Mal's Ecological
&
Environmental Services
PTY LTD

Consulting in Ecological Management
and Restoration
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Fauna survey

of

Capel Sound Foreshore Reserve

Capel Sound

Final **Report**

Prepared for Capel Sound Foreshore Reserve Committee of Management Inc.

13th July 2022

FAUNA SURVEY OF CAPEL SOUND FORESHORE RESERVE, CAPEL SOUND, 13TH JULY 2021

Mal's Ecological & Environmental Services PTY LTD

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Wayne Nicholls	Foreshore reserve manager
Matt Landy	Foreshore reserve ranger
CSFR C of M	

Profiles Front Page

Top to bottom:

- Fauna nesting box
- Pair of Black Swans
- Coast Banksia Woodland EVC
- Coastal Dune Scrub EVC
- Pair of Sooty Oystercatchers
- Swamp Rat activity

Executive Summary

Mal's Ecological & Environmental Services PTY LTD was commissioned by the Capel Sound Foreshore Reserve Committee of Management Inc. (BCSFR C of M) to conduct a vertebrate fauna survey within the Capel Sound Foreshore Reserve, Capel Sound. The study site is approximately 4 kilometers long and contains woodlands, scrub, grasslands, Chinaman's Creek Estuary and Port Phillip Bay. To the east of the foreshore reserve urban development is apparent. Largish remnant reserves within the vicinity of the foreshore reserve include: Tootgarook Wetlands, adjacent foreshore reserves and Chinaman's Creek. The area has a maritime climate with wet moist winters and dry warm summers.

Four identified Ecological Vegetation Classes are present within the foreshore reserve, with one listed as endangered, one listed as vulnerable and a further one is listed as depleted within the Gippsland Plains Bioregion. The foreshore reserve is also part of the Port Phillip Bay Biolink and Tootgarook Wetlands via Chinaman's Creek biolink. The presence of endangered & threatened EVCs and flora and fauna species indicates that the foreshore reserve is of regional to state Significance.

Fauna surveys and mapping were undertaken from August 2021 to July 2022 to:

- obtain base line data on all vertebrate fauna species,
- obtain population densities of birds, amphibians, nocturnal fauna and feral species,
- conduct Fauna Environmental Indicator Species (FEIS) assessments of remnant Broad Vegetation Communities within the foreshore reserve,
- consider biodiversity issues and
- make management recommendations to protect and enhance its biodiversity values into the future.

Key ecological values

The field study identified the following key ecological values in the foreshore reserve:

- 75 species of native fauna and eight species of introduced fauna were recorded during the survey comprising:
    - three species of fish
    - four amphibian species
    - nine reptile species: one tortoise, seven lizards and one snake
    - 53 bird species, including four introduced
    - 14 mammal species, including four introduced

- Five State Significant species were recorded of which one species is listed under the state *Flora and Fauna Guarantee Act 1988* (FFG Act) as threatened.

- A further 12 species recorded are considered to be of Regional Significance, and three species recorded are of High Local Significance.

- Due to large population and habitat losses across the Mornington Peninsula, the remaining native fauna recorded within the reserve can be considered to be of Local Significance.

Government legislation and policy

Key biodiversity legislation and policy is summarised in Table A below.

Table A: Key biodiversity legislation and policy

Legislation / Policy	Relevant ecological feature on site
EPBC Act	Habitat for Nationally threatened fauna species and migratory bird species
FFG Act	Habitat for two FFG listed fauna species
Planning & Environmental Act	Possible future vegetation to be removed during weeding practices and fire protection measures
CaLP Act	No noxious weed species recorded

State significant fauna species identified

The State significant fauna species identified during this assessment are listed in Table B below.

Table B: Significant fauna species identified within the foreshore reserve

Species name	Area of value within the study site
EPBC Act listed species	
Nil	
FFG Act/ DSE Advisory List species	
Common Long-necked Tortoise	In creek.
Swamp Skink	Along creek estuary and adjacent foreshore scrub.
Pied Cormorant	Coastal areas.
Pacific Gull	Coastal areas.
White-bellied Sea-Eagle	Boat ramp.

Aims and objectives

The brief for this project was to identify the vertebrate fauna within the foreshore reserve.

The outcomes of the study will inform the foreshore reserve managers in:-

- sustaining the significant and common fauna and their habitats (as detected in this survey) and identifying possible impacts or risks;
- developing and implementing a monitoring program for endangered and threatened fauna species within the reserves;
- identifying and implementing methods to enhance or restore significant fauna habitats.

Study limitations

The field survey was conducted over a 12-month period which included all seasons of the year. However there are a number of reasons why the survey may not have detected all vertebrate species at the site, including low individual species populations, migration, predation of native species by native or introduced fauna, and variable seasonal conditions. The foreshore reserve is densely vegetated in some areas and this may have reduced the detection of faunal species and population densities.

Vegetation

The vegetation and associated habitat of the foreshore reserve and greater area are today highly modified and fragmented, a result of intense urbanization of the area over the last 50 years and earlier historical changes to the Nepean Peninsula vegetation following European settlement. The

native vegetation within the study area has partial connectivity with broader areas of vegetation in the greater area (reserve and Tootgarook Wetlands biolink and adjacent foreshore reserve biolinks), remnant vegetation on private and public land, and remnant vegetation along creeks and roadsides.

The study site supports four Ecological Vegetation Classes (EVCs), as shown in the table below.

Table C: EVCs and their status within the foreshore reserve

EVC No	EVCs	Status within Bioregion	Current distribution within the study site
002	Coast Banksia Woodland	Vulnerable	Majority of the foreshore reserve.
160	Coastal Dune Scrub	Least Concern	Some sections between the Coastal Dune Grassland and the Coast Banksia Woodland.
858	Coastal Alkaline Scrub	Depleted	Small section in section 2 where small stand of Moonah exists.
879	Coastal Dune Grassland	Endangered	Found on the primary dune along the entire foreshore reserve.

The quality of vegetation within the EVCs is generally of medium to high standard, with large majority of woody weeds controlled in the past.

Fauna survey methods

Methods, undertaken in accordance with permit conditions, included:

- identifying appropriate habitat,
- mapping all vertebrate fauna species,
- active searching,
- scat analysis,
- digging analysis,
- deploying Color bond tiles,
- conducting spotlight walks,
- Anabat 2 Bat Detector,
- vocalization identification, and
- FEIS assessments.

Conclusion and recommendations

The foreshore reserve contains a medium range of terrestrial and arboreal habitats across a range of EVCs that are assessed as endangered within the bio-region. It supports significant indigenous fauna species listed under State biodiversity acts.

Overarching recommendation: Collectively, the foreshore reserve is of regional to State Significance and its continued protection should accordingly be of high priority.

Priority recommendations to help protect and maintain the foreshore reserve's diverse habitats and fauna species:

1. **Habitat protection**: Maintain and increase crucial indigenous habitats throughout the foreshore reserve and continue to remove habitat-changing weeds.
2. **Woodland habitat**: Continue to restore the woodlands and scrub throughout the camping areas by removing pines and cypresses over a ten year period and replacing with Coast Banksia, Drooping She-oke and some Manna Gum & Swamp Gum specie
3. **Nesting boxes**: Continue to install nesting boxes (especially in section 2 of the foreshore reserve) for listed key species and deploy additional habitat logs throughout. Deploy a number of different designed microbat boxes.
4. **Pest animal control**: Continue to implement pest animal control programs with specific frequencies to control foxes, cats, turtle-doves, mynas, starlings and rodents.
5. **Environmental monitoring**: Develop and implement a longitudinal environmental monitoring program, informed by the results of this study, which captures changes to species diversity and abundance in response to variable seasonal conditions, particularly for endangered and threatened species.

Action is required on a number of fronts to achieve these five priority recommendations:

- **Fauna surveys**: Continue to conduct fauna surveys every five to ten years and on a yearly basis monitor population density fluctuations in threatened fauna, FEIS's and feral fauna.
- **Pest control**: Carry out integrated, ongoing pest animal control programs throughout the foreshore reserve and surrounding catchment. Priority targets are:
    - *__Red Fox__: Deploy leg-hold traps during four control pulses annually, one during each season. Locate and fumigate fox dens in late winter to early spring.
    - *__Feral Cat__: Target every four months during three control pulses per annum, using cage traps baited with KFC or sardines.
    - *__Common Myna__ and __Common Starling__: deploy specialized cage traps during breeding and post-breeding.
    - *__Black Rat__: Target twice per year, in autumn and spring, using baited cage traps.
    - *__Common Blackbird and Spotted Turtle-dove__ should also be controlled.
- **Legislative recommendations**: Recommendations for fauna species contained in Action Plans and Recovery Plans under the EPBC Act 1999 and the FFG Act 1988 should be implemented within the foreshore reserve and surrounding bushland, including the surrounding catchment on both public and private land.

- **Significant fauna management**: To maintain the significant fauna within the foreshore reserve the managers must adopt the significant fauna management requirements set out in Appendix 4 of this report.
- **Maintaining and increasing habitat**: To maintain and increase crucial indigenous habitats.
    - Continue to weed in sections, staging the process over time.
    - Start from the good areas and work outwards, and control invading weeds on the edges.
    - Only remove woody weeds during the non-bird breeding season.
    - Leave if native birds are nesting.
    - Allow natural regeneration to occur.
    - Plant out indigenous trees and shrubs.
    - If ringtail possum dreys or bird nests occur in weeds then ring-bark with-out poisoning and follow-up after a year.
- **Nesting boxes**: Deploy and monitor additional fauna nesting boxes.
- **Logs and hollows**: Continue to retain and deploy additional terrestrial habitat logs with hollows through-out different habitats.

Contents

1 INTRODUCTION

Malcolm Legg from Mal's Ecological & Environmental Services PTY LTD (MEES) was commissioned by Capel Sound Foreshore Reserve Committee of Management Inc. (CSFR C of M) to conduct a fauna survey of the Capel Sound Foreshore Reserve, Capel Sound. The study was conducted between August 2021 and July 2022 and encompassed field works conducted along the foreshore reserve, between Chinaman's Creek and Shirlow Avenue.

This report provides:

- information on fauna habitats,
- lists of fauna detected within the study site by methods outlined in the method section of this report,
- endangered and threatened fauna species locations within the study site,
- results of fish trap deployment, Color-bond tile deployment, monthly bird surveys, spotlight walks, Anabat 2 Bat Detector surveys, Fauna Environmental Indicator Species (FEIS) assessments, fauna diggings assessments and scat assessments,
- discussions on fauna species, bio-diversity issues, monitoring and feral fauna management, and
- recommendations to maintain fauna and habitat biodiversity values.

1.1 Project background

The scope of works proposed by MEES and CSFR C of M, included the following:

- a review of fauna databases at the site,
- targeted fauna surveys using various methods,
- obtaining baseline data on fauna species and their population densities, and
- a comprehensive report on the project.

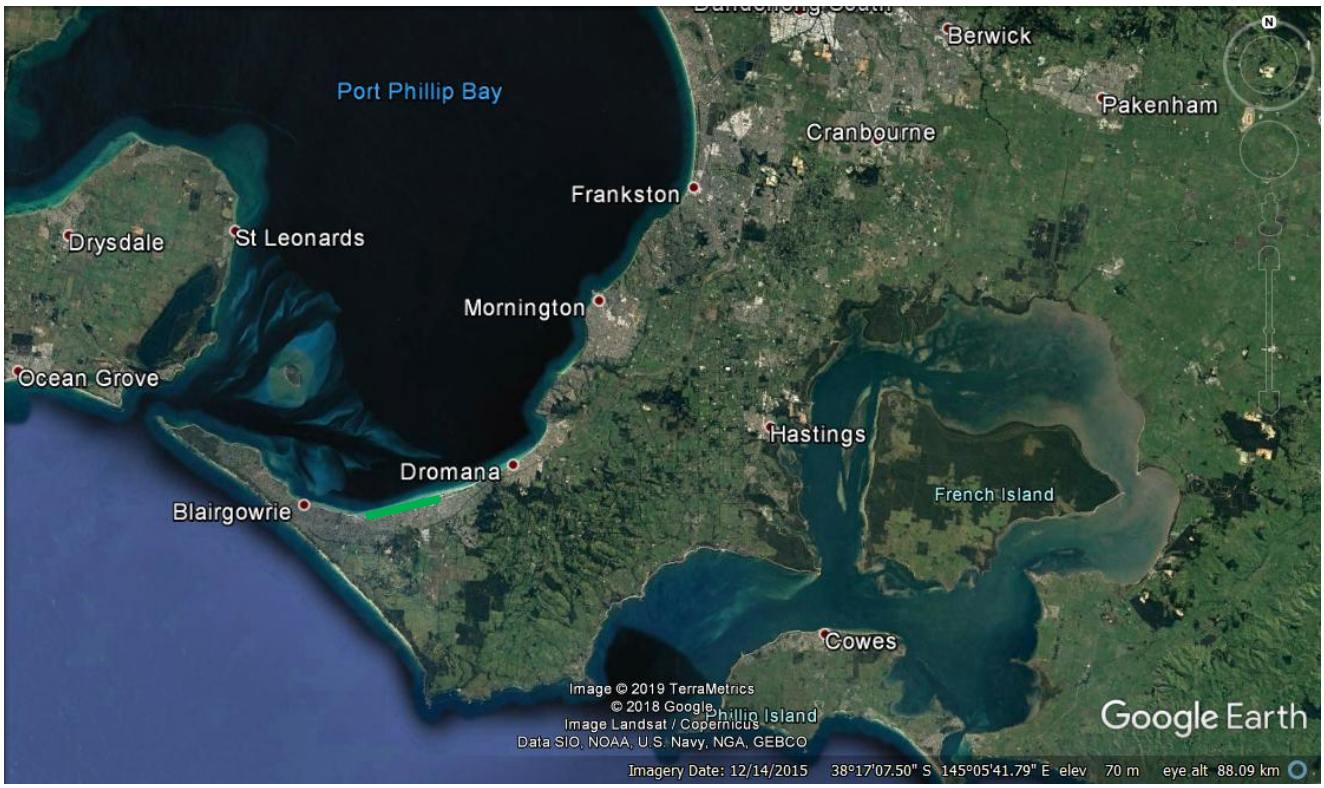
This report aims to:

- guide the maintenance and enhancement of the site's known significant fauna values,
- assess all fieldwork data and information,
- discuss indigenous and feral fauna detected at the site,
- discuss fauna not detected during survey period,
- discuss results from this survey and previous surveys,
- provide recommendations to maintain the site's significant biodiversity values, and
- develop a monitoring program of FEISs and other threatened fauna species within the site.

1.2 Study site

The study area is approximately four kilometers long which encompasses a thin strip of relatively disturbed Coast Banksia Woodland, sandy primary dunes and beaches, intertidal sand banks, the mouth of Chinaman's Creek and Port Phillip Bay. (Melways reference map nos. 169 J2 to 168 K4). Altitude varies from sea level to app. 5m.

Largish remnant bushland reserves in the vicinity of the foreshore reserve include: adjacent foreshore reserves and Tootgarook Wetlands. The area has a maritime climate with wet moist winters and dry warm summers.



Map 1 Location of the study site within the Mornington Peninsula

1.2.1 Ecological Vegetation Class/ Habitats

Four Ecological Vegetation Classes (EVCs) were identified within the study site. One is listed as 'endangered', one is listed as 'vulnerable, one is listed as 'depleted and the last is listed as 'least concern', within the Gippsland Plains Bioregion. These EVCs contain different habitats which provide homes for a diversity of fauna species. The EVCs are of medium to high quality, depending on previous weeding works. The EVCs identified during the survey period and their status is shown in the table below.

TABLE 1: EVCs and their status within the foreshore reserve

EVC No	EVCs	Status within Bioregion	Current distribution within the study site
002	Coast Banksia Woodland	Vulnerable	Majority of the foreshore reserve.
160	Coastal Dune Scrub	Least Concern	Some sections between the Coastal Dune Grassland and the Coast Banksia Woodland.
858	Coastal Alkaline Scrub	Depleted	Small section in section 2 where small stand of Moonah exists.
879	Coastal Dune Grassland	Endangered	Found on the primary dune along the entire foreshore reserve.

EVCs: (02) Coast Banksia Woodland in sections 1 & 2. Photos M. Legg, 2022.

EVCs: (160) Coastal Dune Scrub and (858) Coastal Alkaline Scrub. Photos M. Legg, 2022.

EVC (879) Coastal Dune Grassland Photos M. Legg, 2022.

Map 2: Aerial view of Capel Sound Foreshore Reserve

1.3 Geology

Geologically there are two soil types. The Coast Banksia Woodland soils are derived from raised coastal deposits containing siliceous and calcareous sand with shell beds and were formed in the Recent Period of the Quaternary Era. The primary dunes and sandy beaches are derived from coastal deposits consisting of siliceous sands and shell beds and were formed in the Recent Period of the Quaternary Era.

