Detailed and Targeted Flora and Vegetation Survey

Geographe Leisure Centre

Prepared for SW Environmental
March 2022

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Executive summary

Ecoedge was engaged by SW Environmental, on behalf of the City of Busselton, to undertake a spring targeted and reconnaissance flora and vegetation survey of vegetation surrounding the Geographe Leisure Centre in Recreation Lane in the City.

The City is investigating options for the potential expansion of the Leisure Centre and required the survey to assist with project design and any environmental approvals that may be required as part of a future proposal.

The flora and vegetation survey was undertaken on 31 August, 16 October, 3 November 2021 and 3 March 2022 by Russell Smith (flora permit FB61000473) and Colin Spencer (flora permit FB62000169) in accordance with the Environmental Protection Authority Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

The total area surveyed was approximately 3.9 ha, including approximately 2.3 ha of native vegetation.

One hundred and forty-four taxa were found within the survey area recognised, with thirty-five being introduced species.[1] The most numerous families were the Poaceae (14 taxa), Orchidaceae and Fabaceae with 13 taxa each.

One species of Threatened flora, *Caladenia procera*, was found at three locations within the survey area. The conservation significant taxon, *Conospermum caeruleum* var. 'Busselton' was observed scattered throughout much of the *Corymbia calophylla*, *Melaleuca preissiana* and *Agonis flexuosa* Woodland vegetation unit.

The post-survey likelihood of occurrence for the sixty-five potential occurring significant vascular flora, including Threatened flora, was "unlikely", except for the single Threatened taxon, *Caladenia procera*, which was found and recorded.

Two Declared Pest plants, **Asparagus asparagoides* (bridal creeper) and **Zantedeschia aethiopica* (arum-lily), were found during the survey. Bridal creeper is also recognised as a Weed of National Environmental Significance.

Two vegetation units were recognised in the survey area:

- *Corymbia calophylla*, *Agonis flexuosa* and *Melaleuca rhaphiophylla* Low Forest, and
- *Corymbia calophylla*, *Melaleuca preissiana* and *Agonis flexuosa* Woodland.

The *Corymbia calophylla*, *Agonis flexuosa* and *Melaleuca rhaphiophylla* Low Forest has been recognised as an occurrence of the Priority one ecological community '*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest (near Busselton)' (Ecoedge 2015).

[1] 129 taxa were found during the 2015 survey and 89 taxa in the 2021 survey, including 14 taxa not recorded in 2015.

Two floristic quadrats placed within the *Corymbia calophylla*, *Melaleuca preissiana* and *Agonis flexuosa* Woodland vegetation unit (GELC01, GELC02), were grouped by multivariate analysis mainly with other quadrats from known occurrences of the PEC. On this basis, both vegetation units (specifically, all areas of vegetation in Degraded or better condition) are considered an occurrence of the PEC. There is 1.758 ha of PEC within the survey area.

All the native vegetation within the survey area is considered to be wetland habitat because *Melaleuca preissiana*, *M. rhaphiophylla* and the sedge *Baumea juncea* were found. The survey area is also recognised as part of the Spearwood Dune Wetland Area 2, by Webb et al. (2009), because the *Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest was in degraded or better vegetation condition.

One vegetation complex and one of Beard's vegetation associations are mapped to occur across the survey area: the Yoongarillup Complex and association 1000.

The Yoongarillup complex has more than 30% of its pre-European extent on the SCP remaining (35.81%), but only marginally more than 10% within the City of Busselton (10.9 %). Association 1000 has less than 30% at the state (27.81%) and IBRA region (26.41%) and subregion levels (26.41%), but more than 30 % remaining within the City of Busselton (35.27%). This discrepancy is likely due to the greater differentiation of Beard's association mapping within the City boundary.

The vegetation within the survey area has been mapped by Molloy et al. (2009) as having a 2b linkage proximity rating due to its partial connection to a mapped regional ecological linkage associated with the Vasse - Wonnerup Estuary and coastal reserves system, which passes approximately 600 m to the north of the survey area.

There are no mapped wetlands, including Conservation Category wetlands, within or nearby the survey area. However, as mentioned above, the wetland tree species within the survey area indicate that it is, in fact, a wetland. There are also no watercourses mapped to intersect or nearby the survey area.

While there are no ESAs formally mapped within the survey area, all four mapped occurrences of the Threatened orchid *Caladenia procera* should be recognised as ESAs.

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Statement of limitations

Reliance on data

In the preparation of this report, Ecoedge has relied on data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report. Unless stated otherwise in the report, Ecoedge has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Ecoedge will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed to Ecoedge.

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1 Introduction

Ecoedge Environmental Services (Ecoedge) was engaged by SW Environmental, on behalf of the City of Busselton (the City) in February 2021 to undertake a detailed and targeted spring flora and vegetation survey of vegetation surrounding the Geographe Leisure Centre (GLC) in West Busselton in the City of Busselton (the 'survey area') (**Figure 1** and **Figure 2**).

GLC is located between Recreation Lane and Clydebank Avenue in an urban context approximately 2.5 km southwest of the centre of Busselton Central Business District.

The City is investigating options for the potential expansion of the GLC and required the survey to assist with project design and any environmental approvals that may be required as part of a future proposal.

The flora and vegetation survey was undertaken on 31 August, 16 October, 3 November 2021 and 3 March 2022 by Russell Smith (flora permit FB61000473) and Colin Spencer (flora permit FB62000169) in accordance with the Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

This report compiles findings of the survey.

2 Scope and objectives

SW Environmental required a desktop assessment to be conducted prior to the field survey to identify relevant key features and constraints which were in or nearby the survey area, such as Threatened and Priority flora, Threatened and Priority Ecological Communities (TEC and PECs), riparian vegetation, unusual soil/landscape systems, conservation estates, poorly represented vegetation associations and or vegetation complexes and Environmentally Sensitive Areas (ESA's). The desktop assessment area (the 'study area') encompassed a ten-kilometre (km) buffer to the survey area (**Figure 2**).

The field survey was required to ground-truth the desktop assessment findings and delineate all significant flora and vegetation components within the survey area, including TECs and PECs and Threatened and Priority flora. The focus of the targeted survey was the Threatened orchid *Caladenia procera* and Threatened grass *Austrostipa bronwenae*, both of which have been previously reported to occur in the survey area (Ecoedge 2015).

The survey and report were required to be undertaken in accordance with the Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) and meet requirements of other relevant State and Commonwealth guidelines for threatened species and communities, such as approved conservation advice for *Environmental Protection and Biodiversity Act 1999* (EPBC Act 1999) threatened species and communities.

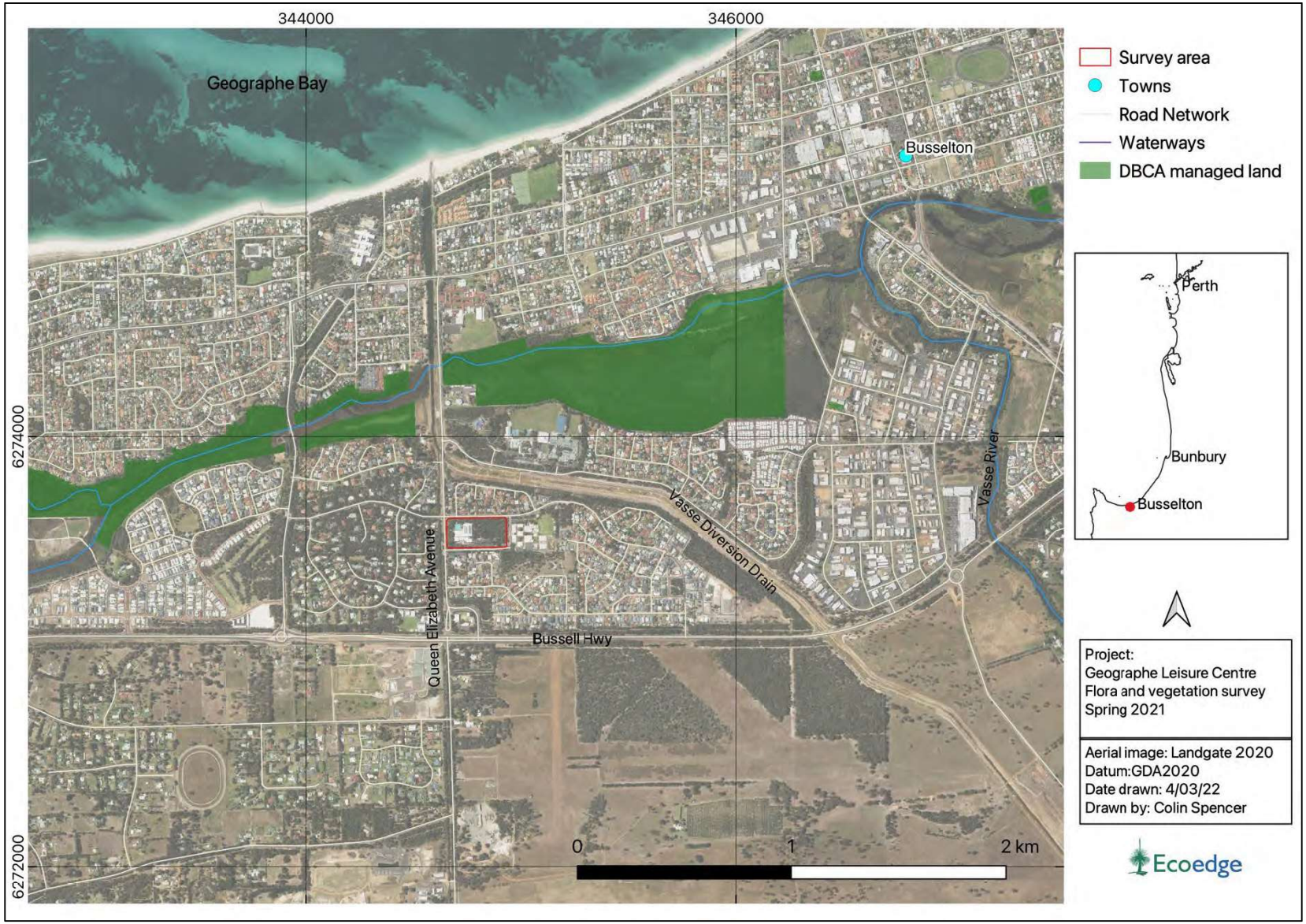

Figure 1. Aerial photograph showing the location of the survey area.

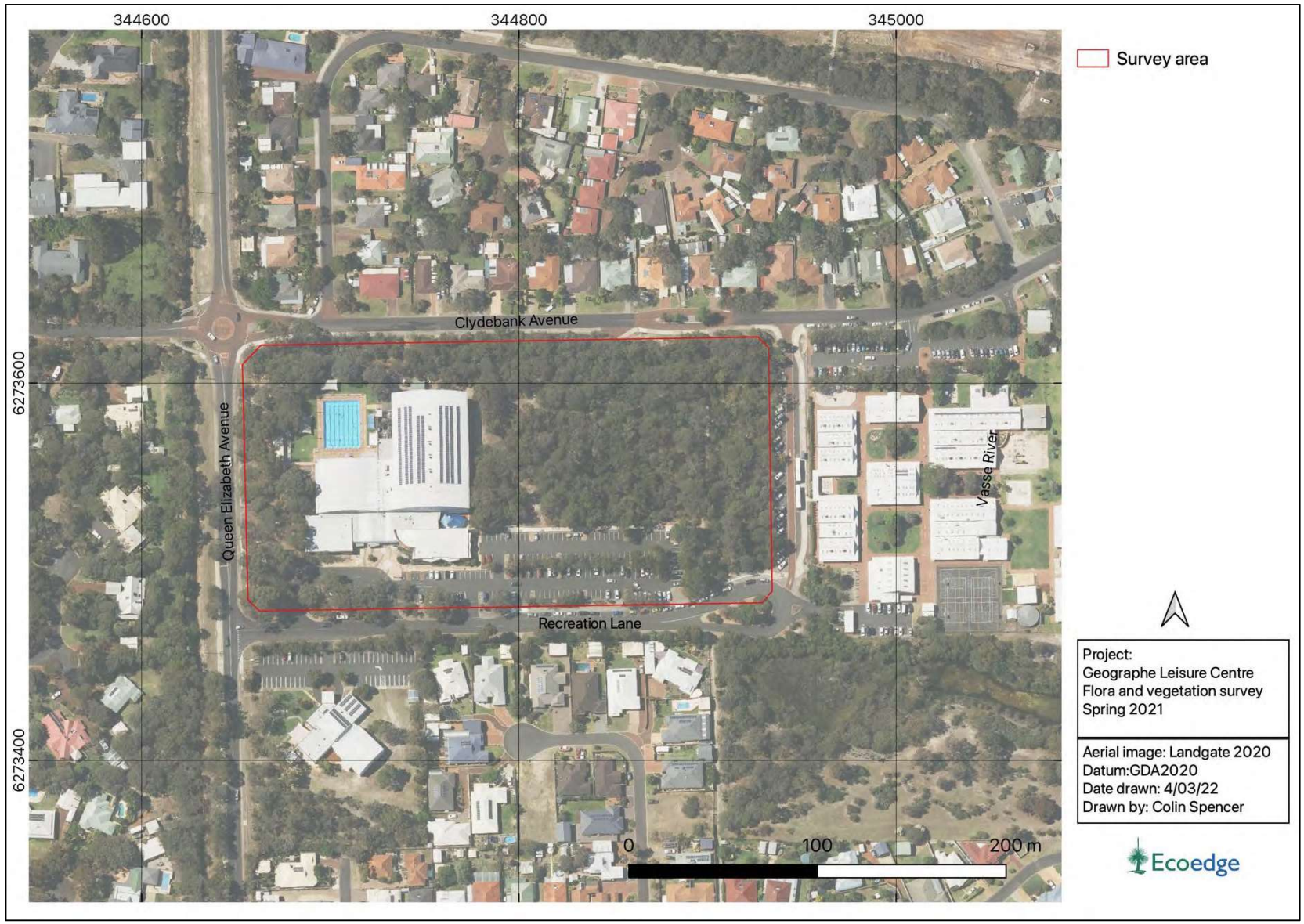

Figure 2. Aerial photograph showing the location of the survey area.

3 Methods

3.1 Desktop assessment

Prior to the field survey, a desktop assessment was undertaken to provide contextual information on the flora and vegetation within the survey area. The desktop studies included a review of the following information.

- Regional geology and soil mapping (Tille & Lantzke 1990)
- Vegetation complex mapping of the South-West Forest Region of Western Australia (Mattiske and Havel 1998) as updated by Webb et al. (2016).
- Beard's Pre-European vegetation association mapping dataset (DPIRD-006**)** (Beard et al. 2013).
- WA Threatened and Priority Ecological Communities DBCA database extracts (DBCA 2021a) and TEC and PEC listings (DBCA 2018a, DBCA 2021b).
- Federal Protected Matters Search Tool results **(**DAWE 2022)[2].
- Extract from the Department's Threatened Flora database and the Western Australian Herbarium database (DBCA 2021c).
- Geomorphic Wetlands, Swan Coastal Plain Data Set DBCA-019 (DBCA 2021d).
- Environmentally sensitive areas distribution maps and data (DWER 2020).
- Surface Hydrology Lines (National) (Crossman & Li 2015).
- Regional Ecological Linkages (Molloy et al. 2009).

