RRON Functional Design

Desktop flora and fauna assessment

Barwon Water

01 December 2023

→ The Power of Commitment

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Our ref: 12585384

01 December 2023

Dr Giles Flower
Senior Approvals and Environmental Advisor
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RRON Functional Design

Dear Dr Flower

We have prepared a desktop flora and fauna assessment for the proposed location of the Regional Renewable Organics Network (RRON) facility at the Black Rock Water Reclamation Plant (WRP). Based on available desktop information, flora and communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or *Flora and Fauna Guarantee Act 1988* (FFG Act) are unlikely to occur at the site. Habitat for threatened and migratory fauna may occur in the planted trees of the revegetated mounds. However, there will be minimal vegetation impacts to these areas, and other areas of native vegetation in the WRP may provide alternative habitats. If any trees are to be removed, a fauna pre-clearance inspection should be completed immediately before removal, and a fauna spotter-catcher should be available in the case that native fauna are impacted during clearing and construction.

We agree with the conclusion that you have reached that a vegetation assessment is not recommended. However, we recommend that a site walk by a qualified ecologist be conducted prior to the works commencing to confirm presence of wildlife (particularly birds) in trees in the revegetated mounds. The ecologist may also provide assistance if needed to move them away from the proposed works at that time.

Please contact us if you have any questions.

Regards

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1. Introduction

1.1 Background and purpose

Barwon Water is the largest regional urban water corporation in Victoria and provides water and wastewater services to up to 545,000 people and covers 8,100 square kilometres in the south-central area of Victoria around Geelong and extending to Colac and Apollo Bay.

The Regional Renewable Organics Network (RRON) will be an organics processing facility that will convert organic waste into valuable end-products and renewable energy. The proposed location is the Black Rock Water Reclamation Plant (WRP) in Connewarre.

The purpose of this report is to complete a desktop flora and fauna assessment, to support ecological aspects of the project's planning approval application for the proposed RRON at the Black Rock WRP.

1.2 Scope and limitations

1.2.1 Scope

The desktop assessment will include a review of desktop information, including:

- NatureKit database (maintained by the Department of Energy, Environment and Climate Action (DEECA)), e.g., mapping of extant and pre-European Ecological Vegetation Classes (EVCs), Location Risk maps and Native Vegetation Extent maps
- The Victorian Biodiversity Atlas (VBA) database for flora and fauna species (maintained by DEECA)
- The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST), which predicts the occurrence of Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- The DEECA Native Vegetation Removal (NVR) Map tool
- Reports from previous relevant studies conducted by GHD and any additional reports provided by Barwon Water
- Aerial imagery of the study site

The results will be incorporated into this report and will include the following:

- Summary of desktop results
- Summary of the likelihood of occurrence of threatened flora, fauna and communities at the site (based on the presence and condition of suitable habitat)
- Map of desktop ecological values
- Summary and conclusions, including recommended next steps for the project

1.2.2 Limitations

This report has been prepared by GHD for Barwon Water and may only be used and relied on by Barwon Water for the purpose agreed between GHD and Barwon Water as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Barwon Water arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and does not include:

– An ecological site visit
– Consultation with other stakeholders not outlined in the scope of works or attendance to any court or legal proceedings
– The preparation of permits and/or referrals under any environmental legislation (e.g., referral of the project to the Commonwealth Department of Environment under the EPBC Act, application of a Permit to take Protected Flora under the *Flora and Fauna Guarantee Act 1988* (FFG Act), application for any local council permits e.g. Tree Protection Local Law permit from Frankston City Council
– The development of detailed mitigation measures that may be required for the project, such as preparation of an Environment Management Plan
– Submission of documents or permit applications to regulatory authorities

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

This report is based on a desktop assessment only. The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

1.3 Study site

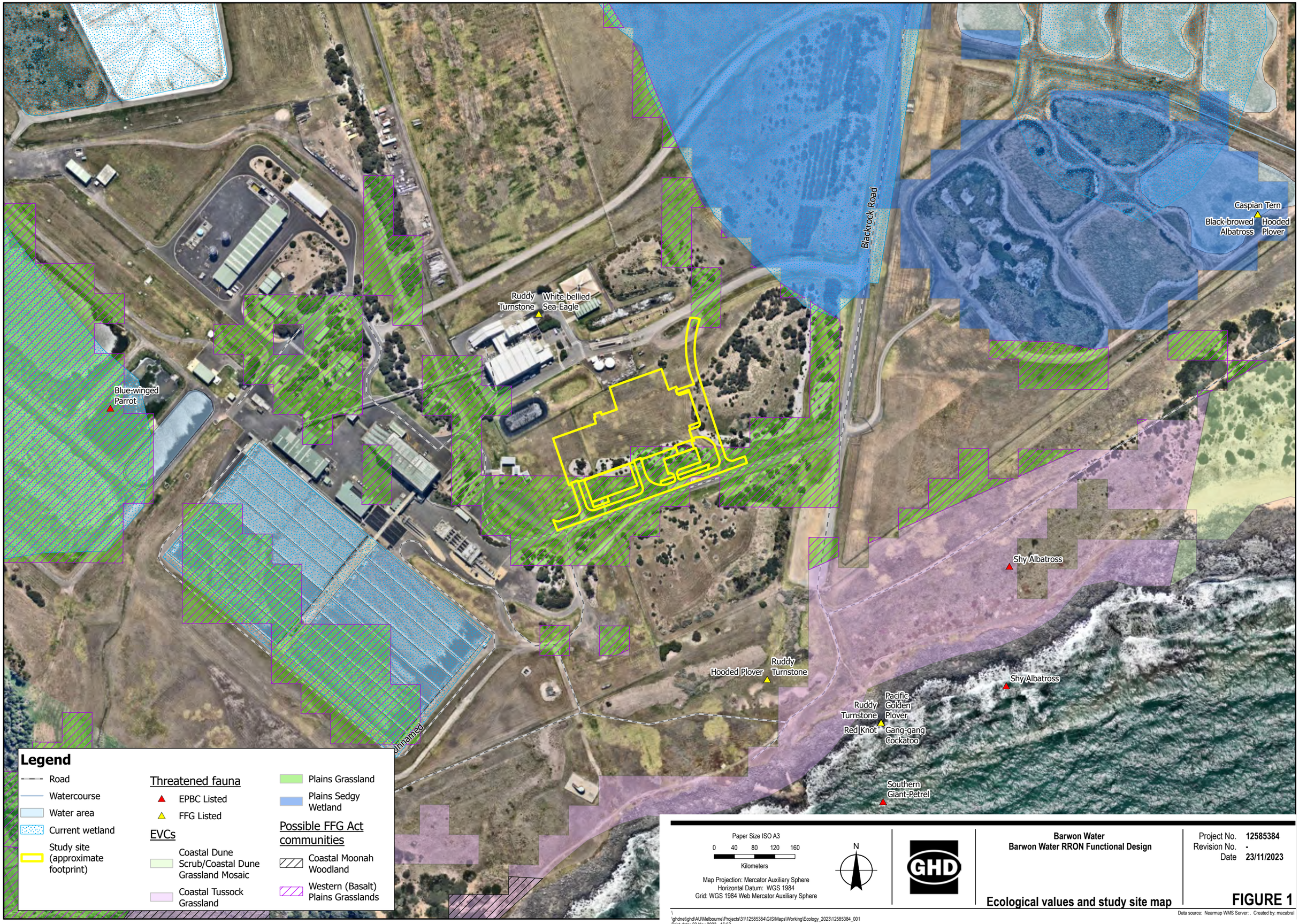
This assessment refers to the study site and study area. For the purposes of this assessment, the term **study site** refers to the area proposed footprint shown in Figure 1. The study site is located at the Black Rock Reclamation Plant in Connewarre in Greater Geelong City council, Corangamite Catchment Management Authority (CMA) and Victorian Volcanic Plain bioregion.

The term **study area** refers to a broader region surrounding the study site (i.e. includes areas that are outside the proposed impact areas and corresponds to a 5 kilometre buffer around the study site). This description covers a broader area than the expected zone of impact, and the additional information captured has been used to provide context to determine the significance of ecological features identified within the study site (for example, whether they are part of a larger area, or whether there are potential impacts on ecological features outside the study site). The study area was not assessed in the field.

1.4 Acknowledgements

GHD acknowledges the assistance, advice and/or information provided by the following:

– The Department of Energy, Environment and Climate Action (DEECA) for access to the Victorian Biodiversity Atlas (VBA) database NatureKit, and NVR Map
– The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) for access to its Protected Matters Search Tool (PMST)



Paper Size ISO A3

0 40 80 120 160

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

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GHD

Barwon Water
Barwon Water RRON Functional Design

Project No. **12585384**
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Date **23/11/2023**

Ecological values and study site map

FIGURE 1

Data source: Nearmap WMS Server: . Created by: macabral

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Print date: 23 Nov 2023 - 16:53

2. Methods

2.1 Desktop review

A desktop assessment of ecological values known or predicted to be present within the study area was undertaken in November 2023. The following resources were considered:

- NatureKit database (maintained by the Department of Energy, Environment and Climate Action (DEECA)), e.g., mapping of extant and pre-European Ecological Vegetation Classes (EVCs), Location Risk maps and Native Vegetation Extent maps
- The Victorian Biodiversity Atlas (VBA) database for flora and fauna species (maintained by DEECA)
- The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST), which predicts the occurrence of Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- The DEECA Native Vegetation Removal (NVR) Map tool
- Reports from previous relevant studies conducted by GHD and any additional reports provided by Barwon Water
- Aerial imagery of the study site (Nearmaps – 2011 earliest, Google – earliest 2002)

2.2 Nomenclature and conservation status

2.2.1 Flora

Unless otherwise noted, common and scientific names for flora follow the VBA database (Version 3.2.8).