1.4 History

The foreshore reserve falls within the traditional lands of the Aboriginal territory of the Bunurong/Boonwurrong clan of the Kulin Nation. Prior to and post European settlement the site was and is an important area to the Bunurong/Boonwurrong people, with high cultural evidence found throughout the greater area, The Bunurong people may have been the first to make contact with those Europeans who had accompanied Captain David Collins (1756-1810) in the establishment of the ultimately unsuccessful settlement at Sorrento in 1803. Early writers observed that animal skins were used as clothing by aboriginal people, possibly because of the climate, and that they built mia-mias for shelter and had a number of semipermanent camp sites. Some of these were known to have been near Arthur's Seat, on Portsea Downs Estate, Portsea and close to the intersection of the Flinders and Cape Schanck Roads, Flinders. As a consequence of contact with Europeans, infectious diseases were primarily responsible for the disappearance of aboriginal people from the region and by 1856, few if any members of the Bunurong people remained on the Mornington Peninsula.

From the mid-1800s the Mornington Peninsula was cleared of its indigenous vegetation from the ridges down to the coast and pastures were created throughout. More recently indigenous vegetation has returned to 18% and weeds have colonized at most sites.

Historical records indicate that by the 1860's ducks were almost shot out on the Port Phillip Bay side of the Mornington Peninsula, and that excessive hunting and drainage of their habitat had reduced numbers dramatically.

Post clearing and the introduction of cats and foxes, soon led to the demise and extinction of many fauna species across the Nepean and Mornington Peninsulas. Historical extinctions include: Tree Goanna, Emu, Australian Bustard, Bush-stone Curlew, Spot-tailed Quoll, Eastern Quoll, Common Wombat, Long-nosed Potaroo, Tasmanian Pademelon, New Holland Mouse, Dingo etc. Recent fauna extinctions within the foreshore reserve and surrounding

areas have and are still occurring and include some of the following: White-footed Dunnart, Eastern Pygmy Possum, Long-nosed Bandicoot, Southern Brown Bandicoot, Feathertail Glider, etc.

The photos below portray some of the species that would have occurred 160 years ago, prior to European settlement.

The Spot-tailed Quoll and the Dingo are now extinct within the Gippsland Plain Bio-region. Photos M. Legg 2010.

Tasmanian Pademelon is now extinct on mainland Australia and the Long-nosed Potaroo range has been reduced to French Island. Photos M. Legg 2011.

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The Bush Stone-curlew and the Emu have become extinct within the Gippsland Plain Bio-region, M. Legg 2010.

2 METHODS

2.1 Existing information

2.1.1 Desktop assessment

The following resources and databases were reviewed as part of the desktop assessment:

- DSE's Advisory List of Threatened Vertebrate Fauna 2013
- EPBC Act Protected Matters Search Tool (DEWHA 2010.

One previous fauna survey of the foreshore reserve has been conducted:

- Legg. M. April 2007) *Fauna Survey and Management Prescriptions for Capel Sound Foreshore Reserve Rosebud West September 2006 to April 2007*. Mal's Ecological & Environmental Services PTY LTD.

2.2 New information

Fauna surveys were carried out using the following methods:

- Fish were sampled by site and bait trap deployment.
- Amphibians were identified by listening to male vocal calls during day and spotlight walks.
- Reptiles were sampled by hand-capture, under Color-bond tiles, and by randomly searching and turning over logs and debris.
- Birds were visually and call identified during daytime and spotlight walks. Population densities for each species were also recorded for each month.
- Mammals were identified by identifying diggings and scats and during spotlight and day walks.
- Nocturnal fauna were identified during four spotlight walks.
- During spotlight walks microbats were recorded on the Anabat 2 Bat Detector and identified using specialized software.

2.2.1 Further detail of some of these fauna survey techniques:

FISH TRAPS

Bait traps were deployed at two sites within Chinaman's Creek Estuary to sample for fish species.

AMPHIBIAN CALL IDENTIFICATION

Amphibians were identified by listening to male vocal calls during spotlight and day walks. Some species were also identified by turning over logs or debris near water bodies.

RANDOM SEARCHING FOR REPTILES

Reptiles were identified by turning over fallen logs, within leaf-litter or by observing and identifying basking species.

COLOR BOND TILES

Four Color-bond tiles (consisting of a sheet of Color-bond c.30x20cm) were deployed in intact understorey throughout the foreshore reserve. In the morning of a sunny day as the tile heats up it attracts small reptiles to warm themselves beneath. The tile is turned over in the morning revealing the species, then placed back as it was.

VISUAL BIRD DETECTING

Birds were identified by walking the entire length of the site, listening to calls or looking through binoculars and identifying individuals. Bird species population densities were counted each month of the survey. Nocturnal birds were identified by calls and sight during spotlight walks.

SCAT ANALYSIS

Indigenous and feral fauna scats were analyzed to determine species and what feral predators had been preying on.

SPOTLIGHTING

Spotlighting was conducted over four nights during mild weather conditions and during some of the pre-full & new moon cycles of 2021-22.

ANABAT 2 BAT DETECTOR

Micro bats omit echo-location calls while flying around at night. Each species has a different call frequency and thus their calls are detected and recorded on the Anabat 2 Bat Detector. The calls are down-loaded onto computer and analyzed using specialized software to determine species.

MOTION-SENSOR CAMERAS

Due to the high probability of camera theft and privacy invasion to the public, it was decided not to deploy cameras. Fauna were identified using the above methods.

2.3 Limitations

The field survey was conducted between August 2021 and July 2022 (12 months), which is normally an optimal period to assess all species that usually utilize a study site. However there are a number of reasons why the survey may not have detected all vertebrate species at the site, including low individual local species populations, migration, predation of native species by native or introduced fauna, and variable seasonal conditions. Parts of the foreshore reserve are densely vegetated and this may have reduced the detection of faunal species and population densities.

2.4 Data handling and storage

Listings of all fauna taxa detected within the foreshore reserve throughout this assessment have been submitted to the DELWP, Nicholson Street, and recorded on the Biodiversity Atlas of Victoria for future reference.

2.5 Mapping

Fauna surveys were conducted throughout the entire foreshore reserve, which was also traversed by foot during several field trips during the project time frame. The surveys encompassed the different habitats within the site, and the fieldwork also included dedicated searches for rare or threatened fauna species. All surveys were conducted by Malcolm Legg.

2.6 Rapid assessment tool: using Fauna Environmental Indicator Species (FEISs) to measure ecosystem health

A rapid assessment tool to measure health of fauna diversity has been developed by Malcolm Legg in an attempt to gauge the level of ecosystem health through fauna species diversity. This considers two aspects:

1. The five phases of extinction since European settlement – five broad categories of extinction based on a benchmark of what fauna were present prior to European settlement; and
2. Indicator species which provide a benchmark for a particular habitat type.

This tool is still in the development phase, and has not undergone rigorous testing. It has not been developed using detailed academic study, nor received peer review. Therefore, it should be used with some caution. However, as there is no other easy-to-use assessment

tools (to the author's knowledge), this tool is presented for interpretation of results and for rapid assessment of the health of bushland for the fauna species diversity. There are many rapid assessment tools developed by DSE and other organizations to measure the health of native vegetation, habitat, creeks and rivers. However few tools exist to measure fauna species diversity or aspects of 'ecological processes'.

The FEIS assessment criteria are discussed and listed in Appendix 3.

3 RESULTS

3.1 Fauna identified within the study site

During this assessment 83 species of vertebrate fauna were recorded within the foreshore reserve. Of these, 75 species are native and eight species are introduced.

3.1.1 Fish

Three species of fish were recorded within Chinaman's Creek Estuary (Appendix 1 & 2).

3.1.2 Amphibians

Four species of amphibians were recorded within the study site (Appendix 1 & 2), mainly found within the vicinity of the creek.

3.1.3 Reptiles

Nine species of reptiles were recorded within the foreshore reserve: a tortoise, seven species of lizard, and one species of snake (Appendix 1 & 2). There appears to be a medium diversity of reptiles within different habitats throughout the foreshore reserve.

3.1.4 Birds

53 species of birds were recorded during this survey (Appendix 1 & 2), including 49 native species and four introduced. The woodland birds dominate the woodlands and scrub, while coastal birds were observed along the coast.

3.1.5 Mammals

14 species of mammals were recorded within the foreshore reserve (Appendix 1 & 2), including four introduced species. There appears to be a medium diversity of terrestrial and arboreal mammals still inhabiting the study site.

3.2 Fauna sampling results

3.2.1 Fish trap results

The table below lists the results from the deployment of fish traps within Chinaman's Creek Estuary.

TABLE 2: Fauna observed during fish trap deployment within the foreshore reserve, May 2022.

Species	Date	Number sampled	Area sampled
Estuary Fauna at the mouth			
Short-finned Eel	08-03-22	3	Fish trap 2
	12-05-22	1	Fish trap 2
Common Galaxias	08-03-22	12	Fish trap 1
	12-05-22	4	Fish trap 1
Tupong	12-05-22	1	Fish trap 1

3.2.2 Bird species and population density results

TABLE 3: Bird species and population densities detected for each month throughout the foreshore reserve from Chinaman's Creek to Trueman's Road upper, August 2021 to July 2022. 'B' denotes when each species bred

SPECIES	Aug 2021	Sep	Oct	Nov	Dec	Jan 2022	Feb	Mar	Apr	May	Jun	Jul
Pied Cormorant	4								4	2	3	4
Little Pied Cormorant	6	4						3	5	7	6	5
Black Swan							5	16	26	12	4	4
Buff-banded Rail								3	2	2		
Purple Swamphen							2	2	2	2	2	2
Australian White Ibis	6	8	2					20+	30+	26	12	16
Straw-necked Ibis	4	80+					20+	40+	40+	60+	30+	40+
Pied Oystercatcher									2	2	2	2
Masked Lapwing	2B	2B	2B	2B	2B	2B	4	4	4	6	6	6
Pacific Gull	10	8							20	200+	350+	100+
Silver Gull	100+	28	12					50+	100+	120	150+	160+
Crested Tern								4	12	10	8	6
White-bellied Sea-Eagle											1	
*Spotted Turtle-dove	8	8	8B	8B	8B	12B	10	6	6	4	4	4
Crested Pigeon							4	8	6	6		
Yellow-tailed Black-Cockatoo	8	6	4									
Galah	6	44						3	8	12	6	6
Little Corella								5	4	6		
Sulphur-crested Cockatoo							2	3	4	6	3	3
Rainbow Lorikeet	6	8				6	12	10	8	3	4	6

SPECIES	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
	2021					2022						
Musk Lorikeet					3	7	6	9	5			
Crimson Rosella	2	6	2					6	6	4	4	4
Eastern Rosella	4	4	4				6	8	8	8	8	6
Shining Bronze-cuckoo			6B	4B	4B	2						
Barn Owl								1				
Tawny Frogmouth					2			3				
Laughing Kookaburra										2	2	
Superb Fairy-wren	60+	60+B	60+B	60+B	60+B	60+B	60+	60+	50+	50+	50+	50+
Spotted Pardalote									6	4		
White-browed Scrub-wren	50+	50+B	50+B	50+B	50+B	50+B	50+	50+	50+	50+	40+	40+
Brown Thornbill	40+	40+B	40+B	40+B	40+B	40+B	40+	40+	30+	30+	30+	40+
Red Wattlebird	10+B	22B	24B	24B	26B	30B	30	22	14	12	10+	12
Little Wattlebird	10+	10+B	10+B	10+B	10+B	10+B	10+	10+	10+	10+	10+	10+
New Holland Honeyeater						4	4	3			2	2
Eastern Spinebill							4	4	4			
Grey Shrike Thrush										2	2	2
Golden Whistler										4	4	
Rufous Whistler		4	2									
Grey Fantail	10+	28B	26B	26B	26B	36B	32	28	17	8	4	4
Magpie-lark	4	4B	4B	4B	4B	8B	8	6	6	6	4	4
Black-faced Cuckoo-shrike								2				
Grey Butcherbird	4	4B	4B	4B	4B	6B	6	6	6	6	4	4
Australian Magpie	8	8B	8B	8B	8B	12B	12	10	8	8	7	8
Australian Raven	3	4						3	5	5	8	12
Little Raven	4						2	6	6	4	3	6
Welcome Swallow								12	16	3		
Red-browed Finch							4	8	8			
Silvereye	4	8B	10B	10B	10B	16	16	24	14	4	6	8
*Common Blackbird	6	8B	8B	8B	8B	12B	14B	14	10	8	6	6
*Common Myna	8	8	8B	8B	8B	16B	16B	14	10	8	6	6
*Common Starling	10	10	8B	8B	8B	10B	14B	14	10	10	10	8

TABLE 4: Bird species and population densities detected for each month throughout the foreshore reserve, from Trueman's Road to Shirlow Avenue, August 2021 to July 2022. 'B' denotes when each species bred

SPECIES	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
	2021					2022						
Australian Pelican								3	4	2		
Pied Cormorant	2	2							1	3	3	2
Little Pied Cormorant	4	2	2					3	4	3	2	2
Australian White Ibis	4	12	4				20+	30+	30+	40+	40+	30+
Straw-necked Ibis	2	60+	20+					20+	80+	60+	20+	20+
Pied Oystercatcher	2	2								2	2	
Masked Lapwing	2	2B	2B	2B	2B	2B	4	4	4	4	4	4
Pacific Gull	6	3	2					3	4	6	11	8

SPECIES	Aug 2021	Sep	Oct	Nov	Dec	Jan 2022	Feb	Mar	Apr	May	Jun	Jul
Silver Gull	50+	20+	10+				20+	40+	80+	100+	145	100+
White-bellied Sea-Eagle											1	
*Spotted Turtle-dove	6	6B	6B	6B	6B	10B	12	12	10	10	10	10
Yellow-tailed Black-Cockatoo	8	12	4				6	8	12	8	8	6
Galah	7									4	4	4
Sulphur-crested Cockatoo									4	3	2	3
Rainbow Lorikeet	4	4					6	6	4			
Musk Lorikeet						6	5	3				
Eastern Rosella		2					4	3	2			
Shining Bronze-cuckoo			2B	4B	4B							
Laughing Kookaburra	3	3							3	3	4	3
Superb Fairy-wren	30+	30+B	30+B	30+B	30+B	38+B	40B	40+	40+	40+	36	38
Spotted Pardalote							6	4	4			
White-browed Scrub-wren	30+	30+B	30+B	30+B	30+B	36+B	40B	36	34+	34+	30+	30+
Brown Thornbill	26	28B	30+B	30+B	30+B	40+B	40B	40+	30+	26+	22	24
Red Wattlebird	10+	14B	16B	16B	16B	16B	26	22	20	14	10+	10+
Little Wattlebird	8+	10B	12B	12B	12B	18B	20+	20+	14	12	8	8
Noisy Miner										2	2	2
New Holland Honeyeater						4	4	6				
Eastern Spinebill							4	4	3			
Grey Shrike-thrush	4	4B	4B	4B	4B							
Grey Fantail	8+	12B	14B	14B	14B	18	20	22	14	6	2	2
Magpie-lark	2	2B	2B	2B	2B	4B	4	4	4	4	4	4
Black-faced Cuckoo-shrike							2	2				
Grey Butcherbird	4	4B	4B	4B	4B	4B	6	6	6	4	2	2
Australian Magpie	4	6B	6B	6B	6B	6B	8	8	8	8	8	8
Australian Raven	2	4	2					2	4	4	3	5
Little Raven	2								3	2		3
Welcome Swallow								6	4	2		
Silvereye	4	6	6B	6B	6B	6B	12	16	8	8	6	6
*Common Blackbird	4	4B	4B	4B	4B	8B	8	6	6	6	4	4
*Common Myna	4	4B	4B	4B	4B	4B	8				2	2
*Common Starling	6	8B	10B	10B	10B	16B	18	12	6	4	4	6

3.2.3 Elliot trap results

Fauna usually sampled in Elliot traps were sampled by other methods, outlined in section 2.2.1

3.2.4 Pitfall trap results

No pitfall trap lines were deployed within the foreshore reserve as interference from the public was inevitable. Fauna usually sampled in pitfall traps were sampled by other methods, outlined in section 2.2.1.

3.2.5 Color-bond tile results

The table below lists the results from the deployment of four Color-bond Tiles.