The assessment also included a review of the following surveys.

- Report of a Level 1 Flora and Vegetation Assessment at the Geographe Leisure Centre (Ecoedge 2015).
- The flora and vegetation of the Busselton Plain (Swan Coastal Plain): a report for the Department of Environment and Conservation as part of the Swan Bioplan Project. Department of Environment and Conservation, Perth, Western Australia. (Webb et al. 2009).

3.1.1 Significant flora likelihood of occurrence

Prior to undertaking the survey, an assessment of the likelihood of occurrence of Threatened and Priority flora occurring within the survey area was undertaken. The rationale for determining this likelihood of occurrence is provided in **Appendix 1**. The rationale for the post-survey likelihood of occurrence is also provided in this Appendix.

3.2 Field survey

The flora and vegetation survey was undertaken on 31 August, 16 October, 3 November 2021 and 3 March 2022 by Russell Smith (flora permit FB61000473) and Colin Spencer (flora permit FB62000169) in accordance with the Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

The time of the survey was within the optimum time for field identification of most of the Threatened and Priority flora identified as potentially occurring within the survey area.

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Specifically, *Drakaea elastica* was searched for on 31 August, *C. procera* on 16 October and *Austrostipa bronwenae* on 3 November 2021 and 3 March 2022.

The dominant and characteristic species, as well as some soil information, was collected at 84 vegetation information points across the survey area. In addition, two floristic quadrats were installed in representative vegetation types within the survey area.

The mapping from Ecoedge (2015) and the vegetation and quadrat information from the current survey was used to identify and describe vegetation units using the NVIS system (Level 5; NVIS 2017).

Location of data collection points (vegetation condition assessment points and relevés) and survey track files was recorded.

Flora species that were not identified in the field were either photographed or collected for later identification.

Vegetation condition was assessed using the method of the EPA (2016) (**Appendix 2**).

3.3 Multivariate analysis

The floristic quadrat data from the two quadrats placed in the survey area was compared to seven quadrats placed in the "*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest" PEC just east of the survey area by AECOM (2017) and Ecoedge (2020) as well as a subset of quadrats from the Swan Coastal Plain (SCP) by Gibson et al. (1994) ("the SCP Survey") using MVA. The subset of the Gibson et al. 1994 dataset used in this analysis comprised 149 quadrats occurring south of Bagieau Road in Myalup, about 45 km north of Bunbury. It was considered that only including quadrats from the Gibson et al. 1994 dataset that were sited within 125 km of the survey area would lead to a more accurate assignment of the appropriate FCT. The software PATN (Belbin 2003) was used for the MVA.

The MVA used two-way classification (Agglomerative Hierarchical Fusion) of the presence/absence data for each quadrat. The flexible UPGMA classification strategy was used (β = -0.1), together with the Bray-Curtis site similarity measure. The default settings for number of groups to be produced by the classification (i.e., the "cut-off level") was accepted in each case. The primary output of the classification were dendrograms and a two-way table of taxa and quadrats.

The data from the Gibson et al. 1994 survey dataset had been subject to taxonomic updating. Taxonomic updating of the 25-year-old data was required because many taxonomic changes have taken place since the original survey was carried out (e.g., *Dryandra* to *Banksia, Eucalyptus calophylla* to *Corymbia calophylla*, etc.). In addition, there is some uncertainty about the identification of such species as *Thysanotus manglesianus* and *T. patersonii*, where many Swan Coastal Plain specimens have intermediate characteristics between the two. In such cases, terms such as '*Thysanotus manglesianus*/*patersonii* complex' were used.

3.4 Survey limitations

Potential limitations with regard to the assessment are addressed in **Table 1.**

Table 1. Limitations of the field survey with regard to assessment adequacy and accuracy.

Aspect	Constraint	Comment
Scope	Not a constraint	The survey scope was prepared in consultation with the Client and was designed to comply with EPA requirements.
Proportion of flora identified	Minor	The survey was carried within the prime flowering season for the high rainfall south-west.
Climatic and seasonal effects	Negligible	Rainfall in 2021 at the Busselton Shire Weather Station No 9515 was slightly above the mean for the station. 2021 rainfall = 811 mm Mean rainfall = 800 mm.
Availability of contextual information	None	A regional survey of the Busselton Plains (Webb et al. 2009) covers the survey area and provides a regional context to the survey.
Completeness of the survey	Negligible	The survey was carried out within the spring and early summer flowering season, and all parts of the survey area were accessible.
Skill and knowledge of the botanists (vascular flora)	Not a constraint	The botanists have a combined 35 years of experience in flora surveys in the south-west of W.A.
Disturbance (fire, grazing, clearing etc.)	Minor	Historically, there has been a disturbance in the eastern part of the survey area by the construction of a drainage basin.

4 Results desktop assessment

4.1 Biogeographic region and location

The survey area is situated within the Perth (SWA02) sub-region of the SCP biogeographic region as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Commonwealth of Australia 2016).

4.2 Landform and soils

The survey area occurs on the Swan Coastal Plain (SCP), bounded by the Darling and Whicher Ranges to the east, the Indian Ocean to the west, Moore River to the north and Dunsborough to the south. The SCP is built up of two belts of sediments that differ in origin: aeolian sediments in the west and alluvial sediments in the east. The aeolian sediments comprise three major dune systems: The Bassendean Dune System is the most easterly and oldest system. The Quindalup System is the most westerly and youngest system, with the Spearwood system located in between. In the Busselton region, these wind-deposited dunes press up against the Abba plain, which is built up of alluvium deposited by streams flowing over the Whicher Range from the Blackwood Plateau. Its alluvial soils are predominantly clays and silts. In places, low dunes of aeolian sands from the west may overlay the alluvial soils (Seddon 1972).

The survey area occurs within the Ludlow plains subsystem (211SpL) of the Spearwood dune system (212Sp). This subsystem comprises a level to gently undulating plain of flats, low rises and depressions of deep yellow sands formed on aeolianite and calcarenite of the Tamala limestone (Tille and Lantzke 1990).

The Ludlow plains subsystem has been divided into soil phases based on local soil conditions, with one phase recognised across the survey area, the 211SpLDw Ludlow wet flats Phase (Tille and Lantzke 1990).This is described in **Table 2** and shown in **Figure 3.**

Table 2. Soil mapping units occurring within the survey area (Tille and Lantzke 1990).

System	Subsystem	Description
Spearwood (211Sp)	Ludlow Plain (211SpLD)	Ludlow wet flats Phase (211SpLDw) Flats with poor subsoil drainage in winter. Deep yellow brown siliceous sands over limestone (i.e. Spearwood Sands).

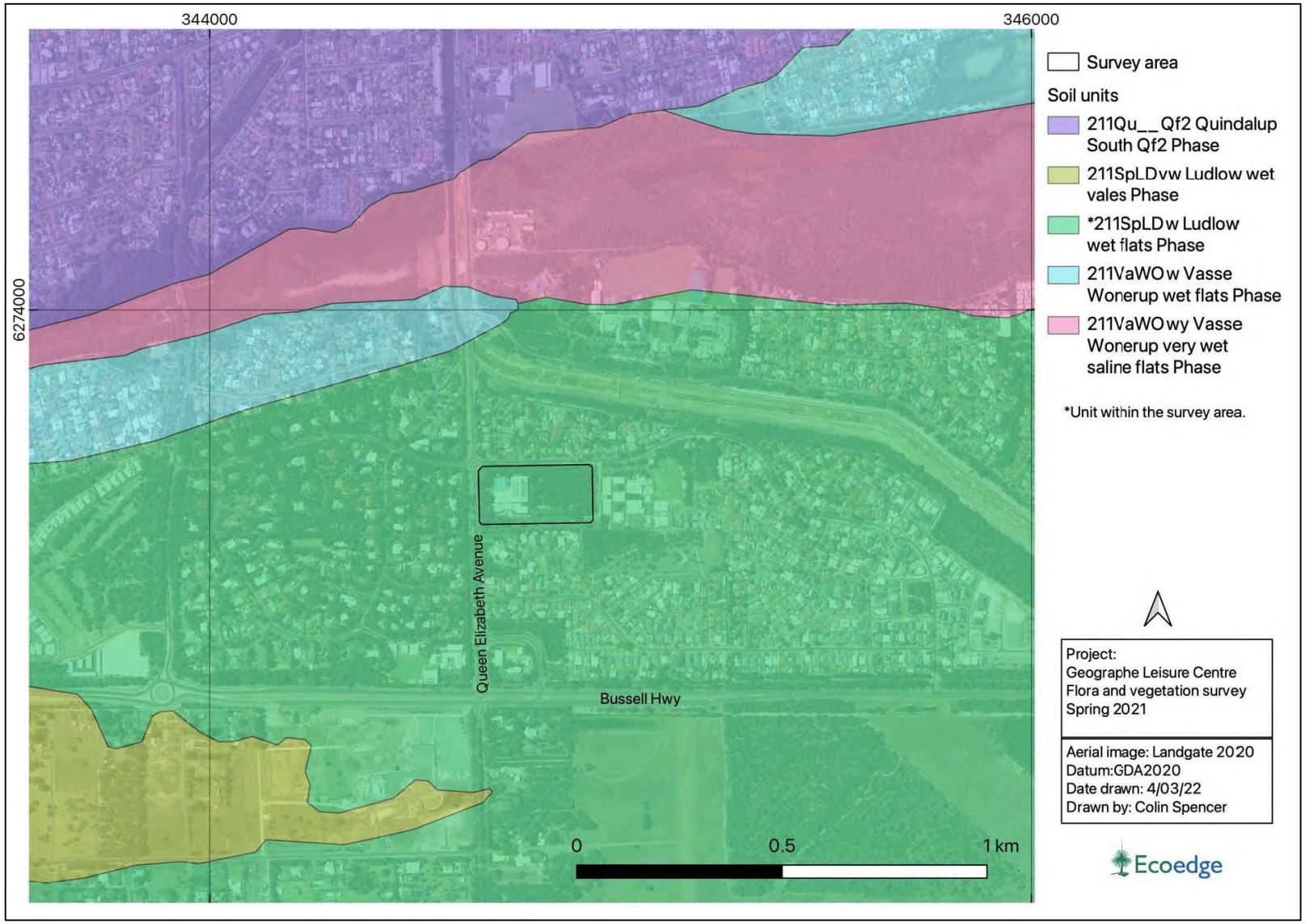

Figure 3. Land units mapped in and nearby the survey area (Tille and Lantzke 1990).

4.3 Vegetation description according to pre-European mapping datasets

4.3.1 Vegetation complexes

In 2016, the Department of Parks and Wildlife (DPaW) revised the vegetation mapping datasets for the Darling Scarp and Plateau Regional Forest Agreement (RFA) mapping of Mattiske and Havel (1998) and the Swan Coastal Plain mapping of Heddle et al. (1980). The purpose of the revision was to fill data gaps and improve alignment and correlation between the two datasets (Webb et al. 2016).

One vegetation complex, the Yoongarillup complex, occurs within the survey area, according to the 1:50,000 mapping of South-West Forest Region of Western Australia (Mattiske & Havel 1998) and the 1:250,000 mapping of vegetation complexes on the SCP (Heddle et al. 1980) as updated by Webb et al. (2016). These are described in **Table 3** and shown in **Figure 4.**

Table 3. Vegetation complexes mapped for the survey area (Webb et al. 2016).

Vegetation Complex	Description
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 calo*phylla (Marri). South of Bunbury is characterised by *Eucalyptus rudis* (Flooded Gum)-*Melaleuca* species open forests.

4.3.2 Vegetation associations

A systematic survey of native vegetation in Western Australia was undertaken by J. S. Beard (along with others) during the 1970s, which described vegetation systems in the southwest of Western Australia at a scale of 1:250,000. Beard's vegetation maps attempted to depict the vegetation as it might have been prior to European settlement in terms of type and extent (Beeston et al. 2001). The Beard Vegetation Association dataset, also referred to as the pre-European native vegetation extent dataset, was digitised by Shepherd et al. (2002).

Beard vegetation associations have been described to a minimum standard of Level 3 "Broad Floristic Formation" for the National Vegetation Inventory System (NVIS) (state-wide to regional scale) [3].

The survey area comprised only one Beard vegetation association: association 1000 'Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; tea tree (*Melaleuca* spp.)' (**Figure 5**).

[3] Beard's vegetation mapping units are referred to as 'associations' however these do not correspond to the NVIS Level 5 'Associations'. The NVIS system was developed long after Beard's work was completed, and while both classification systems use the same term, NVIS 'Associations' describe vegetation in more detail than do Beard's.

Figure 4. Vegetation complexes mapped in and nearby the survey area (Webb et al. 2016).

Figure 5. Vegetation associations mapped in and nearby the survey area (Webb et al. 2016).

4.3.3 Assessment of remaining extent against pre-European extent

In 2001, the Commonwealth of Australia stated National Targets and Objectives for Biodiversity Conservation, which recognised that the retention of 30%, or more, of the pre-clearing extent of each ecological community, was necessary if Australia's biological diversity was to be protected (Environment Australia 2001).

In its report on the Statewide Vegetation Statistics incorporating the Comprehensive, Adequate and Representative (CAR) Reserve Analysis, the Government of Western Australia (GoWA) provides information on the pre-European and current extent of the ecological communities of Western Australia and reports on the status of the CAR reserve system for WA (GoWA 2019a This system is also based on the National retention targets of 30% overall. Only reserves managed by DBCA under the *Conservation and Land Management Act 1984* are considered for inclusion in the "CAR Reserve Analysis"). In Western Australia, these statistics have been calculated for Beard's Vegetation Associations and Webb et al.'s (2016) updated Vegetation complexes.

The pre-European extent vegetation and the percentage of current extent in DBCA managed land for the one complexes and one association described for the survey area are presented in **Table 4** and **Table 5,** respectively. In summary, there is more than 30% of the pre-European extent vegetation remaining for the Yoongarillup Complex at a state level. However, only just over 10% remain within the City of Busselton, and there is less than 30 % of Beard's vegetation association 1000 remaining at State, IBRA region and IBRA subregion levels. This target is exceeded across the City of Busselton.

The red, orange and yellow shading in the tables indicates the status of the Commonwealth 30% retention target.

Status of the commonwealth retention target	>30%	<30%	<10%

Table 4. The vegetation complex mapped within the survey area with regards to the Commonwealth retention targets (GoWA 2019b).

Vegetation Complex	Pre-European (ha)	Current Extent (ha)	% Remaining	% remaining in DBCA reserves
Yoongarillup Complex				
Swan Coastal Plain	27,977.93	10,018.14	35.81	18.41
City of Busselton	3,203.79	349.09	10.90	11.45

* Excludes Crown Freehold Department Interest Lands that are managed under Section 8(a) of the CALM Act.

Table 5. The vegetation association within the survey area with regards to the Commonwealth retention targets (GoWA 2019a).

