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MORNINGTON
PENINSULA
Shire

State of Biodiversity



Prepared for: Mornington Peninsula Shire

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Summary

Mornington Peninsula Shire is developing a Biodiversity Conservation Plan for the Mornington Peninsula. At a time of increasing environmental challenges, the aim of this plan is to assist the Shire and its community in achieving best-practice management for the protection and enhancement of biodiversity values across the Mornington Peninsula Shire. This document provides an overview of the ecological values and ecosystems of the Mornington Peninsula and their current condition, prepared to assist in the development of the Biodiversity Conservation Plan.

The review draws on data and information collected from scientific, government and community sources, including biodiversity atlases, modelled datasets and mapping, technical reports, research papers and biological surveys, to document the condition and extent of the ecological values on the Mornington Peninsula. The key findings of this review are summarised below.

Land Tenure and Land Use

The Mornington Peninsula Shire covers approximately 720 km² of land, and is bounded by over 190 km of coastline, which constitutes approximately 10% of Victoria's coast. It supports a mixture of land uses but retains a predominantly semi-rural character:

- The majority of the Shire is within private ownership, and comprises mostly rural, agricultural land;
- Approximately 70% of the Shire is covered by Green Wedge zoning;
- Private land supports 57% of native vegetation remaining on the Peninsula; and
- Approximately 85% of public land on the Peninsula is held within parks and reserves.

Natural Landforms and Major Habitats

The Mornington Peninsula is built of complex geological formations, resulting in diverse landforms and habitat types. The major habitat types on the Peninsula include:

- Central Hills - Much of the Mornington Peninsula is weakly dissected by fault lines, resulting in a broad zone of uplift through the centre of the Peninsula. These give rise to gently undulating hills at Boneo, Main Ridge, Red Hill, Mount Martha, Mount Eliza and Arthur's Seat, supporting forest and woodland communities;
- North Central Plains – Land in the north of the Mornington Peninsula, around Baxter, Moorooduc, Somerville and Tyabb is of lower relief, and once supported extensive areas of Grassy Woodland with Plains Grassy Wetland, which are now heavily depleted on the Peninsula;
- Waterways – There are 18 creek catchments on the Peninsula, all of which are small and isolated from the Bunyip River Catchment. Creeks traverse almost all vegetation types on the Peninsula, and as such, associated riparian habitats vary accordingly from humid ferny areas to shaded forest to densely shrubby heathland;
- Wetlands – There are few large, naturally occurring inland wetlands on the Mornington Peninsula. The largest inland natural wetland is Tootgarook Swamp (380 ha) at Rosebud West. Devilbend Reservoir is the largest artificial waterbody on the peninsula and linked along Devilbend Creek to Bittern Reservoir to the southeast (approx. 260 ha combined);

- Sandy Beaches and Dunes – Significant areas of sand flats occur along the Port Phillip and south coast. Primary dunes lie immediately above or several metres from the high tide line along beaches, and are either densely shrubby or support a mosaic of low grassy/succulent vegetation. Secondary dunes are susceptible to wind erosion and undergo only gradual minor changes in topography, while tertiary dunes are more extensively covered in vegetation;
- Cliffs and Headlands – Coastal cliffs or headlands occur along extensive sections of the south coast (e.g. Bushrangers Bay and Sorrento) and to a lesser extent on the north coast (e.g. Mount Martha and Mornington). Cliffs vary in geology on the Peninsula and are composed primarily of limestone, basalt and sandstone, and are often void of vegetation;
- Rocky Shores – Rocky shores dominate the exposed southern coastline. Larger examples are rock outcrops on beaches at Somers, Shoreham, Flinders, Cape Schanck, Blairgowrie (south), Point Nepean and Mt Martha;
- Mudflats, Saltmarsh and Mangroves – Mudflats are most extensive around the Western Port shoreline, particularly between Tyabb and Sandy Point. They are largely devoid of vegetation but adjoin either saltmarsh or Mangrove Shrubland; and
- Estuaries – As the transition zone where freshwater streams meet the marine environment, estuaries provide calm, slow-flowing water with salinity levels ranging from sea water to brackish.

Conservation Estate

The Mornington Peninsula supports a number of ecologically important areas designated under international conventions, as well as National, State and local Parks:

- The Mornington Peninsula forms part of the Western Port Ramsar Site and UNESCO Western Port Biosphere Reserve;
- Approximately 10% of the Peninsula's land is protected within parks or reserves, including National Park, State Park, state conservation reserves and local bushland reserves and foreshore coastal reserves; and
- Parks and Reserves support 27% of native vegetation on the Peninsula, comprising 59 Ecological Vegetation Classes (EVCs), and 125 species listed as rare or threatened in Victoria.

Major Vegetation types

Vegetation on the Mornington Peninsula can be classified into five major groups:

- Forest and Woodlands (c. 15,000 ha)
- Heathland and Scrubs (c. 6000 ha)
- Tidal and Estuarine (c. 580 ha)
- Freshwater and Inland Brackish Wetlands (407 ha)
- Grasslands (c. 90 ha)

The Mornington Peninsula supports three vegetation communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*:

- Subtropical and Temperate Coastal Saltmarsh
- Natural Damp Grassland of the Victorian Coastal Plain
- Seasonal Herbaceous Wetlands (freshwater) of the Temperate Lowland Plains

Two vegetation communities are listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988*:

- Coastal Moonah Woodland
- Plains Grassland (South Gippsland) Community

Non-threatened Vegetation communities that are rare or depleted locally include Wet Heath, Sand Heath and Coastal Dune Grassland.

Approximately 30% of native vegetation remains (22,046 ha) within the Mornington Peninsula Shire. Throughout the Peninsula, the majority of native vegetation is of medium quality, according to modelled vegetation condition data.

Threatened Species

Flora species recorded for the Mornington Peninsula Shire include:

- One species considered locally extinct
- Six species listed under the EPBC Act 1999
- Nine species listed under the FFG Act 1988
- Forty-four species classified as rare or threatened in Victoria

Fauna species recorded for the Mornington Peninsula Shire include:

- Ten species considered locally extinct
- Twenty-one species listed as threatened under the EPBC Act 1999
- Twenty-one species listed as threatened under the FFG Act 1988
- Thirty-nine species classified as rare or threatened in Victoria.

The majority of fauna species that are locally extinct, or considered rare or threatened are bird species. Ground dwelling bird species that occupied grassy woodland vegetation have experienced the greatest declines. In contrast, amphibian species have persisted relatively well on the Peninsula, with one quarter of all species remaining widespread on the Peninsula.

Biodiversity Threats

Major threats to biodiversity on the Mornington Peninsula were identified from the published and unpublished literature, and consultation with community and industry stakeholders.

Threats have been grouped into major categories based on standard classification systems, and include:

- Land use change and development
 - Residential and Commercial development
 - Industrial development
 - Agriculture
- Invasive and overabundant species
 - Environmental weeds
 - Pest animals
 - Pathogens
- Transport and Utilities
- Human Disturbance
 - Active recreation
 - Passive recreation
- Pollution
- Climate Change
- Natural System Modification

1 Introduction

This document provides an overview of the ecological values and ecosystems of the Mornington Peninsula and their current condition, prepared to assist in the development of a Biodiversity Conservation Plan for the Mornington Peninsula Shire.

The Mornington Peninsula is one of Victoria's premier tourism destinations, a major producer of food and wine, and is recognised for its scenic landscapes, coastal areas and beaches, biological diversity, sites of historic importance and geomorphological significance. Located south-east of Melbourne, at the metropolitan-rural interface, the Mornington Peninsula supports a mixture of urban and industrial areas, resort townships, rural and agricultural land and natural environments.

The natural environments of the Mornington Peninsula encompass a diverse range of landforms and ecosystems, from coastal areas supporting sandy beaches and dunes, intertidal flats and rocky shores, to ridges and escarpments with woodlands and forests, wetland and waterways. Despite significant loss and alteration of these environments since European settlement, many remaining areas on the Peninsula are of international and national conservation significance, and contribute to the maintenance of biodiversity in the greater Port Phillip and Western Port region. They are also important economically, considered vital by many, to the liveability and sustainability of the wider metropolitan area, through the provision of services such as clean air, water for food production, and as a centre for tourism in the region. However, the Peninsula's proximity to Melbourne's expanding metropolitan area, growing population and climate change, are placing increasing pressures and demands on the environment.

The development of a Biodiversity Conservation Plan for the Mornington Peninsula will assist the Shire with the protection and enhancement of biodiversity on the Peninsula over the next five years. The Mornington Peninsula Shire Council is at the forefront of biodiversity conservation on the Mornington Peninsula, responsible for the management of public freehold and crown land, the regulation of planning scheme controls, and many other day-to-day planning and management decisions that have the potential to affect biodiversity, across multiple land tenures. Council are also strong contributors to biodiversity conservation and research programs on the Peninsula, and over the last 20 years, have initiated numerous surveys and studies to improve understanding of biodiversity values across the Peninsula. However, Council have recognised the need to move towards a more strategic approach to biodiversity management and allocation of priority funding at the municipal-scale. The plan will identify management priorities and guide resource allocation to meet ongoing and increasing environmental challenges on the Peninsula.

This report outlines the patterns and systems supporting biodiversity on the Mornington Peninsula, providing an overview of the current state of biodiversity, as a baseline. It identifies key trends and threats to biodiversity conservation on the Peninsula, and identifies areas of conservation significance, as input into the Biodiversity Conservation Plan.

The review draws on data and information collected from scientific, government and community sources, including biodiversity atlases, modelled datasets and mapping, technical reports, research papers and biological surveys, to document the condition and extent of the ecological values on the Mornington Peninsula (see Appendix 1).

2 Landscape

2.1 Location

The Mornington Peninsula is located approximately 40 – 80 km south-east of Melbourne, separating Port Phillip Bay to the west, and Western Port Bay, to the east. The Mornington Peninsula Shire covers c. 720 km² of land, and is bounded by over 190 km of coastline, which constitutes approximately 10% of Victoria's coast. To the north, the Mornington Peninsula Shire is bordered by the Cities of Frankston and Casey; the northern boundaries are defined by Kackeraboite Creek, Humphries Road, Moorooduc Highway, Sages Road, Baxter-Tooradin Road, Peninsula Link, Golf Links Road, Baxter-Tooradin Road, Dandenong-Hastings Road and South Boundary Road East.

2.2 Climate

The Mornington Peninsula experiences a maritime climate that is influenced by Port Phillip and Western Port Bays and Bass Strait, which provide a buffer to extreme temperatures. The mean maximum monthly temperature at Cerberus varies from 13.6 in July to 25°C in February (1991–2015), while minimum temperatures range between 6.3 and 13.3°C (Bureau of Meteorology 2015). The Peninsula generally experiences relatively reliable, winter-dominated rainfalls due to the low pressure systems in Bass Strait. Arthurs Seat can cause a rain shadow effect, dissipating rain storms that come across Port Phillip Bay (MPS 2010). Mean monthly rainfall varies from 38.1 mm in January to 76.2 mm in June, with an average annual rainfall of 721 mm (1986–2014) (Bureau of Meteorology 2015).

2.3 Geography

The Mornington Peninsula forms part of the Gippsland Plain Bioregion, which extends across south-eastern Victoria from Melbourne to Lakes Entrance, and is characterised by flat to gently undulating coastal and alluvial plains.

Formed by a horst, The Mornington Peninsula is built of complex geological formations. The northern extent of the Peninsula is between Frankston and Pearcedale, where the topography is relatively flat. However, the majority of the Peninsula consists of undulating plains of low elevation, dissected and uplifted by a series of six major fault lines: the Selwyn, Balcombe, Devilbend and Tyabb Faults, which run north-south; and the Flinders and Main Spur Faults which run east-west.

The fault lines give rise to the central hilly landscapes of the Peninsula (between the Selwyn and Tyabb Faults) of Boneo, Main Ridge, Red Hill, Arthur's Seat, Mount Martha and Mount Eliza, leaving land approximately east of Balnarring and Tyabb, and the Nepean Peninsula as lower elevation components (Birch 2003). Arthur's Seat is the highest point on the Peninsula at 305 m above sea level, while Mount Martha and Mount Eliza form two other prominent granitic hills, which rise to c. 150m.

The Selwyn Fault, which is the largest fault line (100 km), cuts across the Nepean Peninsula from Cape Schanck to Dromana, and defines the edge of the Port Phillip Sunland (a natural depression formed 65 million years ago and mostly flooded by Port Phillip Bay), to the west. The Nepean Peninsula is therefore, a distinct geomorphological unit on the Peninsula, characterised by calcareous aeolian dunes between Rosebud and Cape Schanck (Moxham et al. 2009). Consolidation of the sands has formed hard dune sandstones and limestones in some areas; wave action continues to erode the southern side, forming limestone cliffs.

2.4 Land Use and Tenure

As an interface area on the edge of Melbourne, the Mornington Peninsula Shire supports a mixture of land uses but retains a predominantly semi-rural character. The Mornington Peninsula Green Wedge, most of which (98%) falls within the Mornington Peninsula Shire, covers approximately 70% of the Shire’s land mass. It includes a mixture of rural and agricultural land, conservation reserves and major infrastructure (e.g. water reservoirs) to support neighbouring urban areas. The remaining 30% falls within the Urban Growth Boundary (MPS 2012, DELWP 2016), which occurs predominantly along the Port Phillip and north Western Port coastlines.

Approximately 80% of land in the Mornington Peninsula Shire is privately owned. The predominant land use category is rural (56%), with the majority of rural land subject to agriculture (DataVic 2015). Livestock production and horticulture form the main agricultural industries, although viticulture, poultry farming and aquaculture also form important components (MPS 2010). Rural land ownership on the Peninsula is fragmented and based, in-part, on rural living and lifestyle farming on relatively small lots. Urban land uses comprise the next largest single land use category, with residential land covering 17% of the Peninsula’s land mass. There is a near contiguous band of development between Mount Eliza and Dromana, resulting largely from the proximity to metropolitan Melbourne. Smaller and more distinct settlements and townships occur on the Western Port and Bass Strait coasts. Other private land uses account for 26%, while commercial and industrial land uses within township areas comprise less than 1%. Major industry on the Peninsula includes steelworks, petroleum, and the Port of Hastings on Western Port, where significantly, over 3,500 ha have been designated for potential future port-related development, representing approximately 5% of the Peninsula’s area. The future development of Victoria’s port facilities is currently under review by Infrastructure Victoria.

Only 18% of the Mornington Peninsula is under public land management. Parks and reserves account for most public land within the Shire (Figure 1). Commonwealth land occupied by HMAS Cerberus at Crib Point is managed by the Department of Defence and covers approximately 2% of the Peninsula. Other public land uses include education and community facilities, roads and water assets.

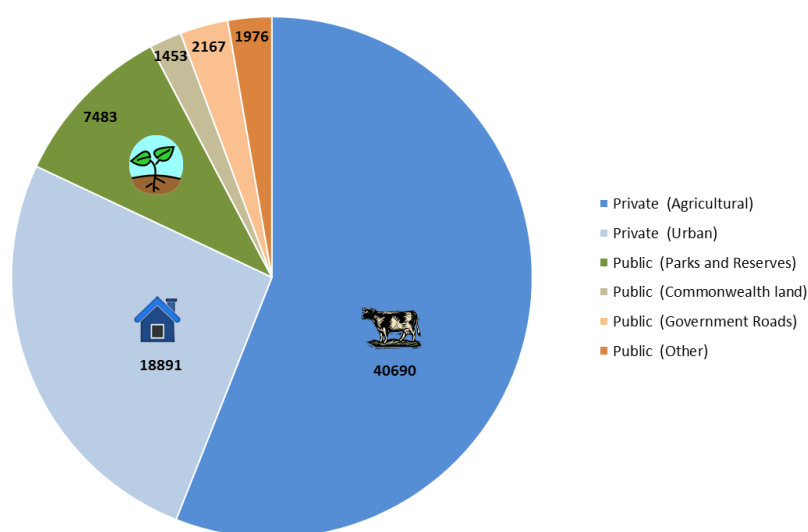


Figure 1 Major land use categories on the Mornington Peninsula by tenure

Note: Numbers indicate area of land in hectares

3 Natural Landforms and Major Habitats

3.1 Inland Environments

3.1.1 Central Hills

Much of the Mornington Peninsula is weakly dissected by fault lines, resulting in a broad zone of uplift through the centre of the Peninsula, which has formed the gently undulating hills at Boneo, Main Ridge, Red Hill, Mount Martha, Mount Eliza and Arthur's Seat. These areas support some of the largest and most important areas of native vegetation remaining on the Peninsula, as well as habitat types that are not found elsewhere on the Mornington Peninsula. Excluding farmland, most of the vegetation on these hillier and higher rainfall areas comprises tall eucalypt forests (e.g. Arthur Seat, Red Hill and Main Ridge). These habitats are important for forest fauna, especially those dependent on mature, hollow-bearing trees (e.g. Powerful Owl *Ninox strenua*). The central hills also support open canopy woodland habitats, with dense ground cover and woody debris (see Plate 1).



Plate 1 Damp Sands Herb-rich Woodland at Main Ridge Bushland Reserve

3.1.2 North Central Plains

The northern Mornington Peninsula, around Baxter, Moorooduc, Somerville and Tyabb is a relatively low relief area of the Peninsula, often referred to as the Moorooduc Plain. This area forms a major catchment of Balcombe Creek. The northern low-lying areas of the Peninsula once supported extensive areas of open Grassy Woodland with Plains Grassy Wetland, vegetation types which are now heavily depleted on the Peninsula. This landscape is now primarily rural, with major townships at Somerville and Tyabb, and small fragments of native vegetation scattered throughout.

3.1.3 Waterways

Waterways within Mornington Peninsula Shire are part of the Bunyip River Basin. There are 18 creek catchments, which can be divided into the:

- Northern catchments: Watsons Creek, Balcombe Creek, Devilbend Creek, Bulldog Creek, Warringine Creek and Brokil Creek; and
- Southern catchments: Dunns Creek, Merricks Creek, Tulum Creek, Coolart Creek, East Creek, Stony Creek, Manton Creek, Main Creek, Splitters Creek, Stockyard Creek, Drum Drum Alloc Creek and Chinamans Creek.

All are small catchments that are isolated from the Bunyip River catchment; there are no large, lotic environments (i.e. rivers) on the Peninsula.

The major waterways within Mornington Peninsula include Balcombe, Devilbend, Dunns, Drum Drum Alloc, Chinamans, Manton, Main, Merricks, Stony and Watson Creeks. Most creeks have perennial flows and are no more than several metres wide. Depth and substrate is variable according to geology and soil type although most inland creeks are shallow with a silty or muddy substrate. Creeks traverse almost all vegetation types on the Peninsula, and as such, associated riparian habitats vary accordingly from humid ferny areas to shaded forest to densely shrubby heathland. Instream vegetation is common including submerged and floating aquatic species (see Plate 2). Fallen logs and branches may be present and instream rocky outcrops and substrates are occasional.



Plate 2 Chinamans Creek at Tootgarook Swamp, Rosebud West

3.1.4 Wetlands

There are few large, naturally occurring inland wetlands on the Mornington Peninsula. The largest inland natural wetland is Tootgarook Swamp (380 ha) at Rosebud West. Tootgarook Swamp is a ground water-dependent wetland, formed in a low-lying area of the Nepean Peninsula, where calcarenite dunes on the western boundary retard flows from the confluence of Drum Drum Alloc Creek and Chinamans Creek. It supports a mosaic of vegetation types, from swampy woodlands and scrubs to sedgelands and marshes, with areas of open water, as determined by the elevation of the terrain, soils and patterns of inundation and drainage. Tootgarook Swamp is recognised for supporting a diverse assemblage of bird fauna (110 species), including a number of migratory and threatened species (Purnell and Wilson 2015). Smaller natural wetlands occur in other areas of the peninsula, including Coolart Wetland, although these are generally few.

Devilbend Reservoir (now decommissioned) is the largest artificial waterbody on the peninsula and linked along Devilbend Creek to Bittern Reservoir to the southeast (approx. 260 ha combined). These provide permanent, open water habitats, supporting limited components of emergent vegetation, and support important habitat for waterfowl. Other larger dams occur at Pioneer quarry, Sorrento Golf Club and Tyabb, which also provide permanent wetland habitats, varying in landscape context and vegetation components. Numerous smaller dams have also been constructed throughout the agricultural landscape, in areas where water naturally accumulates.

3.2 Coastal Environments

Separating two contrasting bays, the Mornington Peninsula's coastal environments support a range of coastal landforms and habitat types. The Port Phillip coastline is dominated by sandy beaches, with small areas of intertidal rocky shores at Mornington and Portsea, while the low energy coastline of Western Port is dominated by extensive intertidal areas of mangrove and saltmarsh. The southern coastline, fronting Bass Strait, supports both sandy beaches on the Nepean Peninsula, and rocky shores from Cape Schanck to Point Leo, surrounded by subtidal rocky reefs, with stable, well vegetated dunes between Dromana, Point Nepean and Cape Schanck and from Shoreham to Crib Point. Calcarenite cliffs and slopes are also present between Point Nepean and Cape Schanck. Provided below, is a brief description of the coastal environments of the Mornington Peninsula.

3.2.1 Sandy Beaches and Dunes

The Port Phillip and south coast beaches support significant areas of sand flats, which are largely composed of siliceous sands and carbonate. Primary dunes lie immediately above or several metres from the high tide line along beaches. They are either densely shrubby or support a mosaic of low grassy/succulent vegetation or open sandy areas (e.g. Plate 3). Secondary and tertiary dunes typically support dry, tall and dense scrub of tea-tree and other shrubs. They are taller and steeper dunes compared to primary dunes with sometimes large open sandy areas in closer proximity to primary dunes. Secondary dunes are susceptible to wind erosion and undergo only gradual minor changes in topography. In contrast tertiary dunes are more extensively covered in vegetation, with less topographic relief although their vegetation is structurally similar. The dunefields of the Port Phillip and south coast are important areas for shorebirds and seabirds, but particularly for the Hooded Plover *Thinornis rubricollis*, which nest on dune systems and sandy flats above the high tide mark.



Plate 3 Coastal dune systems at Rye

3.2.2 Cliffs and Headlands

Coastal cliffs or headlands occur along extensive sections of the south coast (e.g. Bushrangers Bay and Sorrento) and to a lesser extent on the north coast (e.g. Mount Martha and Mornington). Cliffs vary in geology on the Peninsula and are composed primarily of limestone, basalt and sandstone. They are often void of vegetation, excluding small platforms caused by slumping or erosion, but provide unique habitats. In particular, cliff faces provide shelter, roosting and breeding sites for coastal birds and Peregrine Falcons, and roosting sites for microbats. The updraughts produced also provide foraging habitat for swallows and White-throated Needletails *Hirundapus caudacutus*.



Plate 4 Coastal cliffs at Sorrento

3.2.3 Rocky Shores

Rocky shores dominate the exposed southern coastline. Larger examples are rock outcrops on beaches at Somers, Shoreham, Flinders, Cape Schanck, Blairgowrie (south), Point Nepean and Mt Martha. The rock characteristics depend on the underlying geology of limestone, basalt or sandstone. They include rock pools as nursery sites for marine fish and invertebrates, and variable marine algae cover at low tide. Some permanently exposed rock outcrops occur also above the tideline. These shores are important for shorebirds such as the Hooded Plover and Sooty Oyster-catcher *Haematopus fuliginosus* (see Plate 5).