TABLE 5: Fauna sampled under Color-bond Tiles deployed in the foreshore reserve, October 2021 to April 2022

Species	Date	Number sampled	Area sampled
Reptiles			
Eastern Three-lined Skink	14-12-21	1	Color-bond tile 2
	08-02-22	1	Color-bond tile 2
Garden Skink	26-10-21	1	Color-bond tile 1
	14-12-21	2	Color-bond tile 1
	08-02-22	1	Color-bond tile 1
Delicate Skink	14-12-21	1	Color-bond tile 3
Metallic Skink	08-02-22	1	Color-bond tile 4
	14-04-22	1	Color-bond tile 4
Weasel Skink	08-02-22	1	Color-bond tile 3
	14-04-22	2	Color-bond tile 3
Blotched Blue-tongue	08-02-22	1 juv.	Color-bond tile 2
	14-04-22	1 juv.	Color-bond tile 2
White-lipped Snake	14-04-22	1	Color-bond tile 1

3.2.6 Spotlight walk results

Four spotlight walks were conducted within the foreshore reserve during this fauna assessment: the results are shown in the table below.

TABLE 6: Fauna observed during spotlighting within the foreshore reserve October 2021 to May 2022

Species	Date	Number sampled	Area sampled
Amphibians			
Common Froglet	17-10-21	20+	Within the vicinity of Chinaman's Creek
	16-12-21	5	As above
	08-03-22	10+	As above
	12-05-22	10+	As above
Southern Bullfrog	16-12-21	4	As above
	08-03-22	2	As above
Southern Brown Tree Frog	17-10-21	10+	As above
	16-12-21	10+	As above
	08-03-22	5	As above
	12-05-22	12	As above
Verreaux's Tree Frog	17-10-21	5+	As above
	16-12-21	5+	As above
Birds			
Masked Lapwing	17-10-21	4	Both sections of foreshore reserve
	16-12-21	4	As above
	12-05-22	10	As above
Barn Owl	08-03-23	2	Near Chinaman's Creek
Tawny Frogmouth	16-12-21	2	First section

Species	Date	Number sampled	Area sampled
Tawny Frogmouth cont.	08-03-22	3	As above
Mammals			
Common Brushtail Possum	17-10-21	6	Both sections of foreshore reserve
	16-12-21	4	As above
	08-03-22	6	As above
	12-05-22	8	As above
Sugar Glider	16-12-21	2	In trees adjacent to Chinaman's Creek
	08-03-22	2	As above
Common Ringtail Possum	17-10-21	20+	Both sections of foreshore reserve
	16-12-21	20+	As above
	08-03-22	20+	As above
	12-05-22	20+	As above
Microbat species	17-10-21	3 species	Throughout foreshore reserve
	16-12-21	3 species	As above
	08-03-22	4 species	As above
	12-05-22	3 species	As above
*Red Fox	17-10-21	2	Section 1
	16-12-21	1	As above
	08-03-22	1	As above
	12-05-22	2	As above
*Feral Cat	08-03-22	1	As above
	12-05-22	2	Section 1 & 2

3.2.7 Anabat 2 Bat Detector results

The Anabat 2 Bat detector was deployed during four spotlight walks, within the foreshore reserve: the results are displayed in the table below.

TABLE 7: Micro bats recorded on the Anabat 2 Bat Detector throughout the foreshore reserve, October 2021 to May 2022

Species	Date	Number of calls recorded	Area observed
White-striped Freetail Bat	16-12-21	8	Through-out foreshore reserve
	08-03-22	12	As above.
Gould's Wattled Bat	17-10-21	26	As above.
	16-12-21	35	As above.
	08-03-22	46	As above.
	12-05-22	17	As above.
Large Forest Bat	16-12-21	8	As above.
	08-03-22	15	As above.
Little Forest Bat	17-10-21	34	As above.
	16-12-21	38	As above.
	08-03-22	18	As above.
	12-05-22	22	As above.

3.2.8 Current status of Broad Vegetation Class ecosystems within the foreshore reserve using FEIS rapid assessment tool

The FEIS rapid assessment tool was applied to the foreshore reserve, and the tables below show the results, listing the FEISs that still occur and the species that have disappeared within Broad Vegetation Classes across the site. Each Broad Vegetation Class is also given a rating from 1 to 5 depending on loss of FEISs: this score shows the extinction phase the site is currently experiencing.

FEIS assessment of woodlands

TABLE 8: FEIS Assessment of BVT 'woodlands' within the foreshore reserve.

Decapod Crustaceans	Reptiles	Birds	Mammals	No. Of FEISs present and extinction phase
Engaeus sp	Tree Dragon White's Skink Southern Water Skink Eastern three-lined Skink Delicate Skink McCoy's Skink Southern Grass Skink Blotched Blue-tongue or Common Blue-tongue White-lipped Snake Red writing indicates species that have disappeared from the foreshore reserve.	Painted Button Quail Buff-banded Rail Southern Boobook Powerful Owl Eastern Rosella Crimson Rosella Sacred Kingfisher Varied Sitella White-throated Treecreeper White-eared Honeyeater Brown-headed Honeyeater Crescent Honeyeater New Holland Honeyeater Pink Robin Eastern Yellow Robin Crested Shrike-tit Grey Shrike Thrush Golden Whistler Rufous Whistler Rufous Fantail Grey Fantail Satin Flycatcher Grey Currawong Mistletoebird Stubble Quail Brush Bronzewing	Short-beaked Echidna Agile Antechinus White-footed Dunnart Southern Brown Bandicoot Long-nosed Bandicoot Sugar Glider Feathertail Glider Black Wallaby Sothern Forest Bat Large Forest Bat Swamp Rat	30 of the 47 FEISs have disappeared from woodlands within the foreshore reserve. 36.2% of FEISs still remain, which indicates a phase 4 extinction rate within the woodlands throughout the foreshore reserve.

FEIS assessment of Scrub (dry) areas

TABLE 9: FEIS assessment of BBT 'dry scrub' within the foreshore reserve.

Decapod Crustaceans, Amphibians and Reptiles	Birds	Mammals	No. Of FEIS's present and extinction phase
Tree Dragon Whites Skink Eastern Three-lined Skink Metallic Skink Blotched Blue-tongue Common Blue-tongue White-lipped Snake Red writing indicates species that have either disappeared or become extinct within the foreshore reserve.	Stubble Quail Painted Button Quail Eastern Rosella Crimson Rosella Southern Boobook Powerful Owl Singing Honeyeater Spiny-cheeked Honeyeater Crescent Honeyeater New Holland Honeyeater Eastern Yellow Robin Grey Shrike Thrush Golden Whistler Rufous Whistler Grey Fantail Mistletoebird	Short-beaked Echidna Agile Antechinus White-footed Dunnart Southern Brown Bandicoot Long-nosed Bandicoot Black Wallaby Water Rat Large Forest Bat Swamp Rat	17 of the 32 FEIS's have disappeared from Coastal Scrub within the foreshore reserve. 47% of FEIS's still remain which indicates a phase 3 extinction rate within coastal scrub of the foreshore reserve

FEIS assessment of Scrub (dry) areas

TABLE 10: FEIS Assessment of BVT: Grasslands within the foreshore reserve.

Reptiles	Birds	Mammals	No. of FEIS's present and extinction phase
Tree Dragon Whites Skink Swamp Skink Eastern three-lined Skink Delicate Skink Metallic Skink Southern Grass Skink Glossy Grass Skink Blotched Blue-tongue or Common Blue-tongue White-lipped Snake Red writing indicates species that have either disappeared or become extinct within the foreshore reserve.	Stubble Quail Painted Button Quail Buff-banded Rail Southern Emu-wren Golden-headed Cisticola Little Grassbird	Short-beaked Echidna White-footed Dunnart Southern Brown Bandicoot Long-nosed Bandicoot Black Wallaby Swamp Rat	12 of the 22 FEIS's have disappeared from grasslands within the foreshore reserve. 46% of FEIS's still remain which indicates a phase 3 extinction rate within the Grasslands through-out the foreshore reserve.

4 SIGNIFICANT FAUNA

No Nationally Significant species listed under the *Environment Protection and Biodiversity Act 1999* were detected during this survey. Five State Significant species were recorded, of which two species are listed under the *Flora and Fauna Guarantee Act 1988* as threatened. In addition, a further 12 species recorded are considered to be of Regional Significance and three species recorded are considered to be of High Local Significance. Due to large population and habitat losses within the local area (Mornington Peninsula Shire), the remaining native fauna detected can be considered to be of Local Significance.

4.1 Faunal significance within the study site

On the basis of significant species detected during this assessment, which are either listed as State or Regionally Significant fauna species, along with EVCs that are listed as endangered, vulnerable and depleted within the Gippsland Plains Bioregion, the foreshore reserve can be considered to be of Regional to State Significance.

4.2 Habitat significance

The foreshore reserve and its unique range of habitats support a medium to high diversity of vertebrate fauna species and population densities including several bird species. In addition, the indigenous tree & scrub communities support a medium diversity of arboreal mammals, some species of avifauna that are now threatened within the Gippsland Plains Bioregion, and some bird species that have disappeared from several bushland sites across the Mornington Peninsula. The ground vegetation supports a medium diversity of terrestrial fauna and scrub-dwelling avifauna whose population densities are usually greatly reduced when confronted with high population densities of *Red Fox and *Feral Cats across other parts of the Peninsula. Chinaman's Creek and Port Phillip Bay provide additional habitats for aquatic and semi-aquatic fauna species.

4.3 Defining significant species

Fauna within the foreshore reserve were classed according to their high Local, Regional, State and National significance levels. As lists of regionally and locally significant fauna are not available from relevant government authorities, those significant taxa were assessed by the author from his previous records within the bioregion and the Mornington Peninsula.

4.4 Significant fauna detected within the foreshore reserve during this assessment

Key to defining significant species

Signif	**Significant/status of species is designated by:**
N	**National**
S	**State**
R	**Regional**
HL	**High Local**
DSE	**Threatened Vertebrate Fauna in Victoria-2013 (DSE 2013)**
DEPI	**Department of Environment & Primary Industries**
FFG	**Flora and Fauna Guaranteed Act 1988**
ActPl	**Action Plan approved by Environmental Australia**
EPBC	**Environment Protection and Biodiversity Conservation Act 1999**
TR	**International Treaties, C=China (CAMBA) and J=Japan (JAMBA).**
Cen	**critically endangered**
End	**endangered**
Vul	**vulnerable**
LR	**lower risk - near threatened**
NT	**near threatened**
DD	**data deficient**
Ls	**listed**
M	**migratory under the EPBC Act**
Un	**uncommon**
MC	**moderately common**
LC	**locally common**
C	**common**

TABLE 11: Significant fauna detected throughout the foreshore reserve during this assessment

Common name	Scientific name	Signif	DELWP	FFG	ActPl	EPBC	TR	Optimal period to survey
Reptiles								
Common Long-necked Tortoise	*Chelodinia longicollis*	S	DD					Spring/summer
Delicate Skink	*Lampropholis delicata*	R	Un					Spring
Swamp Skink	*Lissolepis coventryi*	S	Vul	Y	Y			Spring
Metallic Skink	*Carinascincus metallicus*	R	MC					Summer/autumn
Weasel Skink	*Saproscincus mustellina*	R	MC					Spring/summer
Blotched Blue-tongue	*Tiliqua nigrolutea*	R	MC					Spring/summer
White-lipped Snake	*Drysdalia coronoides*	R	MC					Spring/summer
Birds								
Pied Cormorant	*Phalacrocorax varius*	S	LR					All year
Buff-banded Rail	*Gallirallus philippensis*	R	Un					Spring to Autumn
Pied Oystercatcher	*Haematopus longirostris*	R	Un					All year
Pacific Gull	*Larus pacifica*	S	LR					All year
Crested Tern	*Sterna bergii*	R	C					All year
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	S	Vul	Y	Y			All year
Yellow-tailed Black-Cockatoo	Calyptorhynchus funereus	HL	MC					Spring
Musk Lorikeet	*Glossopsitta concinna*	HL	MC			M		Sum/aut
Barn Owl	*Tyto alba*	R	Un					Spring to autumn
Mammals								
Short-beaked Echidna	*Tachyglossus aculeatus*	HL	MC					Spring
Sugar Glider	*Petaurus breviceps*	R	MC					All year
Micro bats occurring throughout	*Tadarida, Chalinolobus & Vespadelus sps.*	R	C					Summer/autumn
Swamp Rat	*Rattus lutreolus*	R	C					All year
Australian Fur Seal	*Arctocephalus pusillus*	R	MC					All year

5 DISCUSSION

5.1 Indigenous fauna

5.1.1 Fish

Fish populations within Chinaman's Creek Estuary appear to fluctuate depending on the season. During late summer-autumn, Short-finned Eel and Common Galaxias populations increased as they moved down the creek to migrate (eel) and spawn (galaxias).

Chinaman's Creek Estuary. Photo M. Legg 2022.

5.1.2 Amphibians

Small to medium sized populations of Common Froglet, Southern Brown Tree Frog and Verreaux's Tree Frog were heard calling from the edges of the creek estuary, where it is surrounded by vegetation. The occasional Southern Bullfrog was heard calling during spotlight walks or observed jumping through the understorey.

Rarer species which were not found during this survey and are probably extinct within the area include: Victorian Smooth Froglet, Haswell's Froglet, Southern Toadlet and Growling Grass Frog. It is unlikely that future surveys within the foreshore reserve would identify these species.

5.1.3 Reptiles

During the assessment period reptile species and population densities appeared to be at a medium diversity.

One Common Long-necked Tortoise was observed surfacing within the creek estuary near the bridge during late spring. The diversity of reptile species that still remain can be attributed to reasonably high quality understorey habitats with terrestrial habitat logs present (see photo below), especially where areas are dominated by a grassy or sedgy understorey. Such habitats provide a variety of homes for reptile species. The Skink family was the largest representation of the reptile family, with seven species recorded. The reptiles identified and their habitats are discussed below.

Skinks identified within the foreshore reserve were: Eastern Three-lined Skink, Delicate Skink, Garden Skink, Metallic Skink, Swamp Skink, Weasel Skink and Blotched Blue-tongue. All species of skinks are terrestrial and feed on a variety of insects and fruits. The state significant Swamp Skink was found to be confined to the vegetated sides of the creek estuary and occasionally observed along the vegetated foreshore area, south of the creek. Revegetation works within the Swamp Skink habitats, over the last two decades have contributed to an increase in the population of this species (see photo below).

Coast Tea-tree and Coast Banksia trunks and revegetated sites (Chinaman's Creek) provide essential habitats for reptile species, including the Swamp Skink. Photos M. Legg 2022.

One species of snake was identified, the White-lipped Snake, which appears to be at a low population level.

5.1.4 Birds

A medium diversity of birds inhabits the foreshore reserve. They can be divided into three categories:

- Coastal & wetland birds
- woodland birds
- introduced birds

Coastal & Wetland birds

The coastal birds were mainly found to be roosting or foraging along the shallow parts of the bay, including the elevated sand bars, which retain above the water high tide mark (see photo below). Such species include: Australian Pelican, Pied Cormorant, Little Pied Cormorant, Black Swan, Pied Oystercatcher, Masked Lapwing, Pacific Gull, Silver Gull and Crested Tern. The Black Swans migrate locally to this section of the bay to feed upon sea grasses, post breeding and during molting periods (see photo below).

Wetland bird species identified during this assessment were mainly observed flying overhead, such as the Australian White Ibis and Straw-necked Ibis. Buff-banded Rail and the Purple Swamphen were observed feeding within the revegetated vicinity of the creek and adjacent foreshore vegetation.

A pair of Black Swans observed feeding on Sea Grass during molting phase and a Pair of Pied Oystercatchers observed feeding on exposed sand bar. Photos M. Legg 2022.

Woodland birds

Several species of woodland birds were found to inhabit the woodlands, scrub and understoreys found throughout the foreshore reserve; these species are discussed below.

The White-bellied Sea-Eagle was observed at the boat ramp, where it probably feeds on human caught fish scraps.

Occasional Crested Pigeons were observed feeding on grass seeds through-out. Small flocks of Yellow-tailed Black-Cockatoos were observed through-out feeding on seed within a variety of trees including: Drooping She-oke, Coast Banksia and introduced pines. Galahs, Little Corellas and Sulphur-crested Cockatoos were regularly to occasionally observed flying overhead or feeding on seed either in trees or on the ground. Flocks of Rainbow Lorikeets visited the foreshore reserve to feed on nectar and seed, while smallish flocks of Musk Lorikeet visited the foreshore reserve during the warmer months and were observed feeding on banksia flowers. The occasional Crimson and Eastern Rosellas are breeding residents (within deployed nesting boxes, see photo below) and were observed feeding in the woodlands, scrub and on seed within terrestrial sites.

Specially designed possum proof nesting boxes for bird species, where rosellas have bred. Photo M. Legg 2022.

Migratory birds within Australasia that arrived in the foreshore reserve during spring to autumn included: Shining Bronze-Cuckoo, Eastern Spinebill, Rufous Whistler, Grey Fantail, Black-faced Cuckoo-shrike, Welcome Swallow and Silvereye. The majority of these species arrive in spring or summer to breed and leave for New Guinea and northern or eastern Australia during autumn. After breeding and during autumn the Silvereye migrates from Tasmania back to the mainland especially to the Mornington Peninsula areas. The cuckoos are parasitic, laying their eggs in the nests of honeyeaters, finches, wrens and thornbills. They migrate to Eastern Australia or New Guinea after breeding.