Flora conservation status was determined in accordance with the Commonwealth EPBC Act and the Victorian FFG Act.

Native vegetation is defined in the Victoria Planning Provisions as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses'. For the purpose of the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017), native vegetation is classified into two categories, a **Patch** of vegetation, a **Scattered tree** or a **mapped wetland**:

- A patch of native vegetation is defined as:

  "*an area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native, or 'an area with three or more native canopy trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy*" (DELWP, 2017, pg. 6).
- A scattered tree is defined as "a native canopy tree that does not form part of a patch" (DELWP, 2017, pg. 6)
- A mapped wetland is defined as a "location that is mapped as a wetland in the Current wetlands map, available in DELWP systems and tools" (DELWP, 2017, pg. 8). Mapped wetlands are treated as a patch of native vegetation.

Other forms of vegetation include:

- **Planted native vegetation**, i.e., includes non-indigenous native species and areas of revegetation.
- **Scattered native plants**, i.e., patches of vegetation dominated by introduced species where less than 25% of the total perennial understorey plant cover is native
- **Non-native vegetation**, i.e., vegetation that comprises entirely introduced flora

2.2.2 Vegetation communities

Native vegetation in Victoria is mapped in units known as Ecological Vegetation Class (EVCs). EVCs are described according to a combination of floristic, life form and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each EVC occurs under a common regime of ecological processes within a given biogeographic range and may contain multiple floristic communities.

Other vegetation types that may occur in Victoria include flora communities listed as threatened under the EPBC Act and/or the FFG Act. These have separate vegetation classification systems, each of which is also separate to the EVC classification system. As such, any single patch of native vegetation occurring within the subject site (or anywhere in Victoria) will be classifiable as a particular EVC and may also be separately classified as a different ecological community under the EPBC Act, and/or as another vegetation community under the FFG Act.

3. Results

3.1 Overview of site

Based from the previous field assessment reports and photos, the study site is situated in an area with mostly even terrain and is roughly 500 meters away from the ocean. It features extensive planted vegetation, including Tangled Lignum and Common Boobialla. Barwon Water undertook a vegetation inspection of the proposed RRON location in August 2023, the results or which are captured in a briefing note (Appendix D). From the briefing note, the study site was described to be in three clearly defined zones: the roadway areas, lawn spaces, and revegetated mounds (Plate 1and Plate 2).

Plate 1 Lawn areas in the proposed RRON location consists of non-native understorey vegetation 9 (Flower 2023)

Plate 2 Native trees were planted in the revegetated mounds adjacent the proposed RRON locaton (Flower 2023)

3.2 Vegetation communities

Two (2) remnant EVCs have been modelled in the study area by DEECA at a scale of 1:5,000 (Figure 1): Plains Grassland (EVC 132) and Plains Sedgy Wetland (EVC 647), which are both endangered in the Victorian Volcanic Plain (VVP) bioregion. Based on the site assessment conducted by GHD in September 2022, EVC 647 was identified approximately 100 m north of the study site. However, during Barwon Water's site inspection in August 2023, no EVCs were identified on the study site itself.

Seven (7) EPBC-Act listed threatened ecological communities (TECs) have been identified as having the potential to occur in the study area by the PMST (Table 1). The Western (Basalt) Plains Grassland community under the FFG Act has also been mapped over the study site based on the modelled occurrence of EVC 132 (Plains Grassland). It is unlikely that any threatened communities will occur at the study site after reviewing desktop information and previous site assessment reports. No patches of native vegetation were identified during the recent site assessment by Barwon Water in August 2023.

Table 1 Threatened communities under either EPBC Act or FFG Act predicted to occur at the study area

Threatened Community	Status	Likelihood of occurrence
EPBC Act		
Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community	Endangered	**Unlikely**, EVC 9 (Coastal saltmarsh aggregate) and EVC 10 (Estuarine wetland) is synonymous with this TEC, both of which were not recorded in the study site (Flower 2023).
Natural Temperate Grassland of the Victorian Volcanic Plain	Critically Endangered	**Unlikely**. The study site is regularly landscaped and maintained.
Grassy Eucalypt Woodland of the Victorian Volcanic Plain	Critically Endangered	**Unlikely**. The study site is regularly landscaped and maintained.
Natural Damp Grassland of the Victorian Coastal Plains	Critically Endangered	**Unlikely**. The study site is regularly landscaped and maintained.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	**Unlikely**. The study site is regularly landscaped and maintained.
Giant Kelp Marine Forests of South East Australia	Endangered	**Highly Unlikely**, this TEC does not occur on land.
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	Critically Endangered	**Unlikely**. While EVC 647 may support this TEC, it does not overlap with the proposed location for the RRON.
FFG		
Western (Basalt) Plains Grasslands	Threatened	**Unlikely**. The study site is regularly landscaped and maintained.

3.3 Flora species

Thirty-three (33) flora species listed under either the EPBC Act or FFG Act are known or predicted to occur within 5 km of the study site (see Appendix A). A review of the study site based historical aerial imagery as well as photos from Dr Giles Flower's briefing note (Appendix D) indicates that the majority of native vegetation originally present has been cleared historically, and that the site has been subject to regular landscaping and maintenance works (see Plate 1 and 2 below). Due to the modified nature of the study site, it is considered unlikely that the majority of the threatened flora species identified during the desktop assessment would be present within the study site.

3.4 Fauna species

Fifty-five (55) fauna species listed under either the EPBC Act or FFG Act are known or predicted to occur within 5 km of the study site (see Appendix A). Eleven (11) threatened fauna species have been recorded within 500 metres of the study site (Figure 1):

- Black-browed Albatross (*Thalassarche melanophris*), EPBC Act – vulnerable
- Blue-winged Parrot (*Neophema chrysostoma*), EPBC Act – vulnerable
- Caspian Tern (*Hydroprogne caspia*), EPBC Act – Migratory and FFG Act - vulnerable
- Gang-gang Cockatoo (*Callocephalon fimbriatum*), Endangered under both EPBC Act and FFG Act
- Hooded Plover (*Melanodryas cucullata*), Vulnerable under both EPBC Act and FFG Act
- Pacific Golden Plover (*Pluvialis fulva*), FFG Act – vulnerable
- Red Knot (*Calidris canutus*), Endangered under both EPBC Act and FFG Act
- Ruddy Turnstone (*Arenaria interpres*), EPBC Act – Migratory, FFG Act – endangered
- Shy Albatross (*Thalassarche cauta*), Endangered under both EPBC Act and FFG Act
- Southern Giant-Petrel (*Macronectes giganteus*), Endangered under both EPBC Act and FFG Act
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*), FFG Act - endangered

Blue-winged Parrot, Ruddy Turnstone and the White-bellied Sea-Eagle have been recorded in Black Rock WRP and Blue-winged Parrot may occasionally use the trees in the revegetated mounds to the east and south. In the constructed wetlands further east of the WRP, Black-browed Albatross, Caspian Tern, and Hooded Plover have been recorded but is unlikely to be present in the study site due to absence of suitable habitat. Meanwhile, further to the south are coastal tussock grassland and marine areas where Gang-gang Cockatoo, Hooded Plover, Pacific Golden Plover, Red Knot, Ruddy Turnstone, Shy Albatross and Southern Giant-Petrel have been recorded, but these species are also unlikely to be present in the study site due to the absence of suitable habitat.

A review of site photos and historical aerial imagery in the study site indicates that the majority of native vegetation and fauna habitat originally present has been cleared, and that the site has been subject to regular landscaping and maintenance works. Due to the modified nature of the site, it is considered unlikely that it would support areas of quality fauna habitat and the threatened fauna species identified during the desktop assessment are highly unlikely to be present within the study site.

3.5 Current wetlands and location category

There are no watercourses or mapped current wetlands in the proposed location for the RRON although current wetlands can be found nearby to the northeast, east and west (Figure 1). These wetlands will not be impacted by the works. Based on the NVR Map maintained by DEECA, the study site is mapped as Location 2 (includes locations that are mapped as endangered EVCs) and Location 1 (all remaining locations in Victoria not covered by Locations 2 and 3) (DELWP, 2017, pg. 18).

4. Potential legislative implications

Potential legislative implications of the project are listed in the table below.

