wet flats, swamps. Closest record is 0.82 km west.	Possible – suitable habitat present and has been previously recorded within 1 km of the survey area.	NatureMap, WA Herb, TPFL
Cyperaceae	*Schoenus capillifolius*	P3	-	Semi-aquatic tufted annual, grass-like or herb (sedge), 0.05 m high. Fl. green, Oct to Nov. Brown mud. Claypans. Closest record is 9.46 km north east.	Unlikely – this species has been recorded within 10 km of the survey area. Suitable search effort did not record the species.	NatureMap, WA Herb
Cyperaceae	*Schoenus loliaceus*	P2	-	Annual, grass-like or herb (sedge), 0.03-0.06 m high. Fl. Aug to Nov. Sandy soils.	Possible – this species occurs within 1.22 km of survey area and habitat	NatureMap, WA Herb

FAMILY	TAXON	STATUS		DESCRIPTION AND CLOSEST RECORD INFORMATION (IF AVAILABLE) (WA HERBARIUM 1998-, DBCA 2018, SPRAT DATABASE (DOTEE 2019B))	LIKELIHOOD OF OCCURRENCE	SOURCE
		BC Act	EPBC Act			
				Winter-wet depressions. Closest record is 1.22 km north east.	occurs within the survey area. Suitable search effort did not record the species.	
Cyperaceae	*Schoenus natans*	P4	-	Aquatic annual, grass-like or herb (sedge), 0.3 m high. Fl. brown, Oct. Winter-wet depressions.	Possible – this species is known from claypans in Manea Park and identified by DBCA Flora Officer as potentially occurring. Suitable search effort did not record the species.	DBCA Flora Officer
Ericaceae	*Andersonia gracilis*	T	E	Slender erect or open straggly shrub, 0.1-0.5 m high. Flowers white-pink/purple from September to November. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Unlikely – this species has not been recorded within 5 km of the survey area and is known from a restricted area.	PMST
Ericaceae	*Leucopogon* sp. Busselton (D. Cooper 243)	P2	-	Erect shrub to 0.7 m, Fl white. Closest record is 2.05 km east.	Unlikely – this species occurs within 5 km of survey area with most records south of Capel. Suitable search effort did not record the species.	NatureMap, WA Herb
Fabaceae	*Acacia flagelliformis*	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. Closest record is 0.42 km north.	Unlikely – this species occurs within 0.42 km of survey area in a protected area with no livestock grazing. Habitat occurs within the survey area, however, subject to livestock grazing. Suitable search effort did not record the species.	NatureMap, WA Herb, TPFL

FAMILY	TAXON	STATUS		DESCRIPTION AND CLOSEST RECORD INFORMATION (IF AVAILABLE) (WA HERBARIUM 1998-, DBCA 2018, SPRAT DATABASE (DOTEE 2019B))	LIKELIHOOD OF OCCURRENCE	SOURCE
		BC Act	EPBC Act			
Fabaceae	*Acacia semitrullata*	P4	-	Slender, erect, pungent shrub, (0.1-) 0.2-0.7(-1.5) m high. Fl. cream-white, May to Oct. White/grey sand, sometimes over laterite, clay. Sandplains, swampy areas. Closest record is 2.06 km east.	Recorded – recorded from six locations within the survey area.	NatureMap, WA Herb, TPFL
Fabaceae	*Jacksonia gracillima*	P3	-	Prostrate,spreading or scrambling, shrub, spindly shrub (broom-like). Damplands. Closest record is 7.23 km south east.	Unlikely. this species has not been recorded within 5 km of the survey area. Suitable search effort did not record the species.	NatureMap, WA Herb, TPFL
Fabaceae	*Gastrolobium papilio*	T	E	Tangled, clumped shrub, to 1.5 m high. Fl. cream-red, Oct to Dec. Sandy clay over ironstone and laterite. Flat plains.	Unlikely – this species has not been recorded within 5 km of the survey area. Suitable search effort did not record the species.	PMST
Fabaceae	*Gastrolobium whicherense*	P2	-	Slender, open shrub, to 1.6 m high. Fl. orange/yellow/red, Oct. Red-grey sandy clay over quartzite. Steep westerly slopes. Closest record is 5.72 km east.	Highly Unlikely – this species occurs within 5 km of survey area. No suitable habitat is present.	NatureMap
Fabaceae	*Pultenaea skinneri*	P4	-	Slender shrub, 1-2 m high. Fl. yellow/orange & red, Jul to Sep. Sandy or clayey soils. Winter-wet depressions. Closest record is 0.68 km north.	Unlikely – this species occurs within 1 km of survey area and grazed habitat occurs within the survey area. Suitable search effort did not record the species.	NatureMap, WA Herb, TPFL
Hydatellaceae	*Trithuria australis*	P4	-	Aquatic herb	Unlikely – this species has been recorded within 5 km of the survey area. Suitable search effort did not record the species.	NatureMap

