Reconnaissance and Targeted Flora and Vegetation Survey Mordalup Bridge

Prepared for Main Roads Western Australia
October 2022

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Version	Origin	Review	Review date	Release approval	Issue date
V1	C. Spencer	R. Smith	13/6/2022		
V2	R. Smith	C. Spencer	17/6/2022		
Final Draft	Ecoedge	Main Roads	24/6/2022	Ecoedge	28/6/2022
Final	Main Roads		6/10/2022	Ecoedge	7/10/2022

Executive Summary

Ecoedge Environment Services was engaged by Main Roads Western Australia in July 2021 to undertake a reconnaissance flora and vegetation survey and targeted flora survey to delineate key flora, vegetation, soil and surface water values (wetlands and watercourses adjacent to Mordalup Road and Bridge 3923, between SLK 9.03 and 9.39, in the Shire of Manjimup.

Main Roads are planning the replacement of the bridge, as it has reached the end of its structural lifespan and required the survey in order to inform any environmental assessment and approvals processes that may be required as part of the proposal.

The flora and vegetation survey was undertaken on the 28, 29 October and 21 December 2021 by Russell Smith (flora permit FB61000473) and Colin Spencer (flora permit FB62000169) in accordance with the Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

The total area surveyed was approximately 1.74 hectares (ha), of which 1.13 ha was native vegetation.

Ninety-two vascular flora taxa were found within the survey area, of which twenty-one were introduced species

One Priority 2 species, *Montia australasica*, was found in the survey area with a total population of about 500 plants. No other flora of significance was found.

None of the introduced species was a Declared Pest Plant or Weed of National Significance.

All of the fifty-two potentially occurring Threatened and Priority taxa were assigned a post-survey likelihood of 'unlikely', either because suitable habitat was not present or, if suitable habitat was present, they were searched for at an appropriate time and not found. The priority species found, *Montia australasica*, was not on the list of potential species.

Two vegetation units were identified within the survey area. Neither of these resembled a Threatened or Priority ecological community (TEC/PEC). However, the riverine vegetation unit MpBsW is probably a relatively restricted vegetation type in the region.

The upland vegetation unit EmCcOf was mainly in Good or Very Good condition, whereas the MpBsOW unit was predominantly in Degraded condition. In summary, just over 75% of the vegetation was in Good or Very Good condition.

Vegetation unit MpBsW, which occurs along the edges of the Tone River area, contains several taxa characteristic of riparian habitat.

One vegetation complex was mapped to occur across the survey area, the Wilgarup Complex. The survey area vegetation is generally characteristic of this complex in terms of dominant

species and structure. This complex has more than 30% of its pre-European extent of native vegetation remaining.

The survey area occurs well within Beard's vegetation association 3. The upland part of the survey area vegetation is characteristic of the association in terms of dominant species and structure, however, association 3 does not allow for the distinctive vegetation of creek lines, as occurs in the survey area. Association 3 has more than 30% of its pre-European extent of native vegetation remaining.

All vegetation within the survey area has been assigned 1a PV rating by Molloy et al. (2009) because it is contiguous with vegetation linked to a mapped regional ecological linkage associated with the Tone River and uncleared vegetation in the Department of Biodiversity Conservation and Attractions managed state forest and conservation estate which extend beyond the survey area for some kilometres.

An Environmental Sensitive Area (ESA) is mapped across most of the northern half of the survey area. This ESA is associated with Tone-Perup Nature Reserve which occurs to the north of the survey area.

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Statement of limitations

Reliance on data

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

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1 Introduction

Ecoedge Environmental Services (Ecoedge) was engaged by Main Roads Western Australia (Main Roads) in July 2021 to undertake a reconnaissance flora and vegetation survey and targeted flora survey to delineate key flora, vegetation, soil and surface water values (wetlands and watercourses) adjacent to Mordalup Road and Bridge 3923, between SLK 9.03 and 9.39 (survey area), in the Shire of Manjimup.

The survey area occurs on Shire of Manjimup managed land, which is bounded by the Tone – Perup Nature Reserve, the Tone State Forest and agricultural land within the Shire Manjimup. The survey area is approximately 40 kilometres east south-east of Manjimup (**Figure 1** and **Figure 2**).

Main Roads are planning the replacement of the bridge, as it has reached the end of its structural lifespan and required the survey in order to inform any environmental assessment and approvals processes that may be required as part of the proposal.

This report compiles the findings of the survey.

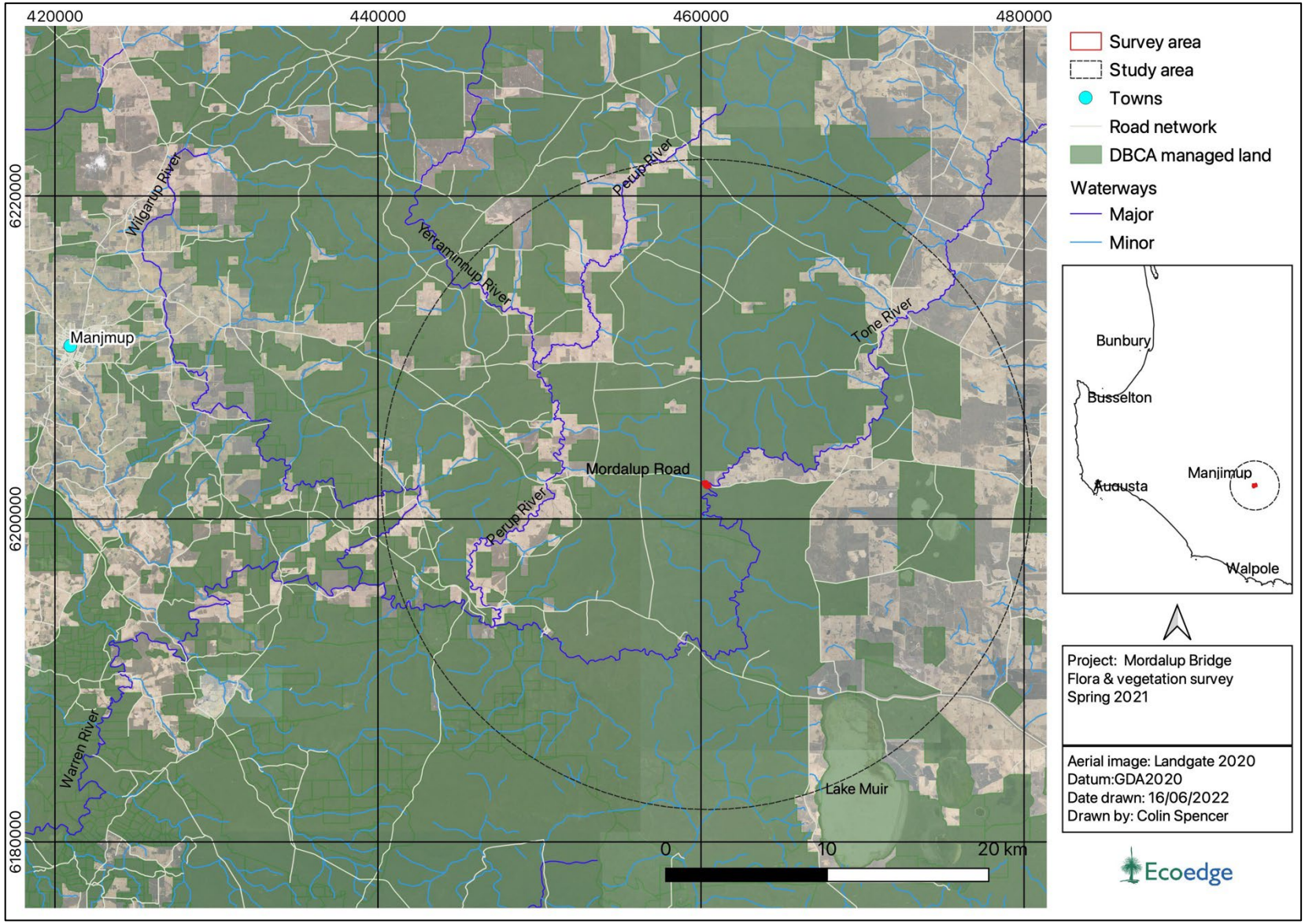

Figure 1. Aerial photograph showing the regional context of the survey area.

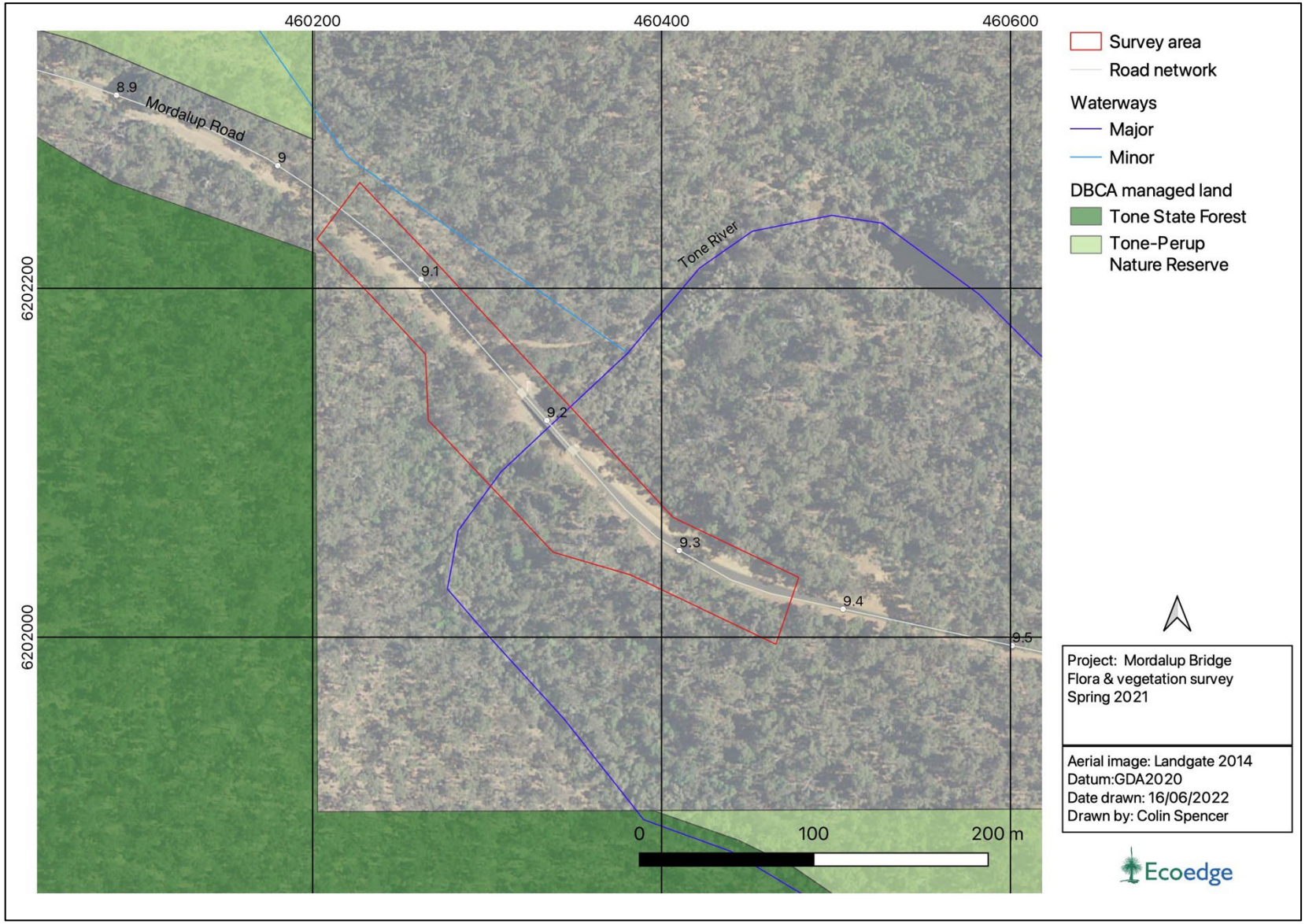

Figure 2. Aerial photograph showing the location of the survey area.

2 Scope and objectives

The scope of the survey comprised two main parts, a desktop study and a field survey.

2.1 Desktop study

A desktop study over a 20 km radius of the survey areas was required prior to the field survey work to identify key features and constraints, which were in, or nearby the survey area, such as significant flora, significant vegetation/ecological communities, unusual or rare soil/landscape systems, surface water values, conservation estate, poorly represented vegetation associations and or vegetation complexes and environmentally sensitive areas (ESA).