Table 2 Flora and fauna approvals requirements for Barwon Water RRON

Legislation	Approvals requirements
Environment Protection and Biodiversity Conservation Act 1999	**Unlikely** – On the basis of the desktop data for this study area, this Project is unlikely to require an EPBC Act referral. It is considered unlikely that study site would support an EPBC Act-listed TEC or EPBC listed flora or fauna. Threatened flora listed under this Act are unlikely to be impacted by the project at the study site. Although, the native trees planted in the revegetated mounds may provide very limited habitat to some threatened and migratory birds, there will be minimal vegetation impacts to these areas and there are other areas of native vegetation in the WRP that may provide alternative and higher quality habitat.
Flora and Fauna Guarantee Act 1988	**Unlikely** – Based on the modified nature of the proposed RRON location, FFG-listed flora or communities are unlikely to be present at the study site. However, there may be limited, low-quality habitat for some threatened fauna listed under the FFG Act. If any trees are to be removed, a fauna pre-clearance inspection should be completed immediately before removal, and a fauna spotter-catcher should be available in the case that native fauna are impacted during clearing and construction.
Environment Effects Act 1978	**Unlikely** – Ecology-related criteria under the EE Act are not expected to be triggered by the Project.
Planning and Environment Act 1987	**Unlikely** – Based on the historical aerial imagery and photos provided by Barwon Water, it is established that the native vegetation present in the proposed RRON location consists of planted native trees in the revegetated mounds to east and south. Lawn areas and roadway and present at the proposed RRON location is dominated by non-native turf grasses. Under clause 52.17 of the local planning scheme, a planning permit is not required to impact planted native vegetation.
Catchment and Land Protection Act 1994	**Possible** – Declared noxious weeds may occur within the study sites due to historical disturbance and presence of some of these species in the VBA records. For any construction, a Construction Environmental Management Plan (CEMP) must be prepared, and it must contain weed management, vehicle, and machinery hygiene protocols, among other mitigation measures.
Wildlife Act 1975	**Possible** – The revegetated mounds in the study site contains small planted native trees that may support minor roosting and foraging for native birds, and they may need to be relocated to safety at the time of construction. A site inspection by a qualified ecologist should be undertaken prior to construction to confirm the presence of native wildlife and if there is a need for a Management Authorisation (a permit under the Wildlife Act) to capture or move individuals with limited mobility (e.g., young birds in nests).

5. Conclusions

Based on the preliminary desktop information, the study site had been subject to historic disturbance, and it is unlikely that flora listed under the EPBC Act or FFG Act are present. Thus, a vegetation assessment is not recommended. In addition, a planning permit for native vegetation removal (Clause 52.17 of the local planning scheme) is not required as the native vegetation consisting of small trees in the revegetated mounds have been planted. Although these trees may provide habitat for some native birds, there will be minimal vegetation impacts to these areas and other areas of native vegetation in the WRP may provide alternative habitat. If any trees are to be removed, a fauna pre-clearance inspection should be completed immediately before removal, and a fauna spotter-catcher should be available in the case that native fauna are impacted during clearing and construction.

6. References

DELWP. (2017). *Guidelines for the removal, destruction or lopping of native vegetation*. Department of Environment, Land, Water and Planning

Flower, G. (2023, August 9). *Vegetation inspection, proposed Regional RON location*

Appendices

Appendix A

Threatened flora

Key to table	
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
CR	Critically Endangered
EN	Endangered
VU	Vulnerable
FFG Act	*Flora and Fauna Guarantee Act 1988*
cr	Critically Endangered
en	Endangered
vu	Vulnerable
Count	Number of records in the VBA database
Source	Records are from the VBA or the PMST
VBA	Victorian Biodiversity Atlas
PMST	Protected Matters Search Tool

Table A.1 Threatened flora recorded or predicted to occur within 5 km of the study site (VBA and PMST)

Scientific Name	Common Name	EPBC	FFG	Count	Last Recorded	Source	Habitat description
Acacia uncifolia	Coast Wirilda		en	5	2023	VBA	Occurs from Geelong to Wilsons Promontory, on coastal dunes or near saltmarsh, chiefly on calcareous sand and sandy loam soils (Walsh & Entwisle 1996).
Adriana quadripartita	Coast Bitter-bush		en	3	2009	VBA	Apart from disjunct inland occurrences at Mt Arapiles and near Ouyen, apparently confined to coastal and near-coastal areas west from Wilsons Promontory (Walsh and Entwisle, 1994).
Amphibromus fluitans	River Swamp Wallaby-grass	VU		0		PMST	Apparently confined to permanent swamps principally along the Murray River Between Wodonga and Echuca, uncommon to rare in the south probably due to alteration of habitat (Walsh and Entwisle 1994).
Atriplex paludosa subsp. *paludosa*	Marsh Saltbush		en	6	2016	VBA	Locally common on fringes of coastal and near coastal saltmarshes west from Wilsons Promontory (Walsh & Entwisle 1996).
Dodonaea procumbens	Trailing Hop-bush	VU		0		PMST	Largely confined in Victoria to the south-west, with disjunct occurrences near Castlemaine, Skipton. Grows in low-lying often winter wet areas in woodland, low open-forest and grasslands on sands and clays (Walsh & Entwisle 1996).
Eucalyptus leucoxylon subsp. *bellarinensis*	Bellarine Yellow-gum		cr	6	2014	VBA	Victorian endemic, occurring along the Bellarine Peninsula only (Walsh & Entwisle 1996).
Glycine latrobeana	Clover Glycine	VU	vu	0		PMST	Widespread but of sporadic occurrence and rarely encountered. Grows mainly in grasslands and grassy woodlands (Walsh and Entwisle 1996).
Juncus revolutus	Creeping Rush		en	2	1977	VBA	Restricted to damp saline or subsaline communities near the coast, with a small number of outlying populations around saline lakes on the volcanic plains (Walsh & Entwisle 1996).
Lachnagrostis adamsonii	Adamson's Blown-grass	EN	en	1	2003	VBA, PMST	Occurs in and around saline depressions on the Volcanic Plain were recorded from Portarlington west almost to the South Australian border (Walsh and Entwisle 1994).
Lachnagrostis robusta	Salt Blown-grass		en	2	1996	VBA	Occurs around margins of salt lakes and saline depressions mostly across the Volcanic Plain, with eastern outliers near Tooradin and Seaspray and a few sites west of the Grampians (Douglas, Natimuk areas).

Scientific Name	Common Name	EPBC	FFG	Count	Last Recorded	Source	Habitat description
Lawrencia spicata	Salt Lawrencia		en	1	1983	VBA	An occasional component of saltmarsh communities along the coast, rare in saline depressions and around salt lakes of south-western Victoria (Walsh & Entwisle 1996).
Lepidium aschersonii	Spiny Peppercress	VU	en	4	2008	VBA, PMST	Mostly on heavy clay soil near salt lakes on volcanic plains, but with outlying records from near lake Omeo (Walsh & Entwisle 1996).
Lepidium hyssopifolium	Basalt Pepper-cress	EN	en	0		PMST	Collected from scattered sites on the volcanic plain, but now much reduced from its former range and recorded recently only from e.g., Moorabool, Winchelsea, Bacchus Marsh, Woodend, Trentham. Most recent collections are from disturbed, rather weedy sites. One collection from near Port Fairy is noteworthy for its occurrence in a slightly saline estuary amongst saltmarsh and fringing sedgeland (Walsh & Entwisle 1996).
Leucochrysum albicans subsp. *tricolor*	Hoary Sunray	EN	en	0		PMST	Very rare in Victoria, the only recent collections from volcanic grassland remnants in the Wickliffe, Willaura, Streatham, Inverleigh and Creswick districts. All other Victorian collections were made last century from Mt Cole, the Grampians and the Port Fairy district.
Melaleuca armillaris subsp. *armillaris*	Giant Honey-myrtle		en #	5	2015	VBA	Mainly confined to near coastal sandy heaths, scrubs, slightly raised above saltmarsh, riparian scrubs, rocky coastlines and foothill outcrops eastwards from about Marlo. Occurrences to the west are naturalized (Walsh & Entwisle 1996).
Pimelea spinescens subsp. *spinescens*	Plains Rice-flower	CR	cr	0		PMST	Grows in grassland or open shrubland on basalt-derived soils west of Melbourne (Walsh and Entwisle 1999).
Poa billardierei	Coast Fescue		en	3	2011	VBA	Of scattered occurrence on coastal sand dunes from near Nelson in the far south-west to the NSW border, but infrequently collected in recent times and possibly being displaced by the superficially similar, introduced Marram-grass (*Ammophila arenaria* (L.) Link).
Pomaderris halmaturina subsp. *continentis*	Glenelg Pomaderris		en	4	2012	VBA	Occasional along the lower Glenelg River in the far south-west of Victoria, where occurring on limestone derived and alluvial soils, with a disjunct easterly occurrence near Torquay. Usually growing in shrubland or shrubby open-forest (Walsh and Entwisle 1996).

Scientific Name	Common Name	EPBC	FFG	Count	Last Recorded	Source	Habitat description
Prasophyllum spicatum	Dense Leek-orchid	VU	cr	0		PMST	Widespread but sporadic across Victoria, growing in heath and heathy woodland (Jeanes and Backhouse 2006) Update 2019: Localised across southern Victoria in coastal heathland and near-coastal heathy forest on sandy soils.
Pterostylis chlorogramma	Green-striped Greenhood	VU	en	0		PMST	Occurs across southern Victoria, growing in heathy woodland. Recorded for few locations, but probably more widespread than current records suggest (Jeanes and Backhouse 2006).
Pterostylis cucullata	Leafy Greenhood	VU	en	0		PMST	Widely distributed but disjunct, mostly occurring in small groups in coastal areas, rarely inland (Walsh and Entwisle 1999).Widespread across southern Victoria, and extending into montane areas of the Eastern Highlands and East Gippsland. Grows in closed scrublands on the landward slopes, swales, and tops of coastal sand dunes. Also grows in open forests on moist slopes, on seasonally inundated inland river flats, and in other riparian habitats. On the coast it grows in deep, well-drained sandy loams while inland it favours heavier sandy loams (Backhouse & Jeanes 1995). Update 2019 Widely distributed but disjunct, mostly occurring in small groups in coastal areas, sometimes near inland watercourses (Jones 1994).
Roepera billardierei	Coast Twin-leaf		en	2	2023	VBA	Found in coastal areas west of Wilsons Promontory were found on dunes and limestone cliffs in scrubby vegetation (Walsh and Entwisle 1996).
Rutidosis leptorhynchoides	Button Wrinklewort	EN	en	0		PMST	In Victoria, confined to basaltic grasslands between Rokewood and Melbourne (Walsh and Entwisle 1999).
Senecio glomeratus subsp. *longifructus*	Annual Fireweed		vu	1	2010	VBA	Grows adjacent to streams and swamps throughout the south and north-east of the state.
Senecio macrocarpus	Large-fruit Fireweed	VU	cr	0		PMST	Largely confined to *Themeda* grasslands on loamy clay soils derived from basalt near Melbourne, west to Skipton area. Also known from auriferous ground near Stawell (Walsh and Entwisle 1999).
Senecio psilocarpus	Swamp Fireweed	VU		0		PMST	Rare in Victoria, restricted to an herb-rich few winter-wet swamps south and west of c. Ballarat, growing on volcanic clays or peat soils (Walsh and Entwisle 1999).