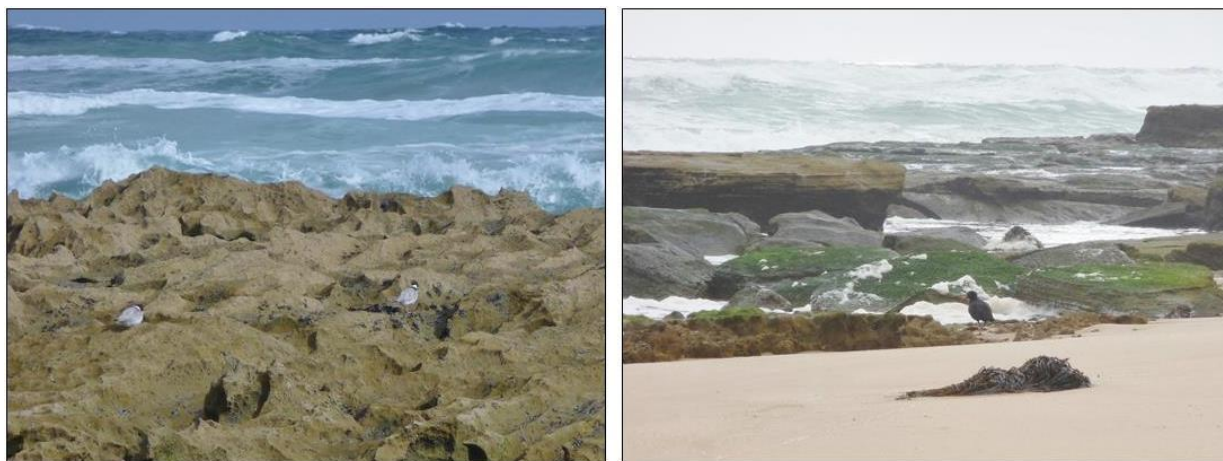


Plate 5 Rocky shores at St Andrews with Hooded Plover (left) and Sooty Oystercatcher (right)

3.2.4 Mudflats, Saltmarsh and Mangroves

Mudflats are most extensive around the Western Port shoreline, particularly between Tyabb and Sandy Point. They are largely devoid of vegetation but adjoin either saltmarsh or Mangrove Shrubland, and are exposed at greatest extent at low tide, when they occupy many hectares. The intertidal mudflats of Western Port are considered to be one of the three most important sites for migratory shorebirds in Victoria. Much of this coastline between Pearcedale and Crib Point has been identified as primary or secondary foraging habitat for shorebirds, with primary foraging areas between Tyabb and Yaringa, and at Hastings and Hanns Inlet. High tide roosts are located at Long Island and around Hanns Inlet to Sandy Point (Hansen et al. 2011) (See Figure 2).

Saltmarsh and mangroves dominate the Western Port shoreline between Sandy Point and Watsons Inlet (e.g. Plate 6). Saltmarsh and mangrove habitats are often clearly zoned reflecting the frequency and depth of tidal inundation. Saltmarsh and mangroves provide important habitat for shorebirds. Mangroves were formerly more abundant on the northern Western Port coastline, but have been depleted by land use changes. Despite historic losses of mangroves there is now considerable evidence of their expansion into saltmarsh communities due to factors not yet fully understood (VSSG 2011). Remaining areas of Mangrove Shrubland are the most southerly populations in the world.



Plate 6 Mangroves and saltmarsh along Western Port Bay near Yaringa

Estuaries

As the transition zone where freshwater streams meet the marine environment, estuaries provide calm, slow-flowing water with salinity levels ranging from sea water to brackish. They have a sandy or silty substrate and a short intertidal zone in lower reaches which include small mudflats, adjoining saltmarsh or Mangrove Shrubland. The most notable are Hanns Inlet at Hastings, Merrick Creek at Balnarring and Balcombe Creek at Mount Martha and Watsons Inlet at Somerville. Martha Cove Marina includes an engineered estuary with some habitat values. Hanns Inlet, Watsons Inlet and the Balcombe Creek estuary are particularly important sites for migratory shorebirds and waterfowl. The estuaries of Main Creek at Cape Schanck, and Stony Creek at Shoreham, provide important habitat for estuarine fish.

4 Conservation Estate

4.1 Internationally Important Areas

4.1.1 Western Port Ramsar Site

The Western Port Ramsar Site was designated as a Wetland of International Importance under the Convention on Wetlands of International Importance (i.e. Ramsar Convention) in 1982 (Kellog Brown & Root 2010). It covers 59,950 ha and comprises a large bay that is connected to Bass Strait via a wide channel between Flinders and Phillip Island, and a small channel between Phillip Island and San Remo. It includes shallow intertidal areas, dissected by deeper channels and narrow strips of the adjacent coast, and encompasses a number of small islands, but excludes French Island (except for the south-western headland – Tortoise Head). The Mornington Peninsula's north-eastern Western Port coastline, from Somerville to Point Leo, forms part of the Ramsar Site (Figure 2).

The Western Port Ramsar site is recognised for its terrestrial and marine flora and fauna values. Specifically, it is recognised as a particularly good example of a natural marine embayment, with extensive intertidal mudflats, saltmarsh and seagrass beds, which provide nursery habitat for many fish species, including several of commercial significance. It regularly supports a high diversity and large numbers of waterbirds; it is one of the three most important areas for migratory shorebirds in Victoria and regularly supports more than 1% of the estimated flyway population of five shorebird species. The site also supports 18 species of international and national conservation significance (Kellog Brown & Root 2010). Ramsar sites are protected under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*, as matters of national environmental significance.

4.1.2 Western Port Biosphere Reserve

The Mornington Peninsula forms part of the Western Port Biosphere Reserve (WPBR), which covers five Local Government Areas around Western Port Bay, including the Cities of Frankston and Casey, and Shires of Cardinia, Bass Coast, and Mornington Peninsula, as well as French Island.

Biosphere Reserves are internationally designated under the United Nations Educational, Scientific and Cultural Organisation's (UNESCO) 'Man and the Biosphere' Program; reserves typically include urban, industrial and agricultural areas, as well as areas of conservation significance. The 'Man and the Biosphere' is an intergovernmental scientific program aimed at promoting a balanced relationship between humans and the biosphere. The WPBR was declared a Biosphere Reserve by UNESCO in 2002, in recognition of the area's significant natural values on Melbourne's urban fringe; it is one of 14 in Australia, and one of 631 world-wide. The EPBC Act 1999 includes provisions for the development of Biosphere Reserves, and sets regulations for their management.

4.2 Parks and Reserves System

The Mornington Peninsula's parks and reserves system covers approximately 10% of the land mass, and 85% of Public Land on the Peninsula (Table 2). It includes land protected under the *National Parks Act 1975*, the *Crown Land (Reserves) Act 1978* and various parcels of public land, owned and/or managed by the Shire as local bushland reserves. Reserved land encompasses 27% of the native vegetation within Mornington Peninsula Shire, and includes representatives of 59 Ecological Vegetation Classes (EVCs).

Of all the flora and fauna species that have been recorded for the Mornington Peninsula Shire, 34 flora species and 91 terrestrial vertebrates listed as threatened or considered rare in Victoria, have been recorded within parks and reserves.

The Mornington Peninsula encompasses some of Victoria’s most iconic parks, including Point Nepean National Park, Mornington Peninsula National Park and Arthur’s Seat State Park, which support some of the largest and most significant remaining areas of native vegetation on the Peninsula, as well as landscape and indigenous and European cultural heritage values. The Mornington Peninsula National Park is the largest on the Peninsula (2686 ha), with inland and coastal components; it is the most visited National Park in Victoria, with intensively used recreation nodes at Portsea, Sorrento and Cape Schanck, that deliver significant local and regional economic benefits. The marine environments of the Mornington Peninsula are also protected within two Marine National Parks (Yaringa and Port Phillip Heads (Nepean segment), which includes the adjoining shorelines (to the high water mark).

Numerous smaller, isolated reserves are scattered across the Peninsula on Parcels of Crown Land and Council-owned land. The Mornington Peninsula Shire manages approximately 250 local bushland reserves, including some foreshore reserves and roadsides areas, across the Peninsula. These reserves cover a total of nearly 2000 ha and encompass 9% of the vegetation within the Shire. Whilst nearly 80% of shire-managed bushland reserves are less than 10 ha in size, they include a number of large, well-connected patches. Some of the largest Shire-managed bushland reserves include Warringine Park – Bittern Coastal Wetlands in Bittern (152 ha), Yaringa Foreshore Reserve in Somerville (112 ha) and bushland areas of The Briars (90ha).

Table 1 Parks and reserves categories and areas on the Mornington Peninsula

Parks and Reserves	Total Area (ha)	% Peninsula
National		
National Park: Terrestrial	3,156	4.3
National Park: Marine	4,560	N/A
Victorian		
State Park	572	0.7
State Conservation Reserves ¹	1,808	2.5
Local		
Bushland Reserves	1,216	1.7
Foreshore Reserves (Committee of Management) ²	368 ²	0.5
Significant Roadside Reserves ²	363 ²	0.5

Source: Data supplied by Mornington Peninsula Shire, 2015

¹ Includes Regional Parks, Nature Conservation Reserves, Coastal Reserves, Historical and Cultural Features Reserves and Natural Features Reserves.

² Total areas represent area of native vegetation only.

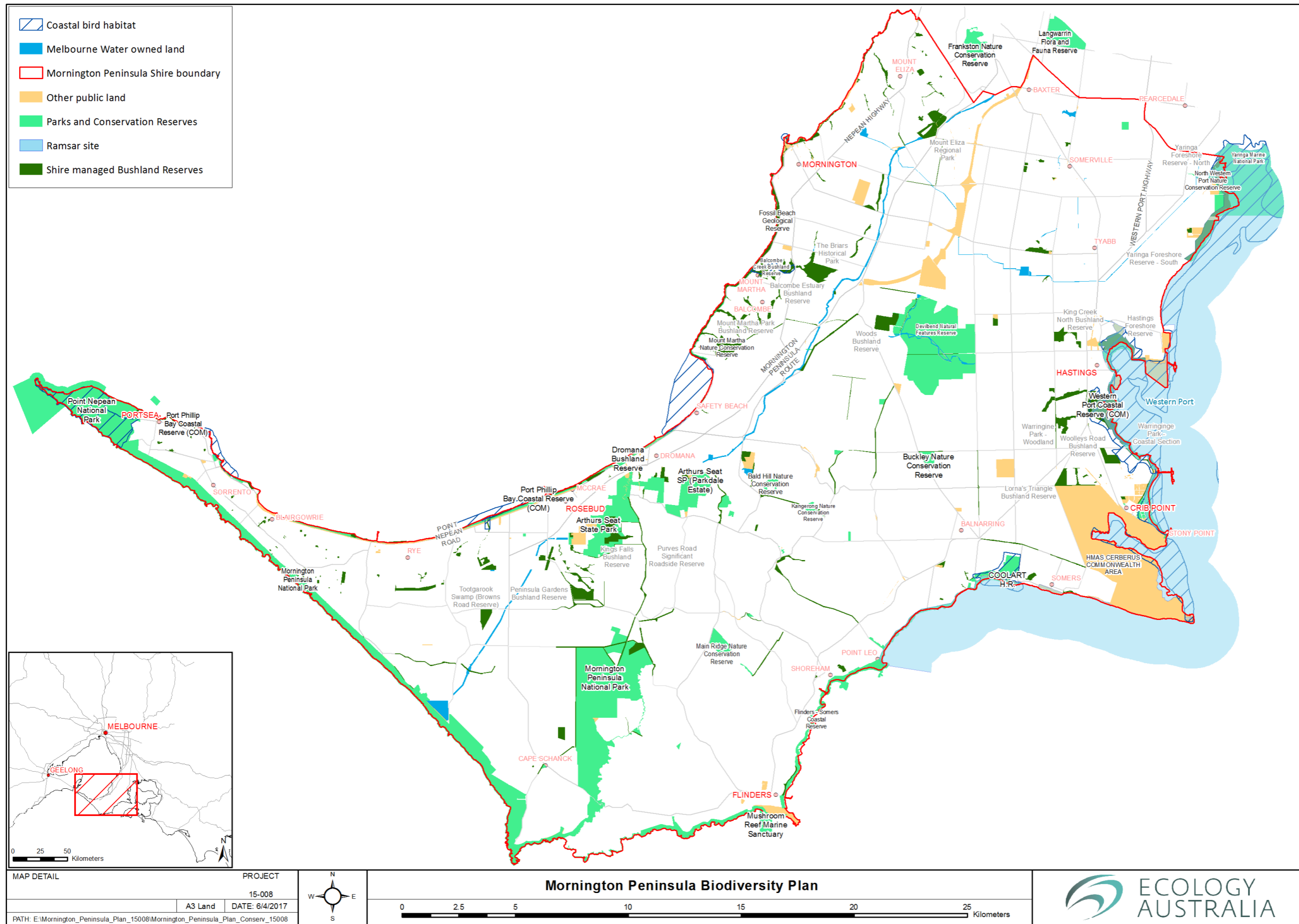


Figure 2 Conservation areas and public land within Mornington Peninsula Shire

5 Vegetation

5.1 Extent and Condition

Historic land clearing has resulted in extensive vegetation loss on the Mornington Peninsula. Approximately 30% of native vegetation remains (22,046 ha) within the Mornington Peninsula Shire, based on current modelling and on-ground mapping. Throughout the Peninsula, the majority of native vegetation is of medium quality, according to modelled vegetation condition data (NV_2005QUAL) (Figure 3). Modelled vegetation condition reflects how close the vegetation is to its mature, natural state, with regard to composition, structure and function, and spatial context. There are few high quality examples and the largest percentage of low quality examples are of grasslands, compared with all other vegetation types.

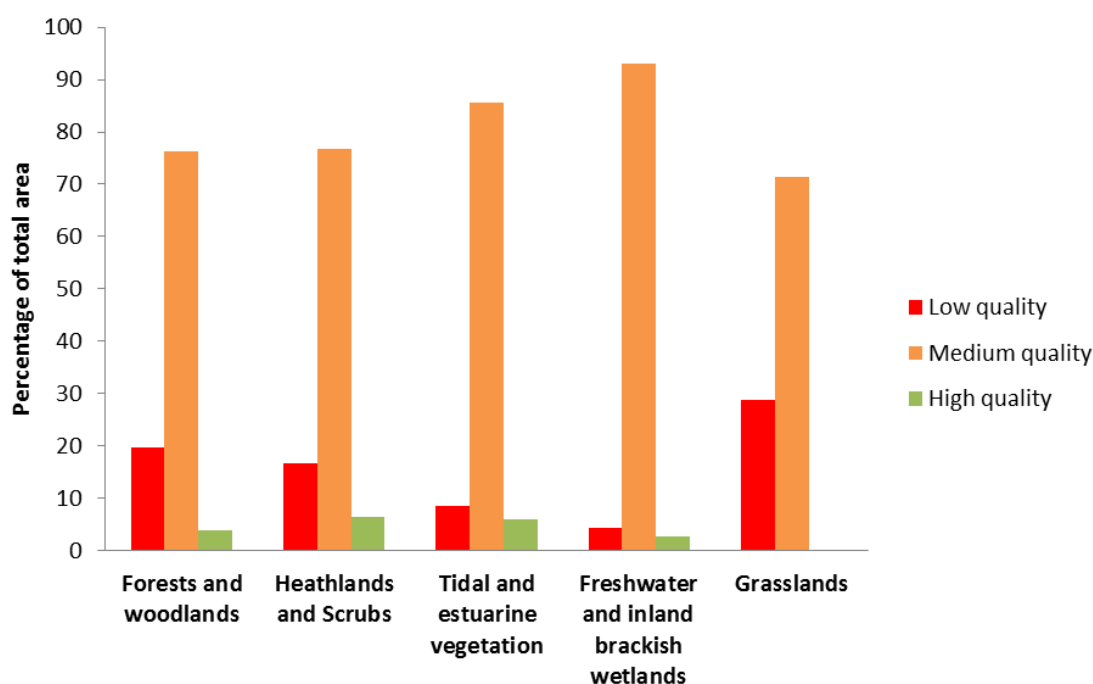


Figure 3 Condition of vegetation groups on the Mornington Peninsula. Quality follows site condition components of native vegetation condition assessment (DSE 2004): Low site quality score 1 – 30; Medium site quality score 31 – 50; High site quality score 51 – 75.

Source: NV_2005 (DELWP)

5.2 Ecological Vegetation Classes, Mosaics, Complexes and Aggregates

The Mornington Peninsula has an estimated total of 22,046 ha of extant native vegetation (Figure 4). This vegetation is mapped or modelled as an Ecological Vegetation Class (EVC) or a mosaic, complex or aggregate of EVCs (Appendix 2); referred to hereafter as mapping units. These mapping units are summarised below, within the vegetation groups Forests and Woodlands, Heathlands and Scrubs, Tidal and Estuarine Vegetation, Freshwater and Inland Brackish Wetlands and Grasslands.

The EVCs are those accepted for use in vegetation quality assessments by Department of Environment, Land, Water and Planning (DELWP), with the exception of those additional described in VSSG (2011) for saltmarsh related EVCs. Other provisional EVCs are not referred to here, such as those in DSE (2012) for use with Index of Wetland Condition assessments.

Forests and Woodlands (15,027.5 ha) is the most widespread vegetation group on the Peninsula and consists of 21 mapping units. Some of these units are in a mosaic with non-forest or woodland EVCs. They are generally distributed on volcanic-, granitic- or sandstone-derived soils, east of the limestone deposits on the Nepean Peninsula. The majority of forest or woodland mapping units have a tree canopy which is dominated by one or more of 10 *Eucalyptus* species and sub-species which are indigenous to the Peninsula. The exceptions are Coast Banksia Woodland (EVC 2) (Plate 7) which is often dominated by Coast Banksia *Banksia integrifolia* and Warm Temperate Rainforest (EVC 32) which is dominated by Muttonwood *Mysine howittiana* and other non-eucalypt species. Coastal Moonah Woodland is included within the following vegetation group – Heathlands and Scrubs.



Plate 7 Grassy Woodland (left), Coast Banksia Woodland (right)

Heathlands and Scrubs (5938.7 ha) are predominantly found on Quaternary limestone of the Nepean Peninsula and Tertiary Baxter Sandstone found in the north of the Peninsula (e.g. around Hastings) and comprises of 13 mapping units. These range from open to closed shrublands about 0.4–6 m tall, and can be drought tolerant communities on well-drained sand, to damp or seasonally inundated communities on peaty-sand or clays (e.g. see Plate 8). Dominant shrub species are typically tea-trees *Leptospermum* species, paperbarks *Melaleuca* species, beard-heaths *Leucopogon* species, sheoaks *Allocasuarina* species and wattles *Acacia* species. The composition of plants in this vegetation type is strongly determined by geology, vicinity to the coast and topography. The most extensive EVC in this group is Coastal Alkaline Scrub (EVC 858) (Plate 12). This is the dominant EVC on the Nepean Peninsula and includes the FFG listed Coast Moonah Woodland and its various modified states (Plate 12). Swamp Scrub (EVC 53) is the second most extensive EVC in this vegetation group and occupies drainage lines on alluvial clays throughout most other lowland areas of the peninsula.



Plate 8 Coastal Dune Scrub (left), Damp Heath (right)

Tidal and Estuarine Vegetation (581.8 ha) includes 16 distinct mapping units which are variably dependent on tidal water-logging or inundation by sea water. Tidal and Estuarine Vegetation mapping units are low-growing shrublands or herbfields, and in some areas have a dominant component of sedges, rushes and grasses. Succulent plants adapted to saline conditions are a common component. Tidal mudflats near the shoreline within Western Port contain Mangrove Shrubland (EVC 140) which makes up almost half of the area of Tidal and Estuarine Vegetation on the Peninsula. This EVC consists largely of one shrub species Grey Mangrove *Avicennia marina* (Plate 9) although grades into Coastal Saltmarsh Aggregate (EVC 9) where it occurs with a mix of other species. Coastal Saltmarsh Aggregate includes a number of EVCs—including the more widespread EVC Wet Saltmarsh Shrubland (Plate 9)—and occupies intertidal and estuarine flats (VSSG 2011). On the Mornington Peninsula, it is mostly found along the coastline of Western Port with minor occurrences elsewhere e.g. at the mouth of Balcombe Creek. Some woodland and scrub vegetation near the Western Port shoreline access saline groundwater lower in the water table, and subsequently have a composition of both salt tolerant and salt intolerant plant species. For example, Swamp Paperbark *Melaleuca ericifolia* is a dominant canopy species in scrub communities and is tolerant of saline ground water. It forms a closed canopy in both estuarine scrub communities (Estuarine Scrub EVC 191) and elsewhere in freshwater scrub communities (Swamp Scrub EVC 53).

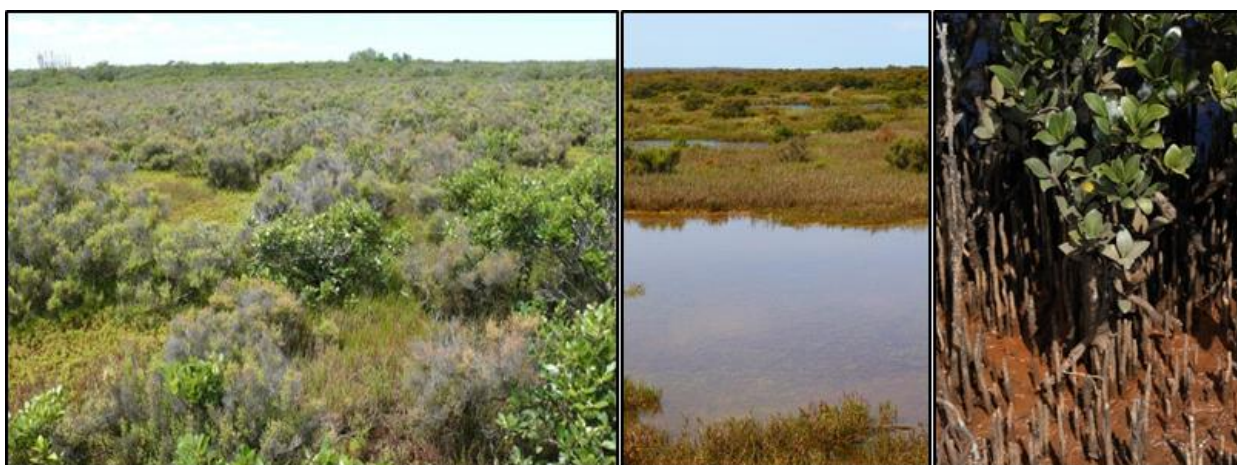


Plate 9 Wet Saltmarsh (left and center), Grey Mangrove *Avicennia marina* subsp. *Australasica* (right)

Freshwater and Inland Brackish Wetlands (407.7 ha) is a vegetation group with most of the 11 mapping units on the Peninsula found within Tootgarook Swamp. These wetlands are dependent on permanent or periodic inundation, or occupy soils with a near-surface water table and include minor occurrences of near-coastal estuarine EVCs. Brackish wetlands occur where soils are influenced by both saline ground water and fresh surface water. Freshwater and Inland Brackish Wetlands are commonly dominated by sedges (Cyperaceae species), rushes (Juncaceae and Restionaceae species), grasses (Poaceae species), water-ribbons/arrow-grasses (*Triglochin* species) or less commonly, other herbaceous plants, and are usually less than 1.5 m in height. The exception is Tall Marsh (EVC 821) (Plate 10) with the dominant grass species Common Reed *Phragmites australis*, and grows to about 3 m tall where it is best developed in permanent waterbodies. Tall Marsh, Wetland Formation (EVC 74) (Plate 10) and Brackish Wetland Aggregate (EVC 656) make up 68% of wetland vegetation on the Peninsula. Brackish Sedgeland (EVC 13), with 1 ha mapped, is represented more extensively within Brackish Wetland Aggregate mapped at Tootgarook Swamp. Of the less common wetland communities, Plains Grassy Wetland (EVC 125) was mapped in the north central parts of the Peninsula near Moorooduc (J. Yugovic pers. comm.) and has been observed in small patches north of Hastings and elsewhere. Its mapped 6.8 ha is consistent with observations that grassy wetlands such as Plains Grassy Wetland are uncommon on the Peninsula.



