Reconnaissance and Targeted Flora and Vegetation Survey

Lot 252 on Plan 411027 and Part Lot 254 on Plan 416516 (67 Devlin Road). Wellesley, Western Australia

Prepared for GHD/Albemarle
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Executive Summary

Ecoedge was engaged by GHD, on behalf of Albemarle Lithium Pty Ltd (Albemarle), to undertake a spring targeted and reconnaissance flora and vegetation survey of part of Lot 252 on Plan 411027 and Part Lot 254 on Plan 416516 (67 Devlin Road), Wellesley within the Kemerton Strategic Industrial Area in the Shire of Harvey. Albemarle is proposing to develop approximately 66 ha of this area for laydown and administrative purposes.

The flora and vegetation survey was required to inform an application to clear native vegetation under s51 of the *Environmental Protection Act 1986*.

The survey was undertaken on 17 and 18 September, 8 October, and 19 November 2021 in accordance with the Environmental Protection Authority Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (2016).

The total area surveyed was approximately 175 hectares.

One hundred and fifty-five vascular flora taxa were identified within the survey area, of which sixteen were introduced species. The number of native flora within the survey area was relatively low for the area of native vegetation. This is attributable to the fact that about 60% of the area classified as native vegetation was previously cleared and grazed and also probably because the vegetation is long unburnt.

No flora listed as Threatened under the EPBC Act or the BC Act were found within the survey area. However, two Priority 4 flora species were found: *Acacia semitrullata* and *Caladenia speciosa*. *A. semitrullata* was quite widely distributed through the western two-thirds of the survey area, including previously cleared areas, whereas *C. speciosa* was confined to relatively intact vegetation in the western third of the survey area.

A post-survey analysis of likelihood of occurrence analysis found that the other twenty-six taxa targeted during the survey were unlikely to occur there because either the habitat was not suitable, or if some of it was suitable, they were not found despite a careful search at an appropriate time of year.

The Declared Pest Plant **Zantedeschia aethiopica* (Arum-lily) was found at two locations during the survey. Currently, there are no obligations for the management of this weed under the Act.

Eight native vegetation units were identified within the survey area, with unit EmBaBiMW being the most extensive type, comprising about 35% of the native vegetation of the survey area. This vegetation is mostly contained within a single intact parcel on the slopes and crest of a low ridge in the western part of the survey area and predominantly in Very Good to Excellent condition.

The other seven vegetation units have, to a varying extent been subject to the effects of partial clearing and grazing and vary from Completely Degraded to Good condition.

Four floristic quadrats had been placed within vegetation unit EmBaBiMW to try to determine its affinities amongst the floristic community types (FCTs) of the Swan Coastal Plain survey using multivariate analysis. The results from the MVA were ambiguous, but the vegetation mapped as EmBaBiMW can be confidently assigned to the Federally-listed TEC 'Banksia Woodlands of the Swan Coastal Plain', which has a classification of 'Endangered' and the State-listed Priority 3 ecological community 'Banksia dominated woodlands of the Swan Coastal Plain IBRA region'. There is 47.28 ha of 'Banksia Woodlands of the Swan Coastal Plain' TEC within the survey area; 28.71 ha in Excellent condition, 15.37 ha in Very Good condition and 2.43 ha in Good condition.

Four of the vegetation units comprised wetland vegetation. Two of them being similar to the well-reserved FCT *Melaleuca preissiana* damplands (FCT04).

One vegetation complex occurs within the survey area: the Bassendean – Central and South Complex, which has less than 30% of its pre-European extent remaining (26.87%). The actual vegetation, when allowance is made for the extent of degradation, is a good match for the vegetation complex.

One Beard vegetation association is mapped across the survey area, Association 1000 'Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; tea tree (*Melaleuca* spp.). This association is a good match for the vegetation within the survey in terms of their dominant species and structure. This association has less than 30% of its pre-European extent on the Swan Coastal Plain remaining (27.81%).

A portion of vegetation within the survey area is linked to two formally recognised Ecological linkage axis lines by Molloy et al. (2009), both of which are recognised by the EPA as part of the McLarty/Kemerton/Twin Rivers/Preston River/Gwindinup Ecological Linkage (EPA 2103). The most connected part in the central west of the survey area was assigned a 1c PV rating, while the other parcels were assigned 2b PV ratings due to its increased level of separation from the linkage.

There are no Conservation Category wetlands within the survey area. A MU sumpland is mapped to occur across much of the eastern portion of the survey area, with occurrences of MU damplands in the southern part of the site.

There are no ESAs within the survey area. The nearest ESA is located approximately 120 m to the east of the survey area and is associated with a Conservation Category wetland.

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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 was engaged by GHD, on behalf of Albemarle Lithium Pty Ltd (Albemarle) in September 2021 to undertake a spring targeted and reconnaissance flora and vegetation survey of part Lot 18, 252 and part Lot 254, Devlin Road, Wellesley within the Shire of Harvey (the survey area) (**Figure 1** and **Figure 2**). It is located approximately 17.5 km northeast of the city of Bunbury.

Albemarle is proposing to develop approximately 66 ha of this Lot for laydown and administrative purposes. The survey area is owned by Development WA and is located immediately north of the Albemarle's lithium processing plant (the Plant) in the [1]Kemerton Strategic Industrial Estate (KSIA). It is bounded to the west, north and south by State managed native vegetation, including a portion in the northwest managed by the Department of Biodiversity, Conservation and Attractions (DBCA).

The flora and vegetation survey was required to inform an application to clear native vegetation under s51 of the *Environmental Protection Act 1986*.

The flora and vegetation survey was undertaken on 17 and 18 September, 8 October and 19 November 2021.

This report compiles findings of the survey.

2 Scope and objectives

GHD 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 5-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 *Drakea elastica*, which is known to occur in the area.

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.

[1] Note the Kemerton Strategic Industrial Area was previously referred to as the Kemerton Industrial Park (KIP).

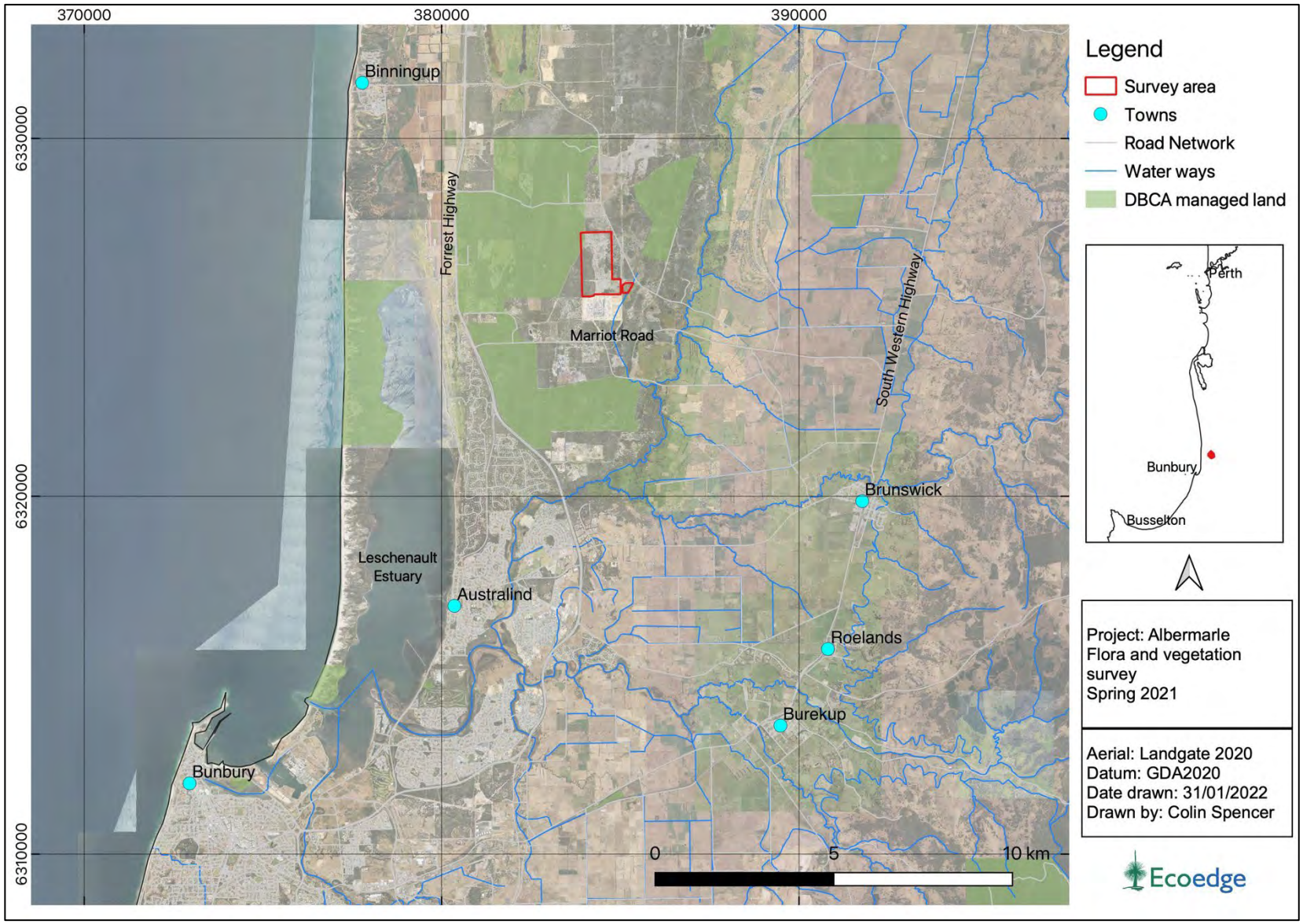

Figure 1. Aerial photograph showing the location of the survey area.

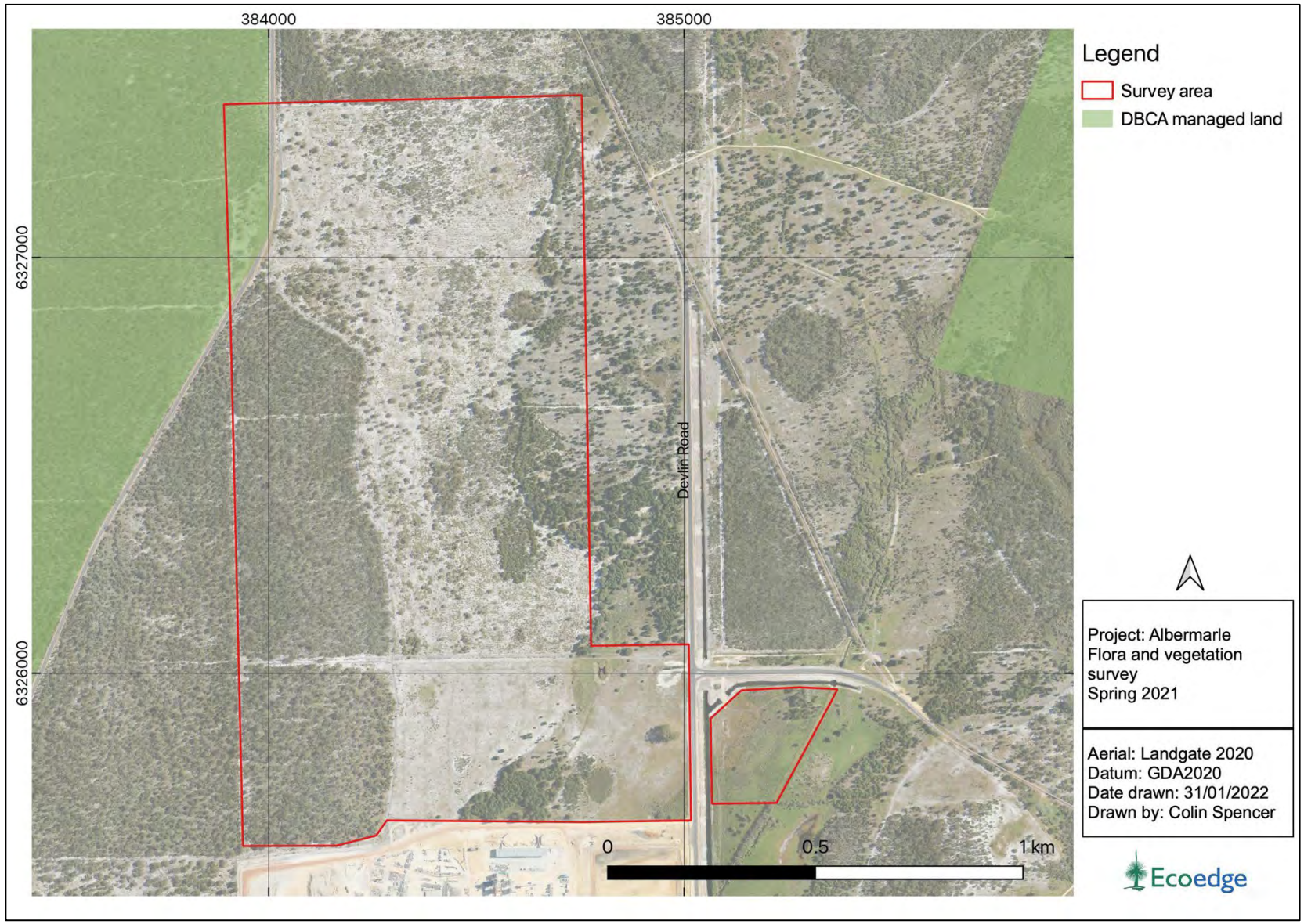

Figure 2. Aerial photograph showing the location of the survey and study area.

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 (Barnesby and Proulx-Nixon 1995).
- 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 2021a).
- Threatened and Priority flora Naturemap search results (DBCA 2021c)**.**
- Extract from the Department's Threatened Flora database and the Western Australian Herbarium database (DBCA 2020d).
- Geomorphic Wetlands, Swan Coastal Plain Data Set DBCA-019 (DBCA 2021e).
- 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.

- Kemerton Industrial Core Flora and Vegetation Survey. Unpublished report prepared for LandCorp May 2010, Project Number V9064 (Cardano 2010).
- Lot 510 Wellesley Road Additional Area Assessment, Unpublished memorandum prepared for Albermarle Lithium Pty Ltd (GHD 2017).
- Targeted Ecological Surveys for the Kemerton Industrial Park, Unpublished report prepared for LandCorp (Eco Logical Australia 2013).

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 17 and 18 September, 8 October and 19 November 2021 by Russell Smith (flora permit FB61000473), Debbie Brace (flora permit FT61000764), and Colin Spencer (flora permit FB62000169) in accordance with EPA 2016 guidelines.

The targeted survey for threatened and priority flora involved inspecting all potential habitat, including drainage lines and wetlands. The time of survey was within the optimum time for field identification of most of the threatened and priority flora, including *Drakaea elastica*[2], identified as potentially occurring within the survey area.

Dominant and characteristic species, as well as some soil information, was collected at relevés across the survey area, and vegetation condition was recorded at these and other points. In addition, four floristic quadrats were installed in the Jarrah-Banksia woodland[3] in the western part of the survey area. Information from the relevés and quadrats was used to describe vegetation units. In total, 374 vegetation information points, 4 floristic quadrats and 118 relevés were recorded.

The relevé information was used to identify and describe vegetation units using the NVIS system (Level 5; DEHA 2003).

Flora species 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**).

[2] *Drakaea glyptodon* (and also *Paracaleana nigrita*) was seen in leaf within the survey area although *D. elastica* was not seen. The sighting of these orchids in leaf provides assurance that the search timing was appropriate.
[3] The EmBaBiMW vegetation unit.

3.3 Survey limitations

Limitations with regards 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 out within the prime flowering season for the high rainfall south-west forests.
Climatic and seasonal effects	Negligible	Rainfall till the end of November for Bunbury (the nearest station within complete records) was 134% of the long-term mean.
Availability of contextual information	None	A regional vegetation survey has been conducted on the south Swan Coastal Plain, and many local surveys have been conducted in the Kemerton area
Completeness of the survey	Negligible	The survey was carried out within the spring flowering season, and most parts of the survey area were easily 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.)	Moderate	About two-thirds of the survey area has been cleared for livestock grazing and part of it subsequently planted to pines.

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), which is bounded by the Darling Scarp 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 of 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. These wind-deposited dunes press up against the Pinjarra plain, which is built up of alluvium deposited by streams from the Darling 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 across the Spearwood dune system in the west and the Bassendean dune system in the east. The Spearwood system is characterised by sand dunes and plains of yellow, deep sands, pale, deep sands and yellow/brown shallow sands (Barnesby and Proulx-Nixon 1995). The Bassendean system is characterised by gently undulating, leached grey siliceous sand dune plains of very low relief sand with intervening sandy and clayey swamp sands (Barnesby and Proulx-Nixon 1995). These systems have been divided into soil phases based on local soil conditions, with five soil phases mapped across the survey area. These are described in **Table 1** and mapped in **Figure 3.**

Table 2. Soil mapping units occurring within the survey area (Barnesby and Proulx-Nixon 1995).