FAMILY	TAXON	STATUS		DESCRIPTION AND CLOSEST RECORD INFORMATION (IF AVAILABLE) (WA HERBARIUM 1998-, DBCA 2018, SPRAT DATABASE (DOTEE 2019B))	LIKELIHOOD OF OCCURRENCE	SOURCE
		BC Act	EPBC Act			
Loganiaceae	*Adelphacme minima*	P3	-	Annual 10 -20 cm tall. Fl. White. Records mostly from the South Coast (Walpole) near swamps. Closest record is 2.57 km south east.	Unlikely – known to occur within 5 km of the survey area however generally restricted to the South Coast.	NatureMap, WA Herb
Malvaceae	*Lasiopetalum membranaceum*	P3	-	Multi-stemmed shrub, 0.2-1 m high. Fl. pink-blue-purple, Sep to Dec. Sand over limestone. Closest record is 0.23 km south.	Recorded. One individual was recorded from the survey area in the northern section.	NatureMap, WA Herb, TPFL
Menyanthaceae	*Ornduffia submersa*	P4	-	Small waterlily-like plant with hairy white flowers and oval, glossy leaves that float flat on the surface of the shallow water. Closest record is 2.68 km south.	Unlikely – this species occurs within 5 km of survey area. Suitable search effort did not record the species in specific preferred habitat.	NatureMap, TPFL
Myrtaceae	*Chamelaucium* sp. S coastal plain (R.D. Royce 4872)	T	V	Intricately branched, spreading shrub up to 1.2 and 0.6 m across. Greenish-white flowers. Swamp margins in winter-wet sandy clay sites.	Unlikely – this species has not been recorded within 5 km of the survey area. Suitable search effort did not record the species.	PMST
Myrtaceae	*Chamelaucium* sp. Yoongarillup (G.J. Keighery 3635)	P4	-	Erect shrub up to 1 m. Fl. Red flower. Nov – Feb. Sand, sandy loams and clayey sands on slopes and flats. Closest record is 7.4 km east.	Unlikely – this species has not been recorded within 5 km of the survey area. Suitable search effort did not record the species.	NatureMap, WA Herb
Myrtaceae	*Eucalyptus rudis* subsp. *cratyantha*	P4	-	Tree, 5-20 m high, bark rough, box-type. Fl. white, Jul to Sep. Loam. Flats, hillsides. Closest record is 4.22 km north.	Possible – this species occurs within 5 km of survey area and habitat occurs within the survey area.	Naturemap, WA Herb

