



## Balcombe Estuary Reserves

### 2019 Flora Survey, Vegetation Mapping and Management Guidelines

(Vegetation Cover/Quality, Weeds & Significant Flora)



Balcombe Creek



Boardwalk



Balcombe Estuary



Bushland

July 2020

Prepared for Balcombe Estuary Reserves Group Mt Martha

## **Balcombe Estuary Reserves 2019 Flora Survey, Vegetation Mapping & Management Guidelines (Vegetation Cover/Quality, Weeds and Significant Flora Species)**

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Version	Date	Reviewer/Authorised by	Notes
0.1	3/04/2020	Gidja Walker	Draft for BERG MM
0.2	1/05/2020	Liz Barraclough	Draft Version 2– responding to BERG queries
0.3	14/05/2020	N/a	Final Version
0.4	31/07/2020	N/a	Added years to Indigenous Vegetation Cover maps

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## 1. INTRODUCTION

Practical Ecology Pty Ltd was commissioned by the bushland friends group Balcombe Estuary Reserves Group Mt Martha (BERG MM) to undertake a range of tasks, mostly field-based, associated with vegetation mapping along the Balcombe Estuary Reserves:

- Digitise the 2002 hand-drawn indigenous vegetation cover mapping data, to provide it in a GIS-accessible format overlaid on aerial imagery.
- Map the current indigenous vegetation cover using tablet-based GIS mapping, to provide an update on the condition of vegetation within the reserves after 17 years of bushland regeneration and revegetation works.
- Compile an inventory and map of significant flora species in the reserves.
- Compile all the data collected and present it in a report with accompanying maps, including: significant species, weeds, and the 2002 and 2019 indigenous vegetation cover.
- Provide management guidelines and recommendations based on our observations during the mapping fieldwork.

This 2019 project updates the first flora survey of the reserves, completed in 2002 and reported in *Flora Survey, Mapping and Management Guidelines for Balcombe Estuary Reserve; Stage 3 July 2001 to June 2002* (Rohan Cuming and Gidja Walker, 2002). The 2002 survey provided a baseline against which to measure the effectiveness of BERG MM's work within the reserves. This survey shows clearly just how effective that work has been in restoring the bushland and its habitat value.

### 1.1 Study Site

The Balcombe Estuary Reserves comprise approximately 76 hectares stretching along Balcombe Creek from its mouth at The Esplanade in Mt Martha, to where it crosses the Nepean Highway below The Briars. Balcombe Estuary is the only significant estuary on the eastern side of Port Phillip Bay and, with its creek, comprises the largest unspoilt waterway entering this side of the Bay. The Estuary is further distinguished by being intermittently closed to the sea by a sandy barrier; possibly the only estuary of this type in the Port Phillip catchment. The surrounding bushland reserves are critical in protecting the waterway's integrity and health. The extent and diversity of the reserves' bushland are also rare on the Mornington Peninsula, and they are an integral part of the bushland corridor that links with The Briars and beyond.

Balcombe Creek arises at the back of Mt Eliza and flows through Baxter and the Moorooduc plain before it is joined by Devilbend Creek and turns westwards towards Port Phillip Bay. In its lower reaches, it flows through The Briars then the Balcombe Estuary Reserves, before entering the bay at Mt Martha.

The 2002 report identified several different vegetation communities within the reserves, including Banksia/Sheoak Woodland, Coast Manna Gum Woodland, Swamp Paperbark Scrub and Saline Swamp Complex. Vegetation communities are now classified as Ecological Vegetation Classes (EVCs; see Section 4). Factors such as geology, coastal influences and the levels of inundation adjacent to the creek govern where the different EVCs occur.

The reserves are predominantly bushland with a network of walking trails and boardwalks that provide passive recreational opportunities. There are also formal recreational facilities located within or abutting the bushland areas, including sporting ovals (Ferrero and Citation Ovals), a pistol club, tennis courts and a bowling club; and between the latter two, a pre-school also abuts the reserves.

The walking trails and boardwalks provide a pedestrian link that passes under the Nepean Highway into The Briars, along a walking track that follows Balcombe Creek. The Balcombe Estuary Reserves are connected to the Mt Martha Foreshore Reserve and they link the foreshore reserve with the bushland at The Briars.

A very active friends group, the Balcombe Estuary Reserves Group Mt Martha (BERG MM), which was formed in 1997, has been instrumental in the protection, rehabilitation and maintenance of the reserves.

The Balcombe Estuary Reserves fall within the Gippsland Plains Bioregion.

Figures 1 and 2 provide, respectively, a map and an aerial image of the Balcombe Estuary Reserves.



Figure 1. Map of Balcombe Estuary Reserves

Image source: <https://www.berg.org.au/>

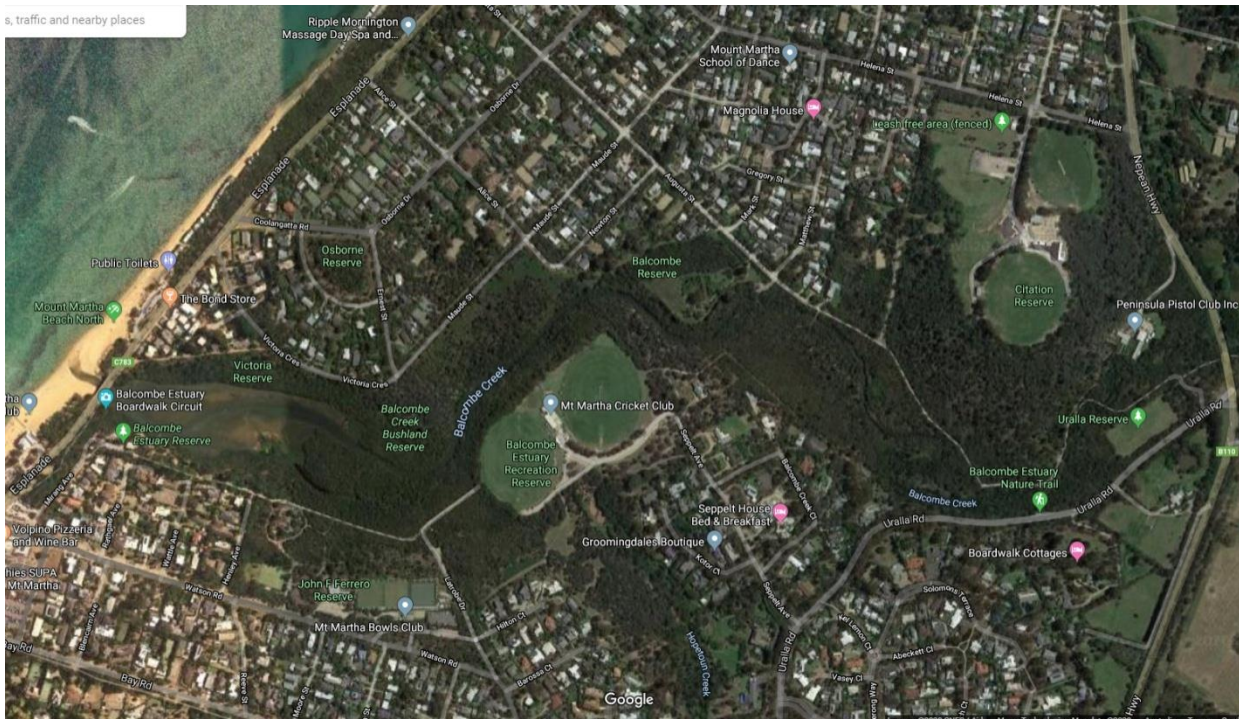


Figure 1. Aerial image of Balcombe Estuary Reserves

Source: Google Maps

## 2. METHODS

The central purpose of this project was to record the vegetation cover and condition, and the location of significant flora species and significant weed species/infestations, throughout the Balcombe Estuary Reserves, and to provide guidelines and recommendations on relevant management issues.

In addition, the 2002 hand-drawn vegetation condition mapping was digitised and overlaid on aerial imagery, to enable direct comparison between the 2002 and 2019 mapping.

The vegetation mapping fieldwork was undertaken by Gidja Walker and Katherine Smedley across three seasons: late summer (15/02/2019), winter (23–24/06/2019) and spring (27–28/10/2019). On each of the survey days, portions only of the reserves (not the entire reserves) were assessed, as outlined in Table 1 (the management zones referred to are shown on the map in Figure 2, in Section 3 of this report).

**Table 1. Fieldwork Dates and Management Zones**

Fieldwork Date	Management Zone Assessed	Comments
15/02/2019	Zone 1– Mirang	Entire zone assessed
	Zone 2– Campground	Entire zone assessed
	Zone 4– Bunyip	Partial assessment. Completed October 2019
23 & 24/06/2019	Zone 16– Victoria (Street)	Entire zone assessed
	Zone 15– Maude Street	Entire zone assessed
	Zone 14– Market Garden	Entire zone assessed
	Zone 11– Citation	Entire zone assessed
	Zone 12– The Jaw	Entire zone assessed
	Zone 13– Augusta	Entire zone assessed
	Zone 9– Uralla Corner	Entire zone assessed
	Zone 10– Eastern Streamline	Entire zone assessed
	Zone 8– The Tongue	Entire zone assessed
	Zone 6– Rabbit Paddock	Partial assessment. Completed October 2019
27 & 28/10/2019	Zone 3– The Spit	Entire zone assessed
	Zone 4– Bunyip	Completion of assessment from February 2019
	Zone 5– Below Ferrero	Entire zone assessed
	Zone 6– Rabbit Paddock	Completion of assessment from June 2019
	Zone 7– Black Sheoak	Entire zone assessed

The 2002 report, *Flora Survey, Mapping and Management Guidelines for Balcombe Estuary Reserve; Stage 3 July 2001 to June 2002* (Rohan Cuming and Gidja Walker, 2002), was utilised throughout the vegetation mapping fieldwork, mostly to compare the 2002 data with what was being observed during the three 2019 fieldwork sessions.

The following sections describe the methods used in mapping the vegetation.

## 2.1 Flora

An incidental (not-targeted, so the data was gathered via random meandering) flora survey was undertaken during the vegetation mapping fieldwork. The results are shown in Appendix 1, and this document also provides a link to an electronic copy of the spreadsheet (see Section 5), so it can be copied, used and added to over time by BERG MM. In addition, we recorded significant flora species within the reserves and, based on our observations, have provided advice and recommendations on vegetation management, both across the whole reserves and for each individual management zone.

The common and scientific names of plants used in this report are in accordance with *A Census of the Vascular Plants of Victoria* (Walsh and Stajsic 2008) and/or the Victorian Biodiversity Atlas (DEPI 2013).

### Symbology

Within this document, symbology is utilised to denote the type of flora species– indigenous, naturalised or exotic, as outlined below:

- Indigenous species– no symbol
- Naturalised species (species that are native to Australia/Victoria, but are not considered indigenous to the study site)– the symbol #
- Exotic species (planted and/or naturally spreading weedy exotic species)– the symbol \*.

#### 2.1.1 Significant Flora Species

The assessment of significant flora species in the reserves was undertaken by Gidja Walker based on her detailed knowledge of the Mornington Peninsula and the Balcombe Estuary Reserves. The assessment also utilised the previous records from the 2002 report: *Flora Survey, Mapping and Management Guidelines for Balcombe Estuary Reserve; Stage 3 July 2001 to June 2002* (Rohan Cuming and Gidja Walker), to determine if significant species observed in 2002 still occurred within the reserves.

The identification of flora species as ‘significant’ has been based on detailed knowledge of the Mornington Peninsula and the Port Phillip Bay foreshore. In some instance, flora species that are commonly recorded across Victoria have been recorded as ‘significant’ for the purposes of this survey if they are low in numbers in the Mt Martha or the Mornington Peninsula area.

Table 2 sets out the categories used to define ‘significance’.

**Table 2. Significant Flora Species Categories**

Category	Significant
EPBC	<p>Conservation status under EPBC Act 1999:</p> <p>EX: Extinct, CR: Critically endangered, EN: Endangered, VU: Vulnerable and CD: Conservation dependant</p>

Category	Significant
<b>FFG</b>	<b>Conservation status under FFG Act 1988:</b> L: Listed, N: Nominated, I: Invalid or ineligible, R: Rejected and D: Delisted
<b>VROTs</b>	<b>Conservation status of Threatened Flora in Victoria (DSE 2005)</b> x: Presumed extinct, e: Endangered, v: Vulnerable, r: rare and k: poorly known
<b>R</b>	Regionally Significant
<b>HL</b>	High Local significance/few individuals along foreshore

### Limitations of the Flora Survey

The flora survey of the reserves is subject to two limitations:

- While the survey involved field work in three different seasons, the observations for each zone relate only to the season/s in which it was surveyed (see Table 1). This means that some flora species that might be present (particularly orchid, lily and other herbaceous species that are visible only for a limited period of time), may not have been visible at the time of the survey. This is especially the case for the zones surveyed in late summer (when sites had dried out) and winter (too cold and not the peak bushland flowering season).
- A one-off seasonal flora survey is never able to capture the full suite of indigenous grassy and herbaceous species growing within a reserve.

Nevertheless, based on previous surveys, maps and local knowledge, we believe that the majority of significant flora species within the reserves were recorded.

### 2.1.2 Weed Species and Control Prioritisation

Across the Balcombe Estuary Reserves, each weed/introduced species that we identified was categorised and assigned a level of priority according to its level of threat and invasiveness within the reserves. Factors taken into consideration were the numbers and ecology of each, and site variables such as tidal influence and/or topography.

Table 3 outlines the weed prioritisation categories used.

**Table 3. Weed Prioritisation Categories**

Weed Prioritisation Categories	Description of each Category
Keystone (K)	<p>Totally dominates structurally and floristically/old populations that have reached the peak of their invasion potential in a given area.</p> <ul style="list-style-type: none"> <li>• Many species (flora and fauna) may have become dependent on weeds.</li> <li>• Work slowly and systematically from highest quality areas outwards. <ul style="list-style-type: none"> <li>• Remove mature specimens first.</li> <li>• Keep in mind buffers/habitat.</li> </ul> </li> </ul>

Weed Prioritisation Categories	Description of each Category
Small patches (S) or the only observed occurrence of a species	Of variable risk, but easiest to eliminate as they are in small numbers
S1	Highest risk and priority for control. Eliminate from the site.
S2	Moderate risk and priority for control. Eliminate from the highest quality areas first.
S3	Low risk and priority for control. Aesthetic weed, no seedlings observed
Ubiquitous species (U)	Scattered weeds of disturbed areas Hard to eliminate; look at management regimes. Eliminate in high quality areas, but of lower priority elsewhere within the site.

*Weed categorisation categories provided by Gidja Walker*

### Limitations of Weed Species Mapping

The weed species mapping is subject to two limitations:

- Whilst the fieldwork occurred over three sessions and seasons, few of the management zones were surveyed in more than one season; therefore the weed species list is mostly 'a point in time' survey list. Some annual weed species that flower in summer/autumn and/or winter may have been missed.
- Late summer, autumn, winter and spring 2019 were exceptionally dry, with lower-than-average rainfall. Had the survey occurred in a year with average rainfall, some other species may have been present and/or some species may have been present in larger numbers. This highlights the effect of climatic differences from year to year.

## 2.2 Vegetation Communities and Ecological Vegetation Classes

The 2002 survey (Cuming and Walker, 2002) identified and mapped vegetation communities across the Balcombe Estuary Reserves. Since then, vegetation communities have been re-classified as Ecological Vegetation Classes (EVCs). This report translates the 'vegetation communities' descriptions into EVCs (see Section 4), but it does not repeat the mapping of the location of those communities/EVCs.

Ecological Vegetation Classes (EVCs) provide a method of systematic organisation of plant communities into common types that occur in similar environmental conditions throughout Victoria. Each EVC is identified on the basis of its floristic composition (the plant species present), vegetation structure (woodland, grassland, saltmarsh), landform (gully, foothill, plain) and environmental characteristics (soil type, climate).

## 2.3 Vegetation Quality and Cover Mapping

Vegetation Cover Mapping provides data on the indigenous vegetation cover and quality in the mapped area. This can help in determining vegetation management priorities. It also provides a baseline for monitoring indigenous ground-storey vegetation quality and cover over time.

The mapping for this project entailed assessing and categorising remnant indigenous vegetation based on the upper (canopy and shrub) and lower (ground-storey) layers. The amount of 'indigenous' versus 'exotic' plant cover was estimated, to determine the vegetation quality/cover category, using a four-level colour-coded rating system, as set out in Table 4.