2.2 Field survey

The reconnaissance and targeted field survey was required to ground-truth outcomes of the desktop assessment, with a focus on the delineation of all significant flora and significant vegetation, vegetation condition, mapping of weeds of national significance (WONS), declared pest plants listed under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) and mapping of riparian vegetation.

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

3 Methods

3.1 Desktop assessment

Prior to the field survey, a desktop assessment was undertaken over a 20 km buffer area (the study area) to provide contextual information on the flora and vegetation within the survey area. The desktop studies included a review of the following information.

- Regional soil-landscape mapping (Stuart-Street 2005).
- Vegetation complex mapping of the southwest forest region of Western Australia (Mattiske and Havel 1998) as updated by Webb et al. (2016).
- Western Australian (WA) Threatened/Priority Ecological community (TEC/PEC), Department of Biodiversity Conservation and Attraction (DBCA). database extracts (DBCA 2021a) and TEC and PEC listings (DBCA 2018a, DBCA 2021b).
- Extract from the Department's Threatened Flora database and the Western Australian Herbarium database (DBCA 2021c).
- Threatened and Priority flora Naturemap search results (DBCA 2021d).
- Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) results (DAWE 2022).
- Atlas of Living Australia occurrence records (ALA 2022)[1]
- Environmentally sensitive areas distribution maps and data (DWER 2020).
- Surface hydrology lines (National) (Crossman & Li 2015).
- Geomorphic Wetlands, Augusta to Walpole DBCA-017 (DBCA 2017)
- Directory of important Wetlands in Australia – Western Australia data set, DBCA-045 (DBCA 2018b).
- Ramsar Wetlands of Australia. Bioregional Assessment Source Dataset. Department of the Environment (2015).
- Regional ecological linkages (Molloy et al. 2009).
- Index of Biodiversity Surveys for Biodiversity Assessments Database Search (DBCA 2022)[2]
- Declared Rare and Poorly Known Flora in the Warren Region (Hearn et al. 2006).

3.1.1 Significant flora likelihood of occurrence

Prior to undertaking the survey, an assessment of the likelihood of occurrence of Threatened and Priority flora occurring or that may occur within the survey area was undertaken. The

[1] An Atlas of Living Australia data base flora search was conducted post survey – no new Threatened or Priority flora were recorded in the search.

[2] An Index of Biodiversity Surveys for Assessment data base search was conducted post survey – no survey reports relevant to the survey area were found in the database.

rationale for determining this pre and post-likelihood of occurrence is provided in **Appendix 1**. The likelihood assessment was revised post-survey based on field observations.

3.2 Field survey

The flora and vegetation survey was undertaken on the 28, 29 October and 20 December 2021 by Russell Smith (flora permit FB61000473) and Colin Spencer (flora permit FB62000169) in accordance with the Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

The time of the survey was within the optimum time for field identification of most of the Threatened and Priority flora identified as potentially occurring within the survey area, including the summer flowering threatened orchid *Diuris drummondii*.

Dominant and characteristic species and some soil information were collected at relevés across the survey area, and vegetation condition was recorded at these and other points. This information was used to describe vegetation units. In total, 48 vegetation condition points and 23 relevés, as well as track files, were recorded.

Flora species not identified in the field were either photographed or collected for later identification. A species list was made of all native and introduced flora identified across all survey area.

The relevé and quadrat information was used to identify, describe and map vegetation units using the NVIS system (Level 7; NVIS 2017).

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

3.3 Survey limitations

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

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

Aspect	Constraint	Comment
Scope	Not a constraint	The survey scope was prepared in consultation with the Client and was designed to comply with EPA requirements.
Proportion of flora identified	Not a constraint	The survey was carried out within the prime flowering season for the high rainfall south-west forests.
Climatic and seasonal effects	Not a constraint	Rainfall till the end of December 2021 for Deeside the nearest station with data for 2021, was 112% of the long-term mean.
Availability of contextual information	Not a constraint	A regional vegetation survey has been conducted of the southern jarrah forest.
Completeness of the survey	Not a constraint	The survey was carried out within the spring flowering season, and all parts of the survey area were accessible.
Skill and knowledge of the botanists (vascular flora)	Not a constraint	The botanists have a combined 35 years of experience in flora surveys in the south-west of WA.
Disturbance (fire, grazing, clearing etc.)	Minor constraint	Some logging has taken place in the upland part of the survey area. Fire protection zone around bridge.

4 Desktop assessment results

4.1 Biogeographic region

The survey area is situated within the Warren biogeographic region (WAR), as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Commonwealth of Australia 2016).

4.2 Landform and soils

The survey area occurs in the northeast of the Denmark Southland Zone (254), stretching from the Darling Scarp in the West to the Stirling Range Zone and Albany Sandplain Zone in the east. Its southern limit is the Southern Ocean, and its northern limit is the southern edge of the Blackwood River Valley. This diverse area formed on the crystalline rocks of the Yilgarn craton and is overlain with a deeply weathered lateritic mantle or sedimentary deposits (Stuart-Street 2005). The Denmark Southland Zone comprises seven soil-landscape systems, three of which occur in close proximity to the survey area: the Frankland Hills and Perup Plateau system. The survey area occurs in loamy gravels and friable red/brown loamy earths of the Wilgarup Valley system in between the Frankland Hills and Perup Plateau system (Stuart-Street 2005).

The Wilgarup Valley system has been further divided into eight subsystems, one of which occurs within the survey area, the Yerraminup Subsystem: comprising valleys with 20-40 m relief, usually with gently slopes (5-8%) and loamy and sandy duplex soils with yellow subsoils (Stuart-Street 2005). Two soil phases of this subsystem occur within the survey area and are summarised in **Table 2.** Soil units within and in proximity to the survey area are shown in **Figure 3**.

Table 2. Soil mapping units occurring within the survey area (Stuart-Street 2005).

Subsystem	Soil Phase Descriptions
Yerraminup Subsystem	254WvYE1 Yerraminup gentle slope Phase: Gentle valley slopes usually <10%; loamy and sandy duplex soils with yellow subsoils are common.
	254WvYE2 Yerraminup steep slope Phase: Slopes of valleys with 20-40 m relief, usually with gently slopes (5-30%); loamy and sandy duplex soils with yellow subsoils are common.

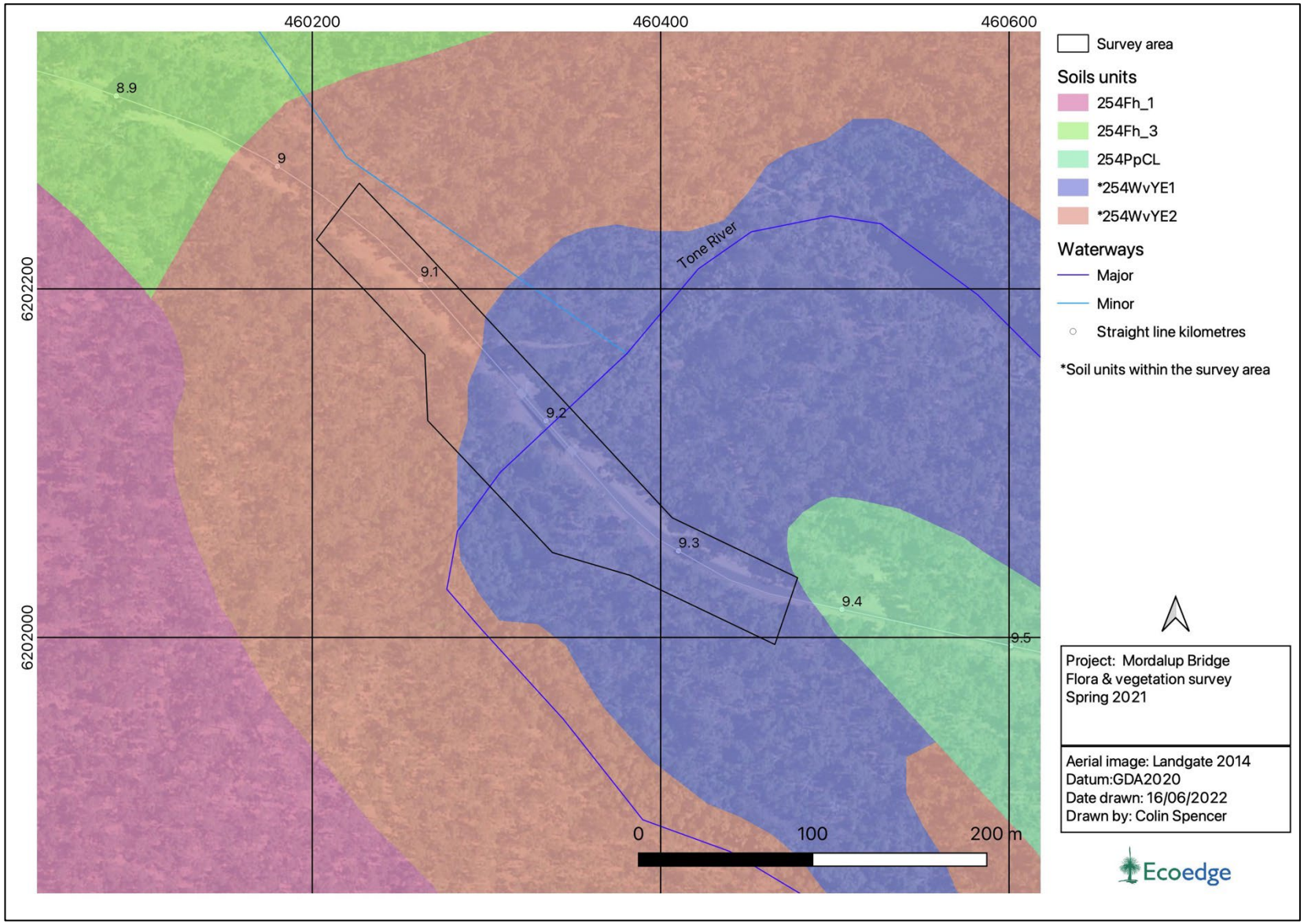

Figure 3. Soil units mapped in and nearby the survey area (Stuart-Street 2005).

4.3 Vegetation description according to pre-European mapping datasets

4.3.1 Complexes

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

One vegetation complex occurs within the survey area, according to the 1:50,000 mapping of the southwest forest region of Western Australia (Mattiske & Havel 1998) as updated by Webb et al. (2016). This is described in **Table 3** and shown in **Figure 4**.

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

Vegetation Complex Name	Description
Wilgarup, WL	Open forest of *Corymbia calophylla* with some *Eucalyptus marginata* subsp. *marginata* on slopes and tall shrubland of Melaleuca spp. on valley floors in the humid zone.

4.3.2 Vegetation associations

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

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

The survey area comprises only one Beard vegetation association, Association 3 'Medium forest; jarrah-marri'. This association extends beyond the survey for at least a radius of two kilometres[4].

[3] Beard's vegetation mapping units are referred to as 'associations' however these do not correspond to the NVIS Level 7 '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.

[4] A map has not been provided for this association because there is only one association which extends well beyond the survey area.