Scientific Name	Common Name	EPBC	FFG	Count	Last Recorded	Source	Habitat description
Thelymitra epipactoides	Metallic Sun-orchid	EN	en	0		PMST	Usually found in coastal and hinterland areas west of Bairnsdale but extending well inland in the far-western part of the state. Grows primarily in mesic coastal heathlands, grasslands and woodlands, but is also found in drier inland heathlands, open forests and woodlands. Substrates may be moist or dry sandy loams (Backhouse & Jeanes 1995) Grows mostly in coastal heathland, grassland and woodland, but extending further inland into similar habitats in the western part of its range. Substrates may be moist or dry sandy soils. (Weber Entwisle 2994)
Thelymitra matthewsii	Spiral Sun-orchid	VU	en	0		PMST	Scattered sporadically across southern Vic and extending as far inland as the northern Grampians. Favours open forests and woodlands, where it is found in well-drained sand and clay loams. Grows best in areas where there has been soil disturbance, for example around old quarries and gravel pits, and on road verges, disused tracks, or animal trails (Backhouse & Jeanes 1995).
Thelymitra orientalis	Hoary Sun-orchid	CR	cr	0		PMST	Grows in damp heathy flats and seepage areas usually in peaty white sands (Jeanes 2014).
Thomasia petalocalyx	Paper Flower		en	1	2015	VBA	In Victoria, scattered in drier forests, heathy woodland and coastal heaths west of Port Phillip Bay, apparently restricted to Wilsons Promontory in the east (Walsh and Entwisle 1996).
Triglochin minutissima	Tiny Arrowgrass		en	1	1983	VBA	Scattered on damp saline soils near salt-lakes and forming part of herbfield in coastal saltmarshes (Walsh & Entwisle 1996).
Triglochin mucronata	Prickly Arrowgrass		en	2	1983	VBA	Occurs in herbfields on damp saline soils of salt-flats and coastal saltmarshes (Walsh & Entwisle 1996).
Xerochrysum palustre	Swamp Everlasting	VU	cr	0		PMST	Occurs in lowland swamps, usually on black cracking clay soils (Walsh and Entwisle 1999).

Appendix B

Threatened fauna

Key to table	
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
CR	Critically Endangered
EN	Endangered
VU	Vulnerable
FFG Act	*Flora and Fauna Guarantee Act 1988*
cr	Critically Endangered
en	Endangered
ex	Extinct
vu	Vulnerable
Count	Number of records in the VBA database
Source	Records are from the VBA or the PMST
VBA	Victorian Biodiversity Atlas
PMST	Protected Matters Search Tool

Table B.1 Threatened fauna recorded or predicted to occur within 5 km of the study site (VBA and PMST)

Common name	Scientific Name	EPBC	FFG	Count	Last recorded	Source	Preferred habitat in Victoria
Mammals							
Spot-tailed Quoll	*Dasyurus maculatus maculatus*	EN	en	0		PMST	Preference for mature wet forest habitat that has been less disturbed by logging. Also occurs in wet sclerophyll forests, lowland forests, open and closed eucalypt woodlands, inland riparian and River Red-gum forests Woodlands, subalpine woodlands and coastal heathlands.
Swamp Antechinus	*Antechinus minimus maritimus*	VU	vu	0		PMST	Wet areas with dense closed ground cover. Typically found in wet heath, heathy woodland, sedgeland and dense tussock grassland, usually at low elevation.
Southern Brown Bandicoot	*Isoodon obesulus obesulus*	EN	en	0		PMST	Typically occurs in heathland, shrubland, heathy forest and woodland, and coastal scrub habitat across southern Victoria. Survival with foxes requires dense understorey vegetation.
Yellow-bellied Glider	*Petaurus australis*	VU	en	0		PMST	Tall forest, coastal gullies, creek flats and forest mixed with woodland.
Grey-headed Flying-fox	*Pteropus poliocephalus*	VU	vu	0		PMST	Densely vegetated flowering and fruiting trees, mainly east of Melbourne. Roosts in dense gullies. Uses a wide range of habitats in Victoria, from lowland rainforest and coastal Stringybark forests to agricultural land and suburban gardens. Established colonies known in Melbourne, Geelong, Bendigo and Mallacoota.
New Holland Mouse	*Pseudomys novaehollandiae*	VU	en	0		PMST	Fire dependent. Inhabits a variety of habitats along the coast of south-eastern Australia, including coastal heath, sclerophyll forest, heathy woodland and coastal scrub habitats, usually with a high density of leguminous ground plants.
Birds							
Plains-wanderer	*Pedionomus torquatus*	CR	cr	0		PMST	Inhabit sparse native grasslands and are often absent from areas where grass becomes too dense or too sparse. They nest amongst native grasses and herbs, or sometimes amongst crops, feeding on a mixture of seeds, invertebrates and leaves.

Common name	Scientific Name	EPBC	FFG	Count	Last recorded	Source	Preferred habitat in Victoria
Lewin's Rail	*Lewinia pectoralis*		vu	11	2019	VBA	Densely vegetated wetlands including wetlands, farm dams, swamps, saline lakes and river flats. Usually forages for a variety of aquatic plants and invertebrates around the water's edge in shallow water and close to cover.
White-faced Storm-Petrel	*Pelagodroma marina*		en	8	2019	VBA	Marine areas, extremely large range.
Soft-plumaged Petrel	*Pterodroma mollis*	VU		0		PMST	Marine areas. Birds burrow among tussock grass and ferns on slopes and valleys. Mainly coastal but occasionally occurs inland.
Gould's Petrel	*Pterodroma leucoptera leucoptera*	EN		0		PMST	Marine areas. Pelagic, mostly foraging at sea, coming ashore only to breed. Australian subspecies breeds and roosts on two islands off NSW, Cabbage Tree and Boondelbah Islands. Mostly breeds among rocky scree and beneath coarse woody debris in gullies dominated by dense rainforest, heavily vegetated with Cabbage Tree Palms (*Livistonia australis*), figs (*Ficus*) and Native Plums (*Planchonella australis*).
Blue Petrel	*Halobaena caerulea*	VU		1	1980	VBA, PMST	Marine areas. Usually pelagic, sometimes in shallow waters. Visits Australian waters in winter and spring.
Southern Giant-Petrel	*Macronectes giganteus*	EN	en	26	1988	VBA, PMST	Marine areas. Occurs in both pelagic and inshore waters. Occasionally attracted to land at sewage outfalls and scavenges ashore.
Northern Giant-Petrel	*Macronectes halli*	VU	en	10	1988	VBA, PMST	Marine areas. Visits areas off the Australian mainland mainly during the winter months (May-October). Immature and some adult birds are commonly seen during this period in offshore and inshore waters.
Fairy Prion	*Pachyptila turtur subantartica*	VU		35	2019	VBA, PMST	Marine areas. Breeding recorded on two rock stacks off Macquarie Island and on the nearby Bishop and Clerk Island. Digs nesting burrows among rocks or low vegetation, sometimes below mat-forming herbs. Feeds by plucking food from the ocean surface. Some individuals may migrate towards southern Australia in winter.
Wandering Albatross	*Diomedea exulans*	VU	cr	13	1979	VBA, PMST	Marine areas. Pelagic; occurs in southern oceans, breeding on subantarctic islands. Forages in pelagic and/or continental shelf waters, rarely occurs in near-shore waters.