Beard Vegetation Association	Pre-European (ha)	Current Extent (ha)	% Remaining	% remaining in DBCA Managed Land*
Association 1000				
State-wide	99,835.86	27,768.84	27.81	5.19
IBRA region: Swan Coastal Plain (SWA)	94,175.31	24,869.20	26.41	5.06
IBRA sub-region Perth (SWA02)	94,175.31	24,869.20	26.41	5.06
City of Busselton	12,034.21	4,244.00	35.27	6.84

* Excludes Crown Freehold Department Interest Lands that are managed under Section 8(a) of the CALM Act.

4.4 Threatened and Priority ecological communities

Ecological communities are defined by Western Australia's DBCA as "...naturally occurring biological assemblages that occur in a particular type of habitat. They are the sum of species within an ecosystem and, as a whole, they provide many of the processes which support specific ecosystems and provide ecological services." (DEC 2013).

Under Section 27 of the *Biodiversity Conservation Act 2016* (BC Act), the Western Australian Minister for Environment may list communities considered under significant threat as a TEC. These TECs can be listed under one of three conservation categories. These categories are Critically Endangered (CR), Endangered (EN), Vulnerable (VU). The BC Act also provides for listing communities as collapsed ecological communities.

Possible TECs that do not meet survey criteria are added to the DBCA's Priority ecological community lists under Priorities 1, 2 or 3 (referred to as P1, P2, P3). Ecological communities that are adequately known, are rare but not Threatened, that meet criteria for near Threatened, or that have been recently removed from the Threatened list are placed in Priority 4 (P4). These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (P5) (DEC 2013).

The current listing of Threatened and Priority ecological communities is specified in DBCA (2018a, 2021b). The conservation categories for these Threatened and Priority ecological communities are defined in **Appendix 3**.

TECs can also be listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). There are three categories of TEC under the EPBC Act: Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) (Department of Agriculture, Water and the Environment) (DAWE 2020a). These are defined in **Appendix 4.**

The desktop assessment, which included a Protected Matters Search[4] (DAWE 2022) and review of DBCA TEC and PEC database extracts (DBCA 2021a), found seven EPBC Act, six BC Act listed TECs, and six State listed PECs within the 10 km study area.

Outcomes of these searches are presented in **Table 6.** The results of the DBCA records are shown in **Figure 6.**

[4] The PMST was conducted post survey.

Table 6. Threatened and Priority ecological communities occurring within study area (DAWE 2022, DBCA 2021a).

Community name and description	Status (WA)	Status (EPBC Act)
'Claypans of the Swan Coastal Plain' – a federally listed TEC consisting of four State-listed communities, two of which occurs in the study area: 1. SCP07 Herb rich saline shrublands in clay pans 2. SCP10a Shrublands on dry clay flats	T (VU) T (EN)	T (CR) T(CR)
SCP10b: Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)	T(EN)	T(EN)
Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain SCP25 Southern *Eucalyptus gomphocephala – Agonis flexuosa* woodlands SCP30b Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands	P3	T (CR)
Shrublands and woodland on Muchea Limestone	T(EN)	T (EN)
'Banksia Woodlands of the Swan Coastal Plain' – a federally listed TEC consisting of numerous State-listed communities	P3	T (EN)
Subtropical and Temperate Coastal Saltmarsh	P3	T (VU)
SCP02 Southern wet shrublands	T (EN)	-
SCP01b *Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain	T(VU)	-
Vasse Blackbutt (near Busselton): *Eucalyptus patens, Corymbia calophylla, Agonis flexuosa* Closed Low Forest	P1	-
Busselton Yate community: *Eucalyptus cornuta, Agonis flexuosa* and *Eucalyptus decipiens* forest on deep yellow-brown siliceous sands over limestone	P1	-
Eucalyptus rudis, Marri and Peppermint Forest: *Eucalyptus rudis* (flooded gum), *Corymbia calophylla, Agonis flexuosa* Closed Low Forest (near Busselton)	P1	-

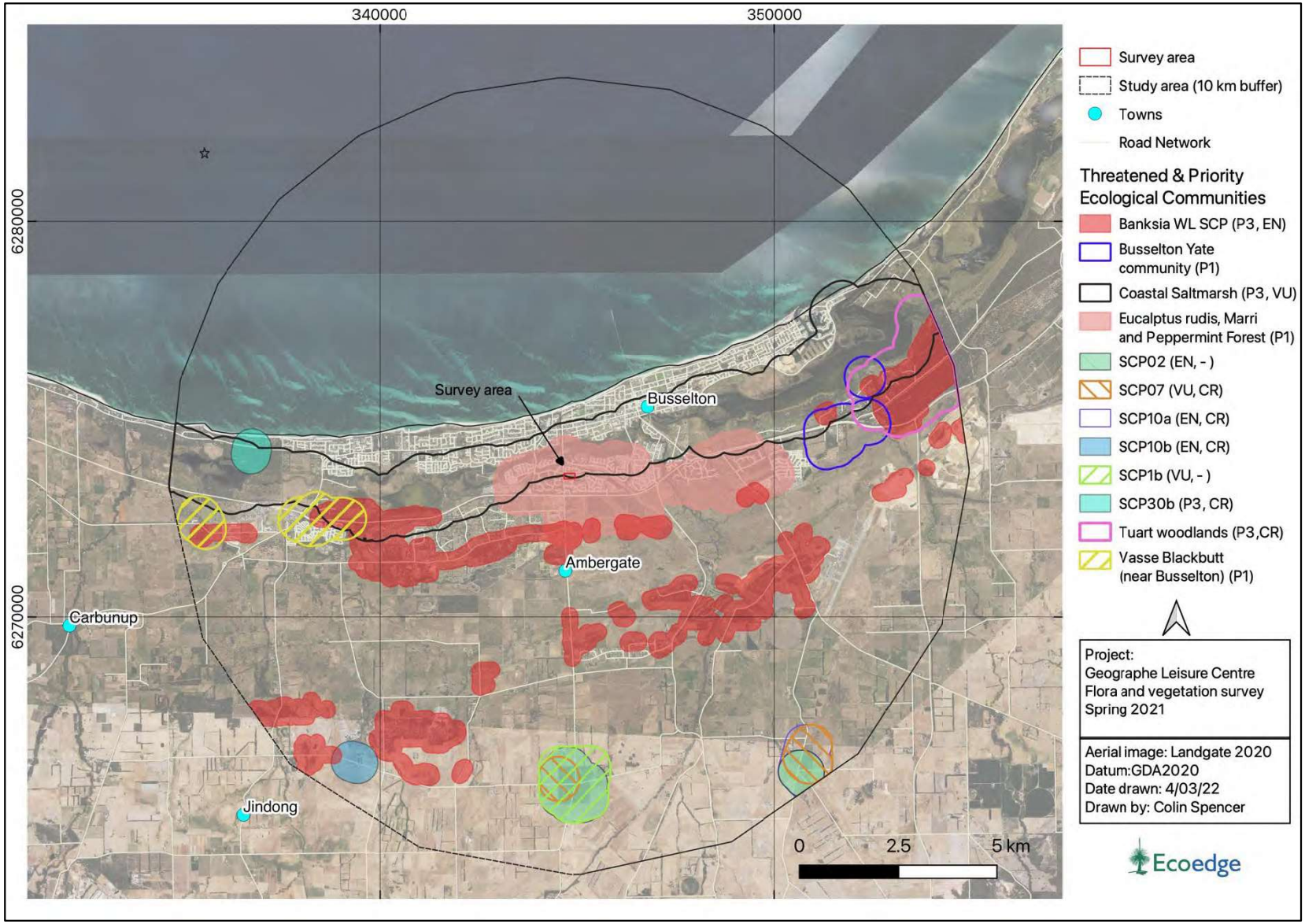

Figure 6. Known and predicted indicative occurrences of TEC and PEC within 10 km of the survey area. (DBCA 2021a)

4.5 Threatened and Priority flora

Species of flora and fauna are defined as having a Threatened or Priority conservation status where their extant populations are restricted geographically and/or under threat of possible extinction. The DBCA recognises these threats and consequently applies regulations towards population and species protection.

Threatened extant flora species are listed under Section 19 of the BC Act. They are ranked according to their level of threat using the International Union for Conservation of Nature (IUCN) Red List categories and criteria. The categories are Critically Endangered (CE), Endangered (EN), Vulnerable (VU). It is an offence to "take" or damage Threatened flora without Ministerial approval. Section 5 of the Act defines "to take" as "… to gather, pluck, cut, pull up, destroy, dig up, remove, harvest or damage flora by any means".

Priority flora is under consideration for future declaration as "Threatened flora", dependent on more information. Species classified as Priority One to Three (referred to as P1, P2 and P3) are in need of further survey to determine their status, while Priority Four (P4) species are adequately known rare or Threatened species that require regular monitoring.

Threatened flora lists are formally reviewed annually, whilst the Priority flora list is subject to a less formal ongoing review. The current listing of Threatened and Priority flora was updated on 5 December 2018 (DBCA 2018b).

Categories of Threatened and Priority flora defined by the BC Act are presented in **Appendix 5** (DBCA 2019).

Threatened flora may also be protected under the Commonwealth EPBC Act and be listed in one of six categories. Definitions of these categories are summarised in **Appendix 6** (DAWE 2020b).

Threatened or Priority flora occurring within 10 km of the survey area generated from a Protected Matters Search Tool query (DAWE 2022). DBCA and WA Herbarium Threatened and Priority flora data downloads (DBCA 2021c) are provided in **Appendix 7**.

Sixty - five significant species were identified within this search area. Of these, three species have been previously recorded in the survey area and are considered likely to be re-recorded within the survey area. Fifteen species were possible and forty-seven Unlikely. The three species likely to occur within the survey area are listed in **Table 7.** The location of all DBCA database significant flora (DBCA 2021c) within the study area are shown in **Figure 7**.

A breakdown of the likelihood of occurrence of all potential species according to conservation status is provided in **Table 8,** with the complete pre and post likelihood of occurrence assessment provided in **Appendix 8**.

Table 7. Conservation significant flora likely to occur within the survey area.

Species	Conservation Status
Caladenia procera	T (CR)
Austrostipa bronwenae	T (EN)
Pimelia ciliata subsp. *longituba*	P3

Table 8 Likelihood of occurrence according to conservation status.

Likelihood of occurrence	Total number	Priority 1	Priority 2	Priority 3	Priority 4	Threatened
Likely	**3**			1		2
Possible	**15**		4	8	2	1
Unlikely	**47**	3	5	13	6	20
Total	**65**	**3**	**9**	**22**	**8**	**23**

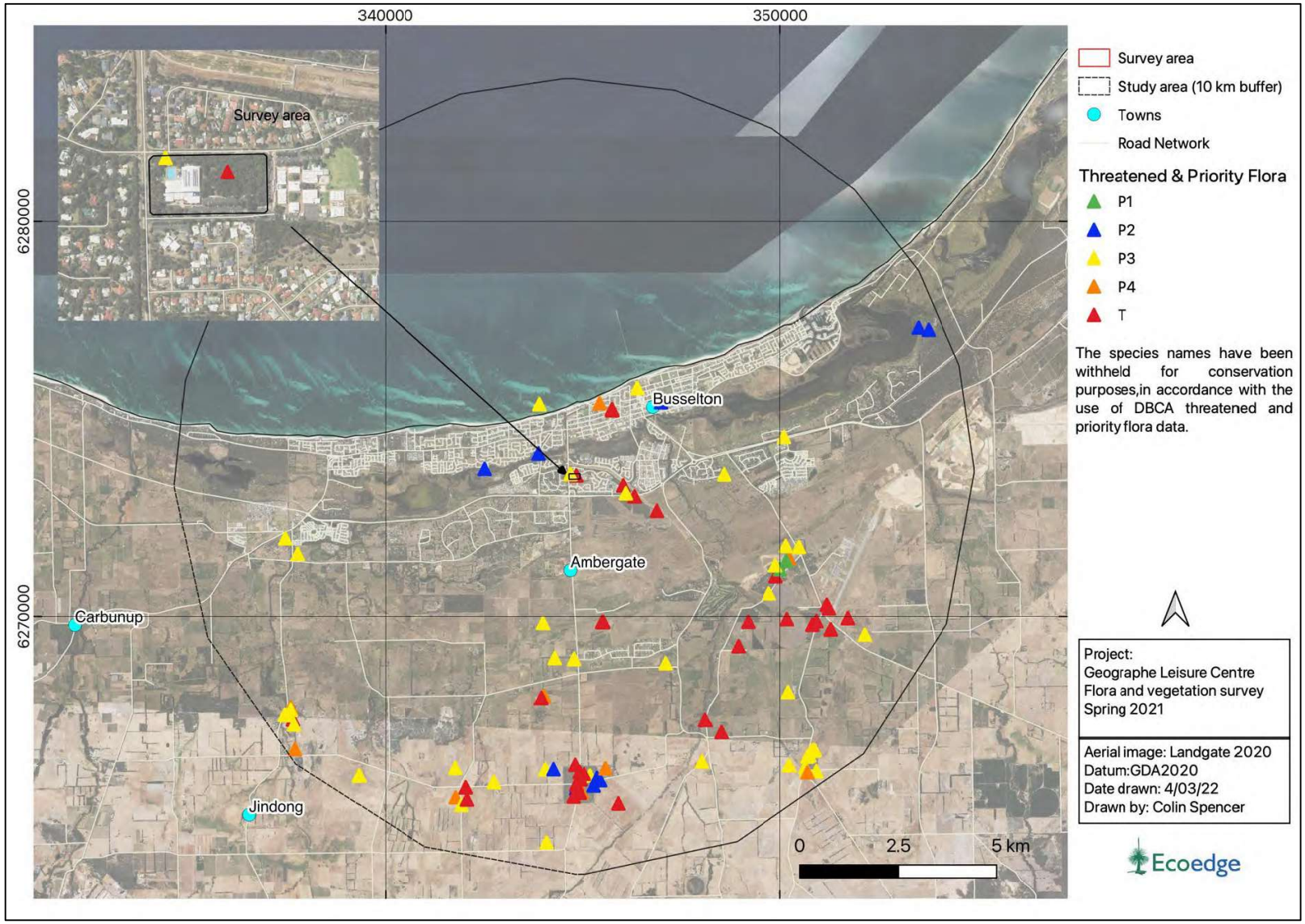

Figure 7. Threatened and Priority flora within the 10 km study area (DBCA 2021c)

4.6 Wetlands and water courses

Wetlands on the SCP have been classified into types using the geomorphic wetland classification system of Semeniuk & Semeniuk (1995), which is based on the characteristics of landform and water permanence, for example, lakes, palusplains and damplands. These are described in **Table 9.** The SCP wetlands have also been evaluated and assigned an appropriate management category and corresponding category objective, providing guidance on the nature of the management and protection the wetland should be afforded. These categories are described in **Table 10.**

Table 9. Wetland types (adapted from Semeniuk & Semeniuk 1995).

Management Category	Basin	Flat	Channel	Slope	Highland
Permanently inundated	Lake		River		
Seasonally inundated	Sumpland	Floodplain	Creek		
Intermittent inundation	Playa	Barlkarra	Wadi		
Seasonally waterlogged	Dampland	Palusplain	Trough	Paluslope	Palusmont

Table 10. Definitions of and objectives for the different wetland management categories (EPA 2008).