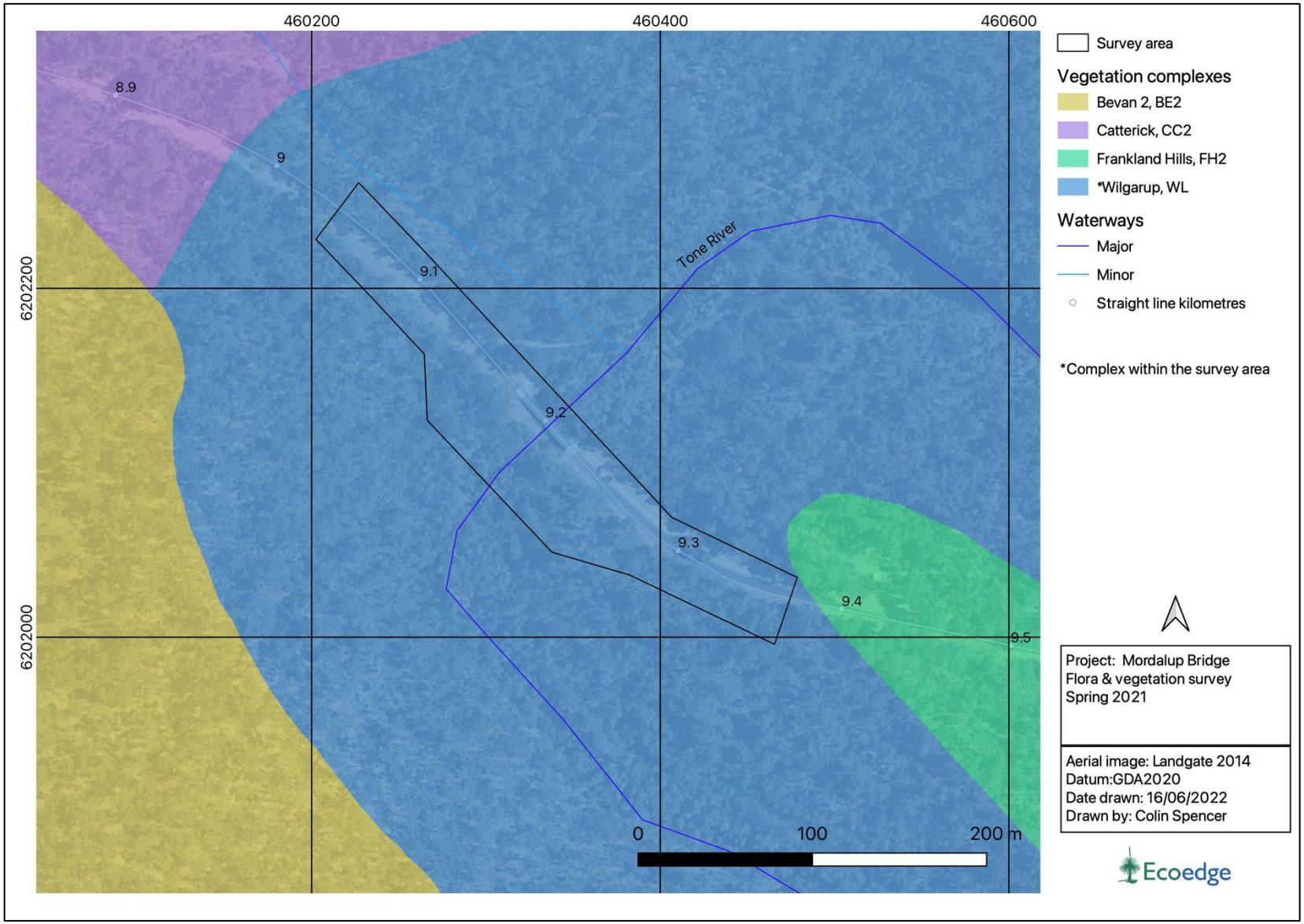

Figure 4. Vegetation complexes mapped in and nearby the survey area (Webb et al., 2016).

4.3.3 Assessment of remaining extent against pre-European extent

In 2001, the Commonwealth of Australia stated national targets and objectives for biodiversity conservation, which recognised that the retention of 30%, or more, of the pre-clearing extent of each ecological community was necessary if Australia's biological diversity was to be protected (Environment Australia 2001).

In its report on the state-wide 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 Western Australia (Government of Western Australia 2019a). This system is also based on the National retention target 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 presents the statistics as they relate to the percentage remaining of pre-European extent vegetation and the percentage of current extent in DBCA managed land of the one vegetation complex identified within the survey area, the Wilgarup Complex (WL). This complex exceeds the 30% pre-European extent retention targets for the Darling Plateau subregion and within the Shire of Manjimup.

Table 5 presents the pre-European extent statistics for one Beard vegetation association, Association 3, mapped across the survey area. This association exceeds the 30% retention targets at all levels of assessment.

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

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

Table 4. Vegetation complexes mapped within the survey area with regard to the Commonwealth retention targets (Government of Western Australia 2019a).

Mapping region	Pre-European (ha)	Current Extent (ha)	% Remaining	% Remaining in DBCA reserves
Wilgarup, WL				
Darling Plateau subregion of the SW Forests	5,906.24	3,461.32	58.60	46.37
Shire of Manjimup	5,906.24	3,461.32	58.60	N/A

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

Table 5. Vegetation associations within the survey area with regard to the Commonwealth retention targets (Government of Western Australia 2019b).

Mapping region	Pre-European (ha)	Current Extent (ha)	% Remaining	% Remaining in DBCA Managed Land*
Association 3				
State-wide:	2,661,404.62	1,803,437.48	67.76	55.23
IBRA region: Warren	250,262.10	195,318.18	78.05	67.98
Shire of Manjimup	287,389.56	238,176.00	82.88	78.48

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

4.4 Threatened and Priority ecological communities

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

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

Possible TECs that do not meet survey criteria may be added to the DBCA's PEC lists under Priorities 1, 2 or 3 (referred to as P1, P2, P3). Ecological communities that are adequately known, are rare but not Threatened, 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).

TECs can also be listed under the Commonwealth EPBC Act. There are three categories of TEC under the EPBC Act: Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) (DAWE 2020a). These are defined in **Appendix 3.**

The current listing of TECs and PECs is specified in DBCA (2018a, 2021b). The conservation categories for these TECs and PECs are defined in **Appendix 4**.

The desktop assessment of DBCA TEC PEC databases and a PMST query found no EPBC Act or BC Act listed TECs or Priority listed communities within 20 km of the survey area (DBCA 2021a, DAWE 2021).

4.5 Threatened and Priority flora

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

Threatened extant flora species are listed under Section 19 of the BC Act. They are ranked according to their level of threat using the International Union for Conservation of Nature (IUCN) Red List categories and criteria of Critically Endangered (CR), 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 is under consideration for future declaration as "Threatened flora", dependent on more information. Species classified as Priority One to Three (referred to as P1, P2 and P3) are in need of further survey to determine their status, while Priority Four (P4) species are adequately known rare or Threatened species that require regular monitoring.

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

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

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

Threatened or Priority flora occurring or predicted to occur within the study area are provided in a likelihood of occurrence table in **Appendix 7.** The list has been generated from a NatureMap search (DBCA 2021d), a PMST query (DAWE 2021) (**Appendix 8**), an Atlas of Living Australia search (ALA 2022) and DBCA and WA Herbarium Threatened and Priority flora data downloads (DBCA 2021c).

The data searches resulted in fifty-two significant species being identified as occurring or potentially occurring within this search area. Thirty-five of the species were considered Possible to occur within the survey area and seventeen Unlikely to occur within the survey area. The Possibly occurring Threatened species are listed in **Table 6**.

A breakdown of the likelihood of occurrence according to conservation status is provided in **Table 7,** with the complete pre and post likelihood assessment provided in **Appendix 7**. Known occurrences of Threatened and Priority flora within the study area are shown in **Figure 5** (DBCA 2021c).

Table 6. Pre-survey likelihood of occurrence according to conservation status.

Likelihood of occurrence	Total no	Priority 1	Priority 2	Priority 3	Priority 4	Threatened
Likely	**0**	0	0	0	0	0
Possible	**35**	3	10	11	4	7
Unlikely	**17**	1	2	6	4	4
Total	**52**	**4**	**12**	**17**	**8**	**11**

Table 7. Threatened flora potentially occurring within the survey area.

Species	Conservation Status	Pre-survey likelihood
Caladenia dorrienii	T (EN)	Possible
Caladenia winfieldii	T (EN)	Possible
Verticordia densiflora var. *pedunculata*	T (EN)	Possible
Caladenia christineae	T (VU)	Possible
Caladenia harringtoniae	T (VU)	Possible
Diuris drummondii	T (VU)	Possible
Diuris micrantha	T (VU)	Possible

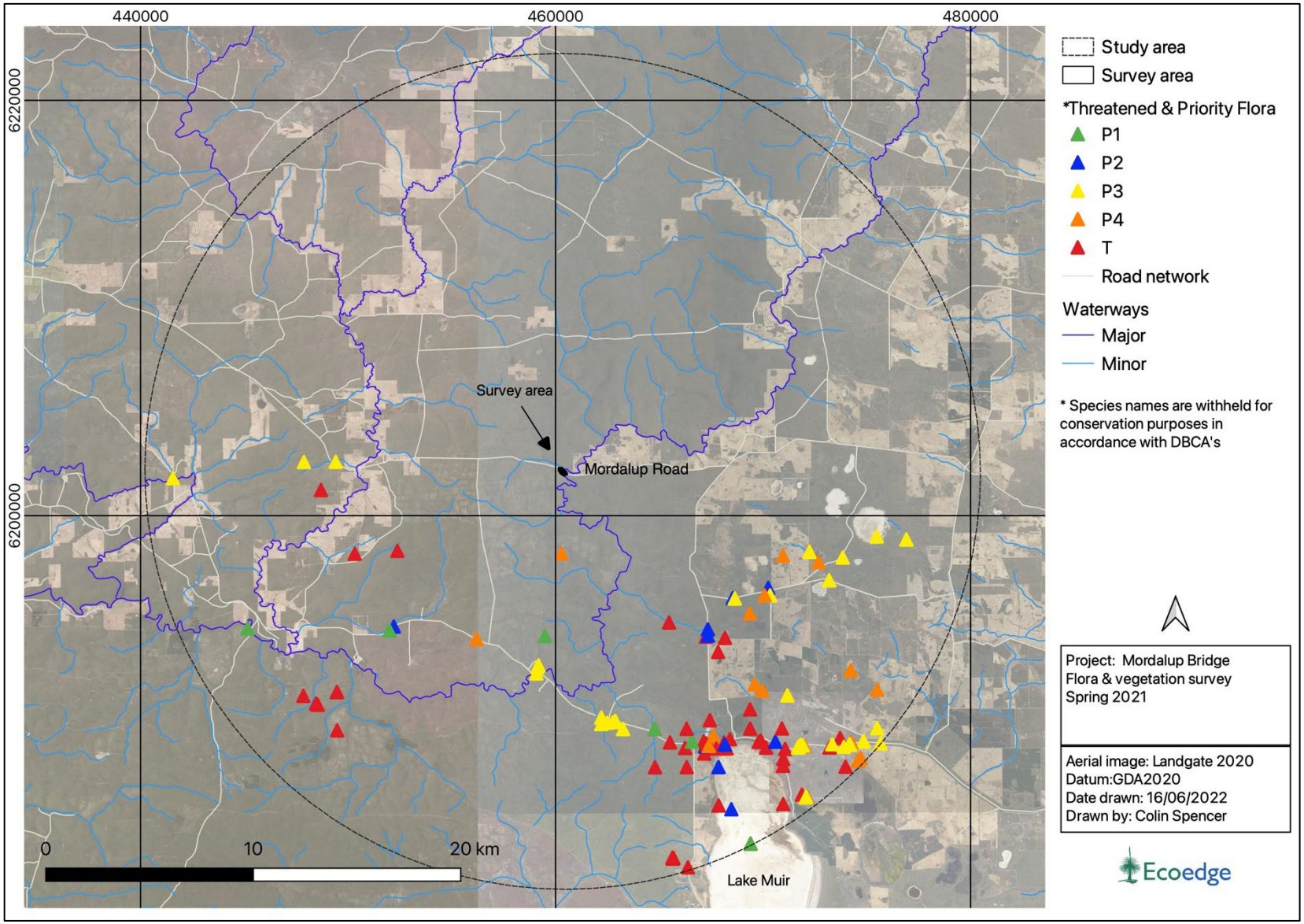

Figure 5. Threatened and Priority flora within 20 km of the survey area (DBCA 2021c).

4.6 Wetlands and watercourses

The Tone River intersects the survey area at approximately 9.2 SLK with an unnamed ephemeral tributary running parallel with the survey area in the western half on the northern side of Mordalup Road, approximately 37 m from the survey boundary (Crossman & Li 2015) (**Figure 6**).

No wetlands are formally mapped within the survey area, or in proximity to the survey area. The nearest formally mapped wetlands occur approximately 7 km to the east (DBCA 2017). These wetlands form part of the Byenup Lagoon wetlands, which are recognised in the Directory of Important wetlands (DIW) of Australia (DBCA 2018b). The Lake Muir wetland system, recognised as a RAMSAR wetland, also occurs within the study area approximately 15 km to the southeast (DoE 2015) (**Figure 7**).