Plate 10 Tall Marsh (left), Wetland Formation (right)

Grasslands (90.3 ha) is a naturally restricted vegetation group on the Peninsula and comprise four mapping units. The most extensive grassland EVCs on the Peninsula are Plains Grassland (EVC 132) (Plate 11) and Coastal Tussock Grassland (EVC 163). The largest contiguous areas of Plains Grassland are within the Tootgarook Swamp and surrounds, where the dominant grass species is Common Tussock-grass *Poa labillardierei* and is representative of the EBPC Act-listed community – see Section 5.2.1. Plains Grassland also occurs in smaller patches at Safety Beach (Sinclair 2007) and elsewhere, and has a higher diversity of tussock grass species compared with Coastal Tussock Grassland, including Common Tussock-grass, Kangaroo Grass *Themeda triandra* and wallaby grasses *Rytidopserma* species. Coastal Tussock Grassland is most extensive on the southern headland of the Peninsula where it also occurs in a mosaic with Coastal Headland Scrub (EVC 161). Coastal Tussock Grassland is usually dominated by Coast Tussock-grass *Poa poiformis* which occurs with a range of other herbaceous plants and small shrubs adapted to coastal conditions.

Coastal Dune Grassland (EVC 879) occurs on the ocean or bay side of the primary dune and contains the most coastal-tolerant plant species, including the often dominant grass Hairy Spinifex *Spinifex sericeus*. Calcareous Swale Grassland (EVC 309) has a very small area of occupancy on the Peninsula (1.8 ha); within this EVC Common Tussock-grass is dominant where it occurs in depressions between dunes (Moxham et al. 2009).



Plate 11 Plains Grassland (left), Coastal Dune Grassland (right)

5.2.1 Listed Communities

There are four threatened ecological communities which are known from the Mornington Peninsula and one other community which has the potential to occur. Three of these communities are nationally listed under the EPBC Act 1999 and two are listed under the state *Flora and Fauna Guarantee (FFG) Act 1988*.

Ecological Communities listed under the EPBC Act 1999

Subtropical and Temperate Coastal Saltmarsh – Vulnerable

The vast majority of patches of Coastal Saltmarsh (EVC 9) on the Mornington Peninsula are examples of the EPBC Act 1999 vulnerable-listed ecological community Subtropical and Temperate Coastal Saltmarsh. This community occurs in the upper inter-tidal zones of bays, along estuaries or within near coastal low-lying areas where there is ground water connectivity. The description above of Coastal Saltmarsh Aggregate, included within the vegetation group Tidal and Estuarine Vegetation, provides general floristic and structural information for this listed community. The listed community requires at least some tidal influence and there can be inclusion of ecotone vegetation between other mapping units e.g. Estuarine Scrub with saltmarsh ground flora and low cover of Swamp Paperbark *Melaleuca ericifolia*. Under the listing, Subtropical and Temperate Coastal Saltmarsh occurs where community composition requirements are met and patches are ≥ 0.1 ha when isolated, or if smaller, then in a mosaic ≥ 0.1 ha with < 30 m between each patch (TSSC 2013). This community is most extensive along the western and north-western shoreline of Western Port (see Figure 4).

Natural Damp Grasslands of the Victorian Coastal Plain – Endangered

Plains Grassland patches on the Peninsula with the dominant grass Common Tussock-grass, and in some cases Kangaroo Grass, represent the listed community Natural Damp Grasslands of the Victorian Coastal Plain. The community may include several other grass species, sedges, rushes and forbs which are suited to slow-draining clay soils. A number of defining criteria apply, including a cover of trees and shrubs less than 5%, and at least 30% native perennial ground layer vegetation. The listing advice (TSSC 2015) for this community provides details of sites on Mornington Peninsula where the community is known to occur. These include sites at Bobbanaring Wetland (Point Leo), Safety Beach and Tootgarook Swamp; with other examples nearby to the north (outside Mornington Peninsula) at Epsom Grassland Reserve (Mordialloc) and Edithvale Wetland. Due to its recent listing, the distribution of this community is not well documented on the Peninsula, although it is naturally rare and otherwise depleted. Areas of damp grassland which meet the defining criteria of this listed ecological community would also account for areas of the FFG Act-listed community Plains Grassland (South Gippsland) Community, described below.

Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains – Critically Endangered

This listed community generally occurs in low-lying swampy plains with minimal topographic relief, which are seasonally inundated by freshwater. The vegetation is treeless and a suite of low-growing grass and/or sedge species are typically common; it does not have tidal influence and is not fed by a riverine system. Amongst other criteria, this community is present where isolated patches are at least 0.5 ha, there is a cluster of patches with a collective area of at least 0.5 ha within a 5 ha area, or a patch of any native vegetation of at least 1 ha occurs with no less than 0.1 ha of the listed community (TSSC 2012). Patches which likely qualified as this community were mapped around Moorooduc (J. Yugovic pers. comm.; NV_2005.) although the status of these patches is now uncertain. Vegetation which may fit this community also occurs to the north of Hastings, on the floodplain of watercourses which drain into The Bluff on Western Port's north-west shoreline. Further investigation is required to determine the status of this community on the Peninsula.

Communities listed under the FFG Act 1988

Coastal Moonah Woodland

This community is a tall, often dense shrubland or low woodland which occupies limestone-derived soils of the Nepean Peninsula and south to Cape Schanck. The shrub or tree layer is frequently occupied by Moonah *Melaleuca lanceolata*, Wirilda *Acacia uncifolia*, Drooping Sheoak *Allocasuarina verticillata*, Coast Tea-tree *Leptospermum laevigatum* and Coast Beard-heath *Leucopogon parviflorus*. The composition of vegetation beneath the canopy varies from conspicuously grassy vegetation, to open ground with abundant leaf litter (Moxham et al. 2010) (see Plate 12). The 2005 modelled distribution (DELWP 2015a) of the EVC Coastal Alkaline Scrub provides a good indication of the former geographic extent of Coastal Moonah Woodland; however, its floristic circumscription is narrower than that of Coastal Alkaline Scrub which includes various modified states. The largest contiguous patches of the listed community occur within Point Nepean National Park.



Plate 12 Coastal Moonah Woodland (FFG Act-listed) and Coastal Alkaline Scrub (EVC); Moonah *Melaleuca lanceolata* canopy (left) and grassy understorey (right)

Plains Grassland (South Gippsland) Community

This community is a variable grassland or open woodland which occurs on a range of soil types (DSE n.d.). The floristic composition is generally broad and can include various dominant species depending largely on drainage. Either, Kangaroo Grass, Common Tussock-grass or Mat Grass *Hemarthria uncinata* may be dominant and intact examples can have a moderate diversity of forbs, rushes, sedges and scattered shrubs (DSE n.d.). The listed community includes three sub-communities (Frood 1994). Most natural grassland communities on the Peninsula—excluding those of Coastal Tussock Grassland or Calcareous Swale Grassland—fall within the definition of Plains Grassland (South Gippsland) Community. Examples with Common Tussock-grass as the dominant are found within Tootgarook Swamp (see Plate 11, above).

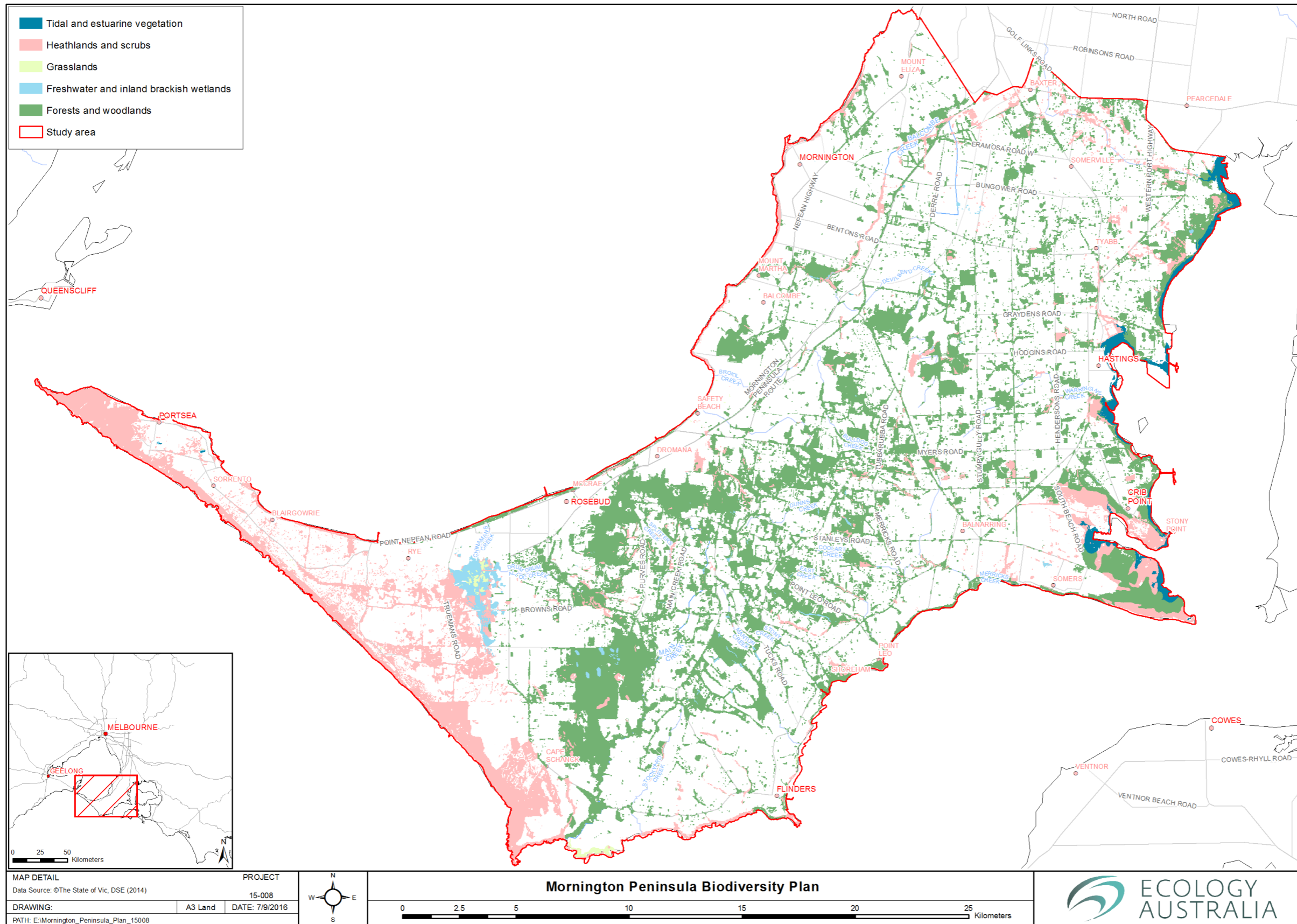


Figure 4 Major vegetation groups within Mornington Peninsula Shire, as modelled by DELWP (2015a)

5.3 Flora Species

Mornington Peninsula Shire has a total of 698 indigenous and 369 non-indigenous/naturalised plant species, sub-species, varieties or forms (taxa) (Table 2). These figures are the total number of taxa in databases recorded for the Peninsula, and the data reflect widely accepted concepts for the separation of taxa at the time of the assessment. The Peninsula’s flora represents almost one fifth of Victoria’s indigenous plants.

The composition of flora on the Peninsula is driven predominantly by a maritime climate and several dominant geological formations; Palaeozoic granites, Tertiary sandstones and volcanics, and Quarternary limestones and marine deposits. The dominant geological formations provide a broad range of soil conditions (e.g. alkaline versus acidic soils) and hydrological variability. Subsequently, the flora is dominated by taxa adapted to dry coastal conditions. The greatest diversity is seen in the wattles (*Acacia* – 18 taxa), eucalypts (*Eucalyptus* – 10 taxa), daisy-bushes (*Olearia* – 9 taxa), bush-peas (*Pultenaea* – 8 taxa), fireweed/groundsels (*Senecio* – 12 taxa), spear-grasses (*Austrostipa* – 11 taxa), spider-orchids and relatives (*Caladenia* – 9 taxa), greenhoods (*Pterostylis* – 15 taxa), rushes (*Juncus* – 16 taxa), sword-sedges (*Lepidosperma* – 14 taxa), tussock-grasses (*Poa* – 13 taxa) and wallaby-grasses (*Rytidosperma* – 14 taxa).

Table 2 Major plant groups on the Mornington Peninsula

Plant Group	Number of Indigenous Taxa	Number of Non-Indigenous Taxa [^]	Threatened species		
			EPBC Act-Listed	FFG Act-Listed	Advisory List
Conifers	0	3	0	0	0
Flowering plants	654	363	6	8	45
Ferns	30	2	0	1	1
Mosses and Liverworts	14	1	0	0	0

Source: DELWP (2015b)

[^]Non-indigenous taxa include those which are native to any area outside of the peninsula, including other parts of Victoria.

The total number of taxa in each group is representative of the current flora, except for mosses and liverworts which are poorly represented in database records for the Peninsula. It is expected that, based on data for similar coastal areas of south-eastern Australia, there would be conservatively 150+ species found on the Peninsula. Database records include 12 moss taxa and three liverwort taxa with one of these being a moss introduced from Europe, *Pseudoscleropodium purum*.




5.3.1 Threatened Species

There are six plant species or sub-species on the Mornington Peninsula which are listed as threatened under the EPBC Act 1999 (DEPI 2014) (Appendix 3). These taxa are both nationally threatened and also have highly restricted areas of occupancy on the Peninsula, with some known from only a few historical records. Many areas of lowland vegetation including heathlands, scrubs and grassy woodlands may provide habitat for these threatened plants although their distribution is poorly understood for most part.

For example, Fringed Spider-orchid *Caladenia thysanochila* (Plate 13) was last known from a single location at Mount Eliza, not recorded since 1992 (Todd 2000) and is now regarded as extinct in Victoria (DEPI 2014). Conversely, Leafy Greenhood *Pterostylis cucullata* (Plate 13) is one of the better known threatened taxa on the Peninsula in terms of the extent of populations and habitat quality. All EPBC Act-listed taxa on the Peninsula are herbaceous plants which occupy the ground layer and five of these are orchid species. Clover Glycine *Glycine latrobeana* (Plate 13) is a small herb which occupies grassy vegetation and is threatened by land use changes.




An additional 38 taxa are considered rare or threatened at state level including nine that are listed as threatened under the FFG Act 1988 (DEPI 2014) (Appendix 3). Including those listed under the EPBC Act and FFG Act, there are 46 plant taxa in total which are considered either extinct (one), endangered (eight), vulnerable (six), rare (22) or poorly known (nine) within Victoria. Poorly known taxa are those which are suspected although not definitely known to be threatened within the state, with uncertainty generally due to lack of sufficient data on distribution e.g. Coast Stackhousia *Stackhousia spathulata* (Plate 13). A note on EPBC Act and FFG Act-listed taxa on the Peninsula is provided in the following.

Fringed Spider-orchid *Caladenia thysanochila*

 EPBC: Endangered  FFG Act-listed  State Advisory: Extinct




This species was known only from Coast Manna-gum *Eucalyptus viminalis* subsp. *pryoriana* woodland, to 15 m tall at Mount Eliza, predominantly from private property and occurring on at least one site documented for its rich orchid flora in a Peninsula context (Carr and McMahon 1988, Carr 1991). It is now presumed extinct in Victoria (DEPI 2014).

Frankston Spider-orchid *Caladenia robinsonii*

 EPBC: Endangered  FFG Act-listed  State Advisory: Extinct

Frankston Spider-orchid was described and previously known only from Frankston (Carr 1991). It has since been recorded on Mornington Peninsula at Rosebud where it is now thought to be confined (Jeanes and Backhouse 2006). Its habitat is included within Damp Sands Herb-rich Woodland (see Plate 1) and similar vegetation.

Purple Eyebright *Euphrasia collina* subsp. *muelleri*

 EPBC: Endangered  FFG Act-listed  State Advisory: Endangered

Recent (2014) observations of Purple Eyebright at Greens Bush (G. Walker pers. comm.) indicate there is a small population present and, in the absence of a suitable disturbance regime, it is very rarely observed and in critically low numbers. It is associated with a range of vegetation types and has been recorded in Mornington Peninsula National Park (Greens Bush), and at Purves Rd, Main Ridge.

Dense Leek-orchid *Prasophyllum spicatum*

 EPBC: Vulnerable  State Advisory: Endangered

This species is known from Stony Point where it was recorded as recently as 2008 (Duncan 2010, AVH 2015). On the peninsula, it is associated with heathland vegetation and dependant on disturbance by fire to promote flowering (Duncan 2010).

Leafy Greenhood *Pterostylis cucullata*

■ EPBC: Vulnerable ■ FFG Act-listed ■ State Advisory: Endangered

Leafy Greenhood (Plate 13) is recorded from a range of sites on calcareous sands, in Coastal Alkaline Scrub and Coastal Headland Scrub, from Rye to Cape Schanck. It occupies significant areas of vegetation on both private and public land, with ground vegetation that varies from densely grassy with a mix of native and introduced plants to sparse understorey vegetation with high cover of leaf litter.

Clover Glycine *Glycine latrobeana*

■ EPBC: Vulnerable ■ FFG Act-listed ■ State Advisory: Vulnerable

All records of Clover Glycine (Plate 13) on the Peninsula are more than 15 years old and distributed around the central Peninsula, on basalt and granodiorite derived soils (DELWP 2015b, Carter and Sutter 2010). The most recent are from the northern foothills area of Arthurs Seat State Park. Associated vegetation often has a grassy or herb-rich understorey and low to moderate canopy cover, although it may also occur in heathland (Carter and Sutter 2010, Scarlett and Parsons 1993).

Venus-hair Fern *Adiantum capillus-veneris*

■ FFG Act-listed ■ State Advisory: Endangered

Venus-hair Fern occurs on limestone in a sheltered gully along Main Creek, east of Cape Schanck (DELWP 2015b, Archer 1986). This is the only known occurrence of Venus-hair Fern on the Peninsula (DSE 2003). This species has both indigenous and introduced populations within Victoria, although the population on the southern Peninsula is regarded here as remnant.

Late Helmet-orchid *Corybas* sp. aff. *diemenicus* (Coastal)

■ FFG Act-listed ■ State Advisory: Endangered

This orchid species, closely related to *Corybas diemenicus*, is known from Point Nepean National Park, Mornington Peninsula National Park (near Fingal Beach and Greens Bush) and at Buckley Nature Reserve. Its habitat comprises Swamp Scrub or Riparian Scrub communities on peat, and it is often associated with the shrub canopy species Woolly Tea-tree *Leptospermum lanigerum* and Swamp Paperbark *Melaleuca ericifolia*.

Coast Helmet-orchid *Corybas despectans*

■ FFG Act-listed ■ State Advisory: Vulnerable

This species occurs within Mornington Peninsula National Park near Cape Schanck and Gunnamatta Beach as well as a few sites to the north at Tootgarook (DELWP 2015b, G. Walker unpub. data.). Its habitat comprises stable dunes on limestone, amongst Coastal Alkaline Scrub or similar vegetation.

Purple Diuris *Diuris punctata* var. *punctata*

■ FFG Act-listed ■ State Advisory: Vulnerable

Purple Diuris occurs in patches along an approximately 3.5 km section of linear reserve within Mornington (from Narambi Oval to Wooralla Drive) (J. Tetteroo pers. comm.). It occurs in Grassy Woodland and is seen flowering most often in open sites with a moderate cover of other ground flora including Kangaroo Grass (J. Yugovic pers. comm.).



Plate 13 Threatened flora recorded from the Mornington Peninsula (from left): Fringed Spider-orchid *Caladenia thysanochila*, now listed as extinct within Victoria and nationally endangered; Clover Glycine *Glycine latrobeana* listed as state and nationally vulnerable; Leafy Greenhood *Pterostylis cucullata* listed as state vulnerable and nationally endangered; Coast Stackhousia *Stackhousia spathulata* listed as poorly known within Victoria.

6 Waterways

Increased pressures from urbanisation and development have modified and degraded waterways on the Mornington Peninsula. The Index of Stream Condition provides an indication of waterway health for major rivers and streams across Victoria. Index of Stream Condition assesses five key aspects of waterway condition: Hydrology, Physical Form, Streamside Zone (vegetation and habitat), Water Quality and Aquatic Life (macroinvertebrates), along selected reaches. Data on each of these aspects is collected from a variety of sources, and used to generate sub-indices, which are then combined to provide an overall measure of environmental condition, with a score between 0 and 50. The scores correspond to one of four condition categories: Very Poor, Poor, Moderate, Good or Excellent.

The most recent Index of Stream Condition (DEPI 2010) assessed nine reaches along eight waterways within Mornington Peninsula Shire. The condition of these sites ranged from Very Poor to Good (Figure 5), which is in line with the overall condition of the Bunyip River Catchment, but much lower than the State average of 23% of river length assessed in good or excellent condition. Stream reaches assessed as being in Poor condition were Drum Drum Alloc Creek and Dunns Creek (see Figure 5). Watson's Creek, along with Upper Balcombe Creek, were assessed as Very Poor, although the lower (estuarine) reach of Upper Balcombe Creek is in Moderate condition. Only one waterway was assessed as being in Good condition – Manton Creek.

The overall condition of waterways assessed on the Peninsula was influenced by poor water quality and hydrology, consistent with the impacts of urbanisation and agriculture on waterway healthy; most waterways assessed within the Bunyip River catchment showed highly elevated phosphorous, salinity and turbidity levels (DEPI 2010). Several sites on the Peninsula also performed poorly against Hydrology and Aquatic Life indices; Watsons Creek is considered to have an extremely modified hydrological regime.

In contrast, good to excellent condition of Physical Form and Streamside Zone were achieved for all sites on the Peninsula, indicating that the quality and extent of riparian vegetation and habitat characteristics is high, and there are few or no physical modifications (e.g. fish barriers). Stony Creek was assessed as being in 'near-reference' condition (DEPI 2010).

For the reaches assessed, Drum Drum Alloc and Balcombe Creek have declined in condition since the second Index of Stream Condition (DSE 2005), while the condition of Manton Creek has improved (Figure 5).