Management Category	Definition	Category Objective
Conservation	Wetlands with high conservation value for both natural or human use	To preserve wetland (natural) attributes and functions
Resource Enhancement (RE)	Wetlands with moderate natural and human use attributes that can be restored or enhanced	To restore wetlands through maintenance and enhancement of wetland functions and attributes
Multiple Use (MU)	Wetlands that score poorly on both natural and human use attributes	To use, develop and manage wetlands in the context of water, town and environmental planning

There are no wetlands, including Conservation Category wetlands (CCW) within or near the survey area (DBCA 2021d). The nearest CCW wetland is located approximately 480 north of the survey area, part of the Vasse River Estuary (**Figure 8** and **Figure 9**).

4.7 Watercourses

According to an examination of aerial photography and watercourse data sets Crossman and Li (2015) (**Figure 9**), there are also no watercourses mapped within proximity or intersecting the survey area.

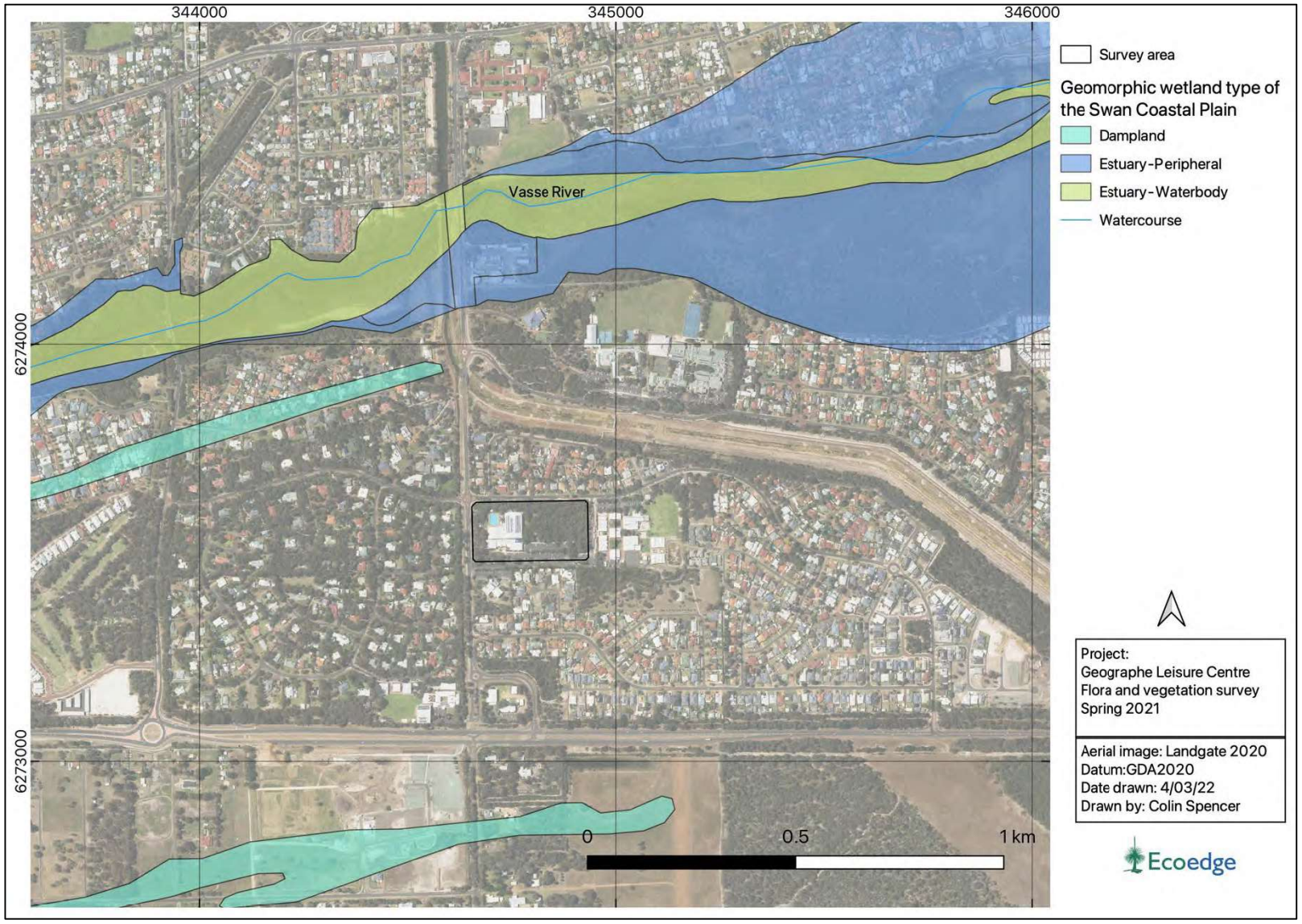

Figure 8. Geomorphic wetland type and waterways in proximity to the survey area (DBCA 2021d).

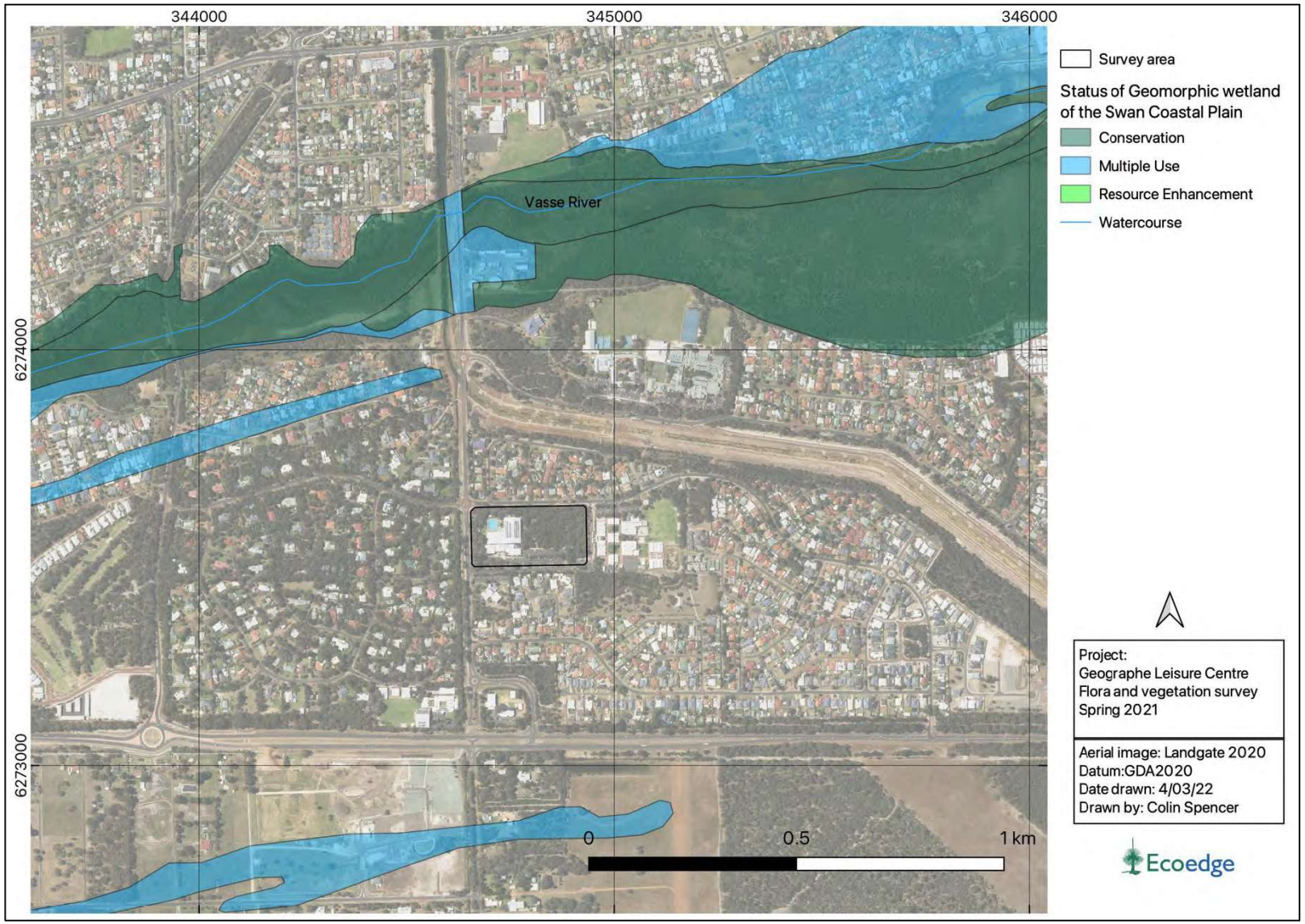

Figure 9. Status of geomorphic wetlands in proximity to the survey area (DBCA 2021d).

4.8 Regional ecological linkages

Regional ecological linkages "link protected patches of regional significance by retaining the best (condition) patches available as stepping stones for flora and fauna between regionally significant areas" (Molloy et al. 2009).

Regional ecological linkages have been mapped by Molloy et al. (2009) across the SW of Western Australia in an area spanning between just north of Mandurah to Walpole in the south-east.

Molloy et al. (2009) assessed and assigned "proximity value" (PV) ratings to all patches of remnant native vegetation as a way of indicating the value of their connectivity with regional ecological linkages. This was based on their distance from the nearest mapped regional ecological linkage axis line and connected parcels of remnant vegetation (**Table 11**).

Table 11. Linkage proximity values rating assigned to patches of remnant vegetation within a landscape from Molloy et al. (2009).

Proximity value	Description
1a	with an edge touching or < 100 m from a linkage
1b	with an edge touching or < 100 m from a natural area selected in 1a
1c	with an edge touching or < 100 m from a natural area selected in 1b
2a	with an edge touching or < 500 m from a linkage
2b	with an edge touching or < 500 m from a natural area selected in 2a
2c	with an edge touching or < 500 m from a natural area selected in 2b
3a	with an edge touching or < 1000 m from a linkage
3b	with an edge touching or < 1000 m from a natural area selected in 3a
3c	with an edge touching or < 1000 m from a natural area selected in 3b

An east-west aligned regional ecological axis line occurs approximately 600 m north of the survey area. This axis line mapped by Molloy et al. (2009) is associated with the Vasse River, Vasse Wonnerup Estuary system and uncleared coastal vegetation. The survey is partially connected to this linkage with its vegetation assigned a 2b linkage proximity rating (**Figure 10**).

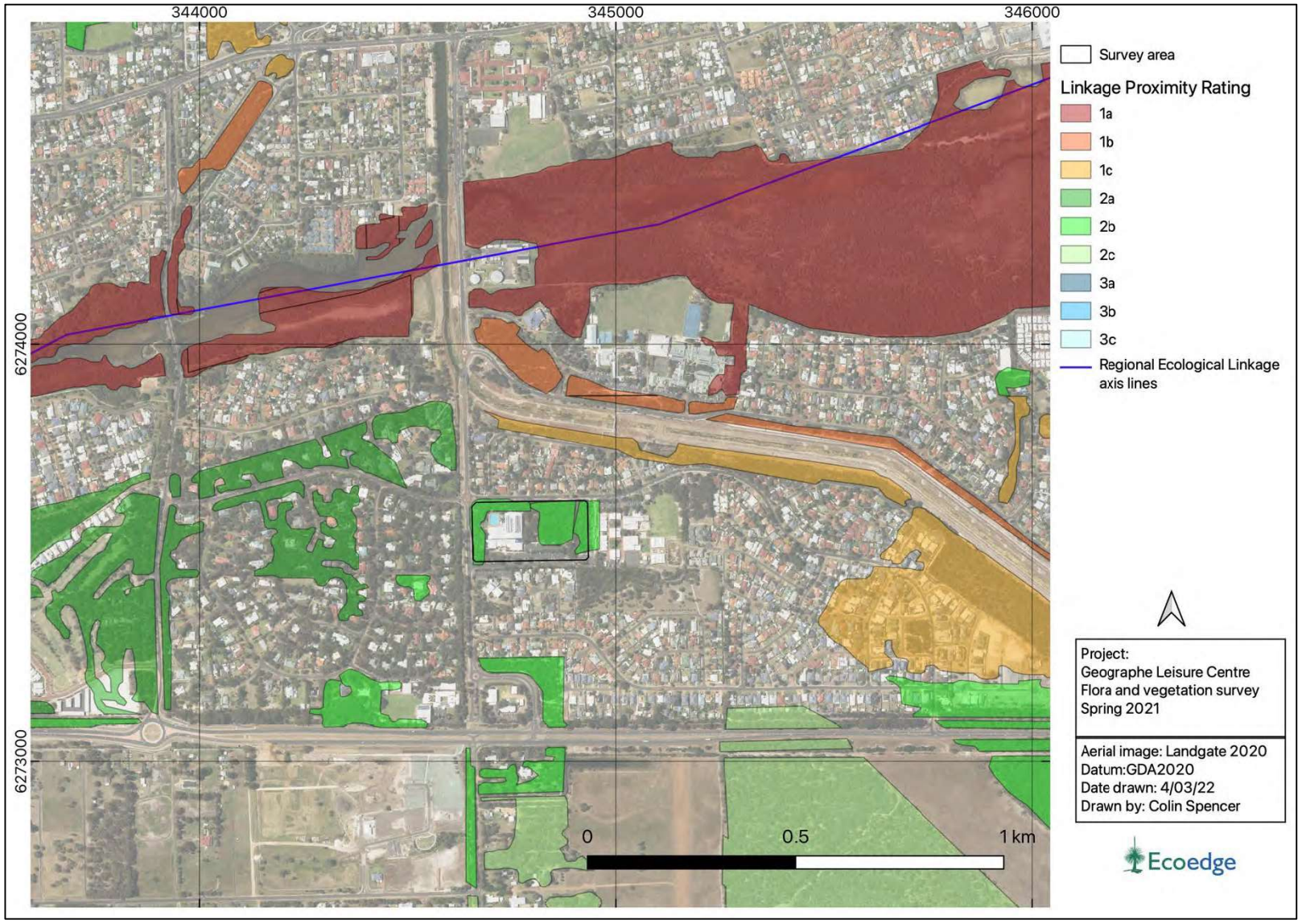

Figure 10. The survey area in relation to regional ecological linkages (Molloy et al. 2009).

4.9 Other reports

One flora and vegetation survey has been previously conducted over the vegetation surrounding the GLC. This was conducted by Ecoedge in 2015. The key outcomes of this report are summarised below.

Ecoedge (2015) Level 1 Flora and Vegetation Assessment at the Geographe Leisure Centre

- Location: the current survey area.
- Area: 3.92 ha.
- Purpose: To determine the significant flora and vegetation values of the survey area vegetation.
- Key outcomes relevant to the current survey: Two vegetation communities were identified across the survey area, one of which, Unit A, was identified as the Priority 1 Ecological Community "*Eucalyptus rudis, Corymbia calophylla, Agonis flexuosa* Closed Low Forest (near Busselton)".
- A single occurrence of the Threatened orchid *Caladenia procera* was recorded within the north-east quadrant of the survey area. The survey also reported that in 2012 DPaW had recorded 82 *C. procera* plants in this general area. No other flora of significance was recorded.

