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WESTERN PORT RAMSAR SITE MANAGEMENT PLAN

June 2025

Acknowledgement of Country

The project team would like to acknowledge the Traditional Custodians of the land this project relates to, the Bunurong people of the South-Eastern Kulin Nation, and their connection to the waterways, the land, the sky and all who inhabit this place, Country. We pay our respects to their Elders, past, present, and emerging.

We recognise the importance of projects such as this in meeting Bunurong people's aspirations and goals as custodians of Country.

Cover photo: Bass River mouth, traditional lands of the Bunurong people.

Acronyms

BLCAC	Bunurong Land Council Aboriginal Corporation
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEECA	Department of Energy, Environment and Climate Action, *formerly* Department of Environment, Land, Water and Planning
ECD	Ecological Character Description
EPA	Environment Protection Authority, Victoria
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
IUCN	International Union for Conservation of Nature
LAC	Limits of Acceptable Change
MERI	Monitoring, evaluation, reporting and improvement
PV	Parks Victoria
PSG	Project Steering Group
RIS	Ramsar Information Sheet
RCT	Resource Condition Target
TWG	Technical Working Group
VWMS	*Victorian Waterway Management Strategy*
WPRSCC	Western Port Ramsar Site Coordinating Committee

Contents

1. Introduction

The *Western Port Ramsar Site Management Plan* established the framework for the maintenance of ecological character through conservation and wise use. The original plan was released in 2017 and since then, there has been significant progress in both our understanding of the ecological character of Western Port and strategic direction in management of the site and Ramsar wetlands in Australia. A consultative and collaborative process was undertaken to review and update the Ramsar site management plan. The outputs of this review process are documented in two products:

1. A revised Western Port Ramsar Site Management Plan (**this document**), including a full description of the plan's development and technical appendices, and
2. A Western Port Ramsar Site Management Plan summary document for a general audience that briefly outlines the process and details the management strategies and responsibilities.

This Ramsar site management plan sits within a framework for the management of aquatic ecosystems within Australia and the State of Victoria. At the national level, the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* establishes the basis for managing Ramsar sites. This management plan for the Western Port Ramsar Site supplements and complements the Melbourne Water Healthy Waterways Strategy and the Port Phillip and Western Port Regional Catchment Strategy.

1.1. Purpose of the management plan

Ecological character

The "Ramsar Convention on Wetlands of International Importance, especially as waterfowl habitat" (hereafter referred to as the Ramsar Convention or Convention) was ratified in Ramsar, Iran in 1971. As of June 2025, there are 172 Contracting Parties, including Australia. Under the terms of the Convention, contracting parties nominate wetlands to be designated as Wetlands of International Importance, with nominated sites required to meet at least one of nine listing criteria. The act of designating a wetland as a Ramsar site carries with it certain obligations, including managing the site to maintain its 'ecological character' and to have procedures in place to detect if any threatening processes are likely to, or have altered the 'ecological character'. The Ramsar Convention has defined "ecological character" and "change in ecological character" as (Ramsar Convention 2005):

"*Ecological character is the combination of the ecosystem components, processes and benefits/services [CPS] that characterise the wetlands at a given point in time*" and

"*…change in ecological character is the human induced adverse alteration of any ecosystem component, process and or ecosystem benefit/service*."

Ramsar: A network of sites

There is a network of over 2000 Ramsar wetlands across the globe that is dedicated to sustaining biodiversity and wise use. One of the important functions, and a primary purpose for the establishment of the Convention, is to protect sites in different countries that are important for migratory birds. The migratory birds that visit Australia are part of the East Asian-Australasian Flyway and most of them migrate from breeding grounds in North-east Asia and Alaska to non-breeding grounds in Australia and New Zealand, covering the journey of 10 000 kilometres twice in a single year.

The lifecycle of most international migratory shorebirds involves (Bamford et al. 2008):

- breeding in May to August (northern hemisphere)
- southward migration to the southern hemisphere (August to November)
- feeding and foraging in the southern hemisphere (August to April), and
- northward migration to breeding grounds (March to May).

During both northward and southward migration, birds may stop at areas on route to rest and feed. These stopovers are referred to as “staging” areas and are important for the birds’ survival. In addition, birds on their first southward migration that have not yet reached breeding maturity may remain in Australia over the southern winter period.

Other migratory species that are supported by the Western Port Ramsar Site include species such as the double-banded plover, which migrate between New Zealand and Australia spending the non-breeding (winter) season on Australian shores.

The Western Port Ramsar Site supports over 30 species that are international migrants and listed under migratory agreements with China, Japan and the Republic of Korea. Important habitats within the site include the extensive intertidal mudflats and saltmarsh where migratory waders feed. High tide roosting sites, where waders can rest are also important.

Migratory shorebirds in Australia need to build up their energy reserves for the homeward journey. This means that they not only require abundant food sources, but they need to minimise their activity. Disturbance of shorebirds when roosting or feeding may result in a significant loss of energy. This may even compromise their ability to build up enough reserves to complete the return journey to breeding grounds. Disturbance of migratory shorebirds may occur as a result of four-wheel driving on beaches or in saltmarsh and intertidal areas, unleashed dogs, recreational fishing (in some instances); boating and jet skiing and any activity in the intertidal zone that causes significant noise or light. Migratory shorebirds are also susceptible to predation by foxes and cats.

Populations of many migratory shorebird species are in decline, primarily through loss of habitat in breeding and staging areas outside Australia. This makes them more vulnerable while in Australia and increases the importance of maintaining habitat and conditions at overwintering sites. Residents and visitors to Western Port need to work together to help protect and conserve these important species.

Under Article 3.2 of the Ramsar Convention, a notification of change is required if the ecological character of a site has changed, is changing, or *is likely* to change as the result of human activities. The Australian Government has established a number of principles to guide notifications in Australia (Department of the Environment, Water Heritage and the Arts 2009):

- Assessment of change will be undertaken with respect to *critical* components, processes, and benefits/services of the ecological character of the site.
- An assessment of change to support a notification must be based on best available science.
- The fact that a site was undergoing human-induced ecological character change at the time of listing does not preclude the need for an assessment, and possible notification of change, if there is evidence of significant ongoing adverse ecological change.
- Where the natural variability of a site cannot reasonably be established for the critical component process, benefit, or service against which change is being assessed, a notification, if made, will only be on the basis of *'is likely to'* change.
- A notification will not be made where the apparent character change has been identified as arising from the use of inadequate data sets at the time of listing.
- A notification will not be made where climate change is the principal cause of identified ecological character change.

Ramsar site management to maintain ecological character is reliant on a number of key documents and processes as illustrated in Figure 1. The three key documents are:

Ramsar Information Sheet (RIS) - compiled for each site worldwide, a RIS documents the essential information related to the site and its management. The Administrative Authority of each Contracting Party submits the RIS to the Ramsar Secretariat. In the case of Australia this is the Australian Government Department of the Climate Change, Energy, the Environment and Water (DCCEEW). RIS information is updated every six years, or on the occasion of any significant change in a site's ecological character. The RIS for Western Port can be obtained from the DCCEEW website (Western Port RIS).

Ecological Character Description (ECD) – provides a more detailed and quantitative description of ecological character for a Ramsar site. The ECD establishes a benchmark, at the time of listing, which in the case of Western Port is 1982. The ECD identifies the critical components, processes and services of the site (critical CPS) and sets limits of acceptable change (LAC). The Australia Government has developed a standard method for describing ecological character (Department of the Environment, Water, Heritage and the Arts 2008). The ECD for Western Port was completed in 2011 and can be accessed from the DCCEEW website (Western Port ECD). In 2016 an update to the ECD was produced that documents the increased knowledge and understanding of the site, and accounts for changes to International and National threatened species lists. The current ECD Addendum can be found here: Western Port ECD Addendum.

Management plan – documents the management strategies required to protect and restore the ecological character of a Ramsar site. In Australia, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) establishes the framework for management of Australian

Ramsar sites, and Schedule 6 of the EPBC Regulations outlines the principles relevant to the preparation of Ramsar site management plans (Text Box 1).

Ramsar site management plans must adhere to these principles. Of note is that the primary purpose of the management plan must be in accordance with the Ramsar Convention:

- to describe and maintain the ecological character of the wetland; and
- to formulate and implement planning that promotes:
    - conservation of the wetland; and
    - wise and sustainable use of the wetland for the benefit of humanity in a way that is compatible with maintenance of the natural properties of the ecosystem.