Common name	Scientific Name	EPBC	FFG	Count	Last recorded	Source	Preferred habitat in Victoria
Antipodean Albatross	*Diomedea antipodensis*	VU		0		PMST	Marine areas. Endemic to New Zealand, but forages widely in open water in the south-west Pacific Ocean, Southern Ocean and the Tasman Sea, notably off the coast of NSW.
Black-browed Albatross	*Thalassarche melanophris*	VU		30	2019	VBA, PMST	Marine areas. In the non-breeding season, follows cold water currents north to the continental shelves of Australia where it can occur in coastal and inshore waters and sometimes enter fjords and channels.
Grey-headed Albatross	*Thalassarche chrysostoma*	EN	en	0		PMST	Marine areas. Remains at sea outside the breeding season and generally only comes onto land to find a nest site, a mate and to breed.
Shy Albatross	*Thalassarche cauta*	EN	en	53	2019	VBA, PMST	Marine areas. Over pelagic waters off the southeast coast of Tasmania. Breeds on three Australian islands and ranges across the southern Indian Ocean.
White-capped Albatross	*Thalassarche cauta steadi*	VU		0		PMST	Marine areas. Probably common off the coast of south-east Australia throughout the year. Breeding colonies occur on islands south of New Zealand.
Salvin's Albatross	*Thalassarche salvini*	VU		0		PMST	Marine areas. During the non-breeding season, uses continental shelves around continents. Occurs both inshore and offshore and enters harbours and bays. Scarce in pelagic waters.
Sooty Albatross	*Phoebetria fusca*	VU	cr	0		PMST	Marine areas. Occurs widely over pelagic waters during breeding and non-breeding seasons, exploiting dispersed sources of food. Forages over coastal kelp beds. Breeds on subtropical and subantarctic islands in the Indian and Atlantic Oceans, on vegetated cliffs and steep slopes that are sheltered from prevailing winds, often amongst tussock grass.
Southern Royal Albatross	*Diomedea epomophora*	VU	cr	0		PMST	Marine areas. Pelagic; occurs in waters off southern Australia at all times of year, especially between July and October. Rarely occurs in near-shore waters.
Northern Royal Albatross	*Diomedea sanfordi*	EN		0		PMST	Marine areas. Pelagic; occurs in waters off southern Australia at all times of year, especially between July and October. Rarely occurs in near-shore waters.
Campbell Albatross	*Thalassarche impavida*	VU		0		PMST	Marine areas, inhabiting sub-Antarctic and subtropical waters from pelagic to shelf-break water habitats.

Common name	Scientific Name	EPBC	FFG	Count	Last recorded	Source	Preferred habitat in Victoria
Northern Buller's Albatross	*Thalassarche bulleri platei*	VU	en	0		PMST	Marine areas. Pelagic, inhabiting subtropical and subantarctic waters of the southern Pacific Ocean. Seen over inshore, offshore and pelagic waters.
Indian Yellow-nosed Albatross	*Thalassarche carteri*	VU	en	3	1979	VBA, PMST	Marine areas. In the Australasian region, occupies inshore and offshore waters. Breeds on islands of the southern Indian Ocean.
Australian Gull-billed Tern	*Gelochelidon nilotica macrotarsa*		en	6	2004	VBA	Shallow terrestrial wetlands and sheltered bays, estuaries, tidal mudflats and beaches. In Australia, mainly breeds in inland areas following floods.
Caspian Tern	*Hydroprogne caspia*		vu	157	2021	VBA	Coastal areas and large inland wetlands and rivers. Exposed ocean beaches, sheltered coastal bays, harbours, lagoons, inlets, estuaries, usually with sandy or muddy margins. Breeds in a variety of coastal habitats including banks, ridges and beaches of sand and shell, often in open or among low or sparse vegetation.
Little Tern	*Sternula albifrons*		cr	6	1997	VBA, PMST	Coastal areas. Mostly recorded in sheltered coastal environments, including bays, lagoons and estuaries. Nests on sandy substrates containing much shell-grit.
Fairy Tern	*Sternula nereis*	VU	cr	14	2008	VBA, PMST	Coastal areas. Inhabits coastal environments including intertidal mudflats, sand flats and beaches. Nests above high-water mark on sandy shell-grit beaches.
Ruddy Turnstone	*Arenaria interpres*		en	126	2018	VBA, PMST	Non-breeding migrant, regular to Victoria. Typically coastal, on intertidal mudflats, sandflats and sandy beaches, rocky shores and intertidal reefs.
Grey Plover	*Pluvialis squatarola*		vu	2	2014	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Coastal. Mudflats, saltmarsh, tidal reefs and estuaries.
Pacific Golden Plover	*Pluvialis fulva*		vu	144	2018	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Usually in coastal habitats including mudflats, sandflats, rocky shores and saltmarsh. Also sub-coastal wetlands and sewage ponds.
Hooded Plover	*Thinornis cucullatus cucullatus*	VU	vu	896	2021	VBA, PMST	Breeding resident in Victoria. Prefers sandy, broad, flat ocean beaches. Prefers beach-cast seaweed for feeding activities and sparsely vegetated back dunes for shelter and nesting.

Common name	Scientific Name	EPBC	FFG	Count	Last recorded	Source	Preferred habitat in Victoria
Lesser Sand Plover	*Charadrius mongolus*	EN	en	0	2010	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Coastal, but occasionally inland. Exposed sandflats and mudflats, estuaries, open sandy beaches. High tide roost sites are often located on beaches.
Greater Sand Plover	*Charadrius leschenaultii*	VU	vu	0		PMST	Non-breeding migrant to Australia during the austral summer. Coastal. Exposed sandflats and mudflats, estuaries, open sandy beaches. High tide roost sites are often located on beaches.
Eastern Curlew	*Numenius madagascariensis*	CR	cr	7	2013	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Coastal. Sheltered coastal habitats, usually with large sand flats or intertidal mudflats with seagrass, estuaries, open sandy beaches. Occasionally on coastal rock platforms.
Whimbrel	*Numenius phaeopus*		en	2	1980	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Typically coastal, including mudflats, sandflats, estuaries, sandy shores and rock platforms. Rarely recorded inland.
Black-tailed Godwit	*Limosa limosa*		cr	12	2019	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Mudflats, sandflats, estuaries, large wetlands. Coastal, but occasionally inland.
Bar-tailed Godwit	*Limosa lapponica*	VU	vu	12	2017	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Mudflats, sandflats, estuaries, large wetlands. Coastal, but occasionally inland.
Bar-tailed Godwit (Alaskan)	*Limosa lapponica baueri*	VU	vu	0		PMST	Non-breeding migrant to Australia during the austral summer. Mudflats, sandflats, estuaries, large wetlands. Coastal, but occasionally inland.
Wood Sandpiper	*Tringa glareola*		en	5	2015	VBA	Non-breeding migrant to Australia during the austral summer. Inhabits well vegetated shallow freshwater wetlands with emergent aquatic plants and dense fringing vegetation. Occasionally in intertidal habitats, including mangroves.
Grey-tailed Tattler	*Tringa brevipes*		cr	2	1988	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Estuaries, tidal mudflats, mangroves, wave-washed rocks and reefs and shallow river margins coastal and inland.
Common Sandpiper	*Actitis hypoleucos*		vu	20	2017	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Uses a wide variety of coastal and inland wetlands with muddy margins, including lakes, rivers, sewage ponds.

Common name	Scientific Name	EPBC	FFG	Count	Last recorded	Source	Preferred habitat in Victoria
Common Greenshank	*Tringa nebularia*		en	180	2021	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Coastal mudflats, estuaries, salt marshes, mangroves, lakes and swamps.
Marsh Sandpiper	*Tringa stagnatilis*		en	40	2019	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Estuaries, and coastal and inland shallow wetlands.
Terek Sandpiper	*Xenus cinereus*		en	2	2014	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Mainly found on intertidal mudflats in sheltered estuaries, bays, harbours, lagoons, coastal swamps.
Curlew Sandpiper	*Calidris ferruginea*	CR	cr	97	2019	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Regular visitor to Victoria. Occurs in a variety of wetland habitats with fringing mudflats including bays, coastal lagoons, lakes, swamps, creeks, inundated grasslands, saltmarshes and artificial wetlands.
Red Knot	*Calidris canutus*	EN	en	14	2015	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Coastal. Typically occurs on intertidal mudflats, sandflats and sandy beaches of sheltered coasts, and a range of other coastal and near-coastal environments such as lakes, lagoons, pools and pans, sewage ponds and saltworks. Inland lakes and swamps less commonly used.
Great Knot	*Calidris tenuirostris*	CR	cr	3	1986	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Coastal. Mainly found on intertidal mudflats, sandflats and sandy beaches.
Australian PaintedSnipe	*Rostratula australis*	EN	cr	3	2013	VBA, PMST	Generally in shallow, terrestrial freshwater wetlands with rank, emergent tussocks of grass, sedges and rushes. Occurs in well vegetated lakes, swamps, inundated pasture, saltmarsh and dams. Fresh to saline water. May use riverine forest.
Brolga	*Antigone rubicunda*		en	55	2021	VBA	Wetlands, dams, flooded fields. Often forages in dry grassland or ploughed paddocks or even desert claypans, especially shallow swamps, where birds may forage with their head entirely submerged.
Little Egret	*Egretta garzetta nigripes*		en	53	2019	VBA	Uses wide range of wetlands, mudflats, estuaries. Typically prefers shallows of wetlands for foraging. Occasionally in small waterways or wet grassland areas.