FAMILY	TAXON	STATUS		DESCRIPTION AND CLOSEST RECORD INFORMATION (IF AVAILABLE) (WA HERBARIUM 1998-, DBCA 2018, SPRAT DATABASE (DOTEE 2019B))	LIKELIHOOD OF OCCURRENCE	SOURCE
		BC Act	EPBC Act			
Myrtaceae	*Verticordia attenuata*	P3	-	Shrub, 0.4-1 m high. Fl. pink, Dec or Jan to May. White or grey sand. Winter-wet depressions.	Possible – this species occurs within 5 km of survey area and habitat occurs within the survey area.	NatureMap, WA Herb, TPFL
Myrtaceae	*Verticordia densiflora* var. *pedunculata*	T	E	Erect to spreading shrub, 0.3-0.6 m high. Fl. pink/pink-white, Dec or Jan. Grey/yellow sand, sandy loam. Winter-wet low-lying areas.	Unlikely – this species has not been recorded within 5 km of the survey area. Suitable search effort did not record the species.	PMST
Orchidaceae	*Caladenia huegelii*	T	E	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey or brown sand, clay loam. Closest record is 0.73 km east.	Unlikely – this species occurs within 1 km of survey area in protected habitat. Habitat occurs within the survey area. Suitable search effort did not record the species.	PMST, NatureMap, WA Herb, TPFL
Orchidaceae	*Caladenia speciosa*	P4	-	Tuberous, perennial, herb, 0.35-0.6 m high. Fl. white-pink, Sep to Oct. White, grey or black sand.	Recorded – this species was recorded from 30 locations within the survey area.	NatureMap, WA Herb, TPFL
Orchidaceae	*Diuris drummondii*	T	V	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow, Nov to Dec or Jan. Low-lying depressions, swamps. Closest record is 1.14 km south.	Unlikely – habitat occurs in the survey area, however, targeted surveys (2017 and 219) did not identify this species and suitable habitat was highly disturbed with high impacts from grazing. Suitable search effort did not record the species.	PMST, Naturemap, WA Herb, TPFL
Orchidaceae	*Diuris micrantha*	T	V	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct.	Unlikely – this species has been recorded within 5 km of the survey	PMST, TPFL

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		BC Act	EPBC Act			
				Brown loamy clay. Winter-wet swamps, in shallow water. Closest record 22.9 km north east.	area. Survey undertaken during optimal time. Suitable search effort did not record the species.	
Orchidaceae	*Diuris purdiei*	T	E	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct. Grey black sand, moist. Winter-wet swamps.	Unlikely – this species has not been previously recorded within 5 km of the survey area. Suitable search effort did not record the species.	PMST
Orchidaceae	*Drakaea elastica*	T	E	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red & green & yellow, Oct to Nov. White or grey sand. Low-lying situations adjoining winter-wet swamps. Closest record is 7.49 km south east.	Unlikely – this species has not been recorded within 5 km of the survey area. Survey sundertaken during optimal time. Suitable search effort did not record the species.	PMST, Naturemap, TPFL
Orchidaceae	*Drakaea micrantha*	T	V	Tuberous, perennial, herb, 0.15-0.3 m high. Fl. red & yellow, Sep to Oct. White-grey sand. Closest record is 5.07 km east.	Unlikely – this species has not been recorded within 5 km of the survey area. Survey sundertaken during optimal time. Suitable search effort did not record the species.	PMST, NatureMap
Orchidaceae	*Thelymitra variegata*	P2	-	Tuberous, perennial, herb, 0.1-0.35 m high. Fl. orange & red & purple & pink, Jun to Sep. Sandy clay, sand, laterite.	Unlikely – this species has not been recorded within 5 km of the survey area. Survey sundertaken during optimal time. Suitable search effort did not record the species.	NatureMap