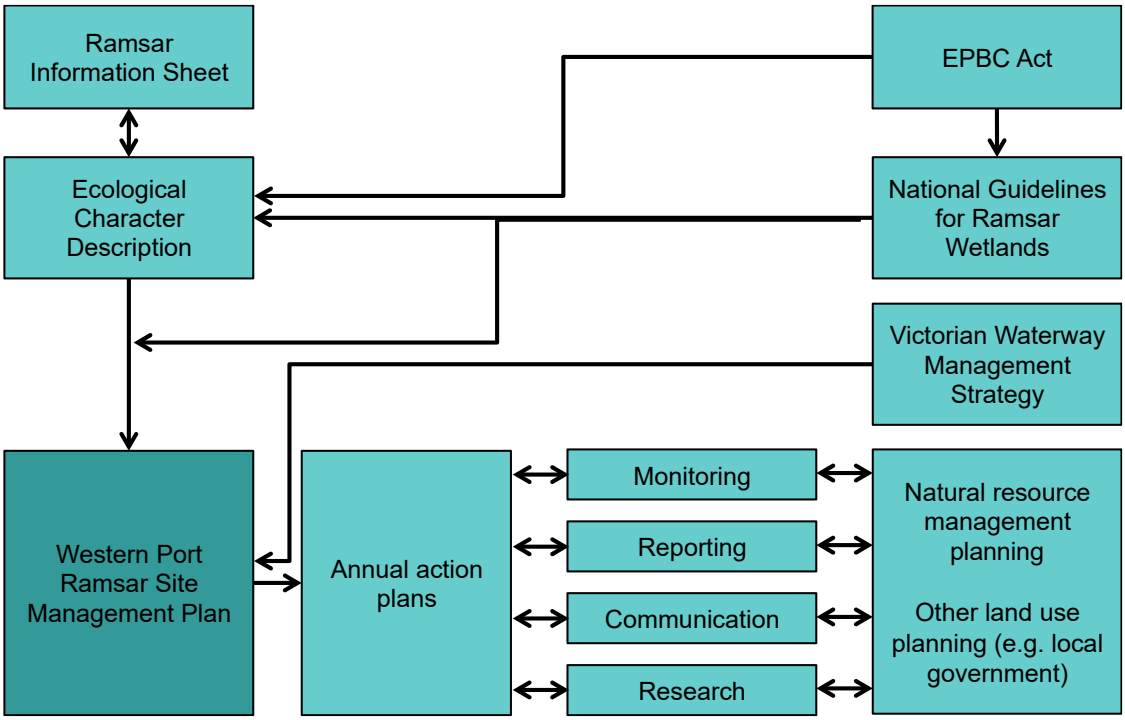

Figure 1: The Western Port Ramsar Site Management Plan in context of other requirements for the management of Ramsar sites (adapted from Department of Environment, Water, Heritage and the Arts 2008).

1 General principles

1.01 The primary purpose of management of a declared Ramsar wetland must be, in accordance with the Ramsar Convention:

(a) to describe and maintain the ecological character of the wetland; and

(b) to formulate and implement planning that promotes:

(i) conservation of the wetland; and

(ii) wise and sustainable use of the wetland for the benefit of humanity in a way that is compatible with maintenance of the natural properties of the ecosystem.

1.02 Wetland management should provide for public consultation on decisions and actions that may have a significant impact on the wetland.

1.03 Wetland management should make special provision, if appropriate, for the involvement of people who:

(a) have a particular interest in the wetland; and

(b) may be affected by the management of the wetland.

1.04 Wetland management should provide for continuing community and technical input.

2 Management planning

2.01 At least one management plan should be prepared for each declared Ramsar wetland.

2.02 A management plan for a declared Ramsar wetland should:

(a) describe its ecological character; and

(b) state the characteristics that make it a wetland of international importance under the Ramsar Convention; and

(c) state what must be done to maintain its ecological character; and

(d) promote its conservation and sustainable use for the benefit of humanity in a way that is compatible with maintenance of the natural properties of the ecosystem; and

(e) state mechanisms to deal with the impacts of actions that individually or cumulatively endanger its ecological character, including risks arising from:

(i) physical loss, modification or encroachment on the wetland; or

(ii) loss of biodiversity; or

(iii) pollution and nutrient input; or

(iv) changes to water regimes; or

(v) utilisation of resources; or

(vi) introduction of invasive species; and

(f) state whether the wetland needs restoration or rehabilitation; and

(g) if restoration or rehabilitation is needed--explain how the plan provides for restoration or rehabilitation;

(h) provide for continuing monitoring and reporting on the state of its ecological character; and

(i) be based on an integrated catchment management approach; and

(j) include adequate processes for public consultation on the elements of the plan; and

(k) be reviewed at intervals of not more than 7 years.

3 Environmental impact assessment and approval

3.01 This principle applies to the assessment of an action that is likely to have a significant impact on the ecological character of a Ramsar wetland (whether the action is to occur inside the wetland or not).

3.02 Before the action is taken, the likely environmental impact of the action on the wetland's ecological character should be assessed under a statutory environmental impact assessment and approval process.

3.03 The assessment process should:

(a) identify any part of the ecological character of the wetland that is likely to be affected by the action;

(b) examine how the ecological character of the wetland might be affected; and

(c) provide adequate opportunity for public consultation.

3.04 An action should not be approved if it would be inconsistent with:

(a) maintaining the ecological character of the wetland; or

(b) providing for the conservation and sustainable use of the wetland.

3.05 Approval of the action should be subject to conditions, if necessary, to ensure that the ecological character of the wetland is maintained.

3.06 The action should be monitored by the authority responsible for giving the approval (or another appropriate authority) and, if necessary, enforcement action should be taken to ensure compliance with the conditions.

Text Box 1. Australian Ramsar Management Principles.

Objectives of the management plan

The primary purpose of the Western Port Ramsar Site Management Plan is to maintain ecological character and support wise use of the site. Wise use is defined by the Convention as (Ramsar Convention 2005):

"*the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development*".

The Western Port Ramsar Site supports a number of socio-economic and cultural values that result from maintaining the condition of the Ramsar site. This plan has adopted the principle that by maintaining (or improving) ecological character, the socio-economic and cultural values associated with the Ramsar site will also be conserved, within the concept of wise use. Therefore, the primary objective of the Western Port Ramsar Site Management Plan is:

"***To maintain, and where necessary improve, the ecological character of the Western Port Ramsar Site and support wise use***".

1.2. Relevant policy and legislation

International

Ramsar Convention

The Convention on Wetlands of International Importance, otherwise known as the Ramsar Convention, was signed in Ramsar Iran in 1971 and came into force in 1975. It provides the framework for local, regional and national actions, and international cooperation, for the conservation and wise use of wetlands. Wetlands of International Importance are selected on the basis of their international significance in terms of ecology, botany, zoology, limnology and/or hydrology.

Migratory bird bilateral agreements and conventions

Australia is party to a number of bilateral agreements, initiatives and conventions for the conservation of migratory birds, which are relevant to the Western Port Ramsar Site. The bilateral agreements are:

- *Japan-Australia Migratory Bird Agreement (JAMBA)* – The agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment, 1974;
- *China-Australia Migratory Bird Agreement (CAMBA)* - The Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment 1986;

- *Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)* - The Agreement between the Government of Australia and the Republic of Korea for the Protection of Migratory Birds and their Environment, 2006; and

- *The Bonn Convention on Migratory Species (CMS)* - The Bonn Convention adopts a framework in which countries with jurisdiction over any part of the range of a particular species co-operate to prevent migratory species becoming endangered. For Australian purposes, many of the species are migratory birds.

Biosphere reserves

In 1971 the United Nations Educational, Scientific and Cultural Organisation (UNESCO) launched its Man and Biosphere Programme (MAB) with the aim of establishing a scientific basis for the improvement of relationships between people and their environments. Under the MAB, 651 World Biospheres have been designated in 120 participating countries. Biosphere Reserves act as a keystone of MAB by providing a global network of sites for cooperative research. The Mornington Peninsula and Western Port Biosphere Reserve was designated a Biosphere Reserve in November 2002 and includes the Ramsar site.