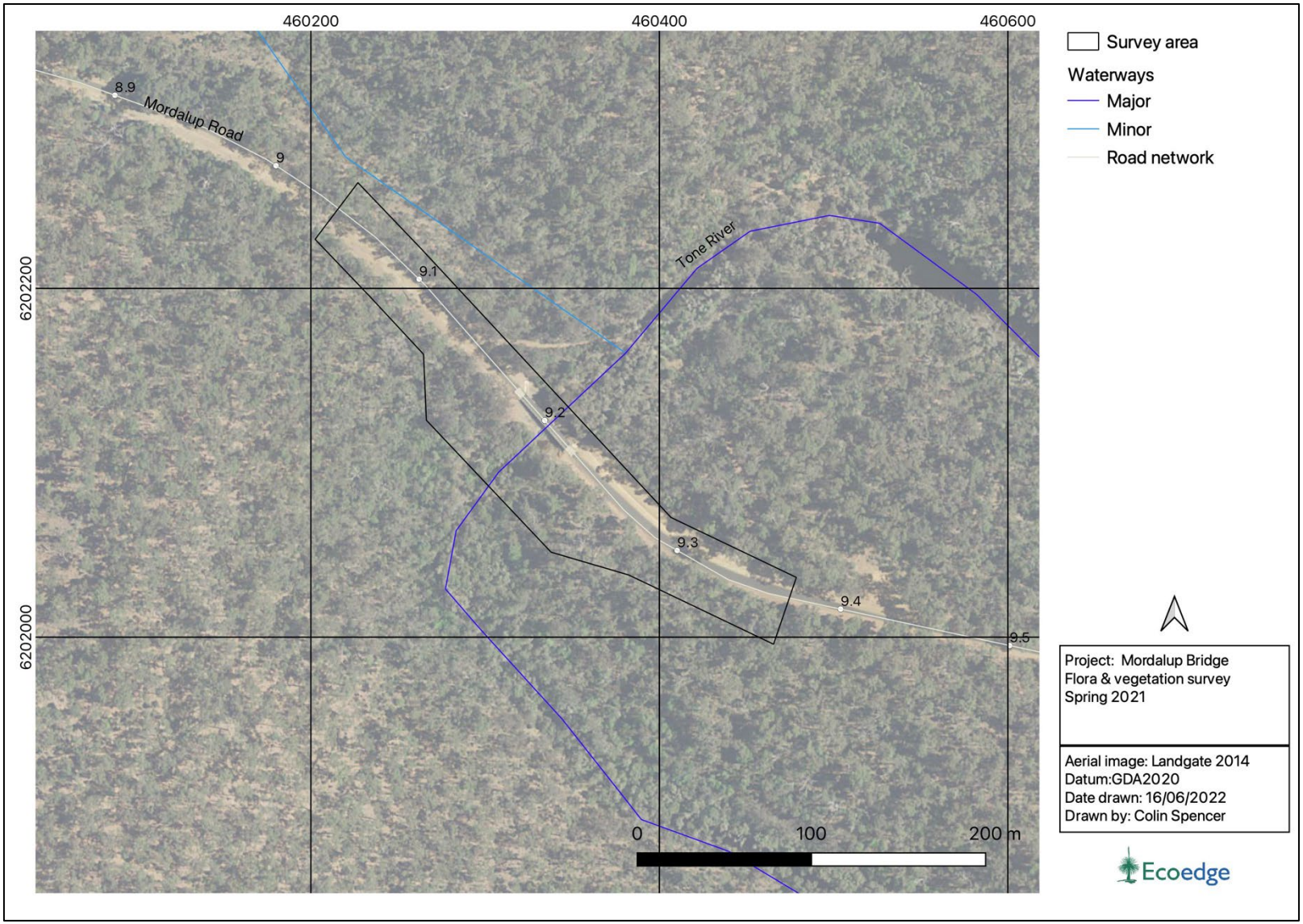

Figure 6. Watercourses and wetlands within the study area (Crossman & Li 2015).

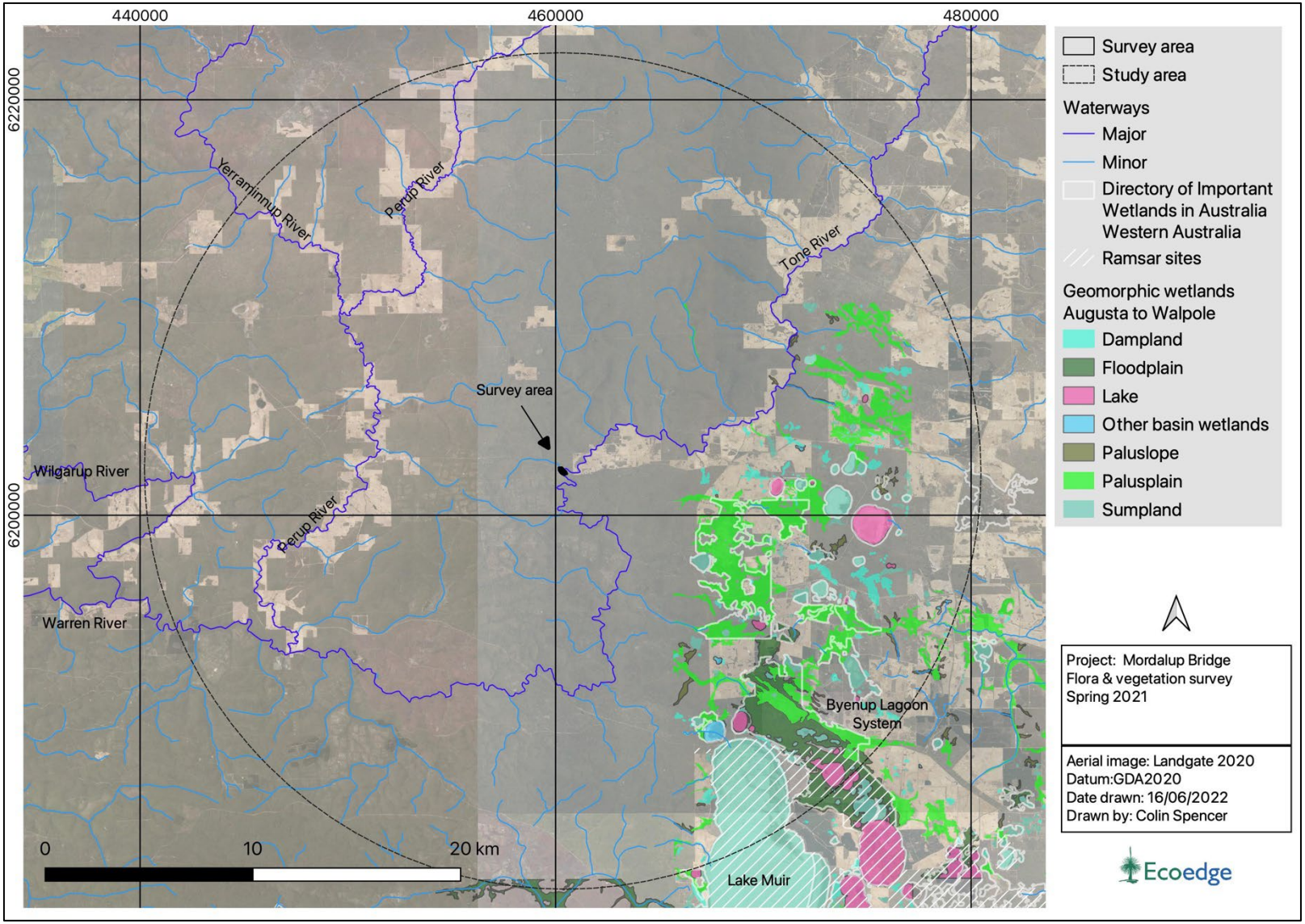

Figure 7. Watercourses and wetlands within the study area (Crossman & Li 2015, DBCA 2018b).

4.7 Regional ecological linkages

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

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

Molloy et al. (2009) assessed and assigned "proximity value" (PV) ratings to all patches of remnant native vegetation as a way of indicating the value of their connectivity with regional ecological linkages. This was based on their distance from the nearest mapped regional ecological linkage axis line and connected parcels of remnant vegetation (**Table 8**).

Table 8. Linkage proximity rating values assigned to patches of remnant vegetation within a landscape (Molloy et al. 2009).

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

All vegetation within the survey area has been assigned 1a PV rating by (Molloy et al. 2009) because it is contiguous with vegetation linked to a mapped regional ecological linkage associated with the Tone River and uncleared vegetation in DBCA managed state forest and conservation estate which extend beyond the survey area for some kilometres (**Figure 8**).

4.8 Environmentally sensitive areas

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

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

An ESA is mapped across most of the northern half of the survey area. This ESA is associated with Tone-Perup Nature Reserve which occurs to the north of the survey area (**Figure 9**). DBCA recognise this Nature Reserve to be home to some of Australia's rarest mammals such as numbats, chuditch, woylie, quenda, ringtail and brushtail possums, many species of birds and reptiles.

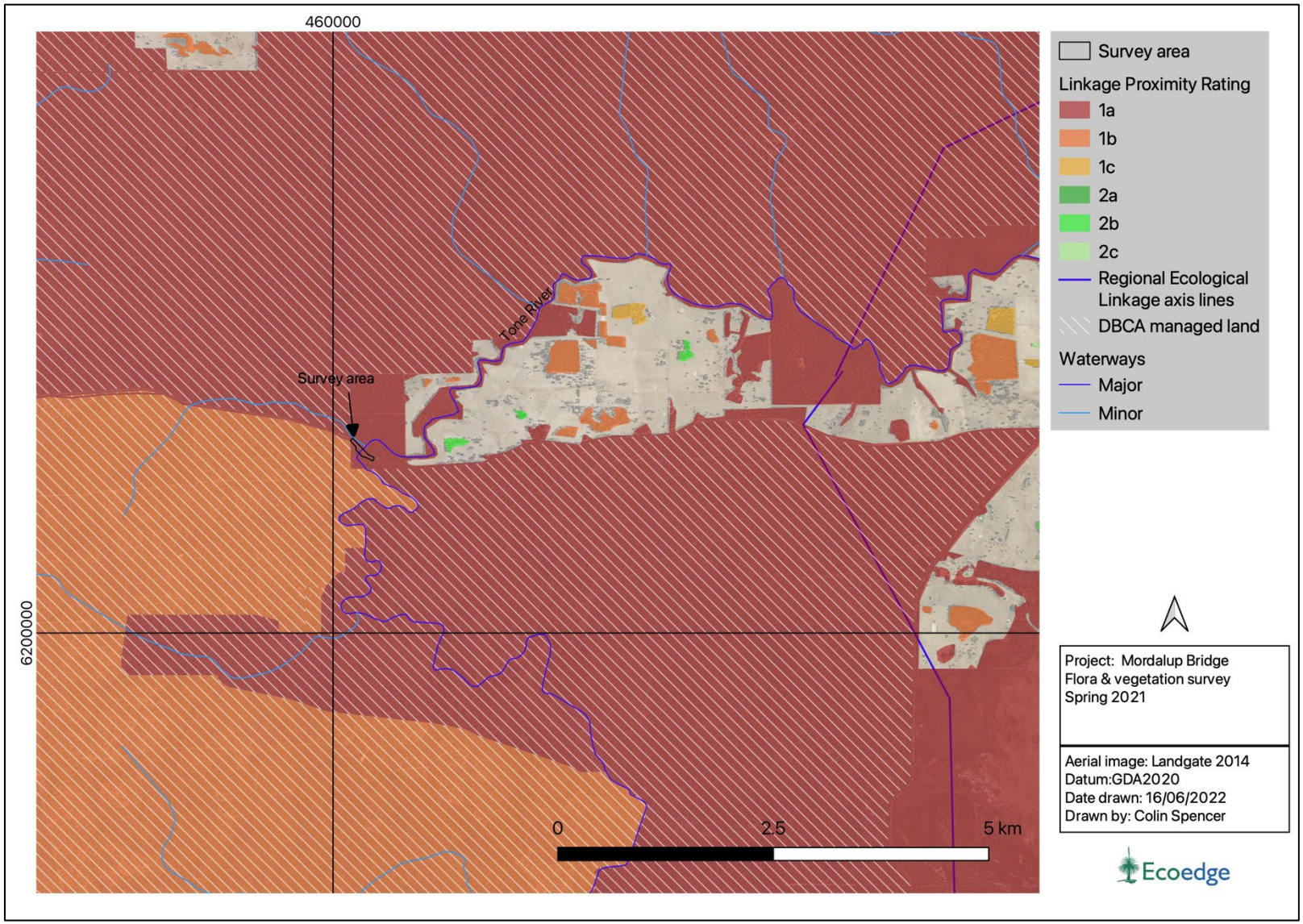

Figure 8. Regional ecological linkages in the study area (Molloy et al. 2009).