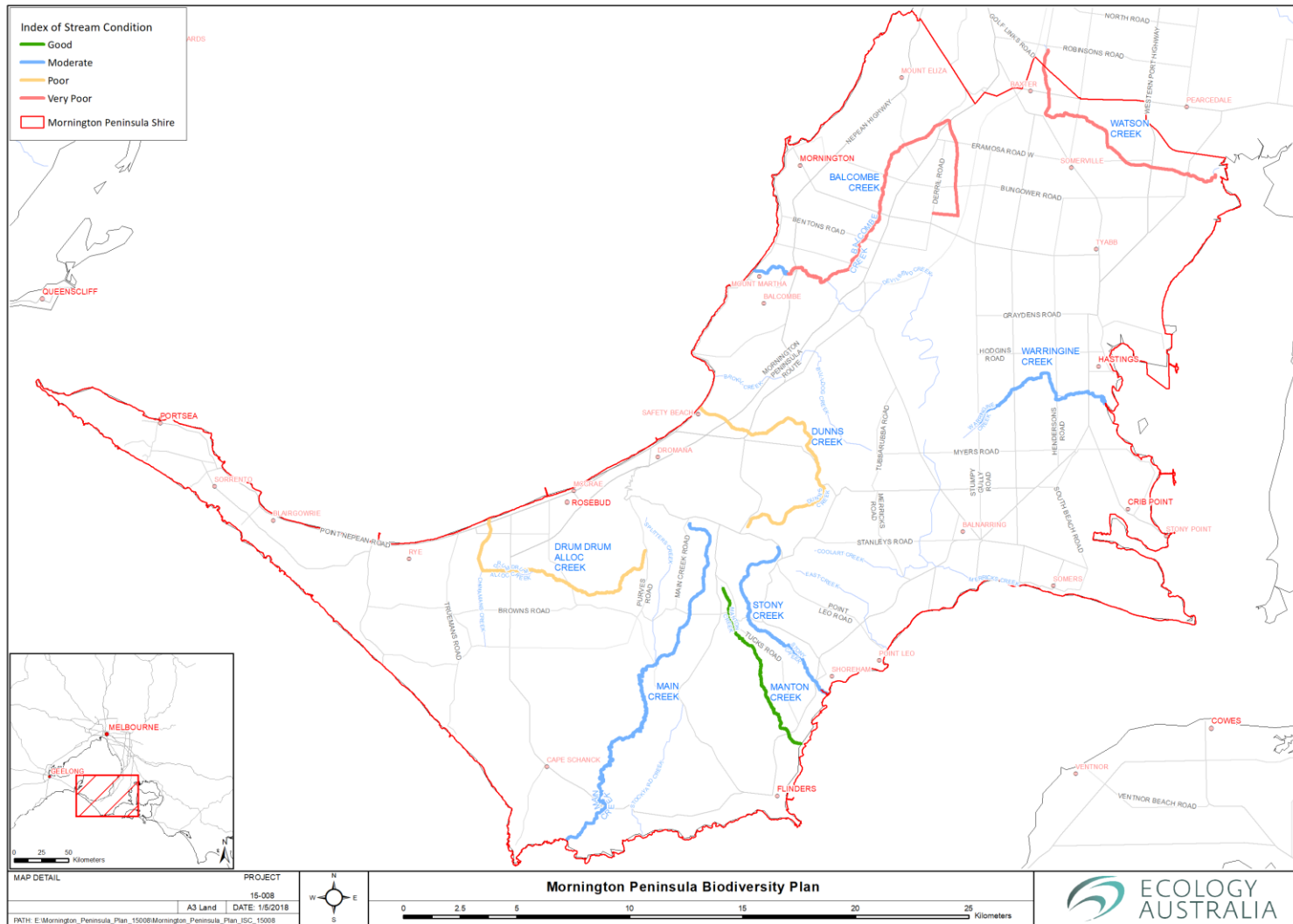


Figure 5 Index of Stream Condition for waterways within Mornington Peninsula Shire (DEPI 2010)

7 Fauna

A total of 437 vertebrate fauna species have been recorded for the Mornington Peninsula. This represents the total number of species recorded for the Mornington Peninsula Shire in state-wide databases, and records from the published and grey literature.

Extensive land clearance and the urbanisation of the Mornington Peninsula has led to an overall decline across all groups of fauna, which mirrors declines that have occurred across Victoria. At least ten species, most of which are birds, have become locally extinct from the Mornington Peninsula Shire, and 81 species are listed as threatened, either nationally or in Victoria (Table 3). There is potential that many more species may be close to extinction or may have already been lost from the Peninsula. A recent analysis of database records, to assess the likely persistence of fauna species in Greater Melbourne, estimated that c. 66% of vertebrate fauna on the Mornington Peninsula have a 75%, or greater, likelihood of being extant (ARCUE 2008). Of all fauna groups, amphibians were estimated to have the highest levels of persistence on the Mornington Peninsula, whilst the persistence of mammals on the Mornington Peninsula was one of the lowest of all areas assessed in the region (ARCUE 2008).

Those species which remain widespread on the Peninsula are those which are generalists, and have adapted relatively well to modified landscapes and urban development. These species often have broad habitat and dietary requirements, or a high reproductive capacity, and are able to exploit novel resources.

Table 3 Vertebrate fauna groups on the Mornington Peninsula

Fauna group	Total No. Species	Locally Extinct [^]	Threatened Species			Introduced (Exotic)
			EPBC Act-Listed	FFG Act-Listed	Advisory List	
Mammals (terrestrial)	49	2	2	1	0	13
Birds	315	8	17	18	35	14
Reptiles	25	0	0	1	3	0
Amphibians	11	0	1	0	1	0
Fish	37	0	1	1	0	8

Source: Data sourced from DELWP (2015b), Birdlife Australia (2015a)

[^] Locally extinct species include only those previously recorded for the Mornington Peninsula in databases

7.1 Mammals

There are records of 49 terrestrial mammals on the Mornington Peninsula, and 17 species of marine mammal, recorded in waters off the Mornington Peninsula, in Port Phillip and Western Port bays. Of the terrestrial mammals, records for three species (Red-necked Wallaby *Macropus rufogriseus*, Little Red Flying-fox *Pteropus scapulatus* and Little Broad-nosed Bat *Scotorepens greyii*) are outside of their distributional ranges, and the single record of a Platypus *Ornithorhynchus anatinus* is unverified – it is unlikely there are established populations on the Peninsula. Thirteen species are introduced to Australia (see Section 8.2.2).

The Mornington Peninsula's indigenous terrestrial mammals represent 67% of the species known from the Port Phillip and Western Port region, broadly reflecting the diversity of habitat types on the Peninsula. Most are now restricted to larger blocks of remnant vegetation in parks and reserves.

Mammals have undergone the largest declines in distribution and abundance of any fauna group in Australia since European settlement due to habitat loss and degradation, and introduced predators (Woinarski et al. 2014), with small, ground-dwelling mammals (including rodents, bandicoots, dasyurids) the most severely impacted (Burbidge and McKenzie 1989, Short and Smith 1994, Smith and Quin 1996). On the Peninsula, ground-dwelling species characteristic of heathy coastal habitats have suffered the greatest declines (e.g. White-footed Dunnart *Sminthopsis leucopus*).

At least two species previously recorded for the Mornington Peninsula have become extinct since European settlement; a further two species which potentially occurred on the Peninsula are likely to have disappeared prior to 1900, and two species between 1900 and 1949 (Menkhorst and Loyn 2011), which are not recorded in databases. The New Holland Mouse *Pseudomys novaehollandiae*, which was last recorded around Tyabb in the early 1970s, is considered to be a more recent extinction (Menkhorst and Loyn 2011, DOE 2015), and the Eastern Pygmy Possum *Cercartetus nanus* (Plate 14), which has not been recorded from the Peninsula since 1987, is now also regarded by some to no longer occur in the region (Menkhorst and Loyn 2011). A further four species are listed as threatened (Appendix 4); a brief note on these species is provided below.

Of the remaining non-threatened species, the majority are restricted in distribution and abundance, and are probably declining across the broader region; only 13 species are considered to be widespread (Menkhorst and Loyn 2011) (Figure 6). The large areas of rural land on the Peninsula, and remnant vegetation in parks and conservation reserves, have enabled some species which have been extirpated from more urbanised areas, to persist in pockets on the Peninsula. For example, two species of bandicoot still occur on the Peninsula: the threatened Southern Brown Bandicoot *Isodon obesulus obesulus* (Plate 14; see below), and Long-nosed Bandicoot *Perameles nasuta*, the latter with extant populations in Point Nepean and Mornington Peninsula National Parks.

Those species which are more common and widespread typically have general habitat requirements and are highly adaptable, capable of exploiting modified urban landscapes. For example, the small, insectivorous bats (microchiroptera) appear to be relatively resilient, with six species considered to be widespread and frequently recorded in suburban areas (Menkhorst and Loyn 2011). In contrast to many species which are declining, some species have also increased to the point where they cause nuisance, or are negatively impacting on other biodiversity values; namely the Common Brushtail Possum *Trichosurus vulpecula* and Common Ringtail Possum *Pseudocheirus peregrinus* (see Section 8.2.2).

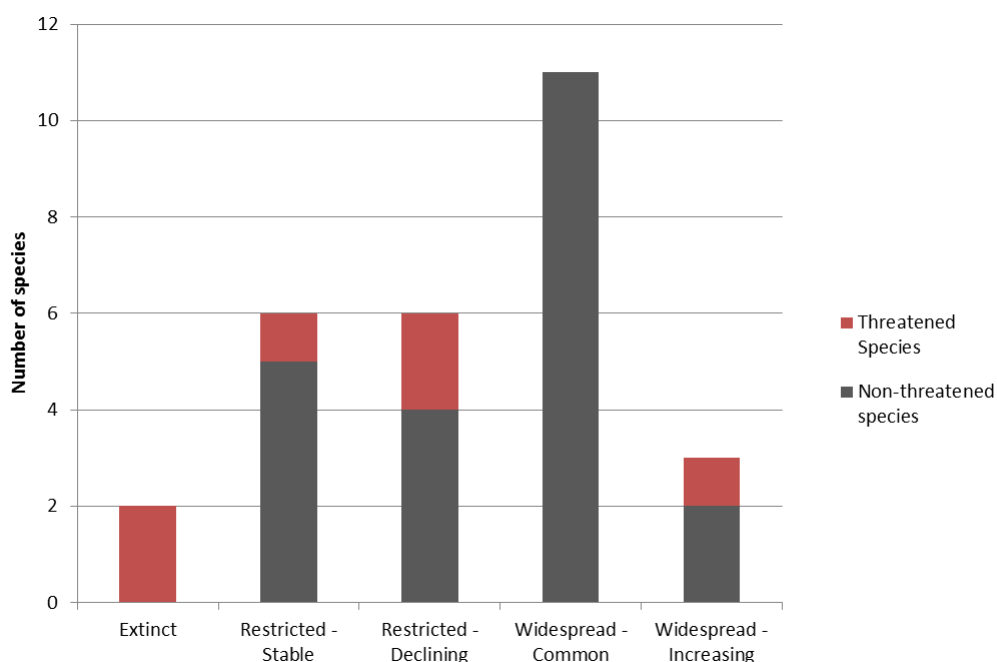


Figure 6 Status and trends of mammal species recorded for Mornington Peninsula Shire, based on analysis by Menkhorst and Loyn (2011)

Southern Brown Bandicoot *Isodon obesulus obesulus*

■ EPBC: Endangered
 ■ FFG Act-listed
 ■ State Advisory: Near Threatened

The Southern Brown Bandicoot occurs in a wide variety of vegetation types with low, dense cover, including Swamp Scrub, Heathy Woodland and Coastal Heathland, often on well-drained sandy soils (Braithwaite and Gullan 1978, Stoddart and Braithwaite 1979, Brown and Main 2010, DOE 2015). It appears to have been relatively common on the northern half of the Peninsula until the 1970s, where it was known from Baxter, Yaringa, Tyabb, Crib Point, Hastings, Arthur’s Seat and Mt Martha (Coates et al. 2008). However, habitat loss and introduced predators have led to serious declines in distribution and abundance across its range (DOE 2015). It is now known primarily from coastal vegetation between Somerville and Hastings which forms part of the broader population around Western Port; locations include the North Western Port Nature Conservation Reserve and immediately south of Western Port Coastal Reserve at BlueScope Steel (Legg 2010a, b). Evidence (i.e. diggings) has also been recorded in coastal habitat at Cribb Point and around the Tyabb Cemetery (S. Hand and D. Nicholls, pers. comm.) and at the Gordon Rolfe Reserve (Legg 2010b). It was widely considered to have become extinct from the southern Peninsula over the last few decades (Coates et al. 2008). However, a recent record (2015) was collected from private property at Red Hill (C. Russel, pers. comm.).

Grey-headed Flying-fox *Pteropus poliocephalus*

■ EPBC: Vulnerable
 ■ FFG Act-listed
 ■ State Advisory: Vulnerable

The Grey-headed Flying-fox has declined significantly in abundance across its range due habitat loss, persecution (e.g. at orchards) and extreme heat events (Westcott et al. 2015), but has increased in Greater Melbourne in recent decades. The establishment of a large, permanent camp in Melbourne (i.e. Yarra Bend Park) as recently as 1986, has been attributed to the ‘heat island’ effect generated by urban areas (Hamer and McDonnell 2010); although, research suggests that the distributional range of the

species may be more dynamic over longer timeframes than previously thought (Westcott et al. 2015). The species consumes the nectar and fruit from a wide range of plant species, including garden plantings, and is capable of flying long distances (20-50 km) to feed. It is now one of the most abundant mammal species across Greater Melbourne (Menkhorst and Loyn 2011). A small camp of 500-2499 individuals was recorded at HMAS Cerberus in 2014 (CSIRO 2014). However, very few camps are continuously occupied, and new camps are established and abandoned on a regular basis (Westcott et al. 2015).

White-footed Dunnart *Sminthopsis leucopus*

FFG Act-listed State Advisory: Near Threatened

This species occurs in coastal habitats, including relatively unstable coastal tussock grassland and sedgeland, as well as more stable, permanent scrubs, including wet heath, and forest or woodland with a dense heathy understorey (>50% cover) or mid-storey (Ahern 1983, Menkhorst 1995). Although, at Sandy Point, near Balnarring, it was captured almost solely on fore-dunes comprising of Marram Grass-Hairy Spinifex *Ammophila arenaria*- *Spinifex sericeus* (Ahern 1983, Menkhorst 1995). The White-footed Dunnart was recorded in a number of areas on the Peninsula throughout the 1970s and 80s, including Point Nepean, Boneo, Mornington Peninsula National Park, Foxeys Hangout, Tubbarubba Creek and HMAS Cerberus. More recent records are from Point Nepean and Mornington Peninsula National Parks and Tootgarook Swamp Bushland Reserve in 2006 (Legg 2006, Practical Ecology 2008, DELWP 2015b), although a recent survey of Tootgarook did not detect the species (Ecology Australia 2016a).

Common Bent-wing Bat *Miniopterus schreibersii* (Group)

FFG Act-listed State Advisory: Vulnerable

Three subspecies of the Common Bent-wing Bat are recognised in Australia, two of which occur in Victoria. Only the southern form, which occurs in western Victoria, *M. s. bassanii* is listed under the EPBC Act 1999; however, as a group, they are listed as threatened under the FFG Act 1988. Distribution of this species is determined by availability of suitable roost sites such as caves, mine shafts, buildings, storm water channels, aqueducts or tunnels. Bats forage for invertebrates, usually above the canopy of wet and dry sclerophyll forest; however, they also occur on the sparsely-treed Volcanic Plain (Menkhorst 1995, Churchill 1998). On the Peninsula, the coastal cliffs on the southern coastline are likely to provide the most suitable roosting habitat.



Plate 14 Eastern Pygmy Possum *Cercartetus nanus* (left), now considered locally extinct; EPBC Act-listed Southern Brown Bandicoot *Isoodon obesulus obesulus* (right)

7.2 Birds

There are 317 bird species recorded for the Mornington Peninsula Shire, including 14 species which are introduced (exotic). A total of 22 native species have been recorded well outside of their natural range: five of these species are likely to be aviary escapees (e.g. Major Mitchell Cockatoo *Lophocroa leadbeateri*, Diamond Dove *Geopelia cunata*), 11 species are vagrants; and records for five species are considered doubtful, possibly misidentified (e.g. Speckled Warbler *Chthonicola sagittatus*).

The composition of the bird fauna on the Mornington Peninsula reflects the broad habitat types and their relative extent on the Peninsula. The greatest diversity is seen in the forest and woodland birds (116 species), wetland birds (48 species), seabirds (47 species) and shorebirds (33 species). The overall dominance of waterbirds in the bird fauna (128 species) reflects the extent of shoreline and wetland habitats on the Peninsula. Other bird guilds on the Peninsula include raptors (17 species), marshbirds (5 species), heathland birds (3 species), grassland birds (8 species) and aerialists (2 species).

The second half of the 20th Century has seen serious declines in bird species on the Mornington Peninsula. Eight species have become locally extinct; they include seven species otherwise listed as threatened, and one non-threatened species, the Beautiful Firetail *Stagnopleura bella*. Three of these species have declined significantly throughout their former range and now have a highly restricted distribution, or are nearing extinction in Victoria. The King Quail *Coturnix chinensis victoriae* declined rapidly across Victoria between 1900 and 1970, and is now known only to occur on French Island, although occasional records are collected from elsewhere (O'Brien 2006, Loyn and Menkhurst 2011). The Ground Parrot *Pezoporus wallicus wallicus* occurred in coastal areas between Airey's Inlet and the Western Port until the early 1900s, but is now restricted to Gippsland, the Otway Ranges and far southwest Victoria (Higgins 1999). The Orange-bellied Parrot *Neophema chrysogaster*, historically recorded in Western Port, with occasional records on the Mornington Peninsula (e.g. Tyabb in 1987, Watson Inlet in 1977, and Boneo and Cape Schanck Road junction in 1983), has not been recorded for almost 30 years (DELWP 2015b). The total population has now declined to c. 50 birds, which frequent the Western Shoreline of Port Phillip Bay.

The remaining five species which are locally extinct, formerly occupied woodland, particularly Grassy Woodlands: Emu *Dromaius novaehollandiae*, Barking Owl *Ninox connivens*, Hooded Robin *Melanodryas cucullata cucullata*, Grey-crowned Babbler *Pomatostomus temporalis* and Beautiful Firetail. The extinction of the Grey-crowned Babbler is relatively recent. The Grey-crowned Babbler was moderately common and widespread on the Peninsula until c. 1950, but by 1997, the known population on the Peninsula was just 13 birds (Lockwood and Robinson 1997); it was last recorded in 2002.

Approximately one quarter of the extant bird species recorded for the Peninsula are listed as threatened or are classified as rare in Victoria (Figure 7). Of these, 17 species are listed as threatened under the EPBC Act 1999. A further 18 species are listed as threatened under the FFG Act 1988, and another 35 species are considered rare or threatened under the Victorian Advisory List (DSE 2013). The greatest numbers of threatened birds are now seen in waterbirds (seabirds, shorebirds and wetland birds), particularly shorebirds and wetland birds (Figure 7). Monitoring over the past 35 years has shown that there has been a general decline in shorebirds across Western Port (Hansen et al. 2011). The reasons may be changes in local environmental conditions, but are more likely to be due to loss of habitat at international staging grounds. Of the remaining bird species which do not have a formal conservation status, trends of decline are most apparent in woodland and forest birds (43 species) and waterbirds (13 species) (see Figure 7). A brief note on key species for the Peninsula is provided below.

Across all habitats, ground-dwelling species, or those that forage on or near the ground, appear to have suffered the largest declines, a trend which is also observed more widely (Recher and Lim 1990). These species are sensitive to habitat fragmentation and alteration. In particular, simplification of habitat, or alteration of the ground layer (e.g. overgrazing, loss of leaf litter) exposes these species to increased risk of predation, due to loss of ground cover, and diminishes the availability of food and nesting resources.

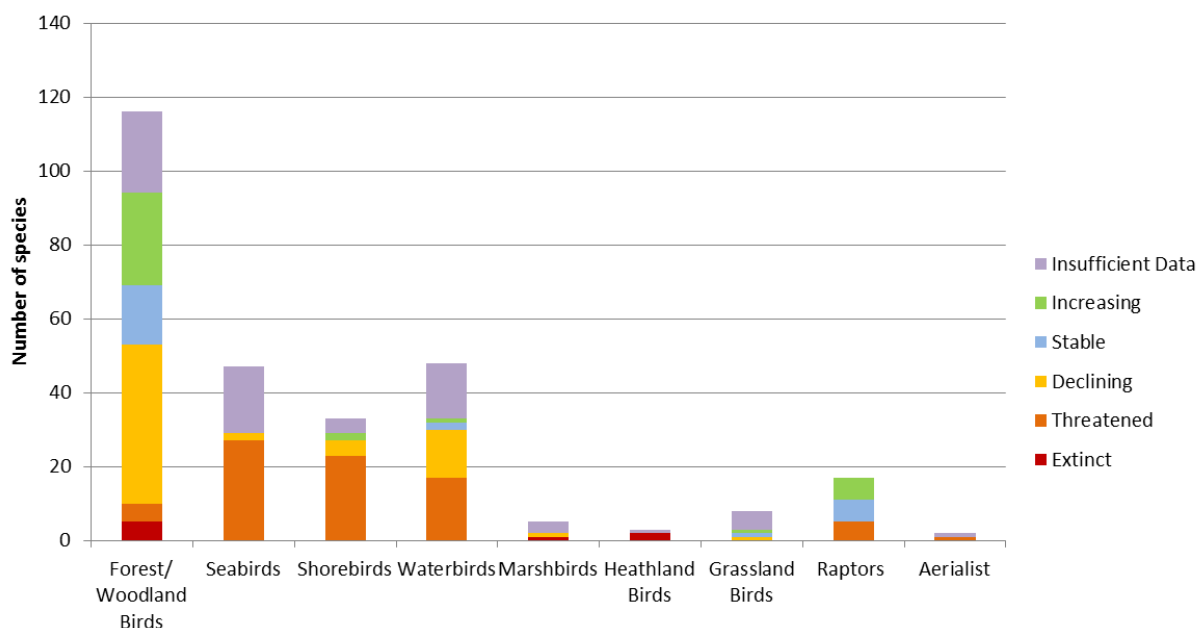


Figure 7 Status and long-term trends in bird species recorded for the Mornington Peninsula Shire, based on analysis of data taken from Birdlife (2015b) and Hansen et al. (2011)

Forest and Woodland Birds

Four species of forest and woodland bird, extant on the Mornington Peninsula, are rare or threatened (Figure 5). They include two EPBC Act-listed species, and two species with uncertain status on the Peninsula. A brief note on these species is provided below.

Swift Parrot *Lathamus discolor*

■ EPBC: Critically Endangered, Marine ■ FFG Act-listed ■ State Advisory: Endangered

The Swift Parrot is a migratory species, endemic to south-eastern Australia. It breeds only in Tasmania, in spring, and migrates to the mainland in autumn. On the mainland, Swift Parrots are semi-nomadic, dispersing widely to feed on winter-flowering eucalypts, psyllid lerps, seeds and fruits. In Victoria, they occur predominantly in box-ironbark forests north of the Great Divide, but also occur across southern Victoria, in response to flowering of Manna Gum, Swamp Gum, Yellow Gum, and flowering street trees (Higgins 1999, Webster et al. 2003). Loss of breeding habitat in Tasmania is considered to be a major cause of decline, along with nest predation by Sugar Gliders *Petaurus breviceps* (Heinsohn et al. 2015). However, the area of occupancy on the mainland has also declined significantly since European settlement; in Victoria, 83% of the principal wintering habitat (box-iron bark forest) has been cleared (TSSC 2016). On the Mornington Peninsula, Swift Parrots have been recorded at a number of locations, including The Briars, Iluka Camp at Shoreham and Balcombe Estate.

Powerful Owl *Ninox strenua*

FFG Act-listed State Advisory: Vulnerable

The Powerful Owl is Australia's largest owl, distributed throughout the forested coastal ranges of eastern Australia. The species is typically associated with contiguous tracts of mature eucalypt forests and woodland, where live hollow-bearing trees provide nesting sites, and arboreal prey items are abundant (Higgins 1999). However, they also occur in urban fringe environments that provide adequate structural diversity, a variety of roosting and nesting sites and prey populations (Cooke et al. 2006). Powerful Owls occupy large territories (>300ha) and naturally occur at low densities, although density is determined by the availability of nest trees and prey populations. Prey populations are generally not limiting in urban environments such as the Mornington Peninsula; rather, the availability of suitable nest trees is likely to be the greatest limiting factor (Cooke et al. 2006). Powerful Owls require large tree hollows for breeding; they generally nest within 100 m of permanent water, or near seasonal watercourses, and show extreme site fidelity (McNabb 1996, Silveira 1997, Higgins 1999). A survey program undertaken in 2013, to determine the distribution of Powerful Owls across the Mornington Peninsula, identified six pairs, six females and one male Powerful Owl, across 13 spatially independent sites between Moorooduc and Cape Schanck. A further three males and one pair were recorded incidentally at an additional four sites (MacHunter et al. 2013). Locations include Mornington Peninsula National Park, Arthur's Seat, Devilbend Reservoir and Main Ridge.