The EPBC Act includes provisions for the development of cooperative arrangements between the Commonwealth, states and territories in the development of biosphere reserves. Parks Australia, DCCEEW, acts as the national focal point for biosphere reserves in Australia while the Australian National Commission for UNESCO has overall responsibility for UNESCO activities in Australia.

National

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
The EPBC Act regulates actions that will have or are likely to have a significant impact on any matter of national environmental significance, which includes the ecological character of a Ramsar wetland (EPBC Act 1999 s16(1)). An action that will have or is likely to have a significant impact on a Ramsar wetland will require an environmental assessment and approval under the EPBC Act. An 'action' includes a project, a development, an undertaking or an activity or series of activities (http://www.environment.gov.au/epbc/index.html).

The EPBC Act establishes a framework for managing Ramsar wetlands, through the Australian Ramsar Management Principles (EPBC Act 1999 s335), which are set out in Schedule 6 of the *Environment Protection and Biodiversity Conservation Regulations 2000*. These principles are intended to promote national standards of management, planning, environmental impact assessment, community involvement, and monitoring, for all of Australia's Ramsar wetlands in a way that is consistent with Australia's obligations under the Ramsar Convention. Some matters protected under the EPBC Act are not protected under local or state/territory legislation, and as such, many migratory birds are not specifically protected under State legislation. Species listed under international treaties JAMBA, CAMBA and CMS have been included in the List of Migratory species under the Act. Threatened species and communities listed under the EPBC Act may also occur or have habitat in the Ramsar site; some species listed under State legislation as threatened are not listed under the EPBC Act as threatened, usually because they are not

threatened at the national (often equivalent to whole-of-population) level. The Regulations also cover matters relevant to the preparation of management plans, environmental assessment of actions that may affect the site, and the community consultation process.

The Department of Climate Change, Energy, the Environment and Water is responsible for implementing the Ramsar Convention in Australia. Key activities include:

- Developing national guidance on implementing the Convention in Australia
- Providing funds to support the conservation and wise use of Ramsar sites
- Developing Ecological Character Descriptions for all Australian Ramsar sites, including Western Port
- Participating in the Partnership for the Conservation of Migratory Waterbirds in the East Asian – Australasian Flyway
- Participation in international treaties for the protection of migratory birds: Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement and the Republic of Korea-Australia Migratory Bird Agreement
- Regularly reviewing Ramsar site condition through the Ramsar Rolling Review
- Working with state and territory governments to promote the conservation Ramsar sites and wise use of all wetlands, and
- Coordinating and facilitating collaboration between the Convention's Oceania member countries.

Native Title Act 1993

This Act provides for the recognition and protection of native title. It establishes ways in which future dealing affecting native title may proceed and sets standards for such dealing. It establishes a mechanism for determining claims to native title. It provides for, or permits, the validation of past acts, and intermediate period acts, invalidated because of the existence of native title.

Victorian state policy and legislation

Crown Land (Reserves) Act 1978

This Act provides the framework for the administration and management of Crown land reserves including nature conservation reserves. The Act also deals with the making of regulations, committees of management and leasing and licensing.

Environmental Effects Act 1978

This Act requires the assessment of the potential significant environmental impacts of a proposed development through the preparation of an Environmental Effects Statement (EES).

The Environment Protection Act 2017

This Act establishes the Environment Protection Authority (EPA) and makes provision for the EPA's powers, duties and functions. It includes environmental obligations and protections for all Victorian and includes a general environmental duty (GED). The general environmental duty (GED) applies to all Victorians. Every Victorian has a responsibility to reduce the risk of harm to human health and the environment from pollution and waste. It is important you know the risks

and take reasonable steps to control them. By following the GED, it keeps our waterways healthy. The EPA is Victoria's environmental regulator and works to prevent and reduce the harmful effects of pollution and waste to Victorians and the environment. The GED falls under the Environment Protection Act 2017 and breaching the GED can lead to criminal or civil penalties.

Fisheries Act 1995

The Act provides a framework for the regulation, management and conservation of Victorian fisheries. It deals with commercial and recreational licences, fish culture, noxious aquatic species, research and development, the declaration and management of fisheries reserves; and the preparation of management plans for individual fisheries, declared noxious aquatic species and fisheries reserves.

Flora and Fauna Guarantee Act 1988

The Act provides a legislative and administrative framework for the conservation of biodiversity in Victoria. The Act provides for the listing of threatened taxa, communities and potentially threatening processes. It requires the preparation of action statements for listed species, communities and potentially threatening processes and sets out the process for implementing interim conservation orders to protect critical habitats. The Act also seeks to provide programs for community education in the conservation of flora and fauna and to encourage co-operative management of flora and fauna.

Marine and Coastal Act 2018

The Marine and Coastal Act 2018 provides an integrated and coordinated approach to planning and managing the marine and coastal environment by:

- enabling protection of the coastline and the ability to address the long-term challenges of climate change, population growth and ageing coastal structures
- ensuring that partners work together to achieve the best outcomes for Victoria's marine and coastal environment.

National Parks Act 1975

The Act makes provision for the preservation and protection of the natural environment including wilderness areas and remote and natural areas. This includes the protection and preservation of indigenous flora and fauna and of features of scenic or archaeological, ecological, geological, historic or other scientific interest in those parks. It allows for the study of ecology, geology, botany, zoology and other sciences relating to the conservation of the natural environment in those parks; and for the responsible management of the land in those parks.

Planning and Environment Act 2017

The purpose of the Planning and Environment Act 1987 is to establish a framework for planning the use, development and protection of land in Victoria. The Act sets out procedures for preparing and amending the Victoria Planning Provisions and planning schemes. It also sets out the process for obtaining permits under schemes, settling disputes, enforcing compliance with planning schemes and permits, and other administrative procedures.

Water Act 1989

The Act establishes rights and obligations in relation to water resources and provides mechanisms for the allocation of water resources. This includes the consideration of environmental water needs of rivers and wetlands as well as for human uses such as urban water supply and irrigation.

Wildlife Act 1975

The Act ensures procedures are in place to protect and conserve Victoria's wildlife and prevent any taxa of wildlife from becoming extinct. The Act also provides for the establishment of State Game Reserves. Regulations under the Act ensure that the consumptive use or other interactions with flora and fauna in Victoria does not threaten the sustainability of wild populations, while facilitating cultural and recreational pursuits in a humane, safe, ethical and sustainable manner.

Catchment and Land Protection Act 1994 (CaLP Act)

The Act sets up a framework for the integrated management and protection of catchments. It establishes processes to encourage and support community participation in the management of land and water resources and provides for a system of controls on noxious weeds and pest animals.

Climate Change and Energy Legislation Amendment (Renewable Energy and Storage Targets) Act 2024

The Climate Change and Energy Legislative Amendment (Renewable Energy & Storage Targets) Act 2024 has made two major amendments to the Planning and Environment Act 1987. These are:

- A new rule for planning authorities preparing a planning scheme or planning scheme amendment. Planning authorities must now consider climate change including climate hazards and emissions reductions targets. The Minister for Planning may publish Ministerial Directions for this new rule. Planning authorities must follow these Directions when fulfilling the new rule.
- A new planning framework objective. The objective includes the consideration of climate change policies and obligations when planning for the use and development of land.

Aboriginal Heritage Act 2006

The Act provides for the protection and management of Victoria's Aboriginal heritage. It establishes the Victorian Aboriginal Heritage Council to advise the Minister in the management of cultural heritage and registered Aboriginal parties. The Act also deals with cultural heritage management plans; cultural heritage permits and agreements. The Act also includes enforcement provisions and processes for handling dispute resolution. This includes the review of certain decisions through the Victorian Civil and Administrative Tribunal (VCAT).

Port Management Act 1995

This Act provides for the establishment, management and operation of commercial trading and local ports in Victoria. The Port of Hastings Corporation, established under the Transport and Integration Act 2010, has been appointed to manage and operate the Port of Hastings.

Parks Victoria is appointed as the local Port Manager for Western Port and has responsibilities for development of the Safety and Environmental Management Plan, as well as primary responsibilities for recreation and navigation outside of the Port of Hastings, including recreational navigational aids, dredging, moorings and management of local port infrastructure catering for recreational and commercial activities including tour operators, ferry services, fishing fleets and aquaculture operations.