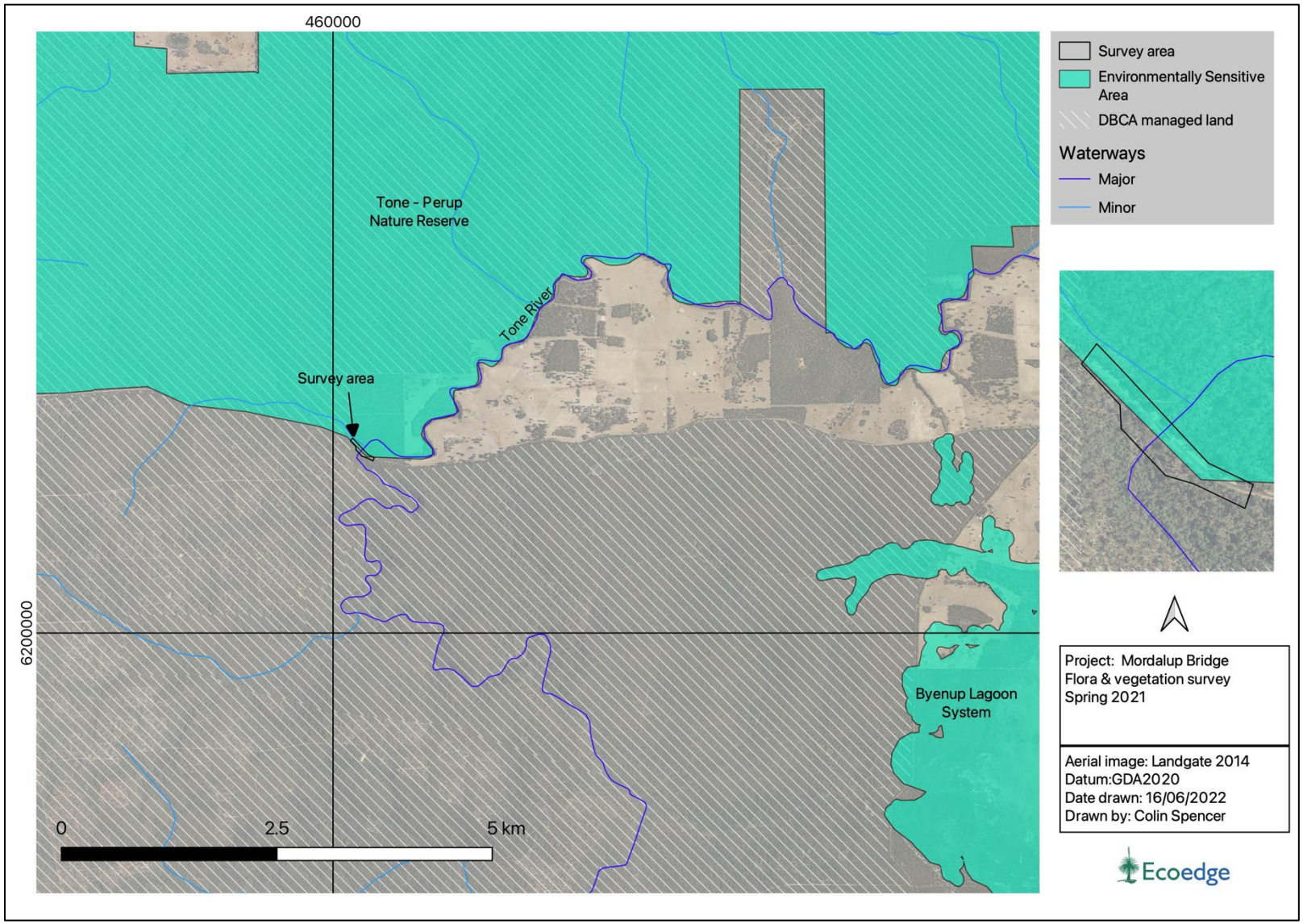

Figure 9. ESAs within the survey area (DWER 2020).

5 Field survey results

A map showing the location of data collection points (vegetation condition assessment points and relevés) and survey track files is provided in **Appendix 9.**

5.1 Flora

Ninety-two vascular flora taxa were identified within the survey area, of which twenty-one were introduced species (**Appendix 10**). The two plant families with the highest representation were the Asteraceae (12 species, incl. 4 non-natives) and Fabaceae (10 species, one non-native).

None of the introduced species was a Declared Pest Plant or Weed of National Significance.

5.1.1 Flora of significance

One Priority 2 species, *Montia australasica*, was found in the survey area on the alluvial flat adjacent to the stream, with a total population of about 500 plants was recorded. The location of the of plants are shown in **Figure 10**.

No other flora of significance was found.

5.1.2 Post survey likelihood of occurrence

A summary of the post-survey likelihood of occurrence according to conservation status is provided in **Table 9.** All of the 52 potentially occurring Threatened and Priority taxa were assigned a post-survey likelihood of 'unlikely', either because suitable habitat was not present or if suitable habitat was present, they were searched for at an appropriate time and not found.

The priority species, *Montia australasica* (P2), found within the survey area was not one of the potentially occurring species. identified in the desktop survey, however approximately 500 plants were found in the survey area. The location of *M. australasica* is shown in **Figure 10**.

Table 9. Vascular post-survey likelihood of occurrence according to conservation status.

Likelihood of occurrence	Total no	Priority 1	Priority 2	Priority 3	Priority 4	Threatened
Likely	**0**	0	0	0	0	0
Possible	**0**	0	0	0	0	0
Unlikely	**52**	4	12	17	8	11
Total	**52**	**4**	**12**	**17**	**8**	**11**

5.2 Significant weeds

There were no Declared Pest Plants or Weeds of National Significance in the survey area.

Figure 10. Location of Priority listed flora within the survey area.

5.3 Vegetation units

Two vegetation units were identified within the survey area, vegetation type EmCcOF (**Figure 11**) and vegetation type MpBsW (**Figure 12**). The EmCcOF vegetation unit is the most extensive type, covering about 76 % of the survey area. These vegetation types are described below.

5.3.1 Vegetation type EmCcOF

Eucalyptus marginata, *Corymbia calophylla*, (*E. rudis**) open forest over tall open shrubland of *Acacia saligna*, *Bossiaea linophylla*, (*Genista monspessulana*), *Hakea oleifolia*, *Xanthorrhoea preissii* over *Hibbertia commutata*, *Leucopogon capitellatus*, *L. propinquus*, *Macrozamia riedlei*, *Pteridium esculentum* medium shrubland over *Chamaescilla corymbosa*, **Erigeron sumatrensis*, *Daucus glochidiatus*, *Dichopogon capillipes*, **Lysimachia arvensis*, *Patersonia occidentalis*, *Sowerbaea laxiflora* forbland and **Briza maxima*, *Neurachne alopecuroidea* very open grassland on grey brown sandy loam. (**Eucalyptus rudis* and *Banksia seminuda* may be a component on lower slopes) (0.92 ha).

Figure 11. Vegetation type EmCcOF, open tall forest.

5.3.2 Vegetation type MpBsW

Melaleuca preissiana, *Banksia seminuda* low woodland over *Melaleuca incana* tall open shrubland over *Atriplex prostrata*, *Acaena echinata*, *Carpobrotus modestus*, **Mentha* x *piperita*, **Rumex acetosella*, **R. conglomeratus* forbland and *Juncus pallidus*, **J. microcephalus* scattered rushes on grey-brown clay loam (**Figure 12**) (0.21 ha).

Figure 12. Vegetation type MpBsW.

5.4 Vegetation condition

The majority of the vegetation was in Good or Very Good condition. The alluvial flats adjacent to the stream (vegetation unit MpBsW) were invaded by introduced species that had evidently originated from agricultural land upstream, and much of this area was rated as being in Degraded condition.

A breakdown of the condition of vegetation within the survey area is provided in **Table 10,** and shown in **Figure 13.**

Table 10. Area and percentage of the survey area in vegetation condition classes.

Condition	Area (ha)	%
Very Good	0.69	61.58
Good	0.16	14.37
Degraded	0.17	15.17
Completely Degraded	0.10	8.87
Total	1.13	100.00
Cleared	0.61	
Grand Total	**1.74**	

The extent and proportion of the total vegetated areas of each of these vegetation units are presented in **Table 11**. It can be seen that the majority (75%) of vegetation unit EmCcOF is in Very Good condition, whereas most of unit MpBsW is in Degraded condition. Vegetation condition is shown in **Figure 14**.

Table 11. Vegetation units by area and condition rating in the survey area.

Vegetation Unit	Condition	Area	%
EmCcOF	Very Good	0.69	75.52
	Good	0.10	10.77
	Degraded	0.03	2.83
	Completely Degraded	0.10	10.88
Sub-total		**0.92**	**100.00**
MpBsW	Good	0.06	30.29
	Degraded	0.15	69.71
Sub-total		0.21	100.00
Cleared		0.61	
	Total	**1.74**	

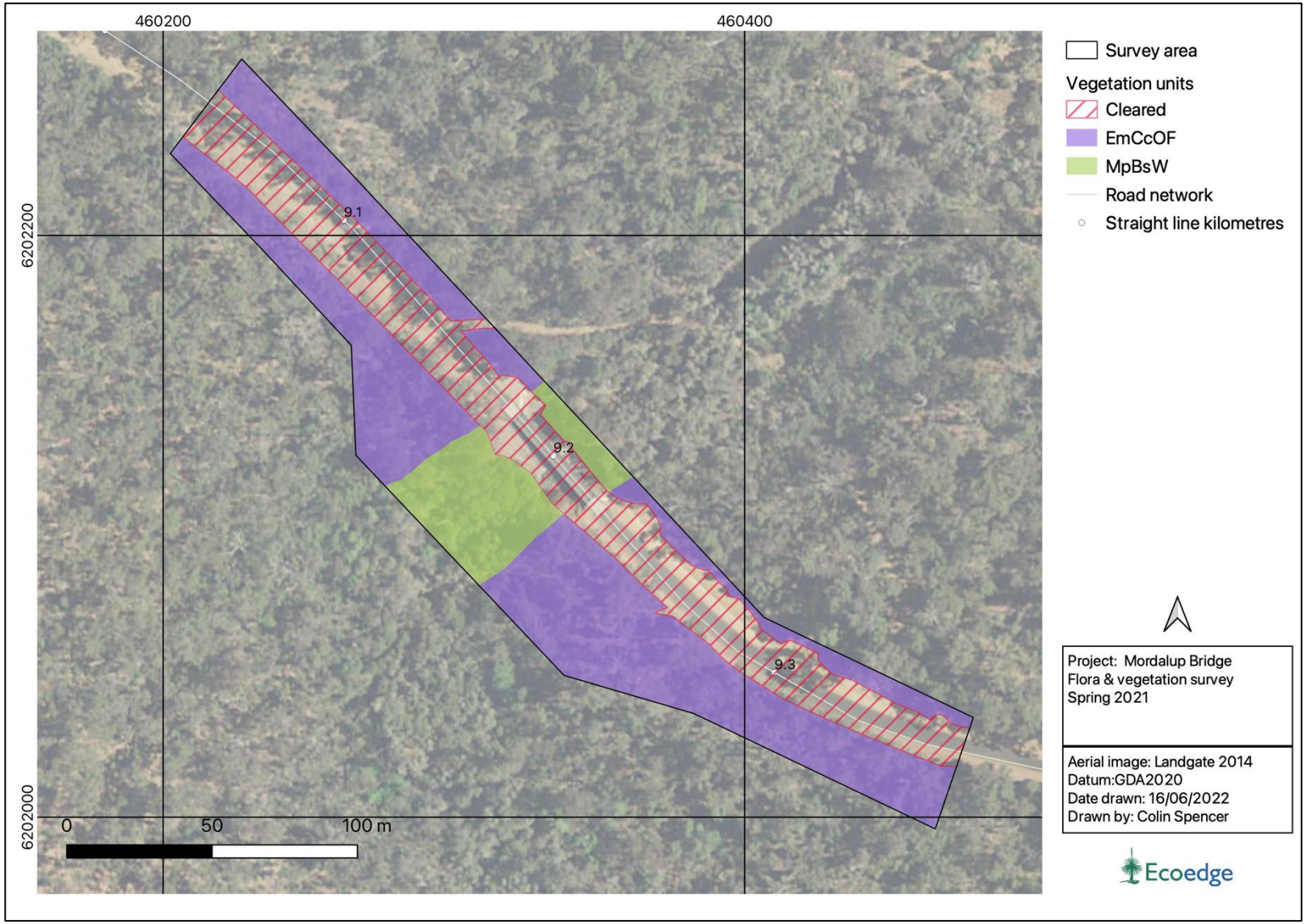

Figure 13. Vegetation units within the survey area.