**Table 4. Indigenous Vegetation Quality Mapping Categories**

Colour	Indigenous Vegetation Quality
Red	<p><b>Less than 25% indigenous vegetation cover</b></p> <p><b>Revegetation Area– lowest priority</b></p> <ul style="list-style-type: none"> <li>• Low diversity of indigenous vegetation</li> <li>• High level of weed invasion and disturbance impacts</li> <li>• Aim to control weed seed production</li> <li>• May plant* in high profile areas (i.e. to create a buffer or to link higher quality areas)</li> <li>• Still may have habitat or buffer values, which weeds will be providing</li> </ul>
Orange	<p><b>25–50% indigenous vegetation cover</b></p> <p><b>Restoration Area– moderate priority</b></p> <ul style="list-style-type: none"> <li>• Moderate to low diversity of indigenous vegetation</li> <li>• Moderate to high weed invasion</li> <li>• Restore slowly</li> <li>• Aim to control weed population</li> <li>• Possible enrichment planting* after allowing time for natural regeneration</li> <li>• Semi-skilled workforce under skilled co-ordination</li> </ul>
Blue	<p><b>50–75% indigenous vegetation cover</b></p> <p><b>Retention area– high management priority</b></p> <ul style="list-style-type: none"> <li>• Moderate diversity of indigenous vegetation</li> <li>• Moderate weed invasion</li> <li>• Restore slowly</li> <li>• Aim to control weed populations</li> <li>• Possible enrichment planting* after allowing time for natural regeneration</li> <li>• Semi-skilled workforce under skilled co-ordination</li> </ul>
Green	<p><b>Greater than 75% indigenous vegetation cover</b></p> <p><b>Retention areas– highest management priority</b></p> <ul style="list-style-type: none"> <li>• High diversity and level of structural integrity</li> <li>• Aim to eliminate all weeds over time</li> <li>• Retain what is left</li> <li>• No planting, allow for natural regeneration/recruitment only</li> <li>• Highly skilled bushland management workforce only to work in these areas– skilled in plant identification and targeted weed control works</li> </ul>

*\* Any planting should only be done using seed collected from the closest indigenous seed source (preferably site specific), and from the same soil type and vegetation community.*

## **Grid Mapping**

A 20m x 20m grid system was overlaid across the entire area of the Balcombe Estuary Reserves to ensure accuracy in the 2019 mapping, and to ensure that each 20m x 20m grid was surveyed. Within the grids, areas with different indigenous vegetation cover were mapped using polygons to show the extent of each 'cover area'.

It is envisaged the grid system will continue to be used as a reference in any future mapping undertaken in the reserves. This system has been imported into Google My Maps so that it can be copied by BERG MM and used for future mapping and ongoing surveys, while the map layers created for this report remain fixed in time, as a point of reference.

## **Limitations**

Issues with vegetation cover mapping include the subjectivity of the different assessors and the time of year in which the mapping is undertaken. The amount of recent rainfall can influence the extent of indigenous versus exotic ground-storey vegetation present; weeds generally prefer higher rainfall, whilst less rainfall can favour indigenous species.

This was relevant, for example, in Zones 2 and 3. Areas mapped in February 2019 (dry season) were initially assessed as having a high (blue or green) indigenous vegetation cover. However when the area was re-visited in October 2019, after rainfall and germination of the annual weedy grasses, the area was re-assessed as having a low to moderate indigenous vegetation cover (orange).

### 3. MANAGEMENT ZONES

Restoration work in the Balcombe Estuary Reserves has taken place within eighteen management zones. This project covered sixteen of those zones, located between The Esplanade and Nepean Highway, mapping their indigenous vegetation cover, significant flora species, and significant weed/s, and providing management recommendations for each zone (see Section 9).

Similar works were also undertaken in 2019 (as a separate project by Gidja Walker) for the section of the reserves between the beach and The Esplanade, known as Management Zone 17 – Foreshore.

Management Zone 18 – Hopetoun was not included in the project, as it is not physically connected to the Balcombe Estuary Reserves, but located to the south along Hopetoun Creek.

Figure 2 shows the location of seventeen of the eighteen management zones; these are also shown in the zones layer in the digital mapping set, which can be accessed via the link below:

[Zone layer on map](#)

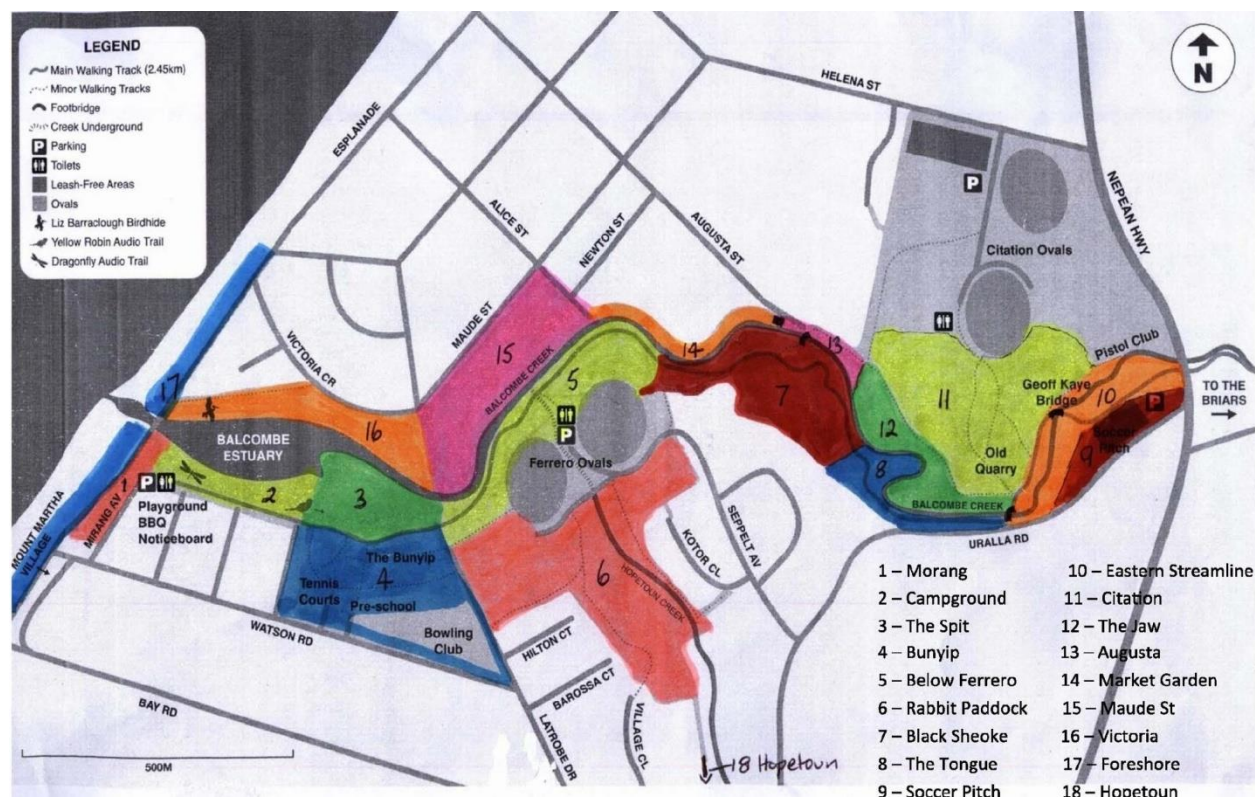


Figure 2. Balcombe Estuary Reserves Management Zones

## 4. ECOLOGICAL VEGETATION CLASSES

As mentioned in Section 2.2, the 2002 project, *Flora Survey, Mapping and Management Guidelines for Balcombe Estuary Reserve* (Cuming and Walker, 2002), identified and mapped vegetation communities across the reserves.

Whilst this 2019 project was not concerned with re-mapping the location of these vegetation communities, it was necessary, to enable comparison of the two studies, to update the vegetation community names and descriptions into the current vegetation classification system of Ecological Vegetation Classes.

Table 5 below outlines each of the vegetation communities and their corresponding EVCs. In some instances a vegetation community identified in 2002 may be considered a mosaic of EVCs due to the extent of modification/disturbance of the vegetation. Without a comprehensive re-mapping of EVCs across the reserves, it is difficult to identify areas where there are EVC mosaics.

The Bioregional Conservation Status (BCS) provided for each EVC is based on the significance of the EVC within the Gippsland Plain bioregion.

**Table 5. 2002 Vegetation Communities and 2019 EVCs**

2002 Vegetation Community	2002 Description (Cuming & Walker, 2002)	Corresponding EVC (and BCS)	2019 Description
Banksia/Sheoak Woodland	Located close to the coast, and above the flood zone, Coast Banksia/Drooping Sheoak Woodland. Most of this community is now no longer extant except for a few old trees and some patches of Sea-berry Saltbush and Bower Spinach.	EVC 2: Coast Banksia Woodland (vulnerable) EVC 175: Grassy Woodland (endangered)	Coast Banksia Woodland Grassy Woodland are located in areas with indigenous canopy layers and some ground-storey species.
Coast Manna Gum Woodland	Manna Gum Woodland would have originally included a variety of communities and sub-communities due to the differing geology across the reserves. The Manna Gum Woodland has largely been invaded by Coast Tea-tree. The natural understorey of the woodland appears to be grassland, particularly within the more inland zones. Closer to the coast, and on more sandy soils, heathland understorey appears to predominate, with indicators	EVC 2: Coast Banksia Woodland (vulnerable) EVC 160: Coastal Dune Scrub (depleted) EVC 3: Damp Sands Herb-rich Woodland (vulnerable) EVC 175: Grassy Woodland (endangered) EVC 48: Heathy Woodland (least concern)	Probably several EVCs: An overlap with EVC 2: Coast Banksia Woodland and EVC 160: Coastal Scrub. EVC 3: Damp Sands Herb-rich Woodland below Augusta St. EVC 175: Grassy Woodland in areas with lilies and grassland diversity eg patch below Citation Oval. EVC 48: Heathy Woodland where there are sedges, Black Sheoak etc. There are lots of ecotones and differing overlaying geologies across the reserves.

2002 Vegetation Community	2002 Description (Cuming & Walker, 2002)	Corresponding EVC (and BCS)	2019 Description
	such as Sand-hill Sword-sedge and Showy Bossiaea. Other Eucalypts such as Narrow-leaf Peppermint and Swamp Gum also occur, particularly on the slate deposits		
Swamp Paperbark Scrub	On alluvial soils closer to the creek line, and within the flood zones, a dense scrub of Swamp Paperbark has formed. The understorey varies from Blue Tussock-grass to a herbfield of saline tolerant species, such as Shiny Swamp-mat and Creeping Cotula.	EVC 953: Estuarine Scrub (*)	Located closer to the coast.
		EVC 53: Swamp Scrub (endangered)	Located further upstream.
Saline Ephemeral Herbfield	On sites subject to tidal influence and inundation, a complex of Saline Swamp communities have developed. Many of these populations are too small or narrow to map individually, and have been collectively mapped under Saline Ephemeral Herbfield. This includes communities such as Aquatic Herbfield, Reed Swamp, Brackish Wetland and Saltmarsh communities.	EVC 952: Estuarine Reed Bed (*)	At the mouth of the estuary, and at the promontory that sticks out north of Henley Ave
		EVC 821: Tall Marsh (*)	Possibly Tall Marsh where Phragmites dominates further inland/upstream from Henley Ave.
		EVC 9: Coastal Saltmarsh**	A small patch located just inside the estuary entrance on the southern shoreline and in the estuary itself.

\*\* The EPBC Act-listed "Subtropical and Temperate Coastal Saltmarsh" community occurs on the southern shoreline just inside the mouth of Balcombe Estuary and between Victoria Crescent and Henley Avenue. It is comprised primarily of Wet Saltmarsh Herbland dominated by Beaded Glasswort *Sarcocornia quinqueflora* ssp *quinqueflora* and Austral Seablite *Suaeda australis* with patches of Estuarine Wetland dominated by Sea Rush *Juncus kraussii* ssp *australiensis*, Salt Club-sedge *Bolboschoenus caldwellii* and Bare Twig-sedge *Baumea juncea* ([see layer on Map Link](#)).

## 5. RESULTS: INDIGENOUS FLORA SPECIES

### 5.1 General Flora Survey Results

A flora survey of the reserves was a core component of vegetation mapping in both 2002 and 2019.

In 2002, 349 species were recorded; of these 176 were indigenous (51%) and 173 were introduced (49%). The 2002 report provides the species list.

In 2019, 310 species were recorded; of these 153 were indigenous (49%) and 157 were introduced (51%). Appendix 1 provides the Total Species List, or use the following link to access an electronic copy:

[Link to electronic spreadsheet](#)

The link will enable BERG MM to copy the flora list spreadsheet, and continue to add species as they are observed.

Given the ongoing revegetation works in the reserves over some years, it was not always possible to determine if some species (especially trees and shrubs) were remnant or have been planted. While species planted within the reserves over the past 20 years or so have been grown from locally sourced indigenous seed stock, the origin of those planted species before that is not known.

### 5.2 Significant Flora Survey Results

We have defined 'significant species', for this project, as:

- those listed as State-threatened species, plus
- those that are locally rare, or
- unusual species (that is species that have a locally restricted distribution), that are growing along the creekline reserve
- those that are of Regional and/or High Local significance, based on
  - previous surveys referenced in the 2002 report (Cumming & Walker, 2002) and/or
  - local knowledge (provided by Gidja Walker) of remnant vegetation within the Mornington Peninsula.

Table 6, combining data from the 2002 and 2019 vegetation surveys, lists all flora species identified within the Balcombe Estuary Reserves that are considered to be significant. It also provides the significance level of each of these species based on the Department of Environment, Land, Water and Planning (DELWP) Victorian Register of Threatened Species (VROT) ratings, and previous surveys and reports or local knowledge (Regional/Local).

Use the link (above) to the 2019 Mapping Dataset to access a map layer showing the location of significant flora species recorded in 2019.

Table 6. Significant Flora Species

Recorded 2002	Recorded/ Added 2019	Significance			Scientific Name	Common Name
		State (VROTs)	Regional	High Local		
	X			X	<i>Acacia mearnsii</i>	Black Wattle
	X			X	<i>Acacia melanoxylon</i>	Blackwood
X				X	<i>Acrotriche prostrata</i>	Trailing Ground-berry
	X			X	<i>Acrotriche serrulata</i>	Honey-pots
	X			X	<i>Adiantum aethiopicum</i>	Common Maidenhair
X	X		X	X	<i>Allocasuarina littoralis</i>	Black Sheoak
X	X		X		<i>Allocasuarina verticillata</i>	Drooping Sheoak
	X			X	<i>Amyema pendulum</i>	Drooping Mistletoe
X			X		<i>Aotus ericoides</i>	Common Aotus
X	X		X		<i>Apium prostratum ssp. prostratum</i>	Sea Celery
	X			X	<i>Arthropodium spp. (s.s.)</i>	Vanilla Lily
	X			X	<i>Arthropodium strictum s.l.</i>	Chocolate Lily
	X			X	<i>Astroloma humifusum</i>	Cranberry Heath
X	X		X		<i>Banksia integrifolia var. integrifolia</i>	Coast Banksia
X	X		X		<i>Banksia marginata</i>	Silver Banksia
X			X		<i>Bossiaea cinerea</i>	Showy Bossiaea
	X			X	<i>Bossiaea prostrata</i>	Creeping Bossiaea
	X			X	<i>Burchardia umbellata</i>	Milkmaids
X	X		X		<i>Caesia parviflora</i>	Pale Grass-lily
X	X		X		<i>Carex appressa</i>	Tall Sedge
X	X		X		<i>Carex breviculmis</i>	Common Grass-sedge
	X			X	<i>Carex fascicularis</i>	Tassel Sedge
X	X		X		<i>Cassinia aculeata</i>	Common Cassinia
X			X		<i>Cassinia arcuata</i>	Drooping Cassinia
X			X		<i>Chamaescilla corymbosa var. corymbosa</i>	Blue Stars
X			X	X	<i>Chiloglottis reflexa</i>	Autumn Bird-orchid
X	X		X		<i>Clematis microphylla</i>	Small-leaved Clematis
	X			X	<i>Comesperma volubile</i>	Love Creeper
X	X		X		<i>Correa reflexa</i>	Common Correa
X	X		X		<i>Dianella longifolia</i>	Flax-lily
	X		X		<i>Daviesia latifolia</i>	Hop Bitter-pea
	X			X	<i>Dipodium sp</i>	Hyacinth Orchid
X	X		X		<i>Disphyma crassifolium ssp. clavellatum</i>	Rounded Noon-flower
X	X		X		<i>Distichlis distichophylla</i>	Australian Salt-grass
	X			X	<i>Exocarpos cupressiformis</i>	Cherry Ballart
X			X		<i>Exocarpos strictus</i>	Pale-fruit Ballart
X			X		<i>Gahnia filum</i>	Chaffy Saw-sedge
X	?		X		<i>Geranium retrorsum</i>	Crane's Bill
X				X	<i>Gratiola peruviana</i>	Austral Brooklime
X	X		X		<i>Hibbertia sericea s.l.</i>	Silky Guinea-flower
X				X	<i>Hydrocotyle hirta</i>	Hairy Pennywort