During spotlight walks a Barn Owl was observed hunting from trees within the vicinity of the creek. Tawny Frogmouths were identified within the woodlands of the first section of the foreshore reserve, usually perched on a tree limb while hunting for prey. They are breeding residents within or nearby.

Kookaburras were occasionally encountered throughout the study site and are breeding residents in old-growth tree hollows adjacent to the foreshore reserve and greater area.

Superb Fairy-wren and White-browed Scrubwren were found to be at medium population densities in understoreys throughout the foreshore reserve. They have also moved into recently vegetated sites, in section one of the reserve, which have been planted along the edge of the foreshore reserve and Point Nepean Road. Brown Thornbill is reasonably common residents of the foreshore reserve and found within thickets, undergrowth and canopies. The Spotted Pardalote was occasionally observed feeding in canopies.

Five species of honeyeater were recorded, mainly in the woodlands and scrub, where they were seen feeding on insects and nectar from the various flowering plants. They include the Red Wattlebird, Little Wattlebird, Noisy Miner, New Holland Honeyeater and Eastern Spinebill. They range from common to rare breeding residents, with some species staying all year round while others migrate to other parts of eastern and south-eastern Australia after breeding. The Wattlebirds are large dominating birds who chase away essential smaller leaf-gleaning birds. This phenomenon can contribute in the die-back of some eucalypt trees.

Grey Shrike-thrush is a rare resident of the foreshore reserve and appears to have moved in since the previous survey was conducted. The Golden Whistlers are rare to the foreshore reserve and were observed post breeding.

Common open-country birds such as the Magpie-lark, Grey Butcherbird, Australian Magpie, Australian Raven and Little Raven range from common to rare breeding residents or visitors. Some species are regularly fed by surrounding residents and campers.

Smallish flocks of Red-browed Finch were observed post breeding, feeding upon seed in the understorey.

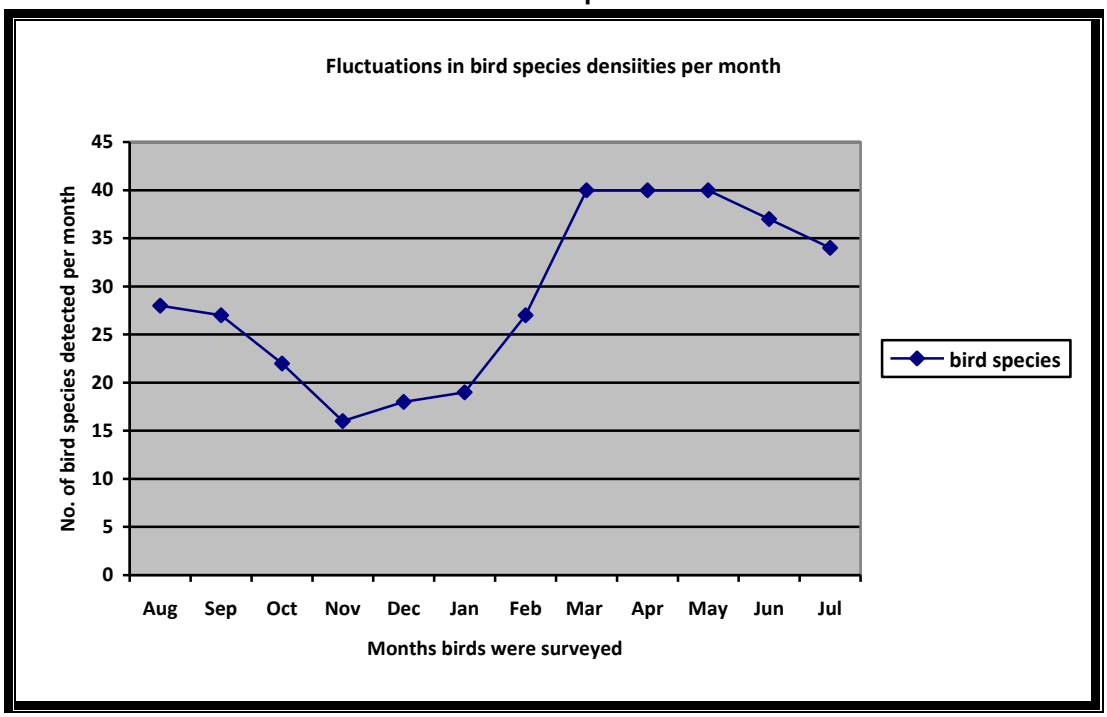
Introduced birds

The introduced *Spotted Turtle-Dove appears to be relatively uncommon and a breeding resident throughout the foreshore reserve, surrounding residential homes and greater area. They are extremely competitive towards the rarer Common Bronzewing for territory and food. The *Common Blackbird is also uncommon throughout the foreshore reserve and is a prolific breeder and spreader of noxious and environmental weed seed. Both the *Common Starling and *Common Myna are common species of the greater area, depriving native birds and mammals of nesting tree hollows. They will also utilize nearby human habitation to roost and breed in.

Comparisons of bird species diversity per month

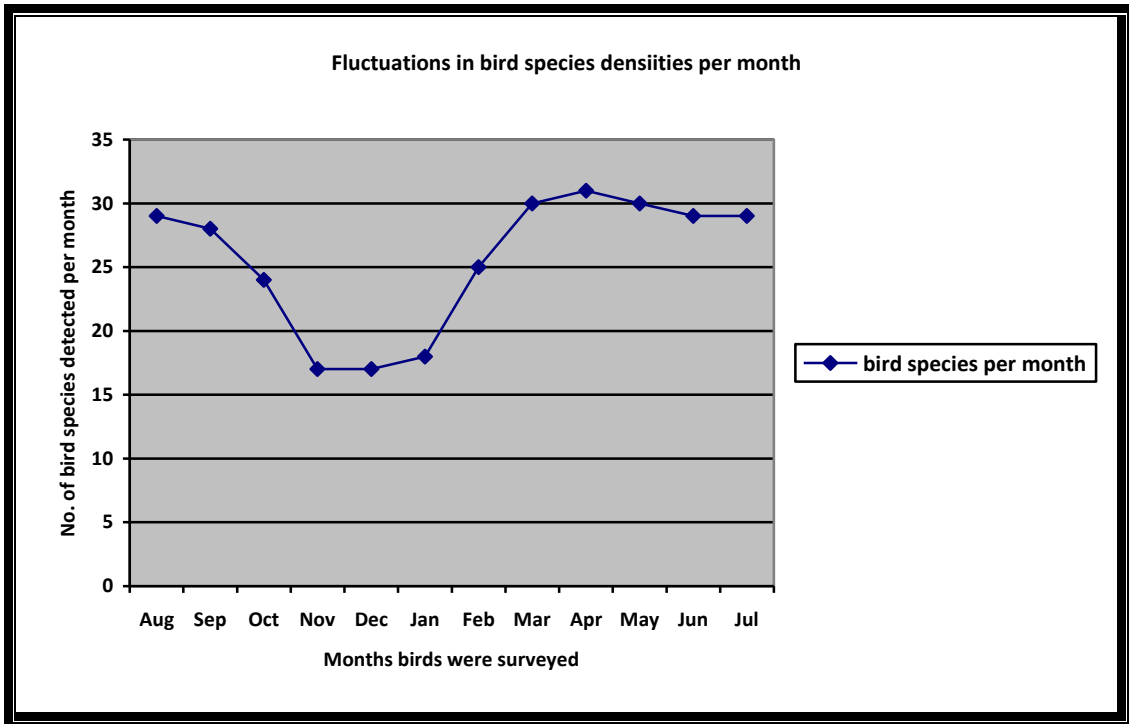
Results shown in graph 1 below indicate that bird species diversity within the first section of the foreshore reserve was the lowest in November 2021, at 16 species, and peaked at 40 species during March, April and May 2022. The graph shows the fluctuations in bird species diversity month by month across the survey period.

Graph 1: Fluctuations in bird species diversity within the first section of the foreshore reserve and over the 12 month period of this assessment.



Results shown in graph 2 below indicate that bird species diversity within the second section of the foreshore reserve was the lowest in November and December 2021, at 17 species, and peaked at 31 species during April 2022. The graph shows the fluctuations in bird species diversity month by month across the survey period.

Graph 2: Fluctuations in bird species diversity within the second section of the foreshore reserve and over the 12 month period of this assessment.



5.1.5 Mammals

The mammal species diversity within the foreshore reserve is at a medium level. Several species were found to be absent which include: Agile Antechinus, Dusky Antechinus, White-footed Dunnart, Southern Brown Bandicoot, Long-nosed Bandicoot, Feathertail Glider, Eastern Pygmy Possum, Common Wombat, Eastern Grey Kangaroo, Black Wallaby, some micro bat species, Eastern Water Rat and New Holland Mouse. Some of these species still occur in bushland areas within the greater area, especially within Tootgarook Wetlands and along Chinaman's Creek. However others have become extinct within the Mornington Peninsula or population densities are at alarmingly low numbers. The mammals recorded during this survey are discussed below.

Marsupials

Short-beaked Echidna activity was observed along the banks of the creek estuary but were not observed through-out the foreshore reserve. Nocturnal possums include the Common Brushtail Possum and Common Ringtail Possum, which were observed during spotlight walks feeding in the canopy or heard calling when disturbed. The ringtail possum population is larger than that of the brushtail possum. Occasional Sugar Gliders were observed during spotlight walks through-out both the first section of the foreshore reserve. Two gliders were also observed in two nesting boxes, which have recently been deployed.

Placental mammals

Four nights of recording micro-bat echolocation calls formed part of this study. Micro-bats were seen on warm nights flying past the light beam of a torch while catching and eating insects in flight. The species identified were White-striped Freetail Bat, Gould's Wattled Bat, Large Forest Bat and Little Forest Bat. Future micro-bat recordings could result in further species identification, as some species are common one month and then absent the next. All species of micro-bats that occur within the foreshore reserve are hollow dependent, nocturnal, and eat three times their body weight in insects each night. This makes them very important around urban and agricultural areas. During the colder months of the year they shut down and hibernate within tree hollows or under bark, venturing out only as climatic conditions become warmer. Microbat roosting boxes need to be deployed within the foreshore reserve.

Swamp Rat populations appear to be relatively common within the vegetated areas of the foreshore reserve, occurring where there are dense grassy and sedgy understoreys. They occupy sites that have a dense understorey of sedges and other graminoids that do not become inundated with water. Underneath this vegetation they excavate runways and build nest chambers at the end of burrows up to one metre long. Burrows are apparent throughout such areas across the foreshore reserve (see photos below). They feed on a variety of rhizomes, seeds and other various vegetation matters from the local graminoids.

Typical Swamp Rat mounds and diggings observed in dense understorey vegetation in the second section of the foreshore reserve. Photos M. Legg 2022

5.2 Introduced mammals

Introduced rodents

The occasional *House Mouse was found under fallen timber within the foreshore reserve. Populations appear to peak during late summer and autumn. They probably provide a large food source for predatory fauna and probably impact on some species in various ways, usually by spreading parasites and disease to small mammals and displacing other fauna.

*Black Rats appear to be relatively uncommon through-out most habitats. *Black Rats impact on fauna in various ways: they spread parasites and diseases to small mammals, displace hollow-dependent and hollow-breeding fauna, and probably take a large proportion of food items that are essential for the survival of threatened mammal species.

Control is usually difficult but further investigation into the feasibility of *Black Rat control is warranted. The most appropriate method is to use baited cage traps, which have been conducted along Chinaman's Creek for several years.

*Feral Cat

*Feral and domestic cats were occasionally observed during field work and the concentration of cats within the foreshore reserve and surrounding areas is contributing to the loss of terrestrial fauna and small bird species. During this assessment the author noted low population densities of some lizard species, which can be attributed to high predation from cats. Refer to section 6 for management recommendations for control of cat populations.

*Red Fox

The occasional *Red Fox was observed or heard squabbling within the foreshore reserve during day and night field work. Other evidence included footprints and scats. This large and efficient predator can cause large-scale destruction of various fauna species, with a major effect on their population densities, to bring about local extinctions of threatened species. Within the greater area foxes have probably caused the local extinction of several mammal species including the nationally endangered Southern Brown Bandicoot. Ongoing and integrated *Red Fox control programs need to continue. This will help to maintain important terrestrial fauna species and their population densities. Refer to section 6 for management recommendations for control of foxes.

5.3 Habitat-changing weeds

Habitat-changing weeds are a serious problem for habitat-specific fauna species, as they quickly invade and kill off vital habitats, changing their structure and eroding ecosystem functionality, diversity and health.

Over the last couple of decades or so many of the habitat-changing weeds have been removed from the foreshore reserve, with smallish out-breaks of some species persisting within the foreshore reserve. Such weed species includes: *Radiata Pine, *Monterey Cypress, *Cape Ivy, *Smilax, Dolichos, *Sallow Wattle, Scrambling Dock, *Sour Sob, *Polygala, *English Ivy, *exotic natives and exotic grasses and etc. Majority of the weeds are situated within the second section of the foreshore reserve.

The removal of majority of the berry bearing weed shrubs and trees has lead to a decrease in the Introduced *Common Blackbird. Future weeding projects should concentrate on removing these weeds over a staged time period and revegetating or allowing natural regeneration to occur. It is vital to re-establish the original EVCs, especially where large weed trees persist such-as pines and cypresses. Pines and cypresses can be removed from sections of the foreshore reserve where they have invaded in sections where important indigenous vegetation occurs (see photos below. The pines and cypresses within the camping grounds lack habitat and feeding values and should be removed over a ten year period and replaced with Coast Banksia and some Manna Gum and Swamp Gum (see photo below). These will provide additional habitats for several species of fauna.

*Pines are invading this section of the foreshore reserve and need to be removed. The pines within the camping grounds can be removed over a ten year period. Photos M. Legg 2022.

5.4 Habitats

A medium diversity of EVCs occurs within the foreshore reserve, and these EVCs appear to retain a medium to high biodiversity rating. The woodlands within the foreshore reserve retain some old-growth banksias, with important hollows and feeding sites for some fauna.

The vegetation along the creek forms important habitats for common and threatened fauna species, while the foreshore scrub and woodlands are important habitats for majority of the foreshore's fauna species. The raised sand bars within the bay are important roosting and feeding sites for coastal birds, while the Sea grass meadows provide important feeding sources for Black Swanks while molting.

Several terrestrial habitat logs have been retained within the woodlands and scrub, and these provide homes and food source for many terrestrial fauna species.

Breeding or nesting boxes have been deployed along the first section of the foreshore reserve and provide important hollows for roosting or breeding species.

Habitats that are adjacent to the foreshore reserve or in the surrounding areas, are important for faunal movement and recruitment. They are listed in the next section.

5.5 Bio-link and significance rating of the foreshore reserve

The foreshore reserve is an important refuge for remaining native fauna within the area and it is part of a major biolink around the eastern side of Port Phillip Bay and the western side of the Mornington Peninsula. Chinaman's Creek is also an important biolink, which links the foreshore reserve with Tootgarook Wetlands.
These biolinks provide stopovers, recruitment and corridors of movement to and from, for a host of fauna species that remain within the greater area (especially woodland bird and mammal species).

The high biodiversity site rating of the greater area, along with the presence of fauna species listed as threatened at a State or Regional level, the EVCs which are listed as endangered, threatened and depleted within the Gippsland Plains Bio region, rates the foreshore reserve and surrounding indigenous vegetation as a regional to State significant site.

It is also important to link up any breakages within the biolinks of the foreshore reserve. Areas such-as parts of the camping grounds at Tootgarook need linking especially on the

actual foreshore area. Refer to photos below. This will allow smaller habitat specific fauna to move around more adequately.

These sites within the second section of the foreshore reserve need linking corridors, especially along the foreshore. Photos M. Legg 2020.

5.6 Key biodiversity issues

5.6.1 Relative importance of key habitats

The foreshore reserve and surrounding bushland sites are part of the 18% of remaining bushland found within the Mornington Peninsula Shire. Such sites help to connect surrounding bushland with remnant vegetation along coastal areas, roadsides, creeks, vegetation on adjacent private properties and on public reserves. These are some of the last remaining largish patches of remnant indigenous vegetation within the greater area. Such sites are extremely important for the large diversity of fauna species that remain in the greater area and provide some of the last remaining habitat as so much of the peninsula has been cleared in the past (around 82%).

The important faunal habitats must be allowed to flourish and increase not only within the environs of the foreshore reserve but in the surrounding landscape as it provides important habitat for both threatened and common native fauna species. This requires ongoing weeding of any serious habitat-changing weed outbreaks that occur or might enter the foreshore reserve in the future.