4.10 Environmentally Sensitive Areas

ESAs are protected under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. They are selected for their environmental values at State or National levels (Government of Western Australia 2005). They include:

- Defined wetlands and riparian vegetation within 50 m
- Areas covered by Threatened ecological communities
- Area of vegetation within 50 m of Threatened flora
- Bush Forever sites
- Declared World Heritage property sites.

There are no formally mapped ESA's within or in close proximity to the survey area. The nearest mapped ESA is located approximately 345 m to the north of the survey area (**Figure 11**). This ESA is associated with a Conservation category wetland, which is part of the Vasse River estuary system (**Figure 9**).

However, the previously mapped occurrences of the Threatened orchid *Caladenia procera* (Ecoedge 2015) and the Threatened grass *Austrostipa bronwenae* identified in the DBCA (2021c) data set should both be recognised as ESA.

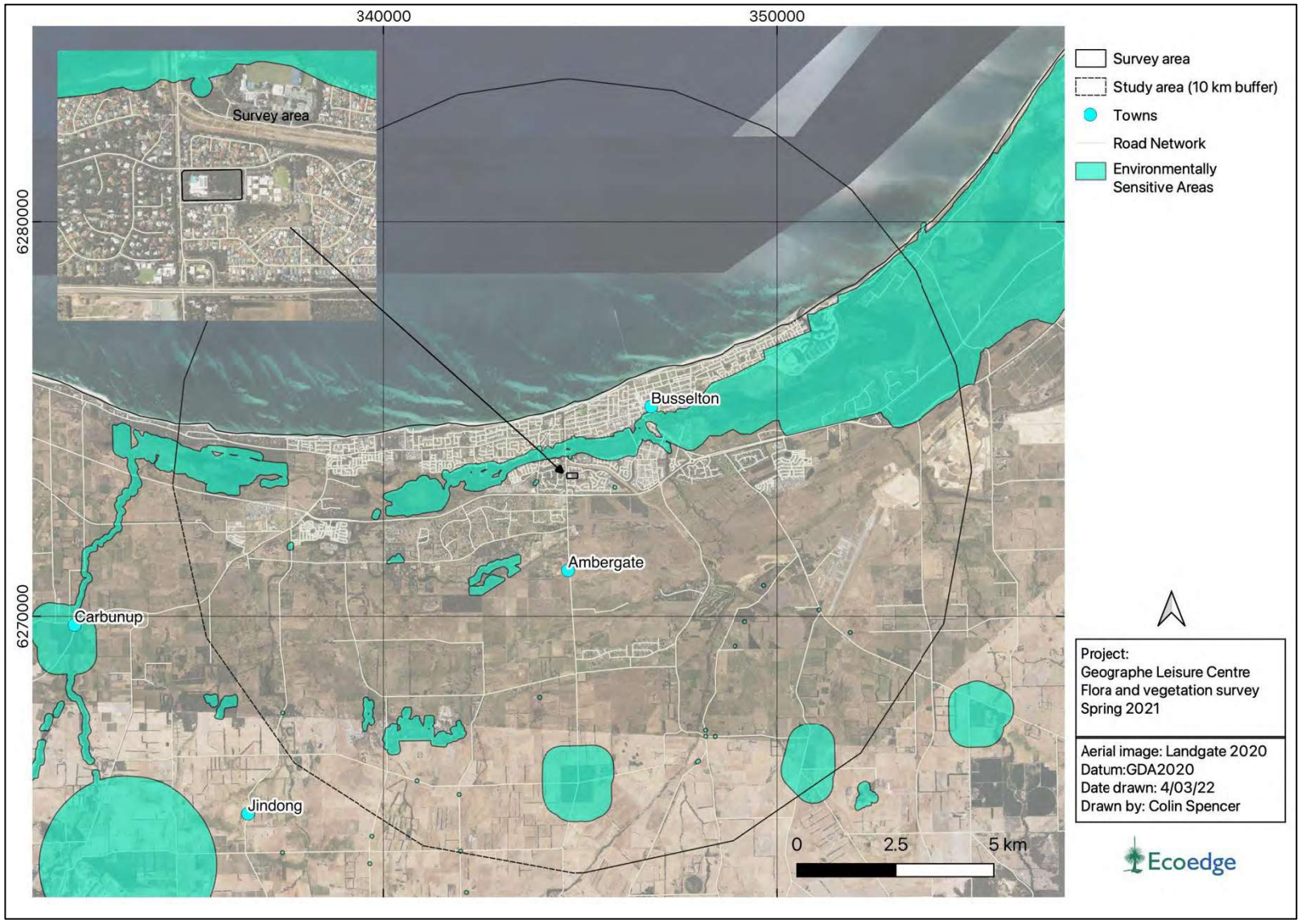

Figure 11. ESAs within the study area (DWER 2020).

5 Survey results

Tracklog and relevés were recorded, and locations are shown in **Appendix 9**. A list of species found during this survey is provided in **Appendix 10**. The threatened flora reporting form is provided in Appendix 11. This will be submitted to DBCA for their records.

5.1 Flora

One hundred and forty-four taxa have been found within the survey area recognised, with thirty-five being introduced species.[5] The most numerous families were the Poaceae (14 taxa), Orchidaceae and Fabaceae with 13 taxa each.

The conservation significant taxon, *Conospermum caeruleum* var. 'Busselton' was observed scattered throughout much of the *Corymbia calophylla*, *Melaleuca preissiana* and *Agonis flexuosa* Woodland vegetation unit (see below).

5.1.1 Flora of conservation significance

Caladenia procera

Three plants of the Threatened orchid *Caladenia procera* (**Figure 12**) were found within the survey area. Their locations are shown in **Figure 13**. This compares to only a single plant being found in the 2015 survey (Ecoedge 2015) [6]. There is also a record from the TPFL DBCA data download (3/10/2012) that recorded zero live plants (DBCA 2021c).

Figure 12. *Caladenia procera* found within the survey area.

[5] 129 taxa were found during the 2015 survey and 89 taxa in the 2021 survey, including 14 taxa not recorded in 2015.

[6] A reference to a search being conducted by DPaW in 2012 within the survey area resulting in 82 plants being found cited in Ecoedge (2015) cannot be substantiated and may relate to a different area or a larger area.

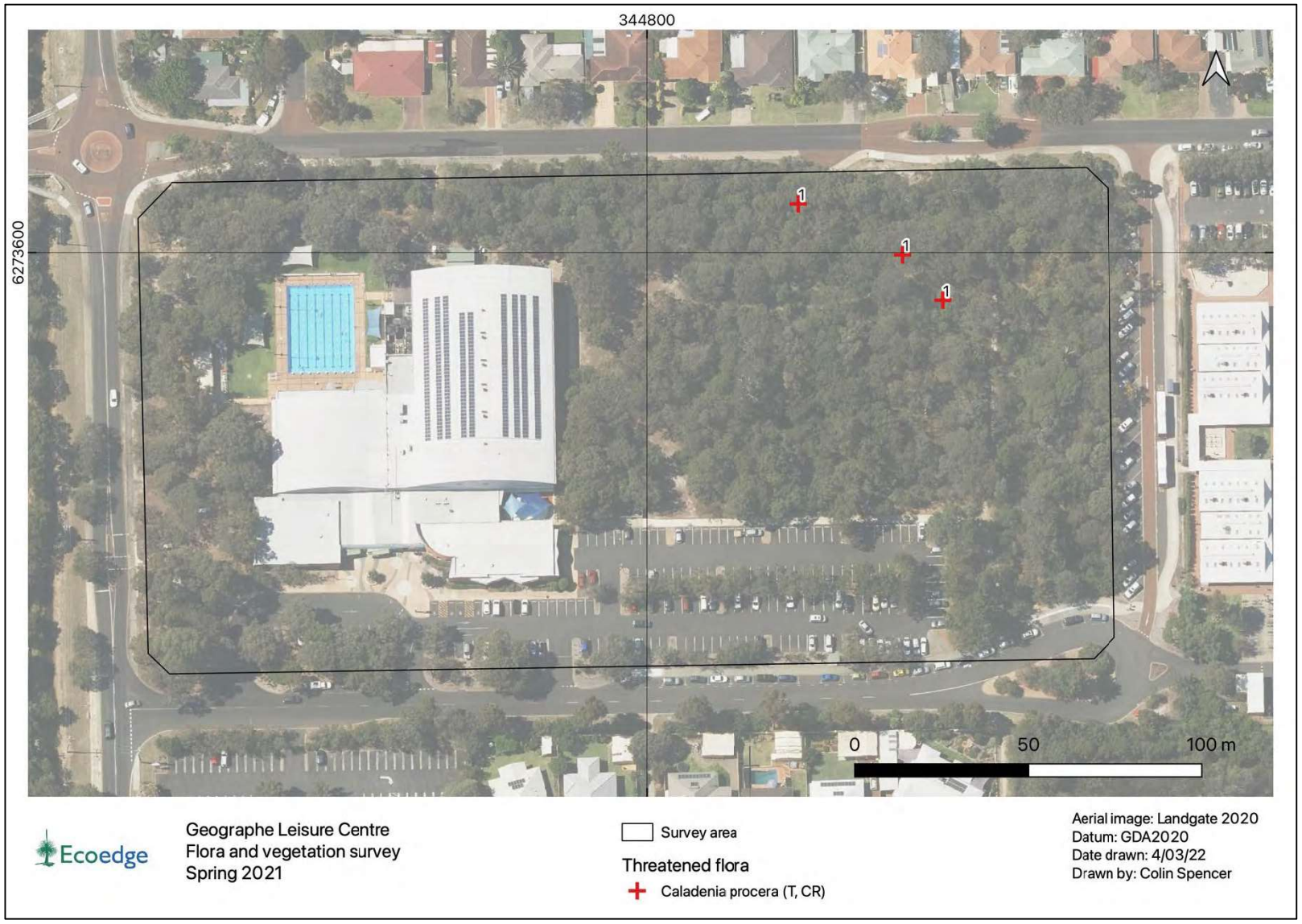

Figure 13. Location of Threatened and Priority Flora within the survey area.

***Conospermum caeruleum* var. 'Busselton'**

Conospermum caeruleum var. 'Busselton' (**Figure 14**) was observed scattered throughout the survey area. While *C. caeruleum* var. 'Busselton' is not recognized as a Threatened or Priority taxon it is recognised as one of three independent Management Units that belong to a single, morphologically variable southwest species, which exhibits a strong population genetic structure (Bradbury et al. 2019). As such, it is important in furthering the understanding of the *C. caeruleum* complex.

Figure 14. *Conospermum caeruleum* var. 'Busselton'.

5.1.2 Targeted flora not found

There is a record dating from 2007 of the Threatened species *Austrostipa bronwenae* occurring in the survey area. However, despite intensive searching, this species was not re-found.

Pimelia ciliata subsp. *longituba* (P3) was not found during this survey.

5.2 Post survey likelihood of occurrence

The post-survey likelihood of occurrence of the sixty-five potential significant vascular flora, including Threatened flora, was "unlikely", except for the single Threatened taxon, *C. procera*, which was recorded. Of the sixty-four taxa recorded as "unlikely" following the survey it was because of no suitable habitat in eight cases. For the other fifty-six taxa, although suitable or potential habitat was present, was appropriately searched, the taxon was not observed.

A summary of the post-survey likelihood of occurrence according to conservation status is provided in **Table 12.**

Table 12. Vascular post survey likelihood of occurrence according to conservation status.

Likelihood of occurrence	Total No.	Priority 1	Priority 2	Priority 3	Priority 4	Threatened
Recorded	**1**					1
Unlikely	**64**	3	9	22	8	23
Total	**65**	**3**	**9**	**22**	**8**	**24**

5.3 Declared pest plants

**Asparagus asparagoides* (bridal creeper) and **Zantedeschia aethiopica* (arum-lily), both with the category s22(2) (C3 Exempt[7]) under the *Biosecurity and Agriculture Management Act 2007*, were found during the survey. Bridal creeper is also recognised as a Weed of National Environmental Significance.

Locations of both bridal creeper and arum-lily are shown in **Figure 15.**

[7] Currently there are no obligations for management of these weeds under the Act.

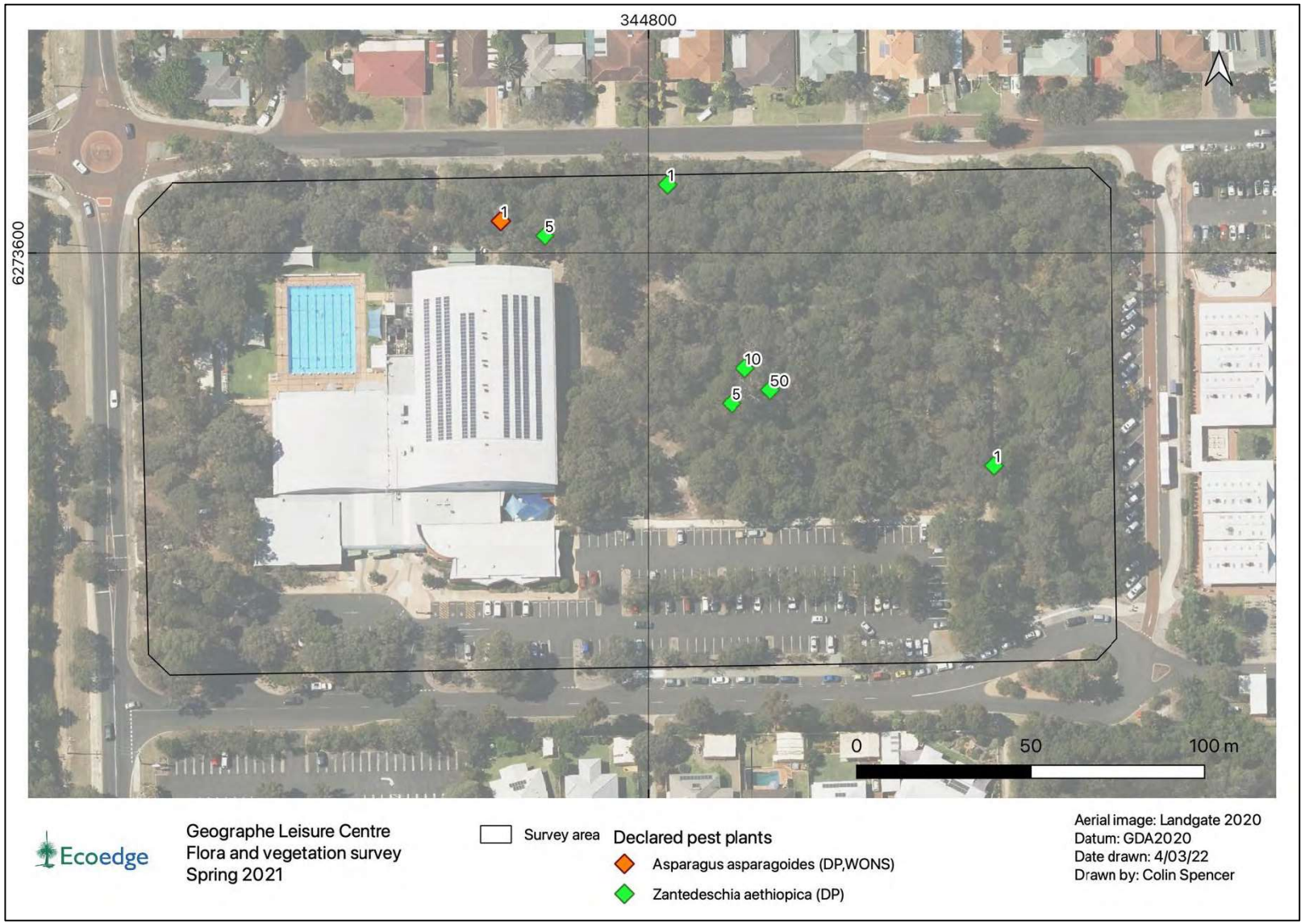

Figure 15. Location of Declared pest plants within the survey area.