Recorded 2002	Recorded/ Added 2019	Significance			Scientific Name	Common Name
		State (VROTs)	Regional	High Local		
	X			X	<i>Hypericum gramineum</i>	Small St John's Wort
X			X	X	<i>Indigofera australis</i>	Austral Indigo
X			X		<i>Isolepis cernua</i>	Nodding Club-sedge
X			X		<i>Isolepis nodosa</i>	Knobby Club-sedge
X	X				<i>Juncus kraussii ssp. australiensis</i>	Sea Rush
X	X		X		<i>Kunzea ericoides</i>	Burgan
	X			X	<i>Lepidosperma gladiatum</i>	Coast Sword-sedge
	X			X	<i>Lepidosperma gunnii</i>	Slender Sword-sedge
X	X		X		<i>Lepidosperma laterale var. majus</i>	Variable Sword-sedge
	X			X	<i>Leptospermum continentale</i>	Prickly Tea-tree
X	X		X		<i>Leptinella reptans</i>	Cotula
X			X		<i>Leptocarpus brownii</i>	Coarse Twine-rush
X	X		X		<i>Leucopogon parviflorus</i>	Coast Beard-heath
X	X		X		<i>Lobelia alata</i> (now <i>L. anceps</i> )	Angled Lobelia
	X			X	<i>Lomandra micrantha s.l.</i>	Small-flower Mat-rush
X			X		<i>Luzula meridionalis</i>	Common Woodrush
X	X			X	<i>Muellerina eucalyptoides</i>	Creeping Mistletoe
X	X		X		<i>Myoporum insulare</i>	Common Boobialla
	X			X	<i>Myoporum viscosum</i>	Sticky Boobialla
X	X		X		<i>Oxalis exilis</i>	Shady Wood-sorrel
		r			<i>Oxalis rubens</i>	Dune Wood Sorrel
X			X	X	<i>Patersonia occidentalis</i>	Long Purple-flag
X	X		X		<i>Phragmites australis</i>	Common Reed
X	X		X		<i>Poa poiformis</i>	Blue Tussock-grass
	X		X		<i>Polystichum proliferum</i>	Mother Shield-fern
	X		X		<i>Pteris tremula</i>	Tender Brake
	X		X		<i>Pterostylis nutans</i>	Nodding Greenhood
	X		X		<i>Ranunculus sp.</i>	Buttercup
	X		X		<i>Rubus parvifolius</i>	Small-leaf Bramble
X	X		X		<i>Senecio minimus</i>	Shrubby Fireweed
X			X		<i>Senecio tenuiflorus</i>	Slender Fireweed
	X			X	<i>Senecio odoratus var. odoratus</i>	Scented Groundsel
X			X		<i>Solanum aviculare</i>	Kangaroo Apple
	X			X	<i>Sonchus hydrophilus</i>	Native Sow-thistle
X			X		<i>Stellaria pungens</i>	Prickly Starwort
X	X		X		<i>Tetragonia implexicoma</i>	Bower Spinach
	X			X	<i>Thelymitra spp.</i>	Sun Orchid
	X			X	<i>Thysanotus patersonii</i>	Twining Fringe Lily
X	X		X	X	<i>Tricoryne elatior</i>	Yellow Rush-lily
X			X		<i>Veronica gracilis</i>	Slender Speedwell
X	X		X	X	<i>Xanthorrhoea minor</i>	Small Grass-tree
	X	r			<i>Zygophyllum billardieri</i>	Coast Twin-leaf

Regional- Regionally significance  
HL- High Local significance

**Conservation status of Threatened Flora in Victoria (DELWP)– VROTs**  
x: Presumed extinct, e: Endangered, v: Vulnerable, r: rare and k: poorly known  
Definitions of Conservation Status Codes are found on DELWP website

## Summary of Significant Flora Species (2002 and 2019)

All local species growing in the Balcombe Estuary Reserves are considered to be significant due to the depletion of remnant coastal and estuarine vegetation along eastern Port Phillip Bay, the on-going pressures from competing land-use interests along the foreshore, and on-going urban development of surrounding land. This was the case in 2002, and remains so in 2019, with these pressures only increasing.

In 2002, no flora species of State significance, and only a few species considered to be of Regional significance were recorded. Species recorded as being of High Local significance were those for which only a few individuals were observed/present in areas within the surveyed area of the reserves; or for which there are only a few database records in the Mount Martha area.

In 2019, two flora species of State significance were recorded, plus 28 species of Regional significance, and 32 species considered of High Local significance, which are present only in a few localised patches within the reserves.

The two VROT/State listed species are the Dune Wood-sorrel *Oxalis rubens* and Coast Twin-leaf *Zygophyllum billardierei*. It is possible that Dune Wood-sorrel, which is scattered in occurrence on mostly sandy soils within the reserves, was previously overlooked due to the difficulty of identifying the *Oxalis* genera to species level. Coast Twin-leaf has been planted within the reserves to preserve its local viability, after one vulnerable plant was found close by in the foreshore reserves.

Whilst mostly the same significant species were recorded in both 2002 and 2019, there are some differences, as presented in Table 5. The differences are mainly due to the dryness of the seasons during the 2019 survey (some annual or geophytic species recorded in 2002 were not evident in winter 2019, which was attributed to the dry 2019 winter), and the limited amount of time spent on site in both the 2002 and 2019 surveys.

Whilst mostly the same significant species were recorded in both 2002 and 2019, there are some differences as presented in Table 5. The differences are mainly due to the dryness of the season of survey– some annual or geophytic species recorded in 2002 were not evident in winter 2019, and the amount of time spent on site.

## 5.3 2019 Significant Flora Species Mapping

The digital mapping set generated in this 2019 project includes a layer showing significant flora species. This layer, which can be accessed via the link below, can be used by BERG MM as an on-going mapping tool that can be added to over time if new locations and/or specimens of significant flora species are found.

The Significant Flora Species map layer also shows the locations of potential midden sites, habitat areas and management issues.

[Significant flora map link](#)

## 6. RESULTS: WEED SPECIES

The 2019 survey recorded 156 introduced flora species within the Balcombe Estuary Reserves. Many of these were also recorded in the 2002 assessment; however an additional 14 new weed species were identified in 2019.

Appendix 2 provides the introduced/weed species list, and in the box below is a link to the electronic spreadsheet, provided so BERG MM can copy, use and add to the list in their bushland management and monitoring works.

[Link to electronic spreadsheet](#)

### Setting Priorities in Weed Control

The 156 weed species recorded in the reserves fall into the following weed priority categories:

- **Keystone:** Panic Veldt Grass \**Ehrharta erecta* is the only Keystone weed across the whole of the reserves. Several other species are considered to be Keystone in one area, but S1 (small patch but high risk) in other areas. These species are: Bridal Creeper \**Asparagus asparagoides*, Cluster Pine \**Pinus pinaster*, Radiata Pine \**Pinus radiata*, Rat-tail Grass \**Sporobolus africanus* and Kikuyu \**Cenchrus clandestinum*.
 

- Management: Keystone weed species need a long-term control approach, with the emphasis being on working from high quality (green) areas outwards.
- **S1:** 32 species are classified as S1 species; these are generally small patches that are a priority for immediate removal. Their location (and that of other introduced/weed species) is shown on the weed layer of the 2019 Mapping dataset (see link below).
- **S2:** 20 species are classified as S2 weeds; these should be controlled, but are not as high a priority as S1 weeds.
- **Ubiquitous:** 58 weed species are considered to be ubiquitous; that is, they tend to be disturbance-generated, are difficult to control, and are not a priority except in the green (high quality) mapped areas. All of these 58 species are considered to be ubiquitous across the reserves; however some of them have also been classified as S1 and S2 weeds, depending on where they were recorded in the reserves, and the quality of the surrounding vegetation.
- Seven species were not assigned a weed prioritisation, as it was not possible to determine their risk/priority level during the fieldwork as only one or a few of these species were observed. These species should be monitored to determine their level of invasiveness and likelihood of spreading within the reserves.

The location of many of these weed species is provided via the link below.

[Weed layer on map link](#)

## Considerations in Weed Control

Weeds vary in their ability to invade and dominate indigenous vegetation. Some will disappear if the disturbance or threatening process is removed or management regimes are changed. Others have been growing in the reserves for a long time and will require a long-term management approach. Some are new arrivals posing varying levels of risk, but they are most easily eliminated before they spread. Considerations in undertaking weed control are:

### Is the plant actually a weed?

- Correct identification is essential.
- If you are not sure, then don't remove it.

### Is the weed nevertheless serving a useful function?

- How long has it been there? Is it serving a function within the ecosystem?
- Is it providing habitat for fauna, shade for ground-storey ecosystems or erosion control along the creekline?
- Weed species that provide these functions should be removed *only* as part of a staged management process that also manages or replaces the function the weed provides.

### Are any significant species present that need protecting?

- Always consider this before starting any weed control works. Always check the 2019 map layers first, then check on site for additional habitat signs.

The responses to these questions will help to determine the type of weed control required.

**Weed invasion is one of the greatest management threats to indigenous vegetation. It requires an on-going management commitment.**

## 7. RESULTS: VEGETATION QUALITY

As outlined previously, the main focus of this project was to map the current (2019) cover and quality of indigenous vegetation in the Balcombe Estuary Reserves, and to digitise the 2002 mapping. In addition, we also mapped the location of significant flora species and weed species.

The map sets are presented as hard copies at the back of this report, and can be accessed in electronic form via the link below, so they can be copied by BERG MM and incorporated into ongoing mapping and monitoring works.

[Map layers](#)

A central aim of the project was to determine if there had been changes since 2002 in vegetation cover and quality, and in the cover and abundance of significant species, after 17 years of on-going bushland management, rehabilitation and restoration works.

The very substantial improvements in vegetation quality over this time are clearly evident in a comparison of the 2002 and 2019 vegetation quality mapping (see maps 1 and 2A at the back of this document).

In summary:

- Almost 10ha of the most weedy vegetation (red; 0–25% indigenous vegetation cover) has been rehabilitated and now falls into a higher level mapping category.
- There has been a slight 1.97ha increase in the amount of weedier moderate quality bushland (orange; 26–50% indigenous vegetation cover).
- There has been a slight 1.33ha increase in the amount of moderate to higher quality bushland (blue; 50–75% indigenous vegetation cover).
- Notably, there has been a large increase in the amount of higher quality bushland (green; 76–100% indigenous vegetation cover).

Table 7 on the next page, outlines these changes by area (hectares) across the reserves. The locations of the changes can be seen by comparing and analysing the two mapping sets (2019 and 2002).

The decrease in almost 10ha of the weediest vegetation and an increase of almost 9.5ha of the highest quality bushland clearly illustrates the hard work and dedication of the BERG MM volunteers, the Mornington Peninsula Shire's Natural Systems Team and the bushland management contractors (Naturelinks) and all their active involvement in the management and rehabilitation of the reserves.

Table 7. Extent of Mapped Vegetation Cover

Year of Vegetation Quality Mapping	Vegetation Quality/Cover Category				Total hectares mapped
	0–25% indigenous vegetation cover (red)	26–50% indigenous vegetation cover (orange)	51–75% indigenous vegetation cover (blue)	76–100% indigenous vegetation cover (green)	
2002	11.58ha	14.53ha	16.47ha	5.46ha	48.04ha
2019	1.7ha	16.5ha	17.8ha	14.8ha	50.8ha
Difference between 2002 and 2019	–9.88ha	+1.97ha	+1.33ha	+9.34ha	+2.76ha

## 8. GENERAL MANAGEMENT RECOMMENDATIONS

This section sets out general management recommendations applicable across the whole of the reserves. Section 9 provides guidelines for each of the sixteen management zones surveyed.

### 8.1 Rabbit-proof Fencing

We observed that the moss layer had disappeared or was dead under the ground layer of rabbit-proof fencing in the reserves.

It has recently been documented that the moss layers surrounding caged and protected orchid colonies disappears under galvanised wire fencing, with the zinc used in galvanising causing the moss layer to die. Moss layers are critical nursery habitat for many orchid and newly germinating species.

**Recommendation – Rabbit-proof fencing:** Future rabbit proof fencing should be constructed of blue steel wire, which does not have a zinc coating. It will last longer and have less impact vegetation.



Dead moss layer under rabbit-proof fencing

## 8.2 Bike Jumps and Tracks

The informal construction and use of mountain bike tracks is creating major erosion and direct impacts on some areas of significant vegetation. This was particularly evident in Zone 4 (Bunyip) and Zone 11 (Citation). Young people derive a lot of benefit from this sport and space needs to be made available for them within easy commuting distance of their homes.

### Recommendations – Bike jumps and tracks

- Set up (in conjunction with Mornington Peninsula Shire Council); a community committee to look at other possible sites for mountain bike tracks. Options might include part of the Rabbit Paddock (for those residents south of the reserves), and the cleared area west of the ovals at Citation Reserve (for residents north of the creek). Cultural advice would be needed, as any elevated site along a creek potentially has cultural significance.
- In conjunction with creating other bike jumps/tracks, restrict access to the current sites that are being impacted, and restore/rehabilitate them.

## 8.3 Recreation Clubs and Pre-school Abutting the Reserves

It is not known whether the Committees of Management for the recreation clubs and pre-school that are adjacent to or within the reserves have representation or contact with Council and/or BERG MM regarding the significance of the surrounding bushland, and what their specific management responsibilities may be regarding any bushland that falls within their site/s may be.

**Recommendation – Recreation Clubs and Pre-school abutting the reserves:** Consider formal liaison with Committees of Management of these organisations to enlist their support in protecting and preserving the reserves' bushland.

## 8.4 Fire and Control Burns

A number of areas in the reserves have been subjected to burns for various reasons over many years, initiated by BERG MM in conjunction with the Mornington Peninsula Shire's Natural Systems Team. It appears in many of these areas that fire (or the planning for it, i.e. creating fuel breaks) has had a detrimental rather than positive effect on the indigenous vegetation.

### Recommendations – Control burns:

- **No further burns** of the scale that have been done in the past should be undertaken until all the data on these burns has been collated regarding their impacts (pre and post burn), and analysed to provide an indication of their success or otherwise.
- **Add a layer** to the 2019 Maps Dataset of all the burns, boundaries, dates, data, etc, to help analyse the impacts of these burns.

## 8.5 Estuary Values

The health of the estuary and its aquatic fauna relies in part on allowing the mouth of the creek to open and close naturally.

The dominant visual green growth recorded on the mud flats in the estuary is the alga Gutweed *Enteromorpha ?intestinalis*; which is a new/only record for this species in the Victorian Biodiversity Atlas, on the eastern side of Port Phillip Bay.

**Recording this species is an interesting observation due to the lack of records. Not much is known about inter-tidal communities, and the Gutweed probably provides important habitat for small crustaceans and fish, plus it is a food resource for some species. More data and research is required on this species and the inter-tidal community it belongs to.**

**Recommendation – Algae identification:** A sample of the algae on the estuary mud flats should be collected and sent to the Herbarium at the Royal Botanic Gardens to confirm the species identification.



Gutweed recorded growing in the estuary mud flats.

## 8.6 Weed Spraying and Off-target Damage

Off-target spraying and herbicide over-use were noticeable across the reserves, and in many cases we consider that spraying was not the best option, especially in high quality bushland areas or areas that support orchid populations. Rather than undertaking general weed spraying, there needs to be better determination of priority weeds to control (such as those identified in this document), and use of the most appropriate methods of control.



Large sprayed areas, with the potential for lots of off-target damage/impacts



Bare areas within orchid sites created through herbicide overuse

**Recommendation – Weed spraying:** Minimise spraying of weeds, particularly in high quality bushland areas or areas that support orchid populations, to avoid off-target damage. Replace spraying with the most appropriate targeted control for each weed species, taking into consideration surrounding vegetation, location within the landscape, characteristics of the weed, and desired control outcomes.

## 8.7 Weed Species: Issues and Recommendations

This section discusses the management of a number specific weed species in the reserves. The complex issue of mature planted non-indigenous trees (native or exotic), at least some of which may also be classed as weeds, is discussed in the next section.

### Coast Tea-tree

In the 2002 report, it was recommended that Coast Tea-tree *Leptospermum laevigatum* be removed as it was overcrowding areas. Since then, research has shown Coast Tea-tree to be a primary colonising plant that stabilises disturbed areas, accumulates soil nutrients and provides shade and shelter for secondary colonising ground-storey species and fungi to emerge and develop. It is also an indication of past management practices and the previous fire history (Morgan & Gent, 2007).

Research into Coast Tea tree response post fire (eg Pt Nepean post-fire monitoring), has shown that it regenerates profusely after Autumn fire but very little regeneration after a late spring fire). The age of areas of dense Coast Teatree can therefore be seen as an indication of a past disturbance event, most likely in late summer/autumn, and it's senescence as part of ongoing succession within the vegetation community. This theory was also borne out by anecdotal evidence from a local resident that mentioned there had been a fire in the 1940's on the north side of the creek around Maude St.

This issue also relates to the recommendation in Section 8.4, which will assist in providing the data to allow fire events and fire history in the reserve to be mapped, and then the corresponding changes/composition of the vegetation communities present can be monitored.

**Recommendation – Coast Tea-tree:** Based on recent research, it is now recommended that the 2002 advice be ignored and Coast Tea-tree be allowed to grow and/or be actively encouraged to regenerate in disturbed areas across the reserves.

## Gladiolus

The bulbous Gladiolus \**Gladiolus undulatus*, recorded in the 2002 survey, is now spread across many sections of the reserves, particularly in areas of EVC 53: Swamp Scrub, but also in areas with EVC 175: Grassy Woodland and EVC 48: Heathy Woodland.

In some places, the Gladiolus has been sprayed, a technique that will never work as it does not destroy the numerous bulbils that form at the bulb base under the soil.



Bulbils that form underground at the base of  
Gladiolus plants



Ineffective spraying around Gladiolus plants

## Italian Buckthorn

Italian Buckthorn\* *Rhamnus alaternus* appears to be more prevalent than in the past. It is a serious weed with bird-dispersed fruits that tend to encourage Blackbirds, and with increased Blackbird numbers, other drupaceous weeds (i.e. fleshy stone fruit) become established. It has separate male and female plants, so targeting the female plants prior to fruiting will at least contain the population.

