Detailed and Targeted Flora and Vegetation Survey along Bussell Highway, Hutton Road to Sabina River (32.10 – 43.92 SLK)

Prepared for Main Roads WA
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Executive Summary

Ecoedge was engaged by Main Roads Western Australia (Main Roads) in July 2018 to undertake a supplementary flora and vegetation survey over portions of remnant vegetation along Bussell Highway between Hutton Road to Sabina River (32.10 – 43.92 SLK).

As part of investigations into the proposed construction of dual lanes along Bussell Highway between Hutton Rd in Capel and the Sabina River (32.10 – 43.92 SLK), Main Roads engaged Ecoedge in 2013 to carry out a Level 1 flora and vegetation survey of 35 ha of road side vegetation, and again in 2014 to carry out a targeted *Verticordia attenuata* survey.

In response to feedback recently received from the Department of Biodiversity, Conservation and Attractions on the 2013 survey report, and to changes in survey requirements and available data, a follow-up survey was now required.

The flora and vegetation survey was undertaken during five visits between August and October 2018 in accordance with the Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016).

Two hundred and eighty-one plant species were identified within the Survey Area of which 66 were naturalized or planted species.

No threatened species recognised under the State *Biodiversity Conservation Act 2016* or the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* were found in the Survey Area.

Five Priority flora species were found within the Survey Area, *viz*. *Acacia flagelliformis* (P4), *Eucalyptus rudis* subsp. *cratyantha* (P4), *Synaphea petiolaris* subsp. *simplex* (P3), *S. hians* (P3) and *Verticordia attenuata* (P3).

Almost 3,000 individuals of *V. attenuata* were found growing in the Survey Area in 2017, which represents one of the largest occurrences of this species.

There is a population of *Eucalyptus cornuta* (Yate) at the southern end of the Survey Area which has regional significance.

Several taxa within the Survey Area are “range-end” occurrences, e.g. *Daviesia divaricata* subsp. *divaricata*, *Schoenoplectus pungens*, and *Eremaea pauciflora* subsp. *pauciflora* (which was found in 2013 but not re-located in 2018).

Two pest plants, Arum Lily (**Zantedeschia aethiopica*) and Bridal Creeper (*Asparagus asparagoides) listed under the *Biosecurity and Agriculture Management Act 2007*, were found within the Survey Area. Neither of these weeds have been assigned a management category under the Act so there is currently no legal requirement to manage these weeds.

The results of a multivariate analysis of data from eleven floristic quadrats installed within the Survey Area provided little clarity about the floristic affinities of the Survey Area vegetation. This is partly a result of the proportion of non-native species in some of the quadrats, and partly because there were no quadrats installed in similar vegetation by the Swan Coastal Plain survey of Gibson *et al*. (1994).

Only 12.2% of the Survey Area was rated as "Good" or "Very Good" condition – where the original vegetation structure is intact and native plant species predominate. Areas categorized as "Degraded" were largely revegetated mining areas or embankments.

The vegetation units with the highest conservation value are A1 and A2, which are Priority ecological communities, and unit E, because of its relative intactness. Sub-unit E4, in particular, was conservation value because of the presence of several range-end taxa, and the unusual combination of species it contains.

The vegetation units with the highest conservation value are A1 and A2 and unit E. Unit A1 is considered the Priority 3 ecological community Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands ('community type 30b') and unit A2 the Priority 1 ecological community '*Eucalyptus cornuta*, *Agonis flexuosa* and *Eucalyptus decipiens* forest on deep yellow-brown siliceous sands over limestone ('Busselton Yate community'). However, both these units are in a Completely degraded condition.

Unit E is significant because of its relative intactness with Sub-unit E4, in particular, having conservation value because of the presence of several range-end taxa, and the unusual combination of species it contains.

No Threatened ecological communities recognised under the State *Biodiversity Conservation Act 2016* or the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* were found in the survey area.

Five vegetation complexes occur within the Survey Area: the Abba Complex, the Cokelup Complex, the Karrakatta Complex – Central and South Complex and the Southern River and the Yoongarillup Complexes. Of these the Southern River Complex is dominant across the Survey Area.

Only the Yoongarillup Complex meets the Commonwealth 30% retention target and is comparatively well reserved in DBCA managed lands. The remaining complexes are significantly diminished across the landscape and are poorly represented in the DBCA estate.

Six Beard vegetation associations occur within the Survey Area: these are Associations 2, 4, 949, 990, 1000 and 1136. Associations 2 and 949 exceed the 30% retention threshold and are both well represented in the DBCA estate. The remaining Associations, in particular

Association 1136, fall short of the threshold. Association 1136 has less than 10% of its vegetation remaining in the SWA IBRA Region and only 3.86% of this occurs in DBCA managed estate.

The boundary of a Conservation category palusplain wetland crosses the Survey Area approximately 360 m WSW of the Ludlow Hithergreen Road intersection. This wetland runs parallel to the Survey Area with its boundary for the most part about 50m SE of the Survey Boundary. Two other Conservation category wetlands occur near the Survey Area. The closest boundary of these wetlands is about 75 m away from the Survey Area.

It is also noted that three rivers, the Sabina, Abba and Ludlow Rivers, cross the Survey Areas and flow into the Conservation Category Vasse-Wonnerup Wetlands located approximately 2 km to the north of the Survey Area.

Conservation category wetlands are regarded as (Environmentally Sensitive Area) ESAs which are specially protected under the *Environmental Protection Act 1986*. Wetlands may be impacted directly or indirectly, examples of direct impacts include vegetation clearing and examples of indirect impacts include polluted storm water.

It is recommended that impacts to Conservation category wetlands (CCW) is avoided where possible.

The Conservation category wetlands within and nearby the Survey Area may present constraints to the development of the site.

Three regional ecological linkage axis lines passing through the Study Area. A small portion of the vegetation within the Survey Area directly forms part of these linkages while the majority is within varying degrees of proximity to those linkages. Clearing of vegetation within close proximity to these areas will likely have a localised impact on mapped ecological linkages, but is it suggest that this will not be significant given the small scale of clearing along the edge of an already cleared road boundary.

The boundary of two ESAs occur within the Survey Area. The one in the south western portion of the Survey Area is associated with the Ludlow State Forest and covers about 2 km of the Survey Area. The other, associated with a CCW located about 360 m WSW of Ludlow Hithergreen Road covers about 225 m of the Survey Area.

ESAs are afforded special protection under the *Environmental Protection Act 1986* and exemptions to clearing under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 do not apply in these areas.

The presence of the ESAs within and to a lesser extent in close proximity to the Survey may present constraints to the development of the site.

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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 and Desktop Assessment

Ecoedge was engaged by Main Roads Western Australia (Main Roads) in July 2018 to undertake a supplementary flora and vegetation survey over portions of remnant vegetation along Bussell Highway from Hutton Road to Sabina River (32.10 – 43.92 SLK) (the 'Survey Area') (**Figure 1**).

As part of the preliminary investigations into the proposed construction of dual lanes along Bussell Highway between Hutton Rd in Capel and the Sabina River bridge (32.10 – 43.92SLK), Main Roads engaged Ecoedge in 2013 (Ecoedge, 2014) to carry out a Level 1 flora and vegetation survey of 35 ha of road side vegetation, and again in 2014 to carry out a targeted *Verticordia attenuata* survey.

In response to feedback recently received from the Department of Biodiversity, Conservation and Attractions (DBCA) on the 2013 survey report, and to changes in survey requirements and available data, a follow-up survey is now required.

The additional requirements include Detailed and Targeted surveys over portions of the previously surveyed areas and a Reconnaissance and Targeted (previously Level 1) survey over 1-1.5 ha of additional remnant vegetation not included in the previous surveys.

This follow-up survey report incorporates the results of the above surveys and includes an updated desktop assessment and survey results from the previous Level 1 survey and targeted *Verticordia attenuata* (a Priority 3 listed species) survey.

The flora and vegetation survey was undertaken during five visits between August and October 2018 in accordance with the Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016).

This report compiles findings of the field survey.

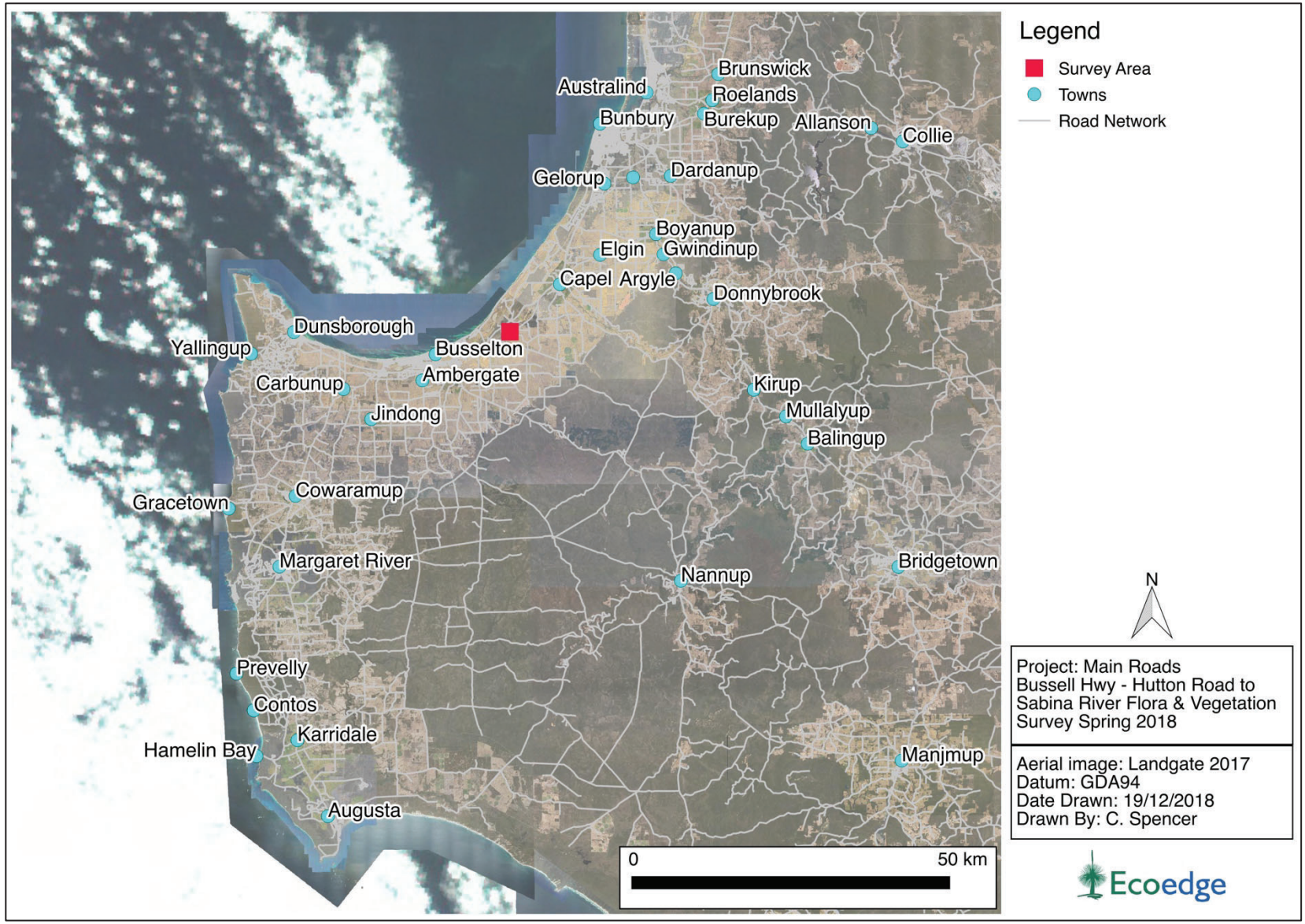

Figure 1 Aerial photograph showing the location of the Survey Area.

1.1 Scope

The scope of the supplementary survey is outlined below. The results of this supplementary survey were combined with those of the previous survey by Ecoedge (2014) to prepare this report.

Supplementary Field Survey

Carry out a Detailed (quadrat-based) and Targeted flora and vegetation survey over portions of the 35 ha of remnant vegetation along Bussell Highway within the Survey Area, as follows:

- Installation of floristic quadrats in vegetation units G, D and H[1] – followed by multivariate analysis and assignment of FCTs. Three quadrats will be installed in vegetation units D and H, and 2 in unit G (the extent of unit G in the Survey Area is not large enough to accommodate 3 quadrats);
- Using a hand-held GPS unit, capture point data of *Eucalyptus cornuta* (Yate) south-west of Sues Road;
- Carry out a targeted survey for *Acacia flagelliformis* and *Drakaea elastica* in late August/early September;
- Revisit, capture point data for, and quantify populations of conservation significant species (as listed by Mr. Webb, and others as required);
- Conduct a Reconnaissance and Targeted survey over the additional areas described above;
- Carry out the necessary field data input and multivariate analysis;
- Prepare rare flora report forms, submit voucher specimens (as required), prepare metadata statements and format shapefiles as per Main Roads and IBSA protocols; and
- Prepare resulting report, incorporating the desktop assessment and results of both previous surveys.

Survey Report

The survey report will detail the scope, methodology and outcomes of the flora surveys and will provide the following:

1. Details of the project's purpose, background and location;
2. Description of the methodologies used to assess biological factors in the desktop and field surveys; and
3. Presentation and discussion of the results of both desktop and field surveys and any resulting conclusions and/or recommendations;

[1] As defined in Ecoedge (2014) Report of a Level 1 Survey along Bussell Highway, Hutton Road to Sabina River (32.10 – 43.92 SLK). Unpublished report to Main Roads Western Australia.

1.2 Biogeographic Region and Location

The Survey Area is situated approximately 6.0 km east of the Busselton town site within the Swan Coastal Plain (SWA02) sub-region of the Swan Coastal Plain biogeographic region, as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Commonwealth of Australia, 2016) (**Figure 1**). Elevation on site falls from 20 m above sea level (ASL) in the north-east to 10 m in the south west.

The Survey Area is located on Freehold land, crown land and public roads. According to the Shire of Busselton Town Planning Scheme 20, the Survey Area is currently zoned as Highway, adjacent to agriculture and recreation zones. Under the Shire of Capel Town Planning Scheme 7, the Survey Area is currently zoned as Primary Regional Road adjacent to rural and state forest zones (**Figure 2**).

1.3 Geology

The Survey Area is situated on the Swan Coastal Plain, which consists of a series of geomorphological elements which are sub-parallel to the present coastline (McArthur and Bettenay, 1960). Each of these geomorphic elements has distinctive geology, vegetation, topography and soils. The western portion of the Swan Coastal Plain is comprised of a series of three successive coastal dune systems representing the geological history of shoreline movement and aeolian deposition of marine particles. The dominant dune systems in the Swan Coastal Plain, from west to east, are Quindalup Dunes, Spearwood Dunes and Bassendean Dunes. In Busselton region (i.e. south of the Capel River), the Quindalup Dunes are adjoined in the east to the Ludlow Plains, which in turn are adjoined in the east and south by the Abba Plains. The Abba Plains are bounded in the east by the Blackwood Plateau (Tille and Lantzke, 1990).

Within the Swan Coastal Plain, the Survey Area is situated on soils of three different land form systems (**Figure 3**).

Abba System (213Ab): The Abba system is very flat, poorly drained and characterised by wet soils and semi-wet soils, pale deep sands, pale sandy earths and grey deep sandy duplexes (Hanran-Smith, 2002).

Spearwood Dune System (211Sp): The Spearwood Dunes are situated between the Quindalup Dunes and the Bassendean Dunes and are separated from the Bassendean Dunes by a line of swamps and lakes. The Spearwood Dune system is of aeolian origin and is comprised of red/brown, yellow and pale yellow/grey sands. It is characterised by limestone capped peaks and low dunes and swales of shallow pale grey sands over yellow sands (McArthur and Bettenay, 1960).

Bassendean System (212Bs): The Bassendean Dune System is the oldest of the aeolian deposits and consists of low hills of siliceous sand interspersed with poorly drained areas (McArthur and Bettenay, 1960).

These soil-landscape systems have been divided into subsystems, and further divided into soil phases (Tille and Lantzke, 1990). Ten soil phases are mapped across the Survey Area. These are described in **Table 1** and mapped in **Figure 3**.

Table 1. Soil phases occurring within the Survey Area (Tille and Lantzke, 1990).

System	Soil Phase	Description
211Sp Spearwood	211SpLD1	Flats and very low dunes. Deep yellow brown siliceous sands over limestone (i.e. Spearwood Sands).
	211SpLDV	Narrow floodplains in small depressions along creeks and rivers. Sandy alluvial soils.
	211SpLDw	Flats with poor subsoil drainage in winter. Deep yellow brown siliceous sands over limestone (i.e. Spearwood Sands).
212Bs Bassendean	212BsGCd2	Gently sloping low dunes and rises (0-5% gradients) with deep bleached sands.
	212BsW_SWAMP	Bassendean system swamp
	212BsX_MINE	Mine. Disturbed land.
	212Bs_B1b	Very low relief dunes of undulating sand plain with deep bleached grey sandy A2 horizons and pale yellow B horizons.
	212Bs_B5	Shallowly incised stream channels of minor creeks and rivers with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.
213Ab Abba	213AbBvw	Small narrow swampy depressions along drainage lines. Alluvial soils.
	213AbCKw	Poorly drained flats with heavy clayey (Cokelup) soils. Some areas saline in summer.

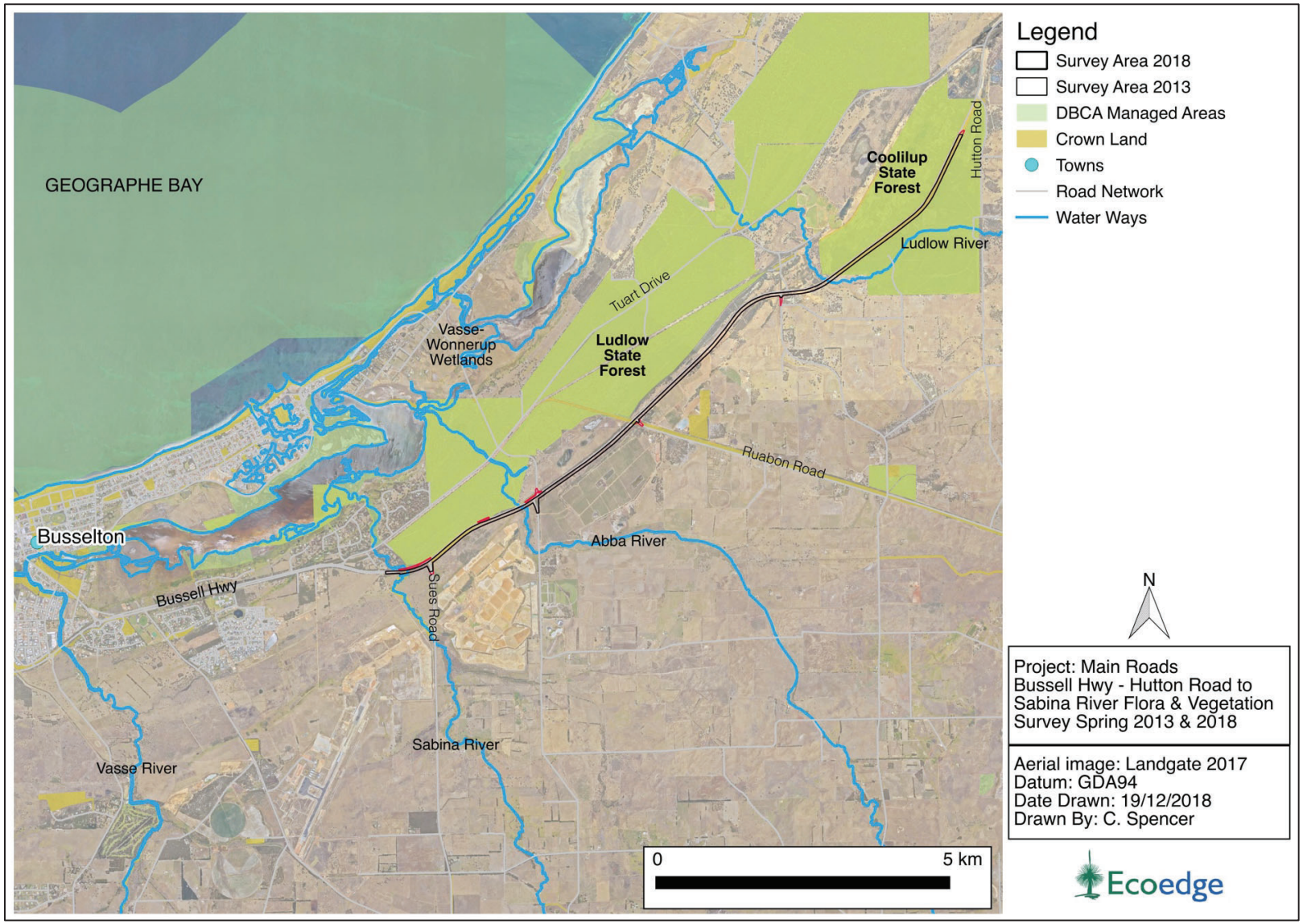

Figure 2. The Survey Area in context of surrounding land uses.

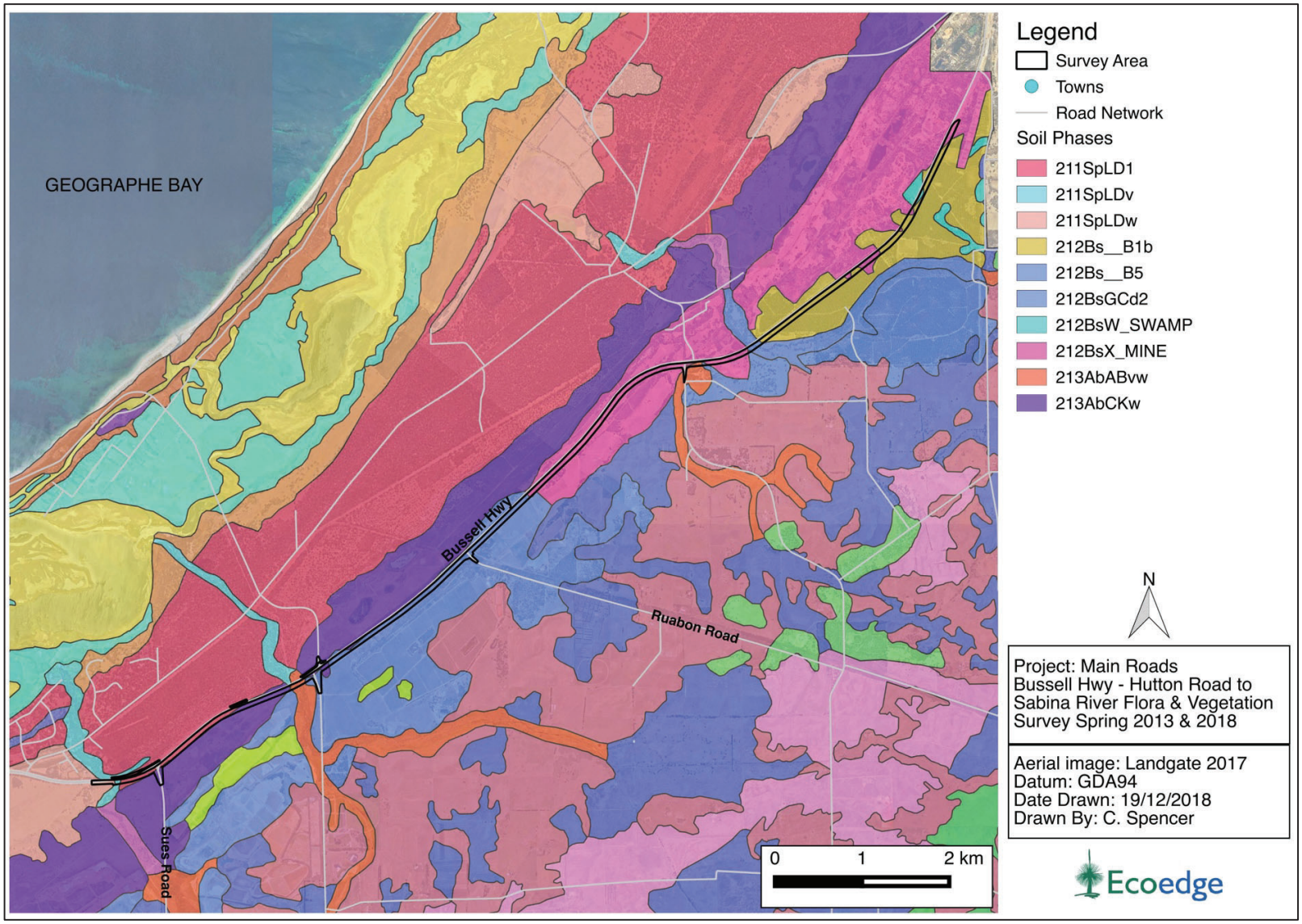

Figure 3. Soil phases mapped for the Survey Area (Tille and Lantzke, 1990).

1.4 Vegetation Description according to pre-European Mapping Datasets

The Survey Area contains approximately 36.7 ha of remnant native vegetation[2].

1.4.1 Vegetation Complexes

In 2016, the Department of Parks and Wildlife (DPaW) revised the 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).

According to the 1:250,000 mapping of Vegetation Complexes in the Swan Coastal Plain of Western Australia (Heddle *et al.,* 1980) as updated by Webb *et al*. (2016), five vegetation complexes occur within the Survey Area. These are described in **Table 2** and mapped in **Figure 4.**

Table 2. Vegetation complexes mapped for the Survey Area (Webb *et al*., 2016).

Vegetation Complex	Description
Abba Complex	A mixture of open forest of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - Banksia species and woodland of *Corymbia calophylla* (Marri) with minor occurrences of *Corymbia haematoxylon* (Mountain Marri). Woodland of *Eucalyptus rudis* (Flooded Gum) - Melaleuca species along creeks and on flood plains.
Cokelup Complex	Closed-scrub/woodland of Melaleuca species over sedges and annually renewed herbs on inundated clay flats. Fringing open forest of *Eucalyptus rudis*, *Corymbia calophylla*, *Banksia littoralis*, *E. gomphocephala*.
Karrakatta Complex – Central and South	Predominantly open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri) and woodland of *Eucalyptus marginata* (Jarrah) - Banksia species. *Agonis* flexuosa (Peppermint) is co-dominant south of the Capel River.
Southern River Complex	Open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - Banksia species with fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark) along creek beds.
Yoongarillup Complex	Woodland to tall woodland of *Eucalyptus gomphocephala* (Tuart) with *Agonis flexuosa* in the second storey. Less consistently an open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri). South of Bunbury is characterized by *Eucalyptus rudis* (Flooded Gum)-Melaleuca species open forests.

[2] The area of remnant vegetation is based on the total area rated as 'Completely Degraded' or better. Scattered trees over pasture grasses were not considered to be 'remnant vegetation'.