Common name	Scientific Name	EPBC	FFG	Count	Last recorded	Source	Preferred habitat in Victoria
Plumed Egret	*Ardea intermedia plumifera*		cr	9	2017	VBA	Wetlands, river margins, mudflats and estuaries. Breeds in flooded or fringing trees alongside wetlands. Forages more widely.
Eastern Great Egret	*Ardea alba modesta*		vu	286	1905	VBA	Saltwater and freshwater wetlands, lakes, dams, river margins, estuaries and mudflats.
Australasian Bittern	*Botaurus poiciloptilus*	EN	cr	16	2019	VBA, PMST	Wetlands with tall, dense vegetation in permanent freshwater habitats, particularly when dominated by sedges, rushes and reeds. Also uses rice paddocks in north.
Magpie Goose	*Anseranas semipalmata*		vu	8	2006	VBA	Seasonal wetlands and flooded fields. Aquatic and terrestrial habitat, mostly in wetlands on flood plains. Historically occurred in SE Australia, but extinct in Victoria by early 1900s. Re-introduction attempts have had mixed results.
Australasian Shoveler	*Spatula rhynchotis*		vu	76	2019	VBA	Filter-feeding duck. Well vegetated larger wetlands, dams and lakes.
Freckled Duck	*Stictonetta naevosa*		en	6	2014	VBA	Filter-feeding duck. Well vegetated shallow wetlands.
Hardhead	*Aythya australis*		vu	61	2019	VBA	Diving duck. Deep permanent wetlands, dams, lakes and slow-flowing rivers. Also occurs in brackish wetlands and water storage ponds. Occasionally in estuarine and littoral habitats such as saltpans, coastal lagoons and sheltered inshore waters.
Blue-billed Duck	*Oxyura australis*		vu	1	1979	VBA	Diving duck. Deep open water in wetlands, dams, lakes and slow-flowing rivers.
Musk Duck	*Biziura lobata*		vu	26	2021	VBA	Diving duck. Deep open water in wetlands, dams, lakes and slow-flowing rivers.
Grey Goshawk	*Accipiter novaehollandiae*		en	4	2018	VBA	Woodlands, forests and riparian habitats, mainly in wetter areas.
Little Eagle	*Hieraaetus morphnoides*		vu	29	2017	VBA	Widespread over diverse habitats across most of Australia, from coastal to inland forest, woodland, open scrub and tree-lined watercourses. Most abundant where open country mixes with wooded or forested hills.
White-bellied Sea-Eagle	*Haliaeetus leucogaster*		en	17	2018	VBA	Coastal, marine and inland. Estuaries, beaches, large wetlands, including deep freshwater swamps, lakes, reservoirs, billabongs and rivers. Uses tall trees in or near water for breeding.
Grey Falcon	*Falco hypoleucos*	VU	vu	0		PMST	Inland wooded watercourses and woodland. Generally rare.

Common name	Scientific Name	EPBC	FFG	Count	Last recorded	Source	Preferred habitat in Victoria
Black Falcon	*Falco subniger*		cr	23	2018	VBA	Grassy woodlands. Also found along tree-lined watercourses and in isolated woodlands, mainly in arid and semi-arid areas. It roosts in trees at night and often on power poles by day.
Masked Owl	*Tyto novaehollandiae*		cr	1	1983	VBA	Tall eucalypt forest. Inhabits a diverse range of forests and woodlands including agricultural and forest mosaics.
Gang-gang Cockatoo	*Callocephalon fimbriatum*	EN	en	6	2019	VBA, PMST	Tends to frequent tall forests and woodlands with dense shrubby understorey in the mountains during the summer breeding period. In winter, tends to move to lower altitudes into drier, more open forests and woodlands. Often seen by roadsides and in parks and gardens of urban areas. Requires tall trees for nest hollows.
Orange-bellied Parrot	*Neophema chrysogaster*	CR	cr	4	2008	VBA, PMST	Winter migrant to coastal Victoria and South Australia from breeding areas in south-west Tasmania. Forages in coastal or near-coastal areas such as saltmarshes, coastal dunes, pastures, shrublands, estuaries, islands and beaches.
Blue-winged Parrot	*Neophema chrysostoma*	VU		163	2021	VBA, PMST	Inhabits a range of habitats from coastal, sub-coastal and inland areas, through to semi-arid zones. Tends to favour grasslands and grassy woodlands and often found near wetlands both near the coast and in semi-arid zones. Breeds in Tasmania, coastal south-eastern South Australia and southern Victoria.
Swift Parrot	*Lathamus discolor*	CR	cr	2	2014	VBA, PMST	Winter migrant to Victoria (and other parts of SE Australia) from breeding areas in Tasmania. In Victoria, prefers dry, open eucalypt forests and woodlands, especially Box Ironbark Forest in north-central Victoria. Occasionally recorded in urban parks, gardens, street trees and golf courses with flowering ornamental trees and shrubs.
White-throated Needletail	*Hirundapus caudacutus*	VU	vu	12	2017	VBA, PMST	Almost exclusively aerial within Australia, occurring over most types of habitat, particularly wooded areas. Less often seen over open farm paddocks but has been recorded in vineyards flying between the rows of trees.

Common name	Scientific Name	EPBC	FFG	Count	Last recorded	Source	Preferred habitat in Victoria
Hooded Robin	*Melanodryas cucullata*	EN	vu	1	1978	VBA, PMST	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey.
Southern Whiteface	*Aphelocephala leucopsis*	VU		0		PMST	Inhabits a wide range of open woodlands and shrublands where there is an understorey of grasses or shrubs, or both. These areas are usually in habitats dominated by acacias or eucalypts on ranges, foothills and lowlands, and plains.
Speckled Warbler	*Pyrrholaemus sagittatus*		en	1	1914	VBA	Woodlands. Generally absent from very wet and very dry areas.
Rufous Bristlebird (Otway)	*Dasyornis broadbenti caryochrous*		vu	1	1914	VBA	Inhabits dense shrubland, including heathland, usually where a high diversity of plant species grow. Also occurs in wet forests where there is a dense understorey of shrubs or bracken. Very occasionally seen on beaches adjacent to shrubland.
Brown Treecreeper	*Climacteris picumnus victoriae*	VU		0		PMST	Forests and woodlands, mainly in drier areas. Threatened sub-species victoriae occurs mainly on southern watershed of Great Dividing Range, and along a narrow intergrade on the northern and western slopes, in a rough line from the Grampians, through Maryborough and to Albury. Non-threatened sub-species picumnus occurs mainly inland of the same line.
Regent Honeyeater	*Anthochaera phrygia*	CR	cr	0		PMST	Open forests and woodlands. Generally absent from very wet and very dry areas. Dry woodlands and forests dominated by Box Ironbark eucalypts. May be restricted to the Chiltern-Mt Pilot National Park (NE Victoria) following population decline and range contraction.
Diamond Firetail	*Stagonopleura guttata*	VU	vu	0		PMST	Occurs in eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats, including farmland and grassland with scattered trees. Prefers areas with relatively low tree density (including few large logs and litter cover) but a high grass cover. Generally absent from very wet and very dry areas.

Common name	Scientific Name	EPBC	FFG	Count	Last recorded	Source	Preferred habitat in Victoria
Reptiles							
Striped Legless Lizard	*Delma impar*	VU	en	0		PMST	Native grasslands and grassy woodlands, where soil is little disturbed. Also some non-native grasslands in areas where native grasslands persist.
Swamp Skink	*Lissolepis coventryi*	EN	en	0		PMST	Swamp scrub habitat in cool, temperate, low-lying areas, including wetlands, river margins, lakes, swamp margins and estuarine areas with a dense shrub layer, particularly in near-coastal areas across southern Victoria. Often associated with stands of paperbark and tea-tree, usually in heathy or scrubby areas.
Amphibians							
Growling Grass Frog	*Litoria raniformis*	VU	vu	0		PMST	Requires a matrix of well-connected permanent and semi-permanent waterbodies, including open vegetated wetlands, flooded paddocks, drains, farm dams and river pools, generally containing abundant submerged and emergent vegetation with little shade. Within lowland grasslands, woodlands and open forests.
Invertebrates							
Golden Sun Moth	*Synemon plana*	VU	vu	0		PMST	Native grasslands and grassy woodlands, particularly where *Austrodanthonia* (*Rytidosperma*) dominant. Now recognised to occur also in exotic grasslands dominated by Chilean Needle Grass.
Fish							
Australian Grayling	*Prototroctes maraena*	VU	en	0		PMST	A diadromous species which spends most of its life in freshwater habitats, typically rivers and streams with cool, clear waters and gravel substrates, but occasionally also in turbid waters. Juveniles inhabit estuaries and coastal seas.
Yarra Pygmy Perch	*Nannoperca obscura*	VU	vu	4	2008	VBA, PMST	Typically occurs in lakes, ponds and slow-flowing rivers (Saddlier & Hammer 2010), but prefers small-medium sized, relatively shallow (1-2 m) freshwater streams with moderate to high flow.

Appendix C

Migratory fauna

Key to table	
Count	Number of records in the VBA database
Source	Records are from the VBA or the PMST
VBA	Victorian Biodiversity Atlas
PMST	Protected Matters Search Tool

Table C.1 Migratory fauna recorded or predicted to occur within 5 km of the study site (VBA and PMST)

Common name	Scientific Name	Count	Last Recorded	Source	Preferred habitat in Victoria
Wilson's Storm-Petrel	*Oceanites oceanicus*	1	1910	VBA	Marine areas.
Sooty Shearwater	*Puffinus griseus*	1	1978	VBA, PMST	Marine and coastal areas. Predominantly a New Zealand species. Uncommon winter visitor to Victoria, including Bass Strait.
Short-tailed Shearwater	*Puffinus tenuirostris*	50	2019	VBA	Marine and coastal areas. Breeds at Phillip Island. Likely to forage across Victorian oceans and coasts.
Flesh-footed Shearwater	*Puffinus carneipes*	0		PMST	Marine and coastal areas. Rare visitor to Victoria, including Bass Strait, and Tasmania.
Southern Giant-Petrel	*Macronectes giganteus*	26	1988	VBA, PMST	Marine areas. Occurs in both pelagic and inshore waters. Occasionally attracted to land at sewage outfalls and scavenges ashore.
Northern Giant-Petrel	*Macronectes halli*	10	1988	VBA, PMST	Marine areas. Visits areas off the Australian mainland mainly during the winter months (May-October). Immature and some adult birds are commonly seen during this period in offshore and inshore waters.
Wandering Albatross	*Diomedea exulans*	13	1979	VBA, PMST	Marine areas. Pelagic; occurs in southern oceans, breeding on subantarctic islands. Forages in pelagic and/or continental shelf waters, rarely occurs in near-shore waters.
Antipodean Albatross	*Diomedea antipodensis*	0		PMST	Marine areas. Endemic to New Zealand, but forages widely in open water in the south-west Pacific Ocean, Southern Ocean and the Tasman Sea, notably off the coast of NSW.
Black-browed Albatross	*Thalassarche melanophris*	30	2019	VBA, PMST	Marine areas. In the non-breeding season, follows cold water currents north to the continental shelves of Australia where it can occur in coastal and inshore waters and sometimes enter fjords and channels.