Spotted Quail-thrush *Cinclosoma punctatum*

State Advisory: Near Threatened

The Spotted Quail-thrush is a cryptic, ground-foraging bird, found in dry, open woodlands and sclerophyll forests with a sparse shrubby understorey and an open, grassy or rocky ground layer (Higgins and Peter 2002). The stronghold for this species is now largely confined to north-eastern Victoria, having disappeared or declined from many areas of its range, including the outer suburbs of Melbourne (Higgins and Peter 2002). On the Mornington Peninsula, there are historical records (early 1900s) from around Ballam Park and Tubba Rubba Creek, and more recent records from Point Nepean in 1986 (Higgins and Peter 2002) and Weerona Bay in 1990 (DELWP 2015b). The species is considered by some to be locally extinct, or very near extinction, on the Peninsula (R. Loyn, pers. comm.), but is very elusive and difficult to observe; the plumage is well camouflaged against leaf litter and the main call of this species is almost inaudible to human ears. It was last recorded on the Mornington Peninsula in Grassy Woodland at Point Nepean (Wilson's Folly) in 2006 (Practical Ecology 2008).

Azure Kingfisher *Alcedo azurea*

State Advisory: Near Threatened

The Azure Kingfisher (Plate 15) is one of the smallest kingfishers, often found perching on low overhanging branches along well-vegetated waterways, typically with still or slow-flowing water, and wetlands in riverine or swampy forest and woodland. In the 1970s and late 1980s it was recorded from Dromana and Sandy Point. The Azure Kingfisher is also considered by some to have become locally extinct on the Peninsula. However, it was recorded in 2008 at Yaringa Boat Harbour (DELWP 2015b).

Wetland Birds

Wetland birds on the Mornington Peninsula include waterfowl (ducks, geese, grebes, waterhens), large wading birds, crakes and rails. Important sites for waterbirds include Tootgarook Swamp, Devilbend and Bittern Reservoirs and Coolart Wetlands.

Australasian Bittern *Botaurus poiciloptilus*

■ EPBC: Endangered
 ■ FFG Act-listed
 ■ State Advisory: Endangered

This species occupies mainly terrestrial freshwater wetlands, though sometimes occurs in estuarine habitats. Permanent freshwater wetlands such as swamps, lakes, rivers and creeks, with dense aquatic vegetation, including rushes, reeds and sedges, over a muddy or peaty substrate are favoured (Emison et al. 1987, Marchant and Higgins 1990). The Australasian Bittern can also sometimes be found in rank, flooded pastures or ditches and drainage lines, yet a deep permanent wetland with rank vegetation is still required for breeding. Tootgarook Swamp is considered to be an important habitat for Australasian Bitterns on the Mornington Peninsula, providing reliable, seasonal habitat for the species (Purnell and Wilson 2015). Other locations include Chinaman's Creek, the Boggy Creek Wetlands and Devilbend Reservoir, and the North Western Port Nature Conservation Reserve.

Seabirds

Most species of seabird recorded for the Mornington Peninsula are pelagic seabirds (albatrosses, petrels, prions and shearwaters), which have been recorded off Cape Schanck, an important seabird site, or as beach-washed birds (A. Silcocks, pers. comm.). Seabird species which occur on inshore waters of the Mornington Peninsula include gulls, terns, skuas and cormorants.

Black-faced Cormorant *Phalacrocorax fuscescens*

■ EPBC: Marine
 ■ State Advisory: Near Threatened

The Black-faced Cormorant is the only cormorant species in Australia confined to inshore marine habitats. It is often found in mixed flocks in large bays, deep inlets, estuaries and rocky headlands, where it forages for fish and roosts on rocks, sandbanks and jetties. The Black-faced Cormorant generally breeds on rocky offshore islands, reefs, and cliff tops, with sparse or no vegetation, often in large colonies (Marchant and Higgins 1990). On the Mornington Peninsula, they are known to roost on rock stacks and artificial structures along the Port Phillip coastline between Moondah and Safety Beaches, and have also been recorded from Point Nepean, Mount Martha, Flinders and Cape Schanck (Birdlife Australia 2015a).

Shorebirds

Coastal environments on the Peninsula provide habitat for a diverse suite of shorebirds. Important shorebird habitats occur along the extensive intertidal mudflats of the Western Port coastline. Three of the most important include Long Island Point to Watsons Inlet, Hastings Bight and Hanns Inlet. These areas are considered to support primary foraging habitat for shorebirds (Hansen et al. 2011, DELWP 2015b, Figure 2). Both Hanns Inlet and Long Island Point are also key roosting sites (Hansen et al. 2011).

Hooded Plover *Thinornis rubricollis*

■ EPBC: Vulnerable, Marine
 ■ FFG Act-listed
 ■ State Advisory: Vulnerable

The Hooded Plover (Plate 15) is a beach-nesting shorebird that inhabits sandy ocean beaches along Australia's southern coastline. It shows a preference for broad and flat beaches, backed by recently formed, sparsely vegetated dunes, with a wide wave-wash zone for foraging and an abundance of washed up seaweed. They are generally absent from beaches without backing dunes or with bare, eroding or heavily vegetated dunes, and are scarce on steep beaches with a narrow wave-wash zone (Marchant and Higgins 1993). This species nests on the ground, in shallow depressions of bare sand, between the high tide line and the base of fore-dunes, and occasionally within the dunes (Marchant and

Higgins 1993). The Hooded Plover is extremely vulnerable to disturbance from humans and their dogs and cats, particularly when breeding (Weston and Elgar 2005, 2007). The Mornington Peninsula provides one of the most important habitats for the Hooded Plover in Australia, and supports the second highest concentration of the species; key sites include Gunnamatta Beach, Point Nepean National Park, and the beaches around Rye (including Rye Ocean Beach, Rye Back Beach and St Andrews Beach), and Portsea (Birdlife Australia 2015a).

Heathland Birds




Chestnut-rumped Heathwren *Calamanthus pyrrhopgius*

 FFG Act-listed  State Advisory: Vulnerable

Chestnut-rumped Heathwrens occupy dense heathlands or dense understorey or ground-layer vegetation, in woodlands and sclerophyll forests in the lowlands or foothills of south-eastern Australia (Emison et al. 1987, Higgins and Peter 2002). They were recorded at a number of locations on the Mornington Peninsula in the 1970s and 1980s, including Fingal (1979), Watson Inlet (1980) and Sandy Point (1986) (DELWP 2015b). The species is also considered by some to be extinct or nearing extinction on the Peninsula (R. Loyn, pers. comm.). However, it was more recently recorded on the Peninsula in 2004 (Antos and White 2004); in 2007 it was recorded from the Highfield Bunkhouse at Mornington Peninsula National Park and Main Creek, and in 2008 was recorded from Somerville (DELWP 2015b).

Raptors

White-bellied Sea-Eagle *Haliaeetus leucogaster*

 EPBC: Marine  FFG Act-listed  State Advisory: Vulnerable

The White-bellied Sea-Eagle primarily occupies coastal and near-coastal habitats, but is also regularly recorded on inland terrestrial wetlands, including freshwater lakes and swamps, and along major inland rivers. They prefer large open terrestrial wetlands with adjoining forest, particularly lakes, swamps, reservoirs and billabongs, but also use shallow freshwater swamps, meadows, deep channels, saltmarsh, salt pans, sewage ponds and ephemeral wetlands when filled after flooding (Marchant and Higgins 1993, Clunie 1994). White-bellied Sea-Eagles did not occur in Melbourne prior to 1970, but a number of pairs have established on large water storages in Melbourne. On the Mornington Peninsula, a resident pair has bred for many years at Devilbend Reservoir (Ecology Australia 2001, Loyn and Menkhorst 2011, DELWP 2015b). The species has also been recorded at Coolart, Mt Martha, Flinders, The Briars and at Tootgarook Swamp (Birdlife Australia 2015a).

Aerialists

White-throated Needletail *Hirundapus caudacutus*

 EPBC: Migratory, Marine  State Advisory: Vulnerable

The White-throated Needletail is a non-breeding migrant to eastern Australia, where it is an almost exclusively aerial species, recorded flying at up to >1000 m above ground, over a wide range of habitats. The species is most often recorded above wooded habitats, including open forest and rainforest (Coventry 1989, Tarburton 1993, Higgins 1999), but in coastal areas, is often recorded around cliffs, and other areas with prominent updraughts, such as ridges and sand dunes (Cooper 1971, Mitchell et al. 1996, DOE 2015). Birds usually feed in rising thermal currents (e.g. storm fronts), and often forage around updraughts (Mitchell et al. 1996), taking insects on the wing. They are known to roost in trees in forest or woodland, either amongst dense canopies or in hollows (DOE 2015).



Plate 15 Azure Kingfisher *Alcedo azurea* (left); EPBC Act-listed Hooded Plover *Thinornis rubricollis* (center); Hardhead *Aythya australis* (right), Vulnerable in Victoria.

7.3 Reptiles

A total of 29 terrestrial reptile species are known from the Mornington Peninsula Shire. Three species of sea turtle have also been recorded in waters off the Mornington Peninsula. The terrestrial reptiles include 21 species of lizard, seven species of snake, and one species of freshwater turtle. Of these, the skinks (Scincidae) are the best represented (15 species), reflecting their dominance in the Australian reptile fauna as the most diverse, widespread and species-rich family. Two species are regarded as non-indigenous to the area. The Marbled Gecko *Christinus marmoratus* is unlikely to have occurred naturally, most likely transported to the area in building materials and firewood; it is uncommon on the Peninsula (P. Robertson, pers. comm.). The Common Long-necked Turtle *Chelodina longicollis* has also been introduced to the region, but is now well-established on the Peninsula and greater Port Phillip and Western Port Region (Hamer and McDonnell 2010). The origins of the Red-bellied Black Snake *Pseudechis porphyriacus* on the Peninsula are also uncertain and it is probably uncommon (P. Robertson, pers. comm.).

Urban and agricultural development has resulted in serious declines and losses of reptile species across metropolitan and Greater Melbourne (Hamer and McDonnell 2010, Clemann 2015), resulting from wide-scale habitat loss, and the fragmentation and isolation of remnant vegetation. Based on the number and distribution of records, only three species are considered to remain relatively common and widespread on the Peninsula (see Figure 8). They include the Garden Skink *Lampropholis guichenoti*, Delicate Skink *L. delicata* and Weasel Skink *Saproscincus mustelinus*, which are common in urban and peri-urban areas (Hamer and McDonnell 2010). These are generalist species with broad habitat requirements that allow them to persist in fragmented and modified areas, including suburban gardens, or have a high reproductive capacity (Anderson and Burgin 2002, Prosser et al. 2006).

Species which have more specialised habitat requirements, depend on particular resources, or require larger areas, are more sensitive to urbanisation and have a lower likelihood of persistence. The Lace Goanna *Varanus varius* (Plate 16) has the largest home range of all reptile species; it has not only been lost from urban areas, but has declined across Victoria (Clemann 2015). Within the region, it is now mostly restricted to large conservation reserves in the ranges east of Melbourne (Hamer and McDonnell 2010). The status of this species on the Peninsula is uncertain, but is likely to be locally extinct.

The drainage of wetlands and loss of wet heathland and saltmarsh have also led to the decline of Swamp Skinks *Lissolepis coventryi* (Plate 16) and Glossy Grass Skinks *Pseudemoia rawlinsoni* (see Clemann 2015), which occupy remnants of these habitats on the Peninsula. These species are addressed below.

With increasing urbanisation, 11 species are considered to be restricted and declining on the Peninsula. For example, White’s Skink is probably secure in back-beach areas, but declining elsewhere on the Peninsula (P. Robertson, pers. comm.). Other species include the Southern Grass Skink *Pseudemoia entrecasteauxii*, Bougainville’s Skink *Lerista bougainvillii*, Eastern Small-eyed Snake *Rhinoplocephalus nigrescens*, White-lipped Snake *Drysdalia coronoides*, and the Common Blue-tongue Lizard *Tiliqua scincoides* (Figure 8). Six species are considered to be restricted but stable: Tree Dragon *Amphibolurus muricatus*, Eastern Three-lined Skink *Acritoscincus duperreyi*, Metallic Skink *Niveoscincus metallicus*, Eastern Brown Snake *Pseudonaja textilis*, Tiger Snake *Notechis scutatus* and Lowland Copperhead *Austrelaps superbus*.

Two species, the Little Whip Snake *Parasuta flagellum* (Plate 16) and Common Scaly-foot *Pygopus lepidopodus*, have naturally restricted distributions on the Peninsula. The Little Whip Snake, which is not recorded for the Peninsula in wildlife databases, is a grassland species known only from the dry slopes of Arthur’s Seat, and is likely to be declining (Wildlife Profiles 1999). The Common Scaly-foot is a legless lizard that mainly occurs in the mallee heathlands and woodlands of north-western Victoria, but four isolated populations occur in southern Victoria, including one on the Peninsula, where it has been recorded in low coastal heath/grassland complexes (Wildlife Profiles 1999, Wilson and Swan 2008). Historically known from Frankston (1933) and Bittern (1935), it was recorded in a number of areas from the late-1980s to early-1990s, including Mount Martha, Rye and Mount Eliza (Sunnyside Beach and Davey Point). The most recent record is from 2000 at Hawkers Beach, Mount Martha (DELWP 2015b, Wildlife Profiles 1999). It is not threatened on a state-wide basis, but on the Peninsula, is considered to be in danger of imminent extinction (P. Robertson, pers. comm.).

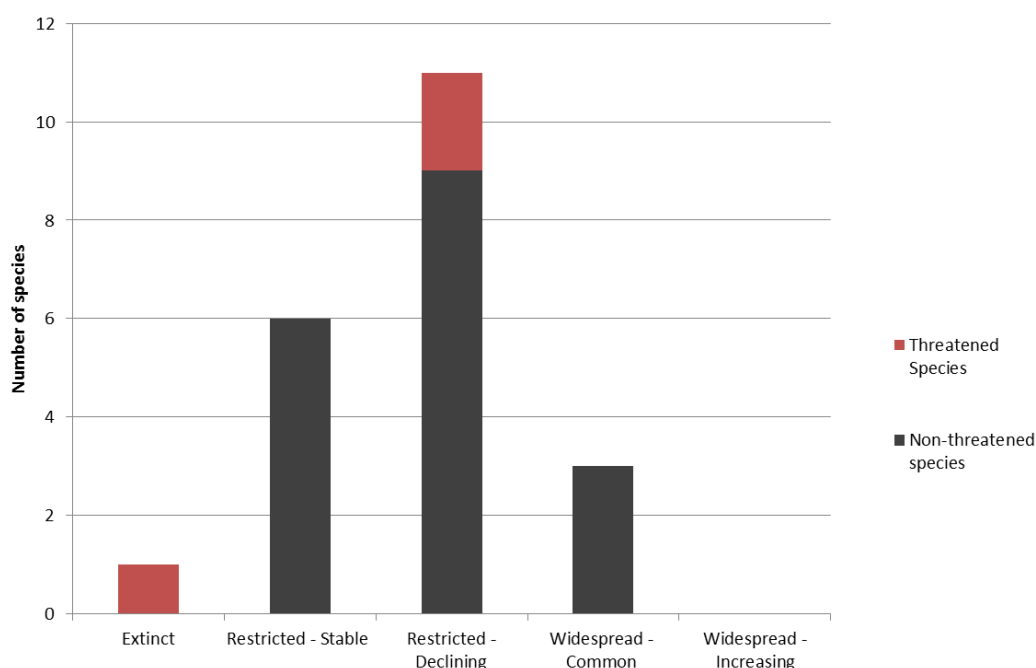


Figure 8 Status and long-term trends of reptile species recorded for the Mornington Peninsula

Lace Goanna *Varanus varius*

 FFG Act-listed  State Advisory: Vulnerable


The Lace Goanna (Plate 16) occupies open scrub, low open woodland, woodland, open forests, tall forest, box-ironbark forests, coastal forests, heathy forests and coastal shrubby forests (Wilson and Swan 2008). The status of this species has declined across Victoria over the past two decades, and it appears to be very rare, and possibly extinct, on the Mornington Peninsula. Wildlife databases contain only four records, dated from between 1932 and 1988. More recently, the species was also recorded on the western side of Devilbend Reservoir in 2000 (see Ecology Australia 2001, DSE 2004). If it still occurs on the Peninsula, larger forest/woodland patches with an abundance of hollow-bearing trees, such as that occurring at Devilbend Natural Features Reserve, Green's Bush and Arthurs Seat State Park, provide the most likely habitat (see Ecology Australia 2012).

Swamp Skink *Lissolepis coventryi*

 FFG Act-listed  State Advisory: Vulnerable

The Swamp Skink (Plate 16) is a cryptic species, most often associated with dense ground level vegetation at freshwater swamps and associated watercourses, or adjacent wet heaths, sedgeland and saltmarsh, especially those supporting Paperbarks (*Melaleuca* spp.) and Tea-trees (*Leptospermum* spp.). It has also been recorded in coastal heathland some distance from water (e.g. Clemann et al. 1998, Robertson 1998, Clemann and Beardsell 1999, Clemann 2000, 2006; Ecology Australia 2008). The Swamp Skink is well known from Tootgarook Swamp, where it is found at the margins of Paperbark thickets and adjacent *Gahnia trifida* sedgelands or other dense, low vegetation (Robertson 1998); the most recent records at Tootgarook Swamp are from 2014 (Ecology Australia 2014a). Swamp Skinks are also known from wet heath and swamp scrub vegetation along Chinaman's Creek, at Greens Bush (Lightwood Creek), Arthur's Seat (Waterfall Creek) and Mount Martha (Tassels Creek) (Robertson 1998). There are also recent records from Boundary Road, Dromana (2011) and Hastings (2010), and Warringine Park (2016) (Legg 2014, 2016; DELWP 2015b).

Glossy Grass Skink *Pseudomoia rawlinsoni*

 State Advisory: Vulnerable

The Glossy Grass Skink occupies dense vegetation, including saltmarshes, sedgeland and grasslands of swamps, lake edges and boggy creeks (Wilson and Swan 2008). The Glossy Grass Skink has most recently been recorded at Chinaman's Creek culvert, Rosebud West (2012) and The Briars, Mount Martha (2013; see Legg 2014). It is also known from the Dromana area, including Dromana Bushland Reserve, Boundary Road and Brassier Avenue Bushland Reserve (DELWP 2015b). Other locations include the headwaters of Lightwood Creek in Mornington Peninsula National Park (Legg 2008), Warringine Park and Hastings Coastal Reserve and Wetlands (DELWP 2015b).



Plate 16 Swamp Skink *Lissolepis coventryi* (left); Little Whip Snake *Parasuta flagellum* (center); Lace Goanna *Varanus varius* (right), considered to be locally extinct from the Mornington Peninsula

7.4 Amphibians

A total of 11 frog species are known for the Mornington Peninsula Shire. Most of these species have persisted relatively well within urban and peri-urban environments, and are common within the broader Port Phillip and Western Port Region; one species (Peron's Tree Frog *Litoria peronii*) is non-indigenous to the region (Hamer and McDonnell 2010), although it is now found across northern and eastern Melbourne, and has been recorded at five locations on the Peninsula (DELWP 2015b). Two species are threatened, and are likely to be declining, as they are in other parts of their range (see below).

A small number of frog species on the Peninsula have adapted well to modified, urban landscapes. Based on an analysis of records, the most common and widespread frog species on the Peninsula include the Common Froglet *Crinia signifera*, Southern Bullfrog *Limnodynastes dumerilli*, Spotted Marsh Frog *Limnodynastes tasmaniensis* and Southern Brown Tree Frog *Litoria ewingii* (Figure 9). These species are habitat generalists and capable of breeding in a broad range of wetland types, such as ponds, dams, swamps, creeks and pools, including degraded wetlands. Some species, such as the Common Froglet are opportunistic, and can utilize almost any available water, including flooded ditches.

Species on the Mornington Peninsula that occupy a narrower range of habitat types are more vulnerable to the impacts of urbanisation, including habitat loss, fragmentation and degradation. For example, the threatened Southern Toadlet *Pseudophryne semimarmorata* (Plate 17) is a terrestrial breeding species of forest and woodland habitats, that lays eggs in moist depressions which are later flooded, allowing tadpoles to develop in water. The life-history traits and habitats of this species are especially sensitive to changes associated with urbanisation, including the loss or simplification of habitat and alteration of drainage patterns (Hamer and McDonnell 2010).

Haswell's Froglet *Paracrinia haswelli* is an uncommon frog species that reaches the western limit of its distribution on Mornington Peninsula (Wildlife Profiles 1999, DSE 2004, DELWP 2015b). It prefers dense, wet, heathy habitat near waterbodies, such as swamps, ponds, dams and creeks, but may also occur in forest, woodland and shrubland near waterbodies (Wildlife Profiles 1999, Ecology Australia 2005a, Ecology Partners 2007). Most records of this species on the Peninsula are more than 20 years old (i.e. pre-1989); however, there is a more recent record from Arthurs Seat Road, Red Hill, from 2005. There are also unconfirmed records from Coolart Wetlands in 2002 and Boogoolum Wetlands (Ecology Partners 2007), near Greens Bush (Mornington Peninsula National Park), which is likely to be an important area for this species.

Three other non-threatened species have a restricted distribution on the Peninsula, and are considered to be declining (Figure 9): Victorian Smooth Froglet *Geocrinia victoriana*, Striped Marsh Frog *Limnodynastes peronii* and Verreaux’s (Whistling) Tree Frog *Litoria verreauxii verreauxii*. The Victorian Smooth Froglet and Striped Marsh Frog occupy a relatively narrow range of habitats, and Verreaux’s Tree Frog is possibly in decline due to Chytrid Fungus (P. Robertson, pers. comm.).

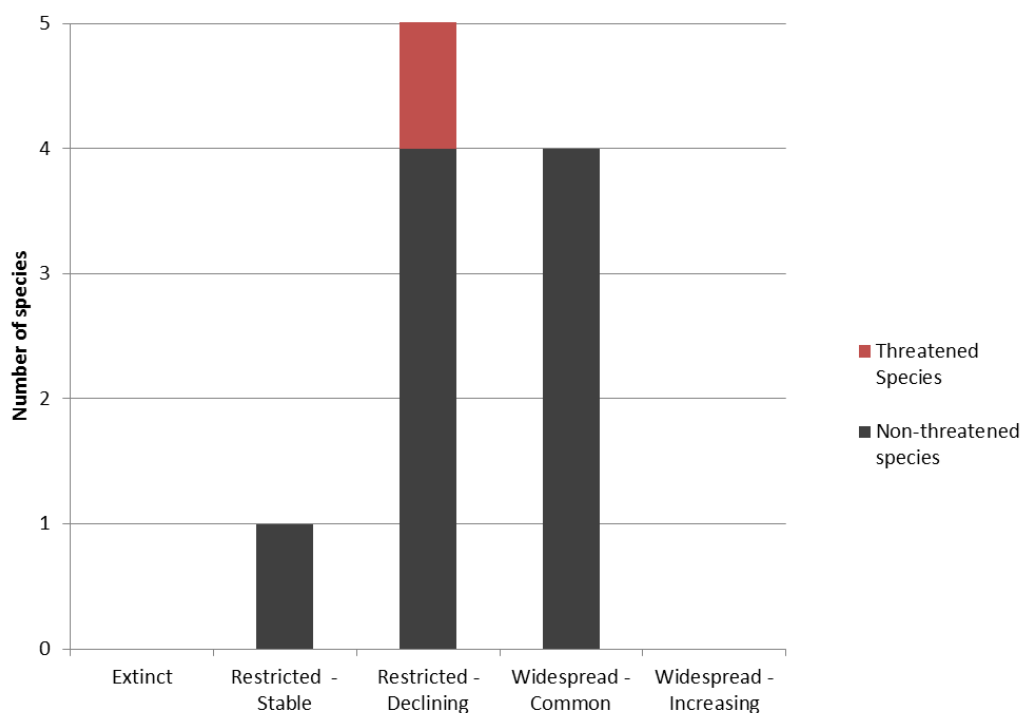


Figure 9 Status and long-term trends of amphibian species recorded for the Mornington Peninsula

Growling Grass Frog *Litoria raniformis*

■ EPBC: Vulnerable
 ■ FFG Act-listed
 ■ State Advisory: Endangered

The Growling Grass Frog (Plate 17) favours clusters of permanent or semi-permanent wetlands that support a high abundance of emergent, submergent and floating aquatic vegetation, and are in close proximity to one another, or well connected via waterways (Heard and Scroggie 2009, Heard et al. 2004, 2008, 2010, 2012a, 2012b, 2012c, 2013). The Growling Grass Frog was once widespread and common on the Mornington Peninsula (Wildlife Profiles 1999, Ecology Partners 2007), as it was across south-eastern Australia, but it has declined across much of its national range. Prior to 2000, the species was recorded at a number of locations, including: Shoreham; Moorooduc Quarry Flora and Fauna Reserve; The Briars, Mount Martha; Boneo; Balcombe; Yaringa and Merricks (DELWP 2015b). Records in from the past 15 years are from Coolart Wetlands (2002), Boneo Road, Flinders (2005), and from Homestead Creek at The Briars (2014) (Ecology Partners 2007, Legg 2014, DELWP 2015b).