1.4.2 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 south-west of Western Australia at a scale of 1:250,000. Beard's vegetation maps attempted to depict the vegetation as it might have been prior to European settlement in terms of type and extent (Beeston *et al.*, 2001). The Beard Vegetation Association dataset, also referred to as the pre-European native vegetation extent dataset, was digitised by Shepherd *et al.* (2002).

Beard vegetation associations have been described to a minimum standard of Level 3 "Broad Floristic Formation" for the National Vegetation Inventory System (NVIS) (state-wide to regional scale) [3]. The Survey Area comprised of six Beard Vegetation Associations. These are described in **Table 3** and presented in **Figure 5**.

Table 3. Beard Vegetation Associations mapped for the Survey Area.

Vegetation Association	Description
2	Tall woodland; tuart (*Eucalyptus gomphocephala*)
4	Medium woodland; marri & wandoo
949	Low woodland; banksia
990	Low forest: peppermint (*Agonis flexuosa*)
1000	Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree (Melaleuca Spp.)
1136	Medium woodland; marri with some jarrah, wandoo, river gum and casuarina

1.4.3 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 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 (Government of Western Australia, 2018). This system is also based on the National

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

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".

Table 4 lists the percentage remaining of each vegetation complex identified within the Survey Area and indicates whether the Commonwealth 30% retention target is met.

Table 4. Vegetation complexes mapped within the Survey Area with regard to the Commonwealth retention target (Government of Western Australia, 2018).

Vegetation Complex	% Remaining of pre-European	Is the 30% Target Met?	% in DPaW Managed Lands*
Abba Complex	6.54	No	0.36
Cokelup Complex	10.49	No	4.70
Karrakatta Complex – Central and South	23.48%	No	8.06%
Southern River Complex	18.452	No	1.59
Yoongarillup Complex	35.55	Yes	18.34

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

Table 5 presents the Statewide Vegetation Statistics as they relate to Beard vegetation Associations within the Survey Area.

Table 5. Beard Vegetation Associations of the Survey Area assessed against the Statewide Vegetation Statistics (Government of Western Australia, 2017).

Beard Vegetation Association	% Remaining of pre-European extent in SWA IBRA region	Is the 30% Target Met?	% of pre-European extent in all DBCA managed land in SWA02 IBRA region
2	59.04	Yes	91.84
4	18.89	No	14.60
949	57.22	Yes	56.45
990	16.38	No	11.54
1000	26.34	No	19.21
1136	6.94	No	3.86

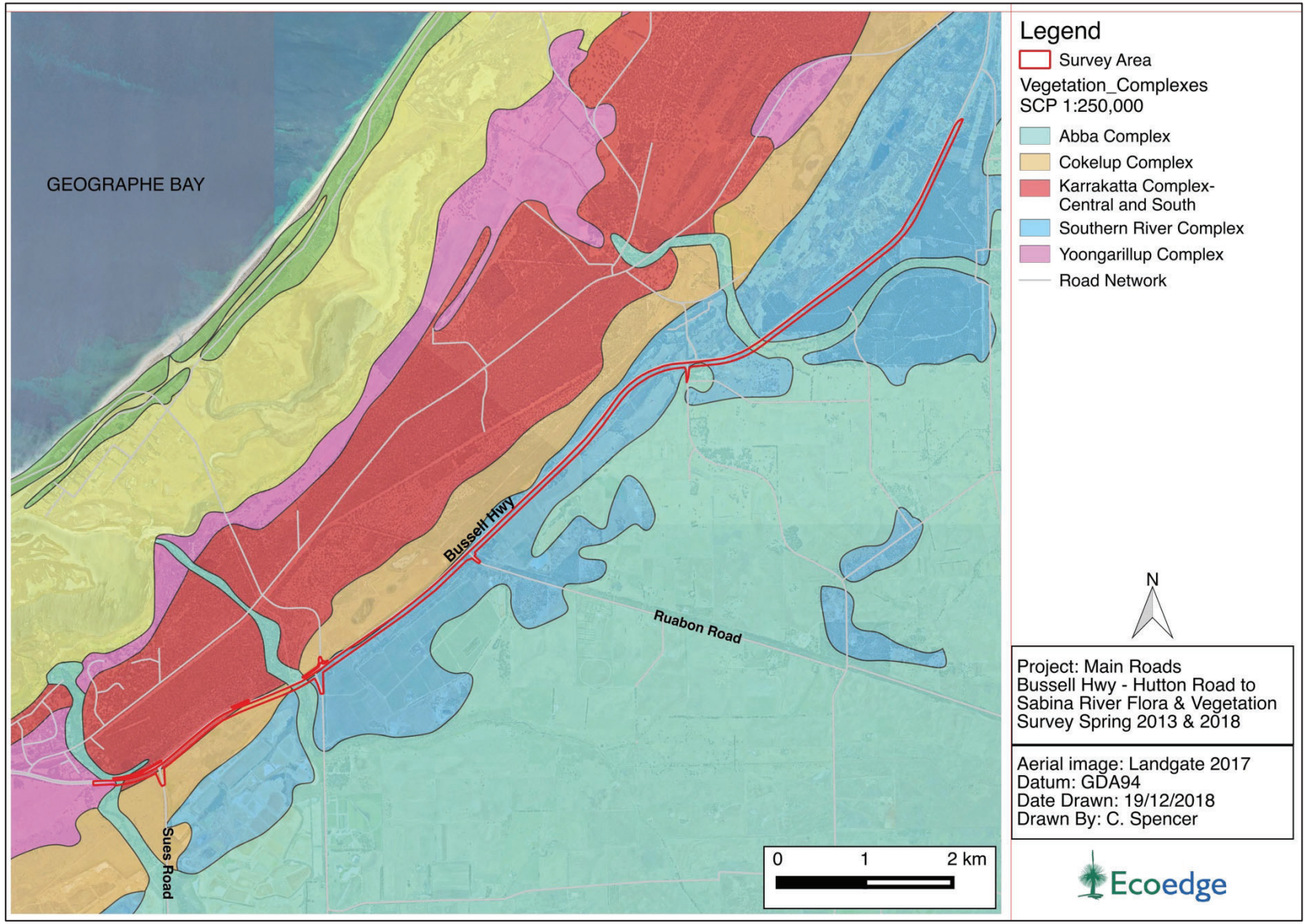

Figure 4. Vegetation complexes mapped within the Survey Area (Webb *et al*., 2016).

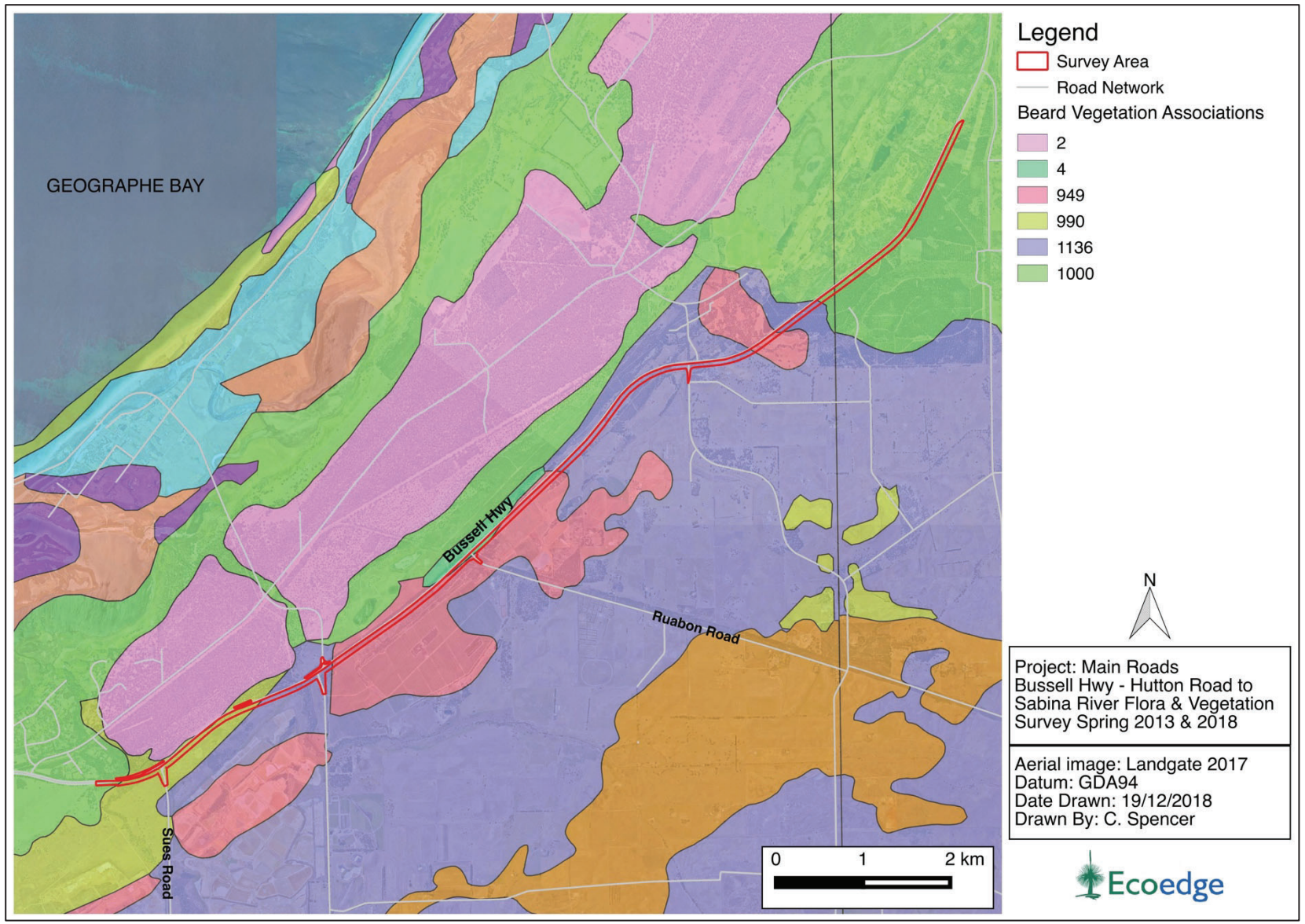

Figure 5. Beard Vegetation Associations Mapped within the Survey Area.

1.5 Threatened and Priority Ecological Communities

Ecological communities are defined by Western Australia's DBCA (previously DPaW and the Department of Environment and Conservation (DEC)) 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 that are considered to be under significant threat as a Threatened ecological communities (TEC). These TECs can be listed under one of three conservation categories; critically endangered (CE), endangered (EN), vulnerable (V). 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, or 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 (2018e, 2019b). The conservation categories for these Threatened and Priority ecological communities are defined in **Appendix 1**.

Threatened ecological communities can also be listed under the Commonwealth *Environment and Biodiversity Conservation Act 1999* (*EPBC Act*) (Department of the Environment and Energy (DotEE), 2018a; Department of Environment, Water, Heritage and the Arts (DEWHA), 1999). There are three categories of TEC under the EPBC Act: Critically Endangered (CE), Endangered (E) and Vulnerable (V). These are defined in **Appendix 2** (DotEE, 2018a).

Under both the State (*BC Act*) and Federal Act (*EPBC Act*) ministerial authorisation is required where significant permanent modification to a TEC will occur.

A Protected Matters Search Tool report for communities listed under the EPBC Act occurring within a 10 km radius of the Survey Area was undertaken (DotEE, 2018b, **Appendix 5**), and the current DBCA TEC and PEC listings were consulted (DBCA, 2018e; DBCA ,2019b). Outcomes of these searches are presented in **Table 6**.

Noting that if any Threatened ecological communities are found during a survey conducted under the auspices of the *Environmental Protection Act 1986* they must be mandatorily reported to DotEE.

Table 6. Threatened and Priority ecological communities occurring within 5 km of the Survey Area (DBCA 2018e; 2019b; DotEE, 2018b).

Community Name	Community Description	Status (WA)	Status (EPBC Act)
'Claypans of the Swan Coastal Plain' – a federally listed TEC consisting of the following four State-listed communities: 1. SCP07: Herb rich saline shrublands in clay pans (TEC) 2. SCP08: Herb rich shrublands in clay pans (TEC) 3. SCP09: Dense shrublands on clay flats (TEC) 4. SCP10a: Shrublands on dry clay flats (TEC)		1. VU 2. VU 3. VU 4. EN 5. P1	CR
'Banksia Woodlands of the Swan Coastal Plain' – a federally listed TEC consisting of numerous State-listed communities		Various	EN
Shrublands on southern Swan Coastal Plain Ironstones (Busselton area) (10b)	Rapidly drying clay flats that occur on small areas of ironstone with thin skeletal soils in the Busselton Area.	CR	EN
Busselton Yate community	*Eucalyptus cornuta*, *Agonis flexuosa* and *Eucalyptus decipiens* forest on deep yellow-brown siliceous sands over limestone.	PEC (P1)	
Subtropical and Temperate Coastal Saltmarsh	The community is typically restricted to the upper tidal environment and consists mainly of halophytes dominated by relatively few families including. Four structural saltmarsh forms are currently recognised based on dominance of a particular vegetation type: 1. succulent shrubs (e.g. Tecticornia) 2. grasses (e.g. *Sporobolus virginicus*) 3. sedges and grasses (e.g. *Juncus kraussii*, *Gahnia trifida*) herbs (e.g. low-growing creeping plants such as *Wilsonia backhousei*, *Samolus repens* and *Schoenus nitens*).	PEC (P3)	VU

Community Name	Community Description	Status (WA)	Status (EPBC Act)
Tuart woodlands of the Swan Coastal Plain	Mostly confined to Quindalup Dunes and Spearwood Dunes from Jurien Bay to the Sabina River, with outliers along some rivers. Tuart (*Eucalyptus gomphocephala*) is the key dominant canopy species. Common flora include Agon*is flexuosa, Banksia attenuata, Banksia grandis, Allocasuarina fraseriana, Xylomelum occidentale, Macrozamia riedlei, Xanthorrhoea preissii, Spyridium globulosum, Templetonia retusa* and *Diplolaena dampieri.*	PEC (P3)	

Note: This table only includes formally recognised TECs that are known of and mapped by DBCA and are included in their database.

1.6 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 Department of Biodiversity, Conservation and Attractions 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 and are ranked according to their level of threat using IUCN Red List categories and criteria of; critically endangered (CE), endangered (EN), and 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 are 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 on an annual basis, whilst the priority flora list is subject to a less formal ongoing review. The current listing of Threatened and Priority flora is specified in (DBCA, 2018e)

Categories of Threatened and Priority flora as defined by the BC Act are presented in **Appendix 3,** (DBCA, 2019a).

Threatened flora may also be protected under the Commonwealth EPBC Act and be listed in one of six categories; the definitions of these categories are summarised in **Appendix 4** (DotEE, 2018c).

Threatened or Priority flora occurring within 5 km of the Survey Area generated from an extract from the DBCA databases (DBCA, 2018a) and a NatureMap search within 5 km of the Survey Area (DBCA, 2018b) are listed in **Table 7.** Taxa listed under the EPBC Act (based on results of the Protected Matters Search Tool query (DotEE, 2018b) were also considered in the preparation of the table. The results of the DBCA datasearch are mapped in **Figure 6**. Several of the species listed in **Table 7** could potentially occur within the Survey Area, based on an assessment of their preferred habitats.

Noting that if any threatened flora species are found during a survey conducted under the auspices of the *Environmental Protection Act 1986* that they must be mandatorily reported to the CEO of the DBCA under Section 43 of the BC Act.

Table 7. Threatened and Priority List flora known to occur within 5 km of the Survey Area (DBCA, 2018a, 2018b; DotEE, 2018b.)

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
Brachyscias verecundus	T (CE)	Nov	Annual (or ephemeral), herb, 0.012-0.022 m high, entirely glabrous. Fl. white/cream. In a moss sward. On a granite outcrop.	Very Low
Caladenia procera	T (CE)	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.	Moderate
Calectasia cyanea	T (CE)	Jun-Oct	Rhizomatous, clump forming, woody perennial, herb, 0.1-0.6 m high, to 0.3 m wide. Fl. blue/purple. White, grey or yellow sand, gravel.	None
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.	Low
Banksia nivea subsp. *uliginosa*	T (EN)	July-Sep	Dense, erect, non-lignotuberous shrub, 0.2–1.5 m high. Fl. yellow, brown. Sandy clay, gravel.	Low
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.	Low
Darwinia whicherensis	T (EN)	Oct-Nov	Erect low shrub to 30 cm, flowers green, outer red. Winter-wet area of shrubland over shallow red clay over ironstone	Low
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.	Moderate
Gastrolobium papilio	T (EN)	Oct-Dec	Tangled, clumped shrub, to 1.5 m high. Fl. cream-red. Sandy clay over ironstone and laterite. Flat plains.	Low

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
Grevillea maccutcheonii	T (EN)	Mar or May or Dec	Densely branched shrub, to 2 m high. Fl. green & red. Shallow soils over laterite, clay. Seasonally inundated sites.	Low
Lambertia echinata subsp. *occidentalis*	T (EN)	Feb/May-Jun/Oct	Prickly, much-branched, non-lignotuberous shrub, to 3 m high. Fl. yellow. White sandy soils over laterite, orange/brown-red clay over ironstone.	Low
Petrophile latericola	T (EN)	Nov	Multi-stemmed shrub, 0.4-1.5 m high. Fl. yellow. Red lateritic clay. Winter-wet flats.	Low
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.	Low
Verticordia densiflora var. *pedunculata*	T (EN)	Dec-Jan	Erect to spreading shrub, 0.3-0.6 m high. Fl. pink/pink-white. Grey/yellow sand, sandy loam. Winter-wet low-lying areas.	Moderate
Verticordia plumosa var. *vassensis*	T (EN)	Sep-Feb	Shrub, 0.3–1 m high. Fl. pink. White/grey sand. Winter-wet flats.	High
Banksia squarrosa subsp. *argillacea*	T (VU)	Jun-Nov	Erect, open, non-lignotuberous shrub, 1.2–4 m high. Fl. yellow, Jun–Nov. White/grey sand, gravelly clay or loam. Winter-wet flats, clay flats.	Low
Chamelaucium sp. S Coastal Plain (R.D. Royce 4872)	T (VU)	Oct-Dec	Winter-wet areas, loams and ironstone.	Moderate
Diuris drummondii	T (VU)	Nov-Jan	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow. Low-lying depressions, swamps.	Moderate

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
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.	Low
Drakaea micrantha	T (VU)	Sep-Oct	Tuberous, perennial, herb, 0.15–0.3 m high. Fl. red, yellow. White-grey sand.	Low
Grevillea elongata	T (VU)	Oct	Shrub, 1.5-2 m high. Fl. white-cream. Gravelly clay, sandy clay, sand. Road verges, swamps, creek banks.	Low
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	T	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.	Low
Tetraria australiensis	T	Nov-Dec	Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Fl. brown. Sandy soils associated with heavy soils on the Pinjarra Plain.	Low
Verticordia plumosa var. *ananeotes*	T	Nov-Dec	Erect, sparsely branched shrub, 0.3-0.5 m high. Fl. pink-purple/white. Sandy loam. Seasonally inundated plains.	Moderate
Caladenia busselliana	T	Sept-Oct	Tuberous, perennial, herb, 0.2–0.3 m high. Fl. green, yellow, cream. Sandy loam. Winter-wet swamps	Moderate
Andersonia ferricola	P1	Oct	Shrub, 0.2-0.5 m high. Fl. purple. White sand or red-brown loam over ironstone. Seasonally wet flats.	Low
Bolboschoenus medianus	P1	-	Rhizomatous, perennial, grass-like or herb (sedge). Fl. red-brown. Mud. In water and on river banks.	Moderate
Stachystemon sp. Keysbrook (R. Archer 17/11/99)	P1		Shrub/herb to 0.2 m high.	Uknown

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
Acacia benthamii	P2	Aug-Sep	Shrub, ca 1 m high. Fl. Yellow. Sand. Typically on limestone breakaways.	Very Low
Amperea micrantha	P2	Oct-Nov	Low, spreading, bushy perennial, herb, 0.1–0.3 m high. Fl. brown. Sandy soils.	Moderate
Cardamine paucijuga	P2	Sep-Oct	Slender erect annual, herb, to 0.4 m high. Fl. white. In moist to dry habitats.	Low
Leucopogon sp. Busselton (D. Cooper 243)	P2	Aug-Sep	Slender, erect shrub to 70 cm; flowers white. Pericalymma ellipticum wet shrubland, Marri-Jarrah woodland.	Low
Montia australasica	P2			Low
Schoenus loliaceus	P2	Aug-Nov	Annual, grass-like or herb (sedge), 0.03–0.06 m high. Sandy soils. Winter-wet depressions.	Moderate
Synaphea petiolaris subsp. *simplex*	P2	Sep-Oct	Tufted shrub, 0.1–0.6 m high. Fl. yellow. Sandy soils. Flats, winter-wet areas.	High
Thelymitra variegata	P2	Jun-Sep	Tuberous, perennial, herb, 0.1–0.35 m high. Fl. orange, red, purple, pink. Sandy clay, sand, laterite.	Low
Adelphacme minima	P3		Sandy soils. Annual 10-20 cm tall. Fl. white.	Unknown
Angianthus drummondii	P3	Oct-Dec	Erect annual, herb, to 0.1 m high. Fl. yellow. Grey or brown clay soils, ironstone. Seasonally wet flats.	Low
Blennospora doliiformis	P3	Oct-Nov	Erect annual, herb, to 0.15 m high. Fl. yellow. Grey or red clay soils over ironstone. Seasonally-wet flats.	Moderate

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
Boronia anceps	P3	Sep-Dec or Jan	Perennial, herb, 0.3-0.6 m high, lacking lignotuber, stem flattened and ancipitous when young. Fl. pink/pink-purple. White sand, gravelly laterite. Seasonally swampy heaths.	Moderate
Boronia tetragona	P3	Oct-Dec	Perennial, herb, 0.3–0.7 m high, leaves sessile, entire, with papillate margins, branches quadrangular, sepals ciliate. Fl. pink, red. Black/white sand, laterite, brown sandy loam. Winter-wet flats, swamps, open woodland.	Moderate
Chamaescilla gibsonii	P3	Sep	Clumped tuberous, herb. Fl. blue. Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	High
Chordifex gracilior	P3	Sep-Dec	Rhizomatous, erect perennial, herb, 0.3-0.5 m high. Fl. brown. Peaty sand. Swamps.	Low
Eryngium sp. Ferox (G.J. Keighery 16034)	P3	Nov	Erect, open tuberous, herb, 0.1–0.3 m high. Fl. green. Grey to brown loamy to sandy clay, brown cracking clay. Winter-wet flats, swamps, dried claypans, ridges.	Moderate
Eryngium sp. Subdecumbens (G.J. Keighery 5390)	P3	Nov	Erect, open tuberous, herb, 0.1–0.3 m high. Fl. green. Grey to brown loamy to sandy clay, brown cracking clay. Winter-wet flats, swamps, dried claypans, ridges.	Moderate
Grevillea brachystylis subsp. *brachystylis*	P3	Aug-Nov	Much-branched, prostrate or decumbent, non-lignotuberous shrub, 0.2-0.5 m high, to 3 m wide. Fl. red. Black sand, sandy clay. Swampy situations.	Low
Hakea oldfieldii	P3	Aug-Oct	Open, straggling shrub, up to 2.5 m high. Fl. white, cream, yellow. Red clay or sand over laterite. Seasonally wet flats.	Low

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
Isopogon formosus subsp. *dasylepis*	P3	Jun-Dec	Low, bushy or slender, upright, non-lignotuberous shrub, 0.2–2 m high. Fl. pink, purple, red. Sand, sandy clay, gravelly sandy soils over laterite. Often swampy areas.	Low
Jacksonia gracillima	P3	Oct-Nov	Decumbent shrub - 20 cm high and 50 cm wide. Flowers standard orange-yellow; eye yellow with red halo; wings/keel red. Seasonally damp shrublands and woodlands, on sandy loams or clay loams	Moderate
Lasiopetalum membranaceum	P3	Sep-Dec	Multi-stemmed shrub, 0.2-1 m high. Fl. pink, blue, purple. Sand over limestone.	Low
Loxocarya magna	P3	Sep-Nov	Rhizomatous, perennial, herb (sedge-like), 0.5-1.5 m high. Sand, loam, clay, ironstone. Seasonally inundated or damp habitats.	Low
Meionectes tenuifolia	P3		Haloragaceae family, broadly distributed across the Swan Coastal Plain, northern and southern Jarrah forests.	Low
Myriophyllum echinatum	P3	Nov	Erect annual, herb, 0.02-0.03 m high. Fl. red. Clay. Winter-wet flats.	Low
Schoenus benthamii	P3	Oct-Nov	Tufted perennial, grass-like or herb (sedge), 0.15-0.45 m high. Fl. brown. White, grey sand, sandy clay. Winter-wet flats, swamps.	Moderate
Schoenus pennisetis	P3	Aug-Sep	Tufted annual, grass-like or herb (sedge), 0.05-0.15 m high. Fl. purple-black. Grey or peaty sand, sandy clay. Swamps, winter-wet depressions.	Moderate

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
Stylidium paludicola	P3	Oct-Dec	Reed-like perennial, herb, 0.35-1 m high, Leaves tufted, linear or subulate or narrowly oblanceolate, 0.5-4 cm long, 0.5-1.5 mm wide, apex acute, margin entire, glabrous. Scape mostly glabrous, inflorescence axis glandular. Inflorescence racemose. Fl. pink. Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	Low
Synaphea hians	P3	Jul-Nov	Prostrate or decumbent shrub, 0.15-0.6 m high, to 1 m wide. Fl. Yellow. Sandy soils. Rises.	High
Tetratheca parvifolia	P3	Oct	Small shrub, 0.2-0.3 m high. Fl. pink. Jarrah, woodland, wandoo woodland, gravelly soils.	Low
Verticordia attenuata	P3	Dec-May	Shrub, 0.4–1 m high. Fl. pink. White or grey sand. Winter-wet depressions	High
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.	Moderate
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.	Moderate
Aponogeton hexatepalus	P4	Jul-Oct	Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green, white. Mud. Freshwater: ponds, rivers, claypans.	Low
Banksia meisneri subsp. *ascendens*	P4	Apr-Sep	Shrub, 0.5-2 m high, leaves ascending, 8-15 mm long. Fl. yellow-orange-brown. White or grey sand. Swampy flats.	Low
Caladenia speciosa	P4	Sep-Oct	Tuberous, perennial, herb, 0.35-0.6 m high. Fl. white, pink. White, grey or black sand.	Moderate

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
Calothamnus quadrifidus subsp. *teretifolius* A.S.George & N.Gibson ms	P4	Nov-Dec	Erect, compact, perennial shrub 1.7 m high x 1 m wide. Fl. Red. Seeds held. Fruit exposed.	Low
Chamelaucium sp. Yoongarillup (G.J. Keighery 3635)	P4	Jul-Oct	Non-lignotuberous shrub, to 2.5 m high. Fl. cream, yellow. Jarrah-marri forest. Loams, sandy clays. Riverbanks, lower slopes, below laterite breakaways.	Moderate
Eucalyptus rudis subsp. *cratyantha*	P4	Jul-Sep	Tree, 5-20 m high, bark rough, box-type. Fl. white. Loam. Flats, hillsides.	High
Franklandia triaristata	P4	Aug-Oct	Erect, lignotuberous shrub, 0.2-1 m high. Fl. white, cream, yellow , brown, purple. White or grey sand.	Low
Laxmannia jamesii	P4	May-Jul	Tufted, stilt-rooted perennial, herb, 0.05–0.2 m high. Fl. red, white. Grey sand. Winter-wet locations.	Low
Microtis quadrata	P4			Low
Ornduffia submersa	P4	Sep-Oct	Tuberous emergent aquatic perennial dwarf shrub, height to 35 cm; flowers white; leaves floating on surface of water. Clay-based ponds and swamps (semi-aquatic)	Low
Schoenus natans	P4	Oct	Aquatic annual, grass-like or herb (sedge), 0.3 m high. Fl. brown. Winter-wet depressions.	Moderate
Stylidium longitubum	P4	Oct-Dec	Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. Pink. Sandy clay, clay. Seasonal wetlands.	Low

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
Stylidium striatum	P4	Oct-Nov	Rosetted perennial, herb, 0.15-0.55 m high, Leaves erect, oblanceolate to spathulate, 1.5-4 cm long, 1.5-6 mm wide, apex acute to acuminate, margin entire, glabrous, striate. Scape sparingly glandular on inflorescence axis, glabrous below. Inflorescence racemose. Fl. yellow. Brown clay loam over laterite. Hillslopes. Jarrah/Marri forest, Wandoo woodland.	Low
Thysanotus glaucus	P4	Oct-Mar	Caespitose, glaucose perennial, herb, 0.1–0.2 m high. Fl. purple. White, grey or yellow sand, sandy gravel.	Moderate
Tripterococcus brachylobus	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.	Moderate
Verticordia lindleyi subsp. *lindleyi*	P4	May or Nov-Dec or Jan	Erect shrub, 0.2-0.75 m high. Fl. pink. Sand, sandy clay. Winter-wet depressions.	Moderate

Note: The BC Act Conservation Status is shown, EPBC Act status, where relevant, is in brackets.