5.7 FEIS assessments

During this study the Broad Vegetation Types (BVT) woodlands, scrub (dry) and grassland areas were assessed within the foreshore reserve using the FEIS rapid assessment tool. This is an assessment of habitat-specific fauna species that quickly disappear when their habitat

changes at a rapid rate. The assessments within the foreshore reserve indicated that 36.2% of FEISs were present within woodlands, 47% of FEISs were present within dry scrub areas and 46% of FEISs were present within grasslands. This indicates phase 4 and 3 extinction rates of FEISs found to occur in all Broad Vegetation Types assessed within the foreshore reserve.

Assessments indicated that old-growth trees with tree hollows were mainly absent in most areas, but several terrestrial logs with small hollows were present through-out the foreshore reserve, especially where intact understorey occurs. Ongoing and integrated pest animal control programs are needed to continue within the foreshore reserve. Additional fauna nesting boxes need to be constructed and deployed within the second section of the foreshore reserve (refer to section 5.11).

5.8 Future survey work

Future fauna surveys every five to ten years are warranted to determine:

- the fluctuations within fauna populations and species diversity,
- if species have disappeared from the foreshore reserve or if new species have arrived, and
- whether the recommendations in this report have contributed to an increase or decrease in fauna diversity and population densities.

Annual monitoring of threatened fauna species and feral predators is needed, following this survey, to determine future population fluctuations and possible extinctions within the foreshore reserve and surrounding areas.

5.9 Climate change

Predicted global warming could see rising sea levels, rising temperatures and prolonged periods of droughts. The foreshore could possibly completely disappear with future rising sea levels. Large losses of flora & fauna populations, especially those exposed directly to the elements, could also occur. This happened during the 2008/2009 summer, the 2013-14 summer and the 2018-19 summer, when large-scale loss of possum populations occurred within the bio-region. Rising temperatures can also be expected to bring severe drought along with large intense fires, as experienced during the 20219-20 summer. The EVCs within the foreshore reserve could also change from woodlands and scrublands to grasslands. These factors will also result in the large-scale loss of fauna species and population densities.

5.10 Monitoring threatened fauna and their population densities within the foreshore reserve

A threatened fauna monitoring program within the foreshore reserve needs to be developed to measure increases or decreases in population densities. Monitoring of threatened species is important as these are the species that quickly disappear when adverse elements are causing a decline in the health of a natural ecosystem such as: severe habitat-changing weed invasion, high feral predation, and intense urban development of surrounding landscapes, where only small unconnected patches of remnant bushland remain. The monitoring program should involve the species listed in the table below.

TABLE 12- Threatened fauna species to be monitored within the foreshore reserve's Broad Vegetation Types

Species	Woodlands	Scrub (dry)	Grasslands	Creek & Coastal	Season to survey
Common Long-necked Tortoise		Yes		Yes	Spring/summer
Delicate Skink	Yes	Yes	Yes		Spring/summer
Swamp Skink	Yes	Yes	Yes		Spring/summer
Metallic Skink	Yes	Yes	Yes		Summer/autumn
Weasel Skink	Yes	Yes	Yes		Spring/summer
Blotched Blue-tongue	Yes	Yes	Yes		Spring/summer
White-lipped Snake	Yes	Yes	Yes		Spring/summer
Pied Cormorant				Yes	Summer/autumn
Buff-banded Rail	Yes	Yes	Yes		Spring to autumn
Pied Oystercatcher				Yes	All year
Pacific Gull				Yes	All year
Crested Tern				Yes	All year
White-bellied Sea-Eagle				Yes	All year
Yellow-tailed Black-Cockatoo	Yes	Yes			All year
Musk Lorikeet	Yes	Yes			Summer/autumn
Barn Owl	Yes	Yes	Yes		Spring
Short-beaked Echidna	Yes	Yes	Yes		Spring to autumn
Sugar Glider	Yes	Yes			All year
Micro bats occurring throughout	Yes	Yes			Summer/autumn
Swamp Rat	Yes	Yes			All year
Australian Fur Seal				Yes	All year

5.11 Installation and monitoring of fauna nesting boxes

Over the last few years, fauna nesting-breeding boxes have been deployed within the first section of the reserve, with rosellas and Sugar Gliders taking up residency. The nesting boxes were deployed three years ago and were donated by the Mornington Peninsula Aviculture Society with the purpose of providing nesting sites for parrot/cockatoo species. They were designed to exclude possums. The following are the results of fauna breeding within the nesting boxes from foreshore ranger Matt Landy:

- first year was quite successful with 6 clutches fledging, (4 Eastern Rosella clutches and 2 Crimson Rosellas clutches).
- the second year only one successful clutch of Eastern Rosellas occurred, had an issue with bees that season, also mynahs and starlings have become an issue too.
- The third year saw 1 Eastern Rosella and 1 Crimson Rosella clutch successfully fledge. Again mynahs and starlings a problem.
- Sugar gliders have set up residence in one box which is great, happy enough for them to be there.

With the success of the deployment of nesting boxes within the first section of the foreshore reserve' additional breeding-nesting boxes need to be deployed within the second section of the foreshore reserve. These can include the following habitat-specific fauna species: Australian Wood Duck, Yellow-tailed Black Cockatoo, Crimson Rosella, Eastern Rosella, Barn Owl, Laughing Kookaburra, Sugar Glider and possums. This will help to compensate for the lack of tree hollows through-out the foreshore reserve. Additional roosting boxes for microbats also need to be deployed through-out the foreshore reserve, which lacks such essential hollows. Deploying nesting boxes for fauna allows additional breeding and roosting sites and an easy way to monitor population densities of such species. Motion-sensor cameras can be mounted a metre away from the nesting boxes to establish when individuals take up residency and to measure population densities in each box.

All nesting boxes must have myna and starling guards on them to prevent these introduced species from entering and breeding.

Deployed nesting boxes in the first section of the foreshore reserve, Photo M. Legg 2022.

5.12 Matt Landy's fauna observations

Over the last two years Matt Landy has recorded all the fauna species that he has observed on the foreshore reserve. This has resulted in an additional number of species compared to what the author has observed (refer to appendix 2) . Significant and important species that he observed, which the author didn't observe included: Little Penguin, Fairy Prion, Hutton's Shearwater, Darter, Nankeen Night Heron, Sooty Oystercatcher, Black-shouldered Kite, Peregrine Falcon, Common Bronzewing, Purple-crowned Lorikeet, Swift Parrot, Flame Robin, Eastern Yellow Robin, Jacky Winter, Bassian Thrush and Agile Antechinus.

5.13 Comparisons between fauna surveys

During the 2007 fauna survey 82 species of fauna (76 species indigenous and eight species introduced) were identified within the foreshore reserve. During this assessment 83 species of fauna (75 indigenous and eight introduced) were identified. This indicates a .83% decrease in identified fauna species during this survey compared to the 2007 survey. Refer to Appendix 2 for new fauna species to the foreshore reserve and species that have disappeared between this assessment and the previous assessment. It is important to note that several fauna species have either disappeared or become extinct on the foreshore reserve since the 2007 survey (refer to appendix 2), (M. Legg fld. obs.).

6 RECOMMENDATIONS

These recommendations are intended to help the foreshore reserve managers to manage the flora and fauna appropriately and in accordance with flora and fauna requirements.

Priority recommendations to help protect and maintain the foreshore reserve's diverse habitats and fauna species:

1. **Habitat protection**: Maintain and increase crucial indigenous habitats throughout the foreshore reserve and continue to remove habitat-changing weeds.
2. **Woodland habitat**: Continue to restore the woodlands and scrub throughout the camping areas by removing pines and cypresses over a ten year period and replacing with Coast Banksia, Drooping She-oke and some Manna Gum & Swamp Gum species.
3. **Nesting boxes**: Continue to install nesting boxes (especially in section 2 of the foreshore reserve) for listed key species and deploy additional habitat logs throughout. Deploy a number of different designed microbat boxes.
4. **Pest animal control**: Continue to implement pest animal control programs with specific frequencies to control foxes, cats, turtle-doves, mynas, starlings and rodents.
5. **Environmental monitoring**: Develop and implement a longitudinal environmental monitoring program, informed by the results of this study, which captures changes to species diversity and abundance in response to variable seasonal conditions, particularly for endangered and threatened species.

Action is required on a number of fronts to achieve the above five priority recommendations:

- **Fauna surveys**: Continue to conduct fauna surveys every five to ten years and on a yearly basis monitor population density fluctuations in threatened fauna, FEIS's and feral fauna.
- **Pest control**: Continue to carry out integrated, ongoing pest animal control programs throughout the foreshore reserve and surrounding catchment. Priority targets are:
    - ***Red Fox**: Deploy leg-hold traps during four control pulses annually, one during each season. Locate and fumigate fox dens in late winter to early spring.
    - ***Feral Cat**: Target every four months during three control pulses per annum, using cage traps baited with KFC or sardines.

- ***Common Myna** and **Common Starling**: deploy specialized cage traps during breeding and post-breeding.
- ***Black Rat**: Target twice per year, in autumn and spring, using baited cage traps.
- ***Common Blackbird and Spotted Turtle-dove** should also be controlled.

- **Legislative recommendations**: Recommendations for fauna species contained in Action Plans and Recovery Plans under the EPBC Act 1999 and the FFG Act 1988 should be implemented within the foreshore reserve and surrounding bushland, including the surrounding catchment on both public and private land.
- **Significant fauna management**: To maintain the significant fauna within the foreshore reserve the managers must adopt the significant fauna management requirements set out in Appendix 4 of this report.
- **Maintaining and increasing habitat**: To maintain and increase crucial indigenous habitats.
    - Continue to weed in sections, staging the process over time.
    - Start from the good areas and work outwards, and control invading weeds on the edges.
    - Only remove woody weeds during the non-bird breeding season.
    - Leave if native birds are nesting.
    - Allow natural regeneration to occur.
    - Plant out indigenous trees and shrubs.
    - If ringtail possum dreys or bird nests occur in weeds then ring-bark with-out poisoning and follow-up after a year.
- **Nesting boxes**: Deploy and monitor additional fauna nesting boxes.
- **Logs and hollows**: Continue to retain and deploy additional terrestrial habitat logs with hollows through-out different habitats, especially Coast Banksia trunks that contain longicorn beetle larvae hollows, which Swamp Skinks and other reptiles utilize to hibernate in..

7 RELEVANT POLICY AND LEGISLATION

This section explores relevant policy and legislation pertaining to biodiversity, from the international through to the regional level, providing a brief overview of the policies in context of the findings of this study.

7.1 National

7.1.1 Environment Protection & Biodiversity Conservation Act 1999

The EPBC Act is the principle piece of federal legislation that aims to guide a variety of planning processes or other actions with regard to any matters listed under the Act. Under the Act species and communities can be listed as threatened. Fauna can also be listed as migratory.

No fauna species, identified by the author, within the foreshore reserve are listed under the EPBC Act as vulnerable or endangered.

7.2 International

7.2.1 International migratory bird agreements

Several bird species recorded within the Mornington Peninsula are listed as 'migratory' under several bird agreements. These include:

- CAMBA (China-Australia Migratory Bird Agreement 1986)
- JAMBA (Japan-Australia Migratory Bird Agreement 1974)
- ROKAMBA (Republic of Korea-Australia Migratory Bird Agreement 2006)

The Convention on Migratory Species, or Bonn Convention, includes birds listed under the agreement on the Conservation of Albatrosses and Petrels (ACAP) 2006.

Internationally migratory birds are also listed as 'migratory' under the Federal Government's EPBC Act 1999. No Internationally migratory species were detected by the author during this survey.

7.3 State

7.3.1 Victoria's Native Vegetation Management Framework

The objective of the Native Vegetation Management Framework is the retention and management of native vegetation (DNRE 2002:13). According to the DSE (2002:14) the goal of native vegetation management in Victoria is to achieve:

> A reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain.

Four individual actions to achieve this goal are outlined in the DNRE's (2002:14) Framework:

- active improvement of the quality of existing vegetation;
- avoidance or minimization of further permanent losses through clearing;
- strategic increase in the cover of native vegetation through revegetation; and
- the flexibility that is required to support landholders as they move towards more sustainable land use.

7.3.2 Flora and Fauna Guarantee Act 1988

The Flora and Fauna Guarantee Act 1988 (FFG Act) was legislated to ensure the continued survival of all Victorian species of flora and fauna and all Victorian communities of plants and animals.

Protected Flora

Protected flora species include all species listed as threatened, all species that belong to communities listed as threatened, and plants requiring protection for other reasons.

Potentially threatening processes

Schedule three of the FFG Act lists numerous Potentially Threatening Processes. These processes have been identified as a threat to the survival of one or more species of flora or fauna or a community. A number of threatening processes operate across Victoria and across all land tenures while some are specific to a defined locality.
A number of the Potentially Threatening Processes are, or could be, operating within the foreshore reserve. These include:

- collection of native orchids,

- habitat fragmentation as a threatening process in Victoria,
- loss of hollow-bearing trees,
- predation of native wildlife by the cat *Felis catus*,
- predation of native wildlife by the introduced Red Fox *Vulpes vulpes,*
- reduction in biomass and biodiversity of native vegetation through grazing by the *European Rabbit *Oryctolagus cuniculus*,
- spread of *Pittosporum undulatum* in areas outside its natural range,
- the invasion of native vegetation by environmental weeds,
- inappropriate fire regimes causing disruption to sustainable ecosystem processes and resultant loss of biodiversity,
- the introduction and spread of the Large Earth Bumblebee *Bombus terrestris* into Victorian terrestrial environments,
- use of Phytophthora-infected gravel in construction of roads, bridges and reservoirs.

Two fauna species identified by the author during this assessment (Swamp Skink and White-bellied Sea-Eagle) are listed under the FFG Act 1988 as threatened.

7.3.3 Catchment and Land Protection Act

The study site supports some weeds that are declared noxious under the Catchment and Land Protection Act 1994 (CLP Act). Plants occurring on this list are known to or have the potential to result in detrimental environmental or economic impact.

Under the CLP Act declared noxious weeds are categorized into four groups depending on their known and potential impact and specific circumstances for each region. These categories are:

- State Prohibited Weeds (S);
- Regionally Prohibited Weeds (P);
- Regionally Controlled Weeds (C); and
- Restricted Weeds (R)

State Prohibited Weeds are either currently absent in Victoria or are restricted enough to be eradicated. The Victorian Government is responsible for their control.

Regionally Prohibited Weeds in the Mornington Peninsula Catchment area are not necessarily widespread but have the potential to become widespread. It is expected that weeds that meet this criterion can be eradicated from the region. Regionally controlled weeds are usually widespread but it is important to prevent further spread.

Restricted Weeds occur in other states and are considered to be a serious threat to primary

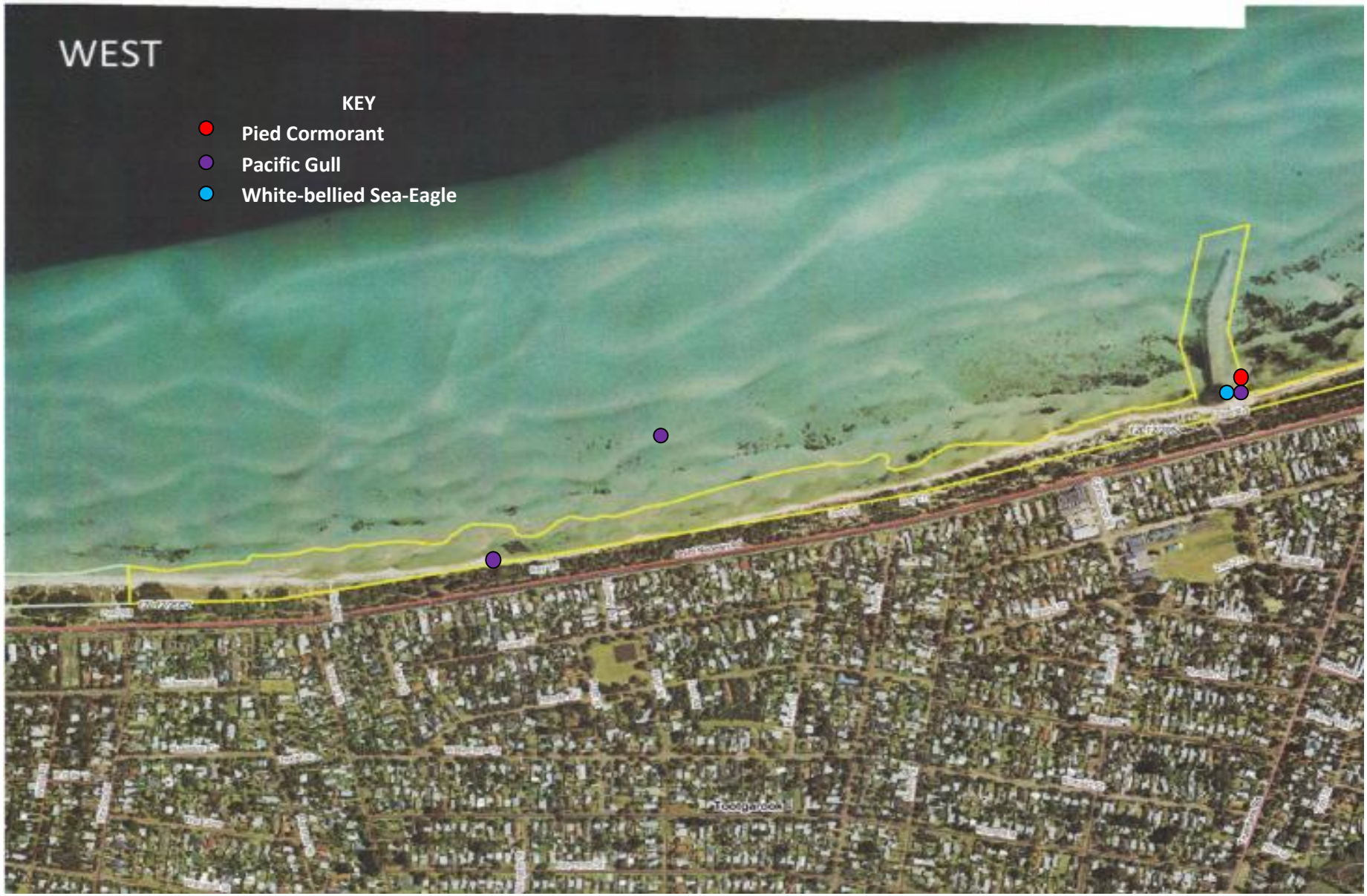
production, crown land, the environment and/or community health were they to be traded in Victoria. No weeds are currently listed as Restricted Weeds.