5.4 Vegetation units

Two vegetation units were recognised in the survey area (**Figure 16** and **Figure 17**) and are described below. The vegetation units are mapped in **Figure 18**.

5.4.1 Corymbia calophylla, Agonis flexuosa and Melaleuca rhaphiophylla Low Forest.

Low Closed Forest/Low Open Forest of *Agonis flexuosa, Banksia littoralis* and *Melaleuca rhaphiophylla* over tall/medium open shrubland of *Exocarpos odoratus, Spyridium globulosum*, *Hakea varia*, *Hardenbergia comptoniana* and (**Acacia longifolia*) over sedgeland of *Baumea juncea* and *Gahnia trifida* and mixed herbs and grasses.

Figure 16. *Corymbia calophylla*, *Agonis flexuosa* and *Melaleuca rhaphiophylla* Low Forest.

5.4.2 Corymbia calophylla, Melaleuca preissiana and Agonis flexuosa Woodland.

Open Forest/Woodland of *Corymbia calophylla, Melaleuca preissiana* and *Agonis flexuosa* over tall open shrubland of (*Acacia saligna*), *Kunzea glabrescens, Jacksonia furcellata* and *Spyridium globulosum* over low/medium open shrubland of *Conospermum caeruleum* var. 'Busselton', *Gompholobium tomentosum*, *Hardenbergia comptoniana*, *Kennedia prostrata* and *Xanthorrhoea brunonis* and *Baumea juncea*, *Lepidosperma longitudinale* open sedgeland over mixed herbs and grasses including *Opercularia hispidula* and *Austrostipa flavescens*.

Figure 17. *Corymbia calophylla*, *Melaleuca preissiana* and *Agonis flexuosa* Woodland.

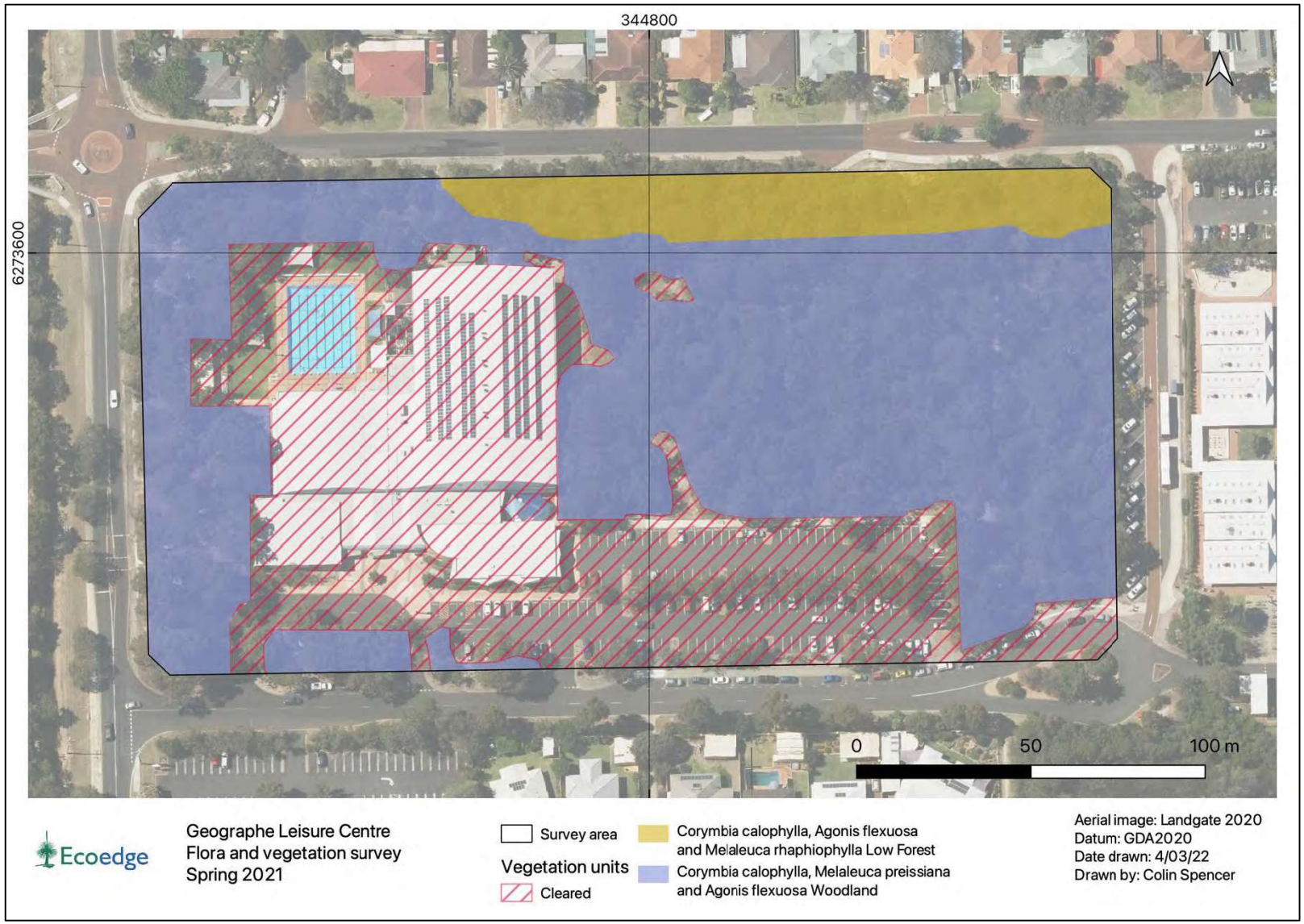

Figure 18. Vegetation units within the survey area.

5.5 Multivariate analysis

The two quadrats (GELC01, GELC02) placed within the *Corymbia calophylla*, *Melaleuca preissiana* and *Agonis flexuosa* Woodland vegetation unit[8] were grouped mainly with other quadrats from known occurrences of the Priority one ecological community '*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest (near Busselton)'. The quadrats placed in known occurrences of the PEC are from AECOM (2017) and Ecoedge (2020). A part of the dendrogram produced by the MVA is shown in **Figure 19**.

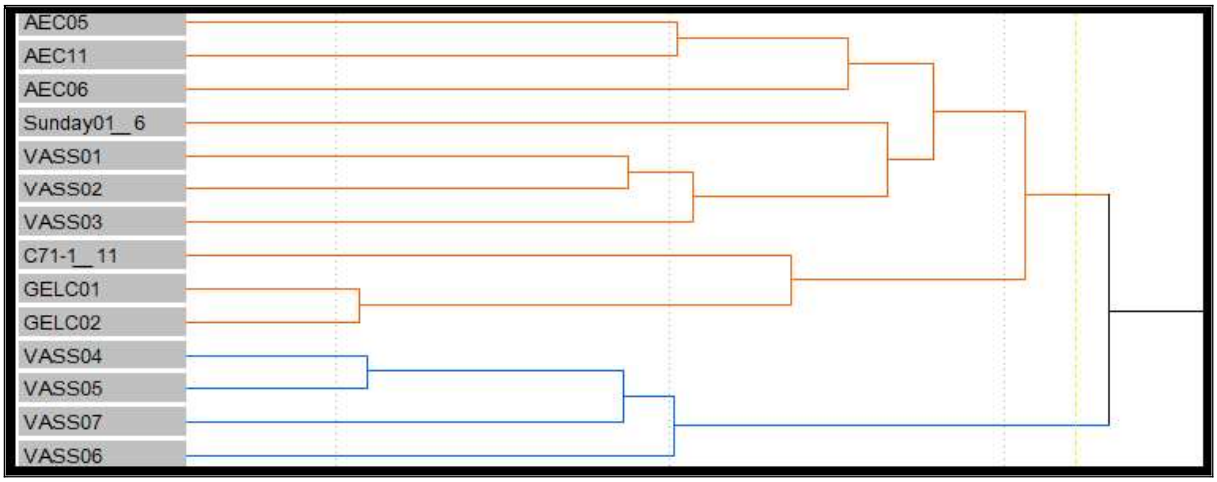

Figure 19. Part of the dendrogram produced by the MVA of quadrat floristic data showing the two survey area quadrats GELC01 and GELC02.

[8] Quadrats were not placed in the *Corymbia calophylla*, *Agonis flexuosa* and *Melaleuca rhaphiophylla* Low Forest unit because that was already acknowledged as an occurrence of the PEC.

5.6 Vegetation condition

Almost two-thirds of the vegetation was in Good or Very Good condition (**Table 13**). Invading weeds and physical disturbance associated with a number of trails and a drainage sump in the eastern part of the survey area have been the main causes of degradation.

Vegetation condition within the survey area is mapped in **Figure 20**.

Table 13. Area and percentage of the survey area in vegetation condition classes.

Condition	Area (ha)	%	PEC
Very Good	0.693	30.38	Yes
Good	0.766	33.58	Yes
Degraded	0.299	13.11	Yes
Completely Degraded	0.523	22.93	No
	2.281	100.00	
Cleared	1.627		
Total	3.908		

5.7 Priority ecological community

The *Corymbia calophylla*, *Agonis flexuosa* and *Melaleuca rhaphiophylla* Low Forest unit was already acknowledged as an occurrence of the PEC (Ecoedge 2015). The results of the MVA show that the *Corymbia calophylla*, *Melaleuca preissiana* and *Agonis flexuosa* Woodland vegetation unit is also a component of the *Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest (near Busselton)' PEC.

To be classified as a Priority ecological community, the vegetation must be in Degraded, Good or Very Good condition. Within this survey area, a total of 1.758 ha is classified as PEC.

The extent of both the vegetation units regarded as '*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest (near Busselton)' PEC within the survey area is shown in **Figure 21**. The extent and proportion of the total vegetated areas of each of these vegetation units are presented in **Table 14**. The PEC reporting form is provided in Appendix 12. This will be submitted to DBCA for their records.

Table 14. Area and condition classes for the various vegetation unit within the survey area.

Vegetation Unit	Condition	Area (ha)	PEC
Corymbia calophylla, *Melaleuca preissiana* and *Agonis flexuosa* Woodland	Very Good	0.439	Yes
	Good	0.766	Yes
	Degraded	0.227	Yes

	Completely Degraded	0.523	
	Sub-total	**1.955**	
Corymbia calophylla, *Agonis flexuosa* and *Melaleuca rhaphiophylla* Low Forest	Very Good	0.254	Yes
	Degraded	0.072	Yes
	Sub-total	**0.326**	

Figure 20. Vegetation condition within the survey area.

Figure 21. The location and condition of the Priority Ecological Community within the survey area.

6 Discussion and conclusions

6.1 Significance of flora

6.1.1 Caladenia procera

Caladenia procera was declared to be Threatened Flora under the *Biodiversity Conservation Act 2016* and is also listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as Critically Endangered. The main threats are clearing for development, road, firebreak, power utility maintenance, weed invasion, inappropriate fire regimes and grazing.

Caladenia procera is currently known from a linear range of less than 15 km to the southwest of Busselton, where it grows in Jarrah, Marri and Peppermint woodland on alluvial sandy-clay loam flats, and also from a disjunct occurrence some 70 km north near Kemerton (DEC 2011). The largest known populations of *C. procera* occur 0.8 to 1.3 km southeast of the survey area (Ecoedge 2020).

All native vegetation within the survey area should be regarded as Critical Habitat for *C. procera* (DEC 2011). Habitat that is critical to the survival of *Caladenia procera* (DEC 2011) and which is protected under the *BC Act* includes the area of occupancy of known populations and the area of similar habitat surrounding known populations. Hence, all the native vegetation within the survey area can be regarded as critical habitat.

6.1.2 *Conospermum caeruleum* var. 'Busselton'

The survey area supports significant habitat for *Conospermum caeruleum* var. 'Busselton'. This subspecies is a distinct form of *Conospermum caeruleum* associated with Spearwood Dune vegetation directly south of Busselton, first documented by Webb et al. (2009). However, it has not been formally recognised by the WA Herbarium to be a distinct form and therefore has not been listed as a Threatened or priority taxon.

Genetic testing was conducted to determine if *C. caeruleum* var. Busselton and the non-threatened *Conospermum caeruleum* subsp. *marginatum* are the same or different taxa (Bennett 2019). The results of genetic testing did not recommend the recognition of the Busselton populations as a distinct subspecies but noted that it is one of three independent Management Units. The genetic research study recommended *Conospermum caeruleum* var. Busselton should be managed separately and considered an independent conservation unit until more information is known (Bradbury et al. 2019).

6.2 Significance of vegetation

The previous report (Ecoedge 2015) recognised only the *Corymbia calophylla*, *Agonis flexuosa* and *Melaleuca rhaphiophylla* Low Forest vegetation unit as a component of the Priority one

ecological community '*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest (near Busselton)'. However, it is clear from the results of the MVA that the more extensive *Corymbia calophylla*, *Melaleuca preissiana* and *Agonis flexuosa* Woodland unit should also be considered an occurrence of the PEC.

The '*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest (near Busselton)' is a highly restricted community that occurs on the Spearwood dunes 'Ludlow Wet Flats' and the 'Ludlow wet vales' soil-landscape phases which occur over massive limestone immediately south of Busselton (Webb et al. 2009). Although *E. rudis* may be present in this community as scattered individuals, it is not always present, and the small remnants of this community can be quite variable in species composition (AECOM, 2017; A. Webb, *pers. comm*.[9]).

6.3 Vegetation complexes and associations

One vegetation complex and one of Beard's vegetation associations are mapped to occur across the survey area: the Yoongarillup Complex and association 1000. These are a reasonable match for the survey area vegetation units in terms of the dominant species and vegetation structure.

The Yoongarillup complex has more than 30% of its pre-European extent on the SCP remaining (35.81%), but only marginally more than 10% within the City of Busselton (10.9 %). Association 1000 has less than 30% at the state (27.81%) and IBRA region (26.41%) and subregion levels (26.41%), but more than 30 % remaining within the City of Busselton (35.27%). This discrepancy is likely due to the greater differentiation of Beard's mapping within the City when compared to the complex mapping with twenty-nine associations compared to the eight complexes. The increased differentiation leads to less representation per mapped unit.

6.4 Regional ecological linkages

The vegetation within the survey area has been mapped by Molloy et al. (2009) as having a 2b linkage proximity rating due to its partial connection to a mapped regional ecological linkage associated with the Vasse -Wonnerup Estuary and coastal reserves system, which passes approximately 600 m to the north of the survey area.