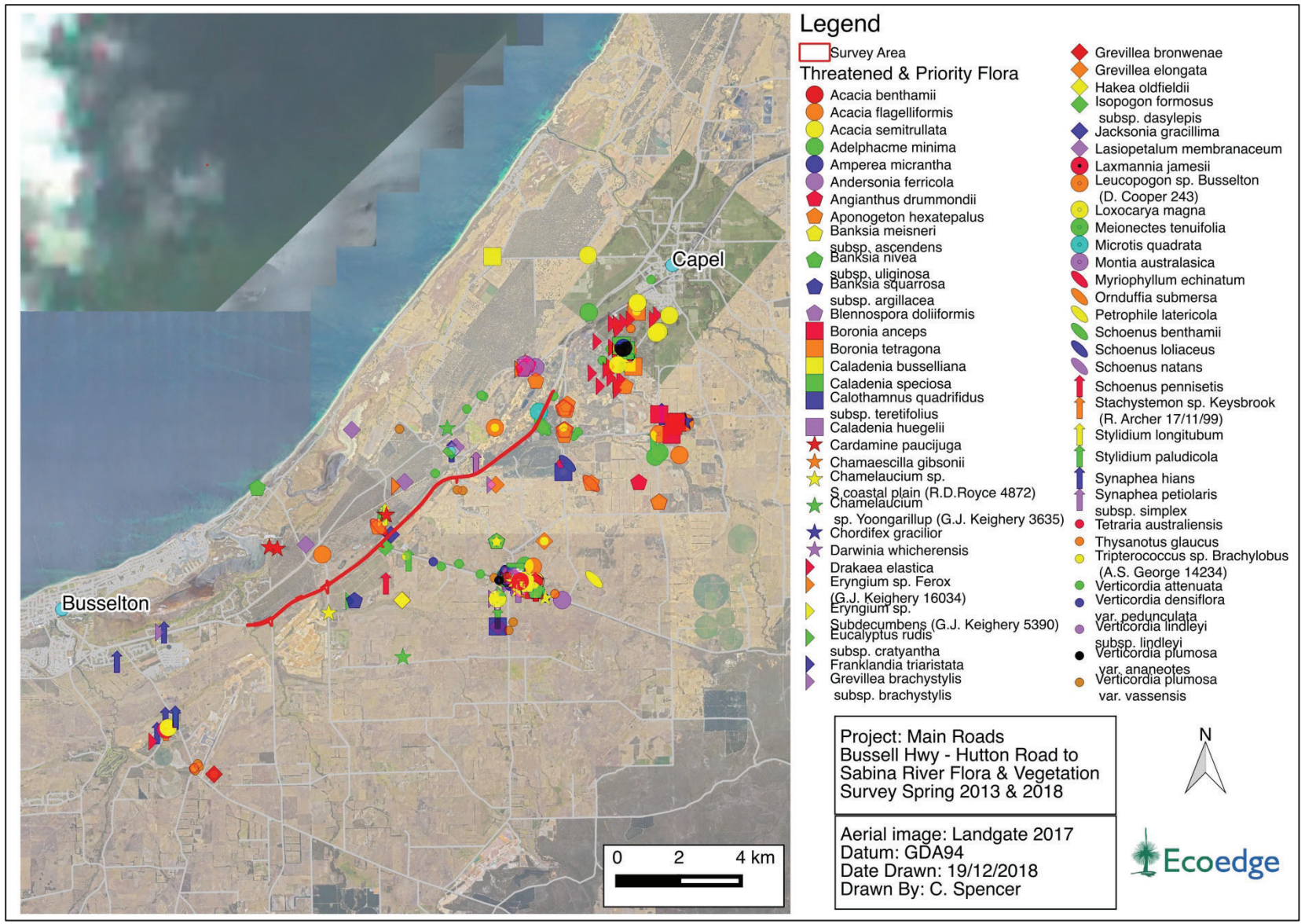

Figure 6. Known occurrences of Threatened and Priority flora within 5km of the Survey Area (DBCA, 2018a).

1.7 Geomorphic Wetlands

Wetlands on the Swan Coastal Plain 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 8.** The Swan Coastal Plain 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 9.**

Table 8. 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 9. Definitions of and objectives for the different wetland management categories (modified from Essential Environmental Services, 2005).

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	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	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

The boundary of a Conservation category palusplain wetland crosses the Survey Area approximately 360 m WSW of the Ludlow Hithergreen Road intersection. This wetland runs parallel to the Survey Area with its boundary for the most part about 50m SE of the Survey Boundary. Two other Conservation category wetlands (CCW) occur near the Survey Area. The closest boundary of these wetlands is about 75 m away from the Survey Area (**Figure 7** and **Figure 8**).

The boundary of Multiple use wetland also occurs within the western and northern portions of the Survey Area. These wetlands are mostly associated with degraded, mostly cleared landscapes (**Figure 7** and **Figure 8**).

Three rivers pass through the boundary of the Survey Area, the Sabina, Abba and Ludlow River. These wetlands flow into the Conservation Category Vasse - Wonnerup Wetland System which are located approximately 2 km north of the Survey Area.

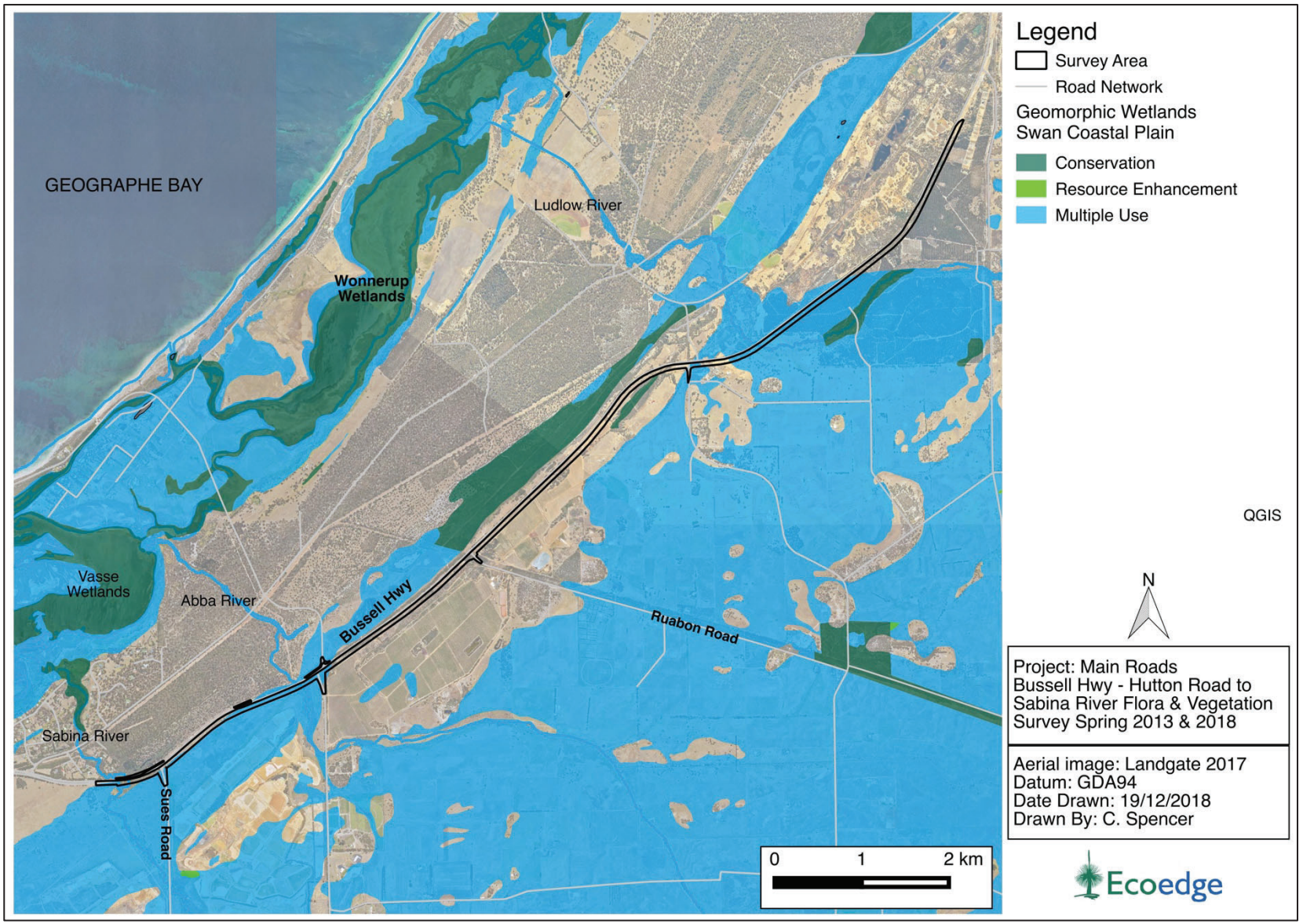

Figure 7. Geomorphic wetlands according to management classifications within the Survey Area.

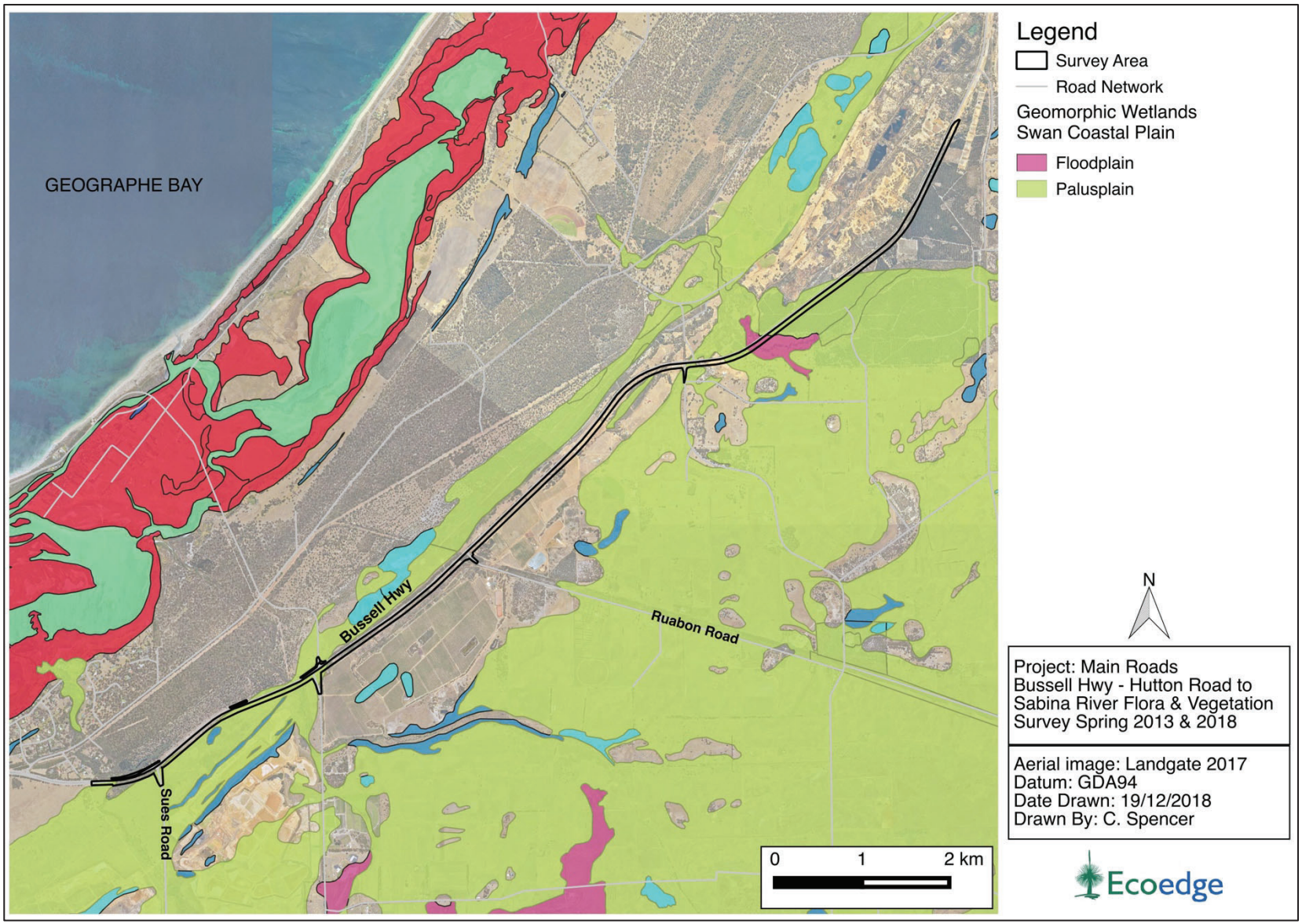

Figure 8. Geomorphic wetland types within the Survey Area.

1.8 Ecological Linkages and Connectivity

Information for this section is taken from Molloy *et al*. (2009) and their report on the South West Regional Ecological Linkages (SWREL) Project.

Ecological linkages are defined as:

"*A series of (both contiguous and non-contiguous) patches which, by virtue of their proximity to each other, act as stepping stones of habitat which facilitate the maintenance of ecological processes and the movement of organisms within, and across, a landscape*."

Regional ecological linkages link protected patches of regional significance by retaining the best (condition) patches available as stepping stones for flora and fauna between regionally significant areas. This increases the long-term viability of all the constituent areas.

The SWREL report is the result of collaboration between the Western Australian Local Government Association's *South West Biodiversity Project* and the then Department of Environment and Conservation's *Swan Bioplan* to provide a tool for the identification of ecological linkages and guidance for the protection of linkages through planning policy documents.

Molloy *et al.* (2009) assessed and assigned "proximity value ratings" to all patches of remnant native vegetation as a way of indicating their distance from the nearest regional ecological linkage axis line. These values are defined in (**Figure 9**). It should be noted however, that the proximity value of a patch of remnant vegetation to an ecological linkage is not intended to replace the need to consider the other biodiversity conservation values of that patch of remnant vegetation.

The *South West Regional Ecological Linkages Technical Report* (Molloy *et al*., 2009) identifies three regional ecological linkage axis lines passing through the Study Area. As a result of the location of these, different patches of remnant vegetation within the Study Area are assigned to proximity categories '1a', '1b', '1c', '2a', '2b' and '2c' which are the highest to sixth highest categories (**Figure 9**). This means that a small portion of the vegetation within the Survey Area directly forms part of an identified regional ecological linkage while the majority is within varying degrees of proximity to those linkages. Large portions of the survey area were absent in vegetation and were not classified with any proximity categories.

While there is no statutory basis for regional ecological linkages identified through the SWREL project, the importance of ecological linkages have been recognised as an environmental policy consideration in EPA and Planning policy over the last decade (EPA, 2009 and references therein). In its statement regarding the SWREL Project, the EPA stated

that even though Ecological Linkages are just one measure of the conservation values of a patch of remnant vegetation it expected that:

> *In preparing plans and proposals for development, consideration will be given to both the site-specific biodiversity conservation values of patches of native vegetation, as well as the landscape function and core linkage significance of a patch in supporting the maintenance of ecological linkage* (EPA, 2009).

Table 10. Linkage proximity rating values assigned to patches of remnant vegetation within a landscape (from Molloy *et al*., 2009).

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

1.9 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are protected under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 and 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; and
- Declared World Heritage property sites.

The boundary of two ESAs occur within the Survey Area. The one in the south western portion of the Survey Area is associated with the Ludlow State Forest and covers about 2 km of the Survey Area. The other, associated with a CCW located about 360 m WSW of Ludlow Hithergreen Road covers about 225 m of the Survey Area (**Figure 10**).

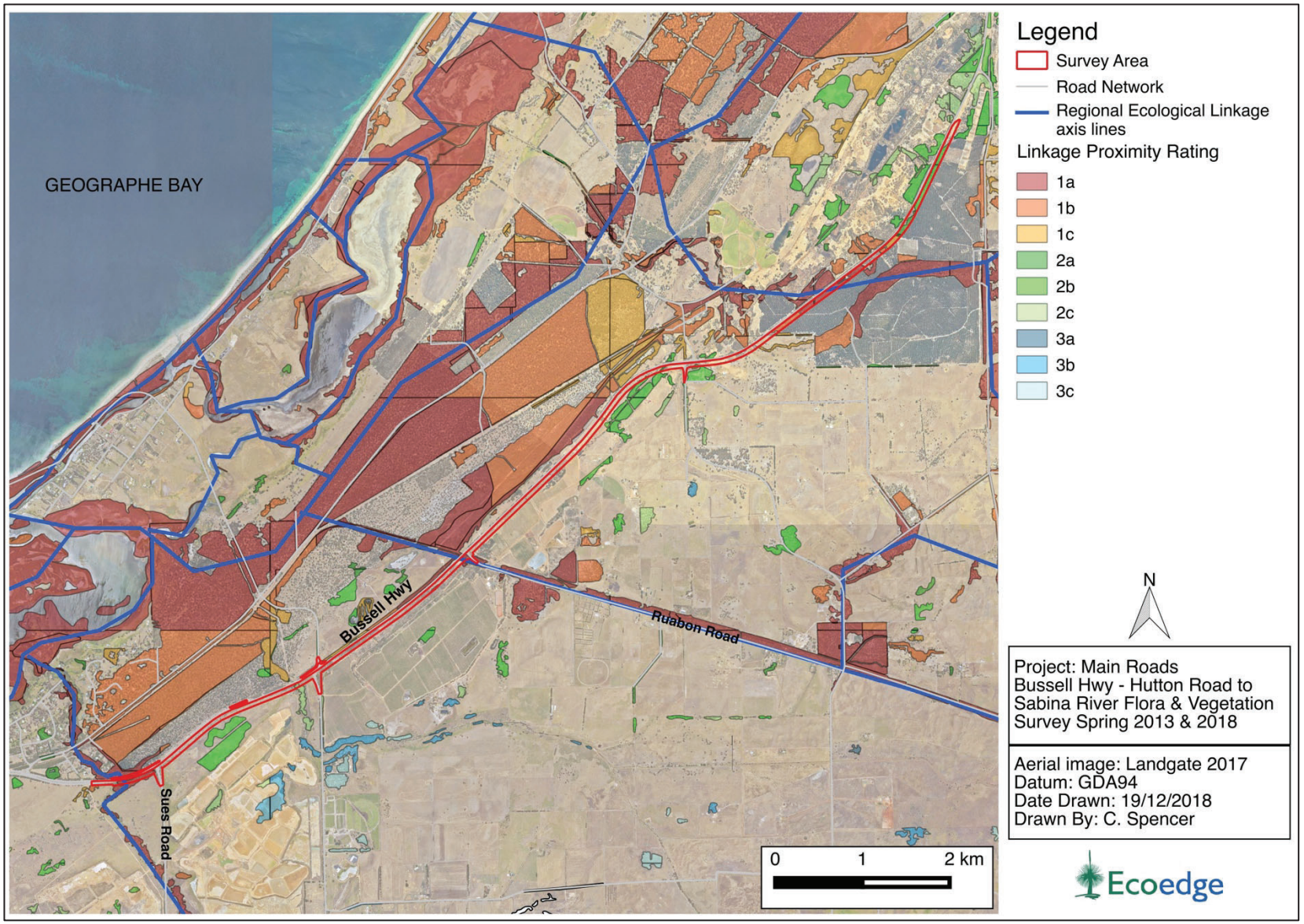

Figure 9. The Survey Area in relation to regional ecological linkages (Molloy *et al.*, 2009).

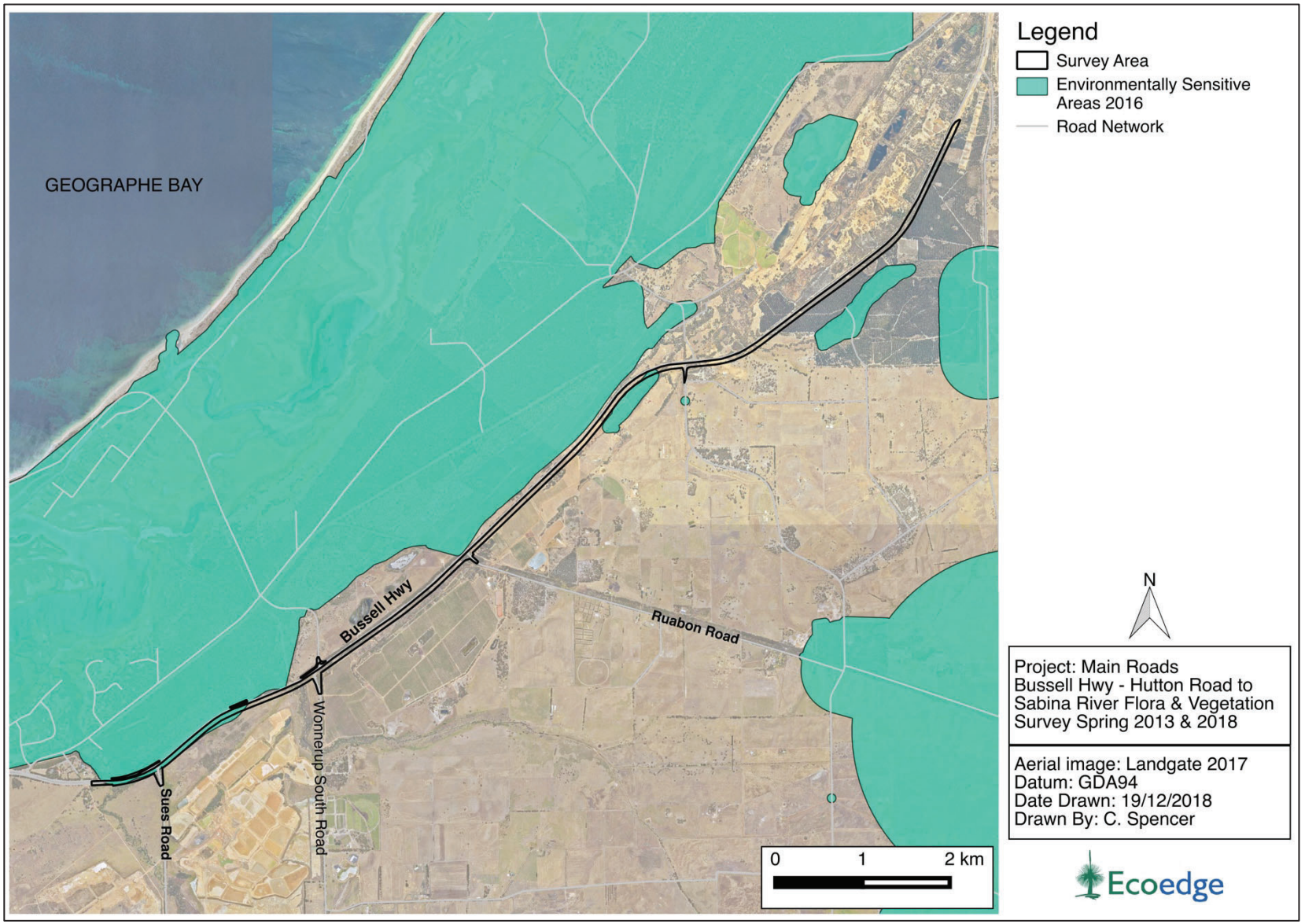

Figure 10. Environmentally Sensitive Areas located in the Survey Area.

2 Methods

2.1 Desktop Assessment

Prior to the field survey, a "desktop assessment" was carried out by downloading, from the Threatened and Priority flora (TPFL) and W.A. Herbarium, databases of records occurring within 5 km of the Survey Area (DBCA, 2018a). A NatureMap report was generated listing all flora (including Threatened flora) occurring within 5 km of the Survey Area (DBCA 2018b) (**Appendix 5**). A Protected Matters Search report was generated to provide information regarding Matters of National Environmental Significance (MNES) know or potentially occurring within 5 km of the Survey Area (DotEE, 2018b) (**Appendix 5**). This data was used to establish the list of Threatened and Priority flora to target during the survey, as well as providing a list of what other plant taxa might be encountered during the survey.

2.2 Field Survey

The supplementary field survey was undertaken by Russell Smith (flora permit SL011843) and Colin Spencer (flora permit SL012460) during five visits between August and October 2018. The previous field survey had been carried out on 22nd and 23rd October 2013, and 19th December 2013. During that survey species composition, vegetation structure and vegetation condition notes were compiled at 50 unmarked relevés within the Survey Area to be used, along with aerial photography, in mapping vegetation type and condition.

Eleven floristic quadrats (100 m^2) were installed in spring 2018 as per the requirements of the supplementary survey outlined in section 1.1, above. Locations of the floristic quadrats are shown in **Figure 23** to **Figure 27** below.

Flora species that were not identified in the field were collected or photographed for later identification. Taxonomy and conservation status of flora species was checked against Parks and Wildlife Service databases (DBCA, 2018c and 2018d).