Victorian Waterway Management Strategy

The Victorian Waterway Management Strategy (VWMS) provides the framework for government – in partnership with the community - to maintain or improve the condition of rivers, estuaries and wetlands so that they can continue to provide environmental, social, cultural and economic values for all Victorians. The framework is based on regional planning processes and decision-making, within the broader system of integrated catchment management in Victoria. The existing Victorian Waterway Management Strategy was released in 2013 and has reached the end of its lifespan. A new VWMS is currently in development and is due to be released in 2025.

Regional plans and policy

Port Phillip and Western Port Regional Catchment Strategy

RCSs are statutory documents under the CaLP Act that provide the overarching framework for land, water and biodiversity management and conservation in each of the ten catchment management regions of Victoria. The Port Phillip and Western Port RCS (https://portphillipwesternport.rcs.vic.gov.au/) is the primary planning document for the region. It identifies priorities for natural resource management for water and biodiversity and provides a framework for integrated management of catchments.

Healthy Waterway Strategy

The Healthy Waterways Strategy 2018 sets a long-term vision for managing the health of rivers, wetlands and estuaries in the Port Phillip and Westernport region, in order to protect and improve their value to the community. The strategy is shared across Melbourne Water, state and local government, water corporations and the community.

Marine and Coastal Policy

The Marine and Coastal Policy guides decision makers in the planning, management and sustainable use of our coastal and marine environment. It provides direction to decision makers including local councils and land managers on a range of issues such as dealing with the impacts of climate change, population growth and ageing coastal structures.

Marine and Coastal Strategy

The Marine and Coastal Strategy lays the foundation to achieve the vision and intended outcomes of the Marine and Coastal Policy. The Strategy aims to:

- Enable Traditional Owners to integrate cultural values, uses and practices in the healing and ongoing management of Country.
- Build the foundations for long-term climate adaptation and environmental protection in Victoria's marine and coastal environment.

- Improve integration and coordination across governments, industries and communities when planning and managing marine and coastal areas.
- Build the skills and capability of Traditional Owners, communities, managers and governments to effectively plan and manage for a healthy and resilient marine and coastal environment.

Ramsar Site Coordination

Melbourne Water is the 'Ramsar Site Coordinator' for the Western Port Ramsar Site and undertake the ongoing coordination and convening of the Western Port Ramsar Site Coordinating Committee (WPRSCC). The WPRSCC are responsible for overseeing and coordinating the on-ground implementation of the Western Port Ramsar Site Management Plan. The WPRSCC also ensure that Ramsar Roles and Responsibilities, as agreed by the Ramsar inter-agency governance group, are implemented by the agencies involved at a site level. Membership includes all agencies and partners that have a responsibility for managing the site. The membership of the WPRSCC includes:

- Melbourne Water
- Bunurong Land Council Aboriginal Corporation
- Parks Victoria
- Department of Energy, Environment and Climate Action
- Western Port Biosphere
- Phillip Island Nature Parks
- Mornington Peninsula Shire Council
- Cardinia Shire Council
- City of Casey
- Port of Hastings Corporation
- Bass Coast Landcare Network
- French Island Landcare

1.3. Development of the plan

The Western Port Ramsar Site Management Plan builds on the foundations of the 2017 and 2003 plans. There have however, been several changes to Ramsar site management planning in Victoria over the past eight years. In line with recommendations from the Victorian Auditor General's Office (VAGO) and Public Accounts and Estimates Committee (PAEC), there is a need for site coordinators and managers to demonstrate that actions are focused on maintaining the ecological character of the Ramsar sites. For this reason, the 2025 update to the Ramsar Site Management Plan is narrower in scope than the 2017 plan and is concerned with components, processes and services identified in the ECD and ECD Addendum as being critical to ecological character. Other values that were identified in the 2017 plan (e.g. visual amenity, recreational fishing, rocky reefs) are not addressed in this plan, but through other management planning processes (e.g. Regional Catchment and Healthy Waterway Strategies). In addition, management of land outside the Ramsar site boundary is not in scope except where threats from these areas are potentially impacting ecological character.

Objectives of the development process

The Port Phillip and Western Port Catchment Management Authority (PPWPCMA) facilitated the renewal of the 2017 Western Port Ramsar Site Management Plan. The project was based on a robust and transparent method to analyse and prioritise values and threats within the Ramsar site, with the aim of maintaining and where possible, improving the ecological character of the site, within a coordinated and collaborative framework for management. Further detail on the methods used is provided in the sections below:

- Risk assessment – section 3.1
- Identification of priority threats – section 3.3
- Management strategies – section 4.

Principles of the planning process

Throughout the development of this Western Port Ramsar Site Management Plan, a number of principles were adopted and underpinned the planning process, consistent with the guiding principles of the VWMS (Department of Environment and Primary Industries 2013):

- Stakeholder involvement – this plan has been developed with the input of a broad range of stakeholders through every phase.
- Evidence-based approach – best available knowledge has been used to underpin the development of this plan including the risk assessment and prioritisation of values and threats.
- Precautionary principle – lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.
- Building on existing activities – there are a large number of activities already being implemented within the catchment and Western Port to maintain and improve condition and ecosystem services. This plan seeks to build on these existing activities rather than duplicate effort.
- Adaptive management – the plan life is for seven years, with a mid-term review after four years.
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Stakeholder involvement

The importance of stakeholder engagement in the development of management plans for Ramsar sites is recognised by the Convention and in the Australian Ramsar Management Principles (Text Box 1). In terms of the development of this Ramsar Site Management Plan, stakeholders were involved in every step of the process.

The major groups involved in the development of this project were:

Western Port Ramsar Site Coordinating Committee (WPRSCC): members comprise representative of the following organisations: Melbourne Water, DEECA, Parks Victoria, Bunurong Land Council, Mornington Peninsula Shire Council, Cardinia Shire Council, City of

Casey, Phillip Island Nature Parks, Port of Hastings Corporation, Western Port Biosphere, Bass Coast Landcare Network, and French Island Landcare.

Stakeholder Group:

1. Technical experts in their respective fields were contacted individually for advice / input;
2. Agencies with an interest and responsibility in managing aspects of Western Port were engaged and invited to participate in workshops related to identifying priority values and threats and high-level strategic actions.
3. **Community**: Broader community and stakeholder engagement through a public consultation process through the Melbourne Water Let's Talk website and the Melbourne Water website.
    a. Western Port Ramsar Site - Let's Talk - Melbourne Water
    b. Western Port wetlands | Melbourne Water

Working with traditional owners

Melbourne Water respectfully acknowledges the Bunurong people as the Traditional Owners and Custodians of the land and water of the Western Port Ramsar site.

Melbourne Water is committed to working collaboratively with Traditional Owners in a way that builds partnerships and supports Aboriginal self-determination and Aboriginal participation in water management.

These commitments help deliver the "We will walk Country together' strategic goal, one of Melbourne Water's nine aspirational goals for 2027 and the policy directions set out in the Water is Life Roadmap.

2. Western Port Ramsar Site

A complete description of the ecological character of the Western Port Ramsar Site is contained in the ecological character description (ECD) (Kellogg Brown and Root 2010) and ECD addendum (Hale 2016). A summary of this information relevant to the management plan for the site is provided below

2.1. Location

The Western Port Ramsar Site is located 60 kilometres southeast of Melbourne and comprises a large proportion of the Western Port embayment to the north of Phillip Island (Figure 2). The site consists of large shallow intertidal areas, dissected by deeper channels and covers approximately 60,000 hectares. It includes a number of small islands such as Quail, Elizabeth and Ram Islands and the southern tip of French Island known as Tortoise Head. The main body of French Island lies in the centre of Western Port but is excluded from the Ramsar Site.