Southern Toadlet *Pseudophryne semimarmorata*

State Advisory: Vulnerable

The Southern Toadlet (Plate 17) occupies sclerophyll forests, woodlands, shrublands, grasslands and heathlands, where it is found in moist microhabitats, such as in leaf litter and under logs, rocks and debris in moist soaks and depressions in. Toadlets burrow into the ground to approximately 5 cm in depth. Males call from the shallow burrow in low lying areas and usually near water. Eggs are spawned in the burrows under litter, in low-lying areas that will later be flooded. Tadpoles are aquatic, living in ponds, flooded grasslands and ditches (Anstis 2013). Records of Southern Toadlet collected from the Peninsula over the past 10 years are from Hillview Quarries Dromana Quarry (2004), Waterfall Gully at Arthurs Seat State Park (2005), Greens Bush/Mornington Peninsula National Park (2005, 2011 and 2013), at the headwaters of Lightwood Creek in Mornington Peninsula National Park (2008), and most recently at The Briars (2014) and Warringine Park (2016) (Ecology Australia 2005b, Legg 2008, 2014, 2016; DELWP 2015b). Many historic sites where the species was recorded prior to 2000 have since been developed (Ecology Partners 2008).



Plate 17 Southern Toadlet *Pseudophryne semimarmorata* (left); EPBC Act-listed Growling Grass Frog *Litoria raniformis* (right)

7.5 Fish

Fish species recorded for the Mornington Peninsula shire comprise 37 species. These include 26 indigenous species and eight exotic species. The Mornington Peninsula is outside the normal range for three of the native species that have been recorded; these records are likely to be of translocated individuals (Macquarie Perch *Macquaria australasica* and Murray Cod *Maccullochella peelii*), or erroneous (Flat-headed Galaxias *Galaxias rostratus*). Murray Cod and Macquarie Perch have not been recorded since 1970, and Flat-headed Galaxias was detected once in 1954 (DELWP 2015b). The persistence of any of these species on the Peninsula is considered highly unlikely. Records of the EPBC-Act-listed Australian Grayling *Prototroctes maraena*, none of which are more recent than 1900, are also considered to be erroneous records (T. Raadik, pers. comm.). The Bunyip River is considered an important location for Australian Grayling (DELWP 2015c), but all of the waterways within the Shire are small coastal waterways, that are isolated from the Bunyip River catchment. As a diadromous species, vagrant juveniles could potentially occur within the estuarine reaches of some of the waterways on the Mornington Peninsula, but it is unlikely that suitable habitat exists to support a resident population.

It is possible that additional fish species occur on the Mornington Peninsula, that are not recorded in databases. Conversely, it is also possible that some species may have been lost from the Peninsula, such as River Blackfish *Gadopsis marmoratus*. However, it is not possible to determine trends in the fish fauna from the current datasets, due to insufficient data and the varying methodological designs that have been used to survey fish over time (ARCUE 2008, Alluvium 2010, Robinson 2014). A review of Melbourne Water's fish monitoring data (including that for the Mornington Peninsula), recommended that at least some of the future fish monitoring should be aimed at 'random' sampling methodology which attempts to measure trends in fish populations.

The fish fauna recorded for the Mornington Peninsula include a combination of obligate freshwater fish, estuarine fish, shallow marine fish, and diadromous fish which migrate between fresh, brackish and saline waters. Most of the fish species recorded from freshwater habitats of the Mornington Peninsula are small-bodied native and exotic species, such as native Galaxiids and the invasive Eastern Gambusia *Gambusia holbrooki*. Large-bodied freshwater fish that are commonly found in the area include indigenous species such as Short-finned Eel *Anguilla australis* and Tupong *Pseudaphritis urvillii*, and exotic species such as Goldfish *Carassius auratus*, Brown Trout *Salmo trutta*, and Redfin *Perca fluviatilis*. Based on database records, common estuarine fish species in the area appear to be Small-mouthed Hardyhead *Atherinosoma microstoma*, Yellow-eye Mullet *Aldrichetta forsteri*, Black Bream *Acanthopagrus butcheri* and Tamar River Goby *Afurcagobius tamarensis*.

Obligate freshwater fish, such as the Southern Pygmy Perch *Nannoperca australis* and Dwarf Galaxias *Galaxiella pusilla* (Plate 18) have limited potential for dispersal outside of the Mornington Peninsula Shire as the waterways in the area are coastal catchments that are isolated from the Bunyip River system. Conversely, this also reduces the potential for species to recolonise post-extirpation (localised extinction). Some dispersal between low-lying catchments is possible during/post flood events (e.g. across the headwaters of the Balcombe and Watsons Creek catchments).

Two threatened fish species are known from the Mornington Peninsula Shire, including one species listed under the EPBC Act 1999 (Dwarf Galaxias), and one species listed as threatened under the FFG Act 1988 (Flatback Mangrovegoby *Mugiligobius platynotus*). A brief note on these species is given below.

Dwarf Galaxias *Galaxiella pusilla*



EPBC: Vulnerable



FFG Act-listed



State Advisory: Endangered

The preferred habitat of the Dwarf Galaxias (Plate 18) consists of still or slow flowing water, including shallow ephemeral or permanent freshwater habitats such as backwaters of creeks and streams, drainage lines, floodplains and swamps, where it is typically found around marginal and preferentially dense vegetation. They also appear to have the ability to survive extended periods without surface water in detritus and artificial burrow habitats (Coleman 2014). The Mornington Peninsula is considered to be one of the strongholds for the species in Victoria, with two areas that have been deemed to support important populations: the Balcombe Creek metapopulation, which includes Balcombe, Tuerong and Watsons Creeks; and the Devilbend Reservoir metapopulation, which includes Devilbend and Bittern Reservoirs (DELWP 2015d). It is recognised that appropriate hydrological conditions that regularly replenish ephemeral freshwater habitats are essential for the survival of the Dwarf Galaxias, and that the degree of wetland connectivity (e.g. via flood or high flow events) to a more permanent waterbody (such as river or creek) may also be vital to their long-term survival (particularly during extended dry conditions) (Saddler et al. 2010).

Flatback Mangrove Goby *Mugiligobius platynotus*

FFG Act-listed State Advisory: Vulnerable

The Flatback Mangrovegoby is the only threatened estuarine fish species in Victoria, and is restricted to Western Port. It inhabits estuarine waters associated with saltmarsh and mangroves, but can survive periods in freshwater. Individuals are typically found in the benthic or lowest region of the water column, with soft, silty substrates. The species can be locally abundant in association with appropriate micro-habitats (Raadik and Hindell 2008), with one record of 30 individuals from 2009 along the coast near Hastings (DELWP 2015b).



Plate 18 EPBC Act-listed Dwarf Galaxias *Galaxiella pusilla* (left); Devilbend Reservoir (right) which supports a metapopulation of Dwarf Galaxias

8 Biodiversity Threats

This section presents a discussion of the major threats to biodiversity operating on the Mornington Peninsula, identified from the published and unpublished literature, and consultation with community and industry stakeholders. Threats have been grouped into major categories based on standard classification systems (e.g. Salafsky et al. 2008), although a number are likely to have interactive effects.

8.1 Land Use Change and Development

Land use change and intensification are major drivers of environmental change. The Mornington Peninsula has seen several periods of major growth and development. The period from first European settlement in 1803 until the early 1900s saw the first period of development, and the most dramatic change. This was the era of pastoral leases and the exploitation of natural resources, including timber cutting and lime burning, which saw landscape scale change on the Peninsula. Significant development also occurred during the post-war years, particularly from the 1960s to the 1980s, as transport links to Melbourne improved, as well as between 1991 and 2011 (DataVic 2015). The large scale clearance of native vegetation on the Peninsula for agricultural land uses and urban development has not only led to the loss of extensive areas of native vegetation, but also habitat fragmentation, where the continuity of habitat is disrupted. The process of habitat fragmentation leaves small remnants of vegetation that are isolated and more prone to degradation. The Victorian Planning Scheme regulates land use changes through zoning, which identifies and limits permitted land uses. Growth on the Peninsula is expected to continue with Victoria's increasing population and the Port of Hastings expansion, which is likely to result in further land use change within the limits of current zoning.

8.1.1 Residential and Commercial Development

The settlement pattern on the Peninsula consists of over 40, more or less, separate townships ranging from the large urban centres of Mornington, Rosebud and Somerville, to smaller villages, such as Red Hill and Merricks. The Urban Growth Boundary extends along the Peninsula's Port Phillip coastline, from Mount Eliza to Portsea, and surrounds a number of major townships, including Flinders, Shoreham, Balnarring, Somers, Hastings, Tyabb and Somerville. While the Mornington Peninsula is not a designated Growth Area, it has experienced strong population growth over the past 20 years (DELWP 2016).

The Mornington Peninsula localised planning statement aims to limit major growth and prevent the expansion of Melbourne's metropolitan area onto the Peninsula. This is consistent with State Planning Policies, which recognise the environmental and landscape values of the Peninsula, and its role as an important area for recreation. However, the Peninsula retains reasonable capacity to accommodate future growth within established township boundaries (MPS 2013, DELWP 2016). Some development within the Green Wedge is also expected, with an estimated 830 vacant lots still available (noting that all dwellings within the Green Wedge require planning approval, with no more than one dwelling permitted on each lot), as of 2015. Within Green Wedge areas, approximately half of the remaining vacant lots are greater than 20 ha in area, whilst small lots (less than 4 ha in area) account for only 4% of the remaining vacant lots in the Green Wedge (Mornington Peninsula Shire, unpubl. data). Threats to biodiversity from residential development in the Green Wedge arise not only from the direct loss of remnant vegetation and fauna habitat, but also from changes in land use and management practices.

These include: reductions in open space; vegetation removal to provide or maintain views, or manage fire risk; and hydrological change as a result of increased hard surfaces and drainage for flood mitigation.

8.1.2 Industrial Development

Coastal land at Western Port, generally north of Hastings and adjacent to Crib Point, is a key industrial area for Victoria. The Port of Hastings is one of Victoria's four major commercial ports; it is the State's largest bulk liquid cargo port, and the port channel is the deepest (DELWP 2016). The port facilities have attracted three major industries; steelworks (BHP Western Port Steelworks); gas (Esso-BHP Gas Fractionation Plant); and petroleum (Whitemark Petrol Storage and Distribution Facility).

Land surrounding the Port of Hastings has been reserved for port related uses since the late 1960s, and is covered by Special Use Zone (Schedule 1) in the Mornington Peninsula Shire Planning Scheme (DELWP 2016). Major expansion of the Port of Hastings has been planned for the development of international container trade, to complement the Port of Melbourne, which is expected to reach capacity in the coming decade. The proposed Port expansion will also result in the development of major infrastructure across the Peninsula, including transport infrastructure (road and rail) to link the Port with local freight and logistics facilities. However, the future development of Victoria's port facilities is currently under review by Infrastructure Victoria, in the context of a recent decision by the State Government, to lease facilities at the Port of Melbourne.

8.1.3 Agriculture

Large areas of land on the Mornington Peninsula were cleared for agricultural land uses during early settlement. Like much of the Gippsland Plain Bioregion, the relatively flat topography and fertile soils, make the Peninsula highly suitable and productive farmland. While most of the Peninsula is considered suitable for grazing only (61%), a significant proportion is suitable for either intensive agriculture (21%) or for cropping and/or grazing on a rotational basis (16%). Land that is most suitable for intensive agriculture lies across the southern and central areas of the Peninsula (MPS 2010). Although agricultural industries on the Peninsula are long-established, viticulture, which currently only accounts for 1% of local agriculture production, is an intensive land use, which is becoming an increasingly important industry on the Peninsula (MPS 2010).

Approximately 77% of the crown land water frontage in cleared catchments, within Victoria, is managed by adjacent landowners under 9300 licenses; grazing of water frontages make up most of these licenses (VEAC 2016). Stock access to waterways is the primary cause of degradation of waterways and riparian vegetation along water frontages. Impacts include soil degradation and erosion, resulting in sedimentation of waterways, increased nutrient inputs and reduced water quality, and alteration of vegetation structure and diversity from grazing, trampling and weed invasion.

8.2 Invasive and Overabundant Species

Invasive species, including environmental weeds and pest animals, radically alter ecosystem composition and function and threaten the survival of native plants and animals. These can include exotic species, as well as native species which have established outside of their natural range, or have become invasive or overabundant.

8.2.1 Environmental Weeds

Environmental weeds are plants which have a negative environmental impact on biodiversity including native vegetation, waterways and marine environments. An environmental weed may be a species introduced from overseas or elsewhere in Australia, but may also be species of local origin which has recently spread or is proliferating in areas not considered part of its natural habitat.

Of the 369 non-indigenous and/or naturalised plant taxa on the Peninsula, there are 21 listed as noxious under the *Catchment and Land Protection Act 1994*; six which are regionally restricted, one which is regionally prohibited and 14 which are regionally controlled within the Port Phillip and Western Port catchment. These weeds are listed on the basis of risk to agricultural values and, along with many other taxa, present a risk to biodiversity values. The level of risk of environmental weeds to vegetation formations on the Peninsula has been assigned according to Carr et al. (1992), and has been used to provide context to the remainder of the state. Lowland Grassland and Grassy Woodland, Dry Forest and Woodland, and Riparian Vegetation are identified on the Peninsula as vegetation formations which are susceptible to invasion by the majority of weed taxa (Figure 10).

Some weed taxa have ambiguous origin or both localised indigenous and non-indigenous populations on the Peninsula. Coast Wattle *Acacia longifolia* var. *sophorae* and Coast Tea-tree *Leptospermum laevigatum* have become invasive on inland sites but are otherwise indigenous on near coastal dune systems (Carr 1993). The Victorian native tree species Sweet Pittosporum *Pittosporum undulatum* may become a high threat environmental weed in some vegetation types. Sweet Pittosporum is not regarded as native to the Mornington Peninsula. The 'Spread of *Pittosporum undulatum* in areas outside its natural distribution' is listed under the FFG Act 1988 (Section 10) as a threatening process. This recognises the potential environmental impact of Sweet Pittosporum across its climate envelope, including on the Mornington Peninsula.

Some taxa may be cosmopolitan rather than introductions to the Peninsula since European settlement. For example, Oval Purse *Hornungia procumens* and Sea Pearlwort *Sagina maritima* occupy geologically recent and/or near-coastal landforms in the southern and northern hemisphere, and are recorded locally in saltmarsh and other vegetation. Both of these species are regarded here as native to the Peninsula. Conversely there are taxa which are very recent introductions to the Peninsula and have great potential to become a more extensive environmental weed. Two-colour Cobra Lily *Chasmanthe bicolor* is a garden escape which is native to South Africa, and has recently been recorded at Red Hill and Cape Schanck. Also, numerous plants of False Baeckea *Astartea heteranthera* have been recorded from a shallow wetland at Baxter and are readily recruiting in this habitat type. Other recently recognised weed taxa occur and, for some, their risk to biodiversity is uncertain.

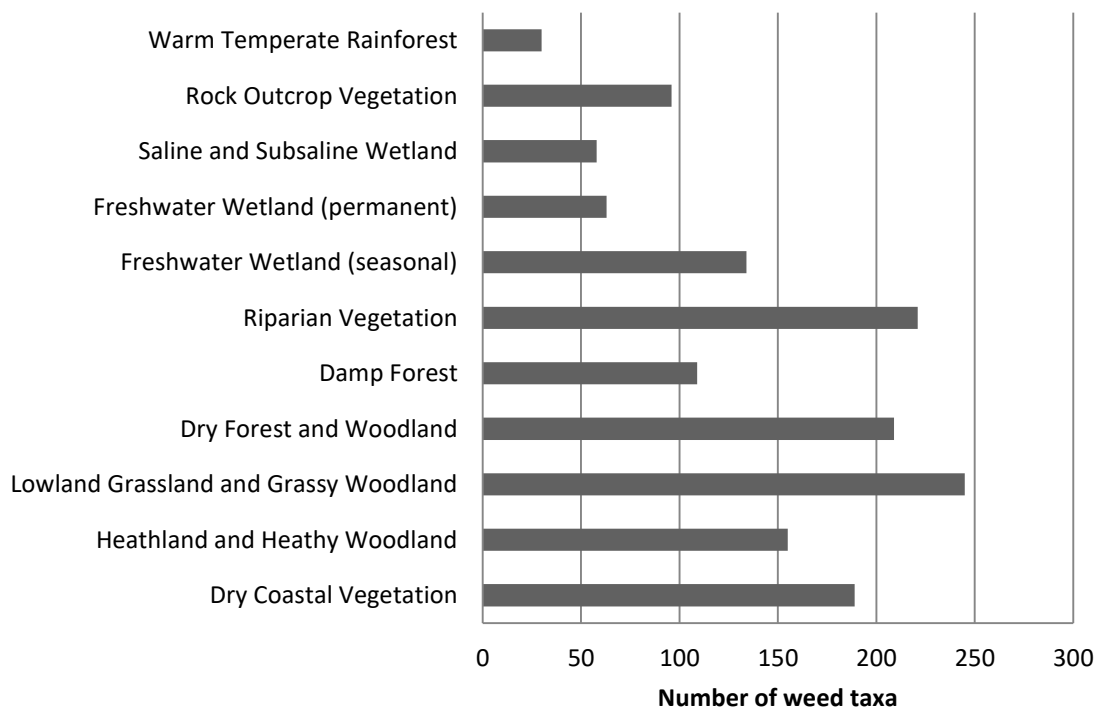


Figure 10 Weed taxa recorded for the Mornington Peninsula Shire which have invaded or have the potential to invade vegetation formations on the Peninsula. Ranking and vegetation formations adapted from Carr et al. (1992).

A risk rating has been applied to all weed taxa recorded on the Peninsula. The rating specifies risk to degradation of native vegetation and associated ecosystems caused by invasion of each weed. Approximately one third of all species on the peninsula have a high to very high risk rating (Figure 11). Species with a very high risk rating are given in Appendix 5. They include Italian Buckthorn *Rhamnus alaternus*, which has invaded large areas of Tootgarook Swamp Bushland Reserve, and Common Dipogon *Dipogon lignosus*, which has invaded large areas of Coast Banksia Woodland (Plate 19). Low risk weeds include ubiquitous or localised species that for one reason or another are less competitive with native species. This may be due to their limited capacity to disperse, low biomass or reduced capacity to invade areas with low disturbance. Examples of low risk weeds include Red Clover *Trifolium pratense*, Sheep Sorrel *Acetosella vulgaris* and Annual Meadow-grass *Poa annua*.

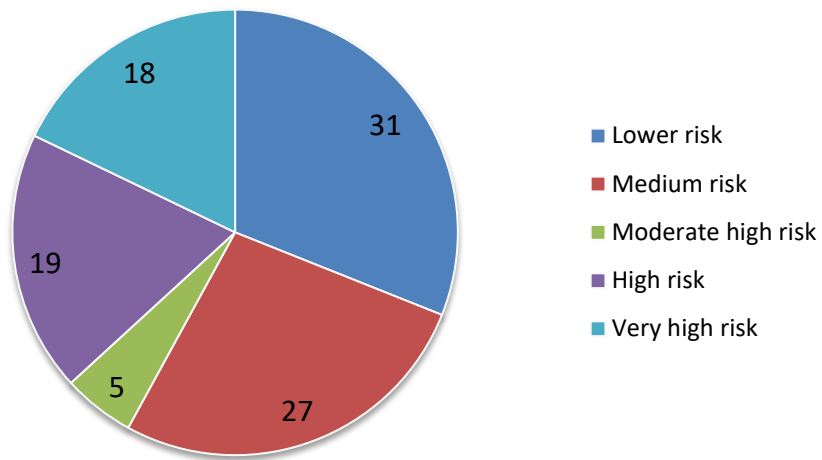


Figure 11 Weed risk rating: percentage of total number of taxa in each risk category.



Plate 19 Coast Banksia Woodland with Common Dipogon *Dipogon lignosus*, a 'very high risk' environmental weed on the Peninsula, in the understory

8.2.2 Pest Animals

A total of 35 vertebrate fauna species recorded for the Morningson Peninsula Shire have been introduced to Australia, comprising 13 mammal species, 14 bird species, and eight fish species. They include those species that are well-established and widespread on both a continental and state-wide scale (e.g. Red Fox *Vulpes vulpes* and European Rabbit *Oryctolagus cuniculus*), and those that are generally considered to have a more localised distribution within the region (e.g. Brown Rat *Rattus norvegicus* and Feral Goat *Capra hircus*).

Of all the exotic species, the most invasive, and those considered to have the greatest impact on native fauna and their habitats, are mammals. Five species and their impacts, all of which are mammals, are listed as *Key Threatening Processes* under the EPBC Act 1999. The FFG Act 1988 lists the impacts of one additional species as a *Potentially Threatening Process* (Sambar *Cervus unicolor*). Three of these species are common and widespread across the Peninsula (Red Fox, Feral Cat *Felis catus* and European Rabbit). Feral pigs *Sus scrofa*, feral goats *Capra hircus* and deer species (*Cervus unicolor* and *C. dama*) are likely to have restricted distributions on the Peninsula (see Table 4).

Two fish species recorded from the Shire are declared 'Noxious' under Section 75 of the *Fisheries Act 1995*: Carp *Cyprinus carpio* and Eastern Gambusia (see Table 4). Two additional exotic fish species, Brown Trout *Salmo trutta* and Redfin *Perca fluviatilis*, are large-bodied, predatory fish that are considered to have significant negative impacts on native species. Goldfish are frequently recorded in databases, and it is highly likely that competition for resources by both Carp and Goldfish is also negatively impacting native fish (Lintermans 2007).

Of the bird species, the Common Myna *Acridotheres tristis* is widespread throughout eastern Australia, and is most abundant in modified habitats where tree density is low. Common Mynas are widely believed to negatively impact native birds through territorial behaviour and competition for nesting cavities; however, perceived impacts are based on limited evidence (Lowe et al. 2011, Invasive Animals CRC 2014). Research shows that in association with habitat change, a high abundance of Common Mynas may impact some cavity-nesting and small bird species (Grarock et al. 2013, 2014), but there is no evidence of an associated decline in total species richness or abundance (Grarock et al. 2014).

One native fauna species is considered to be invasive. The FFG Act 1988 lists the 'Reduction in biodiversity resulting from Noisy Miner *Manorina melanocephala* populations in Victoria' as a *Potentially Threatening Process*, while the 'Aggressive exclusion of birds from potential woodland and forest habitat by over-abundant noisy miners (*Manorina melanocephala*)' is listed as a *Key Threatening Process* under the EPBC Act 1999 (Table 4). The Noisy Miner is a communal, aggressive species that displaces other native birds from vegetation remnants; small insectivorous birds are particularly vulnerable (see Grey and Clarke 2011). The overabundance of Noisy Miners is generally a symptom of habitat clearance and fragmentation.