System	Soil phases	Description
	211Sp__S1c	Dune ridges with deep bleached grey sands with yellow-brown subsoils, and slopes up to 15%.
	211Sp__S2c	Lower slopes (1-5%) of dune ridge with bleached or pale sands with a yellow-brown or pale brown subsoil (like S1c). Usually occurs on the eastern edge of the Spearwood Dunes.
	212Bs__B1a	Extremely low to very low relief dunes, undulating sandplain, and discrete sand rises with deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface; marri and jarrah dominant.
	212Bs__B3a	Broad depression and narrow swales between sand ridges with poor to very poorly drained grey and brown sands, with an iron-organic (or siliceous) hardpan at generally less than one metre.
	212Bs__B6	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.

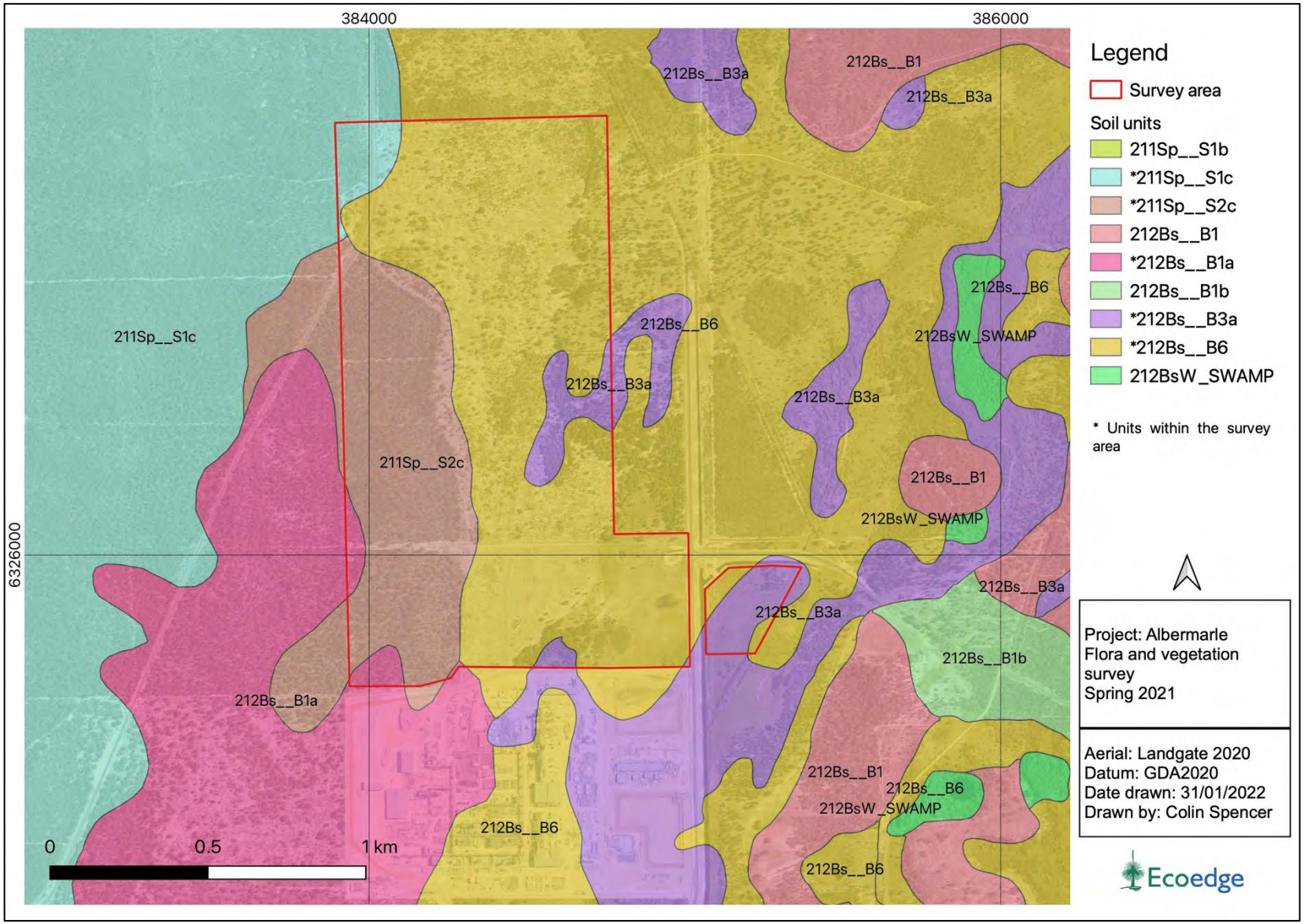

Figure 3. Land units mapped in and nearby the survey area (Barnesby and Proulx-Nixon 1995).

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 Bassendean Complex - Central and South, 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
Bassendean Complex-Central and South	Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) - *Allocasuarina fraseriana* (Sheoak) - Banksia species to low woodland of Melaleuca species and sedgelands on the moister sites. This area includes the transition of *Eucalyptus marginata* (Jarrah) to *Eucalyptus todtiana* (Pricklybark) in the vicinity of Perth.

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) [4].

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**).

[4] 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.

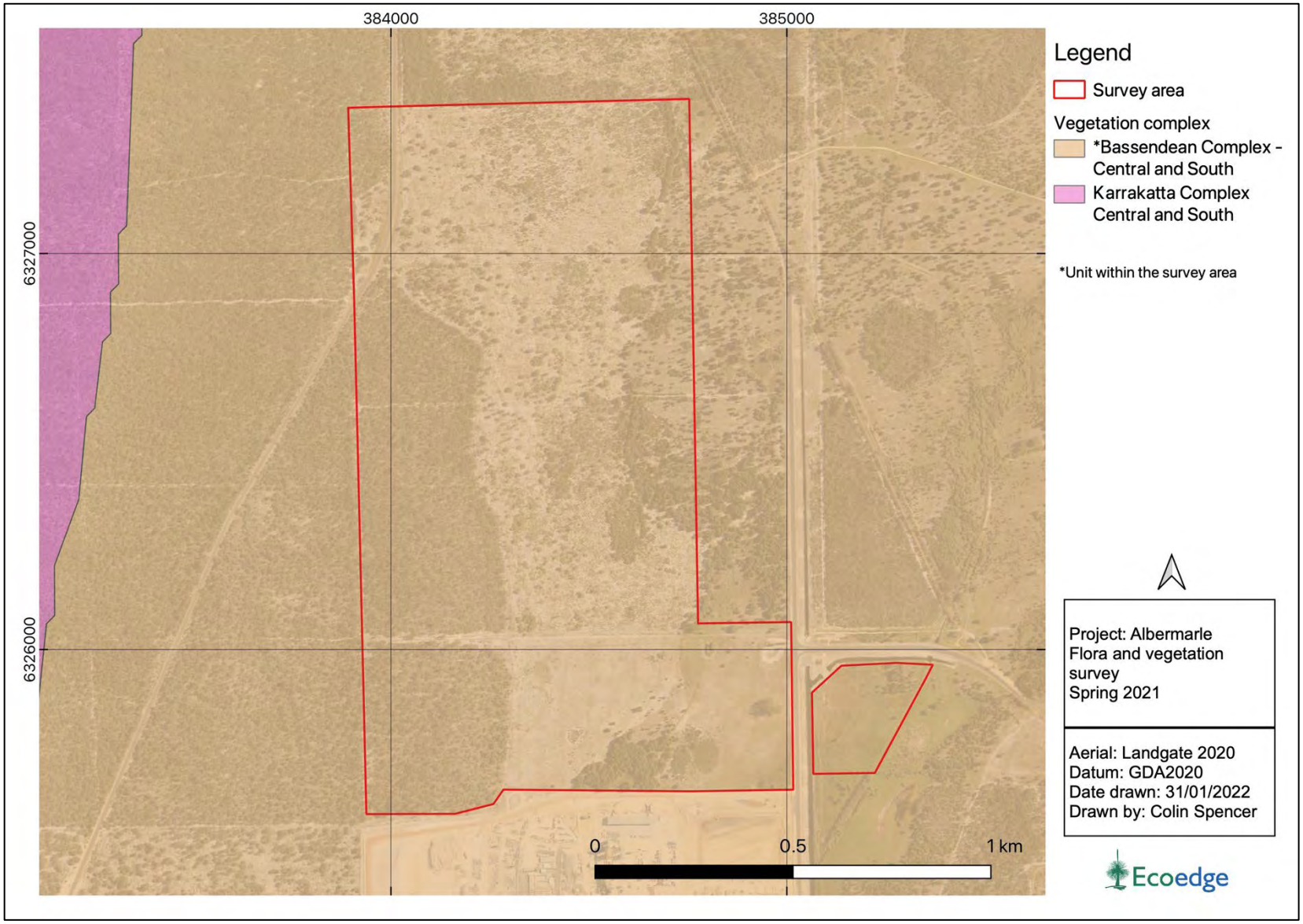

Figure 4. Vegetation complexes mapped in and nearby the survey area (Webb et al. 2016).

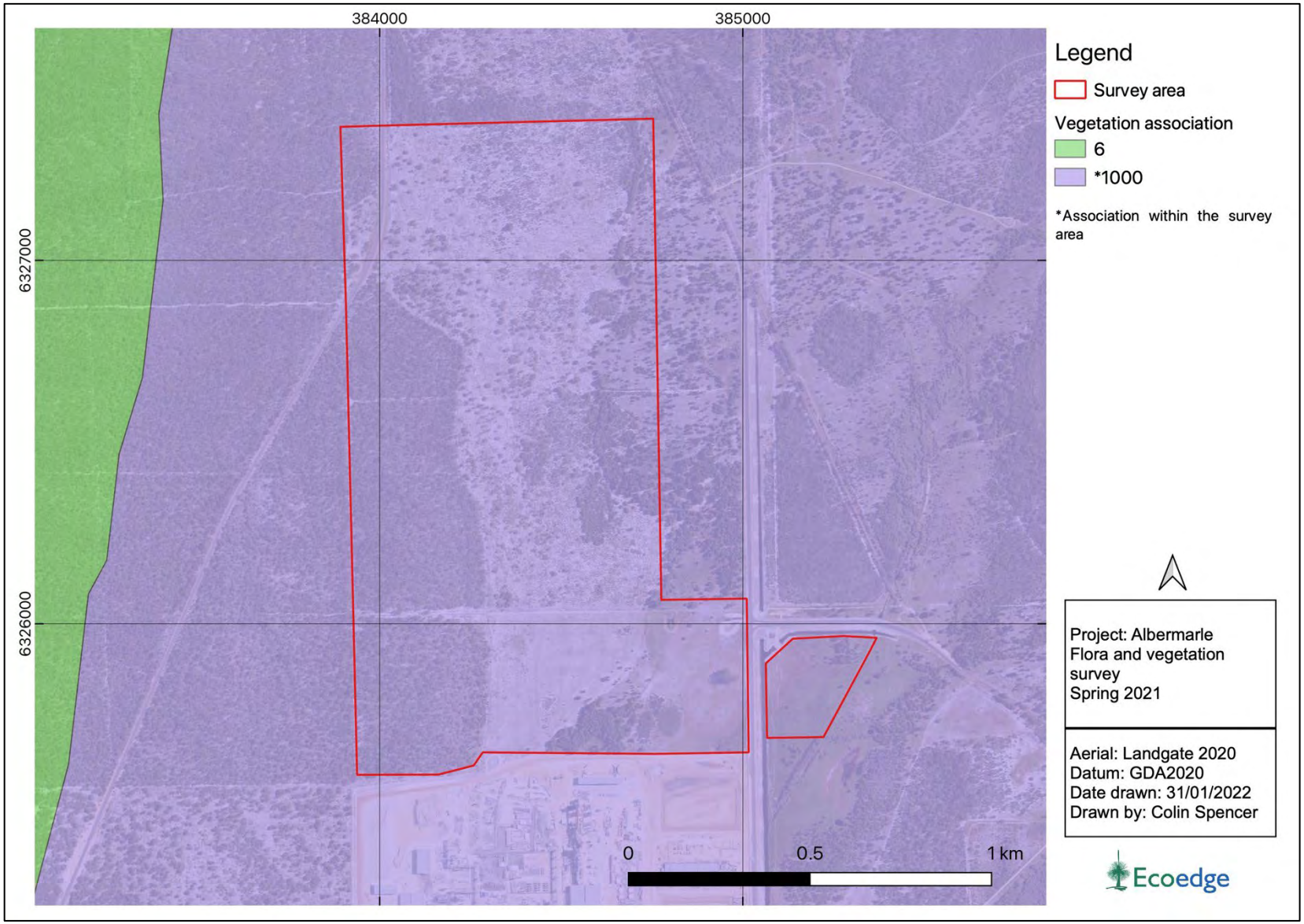

Figure 5. Vegetation associations mapped in and nearby the survey area (Webb et al. 2016).

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".

There is one vegetation complex mapped for the survey area: the Bassendean Central and South Complex. This has less than 30% of its pre-European extent vegetation remaining. The pre-European extent vegetation and the percentage of current extent in DBCA managed land for this complex is presented in **Table 4**.

Table 5 presents the same statistics for the one Beard vegetation association mapped across the survey area: association 1000.

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
Bassendean Complex – Central and South				
Swan Coastal Plain	87,476.26	23,508.66	26.87	5.00
Shire of Harvey	19,017.49	8,155.02	42.88	21.74

* 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
Shire of Harvey	20,121.61	8,209.83	40.80	12.40

* 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 2020b). These are defined in **Appendix 4.**

The desktop assessment, which included a Protected Matters Search (DAWE 2021a) and review of DBCA TEC and PEC database extracts (DBCA 2021a), found five EPBC Act, two BC Act listed TECs, and three State listed PECs within the 5 km study area.

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

Table 6. Threatened and Priority ecological communities occurring within study area (DAWE 2021a, 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, one of which occurs in the study area: 1. SCP08: Herb rich saline shrublands in claypans	T (VU)	T (CR)
Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the 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, including SCP21c 1. SCP21c Low lying *Banksia attenuata* woodlands or shrublands	P3	T (EN)
Subtropical and Temperate Coastal Saltmarsh	P3	T (VU)

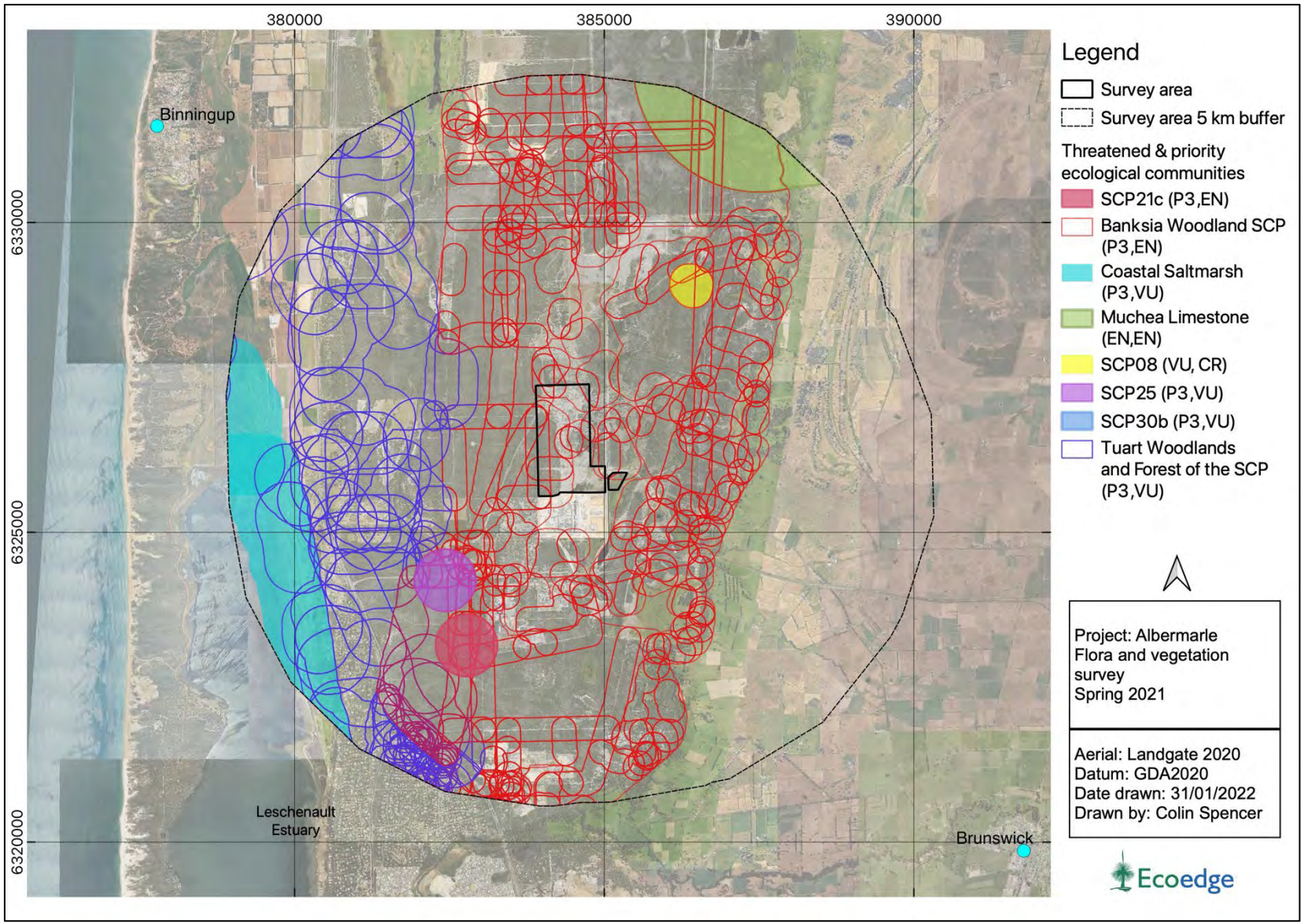

Figure 6. Threatened and Priority ecological communities within 5 km of the survey area. (DBCA 2021a)

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 as 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 2020c).