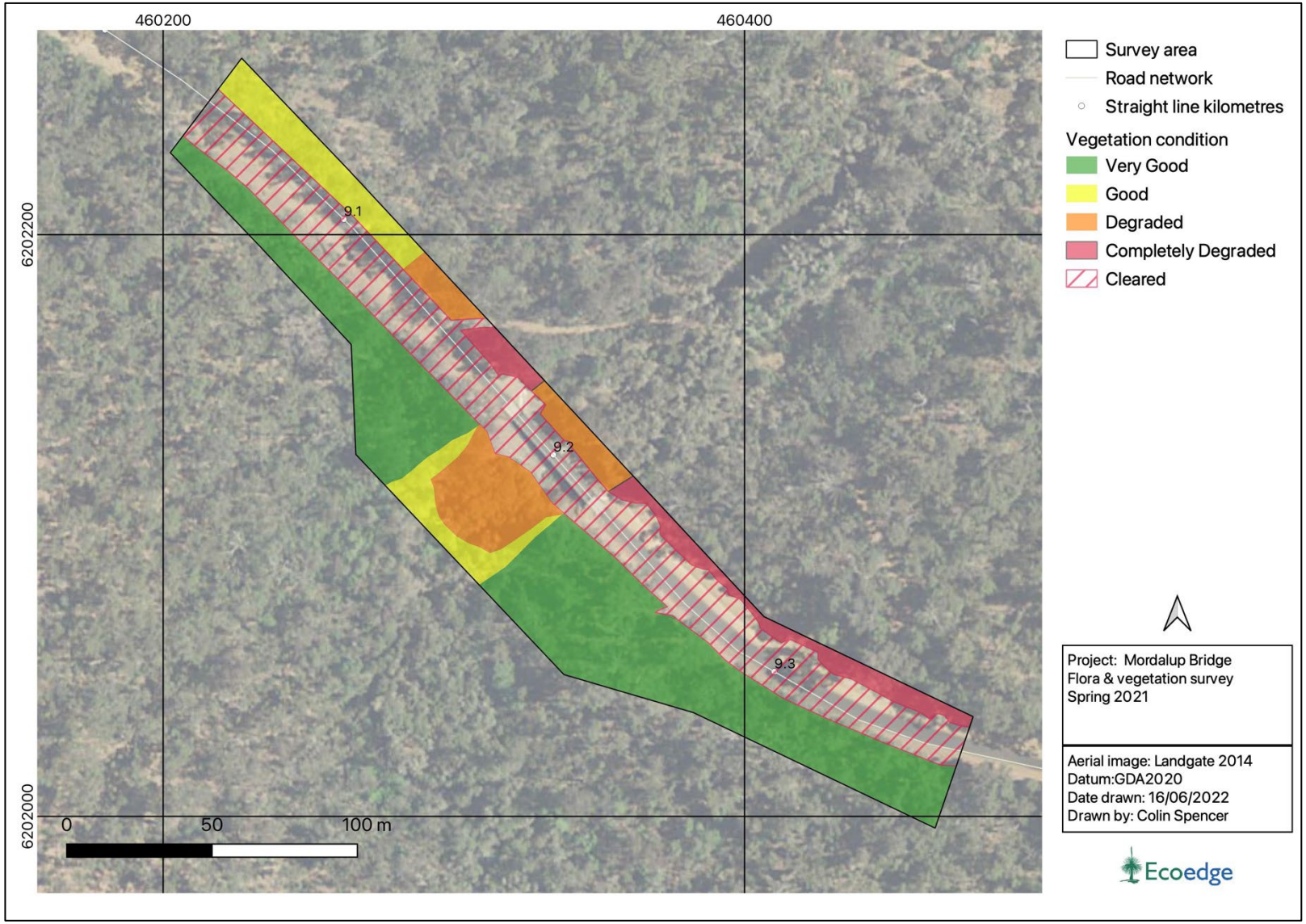

Figure 14. Vegetation condition within the survey area.

6 Discussion and conclusions

6.1 Significance of flora

6.1.1 Montia australasica (P2)

Montia australasica is known from six locations between Darkan, Busselton and Lake Muir. It is also found in the other southern states of Australia in moist to wet areas in grassy wetlands, swamps and creeks and is occasionally aquatic. It is a spreading fleshy herb with ground-running stems, long-stalked small white flowers at the ends of branches with white flowers sometimes tinged pink (**Figure 15**).

Figure 15. *Montia australasica* found on site.

6.2 Significance of vegetation

The EmCcOF vegetation unit is similar to several widespread forest types (e.g., types M and Y) of the north-eastern "low" rainfall parts of the southern jarrah forests studied by Strelein (1988). Vegetation unit MpBsW is similar to type A of Strelein, which he describes as being associated with flats and broad drainage lines and which covers "small areas scattered throughout the north-eastern low rainfall parts of the study area…."

So, although vegetation unit MpBsW is not a TEC or PEC, it does appear to be relatively restricted in area within the southern jarrah forest. Approximately four hundred *M. australasica* (P2) were found in this vegetation unit.

6.3 Vegetation complexes and associations

One vegetation complex was mapped to occur across the survey area, the Wilgarup Complex. The survey area vegetation is generally characteristic of this complex in terms of dominant species and structure. This complex has more than 30% of its pre-European extent of native vegetation remaining.

The survey area is mapped as Beard's vegetation association 3. The upland part of the survey area vegetation is characteristic of this association in terms of dominant species and structure, however, association 3 does not allow for the distinctive vegetation of creek lines, as occurs in the survey area. Association 3 has more than 30% of its pre-European extent of native vegetation remaining.

6.4 Riparian habitat

Vegetation unit MpBsW, which occurs along the edges of the Tone River, contains several taxa generally associated with riverine or wetland vegetation, including *Melaleuca preissiana* and *Banksia seminuda*.

The only riparian vegetation occurs in vegetation unit MpBsW and associated with the Tone River.

6.5 Regional ecological linkages

All vegetation within the survey area has been assigned 1a PV rating by Molloy et al. (2009) because it is contiguous with vegetation linked to a mapped regional ecological linkage associated with the Tone River and uncleared vegetation in DBCA managed state forest and conservation estate, which extends beyond the survey area for some kilometres.

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

6.6 Environmentally sensitive areas

An ESA is mapped across most of the northern half of the survey area. This ESA is associated with Tone-Perup Nature Reserve, which occurs to the north of the survey area

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

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

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

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

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

Appendix 2. Vegetation condition scale (EPA 2016).

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

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

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

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

Conservation code	Category
(T) Threatened ecological community pursuant to Sect 27 of the *Biodiversity Conservation Act 2016.*	
T	(T) CR – Critically endangered An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.
	(T) EN - Endangered An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
	(T) VU - Vulnerable An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.
(P) Priority species – possible threatened communities.	
P1	Poorly known communities Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

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

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

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

Conservation code	Category
P3	Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

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

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

Appendix 7. Pre and post likelihood of occurrence table.

SPECIES	CATEGORY	FLOWERING	DESCRIPTION AND HABITAT	Pre-survey likelihood	Post-survey likelihood
Andersonia annelsii	T (CR)	Oct	Low shrub, 0.1-0.25 m high. Fl. white. Sandy loam or clay, skeletal soils. Low quartzite ridges, granite outcrops	Unlikely	Unlikely (U2)
Brachyscias verecundus	T (CR)	Nov to early December	Annual (or ephemeral), herb, 0.012-0.022 m high, entirely glabrous. Fl. white/cream. Recorded in winter-wet clay over ironstone in open to tall shrubland, other occurrence in moss sward in granite outcrop in Shannon River National Park has been officially disregarded, according the EPBC Act conservation advice (2006) for this species .	Unlikely	Unlikely (U2)
Caladenia dorrienii	T (EN)	Sep-Nov	Tuberous, perennial, herb, 0.1-0.2 m high. Fl. white-cream-yellow. Clayey loam. Moist sites adjacent to rivers and seasonal creeks.	Possible	Unlikely (U2)
Caladenia winfieldii	T (EN)	Oct-Nov	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. pink. Grey-black sand, sandy loam. Winter-wet depressions, swamps.	Possible	Unlikely (U2)
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.	Possible	Unlikely (U2)
Verticordia plumosa var. *vassensis*	T (EN)	Sep-Feb	Shrub, 0.3–1 m high. Fl. pink. White/grey sand. Winter-wet flats.	Unlikely	Unlikely (U2)
Caladenia christineae	T (VU)	Sep-Nov	Tuberous, perennial, herb, 0.25-0.4 m high. Fl. white-cream-yellow. Sand, clayey loam, laterite. Margins of winter-wet flats, swamps, & freshwater lakes.	Possible	Unlikely (U2)
Caladenia harringtoniae	T (VU)	Oct-Nov	Tuberous, perennial, herb, 0.2-0.4 m high. Fl. pink. Sandy loam. Winter-wet flats, margins of lakes, creeklines, granite outcrops.	Possible	Unlikely (U2)

SPECIES	CATEGORY	FLOWERING	DESCRIPTION AND HABITAT	Pre-survey likelihood	Post-survey likelihood
Diuris drummondii	T (VU)	Nov-Jan	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow. Low-lying depressions, swamps.	Possible	Unlikely (U1)
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.	Possible	Unlikely (U2)
Drakaea micrantha	T (VU)	Sep-Oct	Tuberous, perennial, dwarf hammer orchid, 0.15–0.3 m high. Fl. red, yellow. Small heart shaped leaf with green veins. White-grey infertile sand in *Eucalyptus marginata, Allocasuarina fraseriana* woodland or forest. Often under *Kunzea ericifolia, K. glabrescens* with *Paracaleana nigrita* and other Drakaea species.	Unlikely	Unlikely (U1)
Caladenia caesarea subsp. *transiens*	P1	Sep-Oct	Tuberous, perennial, herb, 0.2-0.3 m high. Fl. yellow. Sand, loam.	Possible	Unlikely (U2)
Caladenia validinervia	P1	Sep-Oct	Tuberous, perennial, herb, single erect, hairy leaf and up to three greenish to creamy white flowers with red stripes on the sepals and petals. Only known from an area between Rocky Gully and Collie. Grows in jarrah and marri woodland.	Possible	Unlikely (U2)
Deyeuxia inaequalis	P1	Summer	Erect, tufted annual, grass-like or herb, 0.75 m high. Loam.	Possible	Unlikely (U2)
Thomasia dielsii	P1	Oct to Nov?	3-4 ft high, mauve papery flowers, woody stem. Laterite ridge top.	Unlikely	Unlikely (U1)
Astartea sp. Lake Muir (B.L. Rye 230128 & R.W. Hearn)	P2	Dec - Jan	Non-lignotuberous plants 0.3-0.6 m high, with a fine single stem at base and very erect main branchlets, peduncles often short; flowers very pale to strong medium pink. Swamp habitat.	Unlikely	Unlikely (U2)
Caladenia erythrochila	P2	Sep-Oct	Tuberous, perennial, herb, 0.2-0.25 m high. Fl. red-brown-purple. Grey sand over laterite. Well-drained lateritic soils under scattered jarrah.	Unlikely	Unlikely (U2)

SPECIES	CATEGORY	FLOWERING	DESCRIPTION AND HABITAT	Pre-survey likelihood	Post-survey likelihood
Caladenia startiorum	P2	Sep to Oct	Tuberous, perennial, herb, 0.2-0.6 m high. Fl. pink & white. Clay loam. Winter-wet swamps.	Possible	Unlikely (U1)
Caladenia ultima	P2	Nov to Dec	Tuberous, perennial, herb, 0.15-0.25 m high. Fl. cream-yellow. Winter-wet situations, summer burnt areas.	Possible	Unlikely (U2)
Cardamine paucijuga	P2	Sep-Oct	Slender erect annual, herb, to 0.4 m high. Fl. white. In moist to dry habitats.	Possible	Unlikely (U2)
Eryngium sp. Lake Muir (E. Wittwer 2293)	P2	Jan	Near prostrate herb. Fl. white. Black peaty silty soils. Winter-wet swamps.	Possible	Unlikely (U1)
Euphrasia scabra	P2	Oct	Erect annual, herb, (0.085-)0.15-0.35(-0.5) m high. Fl. Yellow, Margins of swamp areas, often in wet, peaty soil	Possible	Unlikely (U2)
Lepyrodia extensa	P2		Herb (sedge-like), ca. 0.3 m high. Sand & sandy peat. Seasonally inundated swamps.	Possible	Unlikely (U2)
Lilaeopsis polyantha	P2	Nov	Rhizomatous herb, 10 cm high x 75 cm wide. Fl red, maroon, clonal. Winter wet swamp. Black peaty sandy clay.	Possible	Unlikely (U1)
Schoenus loliaceus	P2	Aug-Nov	Annual, grass-like or herb (sedge), 0.03–0.06 m high. Sandy soils. Winter-wet depressions.	Possible	Unlikely (U2)
Senecio oldfieldii	P2	Sep - Nov	Upright annual or perennial, herb, to 1 m high. Fl. yellow, Sep to Nov. Brown sand, pale grey loamy sand over sandy clay. On moderately exposed gently undulating plains, lower slopes, roadsides.	Possible	Unlikely (U2)
Thysanotus unicupensis	P2	Oct to Dec	Erect perennial dwarf shrub, height to 15 cm, width to 11 cm; flowers purple. Jarrah - Marri forest.	Possible	Unlikely (U2)
Amanita drummondii	P3	May to July	Small to medium fruiting bodies with a milky coffee to hazel to sepia pileus with a conspicuous sulcate margin, and a central patch of universal veil that is white or has a pale brown tinge.	Possible	Unlikely (U2)