**Recommendation – Italian Buckthorn:** For mature trees, cutting & painting the stump with diluted herbicide is the usual option. This should *not* be done in areas where Cherry Ballart occurs; rather, cut at ground level then chop into the stump to encourage rotting, and continue to remove any re-sprouting shoots. This will contain seed production and spread.

## African Daisy

African Daisy *\*Senecio pterophorus* is a new and emerging weed for the reserves. The species was located and removed, but it will need ongoing monitoring across the entire reserves area, as its seed is wind-dispersed and the moister sections of the reserves provide a perfect habitat for it. It has become a serious weed in many Mornington Peninsula Shire reserves.

Care needs to be taken that it is not mistaken for local Groundsels/*Senecio* species. African Daisy has winged stems (hence the *ptero* in the name), a white/silvery underside to the leaves, and bright yellow flowers.

**Recommendation – African Daisy:** If suspected African Daisy is found, first double-check the identity (it resembles various indigenous species), then hand-remove the plant, bag any flowering heads, and dispose of them off-site.

## Neat Feather-moss

A patch of the introduced Neat Feather-moss *\*Pseudoscleropodium purum* was found in Zone 16 (Victoria). This is becoming a major problem in an increasing number of bushland reserves in southern Victoria. It was also recorded in The Briars in 2016. It is spread by fragments, so any workers in Zone 16 need to be aware not to spread it. To manage it, the boundary of its extent needs to be properly mapped to determine its rate of spread, and to instigate containment protocols within and around the patch.

According to Bruce Fuhrer, who observed a patch in Warrandyte (2003), it can double in size within a year, as outlined in the following article:

[Link to Friends of Warrandyte newsletter](#)

**Recommendation – Neat Feather-moss:** If the patch is contained and small, then careful hand weeding of all the fragments may be possible. For larger patches, the area should be defined and treated as a ‘quarantine’ area, with limited access and carefully managed works that contain the spread.

A small patch is considered to be anything up to 10m<sup>2</sup>. As this moss species has only recently been discovered as being invasive, there is very little data on it and the management of it. This species spreads vegetatively not by spores. BERG could trial hand removal of the patch, with an appropriate monitoring and follow up program. Every strand will need to be collected, and it will need to be disposed of appropriately outside the reserves.

## Greater Bindweed

Greater Bindweed *\*Calystegia silvatica* subsp. *silvatica* is also a new arrival to the reserves, and has started being recorded in other reserves on the Mornington Peninsula. It is easily mistaken for the indigenous Large Bindweed *Calystegia sepium* subsp. *roseate*, although it is a far more robust species. Its location and extent within the reserves needs further investigation.

It was recorded in Zone 3 (The Spit) in amongst Tall Reeds. Both *Calystegia* species flower over summer. The determining characteristic between the two species is the bracteoles (the green leafy bits at the base of the flower). The bracteoles of the indigenous bindweed are acute, whereas those of the introduced species are broad and rounded.

**Recommendation – Greater Bindweed:** The location and extent within the reserves of this recently arrived weed should be determined,

Research is also required as this is also a newly emerged weed species. The method of control utilised will be dependent on whether the plants are located in wet or drier areas—and how large the population is. A small patch could be hand removed, which would be the ideal situation.

Until the extent of the infestation is mapped, it is difficult to provide specific management recommendations; due to the different methods needed for working in wet and dry areas.

## Weed Successes

Weed control work since the 2002 survey has been very successful with the following three previously widespread weeds:

- **Sweet Pittosporum** *#Pittosporum undulatum* is much more under control than it was in the past.
- The extent of **Bridal Creeper** *\*Asparagus asparagoides* infestations has declined, partly due to bio-control agents.
- The ongoing work to eradicate **Spiny Rush** *\*Juncus acutus* has been very successful.

**Recommendation – Sweet Pittosporum, Bridal Creeper, Spiny Rush:** Ongoing monitoring and follow-up is required to make sure these species remain under control.

## 8.8 Planted Exotic and Non-indigenous Native Trees

There are a number of large planted **Eucalypt**, **Pine** and **Cypress** trees within the reserves, many of which are approaching the end of their life from an arboricultural perspective.

In particular, mature planted **Southern Mahogany #*Eucalyptus botryoides*** trees, a number of them in the old campground, are an ongoing problem, hybridising with the Coast Manna-gums, and also promoting Noisy Miners due to the supply of lerps on their leaves. Southern Mahoganies are known to pollute eucalypt gene pools and cause hybridised species.

Native species such as **Giant Honey-myrtle #*Melaleuca armillaris*** and numerous **Wattle #*Acacia* species** (ie: Cootamundra Wattle, Wreath Wattle and Wattle hybrids) also have the potential to pollute the indigenous flora species gene pool. In EVCs such as EVC 53: Swamp Scrub, seed can no longer confidently be collected from the Swamp Paperbarks *Melaleuca ericifolia* within the reserves, as all offspring in the area appear to be hybridised with the Giant Honey-myrtle. More effort is needed in the control and staged removal of these species.

Many of these native tree/shrub species have been actively planted in the past. Others are seedlings from these plantings or from nearby street plantings.

The presence of these native and exotic trees is complex from a biodiversity perspective and many are iconic species within the reserves. Some of the many issues to consider include:

- Do native animals utilise these trees for habitat?
- If their staged removal is considered, how should it proceed in the four different vegetation quality/cover areas? There is likely to be a higher impact on the surrounding vegetation in the higher versus lower quality areas, although there may also be an indigenous soil seedbank in those areas, just waiting for the removal of introduced trees.
- What other benefits do these trees provide from an ecological perspective? Do they inhibit growth underneath them (of both weedy and indigenous species)?
- They do provide shade in summer, and how will that be replaced, especially if their loss causes people to intrude into the remnant vegetation to seek shade?
- Are these trees providing a similar substrate to that which was originally provided by the Drooping Sheoaks?

The control and/or removal of planted native species is a difficult bushland management issue, and one that is common across many bushland reserves. The issue has evolved from the earlier bushland revegetation works (1970–1990s), when native rather than indigenous species were planted in bushland reserves.

Without further research into the ecological and landscape function of both native and exotic trees in the reserves, it is difficult to provide recommendations on their removal or retention. For ease of management, decisions should be based on their location with regard to the four vegetation quality/cover categories, and the specific management objectives of each category.

**Recommendations – Non-indigenous trees:**

- **Survey fauna use:** Consider fauna surveys of the mature planted native and exotic trees.
- **Map:** Map the location of all large non-indigenous trees within the reserves in conjunction with the vegetation quality mapping, potentially as a new layer.
- **Seedlings:** Monitor for and remove any seedlings from these trees.
- **Removal policies:** Develop removal policies (if applicable) that detail removal protocols in the four vegetation quality/cover categories (i.e. consider sensitive hand removal versus machine removal, etc). Ensure the policy minimises impacts to surrounding vegetation in all four vegetation quality/cover categories.
- **Plan revegetation:** Develop complementary revegetation programs using suitable indigenous canopy species, particularly Drooping Sheoaks, to replace habitat, landscape and shade values.
- **Staged removal:** Develop a removal program (if applicable) that is staged over a 20-year period, to ensure a slow and staggered process, and that integrates replacement and/or habitat planting to ensure minimal loss of biodiversity, landscape and shade values across the reserves.
- **Fungus check:** Check for presence of Mallee Drumstick fungus under Cypress and Pines.

## 8.9 Training Sessions

Workshops on the use of the data and vegetation maps and overlays provided in this report would facilitate their use by BERG MM, Mornington Peninsula Shire Council, bushland managers (in-house and/or contracted), and volunteers.

**Recommendation – Training in the use of Vegetation Maps:** Run 1–2 workshops to familiarise participants with this report, its data and the vegetation maps and overlays within it, so it can be used as a living resource that can be added to over time.

## 8.10 Use of Mulch in Revegetation and Regeneration Areas

Mulch is being applied to revegetation areas and beds within the reserves and often around remnant vegetation. Mulch often carries weed seed and pathogens; it provides nutrients for weeds and it smothers adjacent indigenous herbs and grasses.

### Recommendations – Mulching:

- **Develop management guidelines** for revegetation beds versus remnant areas (especially in remnant areas with indigenous ground–storey vegetation).
- **Do not apply mulch** to the revegetation/planting beds or around bases of old trees unless there is no existing indigenous vegetation.
- **Do not mulch** around or within remnant patches with ground–storey vegetation.
- **Be cautious:** If identification of remnant ground–storey vegetation is difficult, do not mulch the area.
- **Do not store mulch** in areas where Soursob occurs, as this can spread Soursob bulbils, which is a difficult weed to eradicate once it has become established.

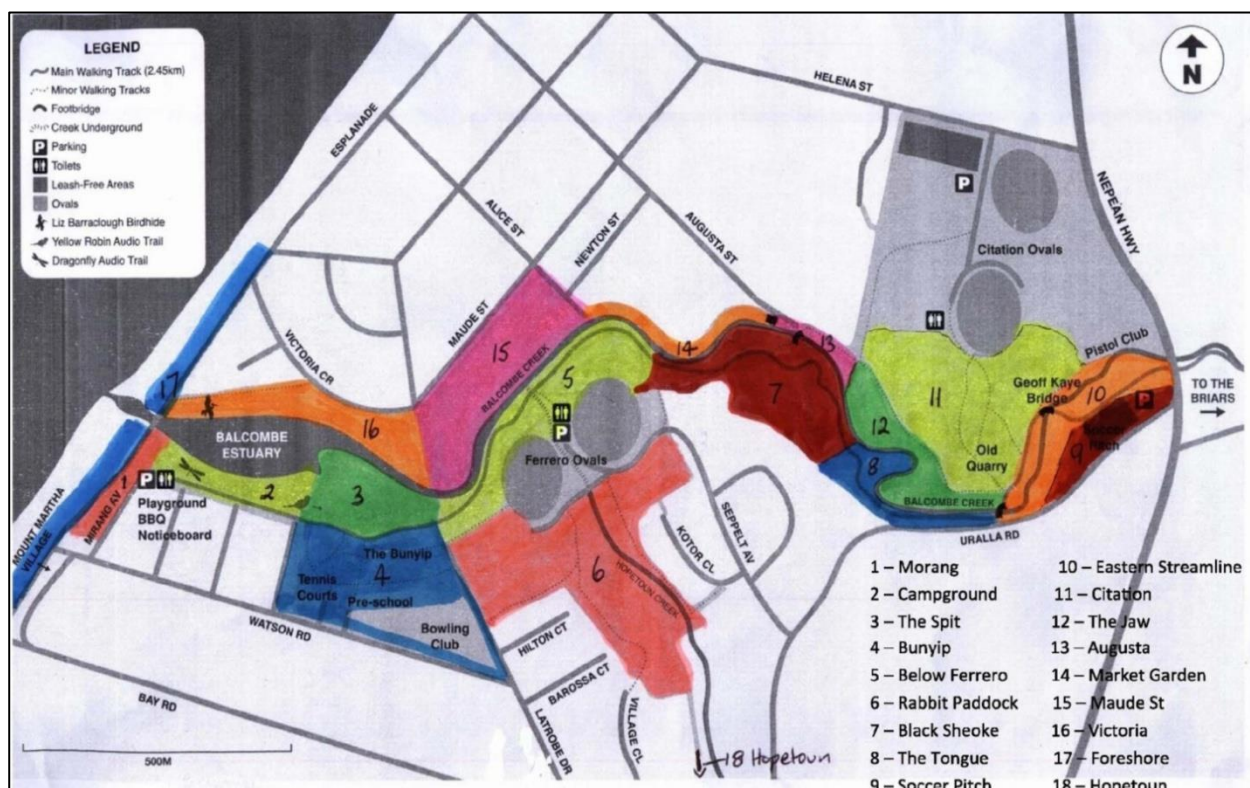
## 9. MANAGEMENT ZONE RECOMMENDATIONS

This section discusses and recommends management actions for each of the sixteen management zones covered by this project. The notes on each zone should be read in conjunction with the notes in the 2002 report, and with the overlays on the electronic maps. Comparisons with the 2002 report's management recommendations will be useful in refining understanding of the changes to bushland cover and quality, and will also highlight any persistent, longer-term management issues.

These notes and recommendations could be imported into the information box provided on the zones layer, which is available via the links below:

[See map link](#)

[See map link—management observations layer](#)



**Balcombe Estuary Reserves Management Zones**

## 9.1 Zone 1 – Mirang

This zone has improved in quality and extent of bushland cover over many years of restoration works. Spiny Rush *\*Juncus acutus* has been successfully eradicated and the dominance of Wreath Wattle *#Acacia saligna* has been reduced (not evident, but it could still be present). As the species has long-lived seed; follow up and monitoring will be required for many years.

Removal of the Sweet Hakea *#Hakea drupacea* that is growing along The Esplanade road verge, and its replacement with indigenous species found in the EVCs Coast Banksia Woodland/Coastal Scrub, would benefit the habitat value.

**Recommendation – Wreath Wattle and Sweet Hakea:** Monitor for and remove seedlings (given the likely remaining seed bank) and/or smother them out in mown areas along the roadside by planting Small-leaf Clematis and succulents such as Bower Spinach *Tetragonia implexicoma*, Coast Twin-leaf *Zygophyllum billardierei*, and Seaberry Saltbush *Rhagodia candolleana* ssp. *candolleana*.

**Recommendation – Drainage line planting:** Replace the Mat Saltbush *Atriplex prostrata* growing along the drainage line with indigenous saline wetland edge species such as Rounded Noon-flower *Disphyma crassifolium* subsp. *clavellatum*, and local chenopods such as Glaucous Goosefoot *Chenopodium glaucum*.

**Recommendation – Coastal Saltmarsh:** Maintain the quality of the EPBC listed Coastal Saltmarsh along the boardwalk at the Balcombe Creek end. This could be challenging, as Saltmarsh is a very sensitive vegetation community, and is vulnerable to impacts caused by trampling.

**Recommendation – Understorey planting:** Plant Short-stem Flax-lilies *Dianella* ssp. and Spiny-headed Mat-rush *Lomandra longifolia* under the Drooping Sheoak *Allocasuarina verticillata* groves to enhance the understorey vegetation.

## 9.2 Zone 2 – Campground

The Southern Mahogany *Eucalyptus botryoides* is the most serious weed present, as the species hybridises with and pollutes the gene pool of local indigenous eucalypt species such as Coast Manna-gum *Eucalyptus viminalis* subsp. *pyroriana*. (See recommendation on non-indigenous trees, Section 8.8.)

A large mature Italian Buckthorn *Rhamnus alaternus* remains just west of the jetty; this is a high priority for removal along with an introduced Wattle species. (See recommendation on non-indigenous trees, above).

### Recommendations – Non-indigenous trees:

- Plan staged removal of **Southern Mahogany** trees as per recommendation for non-indigenous trees, in Section 8.8.
- Remove **Italian Buckthorn (west of jetty)** and introduced Wattle species.

Patches of indigenous grasses (Wallaby *Rytidosperma spp.* and Weeping *Microlaena stipoides* Grasses) and moss were observed growing in some of the mown lawn areas. Establishing 'no mow' patches in these areas could encourage the regeneration of indigenous ground-storey areas. In addition, the growth and spread of an indigenous lawn area could be encouraged, with mowing limited to after seed set (January) and during the colder months.

**Recommendation – Indigenous lawn:** Map the presence of Wallaby Grass, Weeping Grass and indigenous mosses within mown areas, to mark 'no mow' patches; and encourage the spread of these species to form an indigenous lawn area, mown only after seed set and during the colder months.

**Recommendation – Tracks by jetty:** The tracks to the west of the jetty need rationalising to minimise impacts on indigenous vegetation, to reduce access for pest animals (primarily foxes) add to reduce potential erosion issues.

**Recommendation – Non-indigenous Correias:** There are some strange planted Correa forms in the revegetation beds, which do not appear to be indigenous species. Remove these.

**Recommendation – Drain below Henley Avenue:** This drainage line has been revegetated, but management is needed of the nutrient levels and rubbish at the mouth of the drain that then flows into the Estuary.

**Recommendation – Rabbits:** Numerous rabbit warrens were observed. Map these and fumigate in August/September.

**Recommendation – Nest box monitoring:** A bee hive was observed in the nest box at the eastern end of the zone. Nest boxes need ongoing monitoring so they do not become harbours for feral species or hazards for native wildlife.

**Recommendation – Nest box attachment:** Some nest boxes were attached to the trees by nails, which will harm the tree. Future nest box programs should avoid attaching the boxes by nails.

### 9.3 Zone 3– The Spit

The vegetation of this zone is predominantly Swamp Paperbark Scrub and Saline Ephemeral Herbfields within the flood zone, and a small area of Coast Manna Gum Woodland on the more elevated western corner. The Saline Ephemeral Herbfield is dominated by Common Reed *Phragmites australis*, with an understorey of herbaceous species.

Much of the area was difficult to access due to flooding. The dominant weed that has been controlled in this community is Spiny Rush *\*Juncus acutus*, and the control works appear to have been successful along with the control of Myrtle-leaf Milkwort *\*Polygala myrtifolia*, Sweet Pittosporum *Pittosporum undulatum*, and most of the patches of Angled Onion *\*Allium triquetrum* and Blackberry *Rubus anglocandicans*.

Watercress *\*Nasturtium spp.*, Forget-me-not *\*Myosotis arvensis*, Common Violet *\*Viola odorata*, and Bridal Creeper *\*Asparagus asparagoides* still remain in small patches. The Greater

Bindweed \**Calystegia silvatica* subsp. *silvatica*, a new and emerging weed in the reserves, is found in this zone growing amongst Common Reed *Phragmites australis*. Three introduced *Oxalis* species also occur in this zone.