Common name	Scientific Name	Count	Last Recorded	Source	Preferred habitat in Victoria
Grey-headed Albatross	*Thalassarche chrysostoma*	0		PMST	Marine areas. Remains at sea outside the breeding season and generally only comes onto land to find a nest site, a mate and to breed.
Shy Albatross	*Thalassarche cauta*	53	2019	VBA, PMST	Marine areas. Over pelagic waters off the southeast coast of Tasmania. Breeds on three Australian islands and ranges across the southern Indian Ocean.
White-capped Albatross	*Thalassarche cauta steadi*	0		PMST	Marine areas. Probably common off the coast of south-east Australia throughout the year. Breeding colonies occur on islands south of New Zealand.
Salvin's Albatross	*Thalassarche salvini*	0		PMST	Marine areas. During the non-breeding season, uses continental shelves around continents. Occurs both inshore and offshore and enters harbours and bays. Scarce in pelagic waters.
Sooty Albatross	*Phoebetria fusca*	0		PMST	Marine areas. Occurs widely over pelagic waters during breeding and non-breeding seasons, exploiting dispersed sources of food. Forages over coastal kelp beds. Breeds on subtropical and subantarctic islands in the Indian and Atlantic Oceans, on vegetated cliffs and steep slopes that are sheltered from prevailing winds, often amongst tussock grass.
Southern Royal Albatross	*Diomedea epomophora*	0		PMST	Marine areas. Pelagic; occurs in waters off southern Australia at all times of year, especially between July and October. Rarely occurs in near-shore waters.
Northern Royal Albatross	*Diomedea sanfordi*	0		PMST	Marine areas. Pelagic; occurs in waters off southern Australia at all times of year, especially between July and October. Rarely occurs in near-shore waters.
Campbell Albatross	*Thalassarche impavida*	0		PMST	Marine areas, inhabiting sub-Antarctic and subtropical waters from pelagic to shelf-break water habitats.
Northern Buller's Albatross	*Thalassarche bulleri platei*	0		PMST	Marine areas. Pelagic, inhabiting subtropical and subantarctic waters of the southern Pacific Ocean. Seen over inshore, offshore and pelagic waters.

Common name	Scientific Name	Count	Last Recorded	Source	Preferred habitat in Victoria
White-winged Black Tern	*Chlidonias leucopterus*	5	1981	VBA	Coastal areas and large inland wetlands and rivers. Seasonal migrant to Australia. Uses coastal, subcoastal and terrestrial wetlands including bays, estuaries, swamps and floodplains. Most Victorian records are from Gippsland Lakes and western shoreline of Port Phillip Bay.
Australian Gull-billed Tern	*Gelochelidon nilotica macrotarsa*	6	2004	VBA	Shallow terrestrial wetlands and sheltered bays, estuaries, tidal mudflats and beaches. In Australia, mainly breeds in inland areas following floods.
Caspian Tern	*Hydroprogne caspia*	157	2021	VBA	Coastal areas and large inland wetlands and rivers. Exposed ocean beaches, sheltered coastal bays, harbours, lagoons, inlets, estuaries, usually with sandy or muddy margins. Breeds in a variety of coastal habitats including banks, ridges and beaches of sand and shell, often in open or among low or sparse vegetation.
Crested Tern	*Sterna bergii*	182	2021	VBA	Occurs along coasts and estuaries; very rarely further inland or on freshwater ponds/lagoons.
Little Tern	*Sternula albifrons*	6	1997	VBA, PMST	Coastal areas. Mostly recorded in sheltered coastal environments, including bays, lagoons and estuaries. Nests on sandy substrates containing much shell-grit.
Bridled Tern	*Sterna anaethetus*	2	2014	VBA	Widespread in Australia, breeding on offshore islands in western, northern and north-eastern Australia. Forages in offshore, continental shelf waters and only rarely recorded along mainland coasts.
Common Tern	*Sterna hirundo*	13	2014	VBA	Mainly coastal when not breeding. Uses offshore waters, ocean beaches, estuaries and large lakes. Occasionally seen in freshwater swamps, floodwaters, sewage farms and brackish and saline lakes.
Common Noddy	*Anous stolidus*	0		PMST	Usually occurs out to sea during the non-breeding season, but stays near islands when breeding.
Arctic Jaeger	*Stercorarius parasiticus*	3	1981	VBA	Coastal and marine. Breeds on Arctic tundra; spends the rest of the year at sea.
Pomarine Jaeger	*Stercorarius pomarinus*	1	2014	VBA	Coastal and marine. Breeds on Arctic tundra; spends the rest of the year at sea.

Common name	Scientific Name	Count	Last Recorded	Source	Preferred habitat in Victoria
Ruddy Turnstone	*Arenaria interpres*	126	2018	VBA, PMST	Non-breeding migrant, regular to Victoria. Typically coastal, on intertidal mudflats, sandflats and sandy beaches, rocky shores and intertidal reefs.
Grey Plover	*Pluvialis squatarola*	2	2014	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Coastal. Mudflats, saltmarsh, tidal reefs and estuaries.
Pacific Golden Plover	*Pluvialis fulva*	144	2018	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Usually in coastal habitats including mudflats, sandflats, rocky shores and saltmarsh. Also sub-coastal wetlands and sewage ponds.
Lesser Sand Plover	*Charadrius mongolus*	1	2010	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Coastal, but occasionally inland. Exposed sandflats and mudflats, estuaries, open sandy beaches. High tide roost sites are often located on beaches.
Double-banded Plover	*Charadrius bicinctus*	181	2021	VBA, PMST	Breeds in New Zealand; regular winter migrant to Victoria. Occurs in a variety of habitats including bays, mudflats, saltmarshes.
Greater Sand Plover	*Charadrius leschenaultii*	0		PMST	Non-breeding migrant to Australia during the austral summer. Coastal. Exposed sandflats and mudflats, estuaries, open sandy beaches. High tide roost sites are often located on beaches.
Eastern Curlew	*Numenius madagascariensis*	7	2013	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Coastal. Sheltered coastal habitats, usually with large sand flats or intertidal mudflats with seagrass, estuaries, open sandy beaches. Occasionally on coastal rock platforms.
Little Curlew	*Numenius minutus*	0		PMST	Non-breeding migrant to Australia during the austral summer. Common in north, uncommon to rare in south. Open, wet grasslands and plains, also coastal and estuarine areas.
Whimbrel	*Numenius phaeopus*	2	1980	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Typically coastal, including mudflats, sandflats, estuaries, sandy shores and rock platforms. Rarely recorded inland.
Black-tailed Godwit	*Limosa limosa*	12	2019	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Mudflats, sandflats, estuaries, large wetlands. Coastal, but occasionally inland.

Common name	Scientific Name	Count	Last Recorded	Source	Preferred habitat in Victoria
Bar-tailed Godwit	*Limosa lapponica*	12	2017	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Mudflats, sandflats, estuaries, large wetlands. Coastal, but occasionally inland.
Bar-tailed Godwit (Alaskan)	*Limosa lapponica baueri*	0		PMST	Non-breeding migrant to Australia during the austral summer. Mudflats, sandflats, estuaries, large wetlands. Coastal, but occasionally inland.
Wood Sandpiper	*Tringa glareola*	5	2015	VBA	Non-breeding migrant to Australia during the austral summer. Inhabits well vegetated shallow freshwater wetlands with emergent aquatic plants and dense fringing vegetation. Occasionally in intertidal habitats, including mangroves.
Grey-tailed Tattler	*Tringa brevipes*	2	1988	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Estuaries, tidal mudflats, mangroves, wave-washed rocks and reefs and shallow river margins coastal and inland.
Common Sandpiper	*Actitis hypoleucos*	20	2017	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Uses a wide variety of coastal and inland wetlands with muddy margins, including lakes, rivers, sewage ponds.
Common Greenshank	*Tringa nebularia*	180	2021	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Coastal mudflats, estuaries, salt marshes, mangroves, lakes and swamps.
Marsh Sandpiper	*Tringa stagnatilis*	40	2019	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Estuaries, and coastal and inland shallow wetlands.
Terek Sandpiper	*Xenus cinereus*	2	2014	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Mainly found on intertidal mudflats in sheltered estuaries, bays, harbours, lagoons, coastal swamps.
Curlew Sandpiper	*Calidris ferruginea*	97	2019	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Regular visitor to Victoria. Occurs in a variety of wetland habitats with fringing mudflats including bays, coastal lagoons, lakes, swamps, creeks, inundated grasslands, saltmarshes and artificial wetlands.
Red-necked Stint	*Calidris ruficollis*	386	2021	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Regular visitor to Victoria. Occurs in a variety of wetland habitats with fringing mudflats including bays, coastal lagoons, lakes, swamps, creeks, inundated grasslands, saltmarshes and artificial wetlands.