The total area of remnant native vegetation in the Survey Area was approximately 28 ha.

Vegetation condition was assessed against the method of the EPA (2016) (**Appendix 5**).

2.3 Multivariate Analysis

The floristic quadrat data from the Survey Area was subjected to multivariate analysis (MVA) using the software PATN (Belbin, 2003) to determine the relationship of the vegetation units described and mapped within the Survey Area to the floristic community types derived for the Swan Coastal Plain (SCP) by Gibson *et al*. (1994) ("the SCP Survey"). A subset of the Gibson *et al.* 1994 dataset was used in this analysis, comprising 149 quadrats occurring south of Bagieau Road in Myalup, about 45 km north of Bunbury. It was considered that only including quadrats from the Gibson *et al.* 1994 dataset that were sited within 125 km of the Survey Area would lead to a more accurate assignment of the appropriate FCT.

The MVA used two-way classification (Agglomerative Hierarchical Fusion) of the presence/absence data for each quadrat. The flexible UPGMA classification strategy was used (β = -0.1), together with the Bray-Curtis site similarity measure. The default settings for number of groups to be produced by the classification (i.e. the "cut-off level") was accepted in each case. The primary output of the classification were dendrograms and a two-way table of taxa and quadrats[4].

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

2.4 Survey Limitations

Potential limitations with regard to the assessment are addressed in **Table 11.**

Table 11. Limitations of the field survey with regard to assessment adequacy and accuracy.

Aspect	Constraint	Comment
Scope	No	The survey scope was prepared in consultation with the client and was designed to comply with EPA requirements.
Proportion of flora identified	Negligible	The survey was carried out at the end of September, which is within the prime season for flowering in the south-west of Western Australia.
Climatic and seasonal effects	Negligible	Rainfall for the wet season in the south-west of W.A. (1st April – 31st October) was 80-100% of average. Germination and growth of herbaceous species is not expected to have been negatively affected by rainfall.
Availability of contextual information	Negligible	Comprehensive regional surveys of remnant vegetation, as well as more localised surveys, have been carried out on the southern Swan Coastal Plain.
Completeness of the survey	Negligible	The whole search area was covered on foot. Flowering was excellent.
Skill and knowledge of the botanists	Negligible	The senior field botanist conducting the survey has had extensive experience in botanical surveys in south west Australia over a period of 25 years.

[4] These are available if required.

3 Results

3.1 Flora

Two hundred and eighty-one plant species were identified within the Survey Area of which 66 were naturalized or planted species. Representation was highest amongst the Fabaceae with 41 taxa (including 13 introduced species) and Myrtaceae (32 taxa).

The list of vascular flora recorded during the 2018 field survey combined with the previous survey in 2013 (Ecoedge, 2014) is presented in **Appendix 7**.

3.2 Threatened and Priority Flora

No Threatened flora species listed under the *BC Act* or *EPBC Act* were found in the Survey Area.

Five Priority taxa as defined by the Department of Biodiversity Conservation and Attractions (DBCA, 2018f); *Acacia flagelliformis* (P4), *Eucalyptus rudis* subsp. *cratyantha* (P4), *Synaphea petiolaris* subsp. *simplex* (P3), *S. hians* (P3) and *Verticordia attenuata* (P3) were found within the Survey Area. The distribution of these taxa is shown in **Figure 19** and **Figure 20**. Locations of individual plants or groups of plants is shown in **Appendix 8** and completed Threatened and Priority Report Forms are in **Appendix 9.**

3.2.1 Acacia flagelliformis

Acacia flagelliformis (P3) is an erect or sprawling shrub up to about 1 metre high found in winter-wet sandy soils and mainly confined to the Swan Coastal Plain south of Yarloop, with some out-lying populations on the northern Blackwood Plateau. About 50 plants were found within a swampy area at the northern end of the Survey Area, about a kilometre south of the Hutton Road intersection (**Figure 11**).

Figure 11. *Acacia flagelliformis* (yellow flowers) growing in swampland.

3.2.2 *Eucalyptus rudis* subsp. *cratyantha*

Eucalyptus rudis subsp. *cratyantha* (P4) (**Figure 12**) is a tree up to 20 m high that is usually a riparian species inhabiting riverbanks, seasonal creeks, fringing lakes or swampy areas. It was once widespread on the southern Swan Coastal Plain but has suffered much from clearing associated with agriculture and urban development. It is also highly susceptible to insect predation or pathogenic leaf diseases (Greening Australia, 2013). In the Survey Area this taxon was found at 12 locations associated with riverbanks, streamlines and swampy areas, particularly on the alluvial soils adjacent to the Abba River.

Figure 12. *Eucalyptus rudis* subsp. *cratyantha* (P4) (common in vegetation unit B)

3.2.3 *Synaphea petiolaris* subsp. *simplex*

Synaphea petiolaris subsp. *simplex* (P3) (**Figure 13**) is a tufted shrub up to 0.6 m high that is mainly confined to the southern Swan Coastal Plain south of Capel but is found in scattered occurrences as far east as Collie and south to Nannup. Within the study area it was found as a small population of three plants in a small patch of bushland in very good condition just south of the Ruabon Road intersection.

Figure 13. *Synaphea petiolaris* subsp. *simplex* (P3)

3.2.4 *Synaphea hians*

Synaphea hians (P3) (**Figure 14**) is a prostrate or decumbent shrub, up to 0.6 m high and 1 m wide that is found within a zone stretching from Bowelling east of Collie and Lake Unicup east of Manjimup to the Capel-Busselton area (DPaW, 2013b). One population consisting of about 10 plants was found near the northern end of the Survey Area growing in Jarrah-Marri woodland on grey sand.

Figure 14. *Synaphea hians* (P3)

3.2.5 *Verticordia attenuata*

Verticordia attenuata (P3) (**Figure 15**) is a shrub up to 1 m high found growing in winter wet depressions on the southern Swan Coastal Plain south of Bunbury Almost 3,000 plants of this species were found growing within the Survey Area between Ruabon Road and Wonnerup Road (SLK 40.16 to 40.76) (Ecoedge, 2017).

Figure 15. *Verticordia attenuata* (P3).

3.3 Other Conservation Significant Flora

Several species identified in the previous survey (Ecoedge, 2014) were re-visited to confirm identifications and to gather more information on these taxa, these are discussed below.

3.3.1 Banksia nivea subsp. *nivea*

This species was identified in the 2014 report as the threatened *B. nivea* subsp. *uliginosa* and presumed to have been planted as part of the revegetation of the road verge embankment when the dual carriageway was constructed. On re-inspection it was confirmed to be the common *B. nivea* subsp. *nivea*, which is a widespread subspecies in the south-west of Western Australia, although not found on the coastal plain south of Harvey. It is also confirmed as planted.

3.3.2 Eucalyptus cornuta

The only recorded occurrences of Yate (*Eucalyptus cornuta*) on the Swan Coastal Plain are on the Busselton Plain (Webb *et al*., 2009). One of the mapped occurrences of *E. cornuta* occurs at the southern limit of the Survey Area, between 400 and 730 m west of Sues Road (**Figure 19**). The presence of this species is regarded as evidence of the presence of the Priority 1 ecological community '*Eucalyptus cornuta*, *Agonis flexuosa* and *Eucalyptus decipiens* forest on deep yellow-brown siliceous sands over limestone ('Busselton Yate community')' (Webb *et al*., 2009). Close inspection of these trees, which are all on the south side of the highway, indicate that some at least were planted there (**Figure 19**). This is indicated by the presence of furrows and ridges from which the trees are growing.

Figure 16. *Eucalyptus cornuta* (Yate).

3.3.3 Schoenoplectus pungens

Schoenoplectus pungens is an emergent aquatic perennial sedge, 0.5-1 m high. There are only nine records for this species in DBCA databases and based on these it has a sporadic distribution between the Perth metropolitan area, Bunbury and Manjimup. It is found in

North and South America, Europe and New Zealand as well as the southern states of Australia. Because most Western Australian collections are from urban areas it may be introduced to this state.

Within the Survey Area a small population of about 10 individuals of this species is found in a small stream or drain about 130 m north-east of Layman Road (**Figure 19**).

3.3.4 *Daviesia divaricata* subsp. *divaricata*

Daviesia divaricata subsp. *divaricata* is an erect, spreading shrub, usually 0.5 – 1.5 m high, with yellow/orange & red/purple flowers. It is found mainly on the Swan Coastal Plain between Lancelin and Dunsborough. Records on the southern SCP, however, are scarce. This taxon was recorded in spring 2013 at two locations within the Survey Area and these sites were re-inspected to confirm the identity. The presence of this species at the two locations was confirmed and because both sites are relatively undisturbed it is presumed that they are not plantings (**Figure 17**).

Figure 17. *Daviesia divaricata* subsp. d*ivaricata* at the northern site in the Survey Area.

3.3.5 *Eremaea pauciflora* var. *pauciflora*

Eremaea pauciflora var. *pauciflora* is an erect to spreading shrub, to 2 m high, found on a wide range of soil types throughout the south-west of Western Australia. On the Swan Coastal Plain, however, there are only a few records in DBCA databases that occur south of Pinjarra. It has, however, been recorded by one of the authors at Yoganup south-east of Capel, and at Myalup. A photograph taken at the time of the 2013 survey (**Figure 18**) clearly shows the plant to be *E. pauciflora*. However, the location of the original sighting was revisited in spring 2018 and the plant was not re-found. The area is relatively undisturbed, and the plant found in 2013 was unlikely to be a planting.

Figure 18. *Eremaea pauciflora* plant recorded in the Survey Area in 2013.

3.3.6 Banksia menziesii

Banksia menziesii was recorded during the 2013 survey and a note was made that it occurred in an area of planting associated with the construction of the dual carriageway. However, this fact was not recorded in the 2014 report. Natural populations of this species are not found south of Herron Point, 70 km north of Bunbury.

3.3.7 Other Species

Two other taxa, *Grevillea variifolia* and *Darwinia vestita*, were recorded for the 2013 survey. These both appear to be typographical errors, and the species do not occur in the Survey Area.

3.4 Environmental Weeds and Declared Pest Plants

The location of six species of problematic environmental weeds is mapped in **Figure 21** and **Figure 22**. Two of these species (*Zantedeschia aethiopica* and *Asparagus asparagoides*) are listed as pest plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), but neither of these plants have been assigned a management category under the Act, so currently there is no legal requirements with regards to their control.

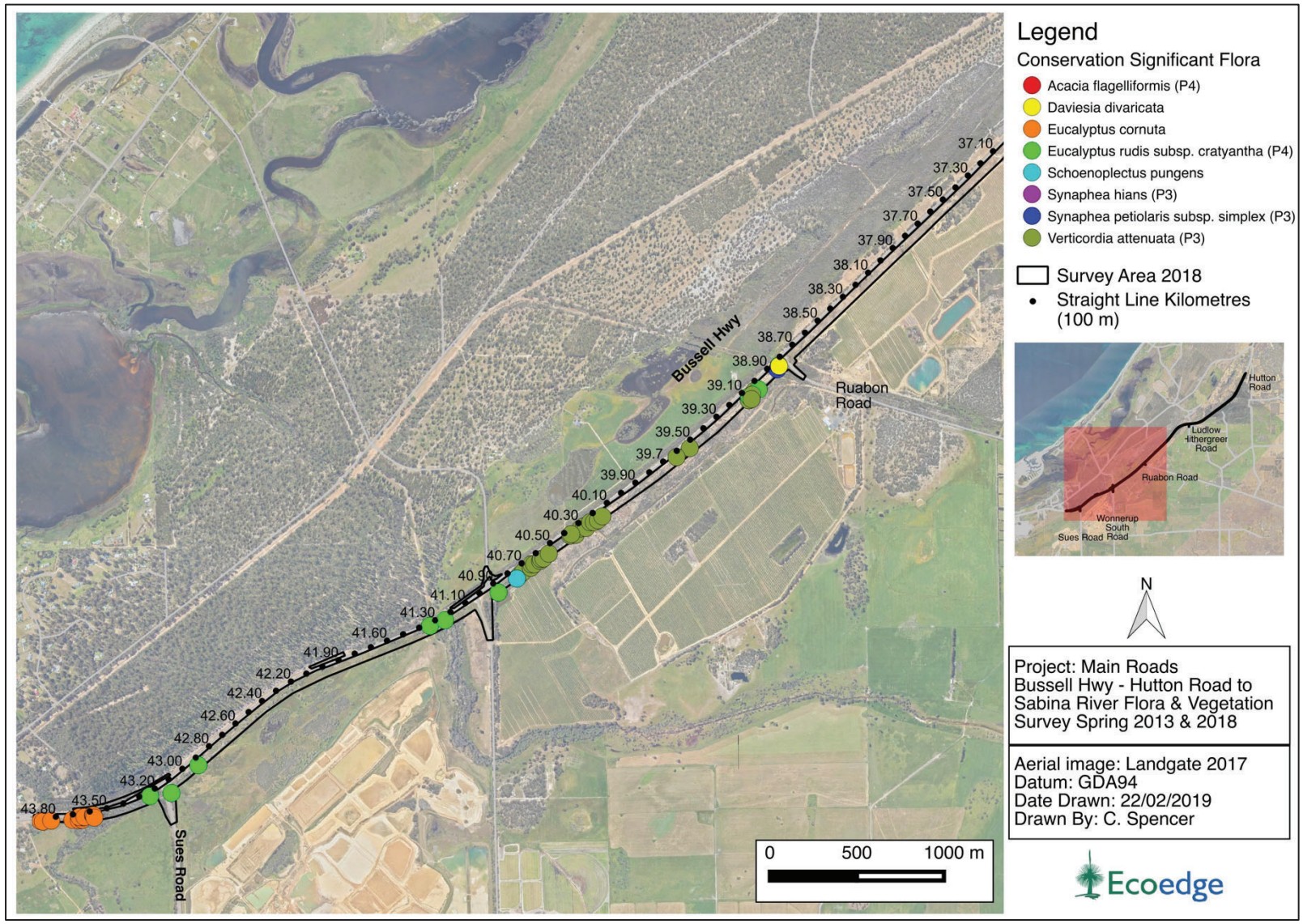

Figure 19. Conservation significant flora located during the field survey (SLK 43.80 – 37.10).

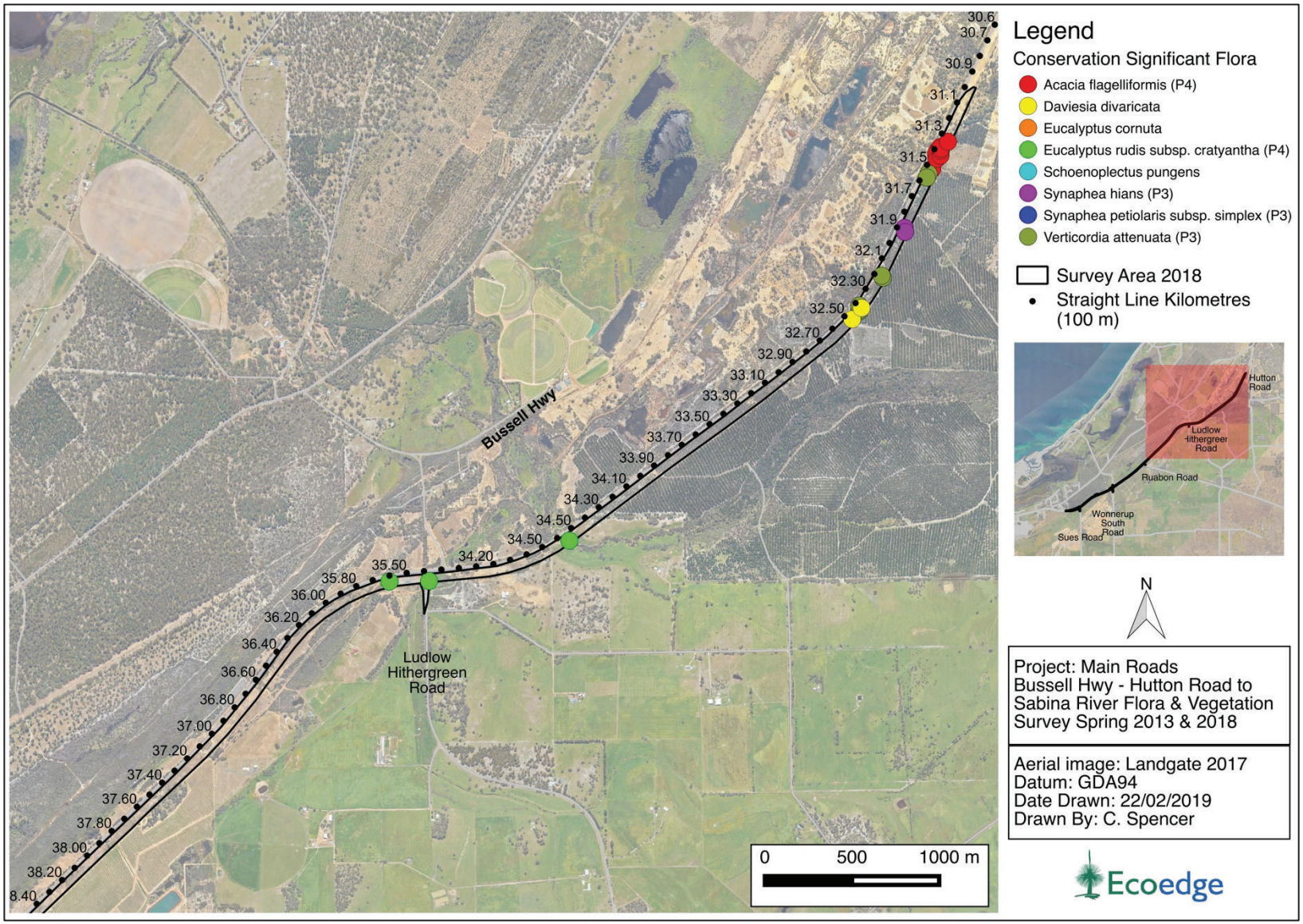

Figure 20. Conservation significant flora located during the field survey (SLK 38.40 – 31.0).

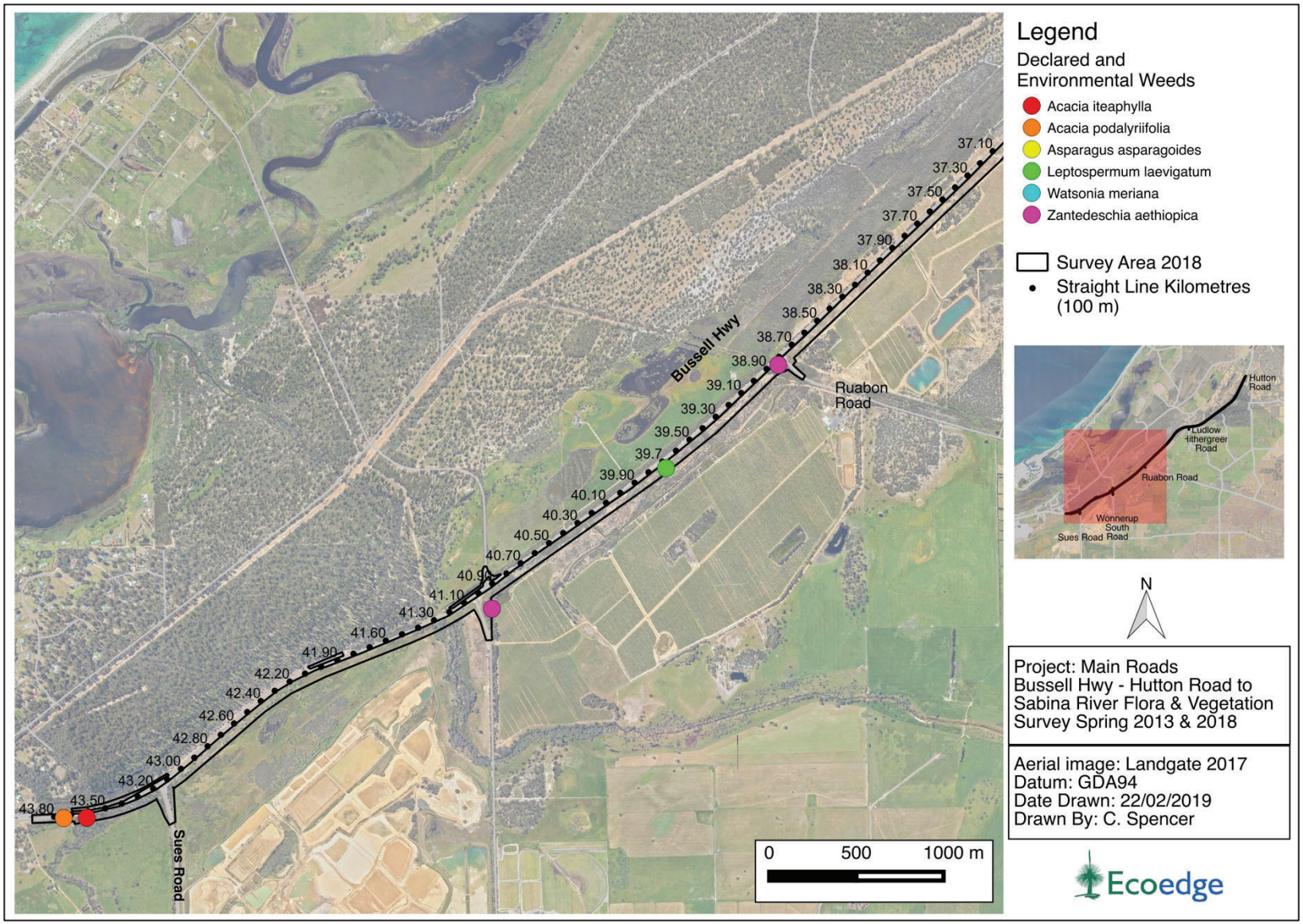

Figure 21. Declared pest plants and environmental weeds located during the field survey (SLK 43.80 – 37.10).

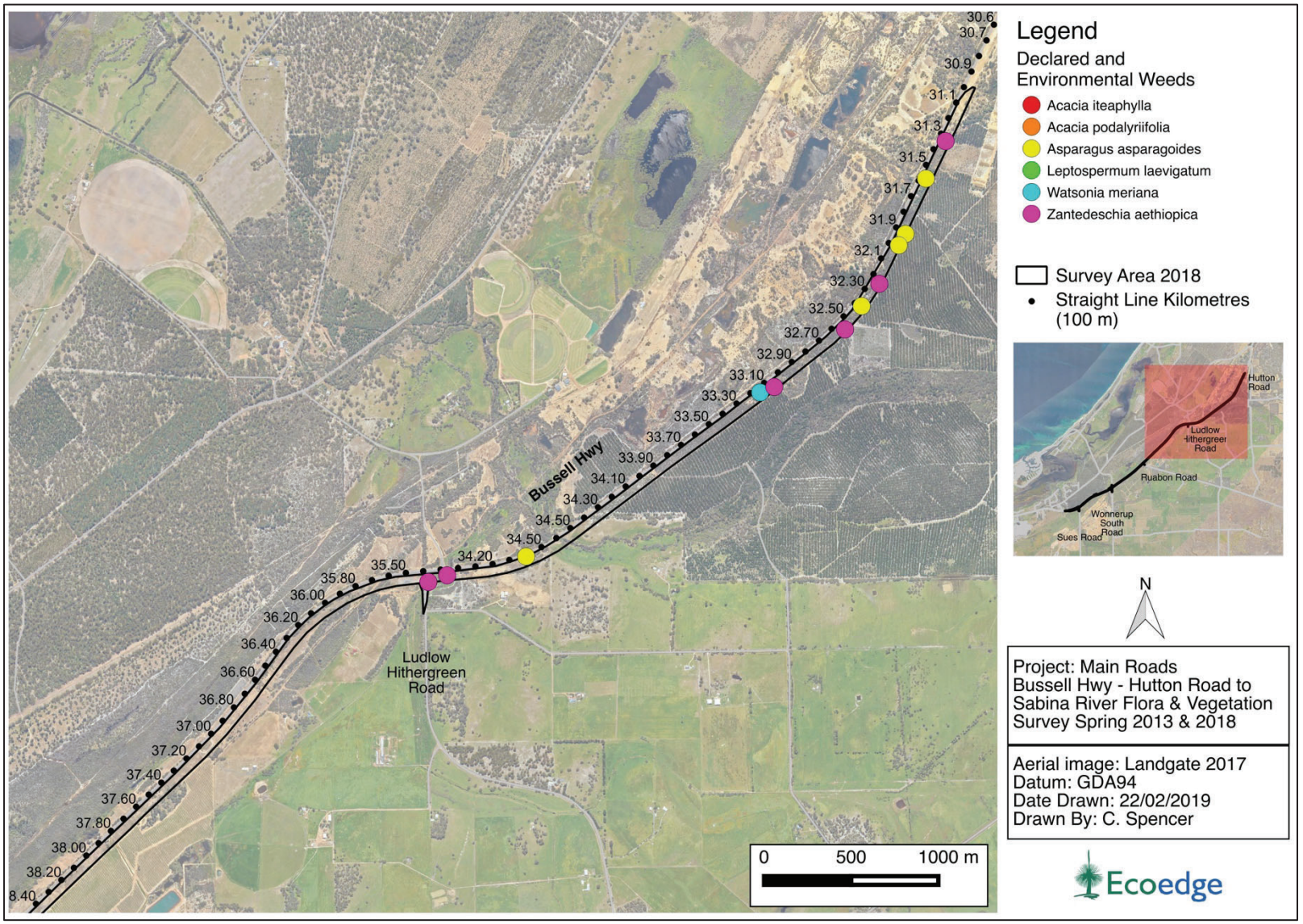

Figure 22. Declared pest plants and environmental weeds located during the field survey (SLK 38.40 – 31.0).

3.5 Vegetation Units

Six vegetation units (**Table 12**), with unit A divided into two sub-units and one, unit E divided into four sub-units, were identified and mapped within the Survey Area (**Figure 23** to **Figure 27**). For the most part the vegetation units are assigned different codes than those used in the original survey report (Ecoedge, 2014). Photographs of each unit are provided in **Appendix 10**. Another mapping unit, not described in **Table 12**, is comprised of roadway, bare ground and annual grasses with scattered native and exotic trees (designated 'CL').

The vegetation units are largely based on the previous survey (Ecoedge, 2014) with some update of the descriptions and mapping based on the 2018 fieldwork.

3.5.1 Multivariate Analysis

The dendrogram showing the relationship of the Survey Area quadrats to the 149 quadrats used from the SCP dataset is available upon request. Quadrats were sited in vegetation units C (WONS01), E1 (SAND03), E2 (SAND01, SAND02), E3 (RIFL03), E4 (DRAI01, DRAI02), D (MINE01, MINE02) and F (RIFL01, RIFL02) (**Figure 23** to **Figure 27**).