**Recommendation – Watercress, Forget-me-not, Common Violet, Bridal Creeper:** Remove remaining small patches with careful hand-weeding.

**Recommendation – Greater Bindweed:** Map the extent and location of this emerging weed over summer, when the plants are flowering to enable easy identification.

**Recommendation – Oxalis:** A handheld flamethrower in the rain appears to be successful on the Pale Wood-sorrel \**Oxalis incarnata* as it destroys the axillary bulbils formed just at the end of flowering. The other species may require a year of solarisation to eliminate them; they are extremely difficult to control and eradicate.

**Recommendation – Wandering Trad:** The recently developed biological control for Wandering Trad \**Tradescantia fluminensis* should be introduced, to control this species in Swamp Scrub areas and along the creekline.

**Recommendation – Spiny Rush and Wild Gladiolus:** Check the zone for any remaining plants, and remove and bag any found. Dispose of the removed plant matter appropriately off-site.

**Recommendation – Coastal Saltmarsh:** Maintain the quality of the fragile EPBC-listed Coastal Saltmarsh at the northern section of this zone along the shoreline of Balcombe Creek. This is a very fragile vegetation community, and is susceptible to the smallest impacts.

## 9.4 Zone 4– Bunyip

This zone supports a diversity of significant species and habitats but has suffered from impacts such as clearing for fire, drainage issues and inappropriate planting.

The former cleared area which has recently been revegetated and protected with rabbit proof fencing (although there was evidence of rabbit activity inside the fence) once contained several orchid patches. With the deep mulching that was undertaken when the original Coast Tea-tree vegetation was cleared post 2002, it appears that very little natural regeneration has occurred in this area. Orchids were not observed in the zone, following the recent plantings, although a plastic meshed area marks one of the original sites; this area supported a healthy Nodding Greenhood population during the last two winters). In addition, hybrid eucalypt species appear to have been planted, which could potentially add to the problems of genetic eucalypt pollution in the reserves (see Section 8.8). Previously, Coast Tea-tree was seen as invasive but is now considered to be an important primary coloniser in coastal areas (refer to Section 8.6).

**Recommendation – Coast Tea-tree *Leptospermum laevigatum*:** Any natural regeneration of this species within this zone should be encouraged.

**Orchid site–** plastic mesh placed on the ground is not best method for managing orchid sites as it is directly on the ground which could affect germination, plus the risk of the plastic melting if there is a fire, which will immediately affect the population. – Other options to identify and protect orchid populations need to be explored.

It appears that the Cherry Ballarts *Exocarpos cupressiformis* and Black Wattles *Acacia mearnsii* are being pruned; this could affect their limb structure and the longer-term viability and structure of the individual trees.

**Recommendation – Pruning:** Stop all pruning of Cherry Ballarts and Black Wattles, to avoid damage to their longer-term viability.

There appears to be an overabundance of planted Common Boobialla *Myoporum insulare*. Potentially these shrubs will continue to spread and may eventually dominate and become locally out of control. In natural bushland, Common Boobialla is generally restricted to the edges of saline areas along creeklines.

**Recommendation – Common Boobialla:** Consider staged removal of some of the mature specimens. Before removal, check for signs of fauna use (nests), and time removal for the cooler months, when fauna are less likely to be breeding.

The construction of bike jumps and trails between the pre-school and the tennis courts is impacting on significant adjacent grassy woodland vegetation; not just by the bikes, but also by the spectators/parents watching them. We observed people standing on Small Grass-trees *Xanthorrhoea minor* and Chocolate Lilies *Arthropodium strictum*. If this recreational use is to continue at this site (see Section 8.2; it may be more appropriately located in the Rabbit Paddock), liaison with the community, education, fencing and signage will be required to protect the surrounding bushland vegetation.

**Recommendation – Mowing:** Restrict mowing along the paths in the lower areas to allow the adjacent Swamp Paperbarks *Melaleuca ericifolia* and Spear Grasses *Austrostipa* spp. to regenerate. Regenerating shrubs and grasses were observed, but they are being impacted by the mowing regime, which is too close to the bushland vegetation.

The drainage line below the tennis courts is drying out. That in addition to the tree pruning and elevated nutrient status is leading to an increase in the weedy exotic grasses cover in the area, which could potentially increase the fire risk through higher grass fuel loads.

**Recommendation – Slashing:** Identify the source of the water, and investigate potentially creating a raingarden to manage the water if appropriate. To control grass levels/fuel loads there are a few options including slashing the annual grasses pre-seed set, allowing the adjacent Swamp Paperbarks to thicken up and shade out the perennial and annual exotic grasses, avoid slashing regenerating Swamp Paperbarks so they can grow and shade out the exotic grasses, and consider planting some Blackwoods to also shade out the grasses.

A frequent, very low slashing regime in the area behind the pre-school has significantly reduced biodiversity and indigenous vegetation. While slashing may be seen as a way of reducing fire risk, removal of the weedy natives such as Giant Honey-myrtle *Melaleuca armillaris* growing along the fence line and seeding from the pre-school may be more effective. Slashing frequency needs to be reduced, its height raised, and the objective changed to target the spring growth flush of exotic grass species. This spring growth flush provides a higher fuel load than indigenous grasses, and the seed set of exotic grasses displaces indigenous species.

If the slashing regime is altered to target the exotic grass species, instead of a general slashing regime, it will reduce the fuel load over time and alter the balance of exotic versus indigenous grasses. Reducing the extent and seed set of exotic grasses will also allow indigenous summer green grasses to recolonise the area.

**Recommendation – Grass slashing:** On the fire break below the pre-school, reduce frequency of slashing, raise slashing height, and time it to target the spring growth flush of exotic grasses.

Beyond the fire break, Bracken *Pteridium esculentum*, one of the species also slashed, is a primary colonising species that provides a nursery' area for other secondary and tertiary colonising species.

**Recommendation – Bracken:** Cease slashing Bracken in areas where it is not adjacent to infrastructure, to promote and preserve biodiversity – particularly below the pre-school.



Area behind the pre-school, which has reduced in biodiversity since 2002

The soils in this zone are highly erodible; and as with much of the reserve the soils support vegetation that is susceptible to Cinnamon Fungus *Phytophthora cinnamomi* spread.

**Recommendation – Cinnamon Fungus:** Consider potential for Cinnamon Fungus spread in all management works, and establish protocols to control any potential spread.

## 9.5 Zone 5– Below Ferrero

This Zone supports a number of large, mature Eucalypts immediately below the ovals. The indigenous Creeping Mistletoe *Muellerina eucalyptoides* was also recorded growing on Coast Manna-gums *Eucalyptus viminalis* subsp. *pryoriana* in the area.

**Recommendation – Mature Eucalypts:** Prioritise gradual weed control among the mature Eucalypts below the ovals to maintain their health.

**Recommendation – Replacement planting:** Plant Black Wattles *Acacia mearnsii* and Hedge Wattle *Acacia paradoxa* to replace the non-indigenous Hakea species, and indigenous Mat-rushes *Lomandra* spp. to replace the exotic garden escapee Wild Iris *\*Dietes* spp., to improve habitat values.

A large patch of Coast Sword-sedge *Lepidosperma gladiatum* is growing on the northern curve of the creek; this is one of only two known occurrences of this indigenous species within the reserves.

The eastern section of the zone supports a high diversity of localised indigenous species, mosses and Grassy Woodland flora.

**Recommendation – Weeding:** Sensitive hand weeding of Gladiolus *Gladiolus undulatus* and introduced grasses, in particular Fescue *\*Vulpia* spp. and Sweet Vernal Grass *Anthoxanthum odoratum*, in the biodiverse eastern section, will promote the regeneration of orchids and other indigenous ground flora.



Fescue growing in the area (dead looking brown grass in the foreground of the photo)

**Recommendation – Herbicides:** Minimise herbicide usage, and avoid it near groves of Cherry Ballarts, as they are parasitic plants that are susceptible to off-target herbicide damage.

**Recommendation – Plant identification:** The Spider-orchid *Caladenia* spp. and Spear Grass *Austrostipa* spp plants need to be checked when flowering next year, to determine their species and potential significance.

**Recommendation – Italian Buckthorn:** Removal is a high priority. Great care is required near Cherry Ballarts: cut Italian Buckthorn trunks near the ground and then cut downwards into the remaining trunk, to promote rotting. This will require follow-up to remove re-sprouting shoots, but will contain the species in the short term, with minimal impact on the sensitive Cherry Ballarts.

**Recommendation – Planted non-indigenous Eucalypts and Corsican Pine** at SE corner along the drainage line: these appear to be providing protection and habitat for vegetation and fauna, but need monitoring and any seedlings removed.

The native Sow Thistle *Sonchus hydrophilus* was also observed in this corner; it is easily mistaken for the weedy Common Sow Thistle. The photograph below depicts a native Sow Thistle recorded in Tootgarook Swamp (the leaves look prickly, but they aren't; and the plant goes purplish in winter, especially after frost).



Native Sow-thistle

**Recommendation – asbestos pipe** at SW corner: this should be removed

## 9.6 Zone 6– Rabbit Paddock

**Recommendation – Non-indigenous trees/shrubs****HIGH PRIORITY:** Remove Southern Mahogany & weedy native shrubs (ie: Giant Honey-myrtle) due to gene pool pollution of indigenous species.

**Recommendation – Rock Rose and Flax-leaf Broom:** Continue control of the weedy Rock Rose *\*Cistus inflatus* and Flax-leaf Broom *\*Genista linifolia*, as the cover of these species has been dramatically reduced through previous control works.

The formally extensive patches of indigenous Cranberry Heath *Astroloma humifusum* appear to be being impacted by mowing and possibly off-target damage from spraying for exotic grasses such as Kikuyu *\*Cenchrus clandestinum* and Bridal Creeper *Asparagus asparagoides* in the grassy area along the roadside bank and the fence line.

**Recommendation – Cranberry Heath:** Stake individual Cranberry Heath plants, so they are can readily be identified and avoided by the mowing and spray crews.



Off-target damage from spraying along the roadside bank and fence line



Stunted Cranberry Heath in spray/mown area

**Recommendation – Box Thorn:** Remove the few large Boxthorn *\*Lycium ferocissimum* and replace with prickly shrubs such as Hedge Wattle *Acacia paradoxa* or Sweet Bursaria *Bursaria spinosa* to maintain habitat values, especially for smaller bird species.

Kangaroo Apple is likely to regenerate naturally in the area.

**Recommendation – Tree planting:** Plant more Coast Manna-gums *Eucalyptus viminalis* subsp. *pyroriana*, Black Wattle *Acacia mearnsii* and Drooping Sheoak *Allocasuarina verticillata* to promote further canopy links. Allow for natural Coast Tea-tree regeneration when planning and planting additional indigenous tree species.

Rabbit presence was still evident; however it was lower than that observed previously.

**Recommendation – Rabbit control mapping:** For monitoring purposes, integrate into the 2019 Mapping Dataset a map layer that documents previous rabbit control trials.

## 9.7 Zone 7– Black Sheoak

The only recorded specimen of Sticky Boobialla *Myoporum viscosum* occurs in this zone.

African Daisy, a new and emerging weed for the reserves, was located and removed, but ongoing monitoring for it across the reserves is needed, as its seed is wind dispersed and the moister sections of the Reserve provides perfect habitat for the species. (See Section 8.6.)

Within the Swamp Paperbark Scrub (EVC 53), the usual cohort of damp-loving ground-storey weeds were recorded.

**Recommendation – Italian Buckthorn:** This is the highest priority for weed removal.

**Recommendation – Ground-storey weeding:** Continue to hand-weed or steam the ground-storey weeds in the Swamp Paperbark Scrub, to create linked ‘islands’ of higher quality (less weedy) within patches of this EVC. On areas of higher ground, concentrate management efforts around any original trees or ground flora patches.

**Recommendation – Land ownership:** Investigate ownership of the triangle of land to the southwest of this zone. It is depicted as green (a reserve) on Google Maps.

## 9.8 Zone 8– The Tongue

A variety of significant indigenous ground flora species occur in this zone, including ferns such as Tender Brake *Pteris tremula*, Sedges and amphibious Buttercups. Care needs to be taken when weeding introduced ground flora species due to the presence of these indigenous species. The patch of Scented Groundsel *Senecio odorata* is the only record of this species within the reserves.

**Recommendation – Scrambling Dock \**Acetosa sagittata*:** This is difficult to eradicate, chemical methods have little effect. First, contain it by cutting off the flowering stems before they set seed. Manual removal of the tuberous roots is the best available long-term option.

**Recommendation – Wandering Trad *Tradescantia fluminensis*:** Introduce biological control into the patches in this zone.

**Recommendation – Blue Periwinkle \**Vinca major*:** Solarisation has proven the best method of elimination (Virginia Carter, Local Habitat, pers com). Cover the patch with black plastic and a layer of mulch, sticks or rocks to hold it down, leave for a year, then remove the black plastic to allow natural regeneration. Periwinkle produces few if any seeds, so is unlikely to regenerate.

**Recommendation – Sugar Gum #*Eucalyptus cladocalyx*:** This is starting to naturalise from plantings along the adjacent road verge. Monitoring, and consider future removal of saplings, and potentially of the mature plants (subject to Council negotiation).

## 9.9 Zone 9– Uralla Corner

This zone was formerly known as 'Soccer Pitch'. This is a highly disturbed and heavily used zone, including an off-leash dogs area.

**Recommendation – Mature Coast Manna-gums and Blackwoods:** There are a number of old mature Coast Manna-gums *Eucalyptus viminalis* subsp. *pyroriana* and Blackwoods *Acacia melanoxylon* in this area, which are in need of care and ground flora restoration. Avoid foliar sprays if possible in works around these trees.

A number of non-indigenous native species have been planted in the past including Southern Mahogany and Giant Honey-myrtle, which threaten the gene pools of Manna Gum and Swamp Paperbark. The planted introduced Wattles are naturalising.

**Recommendation – Non-indigenous natives:** Remove Southern Mahogany, Giant Honey-myrtles and introduced Wattles as a high priority. (See Section 8.8.)

**Recommendation – Gorse \**Ulex europaeus*:** Control Gorse growing along the southern edge of Uralla Corner, as a high priority.

## 9.10 Zone 10– Eastern Streamline

This zone is in a relatively damp and protected area of the reserves, and it supports the only occurrence of the Tall Sword-sedge *Lepidosperma elatior* in the reserves, along with other damp shade loving species such as ferns and Tall Sedge *Carex appressa*.

Along the edge of the track, a localised occurrence of Native Raspberry *Rubus parvifolius* flourishes. Sugar Glider sap feeding lines were found on a Black Wattle at the entrance to the Gun Club.

The drain along the track leading into the Pistol Club is currently being sprayed rather than mown, which potentially impacts the native Crayfish/Yabbies), that currently utilise this habitat.

**Recommendation – Callistemons and Melaleucas:** These non-indigenous natives have been planted in the past and are naturalising in the SE of the zone. They need to be removed, and the area monitored for seedlings every two years, as they possibly have a long-lived soil seed bank.

**Recommendation – Scrambling Dock *Acetosa sagittata*:** This is a high priority to eradicate. See Section 9.8 for methods.

**Recommendation – Madeira Winter-cherry \**Solanum pseudocapsicum*** and other patches of weedy ground flora: Continued removal is a priority.

**Recommendation – Blackberry & English Ivy:** These have been removed in the past. Ongoing monitoring is needed for seedlings regenerating from any soil seed bank.

**Recommendation– Drainage line:** Zoologist to identify crayfish/yabby species, and provide appropriate recommendations.

## 9.11 Zone 11 – Citation

This zone is highly varied in its vegetation quality, its elevation and its geology. Its proximity to recreation areas plus historical disturbances such as an old quarry have created a number of management issues.

The area south of and below Citation Oval has a high number of significant species particularly in the EVC 175: Grassy Woodland & EVC 48: Damp Heathy Woodland patches; and that is where sensitive weed control should be prioritised to allow for natural regeneration, while eliminating species that may invade that area.

**Recommendation – Pine seedlings:** The few mature planted Cluster Pines *Pinus pinaster* at the top of the slope beside the oval are seeding and spreading wildings (saplings) down the hill. Ongoing monitoring and removal of these is required.

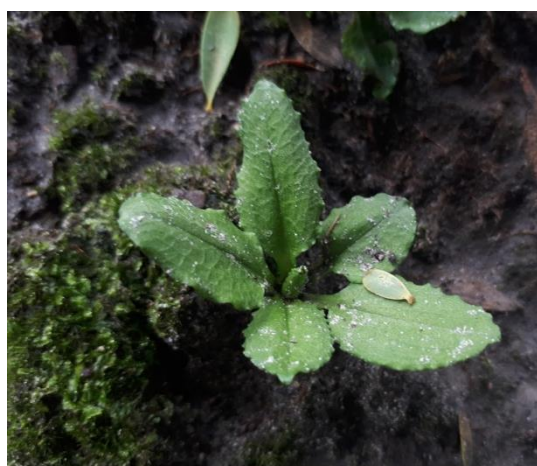
There are large patches of Greenhood orchids *Pterostylis spp* growing under the Coast Tea-tree in the northeast corner of the zone/Reserve. Currently this patch is being impacted by bike jumps and paths. In addition, soil containing the weedy invasive grass Kikuyu has been dumped just outside the oval, above this population.