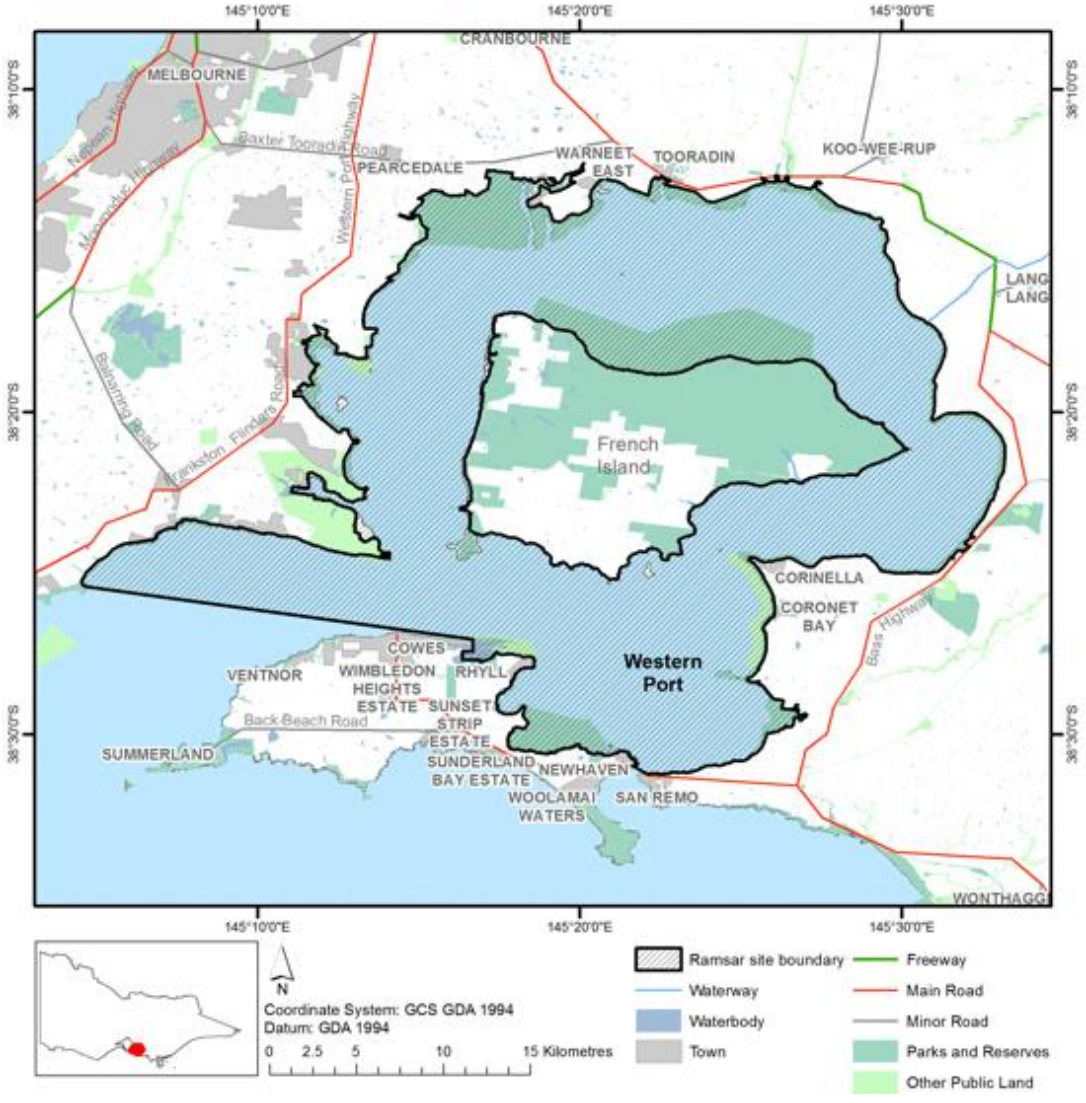


Figure 2: Map of the Western Port Ramsar Site.

2.2. Land use and tenure

The Western Port catchment extends from the Strzelecki Ranges in the east to the Yarra Ranges in the north and the Mornington Peninsula in the west, covering over 3,700 square kilometres. Most of the catchment is modified to support rural and peri-urban land uses (Melbourne Water 2009):

- Primary industries include dairying, beef production, poultry, horticulture and quarrying.
- Urban, industrial and tourist areas and lifestyle and hobby farms make up a smaller proportion.
- Some forested areas remain in the upper catchment on French Island and the Mornington Peninsula.

There are a variety of tenures associated with the lands and waters of the Western Port Ramsar Site, and these are detailed in (Table 1 and Appendix E). There are also a number of different agencies with responsibilities associated with managing aspects of the site, and these are summarised in Table 2.

Table 1: Land tenure within the Western Port Ramsar Site and the associated land managers.

Area	Land tenure	Legal status	Management
Yaringa, French Island and Churchill Island Marine National Parks	Marine National Park	National Parks Act 1975	Parks Victoria
Waters and Sea bed	Unreserved Crown Land	Land Act 1958	DEECA
Waters – Recreation and Navigation	-	Marine Act 1988	Parks Victoria
Port Waters of the Port of Hastings – commercial shipping channels	-	Port Management Act 1995	Ports Victoria (see Appendix E)
150 metres seawards of high water mark around French Island	French Island National Park	National Parks Act 1975	Parks Victoria
Hanns Inlet	Declared naval waters	Control of Naval Waters Act 1918	Department of Defence
Shoreline near Somers	Coastal Reserve	Crown Land (Reserves) Act 1978	Parks Victoria
	Public Purpose Reserves	Crown Land (Reserves) Act 1978	DEECA
	Coastal Reserve	Crown Land (Reserves) Act 1978	Point Leo Foreshore and Public Park Reserves Inc.
	Coastal Reserve	Crown Land (Reserves) Act 1978	Merricks Beach Foreshore Reserve Committee of Management
	Coastal Reserve	Crown Land (Reserves) Act 1978	Balnarring Beach Foreshore and Parks Reserve Committee of Management Inc.
Shoreline from Stony Point to Jacks Beach	Coastal Reserve	Crown Land (Reserves) Act 1978	Crib Point Stony Point Committee of Management
Bittern Coastal Wetlands	Coastal Reserve	Crown Land (Reserves) Act 1978	Mornington Peninsula Shire Council
Jacks Beach to Hastings	Unreserved Crown Land	Land Act 1958	Mornington Peninsula Shire Council

Hastings Foreshore Reserve	Coastal Reserve	Crown Land (Reserves) Act 1978	Mornington Peninsula Shire Council
Shoreline from east of Tyabb to Tooradin	Coastal Reserve	Crown Land (Reserves) Act 1978	Parks Victoria
	Nature Conservation Reserve	Wildlife Act 1975 and Land Act 1958	Parks Victoria
	Coastal Reserve	Crown Land (Reserves) Act 1978	Mornington Peninsula Shire Council (Tyabb Foreshore Reserve)
	Coastal Reserve	Crown Land (Reserves) Act 1978	Warneet Foreshore Reserve Committee of Management Inc.
	Coastal Reserve	Crown Land (Reserves) Act 1978	Cannons Creek Foreshore Reserve Committee of Management Inc.
Blind Bight Foreshore Reserve	Coastal Reserve	Crown Land (Reserves) Act 1978	Casey City Council
	Coastal Reserve	Crown Land (Reserves) Act 1978	Tooradin Foreshore Reserve Committee of Management Inc.
North-eastern Shoreline	Coastal Reserve	Crown Land (Reserves) Act 1978	Parks Victoria
	Nature Conservation Reserve	Land Act 1958	Parks Victoria
Shoreline near Corinella	Coastal Reserve	Crown Land (Reserves) Act 1978	Corinella Foreshore Committee of Management
Shoreline near Bass River	Nature Conservation Reserve	Land Act 1958	Parks Victoria
	Coastal Reserve	Crown Land (Reserves) Act 1978	San Remo Foreshore Committee of Management Inc.
Churchill Island	Nature Park	Crown Land (Reserves) Act 1978	Phillip Island Nature Parks
Shoreline near Rhyll	Coastal Reserve	Crown Land (Reserves) Act 1978	Parks Victoria
	Nature Park	Crown Land (Reserves) Act 1978	Phillip Island Nature Parks
French Island Shoreline	National Park	National Parks Act 1975	Parks Victoria
Elizabeth & Sandstone Islands	Freehold	Private Land	Private
Waters adjacent to the northern shore of French Island National Park	French Island Marine National Park	National Parks Act 1975	Parks Victoria
South of Rhyll, on the eastern shore of Phillip Island	Churchill Island Marine National Park	National Parks Act 1975	Parks Victoria
Crib Point Jetty and adjoining Coastal Crown land Stony Point Jetty and adjoining Coastal Crown land Long Island Point Jetty and adjoining Coastal Crown land Old Tyabb Reclamation Area	Crown Land Reserved and Unreserved	Port Management Act 1995	Port of Hastings Corporation

Table 2: Lead management agencies and their key responsibilities.