The results of the multivariate analysis did not provide a clear indication about which FCT best fitted several of the vegetation units. This is partly because of the level of weed invasion and lack of native species in some of the quadrats. This was particularly the case for quadrat WONS01 which had only 16 species in all, of which only 5 were native species. Furthermore, two of the quadrats (MINE01, MINE02) were sited in vegetation which was partly revegetated mineral sands mine and partly naturally regenerating locally native taxa.

Another reason for the lack of "fit" with the SCP FCTs is that no quadrats were sited by the SCP survey on the soil types occurring within the Survey Area. Although these soils are mapped as Bassendean Sand (**Figure 3**) they have the appearance of Spearwood Sand soils.

Vegetation sub-unit A1, all of which was in Completely Degraded condition, was assigned to FCT 30b purely on the presence of *Eucalyptus gomphocephala*, which is the characteristic species of that community. Sub-unit A2 has *E. gomphocephala* as well as *E. cornuta* (Yate) so it is also presumed to belong to FCT 30b, however it was probably once a distinct community.

Vegetation unit D, which ranges from Degraded to Good condition, and is partly a 'reconstructed' community sited on old mineral sands mining areas can be assigned to FCT 4 (*Melaleuca preissiana* damplands) based on the results of the MVA. This FCT was considered "Well Reserved" and "Low Risk" by Gibson *et al.* 1994.

The affinities of the sub-units of vegetation unit E were not clarified by the MVA. Sub-unit E1 was shown to have affinities with FCTs 1b, 3b and 21a from the Gibson *et al*. (1994) report, but there is no clear indication of which community it belongs to. Vegetation sub-units E2, E3 and E4 could not be assigned to any of the SCP FCTs; the 'fit' is not close enough to any of the SCP quadrats to do this confidently. The reasons for this are both as a result of degradation and loss of species and a lack of sufficient coverage by the survey by Gibso *et al*., as discussed above.

The two quadrats in vegetation unit F (RIFL01, RIFL02) were floristically similar to several Gibson *et al*. quadrats assigned to FCT 17 (*Melaleuca rhaphiophylla-Gahnia trifida* seasonal wetlands). Consequently, unit F is tentatively assigned to this FCT, which was considered 'Well Reserved' and 'Low Risk' by Gibson *et al*. (1994).

Table 12. Description of vegetation units within the Survey Area.

Unit	*Sub-Unit*	Description	Extent in Survey Area (ha)	Corresponding FCT and Status
A	A1	Peppermint--Tuart Woodland: *Agonis flexuosa* low woodland/low open woodland with scattered *Eucalyptus gomphocephala* or *E. cornuta* or **Pinus pinaster* over *Kunzea glabrescens*, (**Acacia longifolia*) shrubland/open shrubland over introduced herbs and grasses including **Lupinus angustifolius*, **Ehrharta calycina* and **E. longifolia* on grey-brown sand/sandy loam or yellow-grey sand. [Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands ('community type 30b')] (*Completely Degraded*)	3.35	FCT 30b (PEC)
	A2	Yate-Tuart-Peppermint Woodland. *Eucalyptus cornuta*, *Agonis flexuosa* woodland with emergent *E. gomphocephala* over introduced herbs and grasses including **Lupinus angustifolius*, **Ehrharta calycina* and **E. longifolia* on grey-brown sand/sandy loam or yellow-grey sand.		
B		Flooded Gum-Marri Woodland: *Eucalyptus rudis* subsp. *cratyantha* or *Corymbia calophylla* woodland/open forest over *Agonis flexuosa*, *Melaleuca preissii* open low woodland with occasional *M. rhaphiophylla* over *Acacia saligna*, *Astartea* sp., *Melaleuca viminea* open shrubland over introduced herbs and grasses including **Ehrharta calycina* on grey-brown sandy-loam or loam. (*Completely Degraded*)	3.08	
C		Marri Woodland: *Corymbia calophylla* woodland (sometimes with *Melaleuca rhaphiophylla*) over **Acacia* spp., *Hibbertia cuneiformis*, *Kunzea glabrescens*, (*Spyridium globulosum*) shrubland over introduced herbs and grasses including **Ehrharta calycina*, **Eragrostis curvula* and **Zantedeschia aethiopica* on grey-brown or yellow-brown sand or sandy loam. (*Degraded*)	2.26	
D		**Acacia*-Kunzea Tall Shrubland: **Acacia* spp., *Kunzea glabrescens* tall shrubland (sometimes with emergent *Agonis flexuosa* or *Melaleuca preissiana*) over *Adenanthos meisneri*, *Gastrolobium praemorsum*, *Jacksonia furcellata*, *Kunzea recurva*, *Melaleuca viminea*, (*Verticordia* sp., *Viminaria juncea*) (*Leucopogon conostephioides*) low shrubland over *Loxocarya cinerea* and introduced herbs and grasses on grey or yellow-brown sand or sandy loam. (Revegetated mined areas and road embankments). (*Degraded to Good*)	13.89	FCT 4

E	E1	Marri-Jarrah-Nuytsia Open Forest: *Corymbia calophylla*, (*Eucalyptus marginata*, *Nuytsia floribunda*) open forest over *Kunzea glabrescens* tall open shrubland over (*Gastrolobium praemorsum*), *Hibbertia hypericoides*, *Leucopogon parviflorus*, *Stirlingia latifolia* and *Xanthorrhoea brunonis* low shrubland and *Tetraria capillaris* and *T. octandra* scattered sedges on grey-brown or yellow brown sand. (*Good*)	2.02	?
	E2	Marri-Jarrah Open Forest: *Corymbia calophylla* and *Eucalyptus marginata* open forest/woodland over *Hibbertia cuneifolia* and *Kunzea glabrescens* tall open shrubland over **Asparagus asparagoides*, *Brachyloma preissii*, *Brachysema praemorsum* and *Xanthorrhoea brunonis* shrubland over *Dampiera linearis*, *Dichopogon capillipes*, **Hypochaeris glabra* open herbland and scattered *Lepidosperma squamatum* and *Tetraria octandra* sedges on yellow-brown or grey-brown sand. (*Good*)	4.34	
	E3	Peppermint Woodland: *Agonis flexuosa* woodland with emergent **Pinus pinaster* and scattered *Eucalyptus marginata* or *Corymbia calophylla*, *Nuytsia floribunda* over **Acacia longifolia*, *Kunzea glabrescens* over **Asparagus asparagoides Pteridium esculentum* and *Conostylis aculeata* herbland on grey-brown sand. (*Good*)	2.36	
	E4	Marri-Bull Banksia Open Forest: *Corymbia calophylla*, (*Eucalyptus marginata*) open forest over *Agonis flexuosa*, *Banksia grandis* low woodland over *Kunzea glabrescens* tall open shrubland over *Acacia alata*, *Grevillea vestita*, *Hakea varia*, *Hibbertia cuneiformis*, *Leucopogon propinquus*, *Melaleuca incana* over **Asparagus asparagoides*, *Brachysema praemorsum*, *Hardenbergia comptoniana* creepers over a variable herbland including *Anigozanthos flavidus*, *Dichopogon capillipes*, *Lomandra micrantha*, *Opercularia hispidula*, **Oxalis glabra*, **O. pes-caprae*, **Romulea rosea* on grey-brown loamy sand. (*Very Good*)	0.83	
F		Melaleuca Low Open Forest: *Melaleuca preissiana* low open forest/low woodland over *Astartea scoparia*, *Melaleuca viminea*, *M. osullivanii* open heath/shrubland over *Baumea juncea* open sedgeland on grey sand over clay. (*Good-Very Good*)	0.88	FCT 17?

Vegetation unit (or sub-unit) codes in **bold** font are those which had quadrats sited within them.

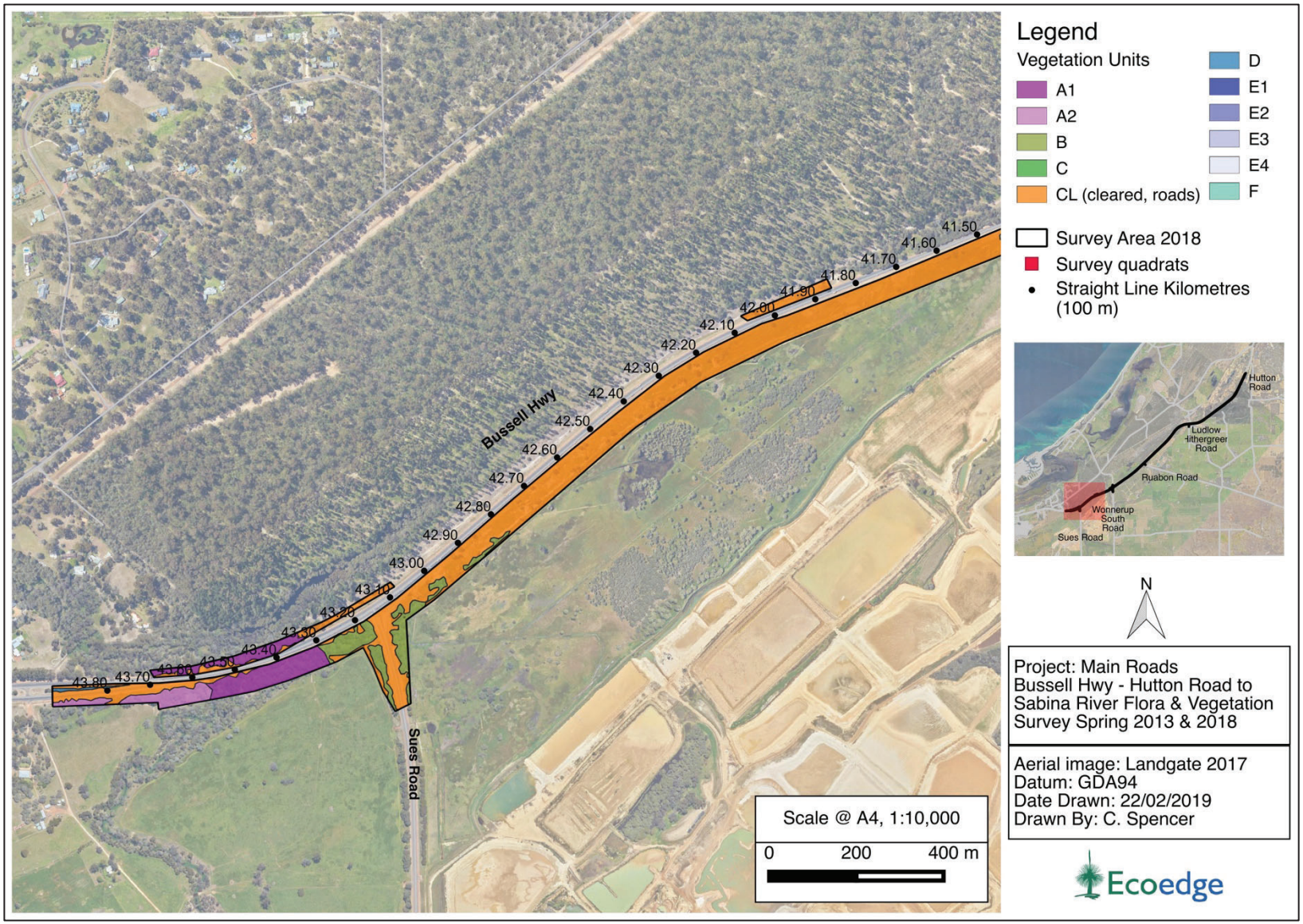

Figure 23. Vegetation units mapped for the Survey Area (SLK 43.80 – 41.50).

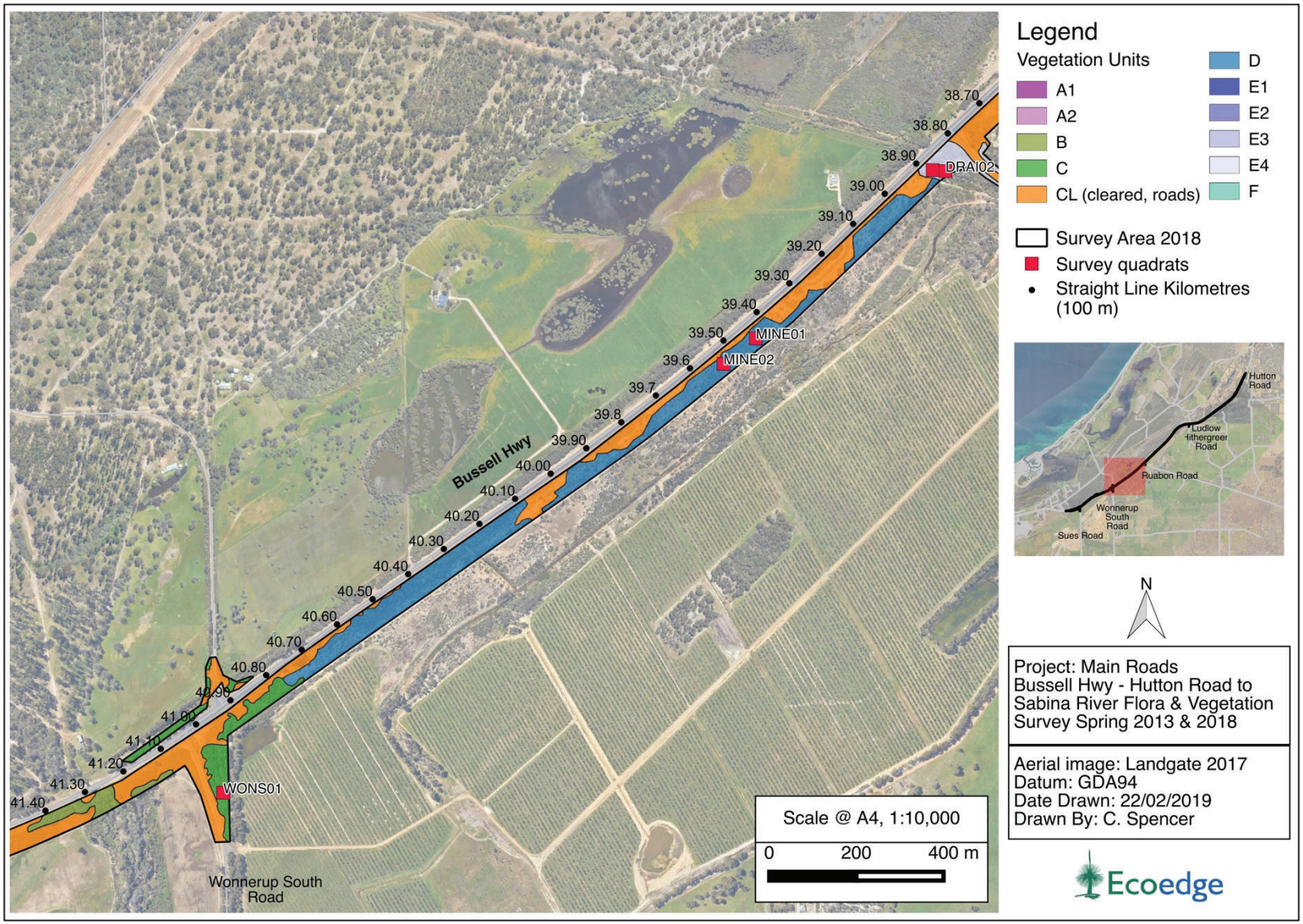

Figure 24. Vegetation units mapped for the Survey Area (SLK 41.40 – 38.70).

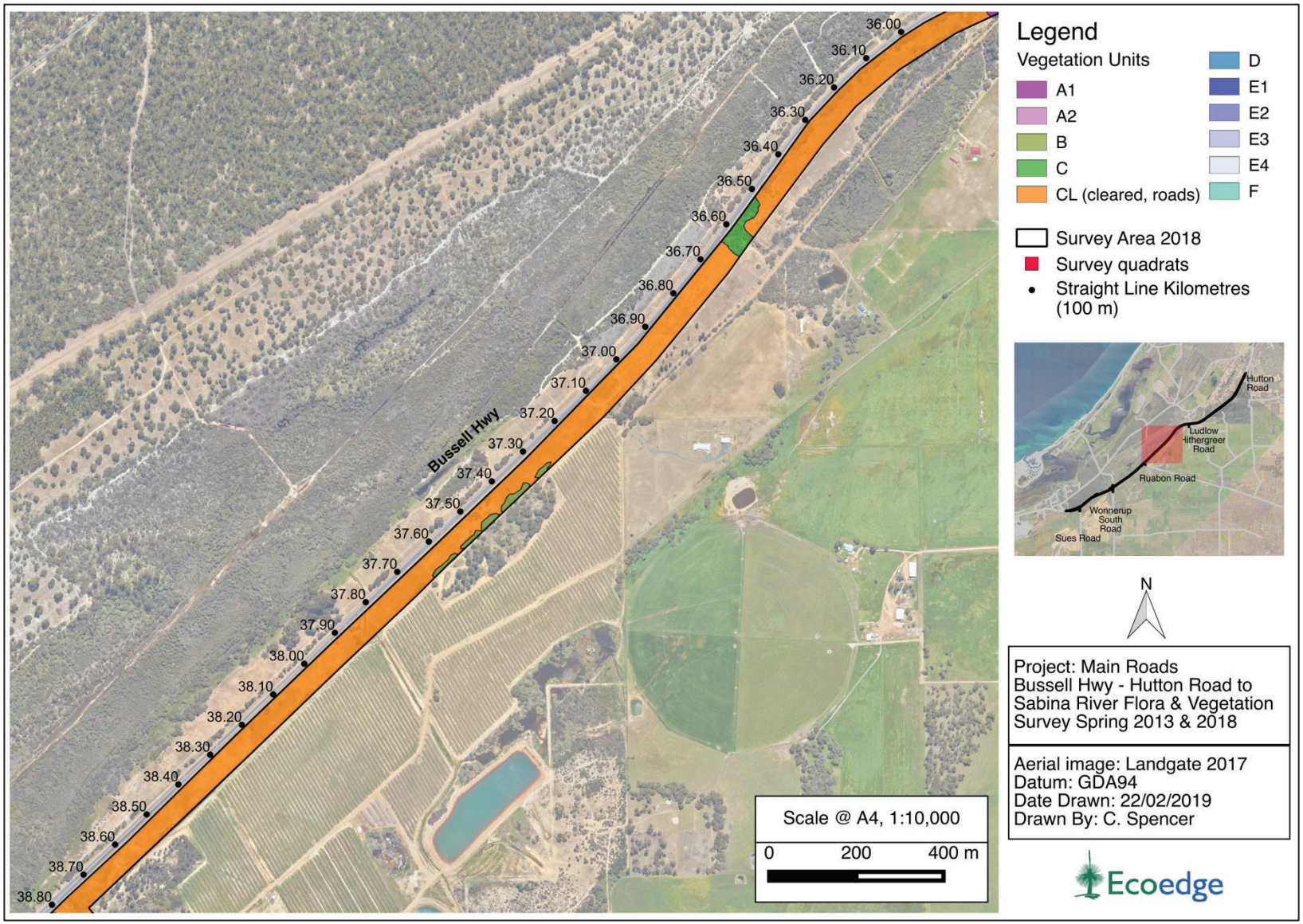

Figure 25. Vegetation units mapped for the Survey Area (SLK 38.80 – 36.00).

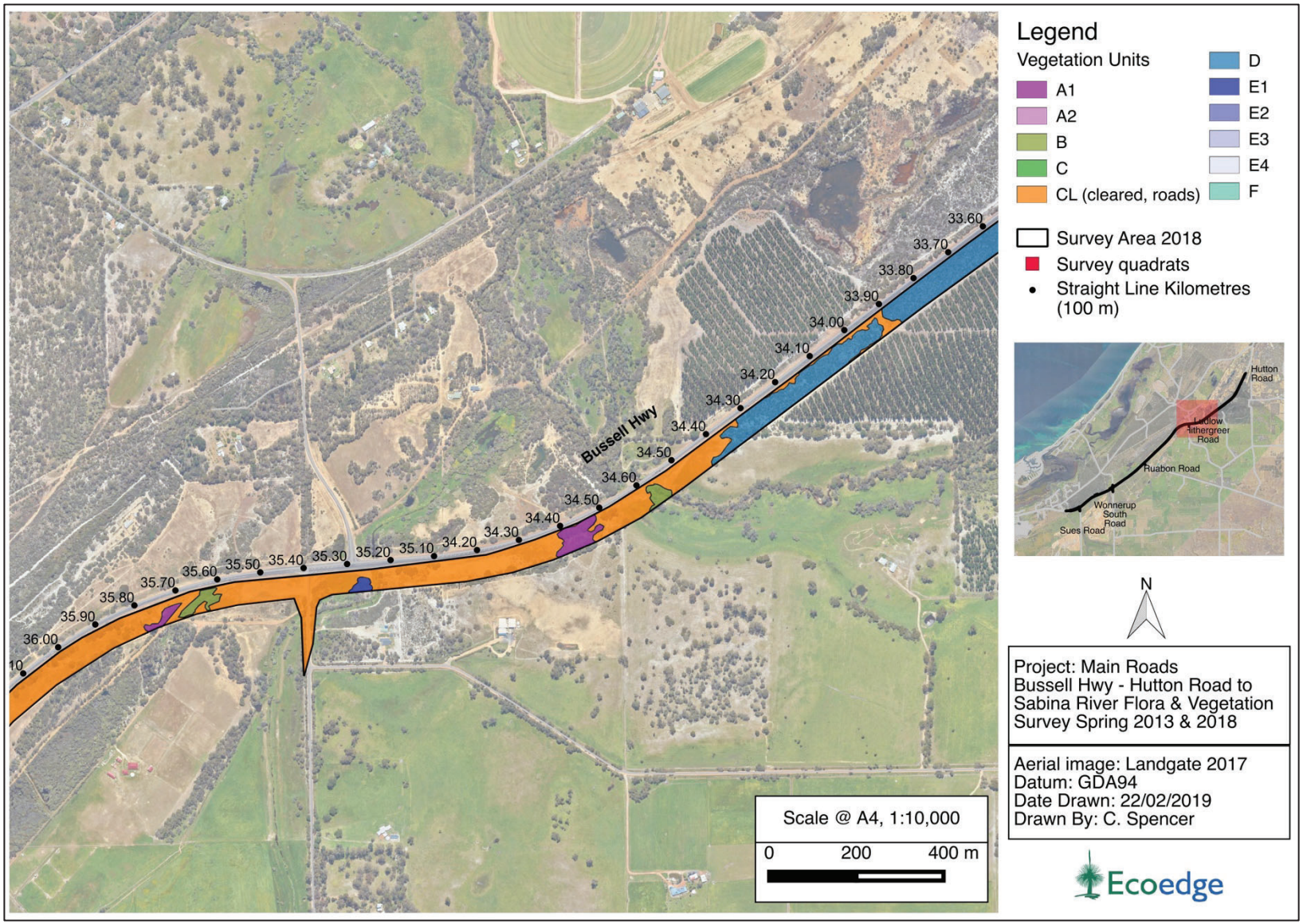

Figure 26. Vegetation units mapped for the Survey Area (SLK 36.00 – 33.60).

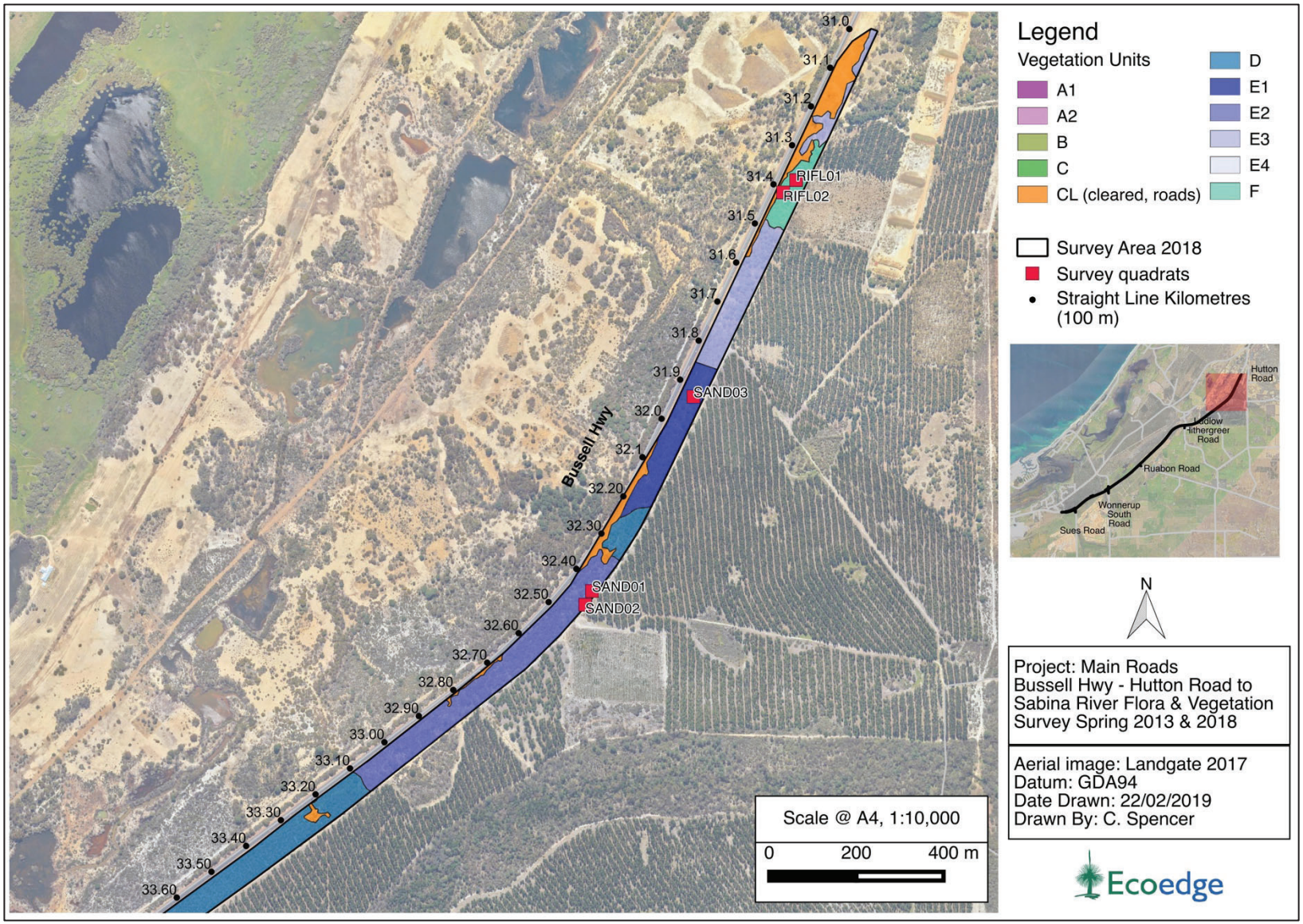

Figure 27. Vegetation units mapped for the Su rvey Area (SLK 33.60 – 31.0).