**Recommendation – Kikuyu:** Dumped soil containing Kikuyu grass in the NE of the zone should be removed as a priority

**Recommendation – Bike tracks:** Management of bike jumps and tracks is a priority, to prevent further damage to indigenous vegetation, particularly Greenhood orchids.



Damage to the ground-storey from the track and bike jumps



Greenhood orchids

**Recommendation – Blackberry spraying:** Over-spraying of Blackberry is causing off-target damage to surrounding indigenous vegetation. Extreme caution should be used in spraying Blackberries, and works should be undertaken by personnel skilled in plant identification.

**Recommendation – Hazardous debris:** Remove debris such as barbed wire and asbestos pipe.

**Recommendation – Planting:** Continue planting Coast Manna-Gum *Eucalyptus viminalis* subsp. *pyroriana*, Narrow-leaf Peppermint *Eucalyptus radiata* and Black Sheoak *Allocasuarina littoralis* as a buffer on the SW side of the ovals, as the patches of mature Pines slowly senesce and open up.

The geology exposed on the walls of the old quarry to the south may be useful for interpretative signage



Geology exposed on quarry wall

**Recommendation – Vegetate drains:** The constructed drains at the western corner of the zone, above the track intersection could be planted out and converted into bio-diverse swales to improve water quality and habitat.



Drain in western corner of the zone

## 9.12 Zone 12– The Jaw

The zone mostly contains patches of EVC 53: Swamp Scrub in relatively good condition, although there is also a large patch containing a Bracken understorey, indicating the presence of a degraded/modified patch of EVC 3: Damp Sands Herb-rich Woodland amongst the Swamp Scrub.

There are several old trees including a Silver Banksia *Banksia marginata* and a hybrid Silver x Coast Banksia, indicative of an ecotone EVC of both coastal and heathland influences (EVC 2: Coast Banksia Woodland and EVC 48: Heathy Woodland), indicating a potential vegetation community change area within the reserves.

This area illustrates the vegetation community issues common across the reserve. As the reserve is so eco-tonal, which is a transitional area of vegetation between two different plant communities, which has some of the characteristics of each bordering community and can contain species not found in either of the adjacent communities; it is difficult to clearly describe and distinguish all the EVCs/vegetation communities across the reserves.

This issue could be better explored by undertaking comprehensive EVC mapping across the reserve, although EVCs can be quite narrow in their descriptions, which is likely to result in a lot of mosaic/ecotone EVC descriptions– it a complex issue in a reserve such as Balcombe Estuary.

### Recommendation – Weeding:

- Remove the **Cluster Pine** at the edge of the track.
- Hand-weed the scattered **Bridal Creeper** and **Gladiolus**.
- Eradicate the small numbers of **Madeira Winter Cherry** by cutting and painting with diluted herbicide.

## 9.13 Zone 13– Augusta

**Recommendation – Cape Ivy:** Remove and bag the Cape Ivy *\*Delairea odorata* that is being dumped from one of the residences opposite the reserves.

**Recommendation – Giant Honey Myrtle:** Remove the Giant Honey-myrtle *Melaleuca armillaris* growing near the bridge.

## 9.14 Zone 14– Market Garden

**Recommendation – Hand-weeding:** An original old Coast Manna-Gum *Eucalyptus viminalis* subsp. *pyroriana* and Honey Pots *Acrotriche serrulata* occur in this zone. Concentrate hand weed control in high quality areas or around these plants.

**Recommendation – Ivy, Italian Buckthorn:** Contain then remove the English Ivy and Italian Buckthorn as a priority, as they could be easily dispersed by birds into the creekline vegetation.

A major impact on this zone is the adjacent market garden land use and residences. The market garden in particular has had a number of major impacts:

- Drains flow from the market garden directly into the creek. These are adding pollutants and nutrients to the creek, potentially reducing water quality, and increasing the potential for weeds to invade the creekline. Past planting of exotic vegetation has taken place outside the property boundary.
- It appears mulch and manure have regularly been dumped outside/over the market garden fence into the reserves. There is also dumping of garden waste/rubbish/green waste, which can smother the vegetation beneath it. Some dumped green matter can potentially spread and become a new weed source.
- It appears some illegal clearing of vegetation has taken place at the eastern end of the zone.



Drain and run-off from the market garden heading into the creek



Dumped green waste refuse outside the market garden fence, in the reserves

**Recommendation – Blackberry spraying:** Over-spraying of Blackberry is causing off-target damage to surrounding indigenous vegetation. Extreme caution should be used in spraying Blackberries, and works should be undertaken by personnel skilled in plant identification.

**Recommendation – ‘Market garden’ purchase:** The location of this market garden is a good example of poor land-use planning. Consideration should be given to buying back the property and including it in the reserves.

## 9.15 Zone 15– Maude Street

The 2002 report outlined that Coast Tea-tree had invaded the Coast Manna Gum Woodland community on the more elevated sites. As discussed in Section 8.6, further research has shown that Coast Tea-tree is a primary coloniser in disturbed sites and has not invaded remnant vegetation in the reserves. This area was anecdotally subjected to fire in the 1940s, and the Coast Tea-tree that colonised following that fire event is now senescing, and slowly leading into the next stage of vegetation succession. A controlled burn was undertaken a few years ago, but it appears to have done little to promote regeneration.

Bracken is a natural component of both EVC 2: Coast Banksia Woodland and EVC 3: Damp Sands Herb-rich Woodland, it is an important structural component for habitat, it has a vital nutrient cycling function, it's a colonising species that provides a 'nursery' area for orchids and herbaceous species, plus it's good habitat for fungi.

To reduce Bracken growth, avoid fire and slashing it, as they both stimulate growth, whilst keeping in mind that it may need to be controlled around built assets. In these areas it is probably better to pull out rather than slash Bracken.

**Recommendation – plantings:** Avoid further mass plantings. Consider small scale plantings of individual species that would have once occurred in the EVC, such as **Drooping Sheoak** *Allocasuarina verticillata*, **Black Sheoak** *Allocasuarina littoralis*, **Silver Banksia** *Banksia marginata* and **Coast Banksia** *Banksia integrifolia*. More **Black Wattles** *Acacia mearnsii* could also occur in the area; these should be introduced via direct seeding.

**Recommendation – Asparagus Fern** *\*Asparagus scandens*; Hand-remove the patch in this area by cutting out the crowns with a sharp knife. It is unnecessary to remove the water storage organs, as it will not regrow from them.

**Recommendation – Coast Tea-tree:** Burning of the Coast Tea-tree has taken place in this zone with mixed results. Allow for natural regeneration before undertaking further planting. Then consider direct seeding of Drooping Sheoak.

## 9.16 Zone 16– Victoria (Crescent)

A State significant flora species, Coast Twin-leaf *Zygophyllum billardierei*, was recorded at the western end of this zone. Potentially another State significant species, Dune Wood-sorrel *Oxalis rubens*, also occurs in this zone, plus one of only two patches of Coast Sword Sedge *Lepidosperma gladiatum* that was recorded within the reserves.

The introduced Neat Feather-moss *Pseudoscleropodium purum* was recorded at the eastern end of this zone growing with an introduced Bedstraw *\*Galium divaricatum* (?) at the edge of an old quarry. This Moss has only been recorded at this one site so far in the lower Balcombe Creek area (it has previously been recorded at The Briars (see below for the Atlas of Living Australia link).

### Atlas of Living Aust

**Recommendation – Neat Feather-moss *Pseudoscleropodium purum*:** Remove as a high priority. This weedy moss is known to spread quickly. See Section 8.6 for management recommendations.

**Recommendation – Giant Honey-myrtle and Southern Mahogany:** Remove these as the next highest priority, as they are polluting the Coast Manna-gum and Swamp Paperbark gene pools and producing hybrid offspring. Replace these species with Sweet Bursaria and Blackwoods. See Section 8.8

**Recommendation – Flaxleaf Broom *\*Genista linifolia* and Myrtle-leaf Milkwort *Polygala myrtifolia*:** Continue control of these weeds and contain their spread

**Recommendation – English Ivy *Hedera helix* and Cruel Vine *\*Araujia sericifera*:** Remove and work towards eliminating these and other high priority weeds identified in the zone (refer the weed layer of the Mapping Dataset).

**Recommendation – Coast Tea-tree:** Retain as an important colonising species.

**Recommendation – Soursob *\*Oxalis pes-caprae*:** Smother with plantings of spreading indigenous species such as Bower Spinach *Tetragonia implexicoma* and Seaberry Saltbush *Rhagodia candolleana* ssp. *candolleana* at the coastal end of this zone.

**Recommendation – Mowing:** Mowing along the tracks and edges of the patches of vegetation is ringbarking some trees, which could compromise their health in the longer term. Measures are needed to prevent this.



Ringbarking/impacts evident to the base of trees from mowing

**Recommendation – Coastal Saltmarsh:** Maintain the quality of the EPBC listed Coastal Saltmarsh at the southern section of this zone along the shoreline of Balcombe Creek. This will require a kayak/canoe or waders and timing regarding tides or water levels. Work with great care: this EVC is extremely fragile.

## 10. CONCLUSION

The 2019 Balcombe Estuary Reserves mapping project was undertaken to document and map the current quality and extent of bushland vegetation in these reserves, including State, Regional and High Locally significant flora species, and the most problematic weed invasions. The report also provides management observations and recommendations for each of the reserves' sixteen management zones assessed, as well as broad recommendations that apply across the reserves.

The 2019 Mapping Dataset was created on Google Maps to provide a tool that could be utilised in the field by BERG MM volunteers, giving them ready access to up-to-date data wherever they are working in the reserves.

A central purpose of the project was to provide comparative data to gauge the success of the previous seventeen years of bushland management and rehabilitation works. To this end, the 2002 hand-drawn vegetation quality maps were digitised as layers to overlay on the 2019 Mapping Dataset.

Comparison of the two sets of maps – 2002 and 2019 – shows dramatically how effective these works have been. As the weediest areas have shrunk in size, there have been huge increases in the areas of higher quality bushland. The extent of the change achieved in these reserves is a tribute to the ongoing, intensive and dedicated efforts of BERG Mt Martha, bushland contractors Naturelinks, and the Mornington Peninsula Shire's Natural Systems Team.

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## APPENDIX 1 INDIGENOUS FLORA SPECIES LIST

Name	Common Name	VROTS	Regional	Local
<i>Acacia longifolia subsp. sophorae</i>	Coast Wattle			
<i>Acacia mearnsii</i>	Black Wattle			X
<i>Acacia melanoxylon</i>	Blackwood			X
<i>Acacia paradoxa</i>	Hedge Wattle			
<i>Acacia verticillata</i>	Prickly Moses			
<i>Acaena novae-zelandiae</i>	Bidgee-widgee			
<i>Acrotriche serrulata</i>	Honey-pots			X
<i>Adiantum aethiopicum</i>	Common Maidenhair			X
<i>Allocasuarina littoralis</i>	Black Sheoak		X	
<i>Allocasuarina verticillata</i>	Drooping Sheoak		X	
<i>Alyxia buxifolia</i>	Sea Box			
<i>Amperea xiphoclada var. xiphoclada</i>	Broom Spurge			
<i>Amyema pendulum</i>	Drooping Mistletoe			X
<i>Apium prostratum subsp. prostratum var. filiforme</i>	Sea Celery		X	
<i>Arthropodium spp. (s.s.)</i>	Vanilla Lily			X
<i>Arthropodium strictum s.l.</i>	Chocolate Lily			X
<i>Astroloma humifusum</i>	Cranberry Heath			X
<i>Atriplex cinerea</i>	Coast Saltbush			
<i>Austrodanthonia spp.</i>	Wallaby Grass			
<i>Austrostipa flavescens</i>	Coast Spear-grass			
<i>Austrostipa mollis</i>	Supple Spear-grass			
<i>Austrostipa stipoides (planted)</i>	Prickly Spear-grass			
<i>Banksia integrifolia subsp. integrifolia</i>	Coast Banksia		X	
<i>Banksia marginata</i>	Silver Banksia		X	
<i>Baumea juncea</i>	Bare Twig-sedge			
<i>Billardiera scandens</i>	Common Apple-berry			
<i>Bolboschoenus caldwellii</i>	Salt Club-sedge			
<i>Bossiaea prostrata</i>	Creeping Bossiaea			X
<i>Burchardia umbellata</i>	Milkmaids			X
<i>Bursaria spinosa</i>	Sweet Bursaria			
<i>Caesia parviflora</i>	Pale Grass Lily		X	
<i>Caladenia sp</i>	Spider Orchid			?
<i>Calystegia sepium subsp. roseata</i>	Large Bindweed			
<i>Carex appressa</i>	Tall Sedge		X	
<i>Carex breviculmis</i>	Common Grass-sedge			
<i>Carex fascicularis</i>	Tassel Sedge		X	
<i>Cassinia aculeata</i>	Common Cassinia			
<i>Cassytha pubescens s.s.</i>	Downy Dodder-laurel			

Name	Common Name	VROTS	Regional	Local
<i>Clematis microphylla</i>	Small-leaved Clematis			
<i>Comesperma volubile</i>	Love Creeper			X
<i>Correa alba</i> var. <i>alba</i>	White Correa			
<i>Correa reflexa</i>	Common Correa			
<i>Cotula australis</i>	Common Cotula			
<i>Crassula</i> spp.	Crassula			
<i>Daviesia latifolia</i>	Hop Bitter-pea		X	
<i>Deyeuxia</i> spp.	Bent-grass			
<i>Dianella brevicaulis</i>	Small-flower Flax-lily			
<i>Dianella longifolia</i> var. <i>longifolia</i> s.l.	Pale Flax-lily		X	
<i>Dianella</i> sp. ? <i>revoluta</i> (2 forms)	Coast Flax-lily		?	
<i>Dichondra repens</i>	Kidney-weed			
<i>Dipodium</i> sp	Hyacinth Orchid			X
<i>Disphyma crassifolium</i> subsp. <i>clavellatum</i>	Rounded Noon-flower		X	
<i>Distichlis distichophylla</i>	Australian Salt-grass		X	
<i>Drosera</i> ? <i>pygmaea</i>	Tiny Sundew		X	
<i>Drosera whittakeri</i> subsp. <i>aberrans</i>	Scented Sundew			
<i>Enteromorpha</i> ? <i>intestinalis</i>	Gutweed			X
<i>Eucalyptus ovata</i>	Swamp Gum			
<i>Eucalyptus radiata</i> s.l.	Narrow-leaf Peppermint			
<i>Eucalyptus viminalis</i> subsp. <i>pryoriana</i>	Coast Manna-gum			
<i>Euchiton japonicus</i> .	Father-and-child Plant			
<i>Exocarpos cupressiformis</i>	Cherry Ballart			X
<i>Ficinia nodosa</i>	Knobby Club-sedge			
<i>Gahnia radula</i>	Thatch Saw-sedge			
<i>Galium</i> spp.	Bedstraw			
<i>Geranium</i> spp.	Crane's Bill		?	
<i>Gonocarpus tetragynus</i>	Common Raspwort			
<i>Goodenia ovata</i>	Hop Goodenia			
<i>Hardenbergia violacea</i> (?planted)	Purple Coral-pea			
<i>Hibbertia sericea</i> s.l.	Silky Guinea-flower		X	
<i>Hypericum gramineum</i>	Small St John's Wort			X
<i>Juncus kraussii</i> subsp. <i>australiensis</i>	Sea Rush		X	
<i>Juncus pallidus</i>	Pale Rush			
<i>Juncus pauciflorus</i>	Loose-flower Rush			
<i>Kennedia prostrata</i>	Running Postman			
<i>Kunzea ericoides</i> (upright form)	Burgan		X	
<i>Lachnagrostis filiformis</i>	Common Blown-grass			
<i>Lagenophora stipitata</i>	Common Bottle-daisy			
<i>Lepidosperma concavum</i>	Sandhill Sword-sedge			
<i>Lepidosperma gladiatum</i>	Coast Sword-sedge			X
<i>Lepidosperma gunnii</i>	Slender Sword-sedge			X