SPECIES	CATEGORY	FLOWERING	DESCRIPTION AND HABITAT	Pre-survey likelihood	Post-survey likelihood
Calytrix pulchella	P3	Aug-Nov	Shrub, 0.3-0.7(-1) m high. Fl. pink. Grey or white sand over laterite. Ridges, flats.	Unlikely	Unlikely (U2)
Cryptandra arbutiflora var. *pygmaea*	P3	Aug-Nov	Low & spreading shrub, 0.05-0.2 m high. Fl. white. Shallow clay. Around granite outcrops.	Unlikely	Unlikely (U2)
Dampiera triloba	P3	Oct	Decumbent shrub 20 cm high x 30 cm wide. Flowers dark blue, throat white, in full flower. Sandy rise, peaty sand over clay.	Possible	Unlikely (U2)
Eryngium sp. ferox	P3	Nov - December	Tuberous herb; flowers metallic blue, inflorescence bracts metallic blue.	Possible	Unlikely (U2)
Kunzea micrantha subsp. hirtiflora	P3	Sept - October	Erect shrub 1.5 m high with pink flowers. Hybanthus hairy.	Possible	Unlikely (U2)
Leptinella drummondii	P3	Nov-Dec or Jan-Feb	Small herb. Fl. yellow-cream. Clay loam, mud. Along rivers.	Possible	Unlikely (U2)
Melaleuca micromera	P3	Sep to Oct	Shrub, 1-4 m high. Fl. yellow. Gravelly sandy loam or clay.	Possible	Unlikely (U2)
Melaleuca pritzelii	P3	Aug-Oct or Dec	Shrub, 0.7-1.6 m high. Fl. cream. Sandy or clayey soils. Swampy areas.	Possible	Unlikely (U2)
Montia australasica	P2		Prostrate perennial herbs with rhizomatous stems to 30 cm long, rooting at the nodes; leaves alternate, erect, linear to narrow-oblanceolate, petals white to pale-pink. Swamp and moist areas. Flowering Nov -March.	Unlikely	Recorded (approximately 500 plants recorded)
Schizaea dichotoma	P3	Jun or Aug	Rhizomatous, perennial, herb or (fern), 0.1-0.5 m high, fronds dichotomously divided; sporangia-bearing segments in pinnately arranged `cock's comb'. Sand. Amongst boulders in gorges.	Unlikely	Unlikely (U2)
Schoenus benthamii	P3	Oct-Nov	Tufted perennial, grass-like or herb (sedge), 0.15-0.45 m high. Fl. brown. White, grey sand, sandy clay. Winter-wet flats, swamps.	Possible	Unlikely (U2)

SPECIES	CATEGORY	FLOWERING	DESCRIPTION AND HABITAT	Pre-survey likelihood	Post-survey likelihood
Stylidium rhipidium	P3	Oct-Nov	Slender annual, herb, ca 0.05 m high. Fl. white. Sandy soils. Wet creek flats, swamps, granite outcrops.	Possible	Unlikely (U2)
Stylidium roseonanum	P3	Oct	Diminutive, short-lived annual, herb, 0.015-0.03 m high. Fl. red-white. Swamps.	Unlikely	Unlikely (U2)
Synaphea decumbens	P3	Sep-Oct	Decumbent shrub. Fl. yellow. Sand over laterite.	Unlikely	Unlikely (U2)
Synaphea hians	P3	Jul-Nov	Prostrate or decumbent shrub, 0.15-0.6 m high, to 1 m wide. Fl. Yellow. Sandy soils. Rises.	Possible	Unlikely (U2)
Wurmbea sp. Cranbrook (A.R. Annels 3819)	P3	Sep - Oct	Growing in wetter depressions in swamp in silty clay sediments.	Unlikely	Unlikely (U2)
Stylidium lepidum	P3	Oct-Nov	Spreading, rosetted perennial, herb, ca 0.05 m high, forming densely packed colonies. Fl. pink, orange. Gravelly sand or loam, clay. Winter-wet depressions.	Possible	Unlikely (U2)
Banksia porrecta	P4	Jul to Aug	Prostrate, sprawling, mat-forming, lignotuberous shrub, 0.2-0.35 m high, 0.6-4 m wide. Fl. white-cream. White/grey sand, sandy loam.	Possible	Unlikely (U2)
Gastrolobium ovalifolium	P4	Aug - Sep	Prostrate, spreading shrub, to 0.1 m high. Fl. orange & purple & yellow & red. Sandy clay. Gravelly hills.	Unlikely	Unlikely (U1)
Microtis quadrata	P4	Dec to Jan	Mignonette orchid 0.3 - 0.8 m high. Fl. Yellow green, clay based winter wet flats.	Possible	Unlikely (U2)
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)	Unlikely	Unlikely (U2)
Schoenus natans	P4	Oct	Aquatic annual, grass-like or herb (sedge), 0.3 m high. Fl. brown. Winter-wet depressions.	Possible	Unlikely (U1)
Tripterococcus sp. Brachylobus (A.S. George 14234)	P4	Nov-Dec or Feb	Perennial, herb, to 1 m high. Fl. yellow/yellow-green. Grey sand, red clay, laterite, often moist. Low-lying flats.	Possible	Unlikely (U2)

SPECIES	CATEGORY	FLOWERING	DESCRIPTION AND HABITAT	Pre-survey likelihood	Post-survey likelihood
Trithuria australis	P4	Nov - Dec	Small reddish aquatic herb. Ponds, pools	Unlikely	Unlikely (U2)
Xanthosia eichleri	P4	Oct-Nov	Erect, procumbent or decumbent shrub (subshrub), 0.05-0.25 m high, leaves simple, cuneate; umbels simple; petals shorter than sepals. Fl. white-cream. Grey sand over granite, sandy loam. Granite outcrops, jarrah/marri woodland.	Unlikely	Unlikely (U2)

Note :

U1= No suitable habitat was observed, and the taxon is known to be restricted to a narrow and clearly defined habitat type.

U2 = Suitable or potential habitat was present and appropriately searched, but the taxon was not observed.

Appendix 8. Protected Matters Search Tool and NatureMap reports

NatureMap
Mapping Western Australia's biodiversity

Bridge 3923 Mordalup NatureMap Sig Flora Report 23/10/21_20km

Created By Guest user on 23/10/2021

Kingdom Plantae
Conservation Status Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 116° 35' 00" E,34° 20' 00" S
Buffer 20km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	14455	*Andersonia annelsii*		T	
2.	20351	*Astartea sp. Lake Muir (B.L. Rye 230128 & R.W. Hearn)*		P2	
3.	32158	*Banksia porrecta*		P4	
4.	13855	*Caladenia caesarea subsp. transiens*		P1	
5.	13617	*Caladenia christineae*		T	
6.	10850	*Caladenia dorrienii*		T	
7.	18504	*Caladenia erythrochila*		P2	
8.	13621	*Caladenia harringtoniae*		T	
9.	15381	*Caladenia startiorum*		P2	
10.	18400	*Caladenia ultima*		P2	
11.	44898	*Caladenia validinervia*		P1	
12.	13864	*Caladenia winfieldii*		T	
13.	5474	*Calytrix pulchella*		P3	
14.	3006	*Cardamine paucijuga*		P2	
15.	14791	*Cryptandra arbutiflora var. pygmaea*		P3	
16.	7485	*Dampiera triloba*		P3	
17.	298	*Deyeuxia inaequalis*		P1	
18.	10796	*Diuris drummondii (Tall Donkey Orchid)*		T	
19.	41803	*Eryngium sp. Ferox (G.J. Keighery 16034)*		P3	
20.	15865	*Eryngium sp. Lake Muir (E. Wittwer 2293)*		P2	
21.	7059	*Euphrasia scabra (Yellow Eye-bright)*		P2	
22.	3911	*Gastrolobium ovalifolium (Runner Poison)*		P4	
23.	19444	*Grevillea acropogon*		T	
24.	17786	*Kunzea micrantha subsp. hirtiflora*		P3	
25.	8100	*Leptinella drummondii*		P3	
26.	17954	*Lepyrodia extensa*		P2	
27.	16985	*Lilaeopsis polyantha*		P2	
28.	5937	*Melaleuca micromera*		P3	
29.	13276	*Melaleuca pritzelii*		P3	
30.	36200	*Ornduffia submersa*		P4	
31.	25782	*Scaevola sp. Cockburn Range (G.W. Carr 3369 & A.C. Beauglehole 47147)*		P1	
32.	25781	*Scaevola sp. Isabella Range (R.D. Royce 1918)*		P1	
33.	22	*Schizaea dichotoma*		P3	
34.	974	*Schoenus benthamii*		P3	
35.	999	*Schoenus loliaceus*		P2	
36.	1003	*Schoenus natans (Floating Bog-rush)*		P4	
37.	23979	*Senecio oldfieldii*		P2	
38.	7747	*Stylidium lepidum (Redcaps)*		P3	
39.	7786	*Stylidium rhipidium (Fan Triggerplant)*		P3	
40.	7791	*Stylidium roseonanum*		P3	
41.	16937	*Synaphea decumbens*		P3	
42.	16769	*Synaphea hians*		P3	
43.	2327	*Synaphea preissii*		P3	
44.	5078	*Thomasia dielsii*		P1	
45.	13783	*Thysanotus sp. Badgingarra (E.A. Griffin 2511)*		P2	
46.	35519	*Thysanotus unicupensis*		P3	
47.	44444	*Tripterococcus sp. Brachylobus (A.S. George 14234)*		P4	
48.	33019	*Trithuria australis*		P4	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
49.	12412	*Verticordia densiflora var. pedunculata*		T	
50.	16394	*Wurmbea sp. Cranbrook (A.R. Annels 3819)*		P3	
51.	18453	*Xanthosia eichleri*		P4	

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

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

Australian Government

Department of Agriculture, Water and the Environment

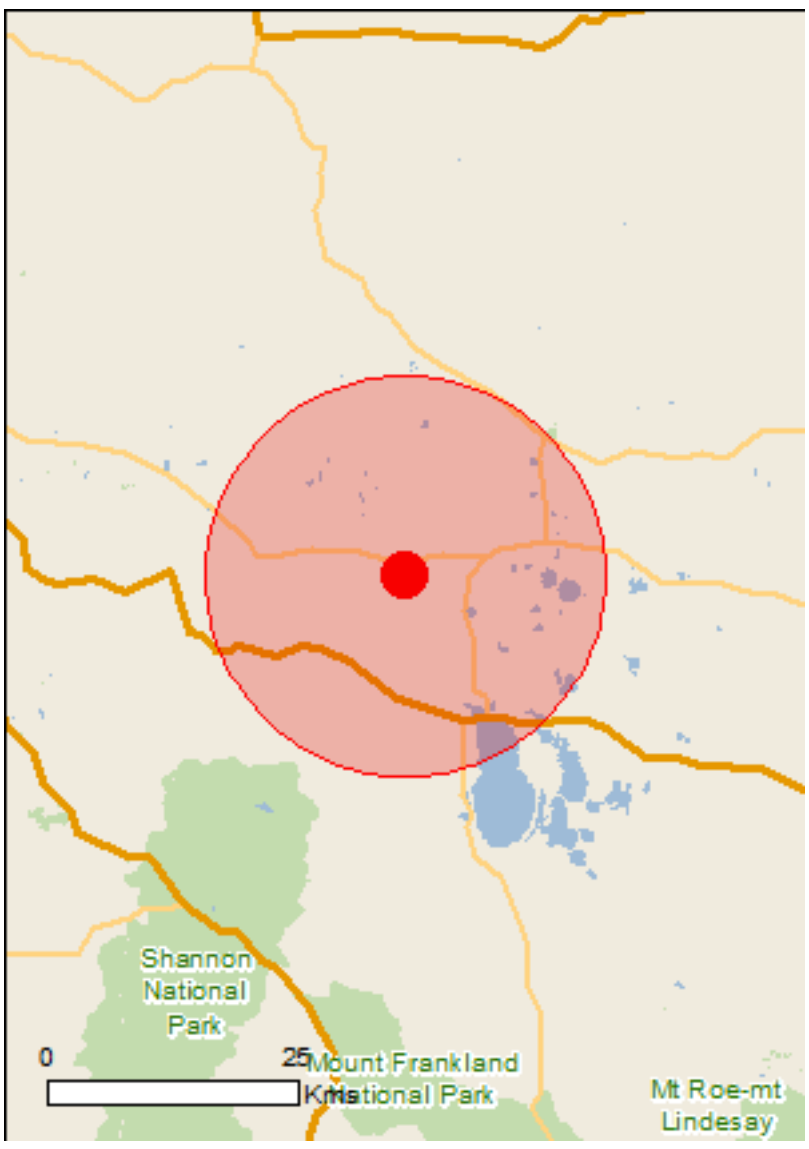
EPBC Act Protected Matters Report

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

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

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

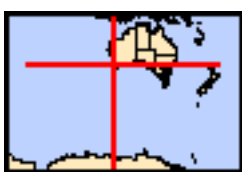
Report created: 23/10/21 13:34:21



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

Coordinates

Buffer: 20.0Km



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:	None
Listed Threatened Species:	26
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	10
Regional Forest Agreements:	1
Invasive Species:	23
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Muir-byenup system	Within Ramsar site