Threatened or Priority flora occurring within 5 km of the survey area generated from a NatureMap search (DBCA 2021c) and a Protected Matters Search Tool query (DAWE 2021a). DBCA and WA Herbarium Threatened and Priority flora data downloads (DBCA 2021d) are provided in **Appendix 7**.

Twenty-nine significant species were identified within this search area. Of these, four species were considered likely to occur within the survey area. Twelve species were possible and thirteen Unlikely. The four species likely to occur within the survey area are listed in **Table 7.** Two of these are Threatened orchids. The locations of these significant flora 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 likelihood of occurrence assessment provided in **Appendix 8**.

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

Species	Conservation Status
Drakaea elastica	T (EN)
Drakaea micrantha	T (VU)
Acacia semitrullata	P4
Caladenia speciosa	P4

Table 8 Likelihood of occurrence according to conservation status.

Likelihood of occurrence	Total number	Priority 1	Priority 2	Priority 3	Priority 4	Threatened
Likely	**4**	0	0	0	2	2
Possible	**12**	3	1	4	3	1
Unlikely	**13**	1	0	2	0	10
Total	**29**	**4**	**1**	**6**	**5**	**13**

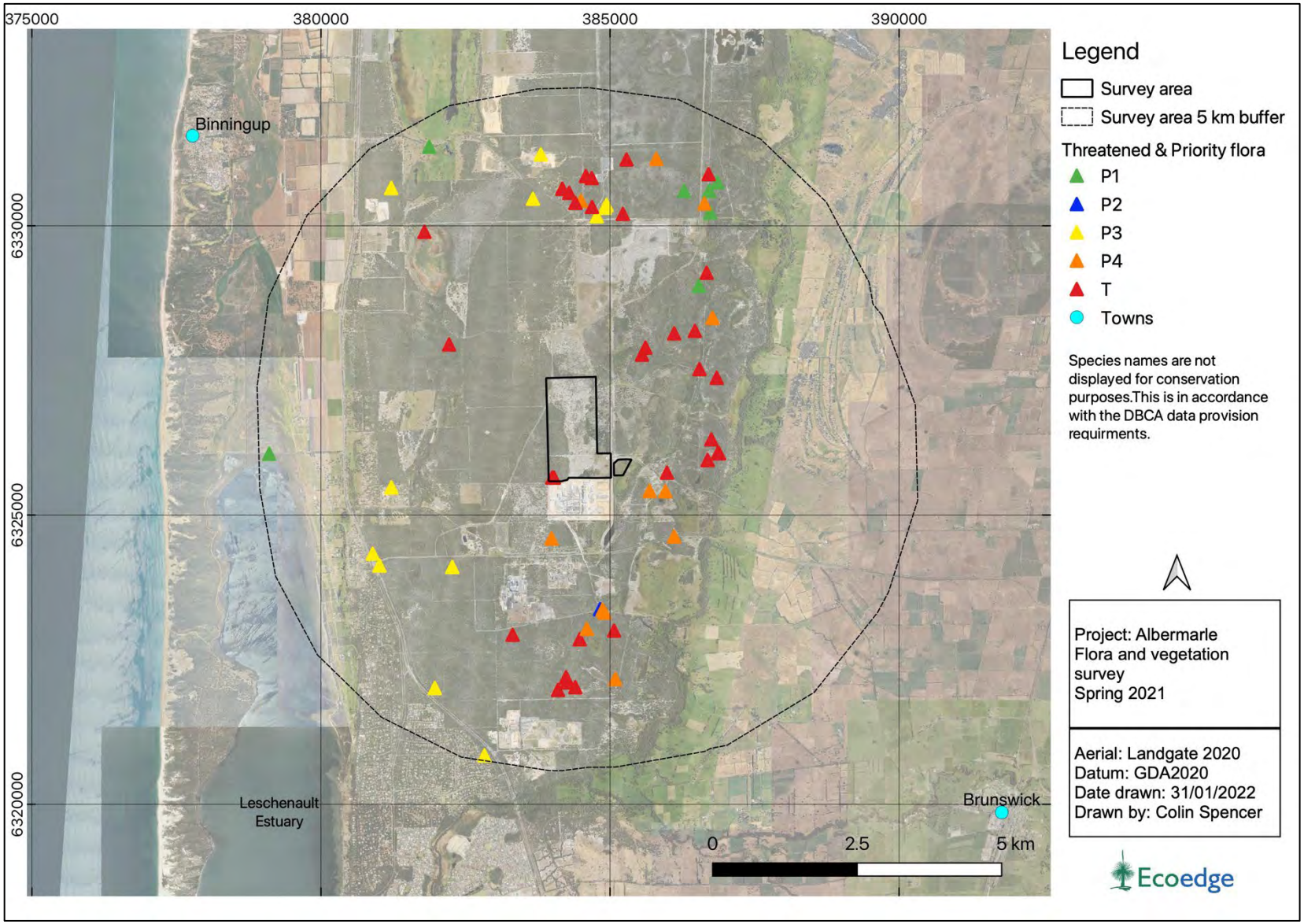

Figure 7. Threatened and Priority flora within the five km study area (DBCA 2021d)

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 Conservation Category wetlands within the survey area (DBCA 2021e). A MU sumpland is mapped to occur across much of the eastern portion of the survey area, with occurrences of MU damplands in the southern part of the site (DBCA 2021e) (**Figure 8**).

4.7 Watercourses

An unnamed minor, non-perennial watercourse is mapped by Crossman and Li (2015) across the south-western boundary of the site. This alignment crosses the area of the lithium processing plant development site south of the survey area, but recent aerial imagery shows that it is likely that its alignment has been redirected into the drainage system, which occurs along the eastern side of Devlin Road (**Figure 8**).

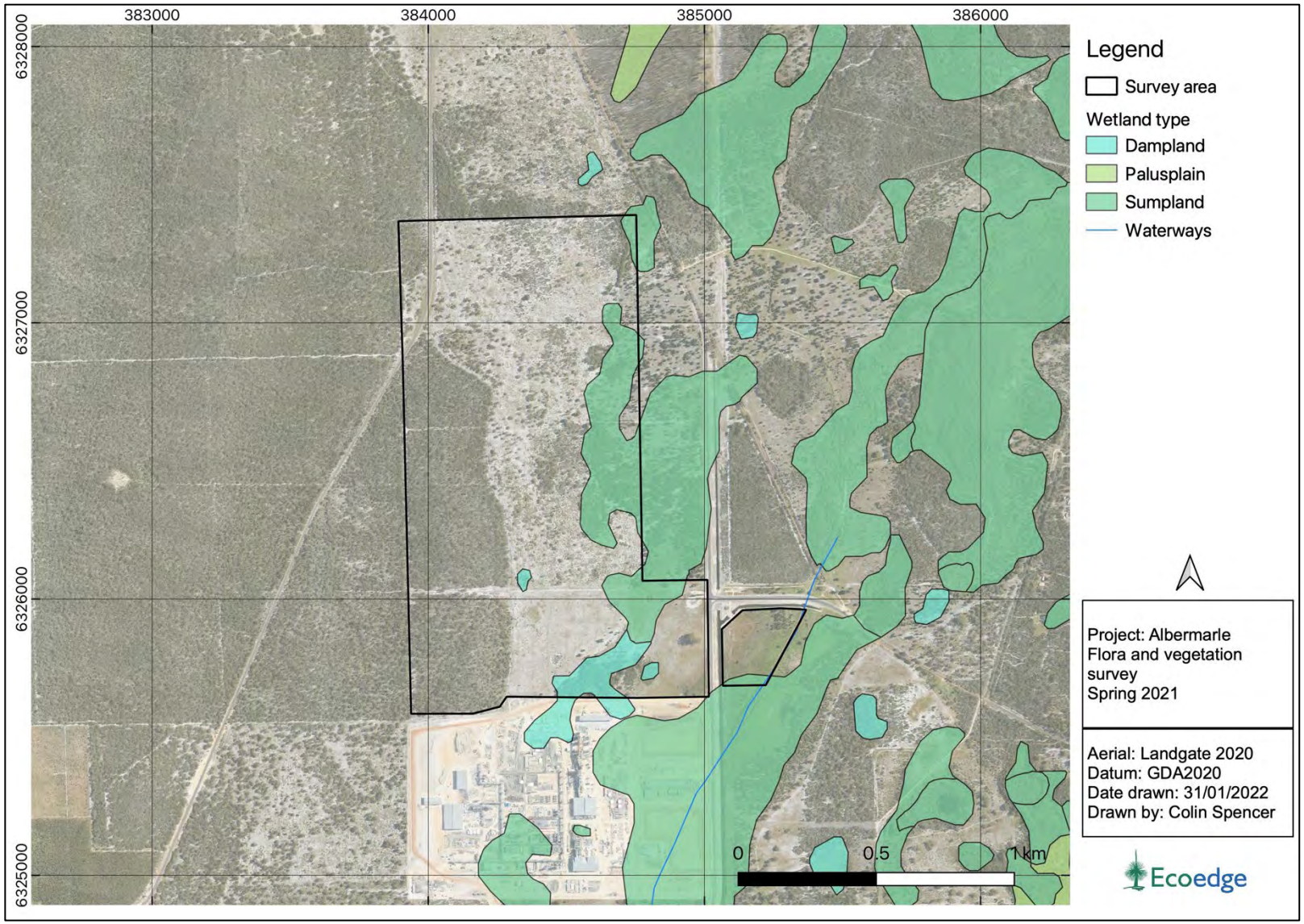

Figure 8. Geomorphic wetland type and waterways in proximity to the survey area (DBCA 2021e).

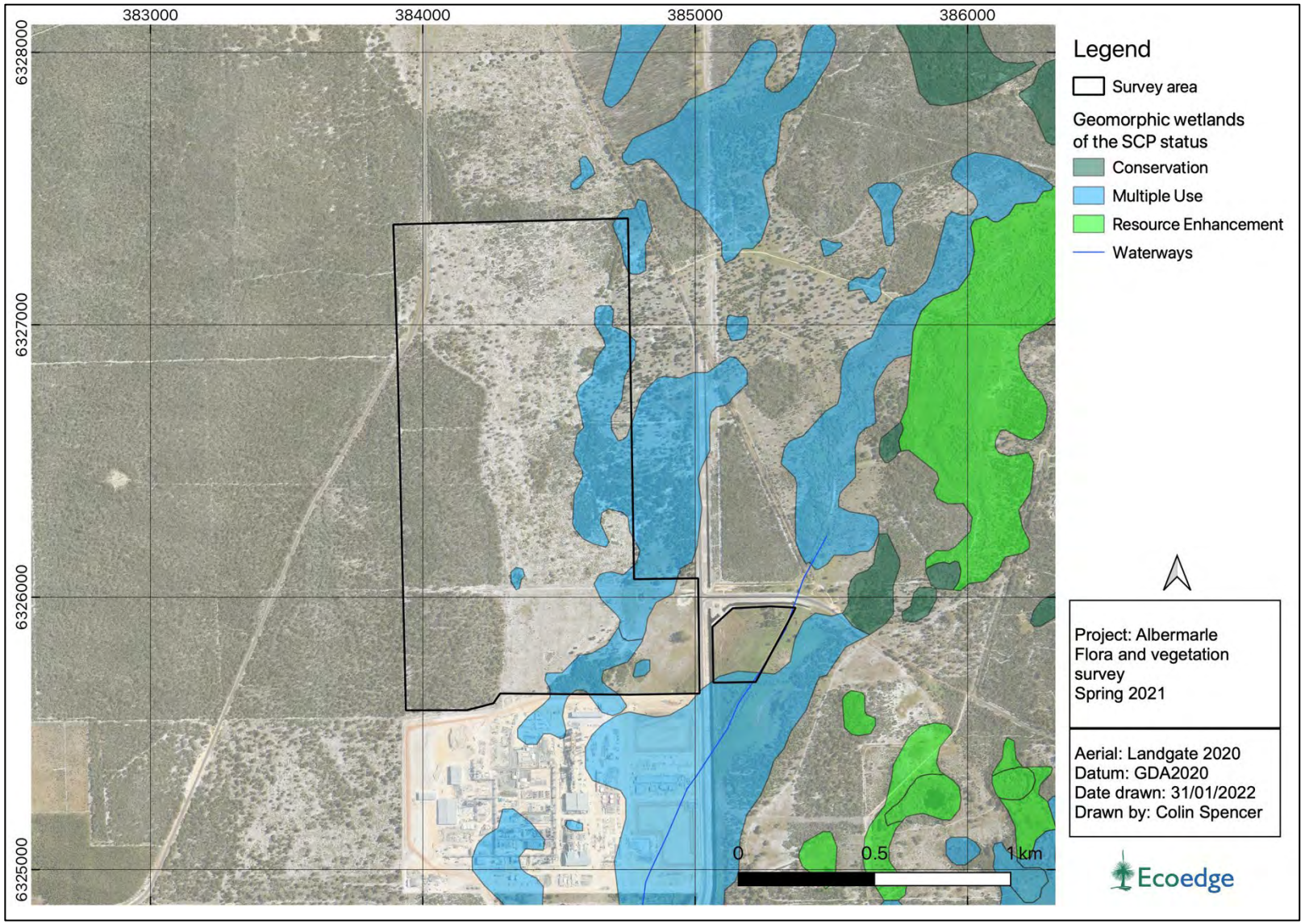

Figure 9. Status of geomorphic wetlands in proximity to the survey area (DBCA 2021e).

4.8 Regional ecological linkages

Regional ecological linkages "link protected patches of regional significance by retaining the best (condition) patches available as steppingstones 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

Two regional ecological axis lines mapped by Molloy et al. (2009) associated with State and privately managed native vegetation occur to the east and west of the survey area. These linkages axis lines form part of the McLarty/Kemerton/Twin Rivers/Preston River/Gwindinup Ecological Linkage recognised by the EPA in its 2013 report and recommendations on the Greater Bunbury Region Scheme (EPA 2013). The axis line in the west is approximately 1.8 km away, and the one in the east is approximately 1.75 km away. Vegetation within the survey area is linked predominantly with the west axis line, with parcels of vegetation within the area being assigned 1c and 2b pv ratings based on their levels of separation from the axis line (**Figure 10**).