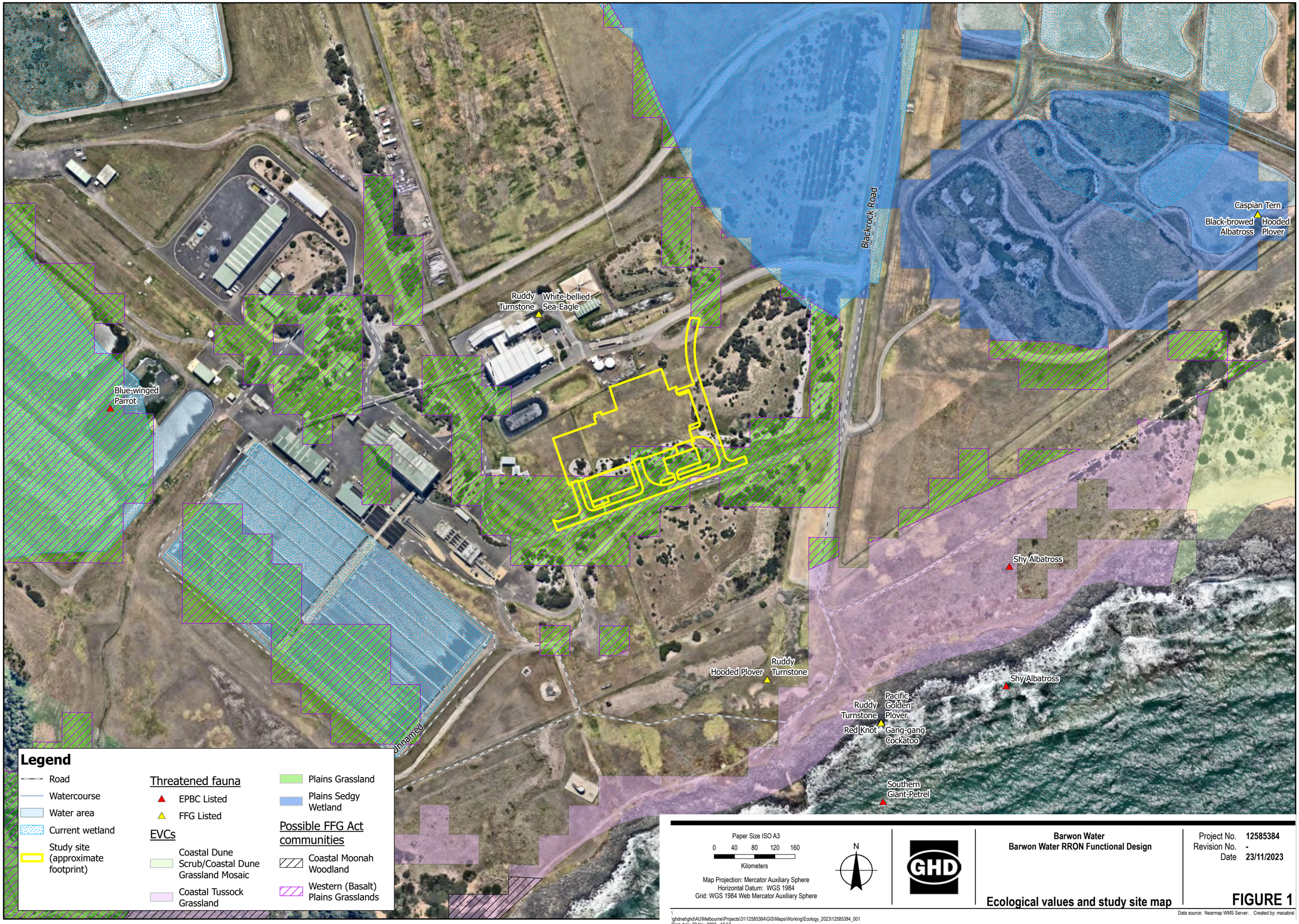
Common name	Scientific Name	Count	Last Recorded	Source	Preferred habitat in Victoria
Sharp-tailed Sandpiper	*Calidris acuminata*	99	2019	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Regular visitor to Victoria. Prefers muddy edges of shallow fresh or brackish wetlands with inundated or emergent low vegetation.
Red Knot	*Calidris canutus*	14	2015	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Coastal. Typically occurs on intertidal mudflats, sandflats and sandy beaches of sheltered coasts, and a range of other coastal and near-coastal environments such as lakes, lagoons, pools and pans, sewage ponds and saltworks. Inland lakes and swamps less commonly used.
Great Knot	*Calidris tenuirostris*	3	1986	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Coastal. Mainly found on intertidal mudflats, sandflats and sandy beaches.
Sanderling	*Calidris alba*	68	2020	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Visits Victoria, with some non-breeding individuals remaining over winter. Typically found on sandy beaches and foraging among piles of seaweed. Also mudflats, river mouths.
Broad-billed Sandpiper	*Limicola falcinellus*	1	1979	VBA	Non-breeding migrant to Australia during the austral summer. Mainly inhabits sheltered parts of the coast, where it can forage on exposed flats of soft mud or sand.
Long-toed Stint	*Calidris subminuta*	3	1981	VBA	Non-breeding migrant to Australia during the austral summer. Mudflats and weedy margins of coastal and inland wetlands.
Little Stint	*Calidris minuta*	9	2016	VBA	Rare summer vagrant to Australia, including Victoria. Occurs in intertidal mudflats and saltmarshes.
Pectoral Sandpiper	*Calidris melanotos*	5	2013	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Occurs in a variety of wetland habitats with fringing mudflats including bays, coastal lagoons, lakes, swamps, creeks, inundated grasslands, saltmarshes and artificial wetlands. Mostly recorded from Port Phillip Bay and Murray River region.

Common name	Scientific Name	Count	Last Recorded	Source	Preferred habitat in Victoria
Ruff	*Philomachus pugnax*	2	1995	VBA	Uncommon but regular non-breeding visitor to Australia during the austral summer. Fresh, brackish or saline wetlands with exposed mudflats at the edges. Also found in terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and floodlands. Occasionally seen on sheltered coasts, in harbours, estuaries, seashores and known to visit sewage farms and saltworks. Sometimes found on wetlands surrounded by dense vegetation including grass, sedges, saltmarsh and reeds.
Red-necked Phalarope	*Phalaropus lobatus*	5	2002	VBA, PMST	Uncommon non-breeding visitor to Australia during the austral summer. Recorded at both inland and coastal lakes/swamps, including highly saline waters and artificial wetlands, notably saltfields.
Latham's Snipe	*Gallinago hardwickii*	35	2019	VBA, PMST	Non-breeding migrant to Australia during the austral summer. Uses a wide variety of permanent and ephemeral wetlands, generally freshwater wetlands with cover. Also recorded along creeks, rivers and floodplains. Forages in soft mud at edge of wetlands and roosts in a variety of vegetation around wetlands including tussock grasslands, reeds and rushes, tea-tree scrub, woodlands and forests.
Swinhoe's Snipe	*Gallinago megala*	0		PMST	Rare, non-breeding summer migrant to northern Australia.
Pin-tailed Snipe	*Gallinago stenura*	0		PMST	Rare, non-breeding summer migrant to Western Australia.
Glossy Ibis	*Plegadis falcinellus*	47	2019	VBA	Wetlands, dams, flooded fields, mudflats, mangroves.
Garganey	*Anas querquedula*	1	1889	VBA	Coastal wetlands. Rare in Victoria.
Osprey	*Pandion haliaetus*			PMST	Found on the coast and in terrestrial wetlands of tropical and temperate Australia and off-shore islands, occasionally ranging inland along rivers. Uncommon in Victoria.
White-throated Needletail	*Hirundapus caudacutus*	12	2017	VBA, PMST	Almost exclusively aerial within Australia, occurring over most types of habitat, particularly wooded areas. Less often seen over open farm paddocks but has been recorded in vineyards flying between the rows of trees.
Fork-tailed Swift	*Apus pacificus*	1	1978	VBA, PMST	Aerial species, occurring over a wide range of environments, predominantly over open country but sometimes over forests and urban landscapes.

Common name	Scientific Name	Count	Last Recorded	Source	Preferred habitat in Victoria
Rufous Fantail	*Rhipidura rufifrons*	2	2016	VBA, PMST	Wet woodlands and sclerophyll forests, temperate rainforests, gullies dominated by Eucalypts.
Satin Flycatcher	*Myiagra cyanoleuca*	0		PMST	Uncommon summer migrant in forests, particularly densely vegetated gullies.
Yellow Wagtail	*Motacilla flava*	0		PMST	Migrates from northern hemisphere. Uses open grassy and waterside habitats in wintering grounds, occasionally in Australia, and in migration. Breeds on Arctic tundra from Alaska to Russia. Ground-dwelling. Often seen near water. Rarely sighted in Australia; most sightings in coastal and northern Australia.

Appendix D

Barwon Water’s 2023 briefing note



Paper Size ISO A3

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Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

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Barwon Water
Barwon Water RRON Functional Design

Project No. **12585384**
Revision No. **-**
Date **23/11/2023**

Ecological values and study site map

FIGURE 1

Data source: Nearmap WMS Server: . Created by: macabral

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