A few native species are also considered by some sectors of the local community (see Ecology Australia 2016b) to be overabundant on parts of the Peninsula; they include the Eastern Grey Kangaroo *Macropus giganteus*, Common Ringtail Possum and Common Brushtail Possum. These species have no pest status and are protected under the *Wildlife Act 1975*, but are considered a nuisance in some areas because of grazing of crops or pasture, damage caused to garden plantings, or browsing of native vegetation. However, overabundance is a subjective term, generally used to describe populations which have increased to the point where they cause damage to other biodiversity values, or impact their own

health. The overabundance of populations of native species is generally a result of human-induced landscape change and alteration, which removes limiting factors or promotes population growth.

The Common Ringtail and Brushtail Possums are two of the most widespread and abundant species in Greater Melbourne. These species have adapted well to urban environments which provide an abundance of resources otherwise not available in natural unmodified habitats, including a wide variety of native and exotic plants and fruits found in parks and gardens and artificial nest sites. This can allow both species to reach high densities, in residential areas and urban reserves (Kerle 2001, Tyndale-Biscoe 2005, Harper et al. 2008). Browsing by locally overabundant Common Ringtail Possums is considered to be a major contributing factor in inducing severe tree decline in a number of locations around Mount Eliza (see Plate 20) and Mount Martha (Ecology Australia 2014b, Yugovic 2015).

There are numerous invertebrates which are regarded as environmental and agricultural pests, most of which are not considered here. Some species, such as the European Honeybee *Apis mellifera* are important agriculturally, but competition from feral honeybee colonies for floral resources or tree hollows may negatively impact biodiversity.

The most serious invasive invertebrate species for the Peninsula is the Argentine Ant *Linepithema humile*. The Argentine Ant displaces native ant species and other invertebrates, disrupts seed dispersal and indirectly affects vertebrates (DEH 2006a, Rowles and O’Dowd 2007). A super colony of nests was found to stretch at least 100 km across Melbourne to the Peninsula; Argentine Ants have been collected near Sorrento (Rowles and O’Dowd 2007).

Table 4 Pest animal species recorded from the Mornington Peninsula, listed under state or federal legislation

Species		EPBC Act	FFG Act	Fisheries Act	Local Distribution
European Red Fox	<i>Vulpes vulpes</i>	●	●		Widespread
Feral Cat	<i>Felis catus</i>	●	●		Widespread
European Rabbit	<i>Oryctolagus cuniculus</i>	●	●		Widespread
Feral Pig	<i>Sus scrofa</i>	●			Restricted
Feral Goat	<i>Capra hircus</i>	●	●		Restricted
Sambar	<i>Cervus unicolor</i>		●		Restricted
Carp	<i>Cyprinus carpio</i>			●	Restricted
Eastern Gambusia	<i>Gambusia holbrookii</i>			●	Widespread
Noisy Miner [^]	<i>Manorina melanocephala</i>	●	●		Widespread

[^] Native species



Plate 20 Evidence of possum browsing on eucalypts at Earimil Creek Reserve (2013)

8.2.3 Pathogens

Invasive pathogens have the potential to negatively impact many of Australia's native plants and animals, as well as agricultural crops. The pathogens of greatest concern on the Morningside Peninsula, and Australia, are Amphibian Chytrid Fungus and Cinnamon Fungus. Diseases caused by these organisms affect health, reproduction and survival of plants, animals and ecological communities; threatened species and communities with reduced and restricted populations are most at risk.

Amphibian Chytrid Fungus

Amphibian Chytrid Fungus infection (Chytridiomycosis) is the most severe disease of wild amphibians. It is a virulent, water-dispersed disease, caused by the fungus *Batrachochytrium dendrobatidis*, which infects the keratinised epidermal cells of amphibians (Heard et al. 2012a, 2014). The disease has the potential to cause 100% mortality in some populations. Wild amphibians are naturally at risk of exposure to infectious disease via contact with the environment, such as water, moist substrates and other amphibians. However, human-mediated contamination is a major risk factor in its spread.

The disease has been implicated in the decline of amphibian species world-wide (Tyler 1997, NSW NPWS 2001), and is listed as a *Key Threatening Process* under the EPBC Act 1999. In Australia, it has been found in all States and Territories and in a wide range of climates and habitats, at both high and low altitudes, and has been detected in 52% of threatened species (DEH 2006b). Some species appear to have a higher level of resistance, persisting as asymptomatic carriers; however, infection with Chytrid fungus presents a major risk to Growling Grass Frog populations on the Peninsula, although its local distribution and prevalence is unknown.

Cinnamon Fungus

Cinnamon Fungus *Phytophthora cinnamomi* is an introduced water mould that attacks the root system of susceptible plants. It is one of the world's most invasive species and Victoria's most significant plant pathogen. The disease has the potential to significantly alter ecosystem function by modifying and reducing the structure and composition of vegetation and reducing habitat quality and suitability for fauna species (DSE 2008). Coastal forest and heathland communities are the most susceptible to the disease, but the overall impact on vegetation also varies with the proportion and dominance of susceptible species and environmental conditions (DSE 2008).

The movement of contaminated plant or landscaping materials, soil and water are major pathways for the spread of *P. cinnamomi*, of which, humans are the main cause. In contaminated areas, human activities such as bushwalking, horse riding, and trail bike riding, and vehicles can easily spread the disease. The spread of *P. cinnamomi* is twice listed as a *Potentially Threatening Process* under the FFG Act 1988 (under two separate processes), and as a *Key Threatening Process* under the EPBC Act 1999. Cinnamon Fungus is present at a number of locations on the Mornington Peninsula, including at Greens Bush, Mornington Peninsula National Park, and local bushland reserves such as Lorikeet Reserve and Mt Eliza Regional Park (Smith et al. 2006).

Myrtle Rust

Myrtle Rust is a disease caused by the exotic fungus *Puccinia psidii* (formerly *Uredo rangeli*), which attacks soft, actively growing leaves, shoot tips and young stems, resulting in deformed leaves, defoliation, reduced reproduction, dieback and plant death (DOEE 2016). It has the potential to affect all plants in the family *Myrtaceae*, which includes bottlebrush (*Callistemon*), tea-tree (*Melaleuca*) and eucalypt (*Eucalyptus*, *Angophora*, *Corymbia*) species. Spores are wind-dispersed, and may also be spread easily through the movement of contaminated plant materials (such as nursery stock, cuttings or wood), equipment and clothing, or by animals that come into contact with spores (e.g. bees, birds or bats) (DOEE 2016).

Myrtle Rust has been detected at 80 sites around Victoria, mainly at production nurseries and wholesale outlets around metropolitan Melbourne, but also in public parks and gardens. On the Peninsula, incursions were recorded at Hastings, Moorooduc, Mornington, Mount Eliza and Somerville. These sites are considered no longer active, however, a number of sentinel sites have been established across the Peninsula (L. Minchinton, pers. comm.).

8.3 Transport and Utility Corridors

Road reserves generally form extensive networks across the urban and rural landscape, and often support secondary conservation values. Roadsides can support a significant proportion of the remnant vegetation in fragmented landscapes, and in some areas, make a significant contribution to ecological connectivity (VEAC 2016). On the Mornington Peninsula, road reserves support approximately 5% of remnant native vegetation on the Peninsula. Roadside vegetation clearance, for road widening or management purposes, therefore, has the potential to impact biodiversity values.

Where new road developments are proposed or widening is required, roads introduce other impacts. Habitat fragmentation and isolation is one the most significant impacts of road infrastructure. Where roads intersect remnant vegetation, they create new edges, leaving the smaller remaining patches with a higher perimeter to area ratio than larger patches. Consequently, these habitats suffer increased

effects of microclimates (e.g. wind, rain and heat), weed invasion, and noise (e.g. from vehicles) and other human disturbances (e.g. rubbish) around the edges. These 'edge effects' can effectively lead to the loss of key habitat elements or structural alteration, reducing habitat suitability for fauna or allowing the incursion of pest species or aggressive native species, such as the Noisy Miner. Roads which intersect fauna habitats can also create barriers or filters to the movement of fauna, which frequently leads to reduced long-term viability of habitat for fauna populations.

Where fauna species attempt to cross roads, road traffic is a major cause of mortality. Some species are more vulnerable to road mortality than others. For example, species which live in roadside vegetation or have a high rate of dispersal are more susceptible, as are species such as reptiles and amphibians, which are often attracted to roads. Random surveys of road-kill on the Mornington Peninsula, undertaken between 2007 and 2011, identified 32 species of bird, 17 mammal species, and seven reptile species (MPS 2015).

8.4 Human Disturbance

The Mornington Peninsula is one of Victoria's premier tourism destinations, and is often described as 'Melbourne's Playground', because of its popularity for nature-based recreation. The Mornington Peninsula National Park is Victoria's most-visited National Park, while Arthur's Seat is also popular. Other attractions include bayside and ocean beaches, golf courses, bushwalking, horse and bike riding and The Briars.

8.4.1 Active Recreation

Active (high-intensity recreation) includes activities such as horse-riding and trail-bike riding, which are popular pursuits on the Mornington Peninsula. Horse riding activities are generally focused around Moorooduc to Red Hill, Main Ridge and Boneo, while the central hills of the Mornington Peninsula are ideally suited to mountain bike riding.

The Mornington Peninsula contains an extensive network of mostly unmade, formal and informal trails for horse riding and mountain bike riding; many follow roads, although some pass through or around the boundaries of reserves.

Where riding trails pass through or around reserves, or along roadsides supporting significant remnant vegetation, these activities can lead to the degradation of natural values. The creation and use of new and existing trails can lead to soil disturbance and degradation, the spread of pathogens and weeds (from tyres or horse manure) and trampling of vegetation, leading to gradual widening of the trail over time.

Mornington Peninsula Shire has developed a number of strategies to guide the development and use of designated shared and single-use trails, to minimise the impacts riding trails, particularly informal trails. As part of this strategy, approximately 52 km of new trails have been proposed, to link existing trails (MPS 2014). They include four long-distance trails, including 'Peninsula Traverse' (primarily for mountain bike riding), 'Red Hill Trail', and the 'Great Sandy Ride' and 'Devilbend Equestrian Trail' (primarily for horse riding) (MPS 2014).

8.4.2 Passive Recreation

Passive (low-intensity) recreation includes activities such as bushwalking, camping and bird watching. The impacts of these activities, themselves, are generally considered to be low, although this depends on the extent that facilities are required; for example, the extensive formal and informal track network across Parks and reserves throughout the Peninsula contributes to the fragmentation of habitat. However, some activities are known to have a detrimental effect on biodiversity values in particular areas; the most notable of these being impacts on the breeding success of the EPBC Act-listed Hooded Plover.

The Hooded Plover is extremely vulnerable to disturbance from humans and their dogs, particularly when breeding (Weston and Elgar 2005, 2007). Human encounters, especially from dog walkers substantially decrease nest attendance and cause disturbance to chicks, more than any other source of disturbance (Weston and Elgar 2005, 2007). Consequently, the Mornington Peninsula National Park, despite supporting one of the highest concentrations of breeding adults, has one of the lowest breeding success rates in Australia. Restrictions on dog-walking (including prohibited and on-leash areas) have been in-force for a number of years, with mixed success. Dog walking is no longer allowed within Mornington Peninsula National Park as of November 2016, to provide greater protection for the Hooded Plover.

8.5 Pollution

There are numerous potential sources of pollution on the Peninsula, including urban and agricultural run-off, industrial wastes, and stormwater and sewage, which may impact waterway health, coastal areas and areas of native vegetation which receive run-off. The Mornington Peninsula faces key challenges with regard to sewerage and drainage infrastructure, particularly in relation to development in un-sewered areas. Despite these developments being approved with onsite wastewater treatment and disposal facilities, there is concern that un-sewered development is contributing to the pollution of waterways, groundwater and beaches, particularly on the Nepean Peninsula.

Dumping of rubbish and garden wastes in parks and reserves or other public land, is also a concern on the Peninsula. The dumping of garden wastes, in particular, poses a significant risk to remnant vegetation, with the potential to spread or introduce new weed species, which become known as garden escapes. The 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' is listed as a *Key Threatening Process* under the EPBC Act 1999. Many garden plants have the potential to become invasive and pose a high risk to native vegetation on the Peninsula. Garden escapes such as Two-cobra Lilly, have recently been recorded, with incursions at Red Hill and Cape Schanck.

8.6 Climate Change

Climate change will impact on biodiversity values in numerous ways, some of which are not yet fully understood; climate change will accentuate natural variability in the climate, leading to uncertainty regarding the full implications for biodiversity. Across Victoria, the climate will become warmer and drier. Around Greater Melbourne warming has increased since 1960, equivalent to 1.2 – 1.4°C on the Peninsula, while rainfall has decreased since 1950 (by up to 100 mm per year on the Peninsula). This trend is likely to continue, and will likely result in:

- Increased number of days of extreme heat and longer heat-waves

- Increased number of days of extreme fire danger
- Less spring and winter rainfall (south of the Divide)
- More frequent and intense downpours
- Fewer frosts
- Rising sea levels

These changes are likely to lead to:

- Increased frequency and intensity of wildfire (altered fire regimes)
- New and emerging environmental weeds and pest animals
- Altered phenology of flora and fauna
- Decreased stream flows and loss of ephemeral waterways
- Increased salinity of freshwater coastal wetlands
- Loss of coastal habitats from sea-level rise.

The most vulnerable habitats and species on the Peninsula are coastal, especially those with restricted distributions, or where the potential for inland migration with sea level rise is limited. These include beaches and primary and dunes, and coastal wetlands, which support nationally endangered species such as the Hooded Plover and migratory shorebirds. Inland streams and wetlands are also likely to be impacted from reduced catchment inflows, leading to decreased streamflow in waterways and decreased hydroperiod (the period of time a wetland holds water) in wetlands. Species which depend on these habitats include the nationally significant Dwarf Galaxias, as well as waterbirds such as the cryptic crakes and rails, and nationally significant Australasian Bittern.

8.7 Natural System Modification

8.7.1 Inappropriate disturbance regimes

Certain types of disturbance to vegetation are natural and an important process in a number of ecosystems on the Peninsula. Fire is an obligate driver for the recruitment of many plant species and is a key factor which determines vegetation composition, particularly in dry vegetation types. Most native plant species on the Peninsula have an evolutionary dependence on fire. The frequency and intensity of fire has different implications for different species. Some species do not tolerate long inter-fire periods while others are fire sensitive and can be destroyed by fire; even resulting in local extinction. The biggest threat with regard to disturbance caused by fire is the exclusion of fire in fire-dependant native vegetation due to conflicts with planning and residential / agricultural land use. Some species of orchid (e.g. *Prasophyllum spicatum* Dense leek-orchid) could become locally extinct if there is no fire within its habitat over a long period (several decades). Other natural disturbances include flooding (e.g. seasonal wetlands) and grazing by native mammals. Inappropriate fire, flooding, grazing and other disturbance regimes are a threat to biodiversity and require consideration in the management of biodiversity.

Other natural disturbances include altered hydrological regimes, such as flooding cycles of seasonal wetlands, modified drainage and increased or decreased flows to waterways and wetlands. Many waterways on the Mornington Peninsula suffer from altered hydrology, due to surrounding urban and agricultural development. Drainage schemes designed to mitigate flooding are often designed and implemented without consideration of ecological impacts. Pressures on natural systems from altered hydrological regimes are likely to increase with the impacts of climate change.

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10 Glossary

Benthic	The ecological area at the lowest level of the water column, including the sediment surface.
Biodiversity	The variety of all life-forms, plants, animals, fungi, protists (including algae) and bacteria, their encoded genes, and the ecosystems of which they form a part.
Bioregion	Defined geographical regions of Australia with similar climatic and geophysical characteristics and which generally contain a suite of distinct ecosystems and species.
Cosmopolitan	Of a plant or animal found all over the world.
Conservation status	Categorisation of the threat risk to biological assets (plant and animal species, EVCs or plant communities) at a defined scale (e.g. national, state), as determined by specific criteria.
Diadromous	Fish species which migrate between freshwater and the sea.
Ecological Vegetation Class (EVC)	A vegetation classification described through a combination of its floristic composition, life form and ecological characteristics, and its association with particular environmental attributes. EVCs may include one or more floristic communities that occur across a biogeographic range, and have similar habitat and ecological processes operating.
Epidermal	Relating to the epidermis; the outer layer of skin.
Environmental Weed	Plants that invade native ecosystems and adversely affect the survival of indigenous flora and fauna.
Exotic	Plants, animals, fungi and other organisms that have been introduced (deliberately or accidentally) to Australia or a given area after European settlement.
Exotic Vegetation	Vegetation comprised wholly or substantially of exotic species.
Floristic	Of or pertaining to plant species, i.e. flora.
Green Wedge	A non-urban area of Melbourne which lies outside of the Urban Growth Boundary. There are 12 Green Wedges which surround the Melbourne metropolitan area.
Horst	A raised block of the earth's crust that has lifted, or remained stationary, while land to either side has subsided.
Indigenous	Plant and animal species found naturally in an area prior to European settlement.
Indigenous Vegetation	Vegetation native to Australia or native to a specific geographic region.
Introduced	Deliberately or accidentally brought to Australia or part of Australia, usually by human agency.
Invasive Species	A species that is non-native to an ecosystem (i.e. occurs beyond its natural distribution), and which has a tendency to spread and cause environmental damage. Not all non-native species may be considered invasive.
Keratinised	Containing keratin, a structural protein that protects cells; occurring in skin cells of adult frogs and in the mouth parts of tadpoles
Life form	An abbreviated description of the habit, growth form and longevity of a plant species (e.g. tree, shrub, vine, annual, submerged aquatic).

Native Vegetation	Species occurring naturally in Australia as part of the pre-European flora or fauna.
Overabundant	Relating to populations of species which have increased in density or abundance to a level that is negatively impacting the environment, including plant and animal species and communities, or is negatively impacting the health of the population itself.
Pathogen	A disease-causing micro-organism.
Pelagic	Relating to the open seas or oceans.
Naturalised	Species introduced to an area following European occupation, which have sustained populations with the capacity for ongoing recruitment and spread.
Species abundance	The number of individuals in the population of a species.
Species richness	The number of different species in an ecosystem or community.
Vegetation Community	Term for interacting plant populations forming vegetation. A vegetation community in formal classifications may have characteristic plant species composition and structure.
Virulent	A pathogen that is highly infective and/or characterised by causing the rapid onset of disease that is severe in its effect.

Appendix 1 Methods for Biodiversity Review

Review of Information

The preparation of this technical document and associated plan involved the review and summary of data from a range of sources. The sources of information are summarised below.

Data Type	Description
Biodiversity Information Databases	All flora and fauna records within the municipality held in the Victorian Biodiversity Atlas: VBA_FAUNA100, VBA_FAUNA25, VBA_FLORA100, VBA_FLORA25 (DEPI 2015b). Bird distribution records from the BirdLife Australia database (Birdlife 2015a). Aquatic fauna records within the municipality held in the Melbourne Water fish database (Melbourne Water 2015). Atlas of Living Australia (fungi and lichens). Mornington Peninsula Shire Fauna Atlas Parks Victoria Database
Native Vegetation and Biodiversity Models	Ecological Vegetation Class modelling (NV_2005, NV_1750) (DEPI 2015a) The Victorian Saltmarsh Study (VSSG 2011) Sinclair et al. (2006) 1:10,000 Ecological Vegetation Class mapping
Flora and Fauna Assessment/Survey Reports	See References (Section 9)
Community Online Survey	Results from general public ranked responses to biodiversity issues.
Community and Industry Stakeholder Workshops	Results from three community workshops held at Mornington Peninsula Shire Offices
Mornington Peninsula Shire	Discussions with Natural Systems Team
Meetings with Experts	Discussion with key experts on specific matters e.g. threatened species distributions.

Curation of Species Information

Records of flora and fauna from the Victorian Biodiversity Atlas and recent ecological survey data were compiled and then curated to produce a list of plant and animal taxa for the Mornington Peninsula Shire. The objective of this process was to remove dubious or taxonomically redundant records. Particular consideration was given to the chronology and complexity of taxonomy for some records; as was the source of data, likely origin of the material attributed to records, opportunities for misidentification by the recorder and opportunities for operator errors in database entries. Subsequently, the number of taxa recorded from databases was reduced, while some taxa were added where they are known from the Mornington Peninsula Shire, but not previously recorded in databases or other information. The final list includes vascular and non-vascular plants, and terrestrial and aquatic vertebrates. Nomenclature follows the Victorian Biodiversity Atlas.

Determination of Species and Community Conservation Status

Species or communities which are nationally significant are determined according to their listing as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Species or communities are nominated for listing and, if compliant, are then referred to the Threatened Species Scientific Committee for consideration. Draft conservation and listing advice are presented for public comment after which time the taxon is assessed for its eligibility for listing as 'threatened' by the committee. The decision of listing is then made by the Minister. Threatened taxa may be listed as either extinct, extinct in the wild, critically endangered, endangered, vulnerable or conservation dependent (DOE 2015).

Species or communities which are state significant are determined according to their listing under the *Flora and Fauna Guarantee Act 1988* (FFG Act) or, where relevant, the Advisory List of Rare or Threatened Plants in Victoria – 2014 (DEPI 2014) and the Advisory List of Threatened Fauna in Victoria (DSE 2013). Species or communities are nominated for listing under the FFG Act according to specific listing criteria within the Flora and Fauna Guarantee Regulations 2011; broadly describing demonstrated likelihood of extinction. The Scientific Advisory Committee provides advice to the Minister and recommendations on the listing of species and communities. Advisory-listed species (DEPI 2014, DSE 2013) are assessed against International Union for Conservation of Nature (IUCN) Red List criteria for fauna and separate criteria for flora, to determine whether species are extinct, threatened or near threatened/rare within the state. Advisory listing assists widely with conservation planning in Victoria. Advisory-listed taxa also have consideration in statutory planning, limited by reference to the lists in the Victorian Planning Provisions incorporated document Permitted Clearing of Native Vegetation – Biodiversity Assessment Guidelines (DEPI 2013).

Assessment of Species and Community Status and Trends on the Mornington Peninsula

The local (Mornington Peninsula Shire) status of plant and animal taxa, and long-term trends, were determined with reference to database records for each species, population trends within the greater Port Phillip and Western Port region, and using data from monitoring programs, where available.

An assessment was made firstly as to whether a taxon was most likely to be extinct within the Mornington Peninsula Shire area. Extinct taxa may be those which have not been recorded for more than 30 years or are known only from a site which has since been cleared of habitat, in consultation with species experts. Where there was no evidence to otherwise support the local persistence of wild population, a taxon was determined as locally extinct.

Remaining taxa were then assessed to determine their status within the local context. Where available, this assessment was from analyses of large, long-term data sets for the region. The local status and trends for mammal species on the Peninsula was assessed with reference to Menkhorst and Loyn (2011), who assessed long-term data for the Port Phillip and Western Port Region from the Victorian Biodiversity Atlas. The status of bird species on the Peninsula were taken from Hansen et al. (2011) and the latest 'State of Australia's Birds' (Birdlife Australia 2015b), both of which have analysed extensive dataset from long-term monitoring programs in the region. Analyses of status and trends in reptiles and amphibians was made with reference to the number, location and age of records for the Mornington Peninsula Shire from state-wide databases and the Mornington Peninsula Shire Fauna Atlas, local knowledge and information taken from unpublished survey reports.

Species were assigned to one of five categories: Extinct, Restricted and Declining, Restricted and Stable, Widespread and Common, Widespread and Increasing.

Risk Assessment of Environmental Weeds

At a municipal level, each weed species was rated within five categories (Lower Risk, Moderate Risk, Moderate to High Risk, High Risk and Very High Risk), based on their risk to native vegetation communities on the Peninsula (Appendix 5). This analysis will enable those weeds with moderate risk or higher to be prioritised for weed management or monitored. Risk ratings were determined with reference to Carr et al. (1992).