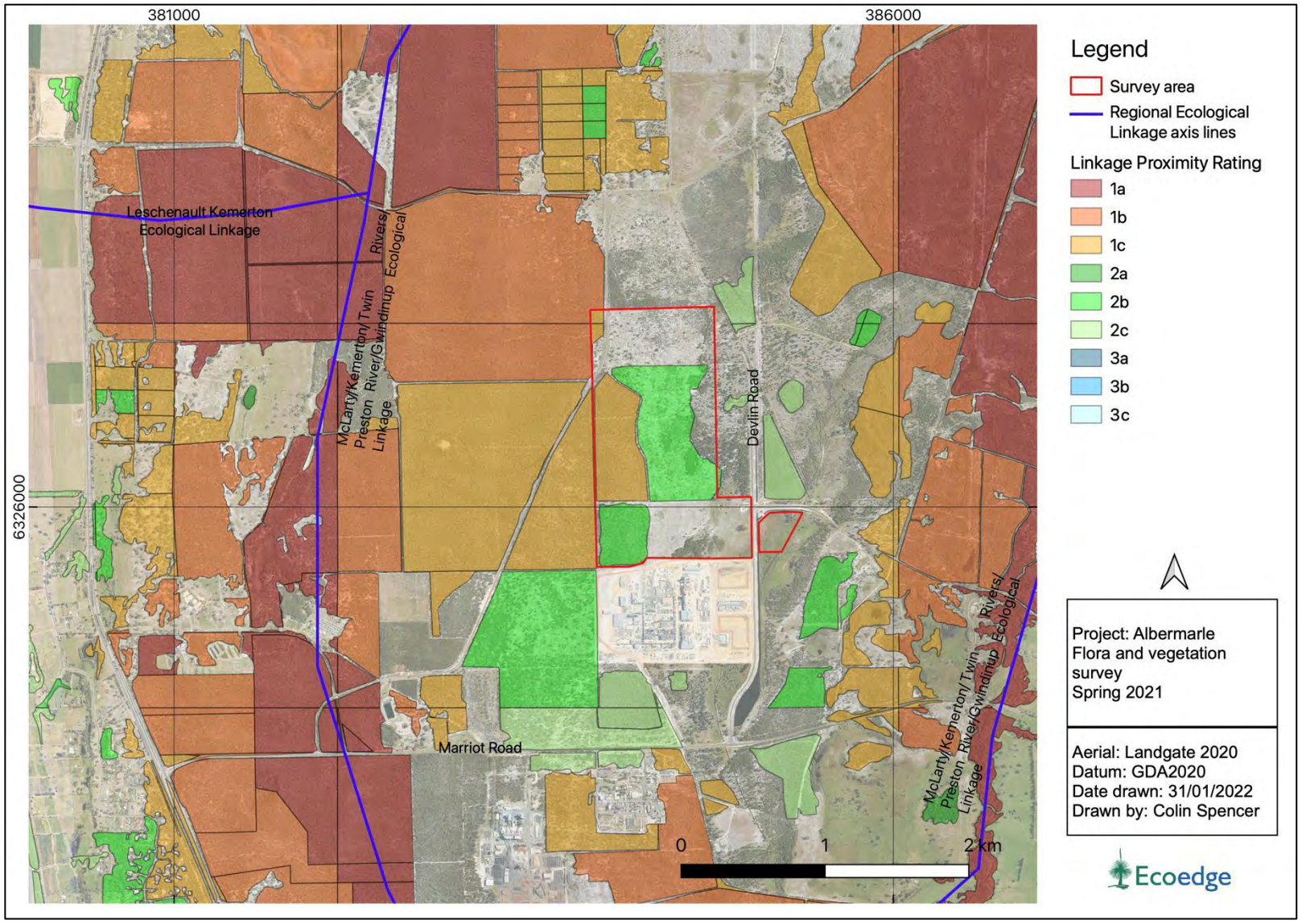

Figure 10. The survey area in relation to regional ecological linkages (Molloy et al. 2009).

4.9 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 ESAs within the survey area. The nearest ESA is located approximately 120 m to the east of the most eastern boundary of the survey area (**Figure 11**). This ESA is associated with a Conservation category wetland (**Figure 9**).

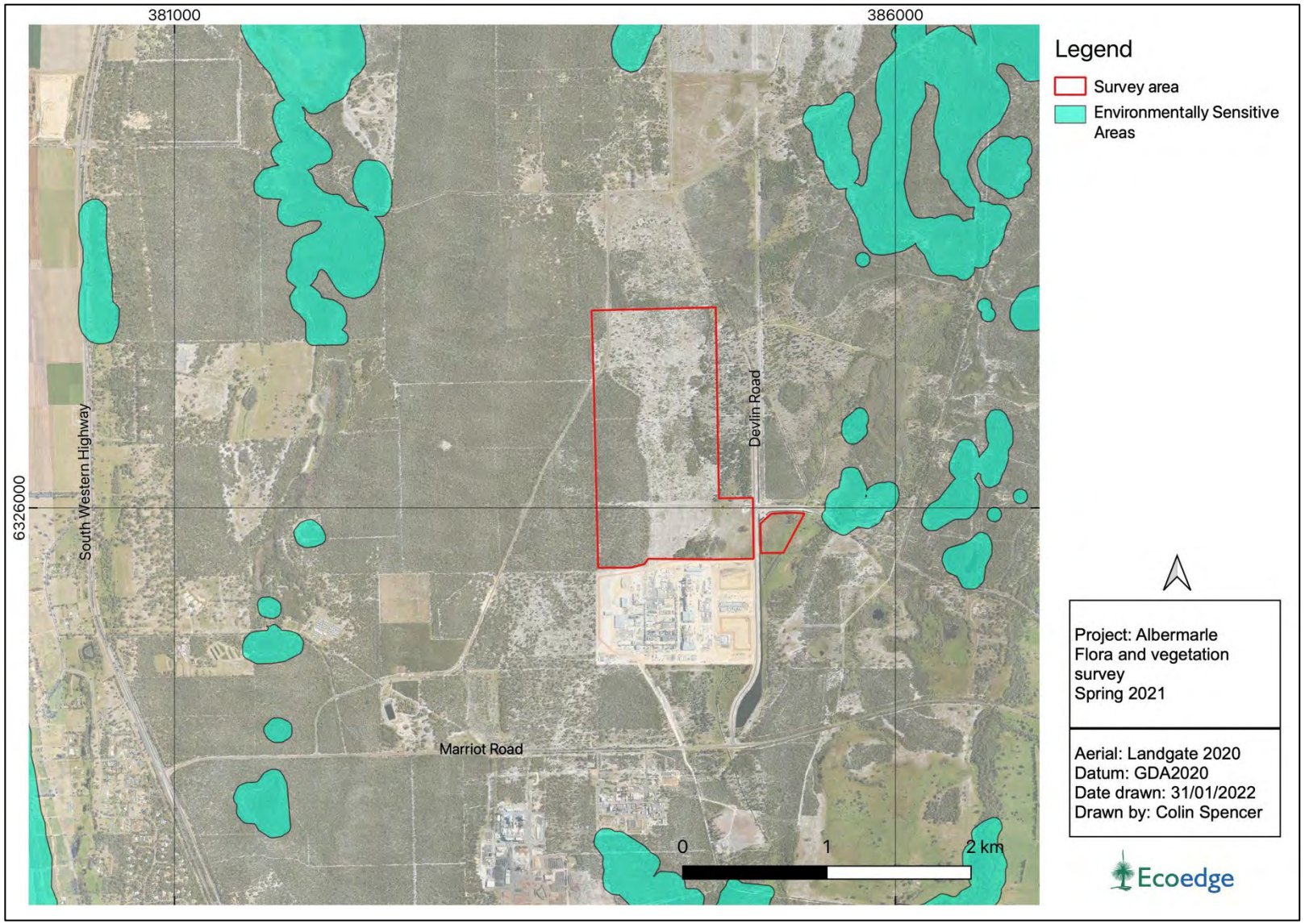

Figure 11. ESAs within study area (DWER 2020).

4.10 Other reports

A number of ecological reports, including flora and vegetation surveys, have been prepared over the Kemerton Strategic Industrial Area (KSIA), including its outer buffer zone, formally the Kemerton Industrial Park (KIP), within which the current survey area occurs. Summaries of three reports relevant to the current survey are provided below. These are relevant because they occurred over or are directly adjacent to the site and present the most current assessment of the survey to date. They are presented in chronological order.

Cardno (2010) Kemerton Industrial Core Flora and Vegetation Survey. Unpublished report prepared for LandCorp.

- Location: the industrial core area of the KIP which covers all of the current survey area. The boundary of the survey area is shown in **Figure 12**.
- Area: 2019 ha
- Purpose: to document the botanical values of the industrial core areas of the KIP.
- Key outcomes relevant to the current survey: Five vegetation communities were identified across the current survey area, two of which, EmCcBa and BaBiKg, were inferred via statistical analysis to be FCT 21c 'Low lying *Banksia attenuata* woodland or shrublands', which is a currently listed state listed PEC and Federally listed TEC as part of the Banksia Woodlands of the Swan Coastal Plain TEC.
- The vegetation condition attributed to the site included the following Pristine to Excellent, Excellent, Good to Degraded, Degraded and Completely Degraded.
- Three occurrences of *Acacia semitrullata* (P4) and one occurrence of *Caladenia speciosa* (P4) were recorded within the current survey area.

Ecological Australia (2013) Targeted Ecological Surveys for Kemerton Industrial Park. Unpublished report for LandCorp

- Location: Kemerton Industrial Park, including the outer buffer area with a focus on the buffer zone, **Figure 12**.
- Area: approximately 7,500 ha
- Purpose: Extrapolate the Cardno (2010) vegetation unit mapping to KIP outer buffer area. Undertake a targeted flora survey of this area with a focus on Threatened orchids likely to occur in the area. Update vegetation condition mapping across the whole area. These actions were recommended following a review of all previous ecological studies across the survey area
- Key outcomes relevant to the current survey: The vegetation unit mapping of Cardano (2010) was retained across the survey area however, the condition of the vegetation was reassessed with a general downgrading and simplification of the condition on site.

The following revised condition ratings were attributed to the vegetation: Completely Degraded, Degraded, Good and Excellent

- The State PEC, and now Federal TEC, Low lying *Banksia attenuata* woodlands or shrublands FCT21c was recognised across the site being attributed to all occurrences of the EmCcBa vegetation unit, including areas of Completely Degraded vegetation.
- The Threatened orchid *Drakaea elastica* was recorded within the SW corner of the current survey area.

GHD (2017) Additional Area Assessment, Unpublished memorandum for Albemarle Lithium Pty Ltd

- Location: Portion of the KSIA part Lot 510 Wellesley Road, Wellesley. This survey occurred on the southern boundary of the current survey area (**Figure 12**).
- Area: 12.27 ha
- Purpose: to delineate key vegetation, flora and fauna constraints within the survey area, with the focus of the targeted flora survey being *Acacia semitrullata* (P4).
- Key outcomes relevant to the current survey: Five vegetation communities, consistent with the EcoLogical Australia (2013) report, were recognised across the survey area. These were not attributed to any State or Federally listed TECs or PEC.
- Fifty-nine *A. semitrullata* plants were recorded at eleven locations. Three of these locations occur along the southern boundary of the survey area.

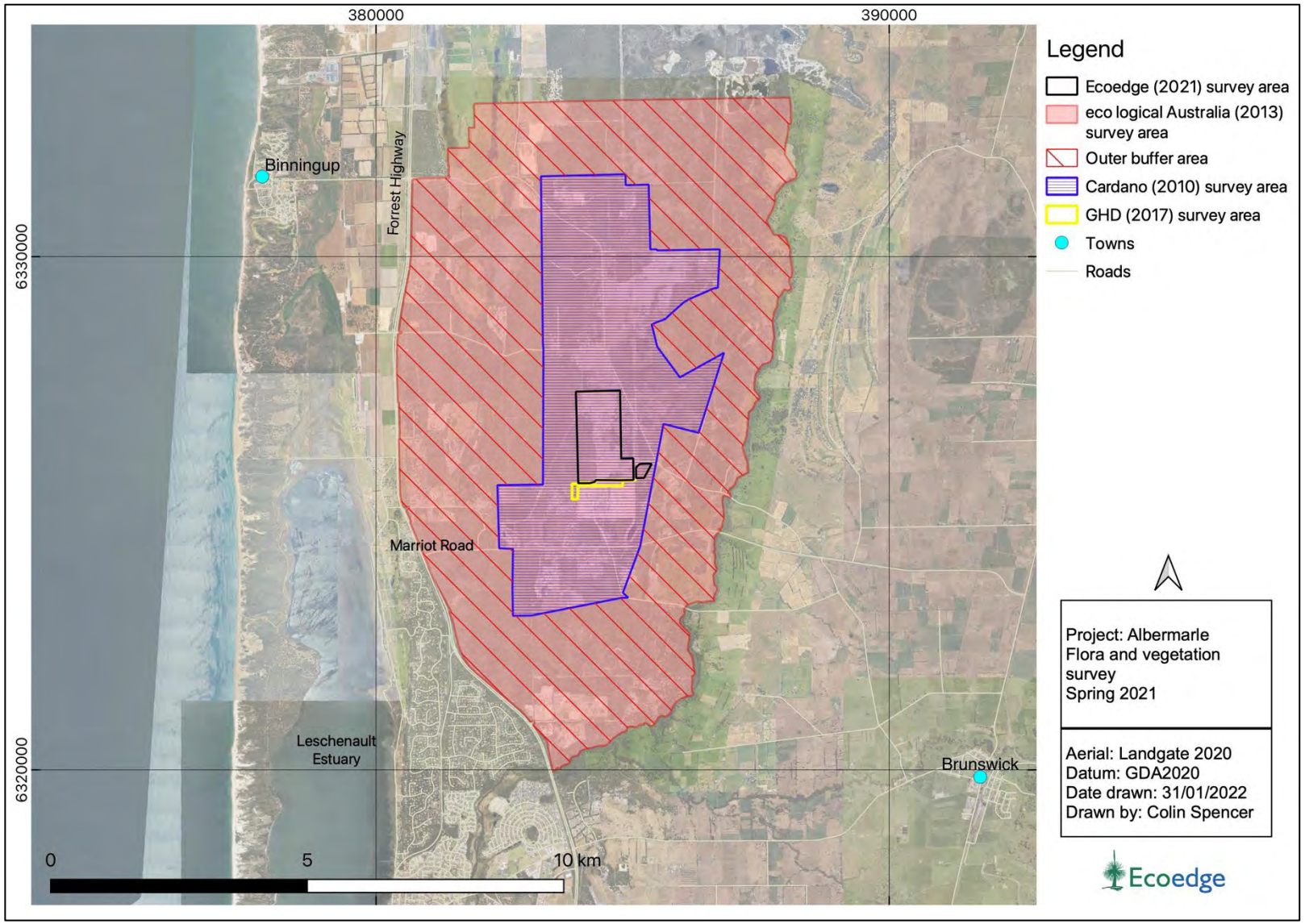

Figure 12. The location of the survey area in relation to other previous relevant flora and vegetation surveys.

5 Survey results

Tracklog and relevés were recorded, and locations are shown in **Appendix 9**.

5.1 Flora

One hundred and fifty-five vascular flora taxa were identified within the survey area, of which sixteen were introduced species (**Appendix 9**). The two plant families with the highest representation were the Fabaceae (fifteen taxa, one of which was introduced) and Orchidaceae (sixteen taxa, one introduced). The number of native flora within the survey area was relatively low for the area of native vegetation (138 ha). This is attributable to the fact that about 60% of the area classified as native vegetation was previously cleared and grazed.[5] Even in the areas with Very Good or Excellent vegetation in the eastern part of the survey area, species richness is relatively low, probably because it is long unburnt.

5.1.1 Flora of conservation significance

No flora listed as Threatened under the *EPBC Act* or the *BC Act* were found within the survey area. A previous survey of part of the current survey area (Ecological Australia 2013) had recorded the Threatened orchid *Drakaea elastica* within the SW corner of the current survey area. However, despite intensive searching of this location, the orchid was not re-found.

Two Priority flora species were found: *Acacia semitrullata* and *Caladenia speciosa*, their distribution is shown in **Figure 13**, and they are discussed below. These species have also been found on land immediately south of the survey area (Cardno 2010; GHD 2017).

Acacia semitrullata (Priority 4) (**Figure 14**)
Acacia semitrullata is found on sandy soils on the Swan Coastal Plain from Mandurah to Dunsborough, on the northern Blackwood Plateau and in the Collie Basin. Generally, it grows in Banksia woodlands which are threatened by *Phytophthora* disease.

Caladenia speciosa (Priority 4) (**Figure 15**)
Caladenia speciosa is mostly found on the Swan Coastal Plain between Lancelin and Ludlow, a straight-line distance of 300 km. While relatively widespread, it is mainly confined to *Banksia* woodlands which are themselves threatened by *Phytophthora* disease and declining rainfall.

[5] Aerial imagery from 1996 shows that about what is now mapped as native vegetation was previously rough pasture.