FAMILY	TAXON	STATUS		DESCRIPTION AND CLOSEST RECORD INFORMATION (IF AVAILABLE) (WA HERBARIUM 1998-, DBCA 2018, SPRAT DATABASE (DOTEE 2019B))	LIKELIHOOD OF OCCURRENCE	SOURCE
		BC Act	EPBC Act			
Poaceae	*Austrostipa bronwenae*	T	E	Perennial grass, 0.6 m high x 0.3 m wide. Flowers green. Sept to October. Closest record 2.73 km north.	Unlikely – previous records in *Melaleuca* swamps. The closest recorded occurrence is approx. 2.73 km from the survey area in protected habitat. Suitable search effort did not record the species.	PMST, NatureMap
Poaceae	*Austrostipa jacobsiana*	T	CE	Tufted rhizomatous herb, to 1.2 m, leaf sheaths hairy. Marri woodland, Melaleuca tall shrubland. Closest record is 1.06 km north.	Unlikely – previous records in *Melaleuca* swamps. The closest recorded occurrence is approx. 1.06 km from the survey area in protected habitat. Suitable search effort did not record the species.	PMST, NatureMap
Poaceae	*Puccinellia vaccica*	P1	1	Caespitose annual or perennial, grass-like or herb, 0.41-0.55 m high. Saline soils. On the outer margins of coastal saltmarshes. Closest record is 6.68 km north.	Unlikely. Suitable habitat does not occur in the survey area and suitable search effort did not record the species.	Naturemap, WA Herb
Proteaceae	*Banksia nivea* subsp. *uliginosa*	T	E	Dense, erect, non-lignotuberous shrub, 0.2-1.5 m high. Fl. yellow-brown, Aug to Sep. Sandy clay, gravel.	Highly Unlikely – this species has not been recorded within 5 km of the survey area and has a limited distribution, near Busselton and Augusta. This Banksia grows in areas of ironstone (not present in survey area).	PMST
Proteaceae	*Banksia squarrosa*	T	V	Erect, open, non-lignotuberous shrub, 1.2-4 m high. Fl. yellow, Jun to Nov.	Highly Unlikely – this species has not been recorded within 5 km of the	PMST

FAMILY	TAXON	STATUS		DESCRIPTION AND CLOSEST RECORD INFORMATION (IF AVAILABLE) (WA HERBARIUM 1998-, DBCA 2018, SPRAT DATABASE (DOTEE 2019B))	LIKELIHOOD OF OCCURRENCE	SOURCE
		BC Act	EPBC Act			
	subsp. *argillacea*			White/grey sand, gravelly clay or loam. Winter-wet flats, clay flats.	project area, has a limited distribution, near Busselton. Surveys were conducted during flowering times and this species was not seen.	
Proteaceae	*Franklandia triaristata*	P4	-	Erect, lignotuberous shrub, 0.2-1 m high. Fl. white-cream-yellow/brown-purple, Aug to Oct. White or grey sand. Closest record is 1.8 km south east.	Unlikely – this species occurs within 2 km of survey area and habitat occurs within the survey area. Suitable search effort did not record the species.	Naturemap, WA Herb
Proteaceae	*Isopogon formosus* subsp. *dasylepis*			Low, bushy or slender, upright, non-lignotuberous shrub, 0.2-2 m high. Fl. pink-purple/red, Jun to Dec. Sand, sandy clay, gravelly sandy soils over laterite. Often swampy areas. Closest record is 7.3 km south.	Unlikely – this species has not been recorded within 5 km of the survey area. Suitable search effort did not record the species.	Naturemap, WA Herb
Proteaceae	*Lambertia echinata* subsp. *occidentalis*	T	E	Prickly, much-branched, non-lignotuberous shrub, to 3 m high. Fl. yellow, Feb or Apr or Dec. White sandy soils over laterite, orange/brown-red clay over ironstone. Flats to foothills, winter-wet sites.	Unlikely – this species has not been recorded within 5 km of the survey area. Suitable search effort did not record the species.	PMST
Proteaceae	*Petrophile latericola*	T	E	Multi-stemmed shrub, 0.4-1.5 m high. Fl. yellow, Nov. Red lateritic clay. Winter-wet flats.	Highly Unlikely – species has not been recorded within 5 km of the survey area and has a very limited distribution. Suitable habitat is considered unlikely to be present within the survey area.	PMST