7.3.4 Species listed on DSE's Advisory List of Threatened Vertebrate Fauna in Victoria, 2013

Within the foreshore reserve there are five fauna species identified by the author that are listed on the Advisory List of Threatened Vertebrate Fauna in Victoria – 2013 (DSE 2013). See maps 3 & 4 on the following pages, for coverage of the five identified species within the foreshore reserve: Common Long-necked Tortoise, Swamp Skink, Pied Cormorant, Pacific Gull and White-bellied Sea-Eagle.

Map 3: Locations of state significant fauna species, first section of foreshore reserve

Map 4: Locations of state significant fauna species, second section of foreshore reserve



7.4 Regional

7.4.1 The Frankston, Mornington Peninsula and Western Port Biosphere Reserve Charter

The conservation functions of the charter include;

- The conservation of ecosystems and species
- The enhancement of ecosystems and biological values
- At the core of the Biosphere charter is the principle of nature conservation.

7.4.2 Regionally significant species

Regional significance is often difficult to determine, however, an attempt at defining regionally significant species has been made by the author over the past two decades. Within the Gippsland Plain Bio-region 115 fauna species are considered to be regionally significant according to three sets of criteria set out below. Within the foreshore reserve 12 species of regional significance were identified by the author.

7.4.3 Port Phillip and Western Port Regional Catchment Strategy

The Port Phillip and Western Port Regional Catchment Strategy (Port Phillip and Western Port CMA 2004) is a broad policy document providing strategic direction in land, water and biodiversity management with the aim of increasing the protection of bays and waterways. The foreshore reserve falls within the region covered by this plan.

The foreshore reserve and surrounding remnant vegetation represent a unique 'catchment asset' within the region by providing substantial habitat and bio-links for flora and fauna of regional and state significance.

7.4.4 Port Phillip and Western Port Vegetation Management Plan

The Port Phillip and Western Port Native Vegetation Plan (Port Phillip and Western Port CMA 2006) establishes a strategic and coordinated approach to native vegetation within the CMA area. Its primary function is to provide guidance and context for native vegetation management in the region.

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Appendix 1: Fauna species detected during this survey within Capel Sound Foreshore Reserve, Capel Sound

Fauna taxa detected throughout study site during the survey by Malcolm Legg of Mal's Ecological & Environment Services PTY. LTD, between August 2021 and July 2022.

Codes for status within the foreshore reserve and Victoria:

*	introduced species
VU	Vulnerable in Victoria (DSE 2013)
EN	Endangered in Victoria (DSE 2013) or Australia (EPBC Act 1999)
NT	Near threatened in Victoria (DSE 2013)
L	Listed as threatened under FFG Act 1988
I	Invalid or ineligible under FFG Act 1988

KEY-Significance/status of species:

N	National
S	State
R	Regional
HL	High Local
L	Local
*	Introduced

Type of record:

h	Heard
s	Seen
I	Incidental (scats, feathers etc.)
t	Trapped/handheld
a	recorded on Anabat 2 Bat Detector
v	Filmed on Scout-guard Camera
B	Breeding residential bird

TABLE 13. Fish results

Scientific Name	Common Name	Conservation status within the foreshore reserve	Type of record
Anguilla australis	Short-fined Eel	Common at times	Lts
Galaxias maculatus	Common Galaxias	Common at times	Lts
Pseudaphritis urvillii	Tupong	Rare	Lts

TABLE 14. Amphibian results

Scientific Name	Common Name	Conservation status within the foreshore reserve.	Type of record
Crinia signifera	Common Froglet	Common	Lhs
Limnodynastes dumerilii	Southern Bullfrog	Rare	Lhs
Litoria ewingii	Southern Brown Tree Frog	Common	Lhs
Litoria verreauxii	Verreaux's Tree Frog	Uncommon	Lhs

TABLE 15. Reptile results

Scientific Name	Common Name	Conservation status within the foreshore reserve	Type of record
TORTOISES			
Chelodinia longicollis	Common Long-necked Tortoise	Rare	Ss
LIZARDS			
Acritoscincus duperreyi	Eastern Three-lined Skink	Uncommon	Lst
Lampropholis delicata	Delicate Skink	Rare	Rt
Lampropholis guichenoti	Garden Skink	Common	Lst
Lissolepis coventryi	Swamp Skink	Uncommon & confined	Ss
Carinascincus metallicus	Metallic Skink	Uncommon	Rt
Saproscincus mustelinus	Weasel Skink	Uncommon	Rst
Tiliqua nigrolutea	Blotched Blue-tongue	Uncommon	Rst
Drysdalia coronoides	White-lipped Snake	Rare	Rst

TABLE 16. Coastal & Wetland bird results

Scientific Name	Common Name	Conservation status within the foreshore reserve	Type of record
Pelecanus conspicillatus	Australian Pelican	Rare	Lhs
Phalacrocorax varius	Pied Cormorant	Rare	Shs
Phalacrocorax melanoleucos	Little Pied Cormorant	Rare	Lhs
Cygnus atratus	Black Swan	Common at times	Lhs
Gallirallus philippensis	Buff-banded Rail	Rare	Rhs
Porphyrio porphyrio	Purple Swamphen	Rare	Lhs
Threskiornis molucca	Australian White Ibis	Common	Lhs
Threskiornis spinicollis	Straw-necked Ibis	Common	Lhs
Haematopus longirostris	Pied Oystercatcher	Rare	Rhs
Vanellus miles	Masked Lapwing	Rare	Lhs
Larus pacifica	Pacific Gull	Uncommon to Common	Shs
Larus novaehollandiae	Silver Gull	Abundant	Lhs
Sterna bergii	Crested Tern	Rare	Rhs

TABLE 17. Woodland bird results

Scientific Name	Common name	Conservation status within the foreshore reserve	Type of record
Haliaeetus leucogaster	White-bellied Sea-Eagle	Rare	Shs
**Streptopelia chinensis*	Spotted Turtle-dove	Uncommon	Hs
Phaps chalcoptera	Crested Pigeon	Rare	Lhs
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	Uncommon	HLhs
Eolophus roseicapillus	Galah	Uncommon	Lhs
Cacatua sanguinea	Little Corella	Rare	Lhs
Cacatua galerita	Sulphur-crested Cockatoo	Uncommon	Lhs
Trichoglossus haematodus	Rainbow Lorikeet	Uncommon	Lhs
Glossopsitta concinna	Musk Lorikeet	Uncommon	HLhs
Platycercus elegans	Crimson Rosella	Rare	Lhs
Platycercus eximius	Eastern Rosella	Uncommon	Lhs
Chalcites lucidus	Shining Bronze-cuckoo	Rare	Lhs
Tyto alba	Barn Owl	Rare	Rhs
Podargus strigoides	Tawny Frogmouth	Rare	Lhs
Dacelo novaehollandiae	Laughing Kookaburra	Rare	Lhs
Malurus cyaneus	Superb Fairy-wren	Common	Lhs
Pardalotus punctatus	Spotted Pardalote	Rare	Lhs
Sericornis frontalis	White-browed Scrubwren	Common	Lhs
Acanthiza pusilla	Brown Thornbill	Common	Lhs

Scientific Name	Common name	Conservation status within the foreshore reserve	Type of record
Anthochaera carunculata	Red Wattlebird	Common	Lhs
Anthochaera chrysoptera	Little Wattlebird	Common	Lhs
Manorina melanocephala	Noisy Miner	Rare	Lhs
Phylidonyris novaehollandiae	New Holland Honeyeater	Rare	Lhs
Acanthorhynchus tenuirostris	Eastern Spinebill	Rare	Lhs
Colluricincla harmonica	Grey-shrike Thrush	Rare	Lhs
Pachycephala pectoralis	Golden Whistler	Rare	Lhs
Pachycephala rufiventris	Rufous Whistler	Rare	Lhs
Rhipidura fuliginosa	Grey Fantail	Common	Lhs
Grallina cyanoleura	Magpie-lark	Rare	Lhs
Coracina novaehollandiae	Black-faced Cuckoo-shrike	Rare	Lhs
Cracticus torquatus	Grey Butcherbird	Uncommon	Lhs
Gymnorhina tibicen	Australian Magpie	Uncommon	Lhs
Corvus coronoides	Australian Raven	Uncommon	Lhs
Corvus mellori	Little Raven	Uncommon	Lhs
Hirundo neoxena	Welcome Swallow	Common	Lhs
Neochmia temporalis	Red-browed Finch	Rare	Lhs
Zosterops lateralis	Silvereye	Common	Lhs
**Turdus merula*	Common Blackbird	Uncommon	hs
**Sturnus vulgaris*	Common Starling	Common	hs
**Acridotheres tristis*	Common Myna	Uncommon	hs

TABLE 18. Mammal results

Scientific Name	Common Name	Conservation status within the foreshore reserve	Type of record
MARSUPIALS			
Tachyglossus aculeatus	Short-beaked Echidna	Rare	HLhs
Trichosurus vulpecula	Common Brushtail Possum	Uncommon	Lhs
Petaurus breviceps	Sugar Glider	Rare	Rhs
Pseudocheirus peregrinus	Common Ringtail Possum	Common	Lhs
PLACENTAL MAMMALS			
MICROBATS			
Tadarida australis	White-striped Freetail Bat	Uncommon	Ra
Chalinolobus gouldii	Gould's Wattled Bat	Common	Ra
Vespadelus darlingtoni	Large Forest Bat	Uncommon	Ra
Vespadelus vulturnus	Little Forest Bat	Common	Ra
RODENTS			
Rattus lutreolus ssp. Lutreolus	Swamp Rat	Common	Rtlv
Arctocephalus pusillus	Australian Fur Seal	Rare	Rs
INTRODUCED MAMMALS			
**Rattus rattus*	Black Rat	Common	tv
**Mus musculus*	House Mouse	Common	tv
**Vulpes vulpes*	Red Fox	Uncommon	s
**Felis catus*	Feral Cat	Rare	s
* *Denotes introduced species*			

Appendix 2: Fauna survey results for Capel Sound Foreshore Reserve

TABLE 19: Fauna taxa detected throughout the foreshore reserve during this fauna survey, 2006-07 fauna survey, foreshore ranger Matt Landy's records (June 2020 To June 2022) and DELWP's Atlas of Victorian Wildlife records. By Malcolm Legg of Mal's Eco. & Enviro. Services PTY LTD.

Scientific Name	Common Name	This fauna survey 2022	Matt Landy's 2021-22 records	2006-07 fauna survey	DELWP's Atlas of Victorian Wildlife, July 2013 edition	Comments
Fish						
Anguilla australis	Short-finned Eel	C at times		C at times	Y	Common in early autumn before migrating.
Galaxias maculatus	Common Galaxias	C at times		C	Y	Common in estuary during autumn before spawning.
Galaxias truttaceus	Spotted Galaxias			R	Y	Last detected in estuary in 2007 survey.
Pseudaphritis urvillii	Tupong	R		R	Y	Rare in estuary.
Aldrichetta sp.	Yellow-eyed Mullet			C at times	Y	Last detected in estuary in 2007 survey.
**Gambusia affinis*	Mosquitofish			C	Y	Last detected in estuary in 2007 survey.
Amphibians						
Crinia signifera	Common Froglet	C		Un	Y	Common in some area of the creek estuary.
Limnodynastes dumerilii insularis	Southern Bullfrog	R		Un	Y	Occasionally found throughout, mainly buried in soil.
Litoria ewingii	Southern Brown Tree Frog	C		Un	Y	Populations appear to be viable through-out.
Litoria verreauxii	Verreaux's Tree Frog	Un		Un	Y	Populations are at lower levels.
Reptiles						
Chelodinia longicollis	Common Long-necked Tortoise	R				New detected species to foreshore reserve.
Bassiana duperreyi	Eastern Three-lined Skink	Un		C	Y	Occurs on sandy soils through-out.
Lampropholis delicata	Delicate Skink	R	Y	Un	Y	Rare and occurs throughout vegetated areas.
Lampropholis guichenoti	Garden Skink	C	Y	C	Y	Populations appear to be viable through-out.
Lissolepis coventryi	Swamp Skink	Un & confined	Y	Un	Y	Confined to vegetated banks of estuary and adjacent vegetated foreshore.
Carinascincus metallicus	Metallic Skink	Un		Un	Y	Confined to environs of creek and some areas of the foreshore reserve.
Saproscincus mustelinus	Weasel Skink	Un		Un	Y	Populations appear to be viable through-out.
Tiliqua nigrolutea	Blotched Blue-tongue Lizard	Un	Y	Un	Y	Populations are becoming at lower levels.
Tiliqua scincoides	Common Blue-tongue			Un	Y	Last detected in estuary in 2007 survey.

Scientific Name	Common Name	This fauna survey 2022	Matt Landy's 2021-22 records	2006-07 fauna survey	DELWP's Atlas of Victorian Wildlife, July 2013 edition	Comments
Drysdalia coronoides	White-lipped Snake	R				New detected species to foreshore reserve.
Birds						
Eudyptula novaehollandiae	Little Penguin		Y, BW			Not recorded by author, Matt Landy record.
Pachyptila turtur	Fairy Prion		Y, BW			Beached washed specimen.
Puffinus huttoni	Hutton's Shearwater		Y, BW			Beached washed specimen.
Pelecanus conspicillatus	Australian Pelican	R	Y	C at times	Y	Becoming rare.
Anhinga melanogaster	Darter		Y			Not recorded by author, Matt Landy record.
Phalacrocorax varius	Pied Cormorant	R	Y	Un	Y	Becoming rare.
Phalacrocorax melanoleucos	Little Pied Cormorant	R	Y	C at times	Y	Becoming rare.
Phalacrocorax carbo	Great Cormorant		Y	Un	Y	Last detected in estuary in 2007 survey.
Phalacrocorax sulcirostris	Little Black Cormorant		Y	C at times	Y	Last detected in estuary in 2007 survey.
Cygnus atratus	Black Swan	C during molting	Y	C at times	Y	Common during molting, feeding on sea grass.
Anas superciliosa	Pacific Black Duck		Y	Un	Y	Last detected in 2007.
Gallirallus philippensis	Buff-banded Rail	R	Y	R	Y	Confined to estuary and adjacent vegetation that has dense grassy understorey.
Gallinula tenebrosa	Dusky Moorhen		Y	Un	Y	Last detected in 2007.
Porphyrio porphyrio	Purple Swamphen	R	Y	R	Y	Confined to along creek and mouth.
Egretta novaehollandiae	White-faced Heron		Y	Un	Y	Last detected in 2007.
Nycticorax caledonicus	Nankeen Night Heron		Y			Not recorded by author, Matt Landy record.
Platalea regia	Royal Spoonbill		Y	R	Y	Last detected in 2007.
Threskiornis molucca	Australian White Ibis	C	Y			Observed flying overhead.
Threskiornis spinicollis	Straw-necked Ibis	C	Y			Observed flying overhead.
Haematopus longirostris	Pied Oystercatcher	R	Y	R	Y	Rare, observed on exposed sand bars.
Haematopus fuliginosus	Sooty Oystercatcher		Y			Not recorded by author, Matt Landy record.
Vanellus miles	Masked Lapwing	R	Y	Un	Y	Populations are at a low level.
Pluviolis fulva	Pacific Golden Plover			R	Y	Last detected in 2007.
Larus pacificus	Pacific Gull	Un to C	Y	Un	Y	Common in autumn and winter, mainly on exposed sand bars.