Vegetation Mapping

Ecological Vegetation Class (EVC) maps were produced using 2005 modelled EVC extent (NV_2005), except for where more detailed on-ground mapping was available for the Victorian Saltmarsh Study (VSSG 2011), Sinclair et al. (2006). All mapping data are applied to GDA94.

Limitations

The technical document intentionally does not include an assessment of strictly marine biota. A number of marine species also occupy estuarine habitats and/or land; however, this study is limited to those that predominantly occupy land, freshwater, or intertidal and estuarine environments. Similarly, the assessment does not consider invertebrate species, for which little is known. Almost all species information in databases comprises vascular plants and vertebrates. Other species groups are grossly under-surveyed and therefore contribute little to the development of the strategy.

Species records are limited by a number of factors. These include misidentifications, taxonomic limitations, age of records, spatial error in records, database entry errors and surveyor bias. These limitations were considered during the curation of species lists. In many instances, species data are entered into the Victorian Biodiversity Atlas as a defined area list, often using property boundaries to define the area. As such, the distribution of species as surveyed within the property is not represented in the Victorian Biodiversity Atlas data.

Biodiversity values may be under-represented on private land. Some areas of private land are inaccessible due to infrastructure security or other reasons. There are areas within the Mornington Peninsula Shire where biodiversity values are predicted although few records exist from these areas in ecological assessment or databases.

Maps of Ecological Vegetation Classes (EVC) by State of Victoria are constructed by modelling (NV_1750 and NV_2005), and are as such, an estimate of the quantity and distribution of each EVC within the municipality. The accuracy of mapping is determined by model performance and errors in the model. Areas outside of saltmarsh mapping by the Victorian Saltmarsh Study (VSSG 2011) should be used as a guide for planning purposes and development of the biodiversity strategy. Other detailed mapping has been commissioned by Mornington Peninsula Shire (Sinclair et al. 2006).

Appendix 2 Ecological Vegetation Classes, mosaics, complexes and aggregates within Mornington Peninsula Shire

Vegetation	Number	Total Area (ha)
Forests and woodlands		
Coast Banksia Woodland	2	682
Coast Banksia Woodland/Coastal Dune Scrub Mosaic	921	0.2
Coast Banksia Woodland/Swamp Scrub Mosaic	904	8.9
Creekline Herb-rich Woodland	164	26.4
Damp Forest	29	220.5
Damp Heathy Woodland	793	660.7
Damp Sands Herb-rich Woodland	3	2195
Damp Sands Herb-rich Woodland/Swamp Scrub Complex	878	5
Granitic Hills Woodlands	72	50
Grassy Woodland	175	3591
Gully Woodland	902	316
Heathy Woodland	48	426
Herb-rich Foothill Forest	23	2432
Lowland Forest	16	3211
Plains Grassy Woodland	55	59
Plains Swampy Woodland	651	1.6
Riparian Forest	18	42
Swampy Riparian Complex	126	33
Swampy Riparian Woodland	83	965
Swampy Woodland	937	100
Warm Temperate Rainforest	32	2.2
Total		15027.5
Heathlands and Scrubs		
Berm Grassy Shrubland	311	0.3
Coastal Alkaline Scrub	858	2927
Coastal Dune Scrub	160	48
Coastal Dune Scrub/Coastal Dune Grassland Mosaic	1	103
Coastal Headland Scrub	161	727
Coastal Headland Scrub/Coastal Tussock Grassland Mosaic	162	85
Damp Heathland	710	81
Estuarine Scrub	953	0.6
Riparian Scrub	191	112
Sand Heathland	6	48
Swamp Scrub	53	1771
Swamp Scrub/Wet Heathland Mosaic	638	33
Wet Heathland	8	2.8
Total		5938.7

Vegetation	Number	Total Area (ha)
Tidal and estuarine vegetation		
Coastal Dry Saltmarsh	-	1.5
Coastal Saltmarsh Aggregate	9	58
Coastal Saltmarsh/Estuarine Wetland	-	17.6
Coastal Saltmarsh/Mangrove Shrubland Mosaic	302	28.8
Coastal Saltmarsh/Saline Aquatic Meadow Mosaic	-	9.3
Coastal Tussock Saltmarsh	-	2.7
Estuarine Brackish Wetland	935	3.8
Estuarine Reedbed	952	0.5
Estuarine Wetland	10	22.5
Estuarine Wetland/Estuarine Swamp Scrub Mosaic	935	0.3
Mangrove Shrubland	140	152
Wet Saltmarsh Herbland	-	32
Wet Saltmarsh Herbland/Estuarine Wetland Mosaic	-	2.8
Wet Saltmarsh Herbland/Saline Aquatic Meadow Mosaic	-	17
Wet Saltmarsh Shrubland	-	233
Saline Aquatic Meadow	842	13.1
Total		594.9
Freshwater and inland brackish wetlands		
Brackish Herbland	538	0.1
Brackish Sedgeland	13	1
Brackish Wetland Aggregate	656	78.4
Aquatic Herbland	653	3.4
Fern Swamp	721	2.3
Forest Creepline Sedge Swamp	728	38.9
Gahnia Sedgeland	968	18.9
Plains Grassy Wetland	125	6.8
Sedge Wetland	136	46.7
Tall Marsh	821	91.2
Wetland Formation	74	106.9
Total		394.6
Grasslands		
Calcareous Swale Grassland	309	1.8
Coastal Dune Grassland	879	6.2
Coastal Tussock Grassland	163	39.6
Plains Grassland	132	42.7
Total		90.3
GRAND TOTAL		22045.7

Appendix 3 Rare or threatened plant taxa on the Mornington Peninsula

Scientific Name	Common Name	Conservation Status		
		EPBC Act	FFG Act	Advisory List
<i>Caladenia thysanochila</i>	Fringed Spider-orchid	Endangered	Listed	Extinct
<i>Caladenia robinsonii</i>	Frankston Spider-orchid	Endangered	Listed	Endangered
<i>Euphrasia collina</i> subsp. <i>muelleri</i>	Purple Eyebright	Endangered	Listed	Endangered
<i>Prasophyllum spicatum</i>	Dense Leek-orchid	Vulnerable		Endangered
<i>Pterostylis cucullata</i>	Leafy Greenhood	Vulnerable	Listed	Endangered
<i>Glycine latrobeana</i>	Clover Glycine	Vulnerable	Listed	Vulnerable
<i>Adiantum capillus-veneris</i>	Venus-hair Fern		Listed	Endangered
<i>Corybas</i> sp. aff. <i>diemenicus</i> (Coastal)	Late Helmet-orchid		Listed	Endangered
<i>Corybas despectans</i>	Coast Helmet-orchid		Listed	Vulnerable
<i>Diuris punctata</i> var. <i>punctata</i>	Purple Diuris		Listed	Vulnerable
<i>Eucalyptus carolaniae</i>	Mount Martha Bundy			Endangered
<i>Nicotiana maritima</i>	Coast Tobacco			Endangered
<i>Adriana quadripartita</i>	Rare Bitter-bush			Vulnerable
<i>Poa halmaturina</i>	Dune Poa			Vulnerable
<i>Thelymitra malvina</i>	Mauve-tuft Sun-orchid			Vulnerable
<i>Acacia uncifolia</i>	Coast Wirilda			Rare
<i>Atriplex paludosa</i> subsp. <i>paludosa</i>	Marsh Saltbush			Rare
<i>Avicennia marina</i> subsp. <i>australasica</i>	Grey Mangrove			Rare
<i>Colobanthus apetalus</i> var. <i>apetalus</i>	Coast Colobanth			Rare
<i>Juncus revolutus</i>	Creeping Rush			Rare
<i>Lachnagrostis punicea</i> subsp. <i>punicea</i>	Purple Blown-grass			Rare
<i>Lachnagrostis scabra</i> subsp. <i>scabra</i>	Rough Blown-grass			Rare
<i>Lawrenca spicata</i>	Salt Lawrenca			Rare
<i>Limonium australe</i> var. <i>australe</i>	Yellow Sea-lavender			Rare
<i>Nicotiana suaveolens</i>				Rare
<i>Olearia</i> sp. 2	Peninsula Daisy-bush			Rare
<i>Oxalis rubens</i>	Dune Wood-sorrel			Rare
<i>Poa billardierei</i>	Coast Fescue			Rare
<i>Pomaderris oraria</i> subsp. <i>oraria</i>	Bassian Pomaderris			Rare
<i>Prasophyllum lindleyanum</i>				Rare
<i>Pteris comans</i>	Netted brake			Rare
<i>Pterostylis grandiflora</i>	Cobra Greenhood			Rare
<i>Pterostylis</i> X <i>ingens</i>	Sharp Greenhood			Rare
<i>Pultenaea canaliculata</i>	Coast Bush-pea			Rare
<i>Salsola tragus</i> subsp. <i>pontica</i>	Coast Saltwort			Rare
<i>Triglochin minutissima</i>	Tiny Arrowgrass			Rare
<i>Zygophyllum billardierei</i>	Coast Twin-leaf			Rare
<i>Berula erecta</i>	Water Parsnip			Poorly known
<i>Caladenia australis</i>	Southern Spider-orchid			Poorly known
<i>Desmodium varians</i>	Slender Tick-trefoil			Poorly known

Scientific Name	Common Name	Conservation Status		
		EPBC Act	FFG Act	Advisory List
<i>Lotus australis</i> var. <i>australis</i>	Austral Trefoil			Poorly known
<i>Oxalis thompsoniae</i>	Fluffy-fruit Wood-sorrel			Poorly known
<i>Poa labillardierei</i> var. (Volcanic Plains)	Basalt Tussock-grass			Poorly known
<i>Ranunculus papulentus</i>	Large River Buttercup			Poorly known
<i>Stackhousia spathulata</i>	Coast Stackhousia			Poorly known
<i>Stylidium dilatatum</i>	Tasman Triggerplant			Poorly known

Appendix 4 Rare or threatened fauna species recorded for Mornington Peninsula Shire

Scientific Name	Common Name	Conservation Status		
		EPBC Act	FFG Act	Advisory List
Mammals				
<i>Isoodon obesulus obesulus</i>	Southern Brown Bandicoot	Endangered	Listed	Near Threatened
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	Vulnerable	Listed	Vulnerable
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Vulnerable	Listed	Vulnerable
<i>Sminthopsis leucopus</i>	White-footed Dunnart		Listed	Near Threatened
<i>Cercartetus nanus</i>	Eastern Pygmy Possum		Ineligible	Near Threatened
<i>Scotorepens greyii</i>	Little Broad-nosed Bat			Near Threatened
Amphibians				
<i>Litoria raniformis</i>	Growling Grass Frog	Vulnerable	Listed	Endangered
<i>Pseudophryne semimarmorata</i>	Southern Toadlet			Vulnerable
Reptiles				
<i>Lissolepis coventryi</i>	Swamp Skink		Listed	Vulnerable
<i>Varanus varius</i>	Lace Monitor			Endangered
<i>Pseudemoia rawlinsoni</i>	Glossy Grass Skink			Vulnerable
<i>Chelodina longicollis</i>	Common Long-necked Turtle			Data Deficient
Birds				
<i>Dromaius novaehollandiae</i>	Emu			Near Threatened
<i>Coturnix chinensis victoriae</i>	King Quail		Listed	Endangered
<i>Anseranas semipalmata</i>	Magpie Goose	Marine	Listed	Near Threatened
<i>Biziura lobata</i>	Musk Duck	Marine		Vulnerable
<i>Stictonetta naevosa</i>	Freckled Duck		Listed	Endangered
<i>Anas rhynchotis</i>	Australasian Shoveler			Vulnerable
<i>Aythya australis</i>	Hardhead			Vulnerable
<i>Oxyura australis</i>	Blue-billed Duck		Listed	Endangered
<i>Geopelia cunata</i>	Diamond Dove		Listed	Near Threatened
<i>Hirundapus caudacutus</i>	White-throated Needletail	Migratory, Marine		Vulnerable
<i>Pelagodroma marina</i>	White-faced Storm-Petrel	Marine		Vulnerable
<i>Diomedea epomophora</i>	Royal Albatross	Vulnerable, Migratory, Marine	Listed	Vulnerable
<i>Diomedea exulans</i>	Wandering Albatross	Vulnerable, Migratory, Marine	Listed	Endangered
<i>Thalassarche melanophris</i>	Black-browed Albatross	Vulnerable, Migratory, Marine	Listed	Vulnerable
<i>Thalassarche cauta</i>	Shy Albatross	Vulnerable, Migratory, Marine	Listed	Vulnerable
<i>Thalassarche chlororhynchos</i>	Yellow-nosed Albatross	Vulnerable, Migratory, Marine	Listed	Vulnerable
<i>Thalassarche chrysostoma</i>	Grey-headed Albatross	Endangered, Migratory, Marine	Listed	Vulnerable
<i>Thalassarche bulleri</i>	Buller's Albatross	Vulnerable, Migratory, Marine	Listed	
<i>Phoebastria fusca</i>	Sooty Albatross	Vulnerable, Migratory,		

Scientific Name	Common Name	Conservation Status		
		EPBC Act	FFG Act	Advisory List
		Marine		
<i>Macronectes giganteus</i>	Southern Giant-Petrel	Endangered, Migratory, Marine	Listed	Vulnerable
<i>Macronectes halli</i>	Northern Giant-Petrel	Vulnerable, Migratory, Marine	Listed	Near Threatened
<i>Halobaena caerulea</i>	Blue Petrel	Vulnerable, Marine		Vulnerable
<i>Pachyptila turtur</i>	Fairy Prion	Vulnerable, Marine		Vulnerable
<i>Pelecanoides urinatrix</i>	Common Diving-Petrel	Marine		Near Threatened
<i>Phalacrocorax varius</i>	Pied Cormorant			Near Threatened
<i>Phalacrocorax fuscescens</i>	Black-faced Cormorant	Marine		Near Threatened
<i>Botaurus poiciloptilus</i>	Australasian Bittern	Endangered	Listed	Endangered
<i>Ardea modesta</i>	Eastern Great Egret	Marine	Listed	Vulnerable
<i>Ardea intermedia</i>	Intermediate Egret	Marine	Listed	Endangered
<i>Egretta garzetta</i>	Little Egret	Marine	Listed	Endangered
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron	Marine		Near Threatened
<i>Plegadis falcinellus</i>	Glossy Ibis	Migratory, Marine		Near Threatened
<i>Platalea regia</i>	Royal Spoonbill			Near Threatened
<i>Lophoictinia isura</i>	Square-tailed Kite		Listed	Vulnerable
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Marine	Listed	Vulnerable
<i>Accipiter novaehollandiae</i>	Grey Goshawk		Listed	Vulnerable
<i>Circus assimilis</i>	Spotted Harrier			Near Threatened
<i>Falco subniger</i>	Black Falcon			Vulnerable
<i>Rallus pectoralis</i>	Lewin's Rail		Listed	Vulnerable
<i>Porzana pusilla</i>	Baillon's Crake	Marine	Listed	Vulnerable
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher			Near Threatened
<i>Pluvialis fulva</i>	Pacific Golden Plover	Migratory, Marine		Vulnerable
<i>Pluvialis squatarola</i>	Grey Plover	Migratory, Marine		Endangered
<i>Charadrius leschenaultii</i>	Greater Sand Plover	Migratory, Marine		Critically Endangered
<i>Charadrius mongolus</i>	Lesser Sand Plover	Migratory, Marine		Critically Endangered
<i>Thinornis rubricollis</i>	Hooded Plover	Vulnerable, Marine	Listed	Vulnerable
<i>Gallinago hardwickii</i>	Latham's Snipe	Migratory, Marine	Nominated	Near Threatened
<i>Limosa limosa</i>	Black-tailed Godwit	Migratory, Marine		Vulnerable
<i>Numenius phaeopus</i>	Whimbrel	Migratory, Marine		Vulnerable
<i>Numenius madagascariensis</i>	Eastern Curlew	Migratory, Marine		Vulnerable
<i>Actitis hypoleucos</i>	Common Sandpiper	Migratory, Marine		Vulnerable
<i>Tringa brevipes</i>	Grey-tailed Tattler	Migratory, Marine	Listed	Critically Endangered
<i>Tringa nebularia</i>	Common Greenshank	Migratory, Marine		Vulnerable
<i>Tringa stagnatilis</i>	Marsh Sandpiper	Migratory, Marine		Vulnerable
<i>Tringa glareola</i>	Wood Sandpiper	Migratory, Marine		Vulnerable
<i>Arenaria interpres</i>	Ruddy Turnstone	Migratory, Marine		Vulnerable

Scientific Name	Common Name	Conservation Status		
		EPBC Act	FFG Act	Advisory List
<i>Calidris alba</i>	Sanderling	Migratory, Marine		Near Threatened
<i>Calidris canutus</i>	Red Knot	Migratory, Marine		Endangered
<i>Calidris melanotos</i>	Pectoral Sandpiper	Migratory, Marine		Near Threatened
<i>Calidris tenuirostris</i>	Great Knot	Migratory, Marine	Listed	Endangered
<i>Calidris ferruginea</i>	Curlew Sandpiper	Critically Endangered, Migratory, Marine		Endangered
<i>Xenus cinereus</i>	Terek Sandpiper	Migratory, Marine	Listed	Endangered
<i>Sternula albifrons</i>	Little Tern	Migratory, Marine	Listed	Vulnerable
<i>Sternula nereis</i>	Fairy Tern	Vulnerable, Marine	Listed	Endangered
<i>Hydroprogne caspia</i>	Caspian Tern	Migratory, Marine	Listed	Near Threatened
<i>Chlidonias hybrida</i>	Whiskered Tern	Marine		Near Threatened
<i>Sterna striata</i>	White-fronted Tern	Marine		Near Threatened
<i>Larus pacificus</i>	Pacific Gull	Marine		Near Threatened
<i>Lophocroa leadbeateri</i>	Major Mitchell's Cockatoo		Listed	Vulnerable
<i>Lathamus discolor</i>	Swift Parrot	Critically Endangered, Marine	Listed	Endangered
<i>Neophema chrysogaster</i>	Orange-bellied Parrot	Critically Endangered, Marine	Listed	Critically Endangered
<i>Pezoporus wallicus wallicus</i>	Ground Parrot		Listed	Endangered
<i>Ninox connivens connivens</i>	Barking Owl		Listed	Endangered
<i>Ninox strenua</i>	Powerful Owl		Listed	Vulnerable
<i>Alcedo azurea</i>	Azure Kingfisher			Near Threatened
<i>Calamanthus pyrrhopgius</i>	Chestnut-rumped Heathwren		Listed	Vulnerable
<i>Chthonicola sagittatus</i>	Speckled Warbler		Listed	Vulnerable
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler		Listed	Endangered
<i>Cinclosoma punctatum</i>	Spotted Quail-thrush			Near Threatened
<i>Melanodryas cucullata cucullata</i>	Hooded Robin		Listed	Near Threatened
Fish				
<i>Galaxiella pusilla</i>	Dwarf Galaxias	Vulnerable	Listed	Endangered
<i>Maccullochella peelii</i>	Murray Cod	Vulnerable	Listed	Vulnerable
<i>Macquaria australasica</i>	Macquarie Perch	Endangered	Listed	Endangered
<i>Mugilgobius platynotus</i>	Flatback Mangrove Goby		Listed	Vulnerable
<i>Prototroctes maraena</i>	Australian Grayling	Vulnerable	Listed	Vulnerable

Appendix 5 Very High Risk weed species recorded for the Mornington Peninsula

Scientific Name	Common Name	Catchment and Land Protection Act 1994 list (Port Phillip and Western Port)
<i>Acacia longifolia subsp. longifolia</i>	Sallow Wattle	
<i>Acacia saligna</i>	Golden Wreath Wattle	
<i>Acetosa sagittata</i>	Rambling Dock	
<i>Agapanthus praecox subsp. orientalis</i>	Agapanthus	
<i>Allium triquetrum</i>	Angled Onion	Restricted
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	
<i>Asparagus asparagoides</i>	Bridal Creeper	Restricted
<i>Asparagus scandens</i>	Asparagus Fern	
<i>Babiana angustifolia</i>	Baboon Flower	
<i>Brassica fruticulosa</i>	Twiggy Turnip	
<i>Centaurium erythraea</i>	Common Centaury	
<i>Chrysanthemoides monilifera subsp. monilifera</i>	African Boneseed	Controlled
<i>Cicendia filiformis</i>	Slender Cicendia	
<i>Coprosma robusta</i>	Karamu	
<i>Cordyline australis</i>	New Zealand Cabbage-tree	
<i>Cotoneaster pannosus</i>	Velvet Cotoneaster	
<i>Cotula coronopifolia</i>	Water Buttons	
<i>Crocsmia X crocosmiiflora</i>	Montbretia	
<i>Cytisus scoparius</i>	English Broom	Controlled
<i>Dactylis glomerata</i>	Cocksfoot	
<i>Delairea odorata</i>	Cape Ivy	
<i>Dipogon lignosus</i>	Common Dipogon	
<i>Ehrharta calycina</i>	Perennial Veldt-grass	
<i>Ehrharta erecta var. erecta</i>	Panic Veldt-grass	
<i>Erica lusitanica</i>	Spanish Heath	
<i>Freesia alba x Freesia leichtlinii</i>	Freesia hybrid	
<i>Gazania linearis</i>	Gazania	
<i>Gazania rigens</i>	Trailing Gazania	
<i>Genista linifolia</i>	Flax-leaf Broom	Controlled
<i>Genista monspessulana</i>	Montpellier Broom	Controlled
<i>Gladiolus undulatus</i>	Wild Gladiolus	
<i>Hedera helix</i>	English Ivy	
<i>Holcus lanatus</i>	Yorkshire Fog	

Scientific Name	Common Name	Catchment and Land Protection Act 1994 list (Port Phillip and Western Port)
<i>Hypericum perforatum subsp. veronense</i>	St John's Wort	Controlled
<i>Ilex aquifolium</i>	English Holly	
<i>Ipomoea indica</i>	Blue Morning-glory	
<i>Juncus acutus subsp. acutus</i>	Spiny Rush	Controlled
<i>Limonium hyblaenum</i>	Sicilian Sea-lavendar	
<i>Lonicera japonica</i>	Japanese Honeysuckle	
<i>Lycium ferocissimum</i>	African Box-thorn	Controlled
<i>Melaleuca armillaris subsp. armillaris</i>	Giant Honey-myrtle	
<i>Moraea flaccida</i>	One-leaf Cape-tulip	Controlled
<i>Myosotis sylvatica</i>	Wood Forget-me-not	
<i>Nassella neesiana</i>	Chilean Needle-grass	Restricted
<i>Olea europaea subsp. cuspidata</i>	Olive	
<i>Oxalis incarnata</i>	Pale Wood-sorrel	
<i>Oxalis pes-caprae</i>	Soursob	Restricted
<i>Passiflora tarminiana</i>	Banana Passion-fruit	
<i>Phalaris aquatica</i>	Toowoomba Canary-grass	
<i>Pinus pinaster</i>	Cluster Pine	
<i>Pinus radiata var. radiata</i>	Radiata Pine	
<i>Pittosporum undulatum</i>	Sweet Pittosporum	
<i>Polygala myrtifolia</i>	Myrtle-leaf Milkwort	
<i>Rhamnus alaternus</i>	Italian Buckthorn	
<i>Rubus anglocandicans</i>	Common Blackberry	
<i>Rubus fruticosus agg.</i>	Blackberry	Controlled
<i>Salix cinerea</i>	Grey Sallow	Restricted
<i>Solanum pseudocapsicum</i>	Madeira Winter-cherry	
<i>Stenotaphrum secundatum</i>	Buffalo Grass	
<i>Tradescantia fluminensis</i>	Wandering Jew	
<i>Ulex europaeus</i>	Gorse	Controlled
<i>Vinca major</i>	Blue Periwinkle	
<i>Viola odorata</i>	Common Violet	
<i>Watsonia meriana var. bulbifera</i>	Bulbil Watsonia	Controlled
<i>Zantedeschia aethiopica</i>	White Arum-lily	