Agency	Overarching responsibility	Responsibility in Western Port
Parks Victoria	Manages parks and conservation reserves and the local port of Western Port including the safety and environmental management plan for water outside the Port of Hastings.	Manage many high value conservation areas including three marine national parks, French Island National Park, coastal crown land reserves. Parks Victoria is the Local Port manager of Western Port.
Department of Environment, Energy and Climate Action (DEECA)	Strategic direction for park and reserve management; flora and fauna management and implementation of the Ramsar Convention in Victoria; catchment and water management, forest management, coastal and local port management; leasing, licensing and management of public land, strategic and statutory land use planning including the administration of the Victorian Planning Provisions.	Policy advice for the management of the Western Port Ramsar Site. Appointment and oversight of Committees of Management on Crown foreshore reserves, including assistance with the preparation of Coastal Management Plans. Administer Coastal Management Act 1995 for use and development of coastal Crown land.
Department of Jobs, Skills, Industry and Regions	Provides strategic direction for fisheries management and research, agricultural services and sustainable development of Victoria's energy and mineral resources.	Manage recreational fishing for the Ramsar site in accordance with Fisheries Act 1995. Strategic and operational catchment management services e.g. soil conservation.
Environment Protection Authority Victoria	Responsibility for and coordination of all activities relating to the discharge of waste into the environment and the generation, storage, treatment, transport and disposal of industrial waste and the emission of noise and for preventing or controlling pollution and noise and protecting and improving the quality of the environment.	Licence sewage and other discharges. Monitor and report on environmental quality as required under the General Environmental Duty (GDE).
Port of Hastings	The Port of Hastings operates within the Western Port Ramsar Site. The Port currently services 130-150 ships annually and is a significant contributor to the Victorian economy. The Port offers a deep-water channel that requires minimal maintenance, existing infrastructure and access to large areas of appropriately zoned land. Western Port been an active trading port since the 1800s with commercial port and shipping activities now being concentrated at the Port of Hastings.	The Port of Hastings includes anchorages and shipping channels in large sections of Western Port. Port facilities includes the Crib Point liquid berths, Stony Point jetty and depot, Long Island Point liquid berth and the Blue Scope Steel wharves. The Port of Hastings facilities and waters are depicted Appendix E.
Melbourne Water	Provision of water and sewerage services and the management of water supply storages and catchments. Waterway Management in the PPWP CMA region. Environmental Water delivery with Victorian Environment Water Holder in Tarago/Bunyip.	Develop and implement Regional Catchment and Healthy Waterway Strategies. Prepare and implement Action Plans. Manage Western Port catchment and inflowing streams and drainage.
Shires of Bass Coast and Cardinia City of Casey Mornington Peninsula SC	Manage foreshores adjoining urban areas. Ensure orderly, sustainable development within the catchment to and within the boundary of the Ramsar site, through strategic land-use planning, improvement to and administration of the Planning Scheme.	Working with community and other agencies in the control of pest plants and animals, domestic animal control, managing buffer zones, water quality and fostering complimentary management practices. Consideration of the potential effects on ecological character in assessing planning applications.
Phillip Island Nature Parks	Manage Crown Land on Phillip Island set aside under the Crown Land Reserves Act for conservation outcomes.	Manage Crown Lands on Phillip Island within the Ramsar site boundary.

2.3. Ramsar criteria met

At the time that Western Port was first nominated as a Wetland of International Importance, the criteria for identifying wetlands of international importance were the "Cagliari criteria", adopted at the first conference of contracting parties in Cagliari, Italy in 1980. The original nomination documentation for the Ramsar site considered that the site met three of these criteria as shown in (Table 3). However, no specific justification for these criteria was provided.

Table 3: Criteria for Identifying Wetlands of International Importance as at listing date, 1982. Criteria for which Western Port was listed are highlighted (Forests Commission 1983).

Basis	Number	Description
Criteria for waterfowl	1a	It regularly supports 10,000 ducks, geese and swans; or 10,000 coots or 20,000 shorebirds
Criteria based on plants and animals	1b	It regularly supports 1% of the individuals in a population of one species or subspecies of waterfowl
	1c	It regularly supports 1% of the breeding pairs in a population of one species or subspecies of waterfowl
	2a	It supports an appreciable number of rare, vulnerable or endangered species or subspecies of plant or animal
	2b	It is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna
	2c	It is of special value as the habitat of plants or animals at a critical stage of their biological cycle
	2d	It is of special value for one or more endemic plant or animal species or communities.
Representative wetlands	3	It is a particularly good example of a specific type of wetland characteristic of its region.

The criteria under which a Ramsar site can be designated have gone through a series of changes, with the most recent major revisions occurring in 2005, when a ninth criterion was added. In addition, there have been changes to threatened species listings, which effects criterion 2, and updates to waterbird population estimates, which affects criterion 6. A revised assessment indicates that the site meets seven of the nine criteria ().

Table 4: Current criteria for Identifying Wetlands of International Importance, those that Western Port meets are highlighted.

Criteria
1. A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region
2. A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities
3. A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region
4. A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions
5. A wetland should be considered internationally important if it regularly supports 20 000 or more waterbirds
6. A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird
7. A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity
8. A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.
9. A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

The appropriate bioregion for the site is the Bass Strait IMCRA[1] Province which extends from Apollo Bay to Waratah Bay in Victoria including Port Phillip Bay and Western Port, the entire north coast of Tasmania and the waters between (Department of the Environment, Water, Heritage and the Arts 2008). Although there is not a complete inventory of wetlands and coastal ecosystems across the bioregion, there is evidence to suggest that Western Port contains good representatives of three Ramsar wetland types: G (intertidal mud, sand or salt flats); H (intertidal marshes) and I (intertidal forested wetlands).

Western Port contains a very large expanse of intertidal sand and mudflats and the extensive areas of saltmarsh and mangroves within the Ramsar site (wetland types H and I) are considered to be in good condition (Boon et al. 2011).

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

This criterion is only applied to ***wetland dependent*** flora and fauna, and those listed as vulnerable, endangered or critically endangered under national legislation (EPBC Act) or internationally (IUCN Red List). The site supports one ecological community, and 11 fauna species listed under the EPBC Act and or IUCN Red List:

- Coastal saltmarsh – Vulnerable ecological community
- Australian fairy tern (*Sternula nereis nereis*) – Vulnerable
- Bar-tailed godwit (*Limosa lapponica baueri*) – Vulnerable
- Common greenshank (*Tringa nebularia*) - Endangered
- Curlew sandpiper (*Calidris ferruginea*) – Critically endangered
- Eastern curlew (*Numenius madagascariensis*) – Critically endangered
- Lesser sand plover (*Charadrius mongolus*) – Vulnerable
- Red knot (*Calidris canutus*) – Endangered
- Ruddy turnstone (*Arenaria interpres*) – Vulnerable
- Sharp-tailed sandpiper (*Calidris acuminata*) – Vulnerable
- Terek sandpiper (*Xenus cinereus*) - Vulnerable
- Australian grayling (*Prototroctes maraena*) – Vulnerable.

While there are historic records of orange-bellied parrot (*Neophema chrysogaster*) from the saltmarshes of the site, the species is in serious decline and has not been recorded in the Western Port for over two decades (BirdLife Australia unpublished data). Similarly, there is a single record of an Australian painted snipe (*Rostratula australis*) from Pyramid Rock in 1979, which is insufficient to indicate that the site provides habitat for this species. There are

[1] Integrated Marine and Coastal Regionalisation of Australia

occasional records of the hooded plover (*Thinornis rubricollis rubricollis*) from beaches within the Ramsar site, including small numbers nesting at Silverleaves beach on Phillip Island. However, habitat requirements and records for this species indicate that the open coast beaches on the southern shore of Phillip Island are more important for hooded plover (Weston 2003, Maguire et al. 2014), which are outside the boundary of the Ramsar site.

Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region

Guidance from the Convention indicates that this criterion should be applied to "hotspots" of biological diversity and centres of endemism within a biogeographical region. As with criterion 1, the relevant bioregion is the expansive Bass Strait IMCRA Bioregion, for which an inventory of wetland dependent species and biodiversity hotspots is not available.