FAMILY	TAXON	STATUS		DESCRIPTION AND CLOSEST RECORD INFORMATION (IF AVAILABLE) (WA HERBARIUM 1998-, DBCA 2018, SPRAT DATABASE (DOTEE 2019B))	LIKELIHOOD OF OCCURRENCE	SOURCE
		BC Act	EPBC Act			
Proteaceae	*Synaphea hians*	P3	-	Prostrate or decumbent shrub, 0.15-0.6 m high, to 1 m wide. Fl. yellow, Jul or Sep to Nov. Sandy soils. Rises.	Unlikley – this species occurs within 5 km of survey area and habitat occurs within the survey area. Suitable search effort did not record the species.	NatureMap
Proteaceae	*Synaphea* sp. Fairbridge Farm (D. Papenfus 696)	T	CE	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Fl. yellow, Oct. Clay soils. Near winter-wet flats, in low woodland *Corymbia calophylla* woodland with *Viminaria juncea.* Closest record is 12.4 km east.	Unlikely – this species has not been recorded within 12.4 km of the survey area and no suitable habitat exists. Suitable search effort did not record the species.	PMST
Proteaceae	*Synaphea* sp. Serpentine (G.R. Brand 103)	T	CE	Flowers from late August to November and fruits have been seen in December, occurs predominantly on flat terrain on grey-brown sandy loams to clay in seasonally wet areas. Closest record is 6.03 km south east.	Unlikely – this species has not been recorded within 5 km of the survey area. Suitable search effort did not record the species.	PMST
Proteaceae	*Synaphea stenoloba*	T	E	Caespitose shrub, 0.3-0.45 m high. Fl. yellow, Aug to Oct. Sandy or sandy clay soils. Winter-wet flats, granite.	Unlikely – this species has not been recorded within 5 km of the survey area. Suitable search effort did not record the species.	PMST
Stylidiceae	*Stylidium longitubum*	P4	-	Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. pink, Oct to Dec. Sandy clay, clay. Seasonal wetlands. Closest record is 1.09 km east.	Possible – this species occurs within 5 km of survey area and habitat occurs within the survey area. Suitable search effort did not record the species.	NatureMap, TPFL

FAMILY	TAXON	STATUS		DESCRIPTION AND CLOSEST RECORD INFORMATION (IF AVAILABLE) (WA HERBARIUM 1998-, DBCA 2018, SPRAT DATABASE (DOTEE 2019B))	LIKELIHOOD OF OCCURRENCE	SOURCE
		BC Act	EPBC Act			
Stylidiceae	*Stylidium paludicola*	P3	-	Reed-like perennial, herb, 0.35-1 m high, Leaves tufted, linear or subulate or narrowly oblanceolate, 0.5-4 cm long, 0.5-1.5 mm wide, apex acute, margin entire, glabrous. Scape mostly glabrous, inflorescence axis glandular. Inflorescence racemose. Fl. pink, Oct to Dec. Peaty sand over clay. Winter wet habitats. Marri and *Melaleuca* woodland, *Melaleuca* shrubland. Closest record is 9.71 km north.	Possible – species was identified by DBCA flora officer as potentially occurring on the edge of wetlands near Centanary Road. Suitable search effort did not record the species.	DBCA Flora Officer
Rutaceae	*Boronia tetragona*	P3	-	Perennial, herb, 0.3-0.7 m high, leaves sessile, entire, with papillate margins, branches quadrangular, sepals ciliate. Fl. pink & red, Oct to Dec. Black/white sand, laterite, brown sandy loam. Winter-wet flats, swamps, open woodland. Closest record is 2.08 km east.	Unlikely – this species occurs within 5 km of survey area and habitat occurs within the survey area. Suitable search effort did not record the species.	NatureMap, WA Herb
Santalaceae	*Leptomeria furtiva*	P2	-	Lax, sprawling shrub, 0.2-0.45 m high. Fl. orange-brown, Aug to Oct. Grey or black peaty sand. Winter-wet flats. Closest record is 3.1 km east.	Possible – this species occurs within 5 km of survey area and habitat occurs within the survey area. Suitable search effort did not record the species.	NatureMap, WA Herb
Xanthorrhoeaceae	*Chamaescilla gibsonii*	P3	-	Clumped tuberous, herb. Fl. blue, Sep. Clay to sandy clay. Winter-wet flats,	Possible – this species occurs within 5 km of survey area and habitat occurs	NatureMap, TPFL

FAMILY	TAXON	STATUS		DESCRIPTION AND CLOSEST RECORD INFORMATION (IF AVAILABLE) (WA HERBARIUM 1998-, DBCA 2018, SPRAT DATABASE (DOTEE 2019B))	LIKELIHOOD OF OCCURRENCE	SOURCE
		BC Act	EPBC Act			
				shallow water-filled claypans. Closest record is 2.81 km south.	within the survey area. Suitable search effort did not record the species.	

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