3.6 Vegetation Condition

Only 12.2% of the Survey Area was rated as “Good” or “Very Good” condition – where the original vegetation structure is intact and native plant species predominate. Areas categorized as “Degraded” were largely revegetated mining areas or embankments. These have a mix of planted species, many of which are not locally-native and regeneration of locally native species, notably the shrub *Kunzea glabrescens*. About half (50.4%) of the Survey Area is cleared, with little or no native vegetation remaining. Areas and proportion of the total Survey Area for the various classes of vegetation condition in the Survey Area is shown in **Table 13** and mapped in

Figure 28 to **Figure 32**.

Table 13. Summary of vegetation condition classes within the Survey Area.

Vegetation Condition	Area (Ha)	%
Very Good	1.71	2.28
Good	7.59	10.12
Degraded	18.8	25.06
Completely Degraded	8.64	11.52
Cleared	38.29	51.03
Total	**75.03**	**100.00**

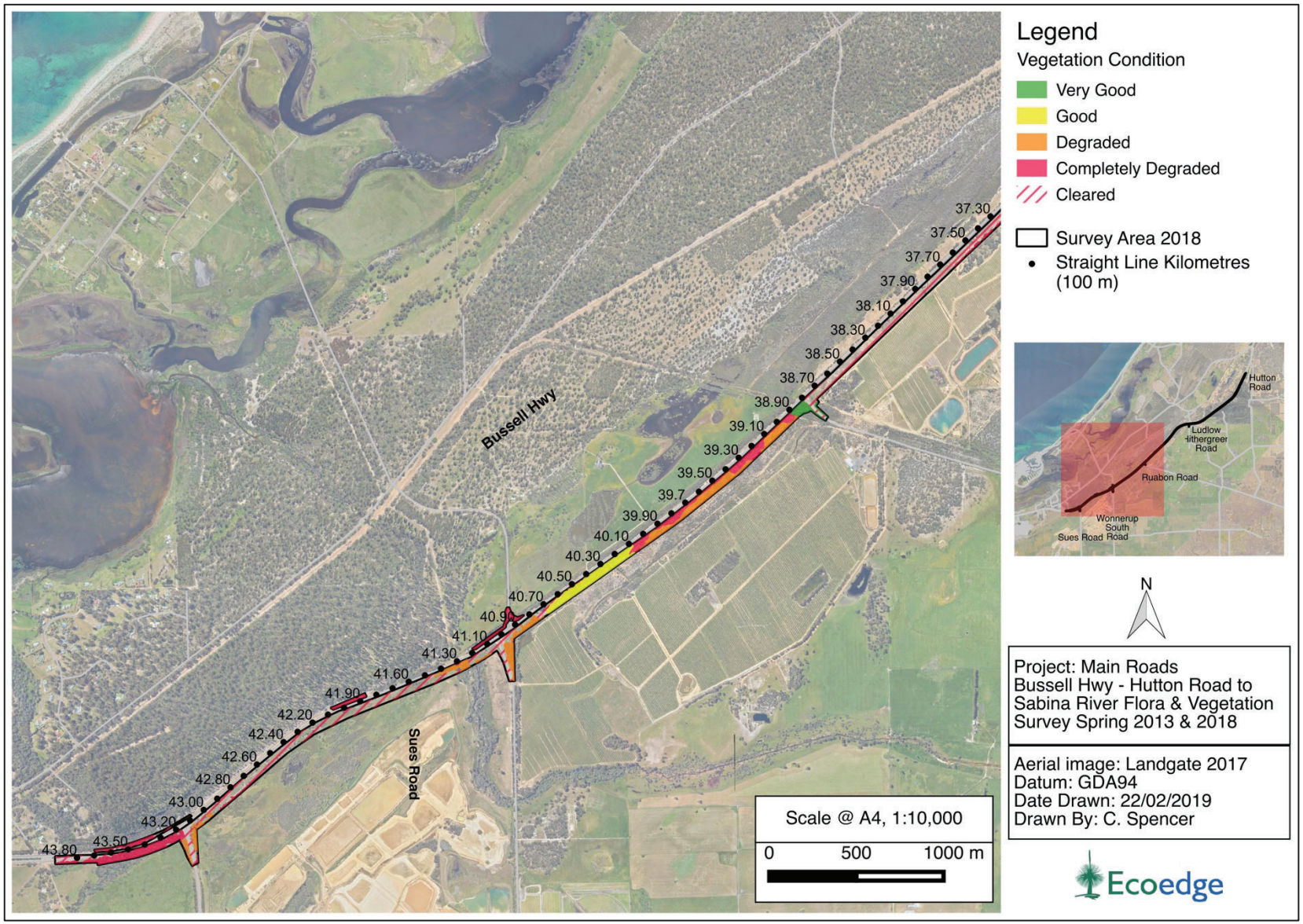

Figure 28. Condition of vegetation within the Survey Area (SLK 43.80 – 41.50).

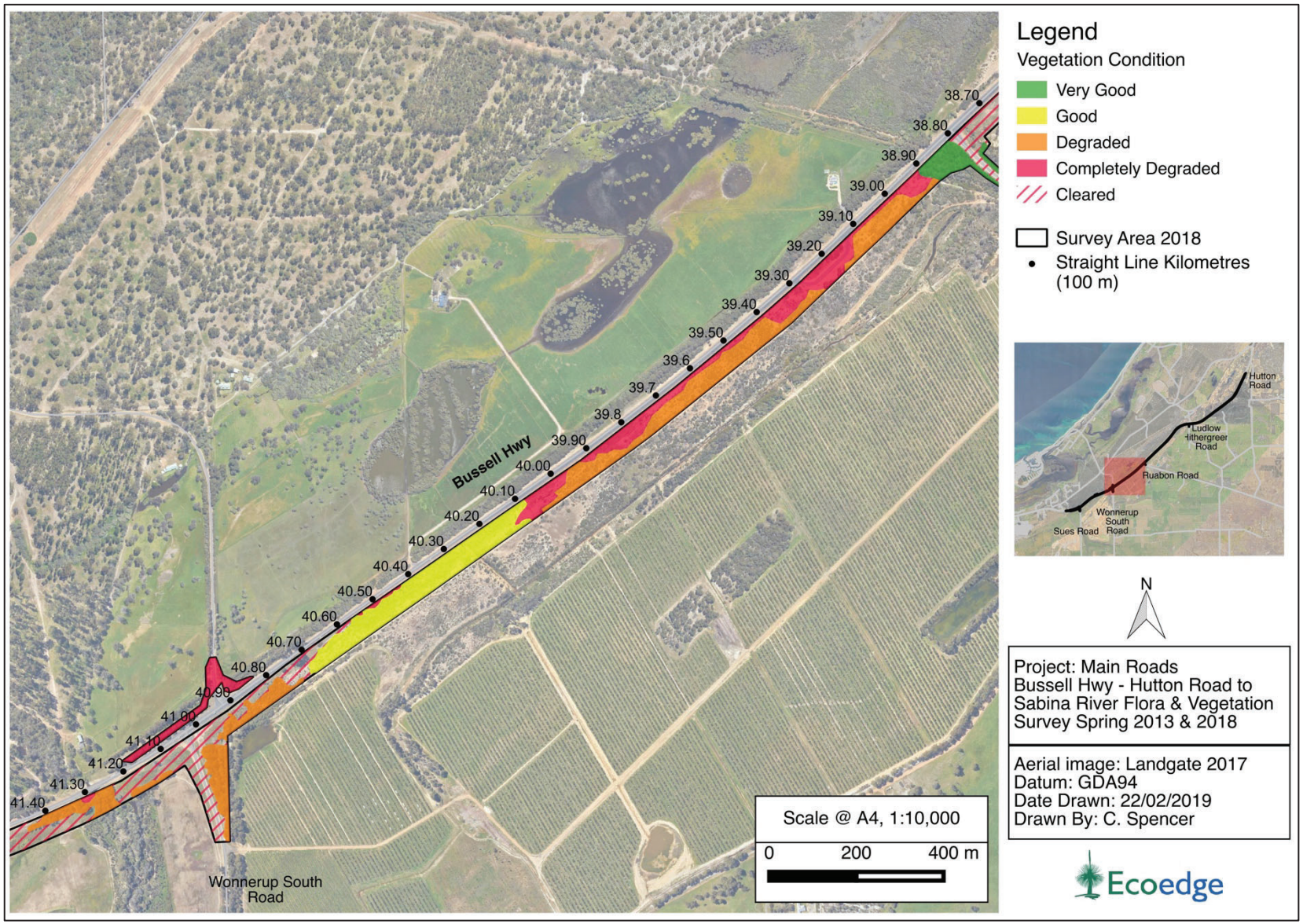

Figure 29. Condition of vegetation within the Survey Area (SLK 41.40 – 38.70).

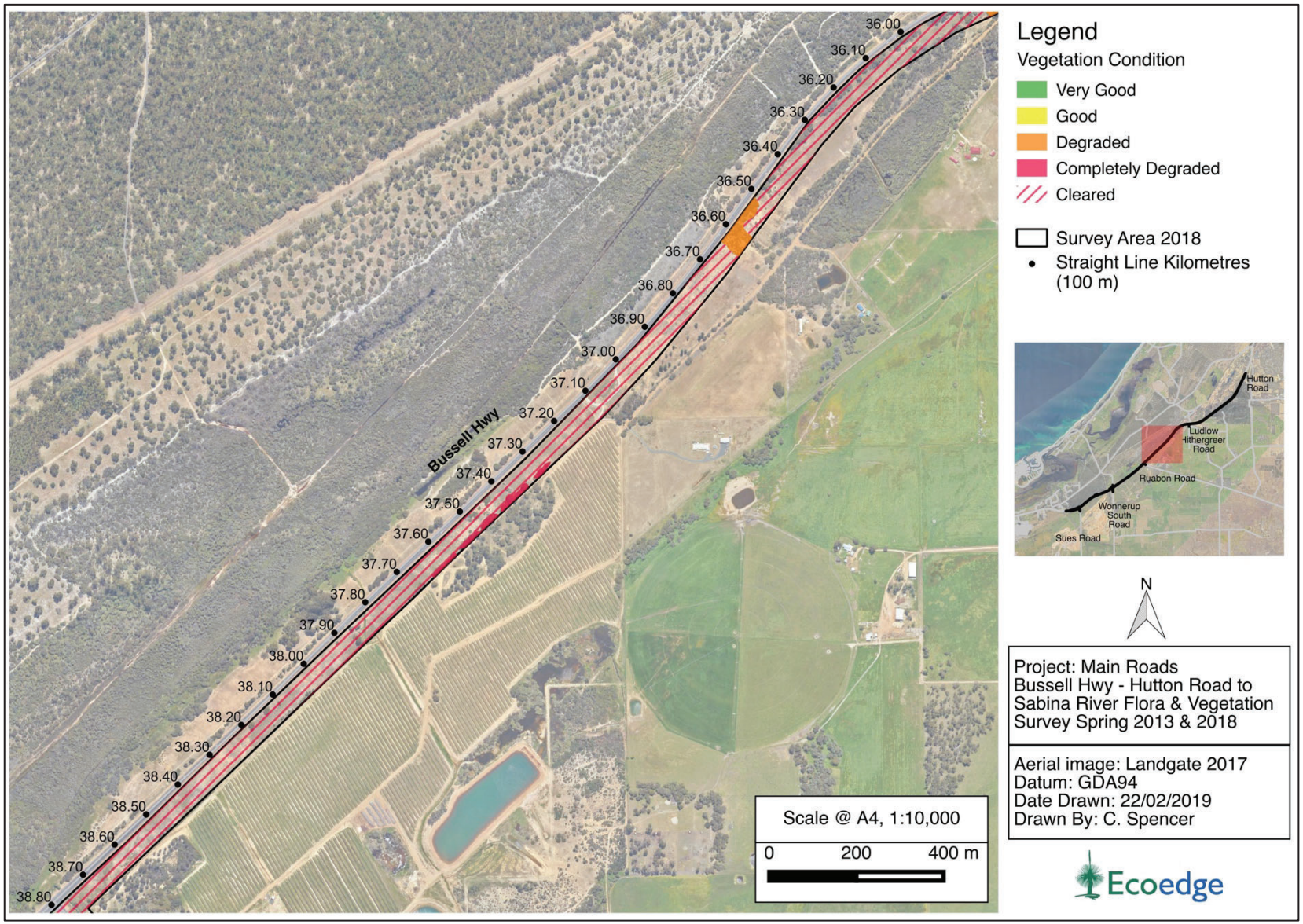

Figure 30. Condition of vegetation within the Survey Area (SLK 38.80 – 36.00).

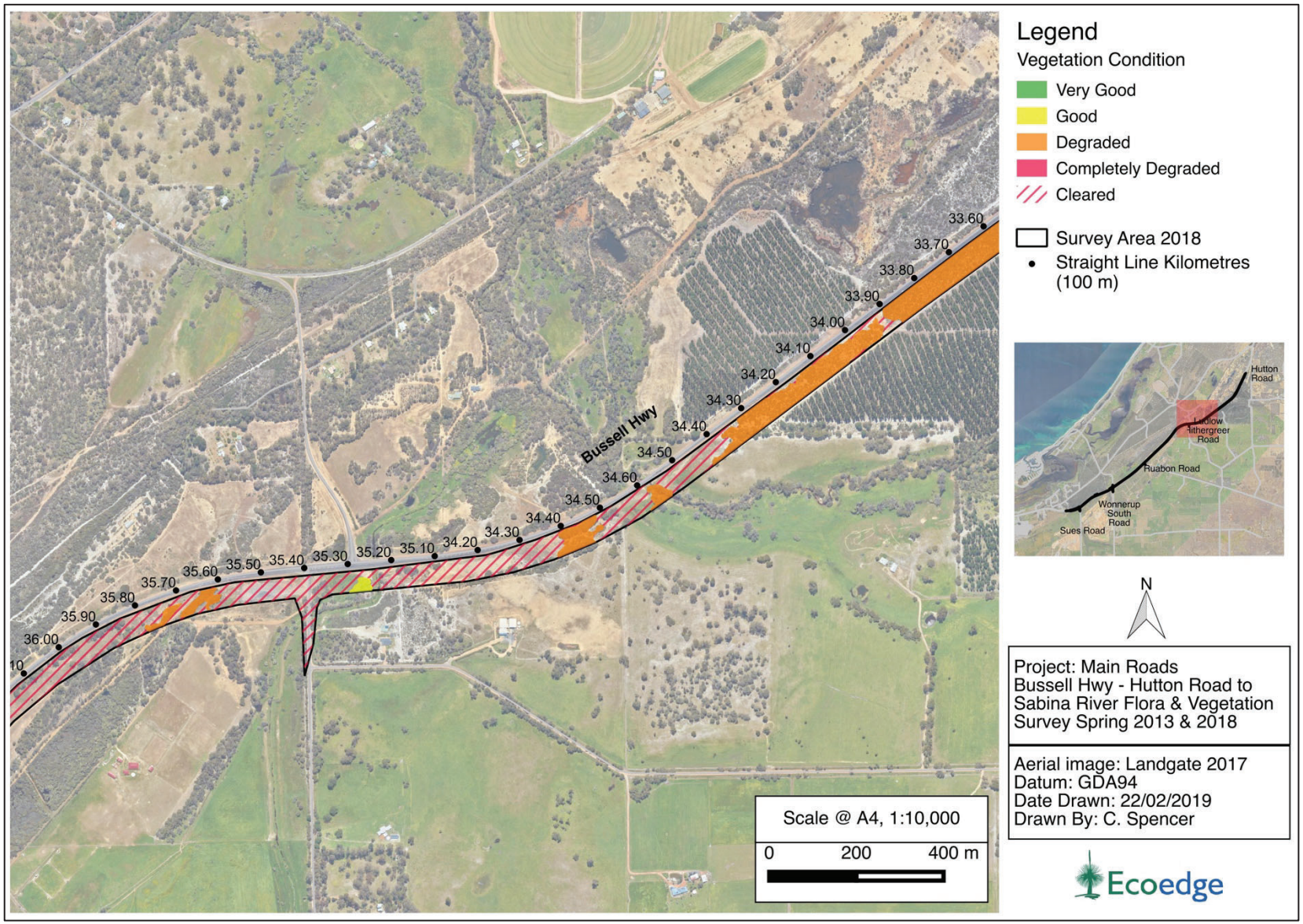

Figure 31. Condition of vegetation within the Survey Area (SLK 36.00 – 33.60).

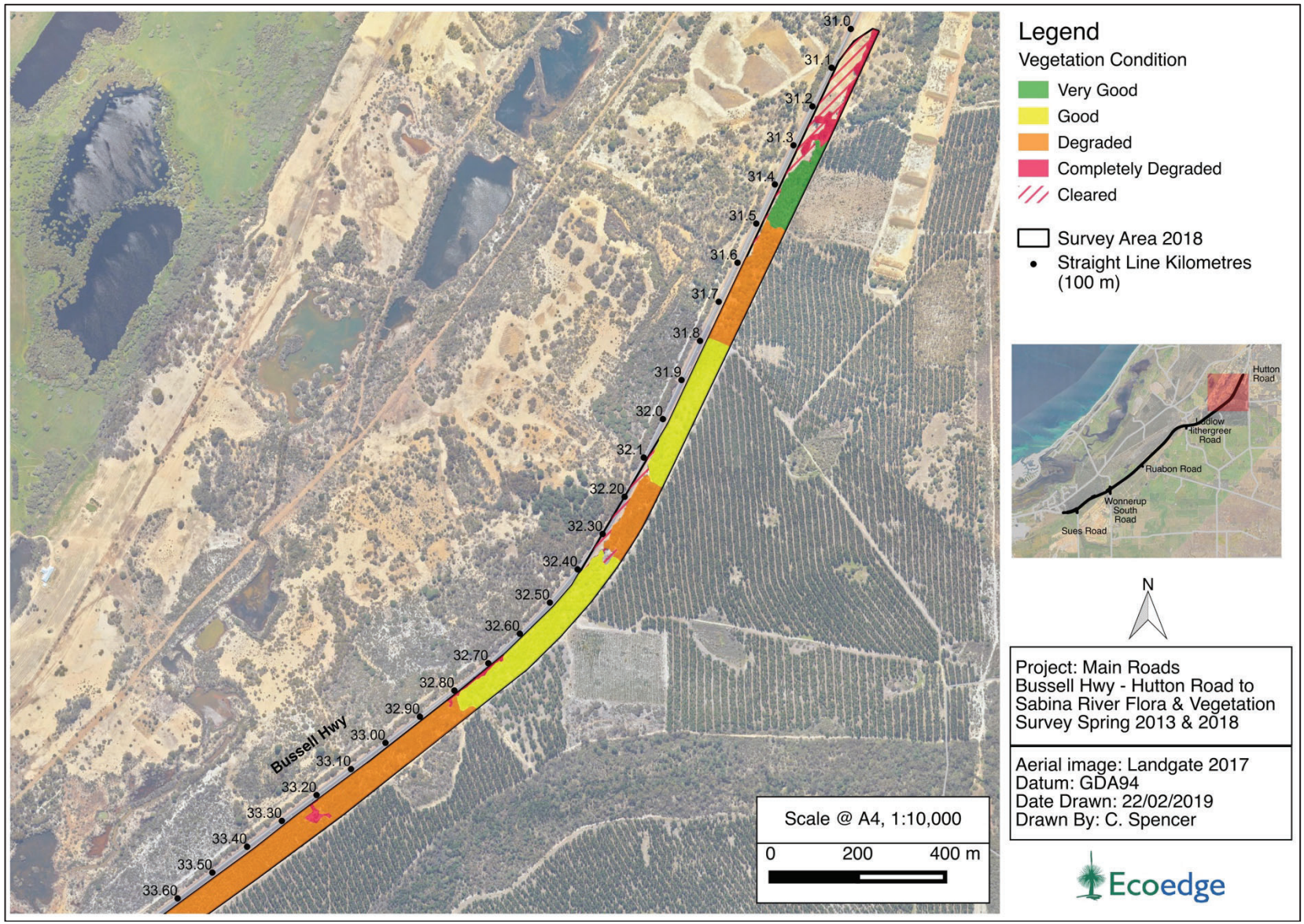

Figure 32. Condition of vegetation within the Survey Area (SLK 33.60 – 31.0).

4 Discussion and Conclusions

4.1 Significance of the Flora

The species of highest conservation significance in the Survey Area are addressed below.

4.1.1 Acacia flagelliformis (P3)

As mentioned above, *Acacia flagelliformis* is mainly restricted to the Swan Coastal Plain south of Yarloop, and most populations occur on road verges and in small areas of remnant vegetation where conservation is not the main purpose. There are 55 records for this taxon in DBCA databases. As with other wetland species on the Swan Coastal Plain *A. flagelliformis* is at risk from a drying climate as well as urban and infrastructure development. It is recommended that the population of *A. flagelliformis* is protected during future roadworks, if possible.

4.1.2 Eucalyptus cornuta

Eucalyptus cornuta (Yate) is not a rare species, however the only occurrences of this taxon on the Swan Coastal Plain are in the vicinity of Busselton. As discussed in sub-section 3.3.2, above, there is some doubt that all the individuals at the southern end of the Survey Area are naturally occurring[5], but there is no doubt that the species does occur in this area (Webb *et al*., 2009). All occurrences of *Eucalyptus cornuta* on the Swan Coastal Plain are considered part of the 'Tuart, *Eucalyptus decipiens* and Yate Woodland' Priority 1 ecological community.

It is recommended that, if possible, the stands of Yate at the southern end of the Survey Area be protected during any future roadworks. Although, some at least of these trees appear to be plantings, this stand of Yate is regarded as natural by DBCA (part SB Remnant 78/1-1) (Webb *et al*., 2009).

4.1.3 Synaphea petiolaris subsp. *simplex* (P3)

This taxon was found at only one location in the Survey Area, in an area of remnant vegetation at the junction of Ruabon Road and Bussell Highway which has particular conservation significance, as will be discussed below. Because of its association with a number of other taxa of limited occurrence on the Swan Coastal Plain this population is regarded as having relatively high conservation significance.

4.1.4 Verticordia attenuata (P3)

A survey by Ecoedge in 2017 resulted in the mapping of seven discrete populations of *Verticordia attenuata* plants totalling almost 2,900 individuals. The population sizes ranged from a few to over two thousand plants and covered 0.63 ha in total area. The distance of the plants from the bitumen ranged from less than 10 m to over 20 m. Other scattered individuals of this species are found in the northern part of the Survey Area.

[5] The Yate trees occur in rows, growing out of what appear to be furrows.

The Priority Three status of *Verticordia attenuata* indicates that it is poorly known and known from only a few locations but is not under imminent threat. Most populations of this taxon are on road verges and small, relatively insecure patches of remnant vegetation. Inspection of DBCA records indicates that *V. attenuata* occurs on only two reserves where conservation is the main purpose – at Kemerton and the Capel Nature Reserve.

The large size of the *V. attenuata* populations in the Survey Area and the fact that they occur at the southern end of the natural range for the species increases their importance for the conservation of the taxon. Therefore, it is recommended that as many of the *V. attenuata* individuals as possible are protect during future roadworks.

4.1.5 Other Conservation Significant Taxa

The populations of *Schoenoplectus pungens*, *Eremaea pauciflora* and *Daviesia divaricata* subsp. *divaricata* have significance because they represent range extensions, or edge of range occurrences. Because of their location at the edge of normal range they represent an important reservoir of genes that may be important for the long-term survival of these taxa.

4.2 Significance of the Vegetation

4.2.1 Vegetation Units

4.2.1.1 Unit A

Vegetation unit A, exists in two forms in the Survey Area, dependent on whether it is dominated by Tuart (*Eucalyptus gomphocephala*) (sub-unit A1) or Yate (*E. cornuta*) (sub-unit A2). Sub-unit A1 is the Priority Three Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands ('community type 30b')] ecological community and sub-unit A2 is the Priority One ecological community '*Eucalyptus cornuta*, *Agonis flexuosa* and *Eucalyptus decipiens* forest on deep yellow-brown siliceous sands over limestone ('Busselton Yate community'). This vegetation unit is in Completely Degraded condition and virtually devoid of native understory taxa. Nevertheless, it has conservation value, particularly that part dominated by Yate, being a small remnant of a once much more widespread community on this part of the Swan Coastal Plain.

4.2.1.2 Units B and C

Vegetation units B and C are Degraded to Completely Degraded and as such have little conservation significance. Unit B represents an example of the "Riverine Sandy Soil Plant Communities" of the Busselton Plain (Webb *et al*., 2009), and unit C would probably once have belonged to the Threatened Ecological Community '*Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain' (SCP 1b), however it is so degraded that it is not regarded as an occurrence of that community.

4.2.1.3 Unit D

Vegetation unit D, some of which was rated as Good condition, is partly a 'reconstructed' community sited on old mineral sands mining areas. The MVA demonstrated that this unit can be assigned to FCT 4 (*Melaleuca preissiana* damplands), which the authors of the SCP Survey (Gibson *et al*., 1994) regarded to be well reserved. The main value of unit D within the Survey Area lies in its providing habitat for the Priority Three species *Verticordia attenuata*.

4.2.1.4 Unit E

Vegetation unit E, which is described in terms of four sub-units contains most of the vegetation in the Survey Area rated as Good or Very Good condition. Unit E is mapped as occurring on Bassendean Sand soils, but in fact they appear to be more like Spearwood soils, mainly being yellow-brown sands with a greyish-brown surface.

Vegetation unit E (Which was mapped as units D and E in the initial report by Ecoedge, 2014) are relatively intact communities in many places, although they have been subject to disturbance in places by road construction and other infrastructure activities. The MVA demonstrated that this vegetation unit, or its four sub-units are not floristically similar to any of the FCTs described by Gibson *et al*. (1994). This is possibly partly because of loss of understorey species through weed invasion and other disturbance, but probably is mostly attributable to the fact that no SCP Survey quadrats were located in this vegetation, or similar vegetation.

Vegetation unit E appears to be an undescribed floristic community type that contains some of the taxa characteristic of Southern *Banksia attenuata* woodlands (SWAFCT21b), some wetland species in damper areas (e.g. *Banksia littoralis*, *Hakea varia*, *Meeboldina coangustata*) as well as several taxa characteristic of Quindalup Dune plant communities (e.g. *Hibbertia cuneiformis*, *Leucopogon parviflorus, Spyridium globulosum*).

One of the sub-units of this community, E4, situated near the junction of Ruabon Road and Bussell Highway, is worthy of further discussion. Over 50 plant taxa, most of them native, were recorded within this 0.5 ha area of bushland, including the Priority Three taxon *Synaphea petiolaris* subsp. *simplex.* As well as Jarrah and Marri, there was *Eucalyptus rudis* subsp. *cratyantha*, *Melaleuca rhaphiophylla*, *Banksia attenuata* (only one individual), *B. littoralis* and *Banksia grandis* in the overstorey layer. Amongst the understorey species are *Acacia myrtifolia*, *A. alata* var. *alata, Daviesia divaricata* subsp. *divaricata* and Grevillea vestita which are uncommon on the southern Swan Coastal Plain.

It is recommended that, if practicable, the remnant at the intersection of Ruabon Road and Bussell Highway be protected during future roadworks.