There is no statutory basis for the protection of regional ecological linkages. However, in general, the importance of ecological linkages has been recognised as an environmental policy consideration in EPA and Planning policy (EPA 2008 and references therein).

6.5 Waterways and wetlands

No wetlands within the Geomorphic Wetlands, Swan Coastal Plain Data Set, including CCW, are mapped or near the survey area (DBCA 2021d). The nearest CCW wetland is located approximately 480 north of the survey area, part of the Vasse River Estuary. There are also

[9] Mr. A. Webb, DBCA, Bunbury, *pers. Comm* 7/2/2019.

no watercourses mapped within proximity or intersecting the survey area, according to an examination of aerial photography and watercourse data sets Crossman and Li (2015).

However, because of the presence of one or both of the taxa *Melaleuca preissiana* and *M. rhaphiophylla*, throughout the survey area, which are both typical wetland trees, and the widespread presence of the sedge *Baumea juncea,* all the native vegetation in the survey area should be regarded as wetland habitat. In addition, the *Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest, which comprises all the survey area vegetation in Degraded or better condition, is recognised as part of the highly cleared Spearwood Dune Wetland Area 2 by Webb et al. (2009). This is further supported by (Tille & Lantzke 1990), who mapped the survey area as being within a flat with poor subsoil drainage in winter.

6.6 Environmentally Sensitive Areas

No ESAs are mapped within or in close proximity to the survey area. The nearest mapped ESA is located approximately 345 m to the north of the survey area. This ESA is associated with a Conservation category wetland part of the Vasse River estuary system.

However, all formally mapped occurrences of *Caladenia procera*, the Threatened orchid within the survey area should be recognised and protected as an ESA. The mapped occurrence of *Austrostipa bronwenae* identified in the DBCA (2021d) data set, whilst not recorded during this survey should also be regarded as an ESA. Because there is a 2007 record of *A. bronwenae* from within the survey area, and because the vegetation is similar to nearby *A. bronwenae* habitat the vegetation within the survey area should be regarded as critical habitat for this species.

Exemptions for the need to obtain a clearing permit under the Environmental Protection (Clearing of Native Vegetation) Regulation 2004 do not apply within the boundary of ESAs.

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Appendix 1 Threatened and Priority flora Likelihood of occurrence assessment methodology.

Rating	Presurvey rationale	Post survey rationale
Recorded		Taxon was or has been recorded in the survey area.
Likely	Known to occur within one kilometre (km) of the survey area with suitable habitat known or predicted to occur within the survey area.	The taxon is known to occur within one km of the survey area and very suitable habitat was present, but the taxon was not observed for one of the following reasons. **L1.** The taxon was dormant at the time of survey and could therefore not be located. **L2.** The habitat was compromised, for example due to a recent fire. **L3.** The survey area is challenging to survey.The taxon is non- descript and difficult to find because, for example, it occurs in large areas of rocky granite outcrops, or within an expanse of open water.
Possible	Known to occur within a five-ten km of the survey area with suitable habitat known or predicted to occur within the survey area.	The taxon is known from within a five to ten km radius of the survey area, and suitable habitat for the species was present, but despite a thorough search being carried out, the species was not observed. The taxon may however be present for any of the following reasons. **P1.** The taxon was dormant at the time of survey and could therefore not be located. **P2.** The habitat was compromised, for example, due to a recent fire. **P3.** The survey area is challenging to survey. Te taxon is non- descript and difficult to find because, for example, it occurs in large areas of rocky granite outcrops, or within an expanse of open water.
Unlikely	Known or predicted to occur within ten km, but no suitable habitat is known or predicted to occur within the survey area.	The taxon was not found and is unlikely to be present for one or more of the following reasons: **U1.** No suitable habitat was observed, and the taxon is known to be restricted to a narrow and clearly defined habitat type. **U2.** Suitable or potential habitat was present and appropriately searched, but the taxon was not observed. **U3.** Suitable habitat present, but these areas were too degraded for the taxon to occur, for example, due to weed invasion and/or clearing.

Example of application of pre and post-survey likelihood of occurrence

Taxon	Cons Status	Flowering	Description	Pre survey likelihood	Post Survey Likelihood
Drakaea elastica	T (EN)	Oct-Nov	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red, green, yellow. White or grey sand. Low-lying situations adjoining winter-wet swamps.	**Likely**	**Unlikely (U3)**

Appendix 2. Vegetation condition scale (EPA 2016).

Vegetation Condition	South West and Interzone Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

Appendix 3. Categories of Threatened ecological communities under the EPBC Act.

Category	Definition
Critically endangered (CR)	If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
Endangered (EN)	If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
Vulnerable (VU)	If, at that time, an ecological, community is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium–term future (indicative timeframe being the next 50 years).

Appendix 4. Categories of threatened and priority ecological communities under the BC Act.

Conservation code	Category
(T) Threatened ecological community pursuant to Sect 27 of the *Biodiversity Conservation Act 2016.*	
T	(T) CR – Critically endangered An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.
	(T) EN - Endangered An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
	(T) VU - Vulnerable An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.
(P) Priority species – possible threatened communities.	
P1	Poorly known communities Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). 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.

Conservation code	Category
P2	Poorly known communities Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) 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.
P3	Poorly known communities a) 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: b) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; c) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. 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.
P4	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. a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5	Conservation dependent ecological communities Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix 5. Definitions of conservation codes for Threatened and Priority flora.

Conservation code	Category
(T) Threatened species pursuant to Sect 19 of the BC Act 2016.	
T	(T) CR – Critically endangered 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*".
	(T) EN - Endangered 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*".
	(T) VU - Vulnerable 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*".
(P) Priority species – possible Threatened species.	
P1	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

Conservation code	Category
P3	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.
P4	(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix 6. Categories of Threatened species under the EPBC Act.

Category	Definition
Extinct (Ex)	A native species is eligible to be included in the ***extinct*** category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (ExW)	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	A native species is eligible to be included in the endangered category at a particular time if, at that time (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the vulnerable category at a particular time if, at that time (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent (CD)	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Appendix 7. Protected Matters Search Tool

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.

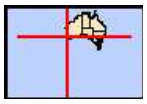
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

Report created: 02/03/22 19:39:06

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 10.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	65
Listed Migratory Species:	51

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	75
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

Extra Information

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

State and Territory Reserves:	15
Regional Forest Agreements:	1
Invasive Species:	25
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	2

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Vasse-wonnerup system	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-west

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
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	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 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 known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species

Name	Status	Type of Presence
		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
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	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 related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat 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
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 known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Extinct within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	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
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat known to 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
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat may occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Breeding 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		
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat likely to occur within area
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat likely to occur within area
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
Caladenia busselliana Bussell's Spider-orchid [24369]	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Caladenia procera Carbunup King Spider Orchid [68679]	Critically 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 known to occur within area
Daviesia elongata subsp. elongata Long-leaved Daviesia [64883]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Grevillea brachystylis subsp. grandis Large-flowered Short-styled Grevillea [85001]	Critically Endangered	Species or species habitat known to occur within area
Grevillea elongata Ironstone Grevillea [64578]	Vulnerable	Species or species habitat may occur within area
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 likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat known to occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat known to occur within area
Verticordia plumosa var. ananeotes Tufted Plumed Featherflower [23871]	Endangered	Species or species habitat known to occur within area
Verticordia plumosa var. vassensis Vasse Featherflower [55804]	Endangered	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour 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
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may 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 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

Name	Threatened	Type of Presence
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	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
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		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	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour 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
Lamna nasus Porbeagle, Mackerel Shark [83288]		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		Species or species

Name	Threatened	Type of Presence
Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		habitat may occur within area
[Megaptera novaeangliae](#) Humpback Whale [38]		Congregation or aggregation known to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
[Orcinus orca](#) Killer Whale, Orca [46]		Species or species habitat may occur within area
[Pristis pristis](#) Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	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 known to occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
[Calidris canutus](#) Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat known to occur within area
[Calidris ruficollis](#) Red-necked Stint [860]		Species or species habitat known to occur within area
[Calidris subminuta](#) Long-toed Stint [861]		Species or species habitat known to occur within area
[Charadrius bicinctus](#) Double-banded Plover [895]		Species or species habitat known to occur within area
[Charadrius mongolus](#) Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
[Limosa lapponica](#) Bar-tailed Godwit [844]		Species or species habitat known to occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

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

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

Name	Threatened	Type of Presence within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		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 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
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat 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
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

Name	Threatened	Type of Presence
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 known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	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
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known 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 carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	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
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat likely to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species

Name	Threatened	Type of Presence
		habitat known 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 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		Species or species

Name	Threatened	Type of Presence
[66276]		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]	Endangered	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour 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	Foraging, feeding or related behaviour 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 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 Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area

Name	Status	Type of Presence
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]		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

Australian Marine Parks [Resource Information]

Name	Label
Geographe	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Broadwater	WA
Fish Road	WA
Locke	WA
NTWA Bushland covenant (0173)	WA
Sabina	WA
Tuart Forest	WA
Unnamed WA25836	WA
Unnamed WA26620	WA
Unnamed WA41568	WA
Unnamed WA41597	WA
Unnamed WA42879	WA
Unnamed WA48837	WA
Unnamed WA49385	WA
Unnamed WA50017	WA
Unnamed WA50270	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species

[Resource Information]

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

Name	Status	Type of Presence
Birds		
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
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		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
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
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Vasse-Wonnerup Wetland System	WA

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Commonwealth marine environment within and	South-west
Western rock lobster	South-west

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

-33.66659 115.32711

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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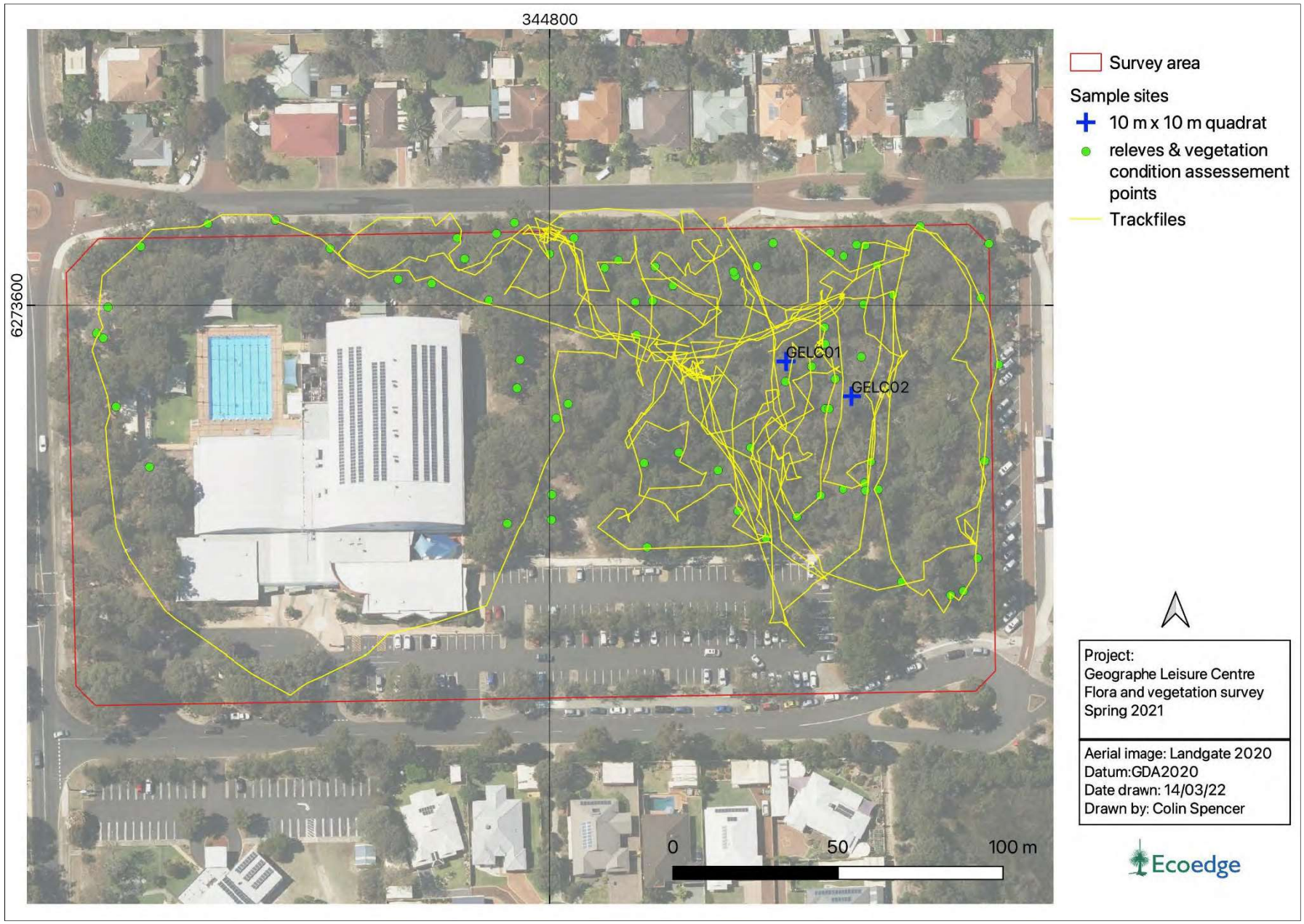
Appendix 8. Pre and post likelihood of occurrence.