Name	Common Name	VROTS	Regional	Local
<i>Lepidosperma laterale</i> var. <i>laterale</i>	Variable Sword-sedge			
<i>Lepidosperma laterale</i> var. <i>majus</i>	Variable Sword-sedge		X	
<i>Lepidosperma</i> spp.	Sword Sedge			X
<i>Leptinella</i> sp ? <i>reptans</i>	Cotula		X	
<i>Leptospermum continentale</i>	Prickly Tea-tree			X
<i>Leptospermum laevigatum</i>	Coast Tea-tree			
<i>Leucopogon parviflorus</i>	Coast Beard-heath		X	
<i>Lobelia anceps</i>	Angled Lobelia		X	
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	Wattle Mat-rush			
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush			
<i>Lomandra</i> ? <i>longifolia</i> subsp. <i>exilis</i>	Cluster-headed Mat-rush			
<i>Lomandra micrantha</i> s.l.	Small-flower Mat-rush		X	
<i>Melaleuca ericifolia</i>	Swamp Paperbark			
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass			
<i>Muehlenbeckia adpressa</i>	Climbing Lignum			
<i>Muellerina eucalyptoides</i>	Creeping Mistletoe			X
<i>Myoporum insulare</i>	Common Boobialla		X	
<i>Myoporum viscosum</i>	Sticky Boobialla			X
<i>Olearia axillaris</i> (?planted)	Coast Daisy-Bush			
<i>Olearia lirata</i>	Snowy Daisy-bush			
<i>Olearia ramulosa</i>	Twiggy Daisy-bush			
<i>Oxalis exilis</i>	Shady Wood-sorrel		X	
<i>Oxalis rubens</i>	Dune Wood Sorrel	r		
<i>Ozothamnus ferrugineus</i>	Tree Everlasting			
<i>Ozothamnus turbinatus</i> (?planted)	Coast Everlasting			
<i>Pelargonium australe</i>	Austral Stork's-bill			
<i>Pelargonium inodorum</i>	Kopata			
<i>Persicaria</i> spp	Knotweed			
<i>Phragmites australis</i>	Common Reed		X	
<i>Pimelea humilis</i>	Common Rice-flower			
<i>Poa labillardierei</i>	Common Tussock-grass			
<i>Poa</i> ? <i>morrisii</i> (mown)	Soft Tussock-grass			
<i>Poa poiformis</i> (2 forms blue & green)	Coast Tussock-grass		X	
<i>Poa sieberiana</i>	Grey Tussock-grass			
<i>Polystichum proliferum</i>	Mother Shield-fern			X
<i>Pomaderris paniculosa</i> subsp. <i>paralia</i>	Coast Pomaderris			
<i>Poranthera microphylla</i>	Small Poranthera			
<i>Portulaca oleracea</i>	Common Purslane			
<i>Pseudognaphalium luteoalbum</i>	Jersey Cudweed			
<i>Pteris tremula</i>	Tender Brake			X
<i>Pterostylis nutans</i>	Nodding Greenhood			X
<i>Pterostylis</i> spp.	Greenhood			

Name	Common Name	VROTS	Regional	Local
<i>Ranunculus sp.</i>	Buttercup			X
<i>Rhagodia candolleana subsp. candolleana</i>	Seaberry Saltbush			
<i>Rubus parvifolius</i>	Small-leaf Bramble			X
<i>Rumex brownii</i>	Slender Dock			
<i>Rytidosperma caespitosa</i>	Common Wallaby-grass			
<i>Rytidosperma setacea</i>	Bristly Wallaby-grass			
<i>Samolus repens</i>	Creeping Brookweed			
<i>Sarcocornia quinqueflora subsp. quinqueflora</i>	Beaded Glasswort			
<i>Schoenus apogon</i>	Common Bog-sedge			
<i>Selliera radicans</i>	Shiny Swamp-mat			
<i>Senecio biserratus</i>	Jagged Fireweed			
<i>Senecio glomeratus</i>	Annual Fireweed			
<i>Senecio minimus</i>	Shrubby Fireweed		X	
<i>Senecio odoratus var. odoratus</i>	Scented Groundsel			X
<i>Senecio quadridentatus</i>	Cotton Fireweed			
<i>Solanum laciniatum</i>	Large Kangaroo Apple			
<i>Solanum spp.</i>	Nightshade			
<i>Sonchus hydrophilus</i>	Native Sow-thistle			X
<i>Sporobolus virginicus</i>	Salt Couch			
<i>Suaeda australis</i>	Austral Seablite			
<i>Tetragonia implexicoma</i>	Bower Spinach			
<i>Thelymitra spp.</i>	Sun Orchid			X
<i>Themeda triandra</i>	Kangaroo Grass			
<i>Thysanotus patersonii</i>	Twining Fringe Lily			X
<i>Tricoryne elatior</i>	Yellow Grass Lily		X	
<i>Viminaria juncea (?planted)</i>	Golden Spray			
<i>Viola hederacea sensu Entwisle (1996)</i>	Ivy-leaf Violet			
<i>Xanthorrhoea minor subsp. lutea</i>	Small Grass-tree		X	
<i>Zygophyllum billardierei</i>	Coast Twin-leaf	r		

## APPENDIX 2 INTRODUCED/WEEDY FLORA SPECIES LIST

Origin	Botanical Name	Common Name
*	<i>Acacia baileyana</i>	Cootamundra Wattle
*	<i>Acacia spp.</i>	Wattle
*	<i>Acetosa sagittata</i>	Rambling Dock
*	<i>Acetosella vulgaris</i>	Sheep Sorrel
*	<i>Agapanthus praecox subsp. orientalis</i>	Agapanthus
*	<i>Agonis flexuosa</i>	Willow Myrtle
*	<i>Agrostis capillaris s.l.</i>	Brown-top Bent
*	<i>Aira spp.</i>	Hair Grass
*	<i>Allium triquetrum</i>	Three-corner Garlic
*	<i>Amaryllis belladonna</i>	Belladonna Lily
*	<i>Anagallis arvensis</i>	Pimpernel
*	<i>Andredera cordifolia</i>	Madeira Vine
	<i>Angophora spp.</i>	Apple
*	<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
*	<i>Aponogeton distachyos</i>	Cape Pond-lily
*	<i>Araujia sericifera</i>	Cruel Vine
*	<i>Arctotheca calendula</i>	Cape Weed
*	<i>Arum italicum</i>	Italian Cuckoo-pint
*	<i>Asparagus asparagoides</i>	Bridal Creeper
*	<i>Asparagus scandens</i>	Asparagus Fern
*	<i>Aster subulatus</i>	Aster-weed
*	<i>Atriplex prostrata</i>	Hastate Orache
*	<i>Avena spp.</i>	Oat
*	<i>Brassicaceae spp.</i>	Turnip
*	<i>Briza maxima</i>	Large Quaking-grass
*	<i>Briza minor</i>	Lesser Quaking-grass
*	<i>Bromus catharticus</i>	Prairie Grass
*	<i>Bromus diandrus</i>	Great Brome
*	<i>Bromus hordeaceus subsp. hordeaceus</i>	Soft Brome
*	<i>Bromus spp.</i>	Brome
*	<i>Cakile edentula</i>	American Sea Rocket
*	<i>Cakile maritima ssp. maritima</i>	Sea Rocket
*	<i>Calystegia silvatica subsp. silvatica</i>	Greater Bindweed
*	<i>Centaureum spp.</i>	Centaury
*	<i>Cerastium spp.</i>	Mouse-ear Chickweed
*	<i>Chasmanthe floribunda</i>	African Cornflag
*	<i>Chenopodium album</i>	Fat Hen
*	<i>Chrysanthemoides monilifera</i>	Boneseed
*	<i>Cirsium vulgare</i>	Spear Thistle
*	<i>Cistus inflatus</i>	White Rock-rose

Origin	Botanical Name	Common Name
*	<i>Conyza spp.</i>	Fleabane
*	<i>Coprosma repens</i>	Mirror Bush
*	<i>Cortaderia selloana</i>	Pampas Grass
	<i>Corymbia ficifolia (planted)</i>	Flowering Gum
#	<i>Corymbia maculata</i>	Spotted Gum
*	<i>Cotoneaster pannosus</i>	Velvet Cotoneaster
*	<i>Cotula coronopifolia</i>	Water Buttons
*	<i>Crassula multicava subsp. multicava</i>	Shade Crassula
*	<i>Crocsmia X crocosmiiflora</i>	Montbretia
*	<i>Cupressus macrocarpa</i>	Monterey Cypress
*	<i>Cupressus sp</i>	Cypress
*	<i>Cynodon dactylon var. dactylon</i>	Couch
*	<i>Cynosurus cristatus</i>	Crested Dog's-tail
*	<i>Dactylis glomerata</i>	Cocksfoot
*	<i>Delairea odorata</i>	Cape Ivy
*	<i>Descurainia sophia</i>	Flixweed
*	<i>Dietes ?iridioides</i>	African Iris
*	<i>Echium candicans</i>	Pride of Madeira
*	<i>Ehrharta erecta var. erecta</i>	Panic Veldt-grass
*	<i>Ehrharta longiflora</i>	Annual Veldt-grass
*	<i>Eucalyptus botryoides</i>	Southern Mahogany
*	<i>Eucalyptus robusta</i>	
*	<i>Euphorbia peplus</i>	Petty Spurge
*	<i>Felicia amelloides</i>	Blue Margurite Daisy
*	<i>Festuca arundinacea</i>	Tall Fescue
*	<i>Fraxinus excelsior</i>	Golden Ash
*	<i>Fraxinus spp.</i>	Ash
*	<i>Fumaria spp.</i>	Fumitory
*	<i>Galium aparine</i>	Cleavers
*	<i>Galium ?divaricatum</i>	Slender Bedstraw
*	<i>Genista linifolia</i>	Flax-leaf Broom
*	<i>Genista monspessulana</i>	Montpellier Broom
*	<i>Geranium molle var. molle</i>	Dovesfoot
*	<i>Gladiolus undulatus</i>	Wild Gladiolus
*	<i>Hakea drupacea</i>	Sweet Hakea
*	<i>Hakea salicifolia subsp. salicifolia</i>	Willow-leaf Hakea
*	<i>Hedera helix</i>	English Ivy
*	<i>Helminthotheca echinoides</i>	Ox-tongue
*	<i>Holcus lanatus</i>	Yorkshire Fog
*	<i>Hypochoeris radicata</i>	Cat's Ear
*	<i>Juncus ?acutus (small non-fertile)</i>	Sharp Rush
*	<i>Lactuca serriola</i>	Prickly Lettuce

Origin	Botanical Name	Common Name
*	<i>Lagunaria patersonia</i>	Pyramid Tree
*	<i>Lagurus ovatus</i>	Hare's-tail Grass
	<i>Leontodon taraxacoides subsp.</i>	
*	<i>taraxacoides</i>	Hairy Hawkbit
	<i>Liliaceae spp. (sensu lato)</i>	Lily
*	<i>Lolium spp.</i>	Rye Grass
*	<i>Lotus subbiflorus</i>	Hairy Bird's-foot Trefoil
*	<i>Lycium ferocissimum</i>	African Box-thorn
*	<i>Malva spp.</i>	Mallow
*	<i>Medicago spp.</i>	Medic
*	<i>Melaleuca armillaris subsp. armillaris</i>	Giant Honey-myrtle
		Giant Honey-myrtle hybrids with Swamp paperbark
*	<i>Melaleuca armillaris X M.ericifolia</i>	
#	<i>Melaleuca lanceolata ?planted</i>	Moonah
*	<i>Melaleuca spp.</i>	Honey-myrtle
*	<i>Modiola caroliniana</i>	Red-flower Mallow
*	<i>Myosotis sylvatica</i>	Wood Forget-me-not
*	<i>Nasturtium microphyllum</i>	Brown Watercress
*	<i>Osteospermum sp</i>	
*	<i>Oxalis incarnata</i>	Pale Wood-sorrel
*	<i>Oxalis pes-caprae</i>	Soursob
*	<i>Oxalis purpurea</i>	Large-flower Wood-sorrel
*	<i>Paspalum dilatatum</i>	Paspalum
*	<i>Passiflora spp.</i>	Passion Flower
*	<i>Pelargonium spp</i>	Pelargonium
*	<i>Pennisetum clandestinum</i>	Kikuyu
*	<i>Phalaris aquatica</i>	Toowoomba Canary-grass
*	<i>Phytolacca octandra</i>	Red-ink Weed
*	<i>Pinus pinaster</i>	Cluster Pine
*	<i>Pinus pinea</i>	Stone Pine
*	<i>Pinus radiata</i>	Radiata Pine
*	<i>Pittosporum undulatum</i>	Sweet Pittosporum
*	<i>Plantago coronopus</i>	Buck's-horn Plantain
*	<i>Plantago lanceolata</i>	Ribwort
*	<i>Plantago major</i>	Greater Plantain
*	<i>Poa annua</i>	Annual Meadow-grass
*	<i>Poa bulbosa</i>	Bulbous Meadow Grass
*	<i>Polygala myrtifolia var. myrtifolia</i>	Myrtle-leaf Milkwort
*	<i>Polygonum aviculare s.l.</i>	Prostrate Knotweed
*	<i>Polypogon monspeliensis</i>	Annual Beard-grass
*	<i>Prunella vulgaris</i>	Self-heal
*	<i>Pseudoscleropodium purum</i>	Neat Feather-moss
*	<i>Ranunculus repens</i>	Creeping Buttercup

Origin	Botanical Name	Common Name
*	<i>Rhamnus alaternus</i>	Italian Buckthorn
*	<i>Romulea rosea</i>	Onion Grass
*	<i>Rorippa spp</i>	Cress
*	<i>Rubus anglocandicans</i>	Blackberry
*	<i>Rubus fruticosus spp. agg.</i>	Blackberry
*	<i>Rumex conglomeratus</i>	Clustered Dock
*	<i>Rumex crispus</i>	Curled Dock
*	<i>Rumex spp.</i>	Dock
*	<i>Senecio pterophorus</i>	African Daisy
*	<i>Solanum douglasii</i>	Douglas' Nightshade
*	<i>Solanum nigrum sensu Willis (1972)</i>	Black Nightshade
*	<i>Solanum pseudocapsicum</i>	Madeira Winter-cherry
*	<i>Sollya heterophylla</i>	Bluebell Creeper
*	<i>Sonchus asper s.l.</i>	Rough Sow-thistle
*	<i>Sonchus oleraceus</i>	Common Sow-thistle
*	<i>Sporobolus africanus</i>	Rat-tail Grass
*	<i>Stellaria media</i>	Chickweed
*	<i>Stenotaphrum secundatum</i>	Buffalo Grass
*	<i>Taraxacum officinale spp. agg.</i>	Garden Dandelion
*	<i>Tradescantia fluminensis</i>	Wandering Jew
*	<i>Trifolium dubium</i>	Suckling Clover
*	<i>Trifolium repens var. repens</i>	White Clover
*	<i>Trifolium spp.</i>	Clover
*	<i>Ulex europaeus</i>	Gorse
*	<i>Verbascum virgatum</i>	Twiggy Mullein
*	<i>Veronica spp.</i>	Speedwell
*	<i>Vicia hirsuta</i>	Tiny Vetch
*	<i>Vicia sativa</i>	Common Vetch
*	<i>Vinca major</i>	Blue Periwinkle
*	<i>Viola odorata</i>	Common Violet
*	<i>Vulpia spp.</i>	Fescue
*	<i>Watsonia meriana var. bulbillifera</i>	Bulbil Watsonia
*	<i>Zantedeschia aethiopica</i>	White Arum-lily

Indigenous vegetation cover  
Balcombe Estuary



2002  
Vegetation  
Cover Mapping

Details  
Date: 20/02/2020  
Version: 1  
Aerial photography from Rivermap D000.  
Base map data Copyright © The State of Victoria.



Scale 1:5,000 (Page size A3)

Disclaimer  
Practical Ecology bears no responsibility for the accuracy and completeness of this information and any decisions or actions taken on the basis of this map. While information appears accurate at publication, nature and circumstances are constantly changing.