4.2.2 Vegetation Complexes

Five vegetation complexes occur within the Survey Area: the Abba Complex, the Cokelup Complex, the Karrakatta Complex – Central and South Complex and the Southern River and the Yoongarillup Complexes. Of these the Southern River Complex is dominant across the Survey Area (**Figure 4**).

Only the Yoongarillup Complex meets the Commonwealth 30% retention target and is comparatively well reserved in DBCA managed lands. The remaining complexes are significantly diminished across the landscape and are poorly represented in the DBCA estate.

Six Beard vegetation associations occur within the Survey Area: these are Associations 2, 4, 949, 990, 1000 and 1136. Associations 2 and 949 exceed the 30% retention threshold and are both well represented in the DBCA estate. The remaining Associations, in particular Assocation 1136, fall short of the threshold. Association 1136 has less than 10% of its vegetation remaining in the SWA IBRA Region and only 3.86% of this occurs in DBCA managed estate.

4.2.3 Environmental Weeds

Populations of six common and problematic environmental weeds were mapped within the survey. Two of these plants *Zantedeschia aethiopica* (Arum-lily) and *Asparagus asparagoides* (Bridal creeper) are recognised as pest plants under the BAM Act there is currently no legal obligation to manage them as they have not been assigned a management category under the Act.

Acacia iteaphyllya, *A. podalyriifolia* and *Leptospermum laevigatum* are woody weeds which have the potential to invade and significantly alter intact bushland, especially after fire. These species can be logistically challenging and expensive to remove once established. *Zantedeschia aethiopica, Watsonia meriana* (watsonia) and *Asparagus asparagoides* are perennial renewed geophytes. They are commonly spread by birds and can rapidly invade and alter intact bushland.

It is recommended that all these weeds are controlled where practically possible. Control efforts should be targeted towards protecting intact and better condition bushland before addressing infestations in degraded bushland.

4.2.4 Conservation Category Wetlands

The boundary of a Conservation category palusplain wetland crosses the Survey Area approximately 360 m WSW of the Ludlow Hithergreen Road intersection. This wetland runs parallel to the Survey Area with its boundary for the most part about 50m SE of the Survey Boundary. Two other Conservation category wetlands (CCW) occur near the Survey Area. The closest boundary of these wetlands is about 75 m away from the Survey Area (**Figure 7** and **Figure 8**).

It is also noted that three rivers, the Sabina, Abba and Ludlow Rivers, cross the Survey Areas and flow into the Conservation Category Vasse-Wonnerup Wetlands located approximately 2 km to the north of the Survey Area (**Figure 7**). It is recommended that impacts to these river systems are avoided where possible, especially as these may have cumulative effects downstream in the Conservation category Vasse-Wonnerup Wetland System.

Conservation category wetlands are regarded as ESAs which are specially protected under the *Environmental Protection Act 1986* (EP Act). Wetlands may be impacted directly or indirectly, examples of direct impacts include vegetation clearing and examples of indirect impacts include polluted storm water.

The Conservation category wetlands within and nearby the Survey Area may present constraints to the development of the site.

4.2.5 Environmentally Sensitive Areas

The boundary of two ESAs occur within the Survey Area. The one in the south western portion of the Survey Area is associated with the Ludlow State Forest and covers about 2 km of the Survey Area. The other, associated with a CCW located about 360 m WSW of Ludlow Hithergreen Road covers about 225 m of the Survey Area both shown in **Figure 10**.

The ESAs are afforded special protection under the EP Act and exemptions to clearing under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 do not apply in these areas.

The presence of the ESAs within and to a lesser extent in close proximity to the Survey may present constraints to the development of the site.

4.2.6 Regional Ecological Linkages

The South West Regional Ecological Linkages Technical Report (Molloy et al., 2009) identifies three regional ecological linkage axis lines passing through the Study Area. As a result of the location of these, different patches of remnant vegetation within the Study Area are assigned to proximity categories '1a', '1b', '1c', '2a', '2b' and '2c' which are the highest to sixth highest categories (**Figure 9**). This means that a small portion of the vegetation within the Survey Area directly forms part of an identified regional ecological linkage while the majority is within varying degrees of proximity to those linkages. Clearing of vegetation within close proximity to these areas will likely have a localised impact on mapped ecological linkages, but is it suggests that this will not be significant given the small scale of clearing along the edge of an already cleared road boundary.

4.2.7 Recommendations

- That the population of *Acacia flagelliformis* is protected during future roadworks.
- That the stands of Yate (*Eucalyptus cornuta*) at the southern end of the Survey Area be protected during any future roadworks.
- That as many of the *Verticordia attenuata* individuals as possible are protect during future roadworks.
- Clearing of under-represented vegetation associations and complexes is minimised, where possible.
- That the bushland remnant at the intersection of Ruabon Road and Bussell Highway (vegetation sub-unit E4) be protected during future roadworks, if practicable.
- It is recommended that all environmental weeds identified within the survey area are controlled where practically possible. Control efforts should be targeted towards protecting intact and better condition bushland before addressing infestations in degraded bushland.
- Where possible, direct and indirect impacts to Conservation Category wetlands and river systems mapped within the Survey Area are avoided or minimised. Examples of direct impacts include clearing of vegetation and examples of indirect impacts include polluted storm water.
- Clearing of vegetation in proximity to regional ecological linkage lines should be minimised or avoided, where possible, to reduce impacts on the regional ecological linkages.
- Impacts to Environmentally Sensitive Areas within and proximity to the Survey Area should be avoided where possible.

5 Requirement for Referral

State Government

All native vegetation is protected in Western Australia under the *Environmental Protection Act 1986*. Permits are required for clearing of this vegetation unless a valid exemption applies. It is understood that exemptions do not apply in respect of Environmentally Sensitive Areas, which do occur within this Survey Area. Furthermore the presence of both Priority flora and Priority ecological communities within the proposed clearing area also necessitates the requirement of a clearing permit. This allows the DWER to make an assessment of the potential impact of the clearing on the species' and communities' survival and conservation status.

This proposal should be referred to DWER to determine the necessary permit requirements and conditions, in respect of native vegetation removal and for any other advice they may have on the proposed clearing for this project. Clearing of native vegetation is prohibited without a valid clearing permit.

Federal Government

No flora or vegetation, protected under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999,* were identified during this Detailed and Targeted flora and Vegetation survey process, and therefore referral to the DoTEE is considered unnecessary for this aspect of the project.

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Appendix 1. Categories of DBCA Threatened and Priority Ecological Communities (DEC, 2013).

Appendix 2. Categories of Threatened Ecological Communities under the EPBC Act (DotEE, 2018a).

Appendix 3. Categories of Threatened and Priority List flora (DBCA, 2019a).

Appendix 4. Categories of Threatened Species under the EPBC Act (DotEE, 2018c).

Appendix 5. Protected Matters Search Tool and NatureMap reports.

Appendix 6. Vegetation Condition Scale (EPA, 2016).

Appendix 7. List of Vascular Flora found within the Survey Area.

Appendix 8. Priority and Significant Flora Location and Abundance Table.

Appendix 9. Completed Threatened and Priority Flora Reporting Form.

Appendix 10. Photographs and Descriptions of Vegetation Units mapped within the Survey Area.

Appendix 1. Categories of DBCA Threatened and Priority Ecological Communities (DEC, 2013).

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.

Conservation code	Category
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 2. Categories of Threatened Ecological Communities under the EPBC Act (DotEE, 2018a).

Category	Definition
Critically endangered	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	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	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 3. Catefories of Conservation Codes for Threatened and Priority flora (DBCA, 2019b).

Conservation code	Category
(T) Threatened species pursuant to Sect 19 of the BC Act 2016.	
T	(T) CR – Critcially 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 4. Categories of Threatened Species under the EPBC Act (DotEE, 2018c).

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.

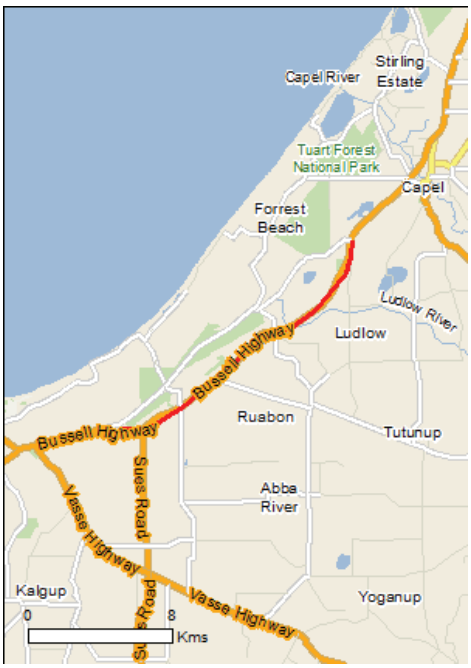
EPBC Act Protected Matters Report

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

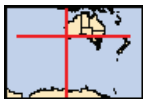
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

Report created: 27/08/18 16:20:59



Coordinates
Buffer: 5.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	63
Listed Migratory Species:	45

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	70
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	8
Regional Forest Agreements:	None
Invasive Species:	25
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Vasse-wonnerup system	Within Ramsar site

Listed Threatened Ecological Communities [Resource Information]

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

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

Listed Threatened Species [Resource Information]

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

Name	Status	Type of Presence
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Extinct within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding likely to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Breeding known to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat known to occur within area
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat likely to occur within area
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
Caladenia busselliana Bussell's Spider-orchid [24369]	Endangered	Species or species habitat known to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Caladenia procera Carbunup King Spider Orchid [68679]	Critically Endangered	Species or species habitat may occur within area
Chamelaucium sp. S coastal plain (R.D.Royce 4872) Royce's Waxflower [87814]	Vulnerable	Species or species habitat known to occur within area
Darwinia whicherensis Abba Bell [83193]	Endangered	Species or species habitat likely to occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Grevillea maccutcheonii McCutcheon's Grevillea [64522]	Endangered	Species or species habitat likely to occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat known to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat known to occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat known to occur within area
Verticordia plumosa var. ananeotes Tufted Plumed Featherflower [23871]	Endangered	Species or species habitat may occur within area
Verticordia plumosa var. vassensis Vasse Featherflower [55804]	Endangered	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area

Name	Threatened	Type of Presence
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area

Name	Threatened	Type of Presence
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
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 known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat likely to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish		Species or species

Name	Threatened	Type of Presence
[66276]		habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area

Name	Status	Type of Presence
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Capel	WA
Ruabon Townsite	WA
Sabina	WA
Tuart Forest	WA
Unnamed WA41568	WA
Unnamed WA44838	WA
Unnamed WA50190	WA
Unnamed WA50270	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

Name	Status	Type of Presence
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista 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

Name	Status	Type of Presence
		within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
McCarleys Swamp (Ludlow Swamp)	WA
Vasse-Wonnerup Wetland System	WA

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-33.65442 115.410014,-33.654992 115.42306,-33.644989 115.442629,-33.630697 115.462199,-33.616117 115.481425,-33.61383 115.493784,-33.60611 115.507174,-33.590668 115.52228,-33.583518 115.525027,-33.577225 115.525713

Acknowledgements

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

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

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

Please feel free to provide feedback via the Contact Us page.

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Appendix 6. 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 7. List of vascular flora found within the Survey Area at Bussell Hwy

No	FAMILY NAME	SPECIES NAME	NATURALISED	CONSV CODE	PLANTED
1	Anarthriaceae	*Lyginia barbata*			
2	Anarthriaceae	*Lyginia imberbis*			
3	Apiaceae	*Xanthosia huegelii*			
4	Araceae	*Zantedeschia aethiopica*	*		
5	Araliaceae	*Trachymene pilosa*			
6	Asparagaceae	*Asparagus asparagoides*	*		
7	Asparagaceae	*Dichopogon capillipes*			
8	Asparagaceae	*Lomandra integra*			
9	Asparagaceae	*Lomandra micrantha*			
10	Asparagaceae	*Lomandra sericea*			
11	Asparagaceae	*Lomandra suaveolens*			
12	Asparagaceae	*Sowerbaea laxiflora*			
13	Asparagaceae	*Thysanotus arenarius*			
14	Asparagaceae	*Thysanotus manglesianus*			
15	Asparagaceae	*Thysanotus tenellus*			
16	Asphodelaceae	*Trachyandra divaricata*	*		
17	Asteraceae	*Arctotheca calendula*	*		
18	Asteraceae	*Asteridea pulverulenta*			
19	Asteraceae	*Cotula coronopifolia*	*		
20	Asteraceae	*Cotula turbinata*	*		
21	Asteraceae	*Hypochaeris glabra*	*		
22	Asteraceae	*Lagenophora huegelii*			
23	Asteraceae	*Millotia tenuifolia* var. *tenuifolia*			
24	Asteraceae	*Podotheca angustifolia*			
25	Asteraceae	*Quinetia urvillei*			
26	Asteraceae	*Rhodanthe citrina*			
27	Asteraceae	*Rhodanthe corymbosa*			
28	Asteraceae	*Siloxerus humifusus*			

No	FAMILY NAME	SPECIES NAME	NATURALISED	CONSV CODE	PLANTED
29	Asteraceae	*Sonchus asper*	*		
30	Asteraceae	*Ursinia anthemoides*	*		
31	Brassicaceae	*Brassica x napus*			
32	Brassicaceae	*Heliophila pusilla*	*		
33	Campanulaceae	*Lobelia gibbosa*			
34	Campanulaceae	*Monopsis debilis*	*		
35	Campanulaceae	*Wahlenbergia capensis*	*		
36	Caryophyllaceae	*Petrorhagia dubia*	*		
37	Caryophyllaceae	*Silene gallica*	*		
38	Casuarinaceae	*Allocasuarina humilis*			
39	Casuarinaceae	*Allocasuarina thuyoides*			x
40	Celastraceae	*Stackhousia monogyna*			
41	Celastraceae	*Tripterococcus brunonis*			
42	Centrolepidaceae	*Aphelia cyperoides*			
43	Centrolepidaceae	*Centrolepis aristata*			
44	Colchicaceae	*Burchardia congesta*			
45	Crassulaceae	*Crassula colorata*			
46	Cyperaceae	*Baumea articulata*			
47	Cyperaceae	*Baumea juncea*			
48	Cyperaceae	*Cyathochaeta avenacea*			
49	Cyperaceae	*Ficinia nodosa*			
50	Cyperaceae	*Gahnia trifida*			
51	Cyperaceae	*Isolepis marginata*			
52	Cyperaceae	*Lepidosperma longitudinale*			
53	Cyperaceae	*Lepidosperma squamatum*			
54	Cyperaceae	*Mesomelaena tetragona*			
55	Cyperaceae	*Schoenoplectus pungens*			
56	Cyperaceae	*Tetraria capillaris*			

No	FAMILY NAME	SPECIES NAME	NATURALISED	CONSV CODE	PLANTED
57	Cyperaceae	*Tetraria octandra*			
58	Dasypogonaceae	*Dasypogon bromeliifolius*			
59	Dennstaedtiaceae	*Pteridium esculentum*			
60	Dilleniaceae	*Hibbertia cuneiformis*			
61	Dilleniaceae	*Hibbertia hypericoides*			
62	Dilleniaceae	*Hibbertia racemosa*			
63	Dilleniaceae	*Hibbertia vaginata*			
64	Droseraceae	*Drosera erythrorhiza*			
65	Droseraceae	*Drosera glanduligera*			
66	Droseraceae	*Drosera menziesii*			
67	Droseraceae	*Drosera pallida*			
68	Elaeocarpaceae	*Platytheca galioides*			
69	Elaeocarpaceae	*Tetratheca hirsuta*			
70	Ericaceae	*Brachyloma preissii*			
71	Ericaceae	*Leucopogon conostephioides*			
72	Ericaceae	*Leucopogon parviflorus*			
73	Ericaceae	*Leucopogon propinquus*			
74	Fabaceae	*Acacia alata* var. *alata*			
75	Fabaceae	*Acacia applanata*			
76	Fabaceae	*Acacia cyclops*			x
77	Fabaceae	*Acacia dealbata*	*		
78	Fabaceae	*Acacia dentifera*			x
79	Fabaceae	*Acacia extensa*			
80	Fabaceae	*Acacia flagelliformis*		4	
81	Fabaceae	*Acacia huegelii*			
82	Fabaceae	*Acacia incurva*			
83	Fabaceae	*Acacia iteaphylla*	*		
84	Fabaceae	*Acacia longifolia*	*		

No	FAMILY NAME	SPECIES NAME	NATURALISED	CONSV CODE	PLANTED
85	Fabaceae	*Acacia melanoxylon*	*		
86	Fabaceae	*Acacia myrtifolia*			
87	Fabaceae	*Acacia podalyriifolia*	*		
88	Fabaceae	*Acacia pulchella*			
89	Fabaceae	*Acacia pycnantha*	*		
90	Fabaceae	*Acacia rostellifera*			x
91	Fabaceae	*Acacia saligna*			
92	Fabaceae	*Acacia stenoptera*			
93	Fabaceae	*Bossiaea eriocarpa*			
94	Fabaceae	*Bossiaea* sp. Waroona *(*B.J. Keighery & N. Gibson 229*)*			
95	Fabaceae	*Brachysema praemorsum*			
96	Fabaceae	*Daviesia divaricata subsp. divaricata*			
97	Fabaceae	*Daviesia incrassata*			
98	Fabaceae	*Daviesia physodes*			
99	Fabaceae	*Dipogon lignosus*	*		
100	Fabaceae	*Eutaxia virgata*			
101	Fabaceae	*Gastrolobium praemorsum*			
102	Fabaceae	*Gompholobium tomentosum*			
103	Fabaceae	*Hardenbergia comptoniana*			
104	Fabaceae	*Hovea trisperma*			
105	Fabaceae	*Jacksonia furcellata*			
106	Fabaceae	*Kennedia prostrata*			
107	Fabaceae	*Lotus subbiflorus*	*		
108	Fabaceae	*Lupinus cosentinii*	*		
109	Fabaceae	*Mirbelia dilatata*			
110	Fabaceae	*Ornithopus compressus*	*		
111	Fabaceae	*Trifolium arvense*	*		

No	FAMILY NAME	SPECIES NAME	NATURALISED	CONSV CODE	PLANTED
112	Fabaceae	*Trifolium dubium*	*		
113	Fabaceae	*Vicia sativa*	*		
114	Fabaceae	*Viminaria juncea*			
115	Gentianaceae	*Cicendia filiformis*	*		
116	Geraniaceae	*Erodium botrys*	*		
117	Geraniaceae	*Erodium cicutarium*	*		
118	Geraniaceae	*Erodium moschatum*	*		
119	Geraniaceae	*Pelargonium capitatum*	*		
120	Goodeniaceae	*Dampiera linearis*			
121	Goodeniaceae	*Goodenia pulchella* subsp. Coastal Plain B (L.W. Sage 2336)			
122	Goodeniaceae	*Scaevola calliptera*			
123	Haemodoraceae	*Anigozanthos flavidus*			
124	Haemodoraceae	*Anigozanthos manglesii*			
125	Haemodoraceae	*Anigozanthos viridis*			
126	Haemodoraceae	*Conostylis aculeata*			
127	Haemodoraceae	*Conostylis candicans*			
128	Haemodoraceae	*Conostylis serrulata*			
129	Haemodoraceae	*Haemodorum spicatum*			
130	Hemerocallidaceae	*Agrostocrinum hirsutum*			
131	Hemerocallidaceae	*Dianella revoluta*			
132	Hemerocallidaceae	*Stypandra glauca*			
133	Hemerocallidaceae	*Tricoryne elatior*			
134	Hypoxidaceae	*Pauridia occidentalis*			
135	Iridaceae	*Gladiolus angustus*	*		
136	Iridaceae	*Patersonia occidentalis*			
137	Iridaceae	*Patersonia umbrosa*			
138	Iridaceae	*Romulea rosea*	*		

No	FAMILY NAME	SPECIES NAME	NATURALISED	CONSV CODE	PLANTED
139	Iridaceae	*Sparaxis bulbifera*	*		
140	Iridaceae	*Watsonia meriana*	*		
141	Juncaceae	*Juncus capitatus*	*		
142	Juncaceae	*Juncus holoschoenus*			
143	Juncaceae	*Juncus microcephalus*	*		
144	Juncaceae	*Juncus pallidus*			
145	Juncaceae	*Juncus planifolius*			
146	Juncaginaceae	*Triglochin striata*			
147	Lamiaceae	*Hemiandra pungens*			
148	Lauraceae	*Cassytha racemosa*			
149	Lentibulariaceae	*Utricularia violacea*			
150	Loganiaceae	*Orianthera serpyllifolia* subsp. *angustifolia*			
151	Loganiaceae	*Phyllangium paradoxum*			
152	Loranthaceae	*Nuytsia floribunda*			
153	Menyanthaceae	*Ornduffia sp.*			
154	Myrtaceae	*Agonis flexuosa*			
155	Myrtaceae	*Astartea leptophylla*			
156	Myrtaceae	*Astartea scoparia*			
157	Myrtaceae	*Callistemon glaucus*			
158	Myrtaceae	*Calothamnus quadrifidus*			x
159	Myrtaceae	*Calytrix fraseri*			
160	Myrtaceae	*Corymbia calophylla*			
161	Myrtaceae	*Eremaea pauciflora*			
162	Myrtaceae	*Eucalyptus cornuta*			
163	Myrtaceae	*Eucalyptus gomphocephala*			
164	Myrtaceae	*Eucalyptus marginata*			
165	Myrtaceae	*Eucalyptus rudis* subsp. *cratyantha*		4	

No	FAMILY NAME	SPECIES NAME	NATURALISED	CONSV CODE	PLANTED
166	Myrtaceae	*Eucalyptus sideroxylon*	*		Planted
167	Myrtaceae	*Hypocalymma angustifolium*			
168	Myrtaceae	*Hypocalymma robustum*			
169	Myrtaceae	*Kunzea glabrescens*			
170	Myrtaceae	*Kunzea micrantha*			
171	Myrtaceae	*Kunzea recurva*			
172	Myrtaceae	*Leptospermum laevigatum*	*		
173	Myrtaceae	*Melaleuca huegelii*			
174	Myrtaceae	*Melaleuca incana*			
175	Myrtaceae	*Melaleuca osullivanii*			
176	Myrtaceae	*Melaleuca preissiana*			
177	Myrtaceae	*Melaleuca rhaphiophylla*			
178	Myrtaceae	*Melaleuca teretifolia*			
179	Myrtaceae	*Melaleuca thymoides*			
180	Myrtaceae	*Melaleuca viminea*			
181	Myrtaceae	*Regelia ciliata*			?
182	Myrtaceae	*Taxandria linearifolia*			
183	Myrtaceae	*Taxandria parviceps*			
184	Myrtaceae	*Verticordia attenuata*		3	
185	Myrtaceae	*Verticordia densiflora* var. *densiflora*			
186	Orchidaceae	*Caladenia attingens*			
187	Orchidaceae	*Caladenia flava*			
188	Orchidaceae	*Caladenia longicauda*			
189	Orchidaceae	*Caladenia paludosa*			
190	Orchidaceae	*Disa bracteata*	*		
191	Orchidaceae	*Elythranthera brunonis*			
192	Orchidaceae	*Elythranthera emarginata*			

No	FAMILY NAME	SPECIES NAME	NATURALISED	CONSV CODE	PLANTED
193	Orchidaceae	*Leporella fimbriata*			
194	Orchidaceae	*Microtis media*			
195	Orchidaceae	*Pterostylis recurva*			
196	Orchidaceae	*Pterostylis vittata*			
197	Orchidaceae	*Pyrorchis nigricans*			
198	Orchidaceae	*Thelymitra antennifera*			
199	Orchidaceae	*Thelymitra crinita*			
200	Orchidaceae	*Thelymitra macrophylla*			
201	Orobanchaceae	*Orobanche minor*	*		
202	Oxalidaceae	*Oxalis glabra*	*		
203	Oxalidaceae	*Oxalis perennans*			
204	Oxalidaceae	*Oxalis pes-caprae*	*		
205	Papaveraceae	*Fumaria muralis*	*		
206	Phyllanthaceae	*Phyllanthus calycinus*			
207	Phyllanthaceae	*Poranthera microphylla*			
208	Pinaceae	*Pinus pinaster*	*		
209	Pittosporaceae	*Billardiera heterophylla*			
210	Plantaginaceae	*Plantago lanceolata*	*		
211	Poaceae	*Aira caryophyllea*	*		
212	Poaceae	*Amphipogon amphipogonoides*			
213	Poaceae	*Austrostipa compressa*			
214	Poaceae	*Austrostipa semibarbata*			
215	Poaceae	*Avena fatua*	*		
216	Poaceae	*Briza maxima*	*		
217	Poaceae	*Briza minor*	*		
218	Poaceae	*Bromus diandrus*	*		
219	Poaceae	*Bromus hordeaceus*	*		
220	Poaceae	*Cenchrus clandestinus*	*		

No	FAMILY NAME	SPECIES NAME	NATURALISED	CONSV CODE	PLANTED
221	Poaceae	*Cynodon dactylon*	*		
222	Poaceae	*Ehrharta calycina*	*		
223	Poaceae	*Ehrharta longiflora*	*		
224	Poaceae	*Eragrostis curvula*	*		
225	Poaceae	*Holcus lanatus*	*		
226	Poaceae	*Lagurus ovatus*	*		
227	Poaceae	*Lolium multiflorum*	*		
228	Poaceae	*Microlaena stipoides*			
229	Poaceae	*Neurachne alopecuroidea*			
230	Poaceae	*Rytidosperma occidentale*			
231	Polygalaceae	*Comesperma calymega*			
232	Polygonaceae	*Rumex crispus*	*		
233	Polygonaceae	*Rumex acetosella*	*		
234	Primulaceae	*Lysimachia arvensis*	*		
235	Proteaceae	*Adenanthos meisneri*			
236	Proteaceae	*Banksia attenuata*			
237	Proteaceae	*Banksia dallanneyi*			
238	Proteaceae	*Banksia grandis*			
239	Proteaceae	*Banksia littoralis*			
240	Proteaceae	*Banksia menziesii*			x
241	Proteaceae	*Banksia nivea* subsp*. nivea*			x
242	Proteaceae	*Grevillea manglesioides*			
243	Proteaceae	*Grevillea vestita* subsp*. vestita*			
244	Proteaceae	*Hakea prostrata*			
245	Proteaceae	*Hakea ruscifolia*			
246	Proteaceae	*Hakea varia*			
247	Proteaceae	*Persoonia longifolia*			
248	Proteaceae	*Petrophile linearis*			

No	FAMILY NAME	SPECIES NAME	NATURALISED	CONSV CODE	PLANTED
249	Proteaceae	*Stirlingia latifolia*			
250	Proteaceae	*Synaphea floribunda*			
251	Proteaceae	*Synaphea hians*		3	
252	Proteaceae	*Synaphea petiolaris* subsp. *simplex*		3	
253	Proteaceae	*Xylomelum occidentale*			
254	Restionaceae	*Desmocladus fasciculatus*			
255	Restionaceae	*Desmocladus flexuosus*			
256	Restionaceae	*Hypolaena exsulca*			
257	Restionaceae	*Hypolaena pubescens*			
258	Restionaceae	*Leptocarpus coangustatus*			
259	Restionaceae	*Leptocarpus scariosus*			
260	Restionaceae	*Leptocarpus roycei*			
261	Restionaceae	*Loxocarya cinerea*			
262	Rhamnaceae	*Cryptandra arbutiflora*			
263	Rhamnaceae	*Spyridium globulosum*			
264	Rubiaceae	*Galium divaricatum*	*		
265	Rubiaceae	*Opercularia hispidula*			
266	Rutaceae	*Philotheca spicata*			
267	Santalaceae	*Exocarpos odoratus*			
268	Solanaceae	*Solanum nigrum*	*		
269	Stylidiaceae	*Levenhookia pusilla*			
270	Stylidiaceae	*Levenhookia stipitata*			
271	Stylidiaceae	*Stylidium brunonianum*			
272	Stylidiaceae	*Stylidium calcaratum*			
273	Stylidiaceae	*Stylidium ciliatum*			
274	Stylidiaceae	*Stylidium junceum*			
275	Stylidiaceae	*Stylidium repens*			

No	FAMILY NAME	SPECIES NAME	NATURALISED	CONSV CODE	PLANTED
276	Thymelaeaceae	*Pimelea lanata*			
277	Typhaceae	*Typha domingensis*			
278	Xanthorrhoeaceae	*Xanthorrhoea brunonis*			
279	Xanthorrhoeaceae	*Xanthorrhoea gracilis*			
280	Xanthorrhoeaceae	*Xanthorrhoea preissii*			
281	Zamiaceae	*Macrozamia riedlei*			

Appendix 8. Priority and Significant Flora Location and Abundance Table.