There is evidence, however, to indicate that the Western Port Ramsar Site meets this criterion, particularly with respect to marine invertebrates. The soft sediments of Western Port support a high diversity of ghost shrimps, including *Michelea microphylla*, a local endemic species known only from Crib Point (Wilson et al. 2011). In addition, the Victorian listed endangered *Pseudocalliax tooradin* has been found in shallow seagrass habitat of Crib Point (Edmunds et al. 2011) as well as more recently in surveys conducted for the Victorian Renewable Energy Terminal project (RPS, Port of Hastings 2025).

The intertidal and subtidal reefs at San Remo, which support a high diversity of one invertebrate group, opisthobranchs (sea-slugs and sea-hares) and Crawfish Rock, although small, is considered especially diverse: 600 species have been documented at this site: 130 algae, 150 sponges, 50 hydroids, 180 bryozoans and 80 ascidians (Shapiro 1975). In addition, the rare hydroid *Ralpharia coccinea* found at Crawfish Rock, and may be endemic to Western Port (Edmunds et al. 2010).

The Western Port Bryozoan Reef Community has recently been studied and is considered to be unique in its species composition, depth range, extensive linear mound formations with high vertical relief and its silty inter-reef sediment and seagrass–Caulerpa association (FFG Scientific Advisory Committee 2021). The Western Port Bryozoan Reef community provides habitat for diverse assemblages of matrix-associated and epifaunal macrofauna. The reefs support significantly higher species diversity of invertebrates and higher fish biomass than their surrounding habitat (Fathom Pacific 2020a, 2020b).

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their lifecycles, or provides refuge during adverse conditions.

The basic description of this criterion implies a number of common functions/roles that wetlands provide including supporting fauna during migration and breeding. Over 35 waterbirds listed under international migratory agreements have been recorded within the Ramsar site. This number includes species that, in Australia, are residents (e.g. eastern great egret) and vagrant seabirds for which the site does not provide significant habitat (e.g. Artic jaeger). There are 12 species of international migratory shorebirds that are regularly supported (in at least two thirds

of seasons) by the Western Port Ramsar Site (Hale 2016). The site provides both feeding and high tide roost sites for these species (Hansen et al. 2011). In addition over 20 species of wetland dependent bird species have been recorded breeding within the site, with breeding of beach nesting birds on French Island and the north shore of Phillip Island identified as being particularly significant (Dann 2011).

Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.

Data provided by BirdLife Australia and Richard Loyn (Western Port Bird Survey 1973 – 2024) indicate Western Port Ramsar Site supports > 20,000 waterbirds in 80 percent of years (annual maximum count). This satisfies the Convention requirements of "at least two thirds of seasons" to meet this criterion. The average total number of waterbirds[2] (1974 – 2024) is 23,500. It should be noted that the actual number of waterbirds supported by the site is likely higher as current monitoring was designed to capture important shorebird sites and while other waterbirds are included in surveys, there are other locations in the site that support significant numbers of non-shorebirds) that are not included in these totals.

Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Assessment of this criterion must be made using the most recent official population estimates (Wetlands International 2012, Hansen et al. 2016). Data provided by BirdLife Australia and Richard Loyn (1973 – 2024) indicate that seven species meet this criterion indicate that six species meet this criterion (Table 5).

Table 5. Waterbirds for which Western Port Ramsar Site regularly supported > 1% of the population over the 1974 – 2024 period (using Wetlands International 2012 and Hansen et al. 2016 population estimates).

Common name	Species name	Mean max. annual count 1974-2024	Pop. estimate	% of pop. 1974-2024
Australian fairy tern	*Sternula nereis nereis*	37	1500	2.4
Australian pied oystercatcher	*Haematopus longirostris*	437	11000	4.0
Curlew sandpiper	*Calidris ferruginea*	3118	90000	3.5
Double-banded plover	*Charadrius bicinctus*	629	19000	3.3
Eastern curlew	*Numenius madagascariensis*	947	35000	2.7
Pacific gull	*Larus pacificus*	353	5000	7.0
Red-necked stint	*Calidris ruficollis*	5963	475000	1.3

Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

[2] Calculated as the sum of the maximum count of each species within a calendar year.

The seagrass and other habitats within the embayment act as important nursery habitat for a range of fish and crustacean species (MacDonald 1992, Jenkins et al. 2013). Western Port is a key breeding area for some species such as elephant fish (*Callorhinchus milii*), school shark (*Galeorhinus australis*) and Australian anchovy (*Engraulis australis*), and a nursery area for other species such as King George whiting (*Sillaginodes punctatus*), yellow-eye mullet (*Aldrichetta forsteri*) and Australian salmons (*Arripis* spp) (Jenkins 2011).

The site also supports a number of fish species that migrate between fresh, estuarine and marine waters as part of their life cycles, including the Australian grayling, black bream (A*canthopagrus butcheri*) and the short-finned eel (*Anguilla australis*).

2.4. Critical components, processes and services

The Australian Government has developed and implemented a framework for describing the ecological character of Ramsar sites (Department of the Environment, Water, Heritage and the Arts 2008). This framework requires the identification and description of critical components, processes and services. These are defined as characteristics of the Ramsar site:

- that are important determinants of the sites unique character,
- that are important for supporting the Ramsar criteria under which the site was listed,
- for which change is reasonably likely to occur over short to medium time scales (less than 100 years), and/or
- that will cause significant negative consequences if change occurs.

The Western Port Ramsar Site ECD (Kellogg Brown and Root 2010) and ECD addendum (Hale 2016) identifies components, process and services that are critical to the ecological character of the Ramsar site. These are described briefly below; more detail on each can be found in the ECDs.

Wetland bathymetry

This critical component is related to the depth profile or morphology of the Western Port Ramsar Site. The site comprises extensive areas of intertidal flats (vegetated and unvegetated), which cover an area of approximately 27,000 hectares. At low tide, approximately 40% of the Ramsar site is exposed (Edgar et al. 1994), and this forms important feeding habitat for shorebirds, including internationally migratory waders. These soft sediments are dissected by deep (> 15 metre) channels, which extend up the north and eastern arms of the site.

Geomorphology and sedimentation

Western Port is characterised by the high sediment loads from the catchment, which are deposited in the river mouths and intertidal areas within the site. Resuspension of sediments by wind and wave action in the predominantly shallow embayment is also an important process (Kellogg Brown and Root 2010).

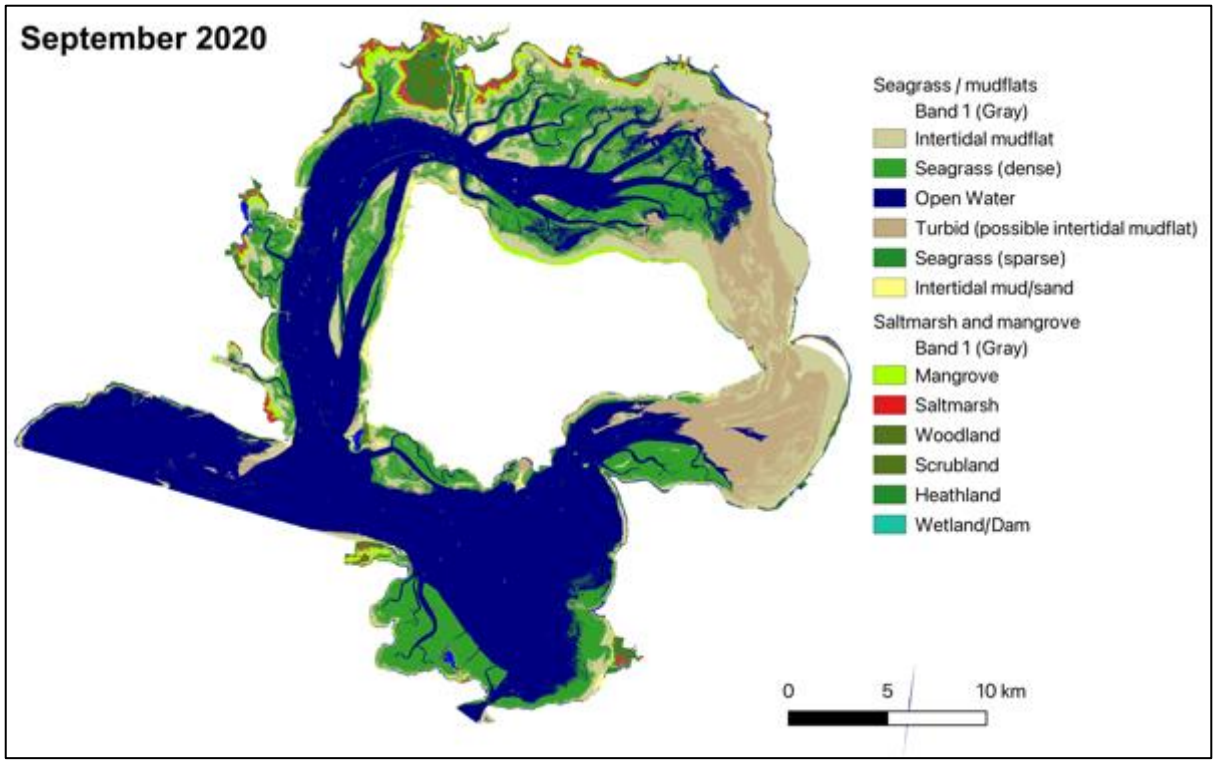


Figure 3: Marine habitats in the Western Port Ramsar Site.