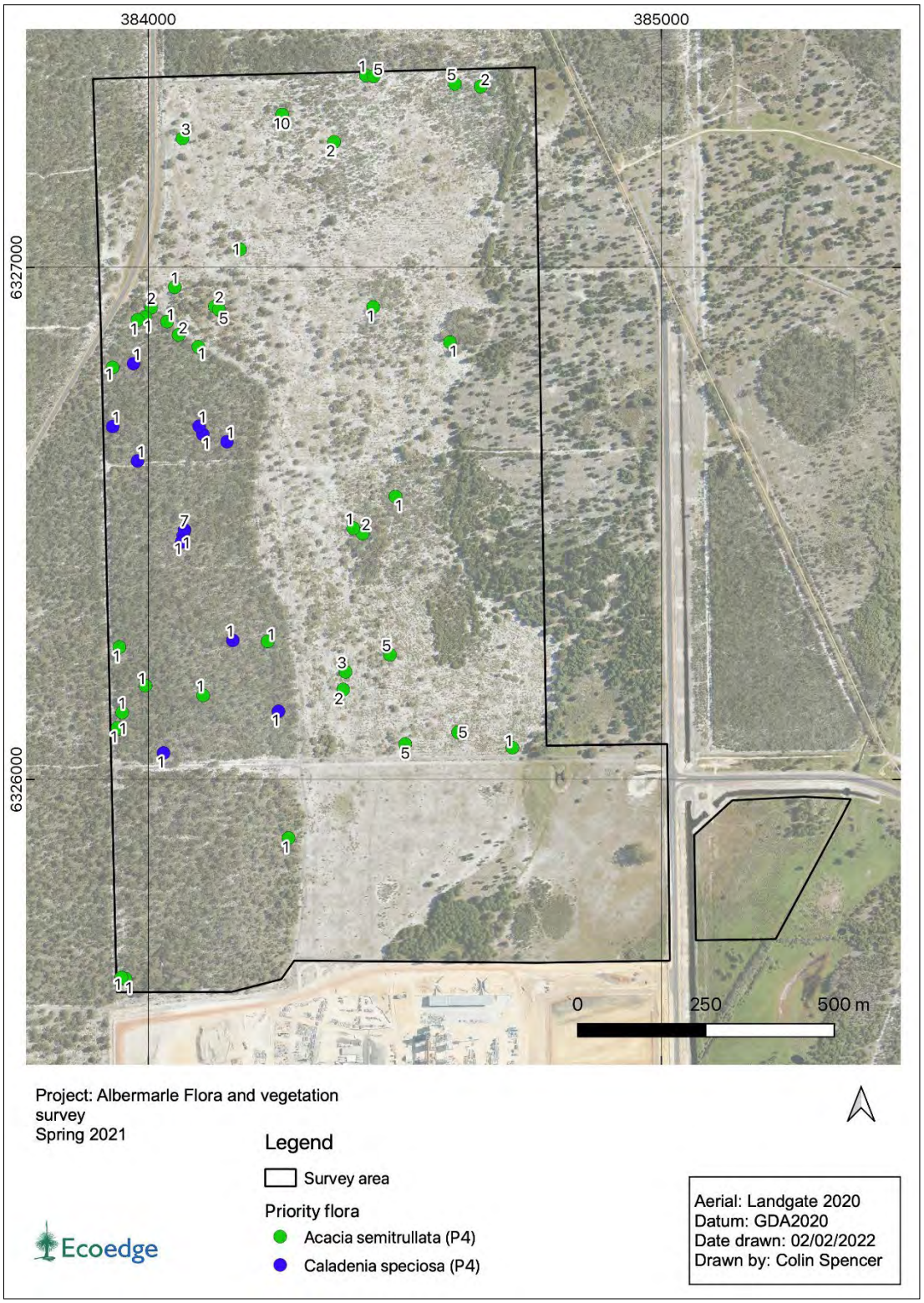

Figure 13. Location of Declared pest plants within the survey area.

Figure 14. *Acacia semitrullata*

Figure 15. *Caladenia speciosa*

5.2 Post likelihood of occurrence

The post-survey likelihood of occurrence of the twenty-eight potential significant vascular flora, including Threatened flora, was “unlikely”, except for the two Priority taxa which were recorded. Of the twenty-six taxa recorded as “unlikely” following the survey it was because of no suitable habitat in twelve cases. For the other fourteen taxa, even though suitable or potential habitat was present, it was appropriately searched, but 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	**2**				2	
Unlikely	**25**	3	1	6	2	13
Total	**27**	**3**	**1**	**6**	**4**	**13**

5.3 Declared pest plants

The weed **Zantedeschia aethiopica* (Arum-lily), which has the category s22(2) (C3 Exempt) under the *Biosecurity and Agriculture Management Act 2007*, was found at two locations during the survey (**Figure 16**). Currently, there are no obligations for the management of this weed under the Act.

Figure 16. Location of Declared pest plants within the survey area.

5.4 Vegetation units

Eight native vegetation units were identified within the survey area and are described below and shown in **Figure 17.** Vegetation unit EmBaBiMW is the most extensive type, comprising about 35% of the native vegetation in the survey area. This vegetation is mostly contained within a single intact parcel on the slopes and crest of a low ridge in the western part of the survey area. Apart from this unit, the others have been affected to varying extents by past clearing or livestock grazing activities.

A pine plantation covers about 10 ha of the survey area and formerly covered a larger portion. The cleared former pine plantation and grazing land have since partly revegetated with native species.

The conservation status of the native vegetation unit is discussed below in **section 6.2**.

Four of the vegetation units comprise wetland or dampland vegetation, and these are discussed further below (**Section 6.5**).

The extent and proportion of the total vegetated areas of each of these vegetation units are presented in **Table 13**.

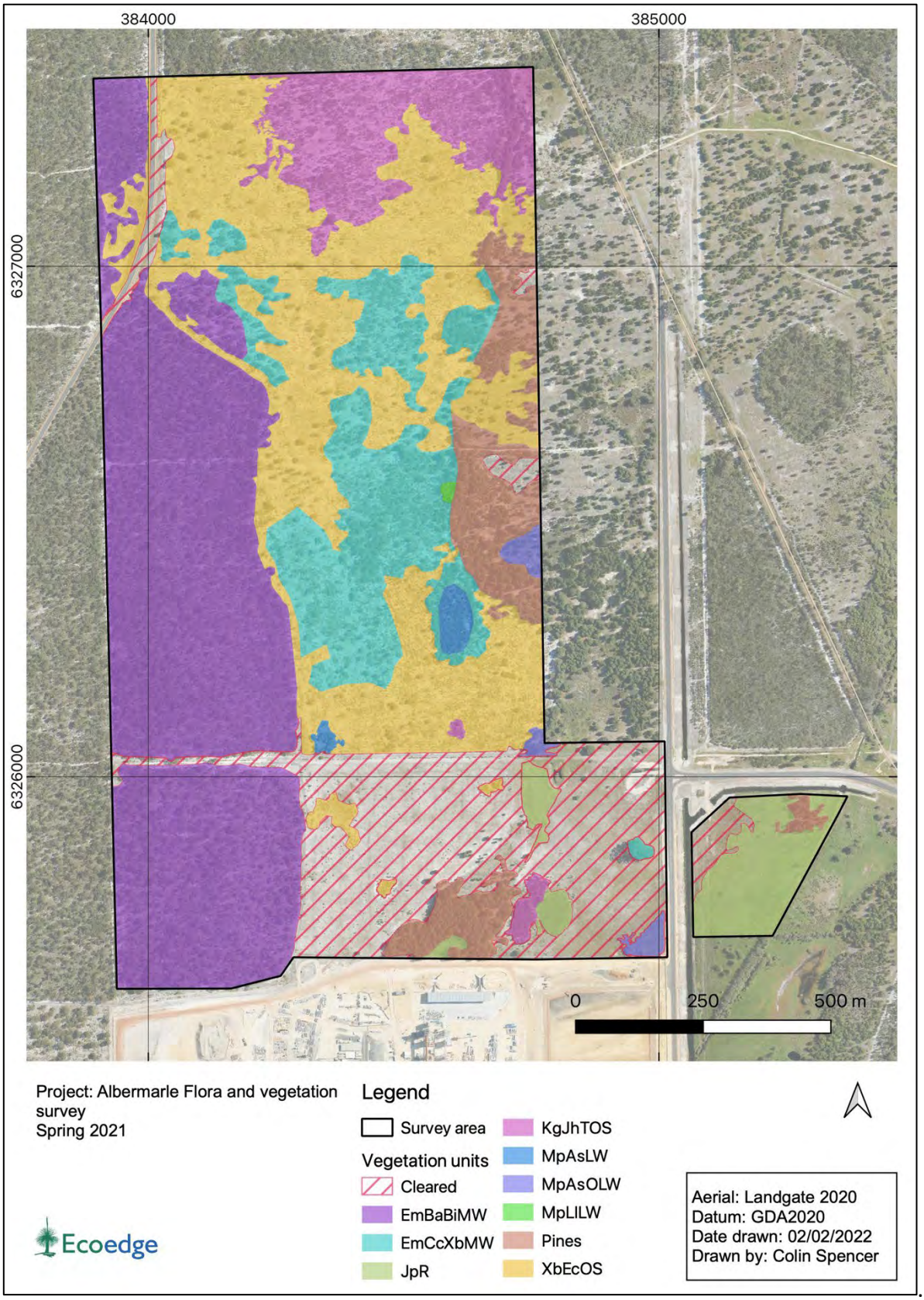

Figure 17. Vegetation units within the survey area.

Unit EmBaBiMW: Medium woodland of *Eucalyptus marginata* over low woodland of *Banksia attenuata*, *B. ilicifolia*, (*Nuytsia floribunda*, *Persoonia longifolia*) over *Jacksonia horrida*, *Kunzea glabrescens* tall very open shrubland over *Adenanthos meisneri*, *Hibbertia hypericoides*, *H. vaginata*, *Hypocalymma angustifolium*, *Melaleuca thymoides*, *Stirlingia latifolia*, *Xanthorrhoea brunonis* medium/low shrubland over *Burchardia congesta*, *Caladenia flava*, *Drosera porrecta*, *Lomandra hermaphrodita*, *Patersonia occidentalis* open forbland and *Lepidosperma squamatum* open sedgeland on grey sand on slopes and ridges (**Figure 18**).

Figure 18. Unit EmBaBiMW.

Unit EmCcXbMW: Medium woodland of *Eucalyptus marginata*, (*Corymbia calophylla*) over *Jacksonia horrida*, *Kunzea glabrescens* tall very open shrubland over *Dasypogon bromeliifolius*, *Macrozamia riedlei*, (*Hypocalymma angustifolium*), *Xanthorrhoea brunonis* low open shrubland over **Briza maxima*, **Ehrharta calycina* open grassland and open forbland including **Disa bracteata*, **Hypochaeris glabra* and **Ursinia anthemoides* on grey sand on flats (occasional planted Eucalypts) (**Figure 19**).

Figure 19. Unit EmCcXbMW.

Unit KgJhTOS: *Kunzea glabrescens*, *Jacksonia horrida* tall open shrubland (with *scattered Eucalyptus marginata* or *Corymbia calophylla or Melaleuca preissiana)* over *Xanthorrhoea brunonis* scattered medium shrubs over **Briza maxima*, **Ehrharta calycina* very open grassland and scattered forbs including **Disa bracteata*, **Hypochaeris glabra* and **Ursinia anthemoides* on grey sand on flats (**Figure 20**).

Figure 20. Unit KgJhTOS.

Unit XbEcOS: *Eucalyptus marginata*, *Nuytsia floribunda* scattered medium trees over *Xanthorrhoea brunonis* (*Adenanthos meisneri*, *Macrozamia riedlei*) open/very open shrubland over *Austrostipa compressa*, **Briza maxima*, **Ehrharta calycina* open grassland and scattered forbs including **Disa bracteata*, **Hypochaeris glabra* and **Ursinia anthemoides* on grey sand on flats (**Figure 21**).

Figure 21. Unit XbEcOS.

Unit MpLlLW: *Melaleuca preissiana* low woodland over *Astartea scoparia* medium open shrubland over *Dasypogon bromeliifolius*, *Hypocalymma angustifolium* low open shrubland over *Lepidosperma longitudinale* sedgeland and **Arctotheca calendula*, *Caladenia flava*, *Chamaescilla corymbosa*, **Hypochaeris glabra* and **Ursinia anthemoides* very open forbland on grey-brown sand in seasonal wetlands (**Figure 22**).

Figure 22. Unit MpLlLW.

Unit MpAsLW: *Melaleuca preissiana* low woodland over *Kunzea glabrescens* tall open shrubland over *Astartea scoparia*, *Jacksonia furcellata* medium open shrubland over *Dasypogon bromeliifolius*, *Hibbertia stellaris*, *H. vaginata*, *Hypocalymma angustifolium*, *Xanthorrhoea brunonis* low shrubland over *Hypolaena exsulca*, *Lyginia imberbis*, *Tricoryne elatior*, *Thysanotus multiflorus* open forbland on grey sand in depressions (**Figure 23**).

Figure 23. Unit MpAsLW.

Unit MpAsOLW: *Melaleuca preissiana* (*Pinus* sp.) very open/open low woodland over *Astartea scoparia* medium closed medium shrubland over *Adenanthos obovata* open low shrubland over sparse forbland including **Arctotheca calendula*, **Hypochaeris glabra* and *Lyginia imberbis* on grey-brown sand in broad damplands (**Figure 24**).

Figure 24. Unit MpAsOLW.

Unit JpR: *Juncus pallidus* closed rushland/open rushland with scattered *Astartea scoparia* or *Kunzea glabrescens* tall shrubs over sparse forbland including **Arctotheca calendula*, **Hypochaeris glabra*, *Lyginia imberbis*, **Rumex acetosella*, and **Ursinia anthemoides* on grey sand in broad damplands (**Figure 25**).

Figure 25. Unit JpR.

Table 13. Extent and proportion of the total vegetated areas of each of the vegetation units.

Veg. Unit	Condition Score	Area (ha)	%	TEC/PEC
EmBaBiMW	Excellent	28.71	60.73	Banksia Woodlands of the SCP TEC PEC (46.51 ha)
	Very Good	15.37	32.51	
	Good	2.43	5.13	
	Degraded	0.77	1.63	
	Total	**47.28**	**100.00**	
EmCcXbMW	Very Good	0.11	0.55	
	Good	7.64	39.25	
	Degraded	11.55	59.35	
	Completely Degraded	0.17	0.85	
	Total	**19.47**	**100.00**	
KgJhTOS	Good	1.29	10.66	
	Degraded	10.82	89.34	
	Total	**12.11**	**100.00**	
XbEcOS	Degraded	40.67	98.78	
	Completely Degraded	0.50	1.22	
	Total	**41.17**	**100.00**	
MpAsLW	Good	0.98	100.00	
	Total	**0.98**	**100.00**	
MpAsOLW	Very Good	0.44	36.89	
	Degraded	0.75	63.11	
	Total	**1.19**	**100.00**	
JpR	Degraded	6.11	100.00	
	Total	**6.11**	**100.00**	
MpLlLW	Good	0.10	100.00	
	Total	**0.10**	**100.00**	
Total		**128.41**		

5.5 Multivariate analysis

Following the multivariate analysis (MVA), the four survey area quadrats were grouped with several other quadrats from the survey of the Swan Coastal Plain (Gibson et al., 1994). They were mainly assigned to the floristic community types (FCTs) 21a, 21b and 21c, which are all part of the Banksia Woodlands of the Swan Coastal Plain TEC. However, as was expected, the MVA did not place the four survey area quadrats within one of the two sub-groups (21a and 21c in one sub-group and 21b in the other), but instead, they formed a separate subgroup (**Figure 26**).

The reason for this separate clustering of the survey quadrats is probably the large disparity in the number of species in the survey area quadrats (average of 28 taxa) versus the average of approximately fifty species/quadrat in the SCP FCTs (21a, 21b and 21c). Previous experience has demonstrated that large disparities in species richness of quadrats when compared with the SCP dataset can lead to this problem in attempting to assign the appropriate FCT.