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris 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	Species or species habitat 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
Falco hypoleucos		
Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Fish		
Galaxiella nigrostriata		
Blackstriped Dwarf Galaxias, Black-stripe Minnow [88677]	Endangered	Species or species habitat known to occur within area
Nannatherina balstoni		
Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Bettongia penicillata ogilbyi		
Woylie [66844]	Endangered	Species or species habitat known to occur within area
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Myrmecobius fasciatus		
Numbat [294]	Endangered	Species or species

Name	Status	Type of Presence
		habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat known to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat likely to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Andersonia annelsii [84925]	Critically Endangered	Species or species habitat known to occur within area
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
Caladenia christineae Christine's Spider Orchid [56716]	Vulnerable	Species or species habitat known to occur within area
Caladenia harringtoniae Harrington's Spider-orchid, Pink Spider-orchid [56786]	Vulnerable	Species or species habitat known to occur within area
Caladenia winfieldii Majestic Spider-orchid [64504]	Endangered	Species or species habitat known to occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat may occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Grevillea acropogon [68272]	Endangered	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. vassensis Vasse Featherflower [55804]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea 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 ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Boyndaminup	WA
Cowerup	WA
Greater Kingston	WA
Kodjinup	WA
Lake Muir	WA
NTWA Bushland covenant (0124)	WA
Pindicup	WA
Shannon	WA
Tone-Perup	WA
Unicup	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		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
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within

Name	Status	Type of Presence
		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
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Byenup Lagoon System	WA
Lake Muir	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

-34.33333 116.58333

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 9. Track log, quadrats and relevés within the survey area.

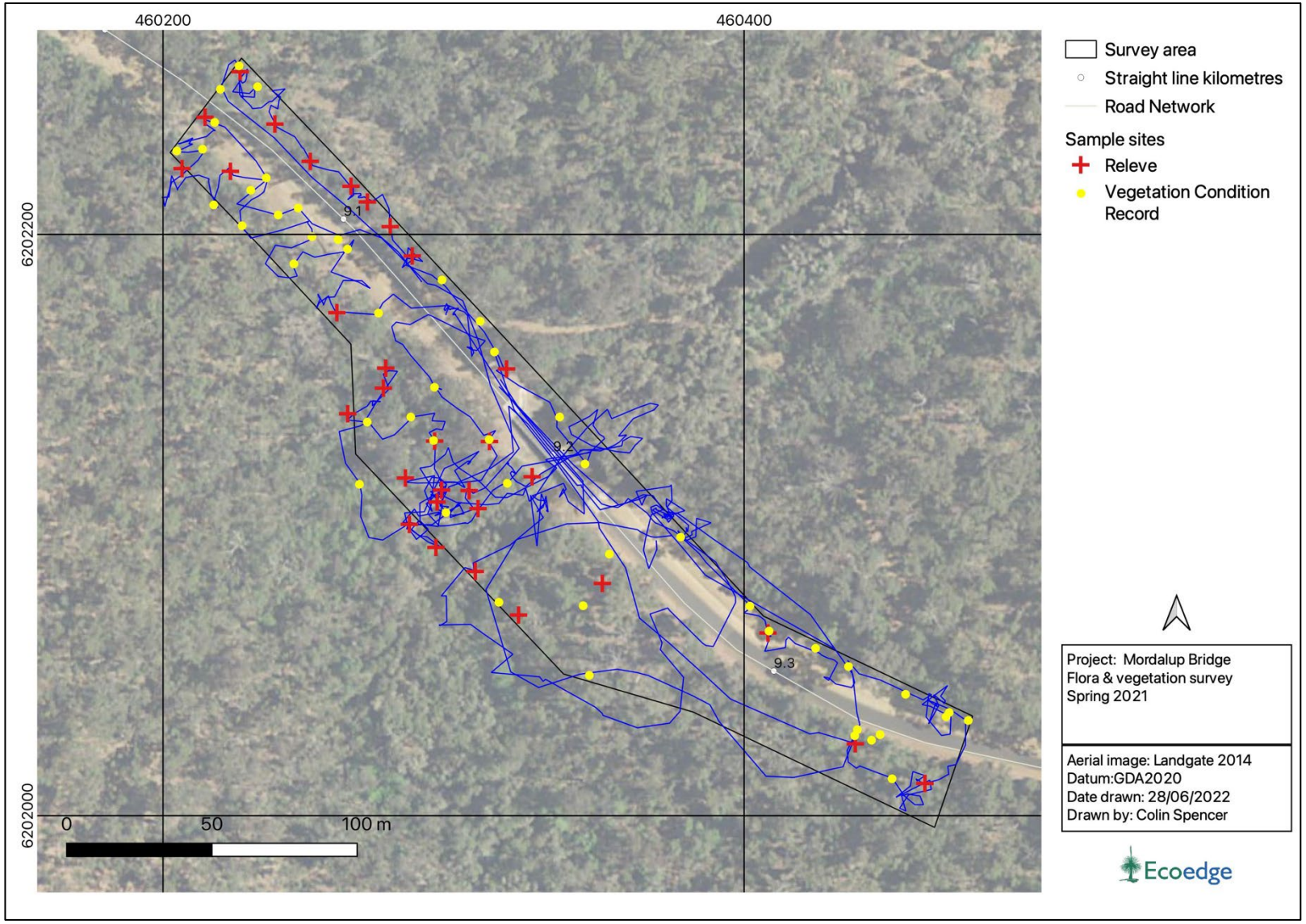

Figure I. Sample sites within the survey area.

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

#	FAMILY_NAME	SPECIES	NATURALISED	CONSV_CODE
1	Fabaceae	*Acacia saligna*		
2	Fabaceae	*Acacia urophylla*		
3	Rosaceae	*Acaena echinata*		
4	Asteraceae	*Asteridea pulverulenta*		
5	Chenopodiaceae	*Atriplex prostrata*	*	
6	Proteaceae	*Banksia seminuda*		
7	Rutaceae	*Boronia spathulata*		
8	Fabaceae	*Bossiaea linophylla*		
9	Poaceae	*Briza maxima*	*	
10	Poaceae	*Briza minor*	*	
11	Poaceae	*Bromus diandrus*	*	
12	Asteraceae	*Carduus pycnocephalus*		
13	Aizoaceae	*Carpobrotus modestus*		
14	Apiaceae	*Centella asiatica*		
15	Centrolepidaceae	*Centrolepis drummondii*		
16	Centrolepidaceae	*Centrolepis polygyna*		
17	Caryophyllaceae	*Cerastium glomeratum*	*	
18	Asparagaceae	*Chamaescilla corymbosa*		
19	Pteridaceae	*Cheilanthes sieberi*		
20	Fabaceae	*Chorizema cordatum*		
21	Myrtaceae	*Corymbia calophylla*		
22	Asteraceae	*Cotula coronopifolia*	*	
23	Juncaginaceae	*Cycnogeton huegelli*		
24	Apiaceae	*Daucus glochidiatus*		
25	Restionaceae	*Desmocladus asper*		
26	Restionaceae	*Empodisma gracillimum*		
27	Asteraceae	*Erigeron sumatrensis*	*	
28	Myrtaceae	*Eucalyptus marginata*		
29	Myrtaceae	*Eucalyptus rudis*		
30	Fabaceae	*Gastrolobium praemorsum*		
31	Fabaceae	*Genista monspessulana*	*	
32	Geraniaceae	*Geranium solanderi*		
33	Fabaceae	*Gompholobium marginatum*		
34	Fabaceae	*Gompholobium polymorphum*		
35	Proteaceae	*Hakea oleifolia*		
36	Asteraceae	*Helichrysum luteoalbum*		
37	Dilleniaceae	*Hibbertia amplexicaulis*		
38	Dilleniaceae	*Hibbertia commutata*		
39	Dilleniaceae	*Hibbertia quadricolor*		
40	Dilleniaceae	*Hibbertia racemosa*		
41	Apiaceae	*Homalosciadium homalocarpum*		
42	Asteraceae	*Hyalosperma demissum*		
43	Asteraceae	*Hypochaeris glabra*	*	
44	Cyperaceae	*Isolepis cyperoides*		
45	Fabaceae	*Isotropis cuneifolia*		

#	FAMILY_NAME	SPECIES	NATURALISED	CONSV_CODE
46	Juncaceae	*Juncus bufonius*	*	
47	Juncaceae	*Juncus pallidus*		
48	Fabaceae	*Kennedia coccinea*		
49	Asteraceae	*Lagenophora huegelii*		
50	Cyperaceae	*Lepidosperma effusum*		
51	Ericaceae	*Leucopogon australis*		
52	Ericaceae	*Leucopogon capitellatus*		
53	Stylidiaceae	*Levenhookia stipitata*		
54	Asparagaceae	*Lomandra caespitosa*		
55	Primulaceae	*Lysimachia arvensis*	*	
56	Lythraceae	*Lythrum hyssopifolia*	*	
57	Zamiaceae	*Macrozamia riedlei*		
58	Myrtaceae	*Melaleuca incana*		
59	Myrtaceae	*Melaleuca preissiana*		
60	Asteraceae	*Millotia tenuifolia*		
61	Portulacaceae	*Montia australasica*		2
62	Poaceae	*Neurachne alopecuroidea*		
63	Oxalidaceae	*Oxalis corniculata*	*	
64	Oxalidaceae	*Oxalis exilis*		
65	Iridaceae	*Patersonia occidentalis*		
66	Caryophyllaceae	*Petrorhagia dubia*	*	
67	Thymelaeaceae	*Pimelea ciliata*		
68	Asteraceae	*Podolepis lessonii*		
69	Caryophyllaceae	*Polycarpon tetraphyllum*	*	
70	Dennstaedtiaceae	*Pteridium esculentum*		
71	Amaranthaceae	*Ptilotus mangesii*		
72	Ranunculaceae	*Ranunculus colonorum*		
73	Polygonaceae	*Rumex conglomeratus*	*	
74	Polygonaceae	*Rumex pulcher*	*	
75	Poaceae	*Rytidosperma setaceum*		
76	Asteraceae	*Senecio diaschides*		
77	Solanaceae	*Solanum nigrum*	*	
78	Asteraceae	*Sonchus asper*	*	
79	Asparagaceae	*Sowerbaea laxiflora*		
80	Stylidiaceae	*Stylidiuym spathulatum*		
81	Ericaceae	*Styphelia tenuiflora*		
82	Ericaceae	*Styphelia propinqua*		
83	Poaceae	*Tetrarrhena laevis*		
84	Orchidaceae	*Thelymitra graminea*		
85	Araliaceae	*Trachymene pilosa*		
86	Elaeocarpaceae	*Tremandra diffusa*		
87	Juncaginaceae	*Triglochin* sp. "Small"		
88	Hydrocharitaceae	*Vallisneria australis?*	*	
89	Plantaginaceae	*Veronica plebeia*		
90	Poaceae	*Vulpia bromoides*	*	
91	Xanthorrhoeaceae	*Xanthorrhoea preissii*		
92	Apiaceae	*Xanthosia candida*		