Occurrence	Taxon Name	Abundance	WAConStat	Easting	Northing
1	*Acacia flagelliformis*	10	P4	362541.34	6282017.27
2	*Acacia flagelliformis*	10	P4	362530.53	6282033.09
3	*Acacia flagelliformis*	10	P4	362547.65	6282056.40
4	*Acacia flagelliformis*	5	P4	362523.65	6282014.03
5	*Acacia flagelliformis*	1	P4	362503.03	6281931.10
6	*Acacia flagelliformis*	1	P4	362528.02	6281987.80
7	*Acacia flagelliformis*	5	P4	362549.57	6282006.08
8	*Acacia flagelliformis*	5	P4	362551.74	6282035.94
9	*Acacia flagelliformis*	5	P4	362552.96	6282048.05
10	*Acacia flagelliformis*	1	P4	362592.98	6282086.11
1	*Eucalyptus cornuta*	1		352827.41	6274776.09
2	*Eucalyptus cornuta*	1		352838.96	6274773.50
3	*Eucalyptus cornuta*	1		352887.66	6274779.02
4	*Eucalyptus cornuta*	1		353008.73	6274783.20
5	*Eucalyptus cornuta*	1		353047.79	6274788.35
6	*Eucalyptus cornuta*	1		353045.97	6274780.34
7	*Eucalyptus cornuta*	1		353063.26	6274784.37
8	*Eucalyptus cornuta*	1		353065.58	6274784.07
9	*Eucalyptus cornuta*	1		353070.75	6274797.46
10	*Eucalyptus cornuta*	1		353065.96	6274800.94
11	*Eucalyptus cornuta*	1		353049.11	6274799.35
12	*Eucalyptus cornuta*	1		353078.79	6274799.58
13	*Eucalyptus cornuta*	1		353126.48	6274810.62
14	*Eucalyptus cornuta*	1		353130.40	6274808.81
15	*Eucalyptus cornuta*	1		353134.96	6274796.34
1	*Eucalyptus rudis* subsp. *cratyantha*	1	P4	353455.13	6274918.85
2	*Eucalyptus rudis* subsp. *cratyantha*	1	P4	353578.10	6274937.09
3	*Eucalyptus rudis* subsp. *cratyantha*	1	P4	353732.85	6275096.54
4	*Eucalyptus rudis* subsp. *cratyantha*	1	P4	355063.79	6275896.17
5	*Eucalyptus rudis* subsp. *cratyantha*	1	P4	355150.29	6275928.53
6	*Eucalyptus rudis* subsp. *cratyantha*	1	P4	355457.43	6276087.40
7	*Eucalyptus rudis* subsp. *cratyantha*	1	P4	356896.93	6277212.70
8	*Eucalyptus rudis* subsp. *cratyantha*	1	P4	356951.65	6277252.12
9	*Eucalyptus rudis* subsp. *cratyantha*	1	P4	357068.44	6277390.69
10	*Eucalyptus rudis* subsp. *cratyantha*	1	P4	359387.45	6279564.21
11	*Eucalyptus rudis* subsp. *cratyantha*	1	P4	359615.15	6279567.15
12	*Eucalyptus rudis* subsp. *cratyantha*	1	P4	360420.07	6279798.98

Occurrence	Taxon Name	Abundance	WAConStat	Easting	Northing
1	*Schoenoplectus pungens*	10		355563.19	6276166.98
1	*Synaphea hians*	5	P3	362344.15	6281592.55
2	*Synaphea hians*	5	P3	362346.91	6281568.74
1	*Synaphea petiolaris* subsp. *simplex*	2	P3	357060.10	6277368.06
1	*Verticordia attenuata*	10	P3	362219.71	6281306.39
2	*Verticordia attenuata*	10	P3	362212.40	6281317.83
3	*Verticordia attenuata*	10	P3	362085.30	6281114.04
4	*Verticordia attenuata*	10	P3	362082.98	6281120.33
5	*Verticordia attenuata*	10	P3	362084.27	6281146.74
6	*Verticordia attenuata*	1	P3	356557.06	6276915.91
7	*Verticordia attenuata*	2	P3	356480.37	6276864.08
8	*Verticordia attenuata*	10	P3	356896.77	6277190.72
9	*Verticordia attenuata*	10	P3	356895.85	6277190.04
10	*Verticordia attenuata*	10	P3	356904.76	6277209.15
11	*Verticordia attenuata*	10	P3	356923.30	6277234.49
12	*Verticordia attenuata*	10	P3	356928.43	6277244.65
13	*Verticordia attenuata*	500	P3	355871.04	6276413.83
14	*Verticordia attenuata*	750	P3	355900.75	6276418.83
15	*Verticordia attenuata*	50	P3	355930.16	6276454.98
16	*Verticordia attenuata*	50	P3	355949.28	6276466.92
17	*Verticordia attenuata*	50	P3	355960.19	6276457.10
18	*Verticordia attenuata*	50	P3	355984.00	6276490.18
19	*Verticordia attenuata*	25	P3	356005.04	6276491.27
20	*Verticordia attenuata*	25	P3	356028.63	6276501.83
21	*Verticordia attenuata*	50	P3	356054.18	6276524.06
22	*Verticordia attenuata*	3	P3	362481.43	6281903.07
23	*Verticordia attenuata*	3	P3	362471.45	6281880.97
24	*Verticordia attenuata*	1	P3	355578.63	6276187.42
25	*Verticordia attenuata*	1	P3	355598.05	6276204.49
26	*Verticordia attenuata*	1	P3	355642.77	6276229.20
27	*Verticordia attenuata*	1	P3	355646.30	6276249.20
28	*Verticordia attenuata*	1	P3	355662.77	6276249.79
29	*Verticordia attenuata*	2	P3	355696.90	6276268.62
30	*Verticordia attenuata*	2	P3	355701.61	6276279.80
31	*Verticordia attenuata*	2	P3	355715.73	6276282.74
32	*Verticordia attenuata*	2	P3	355746.33	6276310.40
33	*Verticordia attenuata*	5	P3	356916.05	6277221.82
34	*Verticordia attenuata*	5	P3	356911.34	6277196.22
35	*Verticordia attenuata*	1250	P3	355875.07	6276422.05

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Threatened and Priority Flora Report Form

Version 1.3 August 2017

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at http://dpaw.wa.gov.au/ under *Standard Report Forms*

TAXON: Acacia flagelliformis **TPFL Pop. No:**

OBSERVATION DATE: 7/08/2018 **CONSERVATION STATUS:** P4 New population ☐

OBSERVER/S: Russell Smith **PHONE:** 0447809124

ROLE: Botanist **ORGANISATION:** Ecoedge

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Bussell Hwy, from 950 to 1,020 m south of Hutton Road, south side of highway

Reserve No:

DBCA DISTRICT: **LGA:** Busselton Land manager present: ☐

DATUM:

GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)

DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 6281987.8

Long / Easting: 362528.02

ZONE: 50

METHOD USED:

GPS ☒ Differential GPS ☐ Map ☐

No. satellites: _____ Map used: _____

Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐ Timber reserve ☐ Private property ☐ Rail reserve ☐ Shire road reserve ☐
National park ☐ State forest ☐ Pastoral lease ☐ MRWA road reserve ☐ Other Crown reserve ☒
Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole _____ to _____ Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☒ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☐ Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	**Mature:**	**Juveniles:**	**Seedlings:**	**Totals:**
Alive	50			50
Dead				

Area of pop (m²): 2,300

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 100%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

Please return completed form to **Species And Communities Branch** DBCA,

Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

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Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

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GOVERNMENT OF WESTERN AUSTRALIA

Threatened and Priority Flora Report Form

Version 1.3 August 2017

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☒
Sandy loam ☐
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☒
Yellow ☒
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☒
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☐ Moist ☒ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Shrubland of Melaleuca viminea and M. preissiana
2.
3.
4.

ASSOCIATED SPECIES:
Astartea scoparia, Melaleuca osullivanii open heath/shrubland over Baumea juncea

Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☒ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Russell Smith Role: botanist Signed: _____ Date: 14/02/2019

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TAXON: Synaphea hians **TPFL Pop. No:**

OBSERVATION DATE: 23/10/2013 **CONSERVATION STATUS:** P3 New population ☐

OBSERVER/S: Russell Smith **PHONE:** 0447809124

ROLE: Botanist **ORGANISATION:** Ecoedge

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Bussell Hwy, 1500 m south of Hutton Road

Reserve No:

DBCA DISTRICT: **LGA:** Busselton Land manager present: ☐

DATUM:

GDA94 / MGA94 ☐

AGD84 / AMG84 ☐

WGS84 ☐

Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)

DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 6281592.55

Long / Easting: 362344.15

ZONE: 50

METHOD USED:

GPS ☒ Differential GPS ☐ Map ☐

No. satellites: Map used:

Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐ Timber reserve ☐ Private property ☐ Rail reserve ☐ Shire road reserve ☐

National park ☐ State forest ☐ Pastoral lease ☐ MRWA road reserve ☐ Other Crown reserve ☒

Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole ____ to ____ Specify other:

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☒ Area observed (m²):

EFFORT: Time spent surveying (minutes): No. of minutes spent / 100 m^2:

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☐ Count method:

(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	10			10
Dead				

Area of pop (m²): 50

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. Size Data attached ☐ Total area of quadrats (m²):

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒

Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 100%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

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HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☒
Sandy loam ☐
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☒
Yellow ☒
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☒
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Marri open forest
2.
3.
4.

ASSOCIATED SPECIES:
Brachysema praemorum, Hibbertia cuneiformis, Kunzea glabrescens

Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☒ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Russell Smith Role: botanist Signed: _____ Date: 14/02/2019

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TAXON: Synaphea petiolaris subsp. simplex **TPFL Pop. No:**

OBSERVATION DATE: 23/10/2013 **CONSERVATION STATUS:** P3 New population ☐

OBSERVER/S: Russell Smith **PHONE:** 0447809124

ROLE: Botanist **ORGANISATION:** Ecoedge

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Bussell Hwy, 60 m southwest of the Ruabon Road intersection

Reserve No:

DBCA DISTRICT: **LGA:** Land manager present: ☐

DATUM:

GDA94 / MGA94 ☐

AGD84 / AMG84 ☐

WGS84 ☐

Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)

DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 6277368.06

Long / Easting: 357060.10

ZONE: 50

METHOD USED:

GPS ☒ Differential GPS ☐ Map ☐

No. satellites: Map used:

Boundary polygon captured: ☐ Map scale:

LAND TENURE:

Nature reserve ☐ Timber reserve ☐ Private property ☐ Rail reserve ☐ Shire road reserve ☐

National park ☐ State forest ☐ Pastoral lease ☐ MRWA road reserve ☐ Other Crown reserve ☒

Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole _____ to _____ Specify other:

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☒ Area observed (m²):

EFFORT: Time spent surveying (minutes): No. of minutes spent / 100 m²:

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☐ Count method:

(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	**Mature:**	**Juveniles:**	**Seedlings:**	**Totals:**
Alive	2			2
Dead				

Area of pop (m²):

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. Size Data attached ☐ Total area of quadrats (m²):

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒

Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 100%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
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RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by: **Sheet No.:** **Record Entered in Database** ❑

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Threatened and Priority Flora Report Form

Version 1.3 August 2017

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GOVERNMENT OF WESTERN AUSTRALIA

Threatened and Priority Flora Report Form

Version 1.3 August 2017

HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☒
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☒
Yellow ☒
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☒
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☒ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Marri open forest
2.
3.
4.

ASSOCIATED SPECIES:
Other (non-dominant) spp: Brachysema praemorum, Hibbertia cuneiformis

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☒ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Russell Smith Role: botanist Signed: _____ Date: 14/02/2019

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TAXON: Verticordia attenuata **TPFL Pop. No:**

OBSERVATION DATE: 12/12/2016 **CONSERVATION STATUS:** P4 New population ☐

OBSERVER/S: Russell Smith **PHONE:** 0447809124

ROLE: Botanist **ORGANISATION:** Ecoedge

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Bussell Hwy, from Layman Road turnoff to 760 m northeast of turnoff, south side of highway

Reserve No:

DBCA DISTRICT: **LGA:** Busselton Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 6276310.4

Long / Easting: 355746.33

ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐

No. satellites: _____ Map used: _____

Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☐	Other Crown reserve ☒
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☒ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☐ Count method: _____ (Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	**Mature:**	**Juveniles:**	**Seedlings:**	**Totals:**
Alive	2,800			2,800
Dead				

Area of pop (m²): 5000

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 100%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
•			
•			
•			

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HABITAT INFORMATION:

LANDFORM:
- Crest ☐
- Hill ☐
- Ridge ☐
- Outcrop ☐
- Slope ☐
- Flat ☐
- Open depression ☐
- Drainage line ☐
- Closed depression ☐
- Wetland ☐

ROCK TYPE:
- Granite ☐
- Dolerite ☐
- Laterite ☐
- Ironstone ☐
- Limestone ☐
- Quartz ☐

Specify other: _____

LOOSE ROCK: (on soil surface; eg gravel, quartz fields)
- 0-10% ☐
- 10-30% ☐
- 30-50% ☐
- 50-100% ☐

SOIL TYPE:
- Sand ☒
- Sandy loam ☐
- Loam ☐
- Clay loam ☐
- Light clay ☐
- Peat ☐

Specify other: _____

SOIL COLOUR:
- Red ☐
- Brown ☒
- Yellow ☒
- White ☐
- Grey ☐
- Black ☐

Specify other: _____

DRAINAGE:
- Well drained ☒
- Seasonally inundated ☐
- Permanently inundated ☐
- Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☐ Moist ☒ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Shrubland of Kunzea glabrescens, with Melaleuca viminea and M. preissiana
2.
3.
4.

ASSOCIATED SPECIES:
Other (non-dominant) spp: Viminaria juncea

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☒ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Russell Smith Role: botanist Signed: _____ Date: 14/02/2019

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TAXON: Verticordia attenuata **TPFL Pop. No:**

OBSERVATION DATE: 12/12/2016 **CONSERVATION STATUS:** P4 New population ☐

OBSERVER/S: Russell Smith **PHONE:** 0447809124

ROLE: Botanist **ORGANISATION:** Ecoedge

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:**

Bussell Hwy, 210 to 320 south west of Ruabon Road, south side of highway

Reserve No:

DBCA DISTRICT: **LGA:** Busselton Land manager present: ☐

DATUM:
GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)
DecDegrees ☐ DegMinSec ☐ UTMs ☒

Lat / Northing: 6277221.82

Long / Easting: 356916.05

ZONE: 50

METHOD USED:
GPS ☒ Differential GPS ☐ Map ☐

No. satellites: _____ Map used: _____

Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐	Timber reserve ☐	Private property ☐	Rail reserve ☐	Shire road reserve ☐
National park ☐	State forest ☐	Pastoral lease ☐	MRWA road reserve ☐	Other Crown reserve ☒
Conservation park ☐	Water reserve ☐	UCL ☐	SLK/Pole _____ to _____	Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☒ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☐ Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants ☒ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:

	Mature:	Juveniles:	Seedlings:	Totals:
Alive	50			50
Dead				

Area of pop (m²): 500

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☒
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: 100%

CONDITION OF PLANTS: Healthy ☒ Moderate ☐ Poor ☐ Senescent ☐

COMMENT:

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
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HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☒
Sandy loam ☐
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☒
Yellow ☒
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☒
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☐ Moist ☒ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. Shrubland of Kunzea glabrescens, with Melaleuca viminea and M. preissiana
2.
3.
4.

ASSOCIATED SPECIES:
Other (non-dominant) spp: Viminaria juncea, Verticordia sdensiflora subsp. densiflora

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☒ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: _____

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of Record: Russell Smith Role: botanist Signed: _____ Date: 14/02/2019

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TAXON: _____ **TPFL Pop. No:** _____

OBSERVATION DATE: ___/___/___ **CONSERVATION STATUS:** _____ New population ☐

OBSERVER/S: _____ **PHONE:** _____

ROLE: **ORGANISATION:**

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place)**:** _____

Reserve No: _____

DBCA DISTRICT: _____ **LGA:** _____ Land manager present: ☐

DATUM:

GDA94 / MGA94 ☐
AGD84 / AMG84 ☐
WGS84 ☐
Unknown ☐

COORDINATES: (If UTM coords provided, **Zone** is also required)

DecDegrees ☐ DegMinSec ☐ UTMs ☐

Lat / Northing: _____

Long / Easting: _____

ZONE: _____

METHOD USED:

GPS ☐ Differential GPS ☐ Map ☐

No. satellites: _____ Map used: _____

Boundary polygon captured: ☐ Map scale: _____

LAND TENURE:

Nature reserve ☐ Timber reserve ☐ Private property ☐ Rail reserve ☐ Shire road reserve ☐
National park ☐ State forest ☐ Pastoral lease ☐ MRWA road reserve ☐ Other Crown reserve ☐
Conservation park ☐ Water reserve ☐ UCL ☐ SLK/Pole _____ to _____ Specify other: _____

AREA ASSESSMENT: Edge survey ☐ Partial survey ☐ Full survey ☐ Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual ☐ Extrapolation ☐ Estimate ☐ Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants ☐ Clumps ☐ Clonal stems ☐

TOTAL POP'N STRUCTURE:	**Mature:**	**Juveniles:**	**Seedlings:**	**Totals:**
Alive				
Dead				

Area of pop (m²): _____

Note: Pls record count as numbers (not percentages) for database.

QUADRATS PRESENT: No. _____ Size _____ Data attached ☐ Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				

REPRODUCTIVE STATE: Clonal ☐ Vegetative ☐ Flowerbud ☐ Flower ☐
Immature fruit ☐ Fruit ☐ Dehisced fruit ☐ Percentage in flower: _____%

CONDITION OF PLANTS: Healthy ☐ Moderate ☐ Poor ☐ Senescent ☐

COMMENT: _____

THREATS - type, agent and supporting information: Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. **Specify agent** where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)	**Current impact (N-E)**	**Potential Impact (L-E)**	**Potential Threat Onset (S-L)**
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HABITAT INFORMATION:

LANDFORM:
Crest ☐
Hill ☐
Ridge ☐
Outcrop ☐
Slope ☐
Flat ☐
Open depression ☐
Drainage line ☐
Closed depression ☐
Wetland ☐

ROCK TYPE:
Granite ☐
Dolerite ☐
Laterite ☐
Ironstone ☐
Limestone ☐
Quartz ☐
Specify other: _____

LOOSE ROCK:
(on soil surface; eg gravel, quartz fields)
0-10% ☐
10-30% ☐
30-50% ☐
50-100% ☐

SOIL TYPE:
Sand ☐
Sandy loam ☐
Loam ☐
Clay loam ☐
Light clay ☐
Peat ☐
Specify other: _____

SOIL COLOUR:
Red ☐
Brown ☐
Yellow ☐
White ☐
Grey ☐
Black ☐
Specify other: _____

DRAINAGE:
Well drained ☐
Seasonally inundated ☐
Permanently inundated ☐
Tidal ☐

Specific **Landform** Element: _____
(Refer to field manual for additional values)

CONDITION OF SOIL: Dry ☐ Moist ☐ Waterlogged ☐ Inundated ☐

VEGETATION CLASSIFICATION*:
Eg: **1**. Banksia woodland (B. attenuata, B. ilicifolia); **2**. Open shrubland (Hibbertia sp., Acacia spp.) ; **3**. Isolated clumps of sedges (Mesomelaena tetragona)

1. _____
2. _____
3. _____
4. _____

ASSOCIATED SPECIES: _____

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 *Australian Soil and Land Survey Field Handbook* guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine ☐ Excellent ☐ Very good ☐ Good ☐ Degraded ☐ Completely degraded ☐

COMMENT: _____

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: _____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

FENCING: Not required ☐ Present ☐ Replace / repair ☐ Required ☐ Length req'd: _____

ROADSIDE MARKERS: Not required ☐ Present ☐ Replace / reposition ☐ Required ☐ Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant matieral is taken) then no permit/licence is required. For further information on permit and licening requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. ☐ Regional Herb. ☐ District Herb. ☐ Other: _____

ATTACHED: Map ☐ Mudmap ☐ Photo ☐ GIS data ☐ Field notes ☐ Other: _____

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Please return completed form to **Species And Communities Branch** DBCA,

Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by:_____ **Sheet No.:**_____ **Record Entered in Database** ❑

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Threatened and Priority Flora Report Form

Version 1.3 August 2017

Submitter of Record: _____ Role: _____ Signed: _____ Date: / /

Please return completed form to **Species And Communities Branch** DBCA,

Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

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Appendix 10. Photographs and Descriptions of Vegetation Units Mapped within the Survey Area at Bussell Hwy.

Vegetation Unit A1

Agonis flexuosa low woodland/low open woodland with scattered *Eucalyptus gomphocephala* and *Corymbia calophylla* or *E. cornuta* or **Pinus pinaster* over *Kunzea glabrescens*, (**Acacia longifolia*) shrubland/open shrubland over introduced herbs and grasses including **Lupinus angustifolius*, **Ehrharta calycina* and **E. longifolia* on grey-brown sand/sandy loam or yellow-grey sand.

Vegetation unit A2

Yate-Tuart-Peppermint Woodland. *Eucalyptus cornuta*, *Agonis flexuosa* woodland with emergent *E. gomphocephala* over introduced herbs and grasses including **Lupinus angustifolius*, **Ehrharta calycina* and **E. longifolia* on grey-brown sand/sandy loam or yellow-grey sand.

Vegetation Unit B

Eucalyptus rudis subsp. *cratyantha* or *Corymbia calophylla* woodland/open forest over *Agonis flexuosa*, *Melaleuca preissii* open low woodland with occasional *M. rhaphiophylla* over *Acacia saligna*, *Astartea* sp., *Melaleuca viminea* open shrubland over introduced herbs and grasses including **Ehrharta calycina* on grey-brown sandy-loam or loam.

Vegetation Unit C

Corymbia calophylla woodland (sometimes with *Melaleuca rhaphiophylla*) over **Acacia* spp., *Hibbertia cuneiformis*, *Kunzea glabrescens*, (*Spyridium globulosum*) shrubland over introduced herbs and grasses including **Ehrharta calycina*, **Eragrostis curvula* and **Zantedeschia aethiopica* on grey-brown or yellow-brown sand.

Vegetation Unit D

**Acacia* spp., *Kunzea glabrescens* tall shrubland (sometimes with emergent *Agonis flexuosa* or *Melaleuca preissiana*) over *Adenanthos meisneri*, *Gastrolobium praemorsum*, *Jacksonia furcellata*, *Kunzea recurva*, (*Leucopogon conostephioides*), *Melaleuca viminea*, (*Verticordia* sp., *Viminaria juncea*) low shrubland over *Loxocarya cinerea* and introduced herbs and grasses on grey or yellow-brown sand. (Revegetated mined areas and road embankments; is sometimes a shrubland dominated solely by *K. glabrescens*).

Vegetation sub-unit E1

Corymbia calophylla, (*Eucalyptus marginata*, *Nuytsia floribunda*) open forest over *Kunzea glabrescens* tall open shrubland over (*Gastrolobium praemorsum*), *Hibbertia hypericoides*, *Leucopogon parviflorus*, *Stirlingia latifolia* and *Xanthorrhoea brunonis* low shrubland and *Tetraria capillaris* and *T. octandra* scattered sedges on grey-brown or yellow brown sand.

Vegetation sub-unit E2

Corymbia calophylla and *Eucalyptus marginata* open forest/woodland over *Hibbertia cuneifolia* and *Kunzea glabrescens* tall open shrubland over **Asparagus asparagoides*, *Brachyloma preissii*, *Brachysema praemorsum* and *Xanthorrhoea brunonis* shrubland over *Dampiera linearis*, *Dichopogon capillipes*, **Hypochaeris glabra* open herbland and scattered *Lepidosperma squamatum* and *Tetraria octandra* sedges on yellow-brown or grey-brown sand.

Vegetation sub-unit E3

Agonis flexuosa woodland with emergent **Pinus pinaster* and scattered *Eucalyptus marginata* or *Corymbia calophylla*, *Nuytsia floribunda* over **Acacia longifolia*, *Kunzea glabrescens* over **Asparagus asparagoides, Pteridium esculentum* and *Conostylis aculeata* herbland on grey-brown sand.

Vegetation sub-unit E4

Corymbia calophylla, (*Eucalyptus marginata*) open forest over *Agonis flexuosa*, *Banksia grandis* low woodland over *Kunzea glabrescens* tall open shrubland over *Acacia alata*, *Grevillea vestita*, *Hakea varia*, *Hibbertia cuneiformis*, *Leucopogon propinquus*, *Melaleuca incana* over **Asparagus asparagoides*, *Brachysema praemorsum*, *Hardenbergia comptoniana* creepers over a variable herbland including *Anigozanthos flavidus*, *Dichopogon capillipes*, *Lomandra micrantha*, *Opercularia hispidula*, **Oxalis glabra*, **O. pes-caprae*, **Romulea rosea* on grey-brown loamy sand.

Vegetation Unit F

Melaleuca preissiana low open forest/low woodland over *Acacia flagelliformis*, *Astartea scoparia*, *Melaleuca viminea*, *M. osullivanii* open heath/shrubland over *Baumea juncea* open sedgeland on grey sand over clay.