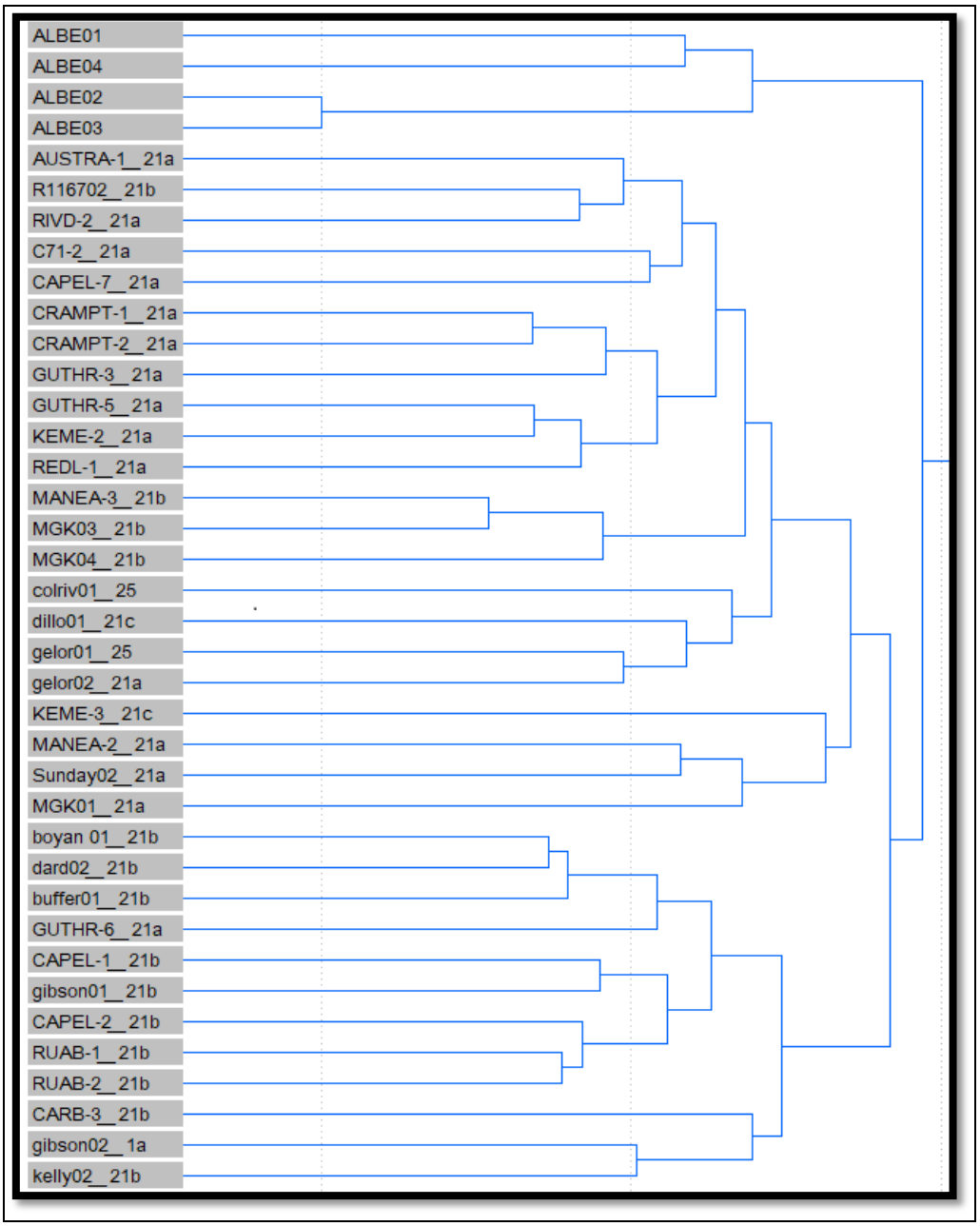

Figure 26. Part of the dendrogram produced by the MVA of floristic quadrat data.

5.6 Vegetation condition

About 40% of native vegetation was in Good-or-better condition (**Table 14**). As mentioned above, approximately two-thirds of the survey area has been subject to past clearing, livestock grazing. In the easternmost area, pines were planted and then these were partially cleared. Over 60% of the area classed as native vegetation is a result of natural regeneration since the original clearing. Most of this regenerated area was classed as Degraded or Completely Degraded condition. **Figure 27** shows the vegetation condition in the survey area and **Figure 28** shows the areas of TEC/PEC.

Table 14. Vegetation condition within the survey area.

Condition Score	Area (ha)	%
Excellent	28.71	20.73
Very Good	15.92	11.50
Good	12.34	8.92
Degraded	70.67	51.01
Completely Degraded	10.85	7.83
	138.49	100.00
Cleared	27.50	
Grand Total	165.94	

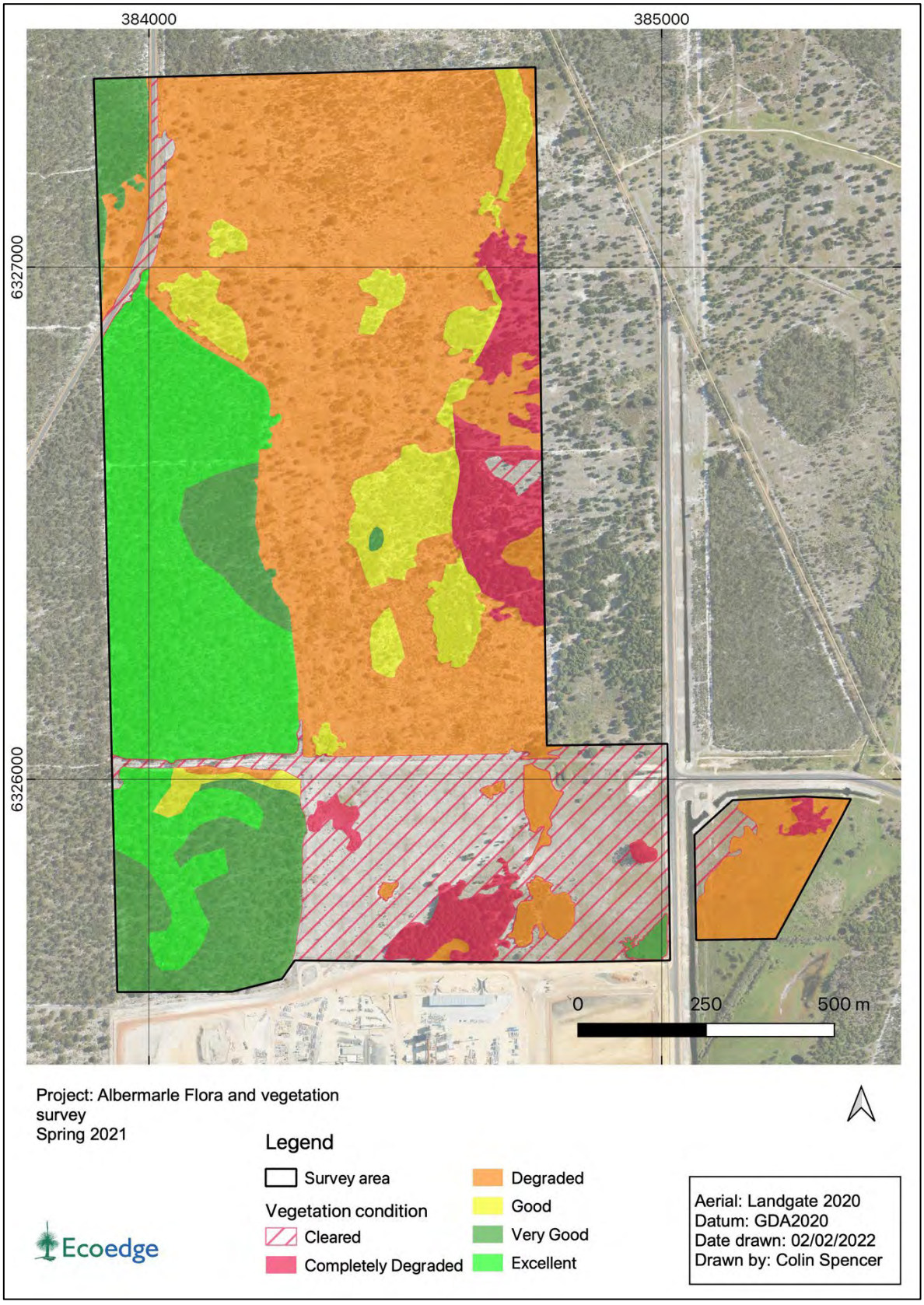

Figure 27. Vegetation Condition within the survey area.

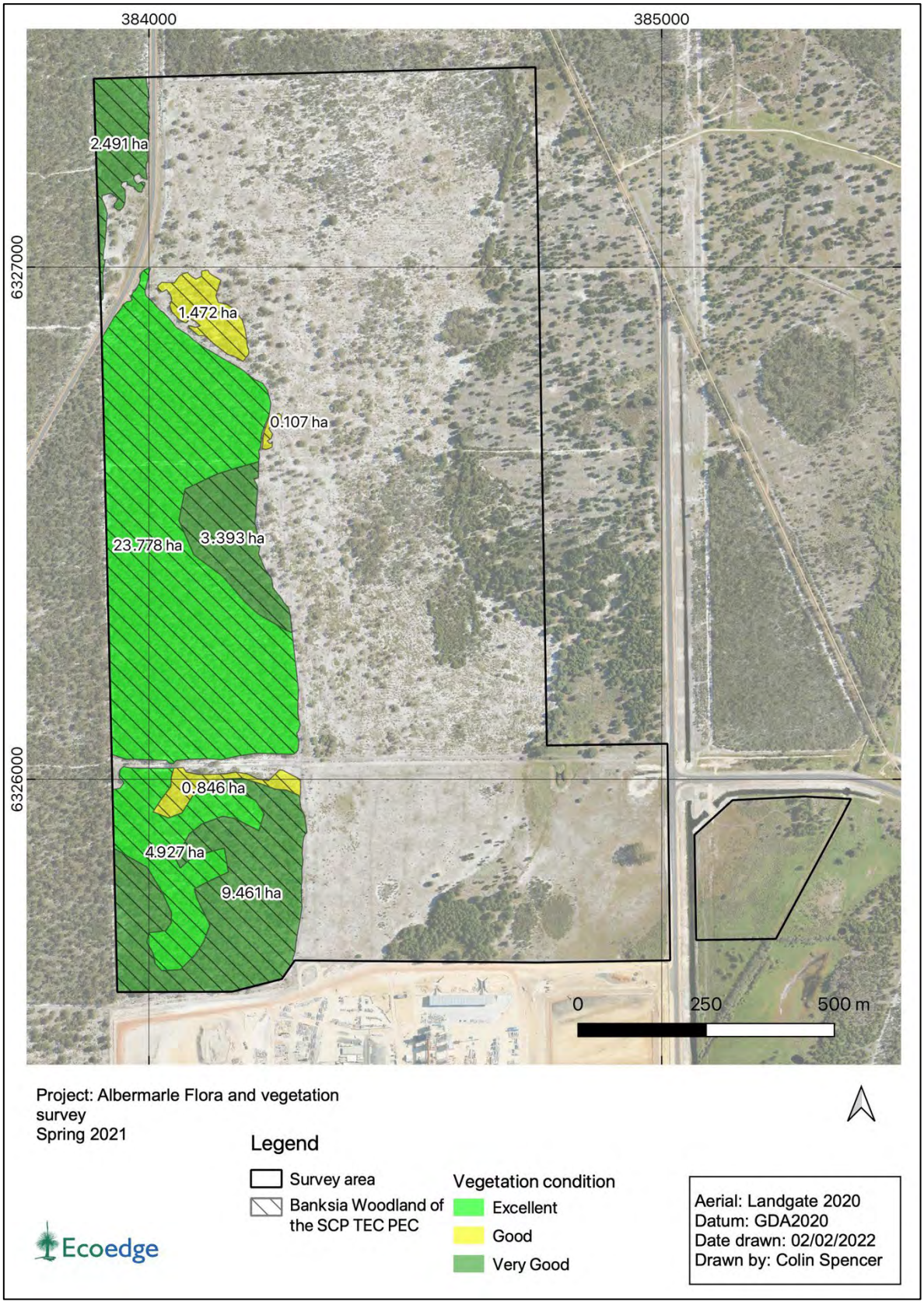

Figure 28. Threatened and Priority Ecological communities within the survey area.

6 Discussion and conclusions

6.1 Significance of flora

The two Priority flora found within the survey area (*Acacia semitrullata* and *Caladenia speciosa*) are both P4, which means they fall into one of the following three categories:

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

Acacia semitrullata on the SCP is often found on road verges or in small reserves. However, it is also found within some larger reserves in the Kemerton-Myalup area of the SCP, where it may be very common with populations comprised of thousands of plants. It also commonly occurs on sandy soils on the Blackwood Plateau, Darling Plateau and Collie Basin, usually in State-forest. *A. semitrullata* doesn't fit into any of the categories above. It is not rare, though some local populations are at risk, and it is doubtful that any foreseeable changed circumstances would cause it to need special protection.

Unlike *A. semitrullata*, *Caladenia speciosa* is almost completely restricted to the SCP, and apart from its presence on a few larger (100 ha+) reserves in the Kemerton-Myalup area, Manea Park and the Capel and Boonaring Nature Reserves, many populations are on road reserves and small (<20 ha) areas of native vegetation. Although several populations of 100 or more plants have been recorded, it is often locally rare, and only a few plants are seen in a population. It might also be at risk because of declining regional rainfall.

Drakaea elastica, was previously found within the survey area (Ecological Australia 2013) but was not able to be found again at this location or elsewhere within the survey area. The survey timing was within the optimum period for finding this species if it had been present.

6.2 Significance of vegetation

Because the MVA was unsuccessful in assigning unit EmBaBiMW to an FCT from the SCP survey, a comparison was made of the list of taxa for each quadrat to the list of "typical" and "other common" species for the three most likely FCTs (21a, 21b and 21c) in Gibson et al. (1994). The outcome of this comparison was equivocal, with the quadrats having slightly more species (one or two) in common with FCT21b than with FCT21a. Consequently, it remains an open question as to which FCT unit EmBaBiMW should be placed in, and the installation of more quadrats and a further MVA may be required to settle the matter.

Cardno (2010) carried out a broadscale vegetation survey over an area that included the current survey area. Only three mapping units within the boundary of the current survey, with only one of them being a native vegetation unit, community EmCcBa which corresponds roughly to unit EmBaBiMW. Vegetation community EmCcBa was determined by Cardno to be FCT21c as defined by the Swan Coastal Plain survey. However, an investigation using quadrats and an MVA by Ecoedge (2018) found that some at least of the vegetation mapped by Cardno as FCT21c either could not be ascribed to any particular Banksia-dominated FCT (because of the degree of degradation) or, in fact was most similar to FCT21a.

Regardless of which FCT it should be assigned to, the species composition of unit EmBaBiMW is consistent with it belonging to the Federally-listed TEC 'Banksia Woodlands of the Swan Coastal Plain', which has a classification of 'Endangered' and the State-listed Priority 3 ecological community 'Banksia dominated woodlands of the Swan Coastal Plain IBRA region' and Federally-listed TEC (EN) 'Banksia Woodlands of the SCP' in terms of its location, species composition, vegetation condition and patch size (TSSC 2016).

There is approximately 46 ha of vegetation unit EmBaBiMW, most of it in Very Good or Excellent condition.

Quadrats were not placed in any of the other vegetation units, mainly because they are degraded and have lost many of the native species that would have originally been present. However, vegetation units MpLlLW, MpAsLW and MpAsOLW are like FCT04 (*Melaleuca preissiana* damplands) of Gibson et al. (1994) a well-reserved FCT.

Vegetation units EmCcXbMW, KgJhTOS and XbEcOS, may have belonged to one of the FCTs within the 'Banksia Woodlands of the Swan Coastal Plain' TEC, but virtually all the Banksia component has disappeared through the effects of clearing, grazing and disease caused by *Phytophthora cinnamomi* and cannot be considered to be part of that community.

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 Bassendean Central and South Complex and association 1000. Both the complex (26.87%) and association (27.81%) have less than 30% of their Statewide pre-European extent remaining.

One vegetation complex occurs within the survey area: the Bassendean – Central and South Complex which has less than 30% of its pre-European extent remaining (26.87%). The actual vegetation, when allowance is made for extent of degradation is made for much of it is a good match for the vegetation complex.

One Beard vegetation association is mapped across the survey area, Association 1000 'Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; tea tree (*Melaleuca* spp.). This association is a good match for the vegetation within the survey in

terms of its dominant species and structure. This association has less than 30% of its pre-European extent on the SCP remaining (27.81%).

6.4 Regional ecological linkages

A portion of vegetation within the survey is linked to two formally recognised Ecological linkage axis lines by Molloy et al. (2009), both of which are recognised by the EPA as part of the McLarty/Kemerton/Twin Rivers/Preston River/Gwindinup Ecological Linkage (EPA 2103).

The most connected part in the central west of the survey area was assigned a 1c PV rating, while the other parcels were assigned 2b PV ratings due to its increased level of separation from the linkage.

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

Vegetation units MpLlLW, MpAsLW, MpAsOLW and JpR represent wetland or dampland[6] habitat. No standing water was observed during the survey, but the presence of several waterholes indicates that the water table during the winter is only about a metre from the surface. Species such as *Melaleuca preissiana*, *Astartea scoparia*, *Lepidosperma longitudinale* and *Juncus pallidus* are characteristic of wetlands. Some of the wetland vegetation, in particular in units MpAsLW and MpAsOLW, was in Good or Very Good condition.