Scientific Name	Common Name	This fauna survey 2022	Matt Landy's 2021-22 records	2006-07 fauna survey	DELWP's Atlas of Victorian Wildlife, July 2013 edition	Comments
Larus dominicanus	Kelp Gull		Y	Un	Y	Last detected in 2007.
Larus novaehollandiae	Silver Gull	A	Y	C	Y	Observed flying overhead and on exposed sand bars.
Sterna bergii	Crested Tern	R	Y	C at times	Y	Observed flying overhead and on exposed sand bars.
Elanus axillaris	Black-shouldered Kite		Y			Not recorded by author, Matt Landy record.
Haliaeetus leucogaster	White-bellied Sea-Eagle	R	Y			Observed at boat ramp by author and Matt Landy.
Accipiter fasciatus	Brown Goshawk			R	Y	Last detected in 2007.
Accipter cirrahocephalus	Collared Sparrowhawk		Y			Not recorded by author, Matt Landy record.
Falco peregrinus	Peregrine Falcon		Y			Not recorded by author, Matt Landy record.
Falco cenchroides	Nankeen Kestrel		Y	R		Last detected in 2007.
**Streptopelia chinensis*	Spotted Turtle-Dove	Un	Y	C	Y	Mainly occurs on the urban edges of the area.
Phaps chalcoptera	Common Bronzewing		Y			Not recorded by author, Matt Landy record.
Ocyphaps lophotes	Crested Pigeon	R	Y			Mainly observed in the second section.
Eolophus roseicapillus	Galah	Un	Y	C	Y	Mainly observed in first section.
Cacatua sanguinea	Little Corella	R	Y			Mainly observed in first section.
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	Un	Y			Feeding in a variety of trees and shrubs through-out..
Cacatua galerita	Sulphur-crested Cockatoo	Un	Y			Observed flying overhead.
Trichoglossus haematodus	Rainbow Lorikeet	Un		C at times	Y	Observed flying overhead and feeding in trees.
Glossopsitta concinna	Musk Lorikeet	Un	YY	C at times	Y	Observed flying overhead and feeding in flowering trees.
Glossopsitta porphyrocephala	Purple-crowned Lorikeet		Y			Not recorded by author, Matt Landy record.
Nymphicus hollandicus	Cockatiel		Y	R aviary escapee	Y	Probably aviary escapee.
Lathamus discolor	Swift Parrot		Y			Not recorded by author, Matt Landy record.
Platycercus elegans	Crimson Rosella	R	Y			Observed in first section.
Platycercus eximius	Eastern Rosella	Un	Y	C	Y	Observed through-out.
Chalcites lucidus	Shining Bronze-cuckoo	R	Y			Occasionally observed within the foreshore reserve.
Tyto alba	Barn Owl	R				Rare to the area.
Podargus strigoides	Tawny Frogmouth	R	Y	R	Y	Populations are rare within the foreshore reserve.
Hirundapus caudacutus	White-throated Needletail		Y	C at times	Y	Last detected in 2007.

Scientific Name	Common Name	This fauna survey 2022	Matt Landy's 2021-22 records	2006-07 fauna survey	DELWP's Atlas of Victorian Wildlife, July 2013 edition	Comments
Dacelo novaehollandiae	Laughing Kookaburra	R	Y			Rare, usually observed within the woodlands.
Malurus cyaneus	Superb Fairy-wren	C	Y	C	Y	Common species of the undergrowth.
Pardalotus punctatus	Spotted Pardalote	R		C at times	Y	Observed throughout the woodlands.
Sericornis frontalis	White-browed Scrubwren	C	Y	C	Y	Common species of the undergrowth.
Acanthiza pusilla	Brown Thornbill	C	Y	C	Y	Common species of the undergrowth and canopy.
Anthochaera carunculata	Red Wattlebird	C	Y	C	Y	Observed feeding throughout woodlands.
Anthochaera chrysoptera	Little Wattlebird	C	Y	C	Y	Observed feeding throughout woodlands.
Acanthagenys rufogularis	Spiny-cheeked Honeyeater		Y	Un	Y	Last detected in 2007.
Manorina melanocephala	Noisy Miner	R	Y			Rare, new species detected in foreshore reserve.
Lichenostomus virescens	Singing Honeyeater		Y	R	Y	Last detected in 2007.
Phylidonyris novaehollandiae	New Holland Honeyeater	R	Y	C	Y	Rare, observed feeding through-out woodlands.
Acanthorhynchus tenuirostris	Eastern Spinebill	R	Y			Rare, observed feeding through-out.
Petrocia phoenicea	Flame Robin		Y			Not recorded by author, Matt Landy record.
Eopsaltria australis	Eastern Yellow Robin		Y			Not recorded by author, Matt Landy record.
Microeca fascinans	Jacky Winter		Y			Not recorded by author, Matt Landy record.
Colluricincla harmonica	Grey Shrike Thrush	R	Y			Rare, new species detected in foreshore reserve.
Pachycephala pectoralis	Golden Whistler	R				Rare, new species detected in foreshore reserve.
Pachycephala rufiventris	Rufous Whistler	R				Rare, new species detected in foreshore reserve.
Rhipidura fuliginosa	Grey Fantail	C	Y	C at times	Y	Common throughout.
Rhipidura leucophrys	Wily Wagtail		Y	R	Y	Last detected in 2007.
Grallina cyanoleura	Magpie-lark	R	Y	Un	Y	Populations appear to becoming rare .
Coracina novaehollandiae	Black-faced Cuckoo-shrike	R	Y			Rare, new species detected in foreshore reserve.
Cracticus torquatus	Grey Butcherbird	Un	Y	Un	Y	Populations appear to be uncommon.
Gymnorhina tibicen	Australian Magpie	Un	Y	C	Y	Populations fluctuate.
Corvus coronoides	Australian Raven	Un	Y	C	Y	Populations fluctuate.
Corvus mellori	Little Raven	Un	Y	C at times	Y	Populations fluctuate
Hirundo neoxena	Welcome Swallow	C at times	Y			Common at times. New species detected in foreshore reserve.

Scientific Name	Common Name	This fauna survey 2022	Matt Landy's 2021-22 records	2006-07 fauna survey	DELWP's Atlas of Victorian Wildlife, July 2013 edition	Comments
Anthus novaeseelandiae	Richards Pipit			R	Y	Last detected in 2007.
**Passer domesticus*	House Sparrow		Y			Not recorded by author, Matt Landy record.
Neochmia temporalis	Red-browed Finch	R	Y			Rare, new species detected in foreshore reserve.
Zosterops lateralis	Silvereye	C at times	Y	C	Y	Populations appear to be common.
Zoothera lunulata	Bassian Thrush		Y			Not recorded by author, Matt Landy record.
**Turdus merula*	Common Blackbird	Un	Y	C	Y	Populations appear to be decreasing.
**Sturnus vulgaris*	Common Starling	C	Y	C	Y	Populations appear to be viable.
**Acridotheres tristis*	Common Myna	Un	Y	C	Y	Populations appear to be viable.
Mammals						
Tachyglossus aculeatus	Short-beaked Echidna	R				Rare, new species detected in foreshore reserve.
Antechinus agilis	Agile Antechinus		Y			Not recorded by author, Matt Landy record.
Phascolarctos cinereus	Koala			R	Y	Last detected in 2007.
Trichosurus vulpecula	Common Brushtail Possum	Un	Y	Un	Y	Populations appear to be stable within.
Petaurus breviceps	Sugar Glider	R	Y			Rare, new species detected in foreshore reserve.
Pseudocheirus peregrinus	Common Ringtail Possum	C	Y	C	Y	Populations appear to be common within.
Macropus giganteus	Eastern Grey Kangaroo			R	Y	Last detected in 2007.
Wallabia bicolor	Black Wallaby			R	Y	Last detected in 2007.
Tadarida australis	White-striped Freetail Bat	Un		R	Y	Populations appear to be uncommon within.
Chalinolobus gouldii	Gould's Wattled Bat	C		C	Y	Populations appear to be common within.
Vespadelus darlingtoni	Large Forest Bat	Un				Rare, new species detected in foreshore reserve.
Vespadelus vulturnus	Little Forest Bat	C		Un	Y	Populations appear to be uncommon within.
Arctocephalus pusillus	Australian Fur Seal	BW	Y			Beach washed specimens.
Eubalaena australis	Southern Right Whale			R	Y	Last detected in 2007.
Rattus lutreolus ssp. Lutreolus	Swamp Rat	C	Y	C	Y	Common within areas that retain grassy or sedgy understorey.
**Mus musculus*	House Mouse	C	Y	C	Y	Populations appear to be viable within.
**Rattus rattus*	Black Rat	C	Y	C	Y	Populations appear to be viable within.
**Vulpes vulpes*	Red Fox	Un	Y	C	Y	Populations becoming rare, due to control measures.

Scientific Name	Common Name	This fauna survey 2022	Matt Landy's 2021-22 records	2006-07 fauna survey	DELWP's Atlas of Victorian Wildlife, July 2013 edition	Comments
**Felis catus*	Feral Cat	R	Y	C	Y	Populations becoming rare, due to control measures.
Total number of fauna species recorded		**83**	**93**	**81**	**81**	

KEY for the above table

R = Rare BW = Beach Washed

Yes = fauna species Identified during previous surveys A = Abundant

Un = Uncommon

C = Common

APPENDIX 3: FEIS assessment criteria

PHASES OF EXTINCTION

Different extinction levels are occurring on each allotment of remaining remnant native vegetation throughout the Mornington Peninsula, Frankston City, Western Port catchment and bio-region. This is based on the extinction rate of fauna species (in the past and at present) within remaining bushland sites. Factors that determine extinction of fauna species within remaining bushland sites include:

- size of remaining bushland,
- status of bushland health,
- amount of weed invasion,
- status of feral populations,
- status of native fauna populations,
- whether the site has bio-links,
- the determined future of the site and
- whether the site has tree hollows and fallen hollow logs.

A large healthy parcel of vegetation with bio-links will have high species diversity, whereas a small isolated parcel of vegetation with no bio-links will have a very low diversity of fauna species.

Each ecosystem within remaining native vegetation allotments can be categorized into the following processes of fauna extinctions, all of which are associated with post-European settlement disturbance of the past and or present. These processes are explained below, in the '5 phases of extinction', which are based on fauna data collected and collated from over 500 sites on the Mornington Peninsula, 50 sites within Frankston City and other significant sites within the sub-bioregion which have had fauna surveys conducted by the author Malcolm Legg in the last 15 years.

FIRST PHASE

In the first phase of extinction the land has been cleared and only a few large and several small areas of indigenous bush remain. These areas have mostly been set aside for national parks and large foreshore reserves (Western Port side) which retain most species (especially if feral works and weeding have been conducted) apart from larger carnivores (which have been replaced by foxes and cats) and a few habitat-specific species which are now extinct: Tree Goanna, Emu, Spot-tailed Quoll, Eastern Quoll, Common Wombat, etc. Several species threatened in phase two are still moderately common in this phase and most or all FEISs (80% to 100%) still remain and are present in low to high population densities. Such examples within the area include: Mornington Peninsula National Park, Point Nepean National Park, Devilbend Reservoir, Westernport coastal bio-link from Tooradin to Flinders,

Pines Flora and Fauna Reserve, Langwarrin Fauna and Flora Reserve, and Quail Island. 80% to 100% of FEISs still remain.

MANAGEMENT

- Conduct pest animal control programs.
- Conduct habitat-changing weed control programs.
- Monitor threatened or endangered fauna species and their population densities.
- Monitor FEISs.
- Prevent the site from slipping into the second and third extinction phases.

SECOND PHASE

The second phase usually occurs in large bushland areas that have been set aside for state parks, regional reserves and remaining large bush patches on private land. Usually between 10% and 20% of fauna species have become extinct or disappeared and several species are either endangered or threatened at various levels. Around 60% to 80% of FEISs are present in this phase and at reasonable densities. Examples within the area include: Arthur's Seat State Park, Peninsula Gardens Bushland Reserve, Mt Eliza Regional Park, Mt Martha Regional Park, Warringine Park, Tootgarook Swamp and Edithvale & Seaford Wetlands.

MANAGEMENT

- Conduct pest animal control programs.
- Conduct habitat-changing weed control programs.
- Monitor threatened or endangered fauna species and their population densities.
- Monitor FEISs.
- If old growth trees with hollows are rare then install roosting and breeding boxes for hollow-dependent species and monitor.
- Deploy additional terrestrial habitat logs with hollows for terrestrial species.
- Connect site with other surrounding bushland sites via biolinks.
- Prevent the site from slipping into third or fourth extinction phases.

THIRD PHASE

Phase 3 usually occurs in small to medium-sized Parks Victoria reserves, some foreshore reserves (Port Phillip Bay side), council reserves that retain good habitat, and smaller patches on private land. Most of these sites have weed infestations which have killed off essential understorey including the overstorey of old-growth eucalypts with hollows, and feral fauna dominates. Several species are threatened at a regional and local level. Some state significant species still remain and possibly one or two nationally threatened species.

Several FEISs have disappeared and the health of the ecosystem is usually poor and failing. Some examples include rural roadsides, large urban bushland reserves usually over five

hectares, small rural allotments usually under ten hectares, and on private property less than ten hectares in size with some remnant bushland. 40% to 60% of FEISs still remain.

MANAGEMENT

- Conduct-habitat changing weed control programs.
- Yearly monitor threatened or endangered fauna species and their population densities.
- Monitor FEISs.
- Retain old-growth trees with hollows, whether dead or alive, including any in the surrounding landscape.
- Introduce Common Myna and Common Starling control programs within the reserve and surrounding landscape.
- If old-growth trees with hollows are rare then install roosting and breeding boxes for hollow-dependent species and monitor.
- Deploy additional terrestrial habitat logs with hollows for terrestrial species.
- Connect site with other surrounding bushland sites via biolinks.
- Install vermin-proof fence around the outer boundary with small gates to allow the movement of terrestrial species in and out of the reserve,
- Conduct pest animal control programs within and outside the fence.
- Control visitor management by only doing guided walks.
- Educate surrounding property owners to keep their pets within their property and not in the reserve. Prevent domestic pets from entering the reserve.
- Look at reintroducing endangered or extinct fauna back into the vermin proof reserve.
- Prevent the site from slipping into fourth or fifth extinction phases.

FOURTH PHASE

Phase 4 extinction rate can usually be associated with urbanization or highly degraded remnant rural sites. The only indigenous habitat that remains is a few isolated pockets along creeks, drainage lines and small shire reserves. The majority of these sites are highly degraded and facing extinction in the final stages. 20% to 30% of fauna species remains but several are quickly depleted by domestic cats, dogs and vermin. 20% to 40% of FEISs still remain and several FEISs have become extinct or disappeared. However a low percentage of significant species could still remain. Noisy Miners dominate on the fringes and chase smaller essential insect gleaming birds away.

MANAGEMENT

- Only put resources into the site if it is along a creek or has reasonable connectivity.
- Conduct habitat-changing weed control programs.
- Yearly monitor threatened or endangered fauna species and their population densities.

- Monitor FEISs.
- Retain old-growth trees with hollows, whether dead or alive, including any within the surrounding landscape.
- Introduce Common Myna and Common Starling control programs within the reserve and surrounding landscape.
- If old-growth trees with hollows are rare then Install roosting and breeding boxes for hollow-dependant species and monitor.
- Deploy additional terrestrial habitat logs with hollows for terrestrial species.
- Connect site with other surrounding bushland sites via biolinks.
- Install vermin-proof fence around the outer boundary with small gates to allow the movement of terrestrial species in and out of the reserve,
- Conduct pest animal control programs within and outside the fence.
- Control visitor management by only doing guided walks.
- Educate surrounding property owners to keep their pets within their property and not in the reserve. Prevent domestic pets from entering the reserve.
- Look at reintroducing endangered or extinct fauna back into the vermin proof reserve.
- Prevent the site from slipping into a fifth extinction phase.

FIFTH PHASE

The fifth and final phase can be associated with suburbanization and rural allotments that have been 100% cleared of native vegetation, replanted with pine or conifer rows and European plants around the house. 90% to 100% of all fauna species have become extinct or disappeared apart from a few common species, and introduced fauna species thrive. New vegetation planted within urban areas is usually exotic or non-indigenous and attracts exotic species and out-of-balance native bird species. All significant and most FEISs have disappeared or become extinct with 0% to 20% of FEISs still remaining.