SPECIES	CATEGORY	FLOWERING	DESCRIPTION AND HABITAT	Pre-survey likelihood	Post-survey likelihood
Stachystemon exilis	P1		Monoeicious shrub/herb to 0.2 m high. Fl. Green yellow. Open, low-lying Banksia woodland in which B. ilicifolia is a significant component of the upper canopy. Other associated species are Melaleuca preissiana, M. thymoides, Adenanthos meisneri and Hypocalymma angustifolium.	Unlikely	Unlikely (U1)
Gastrolobium sp. Yoongarillup (S. Dilkes s.n. 1/9/1969	P1	Aug-Oct	Erect, perennial shrub; 0.5 m high, 1.0 m wide; flowers yellow/orange. Jarrah-Marri forest, white sand, gravel	Unlikely	Unlikely (U2)
Puccinellia vassica	P1	Sep-Nov	Caespitose annual or perennial, grass-like or herb, 0.41–0.55 m high. Saline soils. On the outer margins of coastal saltmarshes	Unlikely	Unlikely (U2)
Leucopogon sp. Busselton (D. Cooper 243)	P2	Aug-Sep	Slender, erect shrub to 70 cm; flowers white. Pericalymma ellipticum wet shrubland, Marri-Jarrah woodland.	Possible	Unlikely (U1)
Amanita walpolei	P2	July - August	Agaric type mushroom, pileus vinaceous buff in centre.	Possible	Unlikely (U2)
Amperea micrantha	P2	Oct-Nov	Low, spreading, bushy perennial, herb, 0.1-0.3 m high. Fl. brown, Oct to Nov. Sandy soils.	Possible	Unlikely (U2)
Cardamine paucijuga	P2	Sep-Oct	Slender erect annual, herb, to 0.4 m high. Fl. white. In moist to dry habitats.Tuart Forest	Possible	Unlikely (U2)
Andersonia barbata	P2	Nov	Erect shrub, ca 0.4 m high. Fl. blue, pink. White sand. Swampy areas.	Unlikely	Unlikely (U2)
Calystegia sepium subsp. *roseata*	P2	Oct-Dec	Vine 5 m high x > 5 m wide. Flowers rose-pink; largely in bud.	Unlikely	Unlikely (U2)
Leptomeria furtiva	P2	Jan, Aug-Oct	Lax, sprawling shrub, 0.2–0.45 m high. Fl. orange, brown. Grey or black peaty sand. Winter-wet flats.	Unlikely	Unlikely (U2)
Lepyrodia extensa	P2		Herb (sedge-like), ca. 0.3 m high. Sand & sandy peat. Seasonally inundated swamps.	Unlikely	Unlikely (U2)
Synaphea petiolaris subsp. *simplex*	P2	Sep-Oct	Tufted shrub, 0.1–0.6 m high. Fl. yellow. Sandy soils. Flats, winter-wet areas.	Unlikely	Unlikely (U2)

SPECIES	CATEGORY	FLOWERING	DESCRIPTION AND HABITAT	Pre-survey likelihood	Post-survey likelihood
Isopogon formosus subsp. *dasylepis*	P3	Jun-Dec	Low, bushy or slender, upright, non-lignotuberous shrub, 0.2–2 m high. Fl. pink, purple, red. Sand, sandy clay, gravelly sandy soils over laterite. Often swampy areas.	Possible	Unlikely (U1)
Jacksonia gracillima	P3	Oct-Nov	Decumbent shrub - 20 cm high and 50 cm wide. Flowers standard orange-yellow; eye yellow with red halo; wings/keel red. Seasonally damp shrublands and woodlands, on sandy loams or clay loams	Possible	Unlikely (U1)
Synaphea hians	P3	Jul-Nov	Prostrate or decumbent shrub, 0.15-0.6 m high, to 1 m wide. Fl. Yellow. Sandy soils. Rises.	Possible	Unlikely (U1)
Boronia tetragona	P3	Oct-Dec	Perennial, herb, 0.3–0.7 m high, leaves sessile, entire, with papillate margins, branches quadrangular, sepals ciliate. Fl. pink, red. Black/white sand, laterite, brown sandy loam. Winter-wet flats, swamps, open woodland.	Possible	Unlikely (U2)
Chorizema carinatum	P3	Oct-Dec	Erect or spreading shrub, 0.1–0.6 m high. Fl. yellow. Sand, sandy clay.	Possible	Unlikely (U2)
Lepyrodia heleocharoides	P3	Dec	Rhizomatous, slender, tufted perennial, herb (sedge-like), 0.15–0.25 m high. Moist peaty sand. Dry or seasonally inundated heath or woodland, swamps.	Possible	Unlikely (U2)
Schoenus benthamii	P3	Oct-Nov	Tufted perennial, grass-like or herb (sedge), 0.15-0.45 m high. Fl. brown. White, grey sand, sandy clay. Winter-wet flats, swamps.	Possible	Unlikely (U2)
Verticordia attenuata	P3	Dec-May	Shrub, 0.4–1 m high. Fl. pink. White or grey sand. Winter-wet depressions	Possible	Unlikely (U2)
Angianthus drummondii	P3	Oct-Dec	Erect annual, herb, to 0.1 m high. Fl. yellow. Grey or brown clay soils, ironstone. Seasonally wet flats.	Unlikely	Unlikely (U2)
Blennospora doliiformis	P3	Oct-Nov	Erect annual, herb, to 0.15 m high. Fl. yellow. Grey or red clay soils over ironstone. Seasonally-wet flats.	Unlikely	Unlikely (U2)
Chordifex gracilior	P3	Sep-Dec	Rhizomatous, erect perennial, herb, 0.3-0.5 m high. Fl. brown. Peaty sand. Swamps.	Unlikely	Unlikely (U2)
Eryngium sp. Subdecumbens (G.J. Keighery 5390)	P3	Nov	Erect, open tuberous, herb, 0.1–0.3 m high. Fl. green. Grey to brown loamy to sandy clay, brown cracking clay. Winter-wet flats, swamps, dried claypans, ridges.	Unlikely	Unlikely (U2)

SPECIES	CATEGORY	FLOWERING	DESCRIPTION AND HABITAT	Pre-survey likelihood	Post-survey likelihood
Grevillea brachystylis subsp. *brachystylis*	P3	Aug-Nov	Much-branched, prostrate or decumbent, non-lignotuberous shrub, 0.2-0.5 m high, to 3 m wide. Fl. red. Black sand, sandy clay. Swampy situations.	Unlikely	Unlikely (U2)
Grevillea bronwenae	P3	Jun-Dec	Slender, erect shrub, 0.5–1.6 m high. Fl. red. Grey sand over laterite, lateritic loam. Hillslopes.	Unlikely	Unlikely (U2)
Hakea oldfieldii	P3	Aug-Oct	Open, straggling shrub, up to 2.5 m high. Fl. white, cream, yellow. Red clay or sand over laterite. Seasonally wet flats.	Unlikely	Unlikely (U2)
Johnsonia inconspicua	P3	Oct-Nov	Rhizomatous, tufted perennial, grass-like or herb, 0.1–0.3 m high, to 0.2 m wide. Fl. green, white, pink. White-grey or black sand. Low dunes, winter-wet flats.	Unlikely	Unlikely (U2)

Appendix 9. Track log and relevé points.



Appendix 10. List of vascular flora found within the survey area.

#	FAMILY_NAME	TAXON	NATURALISED	CONSV_CODE	2015	2022
1	Alliaceae	*Allium triquetrum*	*		x	
2	Anarthriaceae	*Lyginia imberbis*			x	x
3	Apiaceae	*Daucus glochidiatus*			x	
4	Apiaceae	*Xanthosia candida*			x	x
5	Apiaceae	*Xanthosia huegelii*			x	
6	Araceae	*Zantedeschia aethiopica*	*		x	
7	Araliaceae	*Trachymene pilosa*				x
8	Asparagaceae	*Asparagus asparagoides*	*		x	
9	Asparagaceae	*Lomandra micrantha*				x
10	Asparagaceae	*Lomandra nigricans*			x	x
11	Asparagaceae	*Lomandra pauciflora*			x	x
12	Asparagaceae	*Lomandra purpurea*			x	x
13	Asparagaceae	*Sowerbaea laxiflora*			x	x
14	Asparagaceae	*Thysanotus multiflorus*			x	
15	Asparagaceae	*Thysanotus patersonii*			x	x
16	Asparagaceae	*Thysanotus tenellus*				x
17	Asteraceae	*Arctotheca calendula*	*		x	
18	Asteraceae	*Craspedia variabilis*			x	x
19	Asteraceae	*Erigeron sumatrensis*	*		x	
20	Asteraceae	*Hypochaeris glabra*	*		x	x
21	Asteraceae	*Lactuca serriola*	*		x	
22	Asteraceae	*Lagenophora huegelii*			x	x
23	Asteraceae	*Osteospermum ecklonis*	*		x	
24	Asteraceae	*Sonchus asper*	*		x	
25	Asteraceae	*Sonchus oleraceus*	*		x	
26	Asteraceae	*Ursinia anthemoides*	*		x	
27	Campanulaceae	*Lobelia tenuior*			x	x
28	Caryophyllaceae	*Petrorhagia dubia*	*		x	

#	FAMILY_NAME	TAXON	NATURALISED	CONSV_CODE	2015	2022
29	Caryophyllaceae	*Silene gallica*	*		x	
30	Celastraceae	*Stackhousia monogyna*			x	
31	Celastraceae	*Tripterococcus brunonis*			x	x
32	Colchicaceae	*Burchardia multiflora*			x	x
33	Cyperaceae	*Baumea juncea*			x	x
34	Cyperaceae	*Cyathochaeta avenacea*			x	
35	Cyperaceae	*Gahnia trifida*			x	x
36	Cyperaceae	*Lepidosperma longitudinale*			x	x
37	Cyperaceae	*Lepidosperma pubisquameum*			x	x
38	Cyperaceae	*Lepidosperma squamatum*			x	x
39	Cyperaceae	*Schoenus obtusifolius*			x	
40	Cyperaceae	*Tetraria octandra*			x	x
41	Dilleniaceae	*Hibbertia diamesogenos*			x	
42	Dilleniaceae	*Hibbertia hypericoides*				x
43	Dilleniaceae	*Hibbertia racemosa*			x	x
44	Droseraceae	*Drosera glanduligera*				x
45	Droseraceae	*Drosera pallida*			x	x
46	Elaeocarpaceae	*Platytheca galioides*			x	x
47	Ericaceae	*Leucopogon australis*				x
48	Ericaceae	*Styphelia discolor*			x	x
49	Ericaceae	*Styphelia propinqua*			x	x
50	Euphorbiaceae	*Euphorbia peplus*	*		x	
51	Fabaceae	*Acacia iteaphylla*	*		x	
52	Fabaceae	*Acacia longifolia*	*		x	x
53	Fabaceae	*Acacia pulchella*			x	x
54	Fabaceae	*Acacia saligna*			x	
55	Fabaceae	*Acacia stenoptera*			x	x
56	Fabaceae	*Daviesia physodes*			x	x
57	Fabaceae	*Eutaxia virgata*			x	x
58	Fabaceae	*Gompholobium tomentosum*			x	x
59	Fabaceae	*Hardenbergia comptoniana*			x	x

#	FAMILY_NAME	TAXON	NATURALISED	CONSV_CODE	2015	2022
60	Fabaceae	*Jacksonia furcellata*			x	x
61	Fabaceae	*Kennedia prostrata*			x	x
62	Fabaceae	*Trifolium campestre*	*		x	
63	Fabaceae	*Viminaria juncea*			x	
64	Geraniaceae	*Erodium botrys*	*		x	
65	Goodeniaceae	*Dampiera linearis*			x	x
66	Goodeniaceae	*Scaevola calliptera*			x	
67	Haemodoraceae	*Anigozanthos manglesii*			x	x
68	Haemodoraceae	*Conostylis aculeata*			x	x
69	Haemodoraceae	*Conostylis laxiflora*			x	
70	Haemodoraceae	*Haemodorum spicatum*			x	
71	Hemerocallidaceae	*Agrostocrinum scabrum*			x	x
72	Hemerocallidaceae	*Caesia micrantha*			x	x
73	Iridaceae	*Patersonia occidentalis*			x	x
74	Iridaceae	*Romulea rosea*	*		x	
75	Iridaceae	*Sparaxis bulbifera*	*		x	x
76	Juncaceae	*Luzula meridionalis*				x
77	Loganiaceae	*Orianthera serpyllifolia* subsp. *angustifolia*			x	x
78	Loranthaceae	*Nuytsia floribunda*			x	
79	Myrtaceae	*Agonis flexuosa*			x	x
80	Myrtaceae	*Corymbia calophylla*			x	x
81	Myrtaceae	*Eucalyptus rudis*				x
82	Myrtaceae	*Kunzea glabrescens*			x	x
83	Myrtaceae	*Melaleuca preissiana*			x	x
84	Myrtaceae	*Melaleuca rhaphiophylla*			x	x
85	Orchidaceae	*Caladenia attingens*			x	x
86	Orchidaceae	*Caladenia ferruginea*			x	
87	Orchidaceae	*Caladenia flava*			x	
88	Orchidaceae	*Caladenia latifolia*			x	
89	Orchidaceae	*Caladenia paludosa*			x	

#	FAMILY_NAME	TAXON	NATURALISED	CONSV_CODE	2015	2022
90	Orchidaceae	*Caladenia procera*		T	x	x
91	Orchidaceae	*Cyrtostylis huegelii*				x
92	Orchidaceae	*Diuris porphyrochila*				x
93	Orchidaceae	*Lyperanthus serratus*			x	
94	Orchidaceae	*Microtis media subsp. densiflora*			x	x
95	Orchidaceae	*Pterostylis vittata*			x	
96	Orchidaceae	*Pterostylis* sp. Bloated snail orchid (W. Jackson BJ 486)				x
97	Orchidaceae	*Pyrorchis nigricans*			x	x
98	Orchidaceae	*Thelymitra cornicina*			x	
99	Orchidaceae	*Thelymitra crinita*			x	x
100	Orchidaceae	*Thelymitra macrophylla*			x	
101	Orobanchaceae	*Orobanche minor*	*		x	
102	Oxalidaceae	*Oxalis pes-caprae*	*		x	
103	Papaveraceae	*Fumaria capreolata*	*		x	
104	Phyllanthaceae	*Phyllanthus calycinus*			x	
105	Plantaginaceae	*Plantago lanceolata*	*		x	
106	Poaceae	*Aira caryophyllea*	*		x	
107	Poaceae	*Austrostipa flavescens*			x	x
108	Poaceae	*Avena fatua*	*		x	x
109	Poaceae	*Briza maxima*	*		x	x
110	Poaceae	*Bromus diandrus*	*		x	x
111	Poaceae	*Cenchrus clandestinus*	*		x	x
112	Poaceae	*Deyeuxia quadriseta*				x
113	Poaceae	*Ehrharta calycina*	*		x	
114	Poaceae	*Ehrharta longiflora*	*		x	x
115	Poaceae	*Lagurus ovatus*	*		x	
116	Poaceae	*Microlaena stipoides*			x	x
117	Poaceae	*Phleum pratense*	*			x
118	Poaceae	*Rytidosperma caespitosum*			x	x
119	Polygalaceae	*Comesperma ciliatum*			x	

#	FAMILY_NAME	TAXON	NATURALISED	CONSV_CODE	2015	2022
120	Polygalaceae	*Comesperma virgatum*			x	
121	Polygonaceae	*Muehlenbeckia adpressa*			x	
122	Primulaceae	*Lysimachia arvensis*	*		x	
123	Proteaceae	*Adenanthos meisneri*			x	x
124	Proteaceae	*Banksia grandis*			x	x
125	Proteaceae	*Banksia littoralis*			x	x
126	Proteaceae	*Conospermum caeruleum* subsp. 'Busselton'			x	x
127	Proteaceae	*Hakea prostrata*			x	x
128	Proteaceae	*Hakea varia*			x	
129	Restionaceae	*Desmocladus fasciculatus*			x	x
130	Restionaceae	*Desmocladus flexuosus*				x
131	Restionaceae	*Hypolaena pubescens*			x	x
132	Rhamnaceae	*Spyridium globulosum*			x	x
133	Rubiaceae	*Galium murale*	*		x	
134	Rubiaceae	*Opercularia hispidula*			x	x
135	Rutaceae	*Boronia tetragona*		3	x	
136	Rutaceae	*Philotheca spicata*			x	x
137	Santalaceae	*Exocarpos odoratus*			x	x
138	Stylidiaceae	*Levenhookia pusilla*				x
139	Stylidiaceae	*Stylidium androsaceum*			x	x
140	Stylidiaceae	*Stylidium brunonianum*			x	x
141	Stylidiaceae	*Stylidium diversifolium*			x	
142	Thymelaeaceae	*Pimelea angustifolia*			x	
143	Xanthorrhoeaceae	*Xanthorrhoea brunonis*			x	x
144	Xanthorrhoeaceae	*Xanthorrhoea gracilis*			x	