There are no Conservation Category wetlands within the survey area. A MU sumpland is mapped to occur across much of the eastern portion of the survey area, with occurrences of MU damplands in the southern part of the site.

The EPA's objective for the management of MU wetlands is to use, develop and manage them in the context of water, town and environmental planning (EPA 2008).

6.6 Environmentally sensitive areas

There are no ESAs within the survey area. The nearest ESA is located approximately 120 m to the east of the survey area and is associated with a Conservation Category wetland.

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.

[6] Technically a "dampland" is a type of wetland that forms a seasonally waterlogged area within a topographic basin. https://www.dpaw.wa.gov.au/management/wetlands .

7 References

Barnesby, B A, King, P D, and Proulx-Nixon, M E. (1995). Land Resources Map -om Harvey to Capel on the Swan Coastal Plain, Western Australia. Department of Agriculture and Food, Western Australia. Map.

Beard, J. S., Beeston, G.R., Harvey, J.M., Hopkins, A. J. M. and Shepherd, D. P. (2013). The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second edition. Conservation Science Western Australia 9: 1-152.

Beeston, G.R., Hopkins, A.J.M. and Shepherd, D.P. (eds) (2001). *Land-use and Vegetation, Western Australia*. Agriculture Western Australia, South Perth and National Land and Water Resources Audit, Canberra, from: http://www.agriculture.gov.au/abares/aclump/Documents/WA%20Luse%201997%20Report.pdf

Belbin, L. (2003). PATN - A Revised User's Guide. Blatant Fabrications Pty Ltd.

Cardano (2010) Kemerton Industrial Core Flora and Vegetation Survey. Unpublished report prepared for LandCorp May 2010, Project Number V9064

Commonwealth of Australia (2016). *Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (Subregions)*. Department of the Environment and Energy. https://data.gov.au/dataset/interim-biogeographic-regionalisation-for-australia-ibra-version-7.

Crossman, S., Li, O. (2015). Surface Hydrology Lines (National). Geoscience Australia, Canberra. http://pid.geoscience.gov.au/dataset/ga/83130

Department of Agriculture, Water and the Environment (DAWE) (2021a). *Protected Matters Search Tool query*. Generated 15 September 2021.

Department of Agriculture, Water and the Environment (DAWE) (2020b). Categories of Threatened ecological communities under the EPBC Act. http://www.environment.gov.au/biodiversity/threatened/communities/about#What_is_a_threatened_ecological_community_TEC.

Department of Agriculture, Water and the Environment (DAWE) (2020c). Categories of Threatened species under the EPBC Act. https://www.environment.gov.au/biodiversity/threatened/species.

Department of Biodiversity, Conservation and Attractions (2018a). Threatened ecological communities endorsed by the Minister for the Environment (June 2018). https://www.dpaw.wa.gov.au/images/plants-animals/threatened-

species/threatened ecological communities endorsed by the minister for the environment june 2018.pdf.

Department of Biodiversity, Conservation and Attractions (2018b). Threatened and Priority Flora list (5 December 2018). Department of Biodiversity Conservation and Attractions. https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants.

Department of Biodiversity, Conservation and Attractions (2019). Conservation codes for Western Australian Flora and Fauna (03/01/2019).

Department of Biodiversity, Conservation and Attractions (2021a). *Extract from the Department's Threatened and Priority Ecological Community database,* DBCA Species and Communities Branch, 22 September 2021.

Department of Biodiversity, Conservation and Attractions (2021b). Priority ecological communities for Western Australia, Version 30. Species and Communities Program, Department of Biodiversity, Conservation and Attractions 21 July 2021. https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Priority%20Ecological%20Communities%20list.pdf

Department of Biodiversity, Conservation and Attractions (2021c). *Naturemap, Western Australian Herbarium*. http://naturemap.dpaw.wa.gov.au/default.aspx accessed 15 September 2021.

Department of Biodiversity, Conservation and Attractions (2021d). Extract from the Department's and Western Australian Herbarium Threatened and Priority Flora database, DBCA Species and Communities Branch, 22 September 2021.

Department of Biodiversity, Conservation and Attractions (2021e). Geomorphic Wetlands, Swan Coastal Plain Data Set DBCA-019, last updated 18/10/21. https://catalogue.data.wa.gov.au/dataset/geomorphic-wetlands-swan-coastal-plain

Department of Environment and Conservation (DEC) (2013). *Definitions, categories and criteria for threatened and priority ecological communities*. Department of Environment and Conservation, Perth, Western Australia.

Department of Water Environment Regulation (DWER) (2020). Clearing Regulations - *Environmentally Sensitive Areas* (DWER046). https://catalogue.data.wa.gov.au/dataset/clearing-regulations-environmentally-sensitive-areas-dwer-046.

Ecoedge (2018). An Investigation using Multivariate Analysis of Vegetation on Lot 508 Marriott Road and on Lot 42 Wellesley Road, Kemerton. Report to GHD.

Eco Logical Australia (2013) Targeted Ecological Surveys for the Kemerton Industrial Park, Unpublished report prepared for LandCorp

Environment Australia (2001). National objectives and targets for biodiversity conservation 2001–2005. http://www.environment.gov.au/resource/national-objectives-and-targets-biodiversity-conservation-2001%E2%80%932005.

Environmental Protection Authority (2008). Environmental Guidance for Planning and Development. Guidance Statement 33.

Environmental Protection Authority (2013) Greater Bunbury Region Scheme Report and recommendations of the Environmental Protection Authority, Bulletin 1108, September 2013.

Environmental Protection Authority of WA (2016). *Technical Guidance Flora and Vegetation Surveys for Environmental Impact.* EPA, Perth, Western Australia. http://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/EPA/Technical/Guidance/FloraandVegetationsurvey_Dec13.pdf

Government of Western Australia (2005). Environmental Protection (Environmentally Sensitive Areas) Notice 2005 (Environmental Protection Act 1986). *Government Gazette, No.55*.

Government of Western Australia (2019a). 2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of March 2019. WA Department of Biodiversity, Conservation and Attractions, Perth. https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics

Government of Western Australia. (2019b). 2018 South West Vegetation Complex Statistics. Current as of March 2019. WA Department of Biodiversity, Conservation and Attractions, Perth, https://catalogue.data.wa.gov.au/dataset/dbca

Heddle, E.M., Loneragan, O.W. and Havel, J.J. (1980). Vegetation of the Darling System. In: Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Environment, Western Australia.

Mattiske, E.M. and Havel, J.J. (1998). Vegetation Mapping in the South West of Western Australia and Regional Forest Agreement vegetation complexes. Map sheets for Pemberton, Collie, Pinjarra, Busselton-Margaret River, Mt Barker, and Perth, Western Australia. Scale 1:250,000. Department of Conservation and Land Management, Perth.

Molloy, S., O'Connor, T., Wood, J. and Wallrodt, S. (2009). South West Regional Ecological Linkages Technical Report. Western Australian Local Government Association (WALGA) and the Department of Environment and Conservation (DEC). West Perth.

NVIS Technical Working Group (2017) Australian Vegetation Attribute Manual: National Vegetation Information System, Version 7.0. Department of the Environment and Energy, Canberra. Prep by Bolton, M.P., deLacey, C. and Bossard, K.B. (Eds).

Seddon, G. (1972) Sense of Place a response to an environment the Swan Coastal Plain Western Australia. UWA press.

Semeniuk, C.A. and Semeniuk, V. (1995), A Geomorphic Approach to Global Classification for Inland Wetlands. Vegetatio, 118, 103-124.

Shepherd, D., Beeston, G. and Hopkins, A. (2002). *Native Vegetation in Western Australia – Extent, Type and Status*. Department of Agriculture, Perth.

Webb, A., Kinloch, J., Keighery, G. and Pitt, G. (2016). The Extension of Vegetation Complex Mapping to Landform boundaries within the Swan Coastal Plain Landform and Forested Region of South West Western Australia. Department of Parks and Wildlife, Bunbury, WA.

Appendix 1. Threatened and Priority flora likelihood of occurrence assessment rationale.

Rating	Presurvey rationale	Post survey rationale
Recorded		Taxon was or has been recorded in the survey area.
Likely	Known to occur within one kilometres of the survey area with suitable habitat known or predicted to occur within the survey area.	The taxon is known to occur within the survey area 1 km of the survey area and very suitable habitat was observed but the taxon was not observed for either of the following reasons. **L1.** The taxon was dormant at 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 and the taxon is non- descript and difficult to find for example, in large areas of rocky granite outcrops, or occurs within an expanse of a water body.
Possible	Known to occur within a 5- 10 km of the survey area with suitable habitat known or predicted to occur within the survey area.	The taxon is known from within a 5- 10 km radius of the survey area and suitable habitat for the species was observed, 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 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 and the taxon is non- descript and difficult to find for example, in large areas of rocky granite outcrops, or occurs within an expanse of a water body.
Unlikely	Known or predicted to occur within 10 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 and NatureMap reports

Australian Government

Department of Agriculture, Water and the Environment

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.

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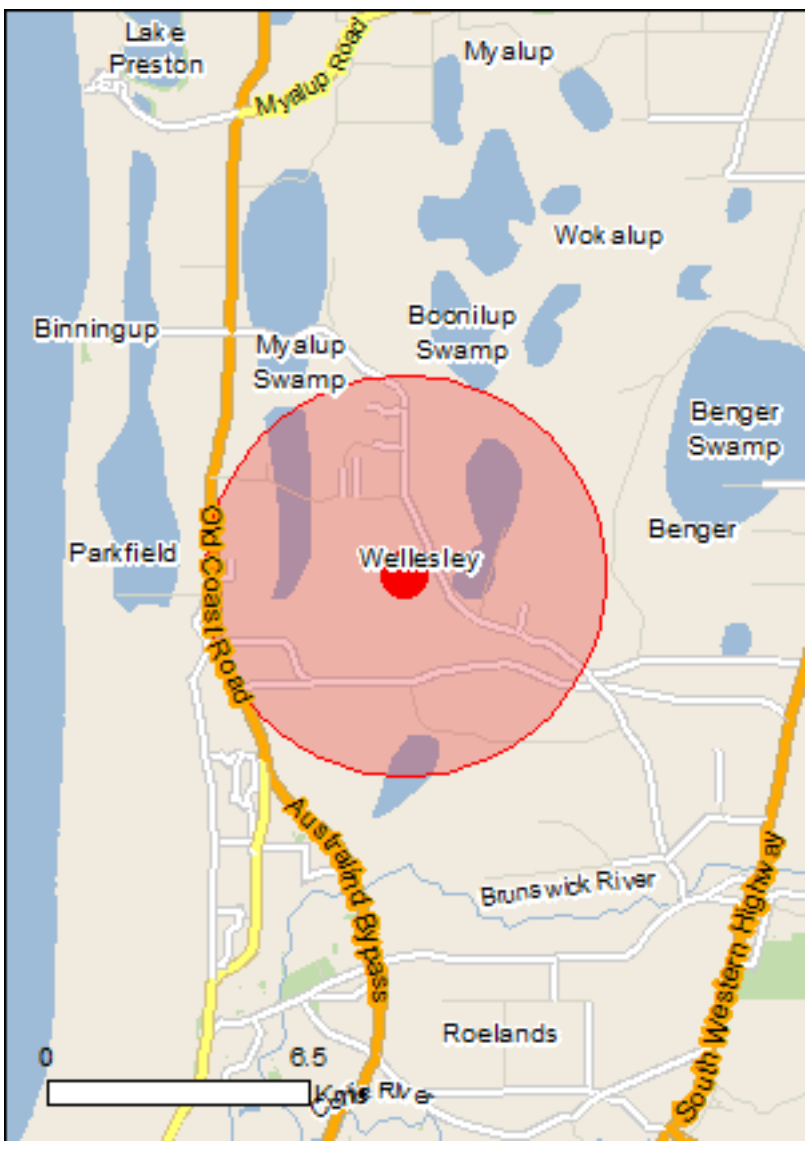

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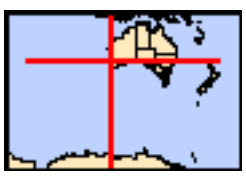

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	30
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	17
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	29
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Peel-yalgorup system	Within 10km of Ramsar

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
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		
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 may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding likely to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Fish		
Galaxiella nigrostriata Blackstriped Dwarf Galaxias, Black-stripe Minnow [88677]	Endangered	Species or species habitat likely to occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Austrostipa bronwenae [87808]	Endangered	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Caladenia procera Carbunup King Spider Orchid [68679]	Critically Endangered	Species or species habitat known to occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Synaphea sp. Fairbridge Farm (D. Papenfus 696)		
Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103)		
[86879]	Critically Endangered	Species or species habitat may occur within area
Synaphea stenoloba		
Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
NTWA Bushland covenant (0004)	WA
NTWA Bushland covenant (0095)	WA

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water 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
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus		
Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis		
Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer		
Feral deer species in Australia [85733]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii		
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Solanum elaeagnifolium		
Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.19378 115.75955

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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Albermarle Consig flora NatureMap Report_150921_5km

Created By Guest user on 17/09/2021

Kingdom	Plantae
Conservation Status	Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115° 45' 34" E,33° 11' 38" S
Buffer	5km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	3339	*Acacia flagelliformis*		P4	
2.	3537	*Acacia semitrullata*		P4	
3.	16633	*Boronia juncea subsp. juncea*		P1	
4.	18038	*Caladenia procera*		T	
5.	13862	*Caladenia speciosa*		P4	
6.	3863	*Dillwynia dillwynioides*		P3	
7.	10796	*Diuris drummondii (Tall Donkey Orchid)*		T	
8.	12938	*Diuris micrantha*		T	
9.	1639	*Drakaea elastica (Glossy-leaved Hammer Orchid)*		T	
10.	13635	*Drakaea micrantha*		T	
11.	5038	*Lasiopetalum membranaceum*		P3	
12.	31731	*Pterostylis frenchii*		P2	
13.	4183	*Pultenaea skinneri (Skinner's Pea)*		P4	
14.	44444	*Tripterococcus sp. Brachylobus (A.S. George 14234)*		P4	
15.	12392	*Verticordia attenuata*		P3	

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

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

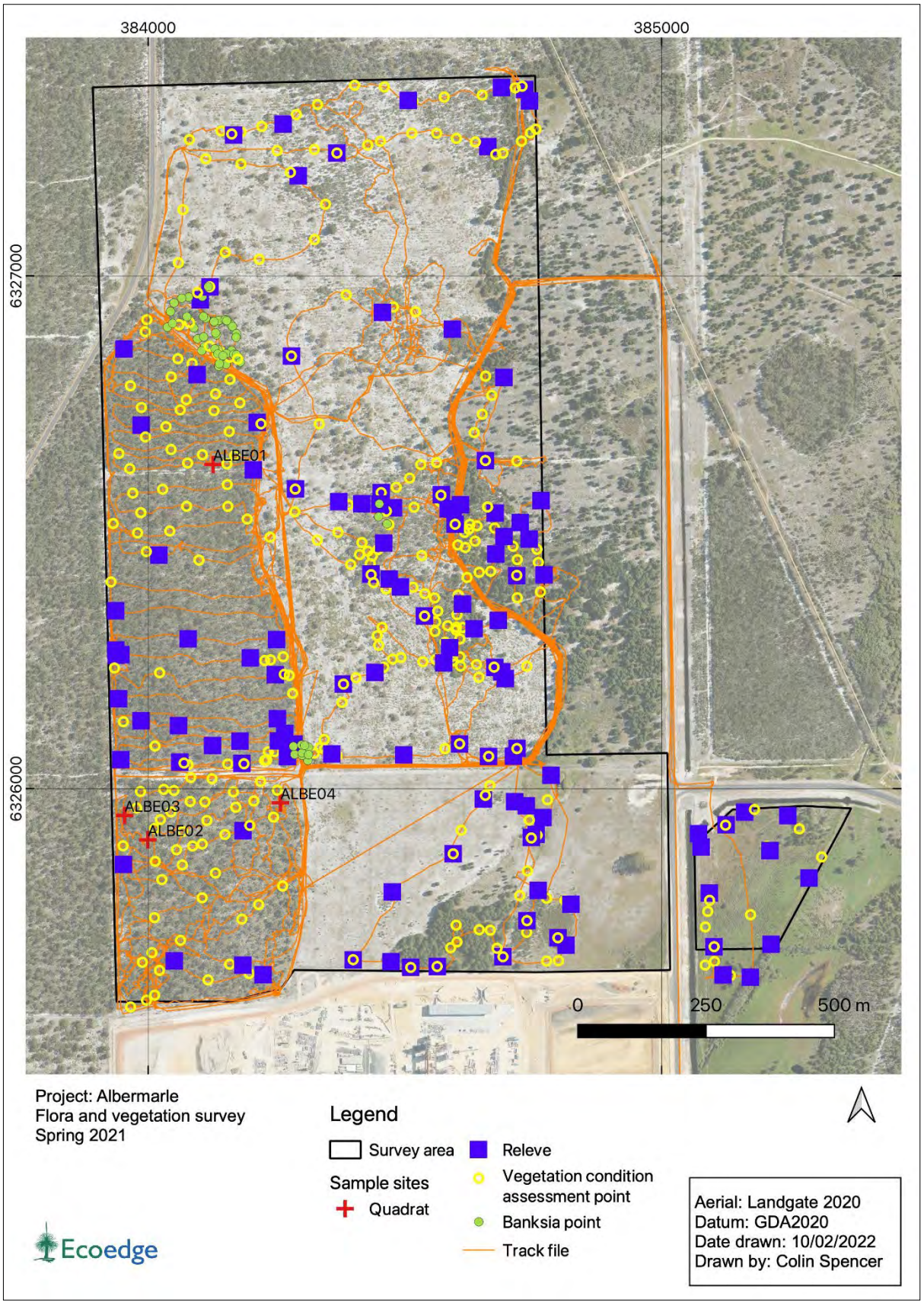
Appendix 8. Pre and post likelihood of occurrence.