MANAGEMENT

- All resources should be invested into the other four extinction phases as it is usually too late or not possible to rehabilitate the site or expect extinct species to return into the site.

FAUNA ENVIRONMENTAL INDICATOR SPECIES (FEISs)

How do we measure the health of ecosystems within bushland sites to determine which of the five extinction phases they are in? Each site needs to be assessed to determine how many FEISs remain. FEISs are habitat-specific fauna species that disappear rapidly from an ecosystem that has been or continues to be altered by humans, as land management moves increasingly away from pre-1750 land practices in Australia. They are therefore an indicator of the health of an ecosystem. Factors that contribute to the phase of extinction include

weed invasion, lack of appropriate fire regimes, clearing practices, high predation by introduced predators, displacement by introduced fauna etc.

The author has determined which FEISs fit into each broad vegetation community that still exists within the Mornington Peninsula, Frankston City, and on and around Western Port catchment.

FEISs and EVCs that fit into Broad Vegetation Types and Assessment Tables

TABLE 20- EVCs that fit into Broad Vegetation Types (BVT)

EVCs Broad Types ⇩ Vegetation →	CBW	DSH-rW	SH	CSM	LF	RS	RF	H-rFF	DF	HW	SS	ESS	SRW	PGW	SW	MS	CDS	CHS	CTG	CH-rW	GW	BGS	AH	BW	DH	DHW	CAS	S-zCS	CDG
Forest					Y		Y	Y	Y																				
Woodland	Y	Y								Y			Y							Y						Y			
Scrub (coastal)																	Y	Y				Y					Y	Y	
Scrub (wet sites)						Y					Y	Y																	
Grassland														Y					Y			Y							Y
Heathland			Y																						Y				
Drainage lines											Y																		
Riparian zone						Y					Y		Y							Y			Y						
Creeks																							Y	Y					
Coastal				Y								Y				Y	Y	Y	Y			Y		Y			Y	Y	Y
Wetlands & swamps														Y	Y								Y	Y					
Salt marsh				Y																									
Mangroves																Y													

KEY to EVC's

CBW-Coast Banksia Woodland, DSH-rW-Damp Sands Herb-rich Woodland, SH-Sand Heathland, CSM-Coastal Salt Marsh, LF-Lowland Forest, RS-Riparian Scrub, RF-Riparian Forest, H-rFF-Herb-rich Foothill Forest, DF-Damp Forest, HW-H
Woodland, PGW-Plains Grassy Wetland, SW-Sedge Wetland, MS-Mangrove Shrubland, CDS- Coastal Dune Scrub, CHS-Coastal Headland Scrub, CTG-Coastal Tussock Grassland, CH-rW-Creekline Herb-rich Woodland, GW-Grassy Woodla
Damp Heathland, DHW-Damp Heathy Woodland, CAS-Coastal Alkaline Scrub, S-zCS-Spray-zone Coastal Shrubland, CDG-Coastal Dune Grassland, GW-Gully Woodland and SW-Swampy Woodland.

FEISs within broad vegetation types

Key to FEISs within broad vegetation types

RF –Rain Forest, F –Forest, W- Woodland, GL –Grassland, Sco –Coastal Scrub, SWA- Scrub in wet areas, H –Heath, DL –Drainage lines,
RZ –Riparian Zone, C –Creeks, Co –Coastal, WL&S –Wetlands and Swamps, M&S –Mangroves and Salt Mash and HR-Habitat Requirements

TABLE 21: FEISs of broad vegetation communities.

FEISs and seasons to survey for FEISs	RF	F	W	GL	Sco	SWA	H	DL	RZ	C	Co	WL&S	M & S	HR
DECAPOD CRUSTACEANS														
Engaeus sps. (All)	Y	Y	Y			Y		Y	Y	Y		Y		Damp & wet areas.
Helograpsus sp (All)													Y	Coastal Salt Marsh.
FISH														
Spotted Galaxias (All)								Y	Y	Y		Y		Lower reaches of creeks.
Broad-finned Galaxias (All)								Y	Y	Y				Upper reaches of creek.
Dwarf Galaxias (All)										Y		Y		Swampy parts of creek.
AMPHIBIANS														
Victorian Smooth Froglet (Autumn)						Y		Y				Y		Dry swampy sites which are inundated i
Southern Toadlet (Autumn)						Y		Y				Y		Dry swampy sites which are inundated
Growling Grass Frog (November to January)										Y		Y		Deep fresh water with reeds.
REPTILES														
Common Long-necked Tortoise (All)								Y		Y		Y		Fresh-water bodies.
Tree Dragon (Spring till autumn)			Y	Y	Y		Y				Y			Dry vegetation & fallen timber with holl
Swamp Skink (Spring)						Y		Y	Y			Y	Y	Wet sites with Decapod. Crustacean bu
Southern Water Skink (Spring)	Y	Y	Y			Y			Y		Y			Riparian and coastal veg. with high raint
White's Skink (Spring)			Y	Y	Y		Y				Y			Dry vegetation & fallen timber with holl
Eastern Three-lined Skink (Spring)			Y	Y	Y		Y				Y			Sedgy and grassy understorey.
Delicate Skink (Spring)		Y	Y	Y			Y		Y					Sedgy & grassy understorey & fallen hol
McCoy's Skink (Autumn & winter)	Y	Y	Y											Grassy understorey with fallen hollow lo
Metallic Skink (Autumn)					Y			Y			Y	Y		Grassy understorey & fallen hollow logs
Glossy Grass Skink (Spring)						Y		Y	Y			Y		Slightly elevated veg. around wetland e
Southern Grass Skink (Autumn)			Y	Y		Y			Y				Y	Grassy understorey & fallen hollow logs
Blotched Blue-tongue (Spring)		Y	Y	Y	Y	Y	Y	Y	Y					Sedgy & grassy understorey & fallen hol
Common Blue-tongue (Spring)			Y	Y	Y						Y			Sedgy & grassy understorey & fallen hol
White-lipped Snake (Spring)		Y	Y	Y	Y			Y	Y		Y			Sedgy & grassy understorey & fallen hol
BIRDS														
Painted Button Quail (Autumn)			Y	Y	Y		Y							Sedgy & grassy understoreys.
Red-capped Plover (Spring)											Y			Coastal with washed up seaweed.
Lewin's Rail (Spring)						Y		Y	Y			Y	Y	Grassy & sedgy understorey along creek
Buff-banded Rail (Spring)			Y	Y		Y		Y	Y			Y	Y	Grassy & sedgy understorey along creek
Baillons Crake (Spring)									Y			Y		Sedges and reeds around wetlands.
Spotless Crake (Spring)												Y		Sedges and reeds around wetlands.
Australasian Bittern (Spring & Summer)								Y				Y		Sedges and reeds around wetlands an

FEISs and seasons to survey for FEISs	RF	F	W	GL	Sco	SWA	H	DL	RZ	C	Co	WL&S	M & S	HR
Brown-headed Honeyeater (Spring)		Y	Y					Y	Y					Forests and woodlands.
Crescent Honeyeater (Spring)			Y		Y	Y		Y	Y					Coastal scrub and scrub along water cou
New Holland Honeyeater (Spring)		Y	Y		Y	Y	Y		Y					Forests, woodlands and scrub.
White-fronted Chat (Spring)												Y	Y	Edges of wetlands and Coastal Salt Mars
Pink Robin (Spring)	Y	Y	Y					Y	Y					Forests and woodlands.
Eastern Yellow Robin (Spring)	Y	Y	Y		Y	Y	Y	Y	Y		Y			Forests, woodlands and scrub.
Crested Shrike-tit (Winter & Spring)		Y	Y				Y	Y	Y					Trunks of gums along water courses.
Grey Shrike-thrush (All)	Y	Y	Y		Y	Y	Y	Y	Y					Forests, woodlands and scrub.
Golden Whistler (Spring)		Y	Y		Y	Y		Y	Y					Forests, woodlands and scrub.
Rufous Whistler (Spring)		Y	Y		Y	Y		Y	Y					Forests, woodlands and scrub along wat
Grey Fantail (All)	Y	Y	Y		Y	Y	Y	Y	Y					Forests, woodlands and scrub.
Rufous Fantail (Spring & Autumn)	Y	Y	Y			Y		Y	Y					Gullies of Forest and woodlands (higher
Satin Flycatcher (Spring till early Autumn)	Y	Y	Y						Y					Forests and woodlands.
Grey Currawong (Spring)	Y	Y	Y			Y		Y	Y					Forests and woodlands.
Mistletoebird (Spring and Autumn)		Y	Y		Y			Y	Y					Forests, woodlands and scrub.
Stubble Quail (Spring)			Y	Y	Y		Y							Scrub, grasslands and intact understore
Brush Bronzewing (Spring)			Y	Y		Y	Y							Grasslands and intact understoreys.
Clamorous Reed Warbler (late Spring to Summer)				Y					Y			Y		Common Reed etc to nest in. Tall grasses, indigenous or exotic.
Golden-headed Cisticola				Y										Tall grasses, indigenous or exotic.
Little Grassbird								Y	Y	Y		Y	Y	Open wet areas to feed and mangroves
Great Egret														
MAMMALS														
Short-beaked Echidna (Spring to Autumn)	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y			Intact understoreys and fallen logs with
Agile Antechinus (Winter & Spring)	Y	Y	Y		Y	Y		Y	Y					Forests, woodlands & scrub with tree ho
Dusky Antechinus (Winter & Spring)	Y	Y				Y	Y	Y	Y		Y			Forests, with intact understorey & fallen
White-footed Dunnart (August till October)			Y	Y	Y		Y				Y	Y		Coastal woodlands, scrub & grasslands,
Southern Brown Bandicoot (Winter to Autumn)		Y	Y	Y	Y	Y	Y	Y				Y	Y	Grassy & heathy woodlands with unders
Long-nosed Bandicoot (Winter & Spring)	Y	Y	Y	Y	Y	Y		Y	Y		Y			Coastal woodlands, scrub & grasslands.
Sugar Glider (Spring till Autumn)	Y	Y	Y					Y	Y					Forests & woodlands with tree hollows.
Feathertail Glider (Spring)	Y	Y	Y					Y	Y					Forests & woodlands with tree hollows.
Black Wallaby (All)	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Forests. Woodlands, scrub and grasslan
Water Rat (Spring till Autumn)					Y	Y		Y	Y	Y	Y	Y	Y	Water bodies including coastal.
Southern Forest Bat (Spring till Autumn)	Y	Y	Y					Y	Y					Forests and woodlands with tree hollow
Large Forest Bat (Spring till Autumn)	Y	Y	Y		Y	Y		Y	Y					Forests and woodlands with tree hollow
Swamp Rat (All)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Most habitats with intact understoreys
Totals	**26**	**38**	**47**	**21**	**32**	**33**	**21**	**43**	**51**	**10**	**21**	**26**	**17**	

Assessment Table for habitat structure and composition of Broad Vegetation Classes Assessed

NAME OF SITE-
LOCATION-
SIZE OF SITE-
HABITAT-

TABLE 22: Evaluating the health of ecosystems by using the presence of habitat structure and composition of site to be assessed

Broad vegetation classes to be assessed at site	% of FEISs present in each BVC	Old-growth trees (% present per hectare)	Middlestorey (% present)	Understorey (% present)	Fallen logs (% present per hectare)	Feral control program (type deployed)	Presence of habitat-changing weeds (% present) and main species	Connectivity or bio-link

Assessment Table for habitat structure and composition of Creeks and still water bodies

NAME OF SITE-
LOCATION-
LENGTH OF CREEK-
STRUCTURE- Includes dams, lakes, estuaries, drainage-lines and creeks.

TABLE 23: Evaluating the health of ecosystems by using the presence of habitat structure and composition of water bodies to be assessed.

Creek or water-body-type	% of in-stream logs present	Percentage of aquatic plants present	Presence of in-stream macro-invertebrates High species diversity Medium species diversity Low species diversity	Presence of streamline vegetation along or around the water body	Presence of old-growth trees alive or dead, with breeding hollows or roosting sites, and still standing either in or on the edge of water body	Feral control program, (type deployed)	Connectivity or b link
Upper reaches							
Middle reaches							
Lower reaches							
Estuary							
Still water body including dams and lakes.							

APPENDIX 4: Threatened Fauna Management and Recommendations

TABLE 24: Significant fauna, their habitat requirements and management actions

Species	Habitat Requirements	Management Actions
Common Long-necked Tortoise	Occurs in water bodies including creeks, swamps, dams and estuaries.	Keep creek free from sediments, pollutants and nutrients. Prevent fox attacks on eggs laid on the banks.
Delicate Skink	Terrestrial dwelling species found amongst fallen timber and leaf-litter where intact understorey occurs.	Retain and increase terrestrial logs and grassy understorey. Continue and control habitat-changing weeds and vermin.
Swamp Skink	State threatened species, that occurs along the creek and some adjacent foreshore areas	Keep grassy and sedgy understorey intact. Deploy additional terrestrial logs with hollows, such-as Coast Banksia trunks. Control habitat changing weeds, foxes and cats within habitat areas.
Metallic Skink	Terrestrial dwelling species found amongst fallen timber and leaf-litter where intact understorey occurs.	Retain and increase terrestrial logs and grassy understorey. Continue and control habitat-changing weeds and vermin.
Weasel Skink	Shade hugging species found amongst fallen timber and leaf-litter where intact understorey occurs.	Retain and increase habitat logs, leaf-litter and grassy understorey. Continue to control habitat-changing weeds and vermin.
Blotched Blue-tongue	Large terrestrial dwelling skink species found where intact understoreys occur. Omnivore.	Retain and increase indigenous understorey and habitat logs throughout. Continue to control vermin and habitat-changing weeds.
White-lipped Snake	Occurs in intact grassy understorey habitats.	Retain and increase indigenous understorey and habitat logs throughout. Continue to control vermin and habitat-changing weeds.
Yellow-tailed Black-Cockatoo	Prefers the woodlands to feed in.	Protect woodlands from habitat changing weeds. Plant out Coast Banksia where mature stands have died or are senescing. Install breeding boxes to encourage breeding.
Pied Cormorant	Aquatic species that utilizes the bay to feed and roosts on exposed sand bars.	Keep sand bars free from human disturbance.
Buff-banded Rail	Semi-terrestrial bird species that prefers dense grassy or sedgy understorey.	Maintain grassy and sedgy understorey along creek and adjacent foreshore areas. Control foxes and cats.
Pied Oystercatcher	Semi-aquatic species that feeds between the high and low tide areas, mainly on bivalves and mollusks.	Keep foreshore and sand bars free from human disturbance.
Pacific Gull	Semi-aquatic species that feeds between the high and low tide areas, mainly scavenges.	Keep foreshore and sand bars free from human disturbance.
Crested Tern	Aquatic species that dive bombs for small fish and roosts on sand bars post feeding.	Keep foreshore and sand bars free from human disturbance.
White-bellied Sea-Eagle	A large raptor of state significance, that feeds upon fish and fish scraps within the bay.	Keep foreshore free from human disturbance.
Musk Lorikeet	Migrates to the peninsula during late summer-autumn to feed on various flowering eucalypts and banksias at the time.	Protect and maintain woodland free of habitat-changing weeds.
Barn Owl	Breeds within large tree hollows and appears to feed along the creek.	Protect and maintain creek and coastal woodlands free of habitat-changing weeds. Install breeding boxes to encourage breeding.
Short-beaked Echidna	Observed along the banks of the creek estuary. Not found in other parts of foreshore reserve.	Protect creek habitat from habitat changing weeds. Deploy terrestrial tree trunks for breeding habitat.
Sugar Glider	Hollow dependant feeding in a variety of eucalypts and wattles. Recently taken over a nesting box.	Protect woodlands from habitat changing weeds Install additional breeding boxes to encourage breeding.

Species	Habitat Requirements	Management Actions
Micro bat species occurring throughout the foreshore reserve	Utilize tree hollows, loose bark, adjacent buildings, caravan annexes and sheds as roost sites. Feeds on insects at night.	Retain, maintain and restore habitat. Implement a bat-box program using a variety of designs. Control habitat-changing weeds and vermin. Plant additional eucalypts in woodlands.
Swamp Rat	Prefers areas of dense undercover e.g. low-lying vegetation and sedges that don't become inundated. Feeds on seeds and rhizomes and excavates runways and burrows. After fire, habitat is not usually suitable for some years.	Protect areas that have intact habitats and understoreys, especially sites of sword-sedge. Continue to control vermin and weeds.
Australian Fur Seal	Aquatic mammal species that occasionally beaches itself to either rest or as dead specimens. Feeds on a variety of fish and other aquatic organisms.	Keep humans and dogs away from beached specimens.

Map 5: Locations of fauna sampling sites, first section of foreshore reserve

Map 6: Locations of fauna sampling sites, second section of foreshore reserve