# Map 1 - Vegetation Quality Assessment

Balcombe Estuary Reserve

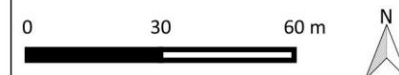
-  Study Area
-  Grid Reference

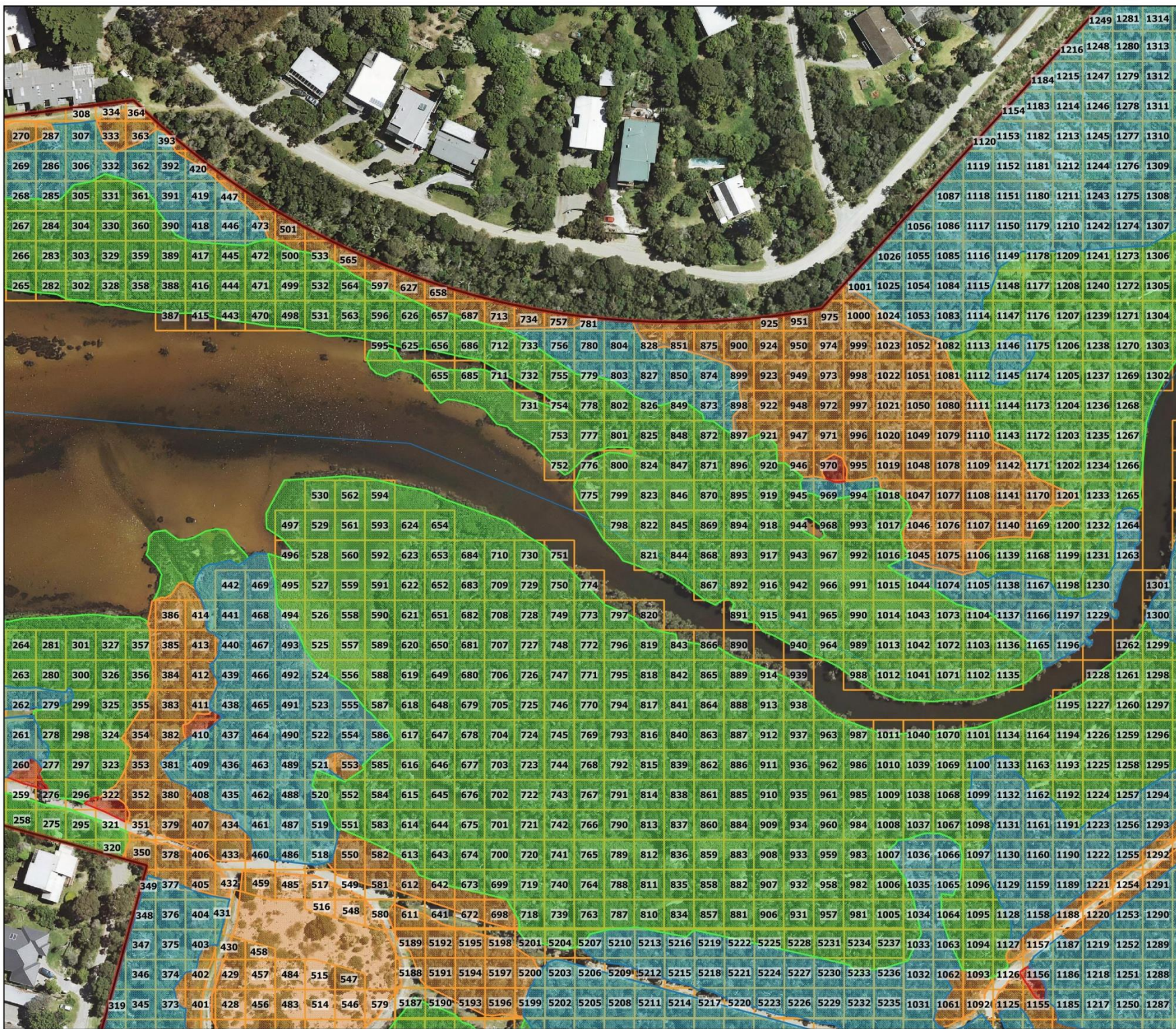
## Indigenous Vegetation Cover

-  0-25%
-  25-50%
-  50-75%
-  75-100%

Date: 24 March 2020  
Created by: Katherine Smedley  
Map Program: QGIS 3.10

Scale (A3) 1:1200



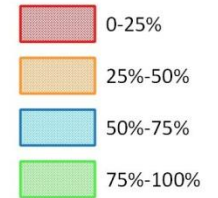


## Map 2 - Vegetation Quality Assessment

Balcombe Estuary Reserve

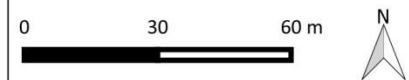


### Indigenous Vegetation Cover



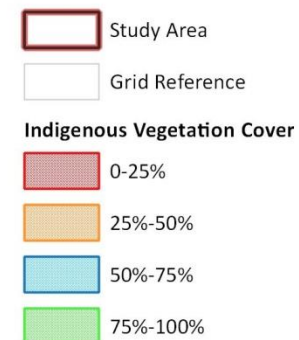
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Scale (A3) 1:1200



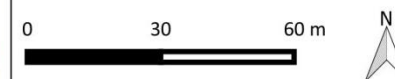
# Map 3 - Vegetation Quality Assessment

Balcombe Estuary Reserve



Date: 24 March 2020  
Created by: Katherine Smedley  
Map Program: QGIS 3.10

Scale (A3) 1:1200



# Map 4 - Vegetation Quality Assessment

Balcombe Estuary Reserve

Study Area  
Grid Reference

## Indigenous Vegetation Cover

0-25%  
25%-50%  
50%-75%

Date: 24 March 2020  
Created by: Katherine Smedley  
Map Program: QGIS 3.10

Scale (A3) 1:1200

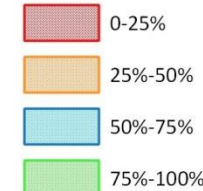
0 30 60 m

# Map 5 - Vegetation Quality Assessment

Balcombe Estuary Reserve

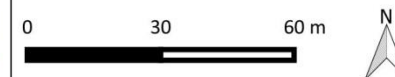


## Indigenous Vegetation Cover



Date: 24 March 2020  
Created by: Katherine Smedley  
Map Program: QGIS 3.10

Scale (A3) 1:1200







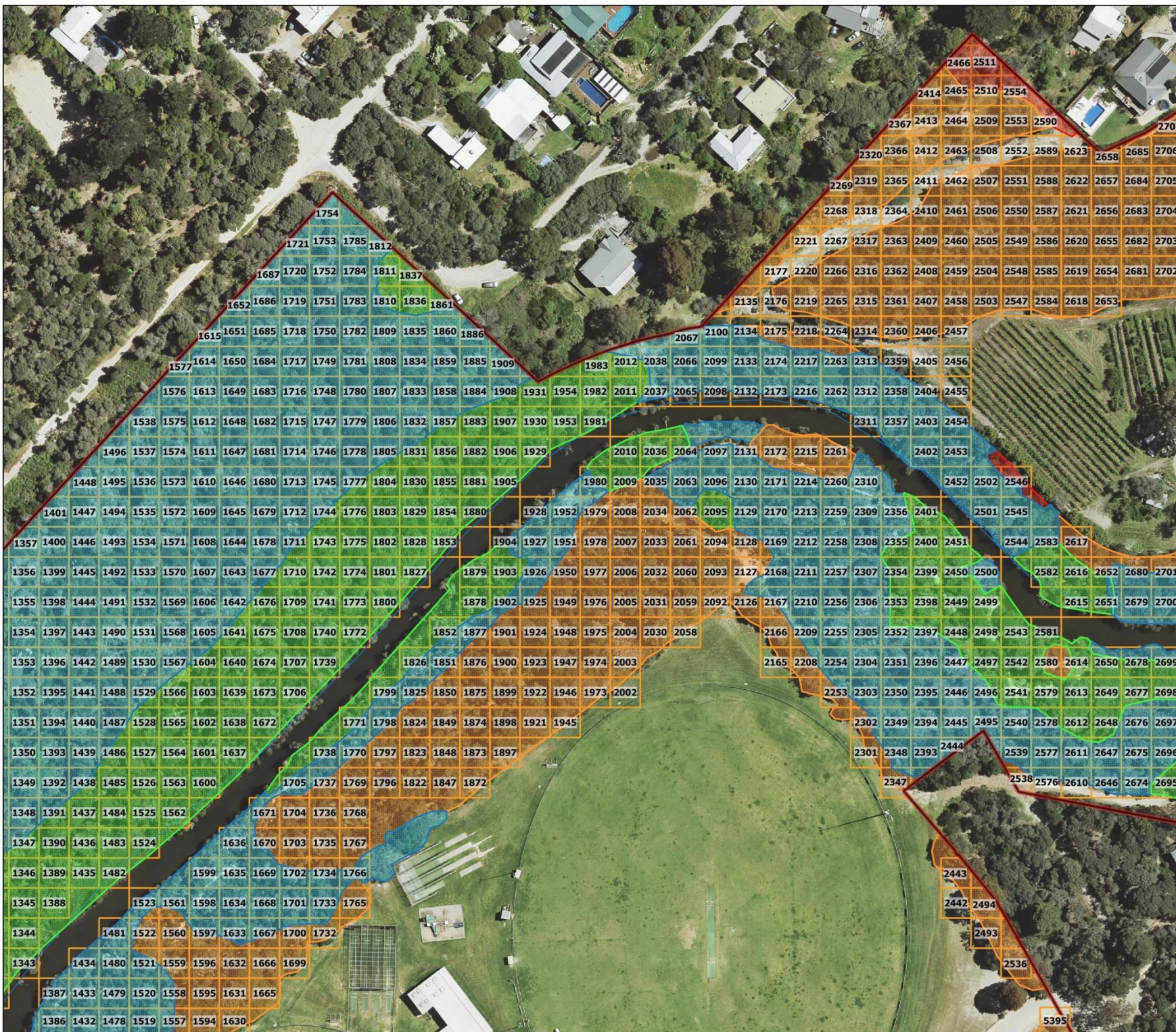
# Map 6 - Vegetation Quality Assessment

Balcombe Estuary Reserve

 Study Area  
 Grid Reference

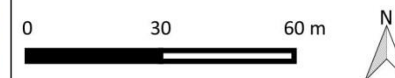
## Indigenous Vegetation Cover

 0-25%  
 25-50%  
 50-75%  
 75-100%



Date: 24 March 2020  
 Created by: Katherine Smedley  
 Map Program: QGIS 3.10

Scale (A3) 1:1200







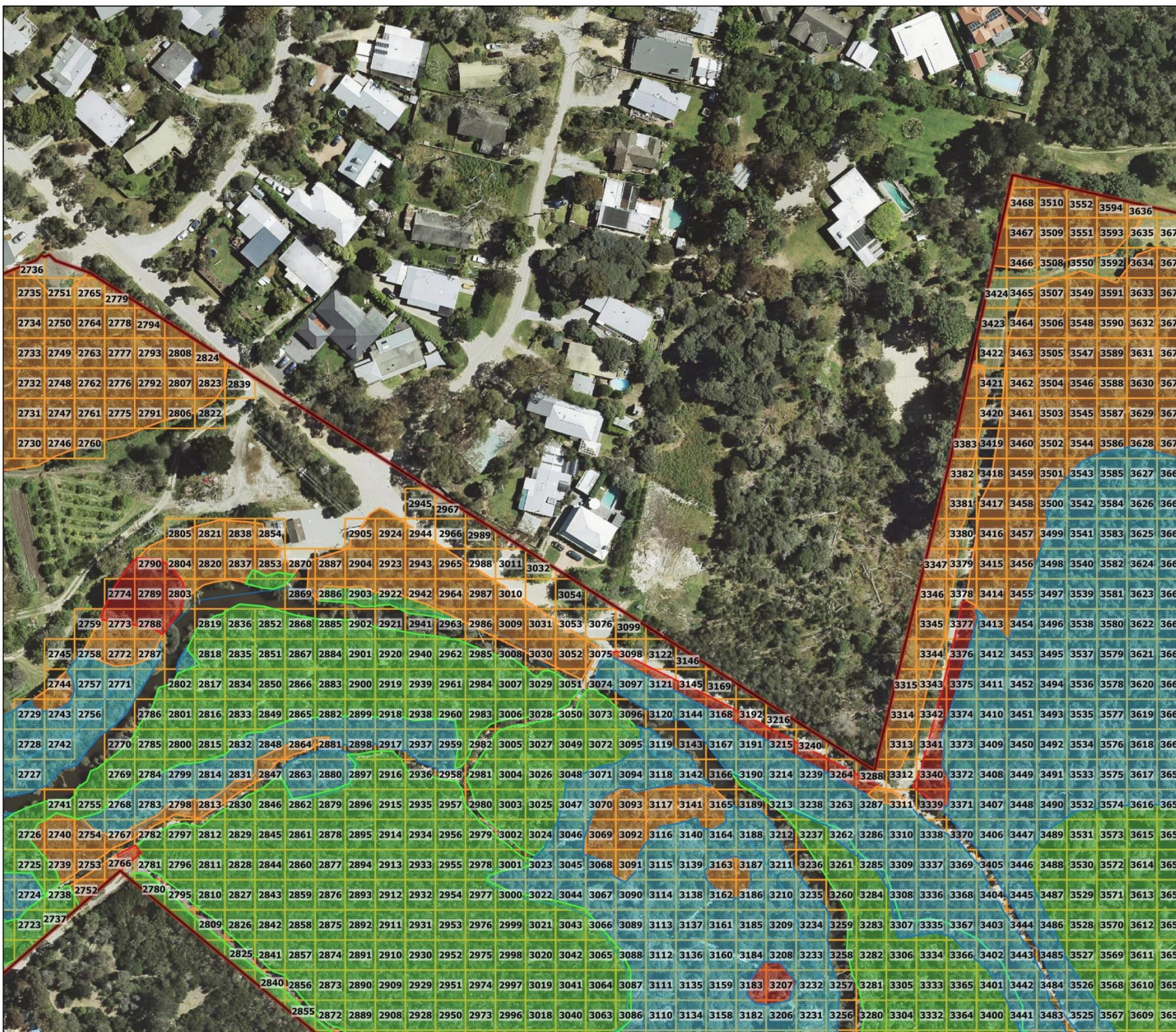
# Map 7 - Vegetation Quality Assessment

Balcombe Estuary Reserve

-  Study Area
-  Grid Reference

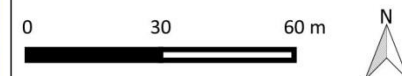
## Indigenous Vegetation Cover

-  0-25%
-  25%-50%
-  50%-75%
-  75%-100%



Date: 24 March 2020  
Created by: Katherine Smedley  
Map Program: QGIS 3.10

Scale (A3) 1:1200







# Map 8 - Vegetation Quality Assessment

Balcombe Estuary Reserve

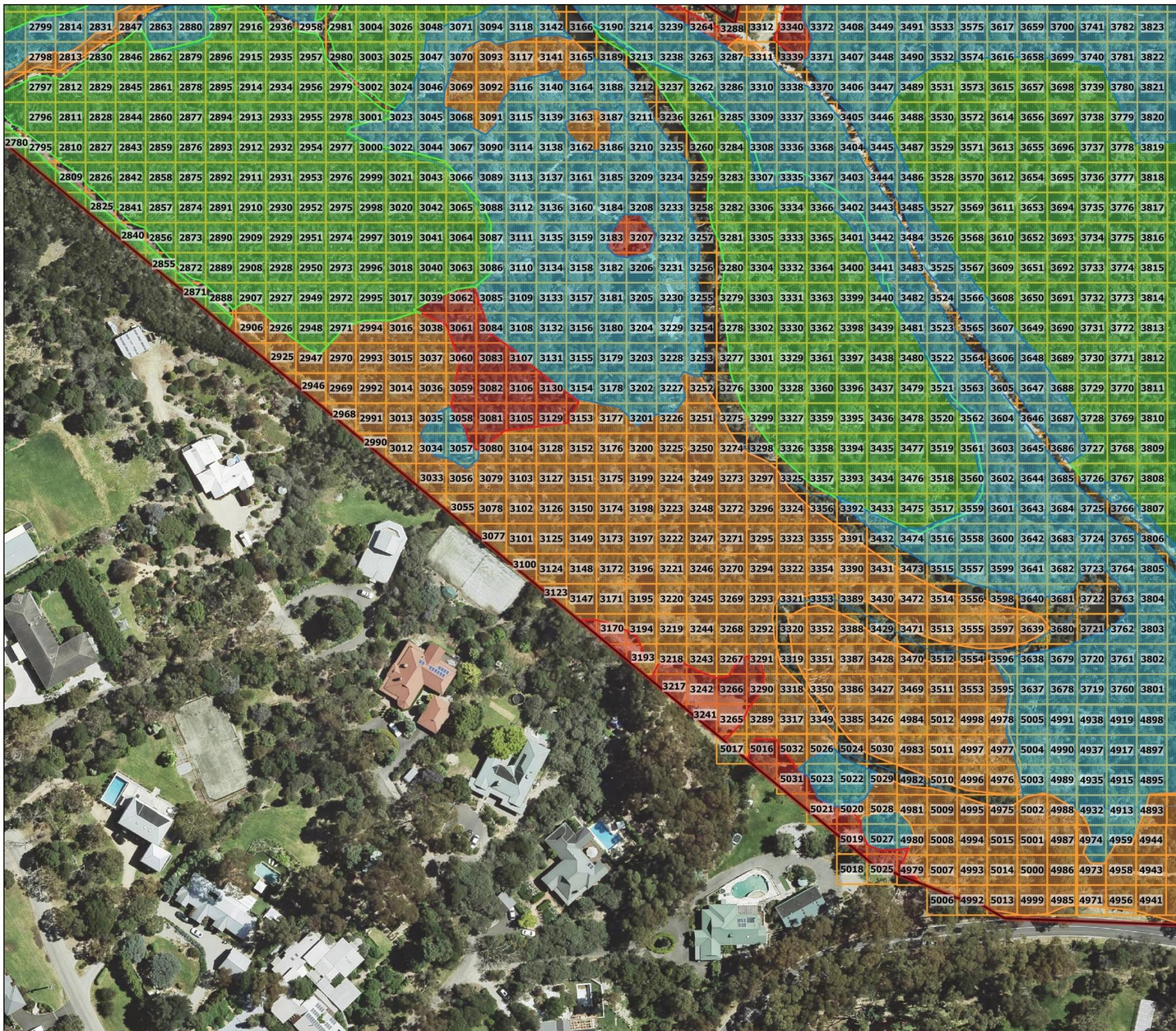
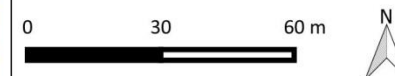
-  Study Area
-  Grid Reference

## Indigenous Vegetation Cover

-  0-25%
-  25%-50%
-  50%-75%
-  75%-100%

Date: 24 March 2020  
Created by: Katherine Smedley  
Map Program: QGIS 3.10

Scale (A3) 1:1200

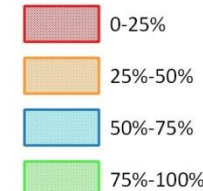


# Map 9 - Vegetation Quality Assessment

Balcombe Estuary Reserve

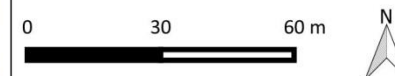


## Indigenous Vegetation Cover



Date: 24 March 2020  
Created by: Katherine Smedley  
Map Program: QGIS 3.10

Scale (A3) 1:1200







# Map 10 - Vegetation Quality Assessment

Balcombe Estuary Reserve

-  Study Area
-  Grid Reference

## Indigenous Vegetation Cover

-  0-25%
-  25%-50%
-  50%-75%
-  75%-100%

Date: 24 March 2020  
Created by: Katherine Smedley  
Map Program: QGIS 3.10

Scale (A3) 1:1200