SPECIES	CATEGORY	FLOWERING	DESCRIPTION AND HABITAT	Likelihood	Post Survey Likelihood
Acacia flagelliformis	P4	May-Sep	Rush-like, erect or sprawling shrub, 0.3-0.75(-1.6) m high. Fl. yellow. Sandy soils. Winter-wet areas.	Possible	Unlikely (U2)
Acacia semitrullata	P4	May-Oct	Slender, erect, pungent shrub, (0.1-)0.2-0.7(-1.5) m high. Fl. cream, white. White/grey sand, sometimes over laterite, clay. Sandplains, swampy areas.	Likely	Recorded
Andersonia gracilis	T (EN)	Sep-Nov	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Unlikely	Unlikely (U2)
Austrostipa bronwenae	T (EN)	Sep-Oct	Perennial grass, 0.6 m high x 0.3 m wide. Flowers green. Grows in calcareous, winter-wet grey-brown sandy-loam or dark brown loam over clay.	Unlikely	Unlikely (U1)
Boronia capitata subsp. *gracilis*	P3	Jun-Nov	Slender shrub, 0.3-0.6(-3) m high, branches pilose. Fl. pink. White/grey or black sand. Winter-wet swamps, hill slopes	Possible	Unlikely (U2)
Boronia juncea subsp. *juncea*	P1	Apr	Slender or straggly shrub, pedicels and sepals glabrous. Fl. pink. Sand. Low scrub.	Possible	Unlikely (U2)
Caladenia huegelii	T (EN)	Sep-Oct	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green, cream, red. Grey or brown sand, clay loam. (Jarrah banksia woodland usually associated with the Bassendean sand-dune system, rarely in the Spearwood system).	Possible	Unlikely (U2)
Caladenia procera	T (CR)	Sep-Oct	Tuberous, perennial, herb, 0.35-0.9 m high. Fl. yellow. Rich clay loam. Alluvial loamy flats, jarrah/marri/peppermint woodland, dense heath, sedges.	Unlikely	Unlikely (U1)
Caladenia speciosa	P4	Sep-Oct	Tuberous, perennial, herb, 0.35-0.6 m high. Fl. white, pink. White, grey or black sand.	Likely	Recorded
Carex tereticaulis	P1	Sep-Oct	Monoecious, rhizomatous, tufted perennial, grass-like or herb (sedge), 0.7 m high. Fl. brown. Black peaty sand.	Possible	Unlikely (U1)
Chamaescilla gibsonii	P3	Sep	Clumped tuberous, herb. Fl. blue. Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	Unlikely	Unlikely (U1)

SPECIES	CATEGORY	FLOWERING	DESCRIPTION AND HABITAT	Likelihood	Post Survey Likelihood
Cyathochaeta teretifolia	P3	Oct-Jan	Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. brown. Grey sand, sandy clay. Swamps, creek edges.	Unlikely	Unlikely (U2)
Dillwynia dillwynioides	P3	Aug-Dec	Decumbent or erect, slender shrub, 0.3–1.2 m high. Fl. red, yellow, orange,. Sandy soils. Winter-wet depressions, inundated flats generally alongside rivers or deeper swamps.	Possible	Unlikely (U2)
Diuris drummondii	T (VU)	Nov-Jan	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow. Low-lying depressions adjacent to areas subject to winter inundation.	Unlikely	Unlikely (U2)
Diuris micrantha	T (VU)	Sep-Oct	Tuberous, perennial, herb, 0.3–0.6 m high. Fl. yellow, brown. Brown loamy clay. Winter-wet swamps, in shallow water.	Unlikely	Unlikely (U1)
Diuris purdiei	T (EN)	Sep-Oct	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow. Grey-black sand to sandy clay soils in and adjacent to areas subject to winter inundation. Found between Perth and Yarloop.	Unlikely	Unlikely (U2)
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 (U2)
Drakaea micrantha	T (VU)	Sep-Oct	Tuberous, perennial, dwarf hammer orchid, 0.15–0.3 m high. Fl. red, yellow. Small heart shaped leaf with green veins. White-grey infertile sand in *Eucalyptus marginata, Allocasuarina fraseriana* woodland or forest. Often under *Kunzea ericifolia, K. glabrescens* with *Paracaleana nigrita* and other Drakaea species.	Likely	Unlikely (U2)
Eleocharis keigheryi	T (VU)	Aug-Nov	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. green. Clay, sandy loam. Emergent in freshwater: creeks, claypans	Unlikely	Unlikely (U1)
Lasiopetalum membranaceum	P3	Sep-Dec	Multi-stemmed shrub, 0.2-1 m high. Fl. pink, blue, purple. Sand over limestone.	Possible	Unlikely (U1)

SPECIES	CATEGORY	FLOWERING	DESCRIPTION AND HABITAT	Likelihood	Post Survey Likelihood
Pterostylis frenchii	P2	Nov-Dec	Tuberous, herb, to 0.35 m high, with rosette leaves. Fl. white. Calcareous sand with limestone, laterite. Flatlands and gentle slopes.	Possible	Unlikely (U1)
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 (U1)
Pultenaea skinneri	P4	Jul-Sep	Slender shrub, 1-2 m high. Fl. yellow, orange, red. Sandy or clayey soils. Winter-wet depressions.	Possible	Unlikely (U2)
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	T (CR)	Oct	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Fl. Yellow. Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	Unlikely	Unlikely (U1)
Synaphea sp. Serpentine	T (CR)	Sep-Oct	Shrublands and woodlands on loamy soils	Unlikely	Unlikely (U1)
Synaphea stenoloba	T (EN)	Aug-Oct	Caespitose shrub, 0.3–0.45 m high. Fl. Yellow. Sandy or sandy clay soils. Winter-wet flats, granite. Shrublands and woodlands on loamy soils.	Unlikely	Unlikely (U1)
Tripterococcus sp. Brachylobus (A.S. George 14234)	P4	Nov-Dec or Feb	Perennial, herb, to 1 m high. Fl. yellow/yellow-green. Grey sand, red clay, laterite, often moist. Low-lying flats.	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)

Appendix 9. Track log and relevé points.



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

#	FAMILY_NAME	LATIN NAME	NATURALISED	CONSV_CODE
1	Anarthriaceae	*Lyginia barbata*		
2	Anarthriaceae	*Lyginia imberbis*		
3	Apiaceae	*Centella asiatica*		
4	Apiaceae	*Platysace filiformis*		
5	Apiaceae	*Xanthosia huegelii*		
6	Araceae	*Lemna disperma*		
7	Araceae	*Zantedeschia aethiopica*	*	
8	Araliaceae	*Trachymene pilosa*		
9	Asparagaceae	*Chamaescilla corymbosa*		
10	Asparagaceae	*Lomandra caespitosa*		
11	Asparagaceae	*Lomandra hermaphrodita*		
12	Asparagaceae	*Lomandra integra*		
13	Asparagaceae	*Lomandra nigricans*		
14	Asparagaceae	*Lomandra purpurea*		
15	Asparagaceae	*Lomandra sericea*		
16	Asparagaceae	*Lomandra sonderi*		
17	Asparagaceae	*Lomandra suaveolens*		
18	Asparagaceae	*Thysanotus manglesianus*		
19	Asparagaceae	*Thysanotus multiflorus*		
20	Asteraceae	*Arctotheca calendula*	*	
21	Asteraceae	*Brachyscome iberidifolia*		
22	Asteraceae	*Carduus pycnocephalus*	*	
23	Asteraceae	*Cotula coronopifolia*	*	
24	Asteraceae	*Cotula turbinata*	*	
25	Asteraceae	*Hyalosperma cotula*		
26	Asteraceae	*Hypochaeris glabra*	*	
27	Asteraceae	*Lagenophora huegellii*		
28	Asteraceae	*Quinetia urvillei*		
29	Asteraceae	*Ursinia anthemoides*	*	
30	Campanulaceae	*Monopsis debilis*	*	
31	Campanulaceae	*Wahlenbergia capensis*	*	
32	Centrolepidaceae	*Centrolepis aristata*		
33	Centrolepidaceae	*Centrolepis drummondiana*		
34	Colchicaceae	*Burchardia congesta*		
35	Crassulaceae	*Crassula decumbens*		
36	Cyperaceae	*Isolepis cernua*		
37	Cyperaceae	*Isolepis cyperoides*		
38	Cyperaceae	*Isolepis marginata*		
39	Cyperaceae	*Lepidosperma longitudinale*		
40	Cyperaceae	*Lepidosperma squamatum*		
41	Dasypogonaceae	*Dasypogon bromeliifolius*		
42	Dennstaedtiaceae	*Pteridium esculentum*		
43	Dilleniaceae	*Hibbertia hypericoides*		

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

#	FAMILY_NAME	LATIN NAME	NATURALISED	CONSV_CODE
44	Dilleniaceae	*Hibbertia racemosa*		
45	Dilleniaceae	*Hibbertia stellaris*		
46	Dilleniaceae	*Hibbertia vaginata*		
47	Droseraceae	*Drosera enodes*		
48	Droseraceae	*Drosera pallida*		
49	Droseraceae	*Drosera porrecta*		
50	Elaeocarpaceae	*Tetratheca hirsuta* subsp. *viminea*		
51	Elaeocarpaceae	*Tetratheca setigera*		
52	Ericaceae	*Conostephium pendulum*		
53	Ericaceae	*Lysinema pentapetalum*		
54	Ericaceae	*Styphelia conostephioides*		
55	Ericaceae	*Styphelia propinqua*		
56	Ericaceae	*Styphelia racemulosa*		
57	Fabaceae	*Acacia extensa*		
58	Fabaceae	*Acacia pulchella var. goadbyi*		
59	Fabaceae	*Acacia semitrullata*		4
60	Fabaceae	*Acacia willdenowiana*		
61	Fabaceae	*Bossiaea eriocarpa*		
62	Fabaceae	*Daviesia incrassata*		
63	Fabaceae	*Daviesia physodes*		
64	Fabaceae	*Gompholobium capitatum*		
65	Fabaceae	*Gompholobium confertum*		
66	Fabaceae	*Gompholobium scabrum*		
67	Fabaceae	*Gompholobium tomentosum*		
68	Fabaceae	*Hovea trisperma*		
69	Fabaceae	*Jacksonia furcellata*		
70	Fabaceae	*Jacksonia horrida*		
71	Fabaceae	*Jacksonia sternbergiana*		
72	Fabaceae	*Lotus subbiflorus*	*	
73	Geraniaceae	*Geranium solanderi*		
74	Geraniaceae	*Pelargonium capitatum*	*	
75	Goodeniaceae	*Dampiera linearis*		
76	Goodeniaceae	*Dampiera pedunculata*		
77	Haemodoraceae	*Anigozanthos manglesii*		
78	Haemodoraceae	*Conostylis aculeata*		
79	Haemodoraceae	*Conostylis aculeata* subsp. *preissii*		
80	Haemodoraceae	*Conostylis setigera*		
81	Haemodoraceae	*Haemodorum spicatum*		
82	Haemodoraceae	*Phlebocarya ciliata*		
83	Hemerocallidaceae	*Agrostocrinum hirsutum*		
84	Hemerocallidaceae	*Tricoryne elatior*		
85	Iridaceae	*Patersonia occidentalis*		
86	Iridaceae	*Watsonia meriana*	*	

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

#	FAMILY_NAME	LATIN NAME	NATURALISED	CONSV_CODE
87	Juncaceae	*Juncus acutus*	*	
88	Juncaceae	*Juncus bufonius*	*	
89	Juncaceae	*Juncus pallidus*		
90	Juncaceae	*Juncus subsecundus*		
91	Lamiaceae	*Hemiandra pungens*		
92	Loganiaceae	*Logania vaginalis*		
93	Loganiaceae	*Orianthera serpyllifolia*		
94	Loranthaceae	*Nuytsia floribunda*		
95	Lythraceae	*Lythrum hyssopifolia*	*	
96	Malvaceae	*Lasiopetalum membranaceum*		3
97	Myrtaceae	*Astartea scoparia*		
98	Myrtaceae	*Calytrix flavescens*		
99	Myrtaceae	*Eucalyptus marginata* subsp. *marginata*		
100	Myrtaceae	*Hypocalymma angustifolium*		
101	Myrtaceae	*Kunzea glabrescens*		
102	Myrtaceae	*Leptospermum laevigatum*	*	
103	Myrtaceae	*Melaleuca preissiana*		
104	Myrtaceae	*Melaleuca thymoides*		
105	Myrtaceae	*Pericalymma ellipticum*		
106	Orchidaceae	*Caladenia flava*		
107	Orchidaceae	*Caladenia longicauda*		
108	Orchidaceae	*Caladenia speciosa*		4
109	Orchidaceae	*Disa bracteata*	*	
110	Orchidaceae	*Drakaea glyptodon*		
111	Orchidaceae	*Elythranthera brunonis*		
112	Orchidaceae	*Eriochilus dilatatus*		
113	Orchidaceae	*Leporella fimbriata*		
114	Orchidaceae	*Microtis media*		
115	Orchidaceae	*Microtis media* subsp. *media*		
116	Orchidaceae	*Pyrorchis nigricans*		
117	Orchidaceae	*Thelymitra crinita*		
118	Orchidaceae	*Thelymitra graminea*		
119	Orchidaceae	*Thelymitra macrophylla*		
120	Orobanchaceae	*Orobanche minor*	*	
121	Phyllanthaceae	*Poranthera microphylla*		
122	Pinaceae	*Pinus pinaster*	*	
123	Pittosporaceae	*Billardiera variifolia*		
124	Poaceae	*Austrostipa elegantissima*		
125	Poaceae	*Briza maxima*	*	
126	Poaceae	*Ehrharta calycina*	*	
127	Poaceae	*Holcus lanatus*	*	
128	Poaceae	*Lolium perenne*	*	
129	Poaceae	*Vulpia bromoides*	*	

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

#	FAMILY_NAME	LATIN NAME	NATURALISED	CONSV_CODE
130	Polygalaceae	*Comesperma calymega*		
131	Polygalaceae	*Comesperma virgatum*		
132	Polygonaceae	*Rumex acetosella*	*	
133	Polygonaceae	*Rumex crispus*	*	
134	Proteaceae	*Adenanthos meisneri*		
135	Proteaceae	*Banksia attenuata*		
136	Proteaceae	*Banksia ilicifolia*		
137	Proteaceae	*Persoonia longifolia*		
138	Proteaceae	*Persoonia saccata*		
139	Proteaceae	*Petrophile linearis*		
140	Proteaceae	*Petrophile serruriae*		
141	Proteaceae	*Stirlingia latifolia*		
142	Proteaceae	*Xylomelum occidentale*		
143	Restionaceae	*Desmocladus flexuosus*		
144	Restionaceae	*Hypolaena exsulca*		
145	Rutaceae	*Philotheca spicata*		
146	Stylidiaceae	*Stylidium androsaceum*		
147	Stylidiaceae	*Stylidium brunonianum*		
148	Stylidiaceae	*Stylidium diversifolium*		
149	Stylidiaceae	*Stylidium piliferum*		
150	Stylidiaceae	*Stylidium schoenoides*		
151	Thymelaeaceae	*Pimelea ciliata*		
152	Typhaceae	*Typha orientalis*		
153	Xanthorrhoeaceae	*Xanthorrhoea brunonis*		
154	Xanthorrhoeaceae	*Xanthorrhoea preissii*		
155	Zamiaceae	*Macrozamia riedlei*		