Seagrass

There are four species of seagrass[3] within the Western Port Ramsar Site (Walker 2011):

- *Heterozostera nigricaulis* is the most common species in Western Port, found predominantly in the north and along channel banks.
- *Zostera muelleri* is an intertidal species forming patchy colonies in shallow water.
- *Amphibolis antarctica* occurs mostly in the areas of sandy sediments with underlying rock in south of Western Port, with only small patches within the Ramsar site boundary.
- *Halophila australis* occurs in small, sparse patches in deeper waters.

Seagrass occurs mostly in the northern and western arms of the Ramsar site (Figure 3). The extent and condition of seagrass in Western Port is highly variable over time. Modelling from Landsat imagery indicates a decline between 1973 and 1990, a subsequent recovery in 1998, then a decline from 2000 to 2014 (Wilkinson et al. 2016). More recent mapping from sentinel imagery from 2017 to 2023 indicates a decline in years of high rainfall, when rivers discharge larger loads of sediment to the system and water clarity was low (2019 and 2020) and increases in lower rainfall years (2017, 2023; Figure 4).

[3] Note that there have been revisions in the taxonomy of seagrasses since early descriptions and mapping. This description reflects current taxonomy.

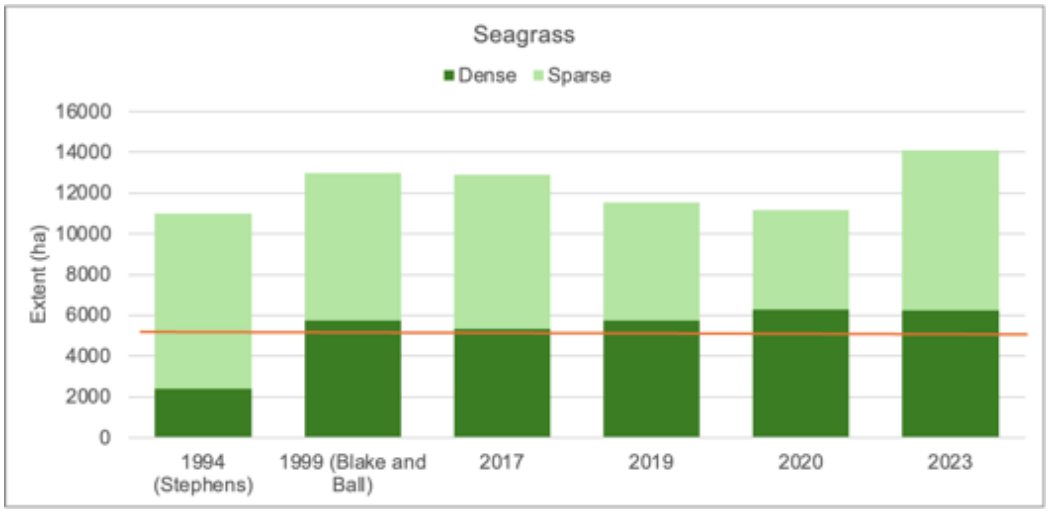


Figure 4. Seagrass extent as mapped in 2017 – 2023 (Hale et al. in prep.) and in previous investigations (Stephens 1995, Blake and Ball 2001). Orange line represents the Limit of Acceptable Change.

Saltmarsh

The Western Port Ramsar Site contains one of the largest expanses of saltmarsh in Victoria, covering an area of around 1400 hectares (Boon et al. 2011)[4]. Saltmarsh occupies the area of the site between mangroves and terrestrial vegetation at higher elevation. The saltmarsh of Western Port is diverse (Boon 2011) and in variable condition, with areas of intact high quality saltmarsh in some areas such as Yaringa Marine National Park, and other areas in poor condition with large areas of bare ground, low diversity and weeds (Mark Rodrigue, Parks Victoria, personal communication). Coastal saltmarsh is listed as a vulnerable ecological community under the EPBC Act and is important habitat for fish, when inundated and feeding and roosting waterbirds, when tides are low.

Mangrove

The mangrove areas of Western Port comprise a single species *Avicennia marina* and represent some of the most southerly extents of the species globally (Dittman 2011). The inundated roots and pneumatophores of mangroves provide good habitat for fish and invertebrates and play a role in stabilizing the soft sediments in the site.

Fish

The Western Port Ramsar Site supports a diversity and abundance of fish and supports an important recreational fishery. At the time of listing the site was also important for commercial fishing, but this was closed in 2007. Fish diversity and abundance is highly linked to habitat (Jenkins 2011):

[4] Note that much of the saltmarsh within the Western Port Bay area lies outside the Ramsar site boundary.

- Seagrass – small resident species with gobies and pipefish / sea dragons common, juveniles of recreationally important species such as King George whiting (*Sillaginodes punctatus*).
- Mangroves – small resident gobies (but not pipefish and seadragons found in seagrass), juvenile fish seasonally, including recreationally important species.
- Open water – large species such as Australian salmon (*Arripis trutta*), snook (*Sphyraena novaehollandiae*) and barracouta (*Thysites atun*).
- Reef – not well documented, but likely to include species such as wrasse (*Notolabrus* spp.) and zebra fish (*Girella zebra*). Recent studies have indicated a particularly high biomass of fish associated with the bryozoan reefs (Fathom Pacific 2020b).

Invertebrates

The soft sediment and reef habitats of the Western Port Ramsar Site support a diversity and abundance of marine invertebrates. One of the outstanding characteristics of the soft-sediment fauna of Western Port is the high diversity of ghost shrimps, which includes the rare species *Paraglypturus (Eucalliax) tooradin*, and a local endemic known only from Crib Point, *Michelea microphylla*. Because of the abundance of invertebrates, soft sediments in intertidal areas are important foraging ground for shorebirds (Wilson et al. 2011).

A recent survey of the bryozoan reefs indicated a high abundance and diversity of invertebrate fauna. Polychaete worms, molluscs, ascidians and sponges of various species were the most dominant taxa associated with the Western Port bryozoan reefs (Fathom Pacific 2020a).

Waterbirds

A total of 115[5] waterbird[6] species have been recorded within the Western Port Ramsar Site, and the site regularly supports 12 species of shorebirds from the East Asian-Australasian Flyway listed under the international migratory bird agreements JAMBA, CAMBA and ROKAMBA. The Western Port Ramsar Site provides significant foraging area for a variety of shorebird species as well as important roosting (resting) sites (Figure 5).

In addition to shorebirds, the Western Port Ramsar Site provides habitat for a variety of waterbird groups or guilds including ducks and swans; grebes; large wading birds such as herons, ibis and spoonbills; gulls and fish eating birds such as cormorants, pelicans and terns (Hansen et al. 2011).

Western Port supports breeding waterbird species and is particularly important for beach nesting birds. Australian fairy tern (*Sternula nereis nereis*) and Caspian tern (*Hydroprogne caspia*) breed semi-regularly on Rams Island (Lacey and O'Brien 2015). Australian pied oystercatchers (*Haematopus longirostris*) breed regularly in the sandy beaches (and even saltmarsh) of French Island. Noting that many species of waterbird such as ibis, spoonbills and cormorants, breed in

[5] Note that this number includes several pelagic seabirds such as albatross, which are not regularly supported by the site.

[6] Waterbirds are defined under the Ramsar Convention as species of birds that are ecologically dependent on wetlands.

swamps and wetlands outside the Ramsar site boundary but may rely on feeding grounds in the Ramsar site during nesting.

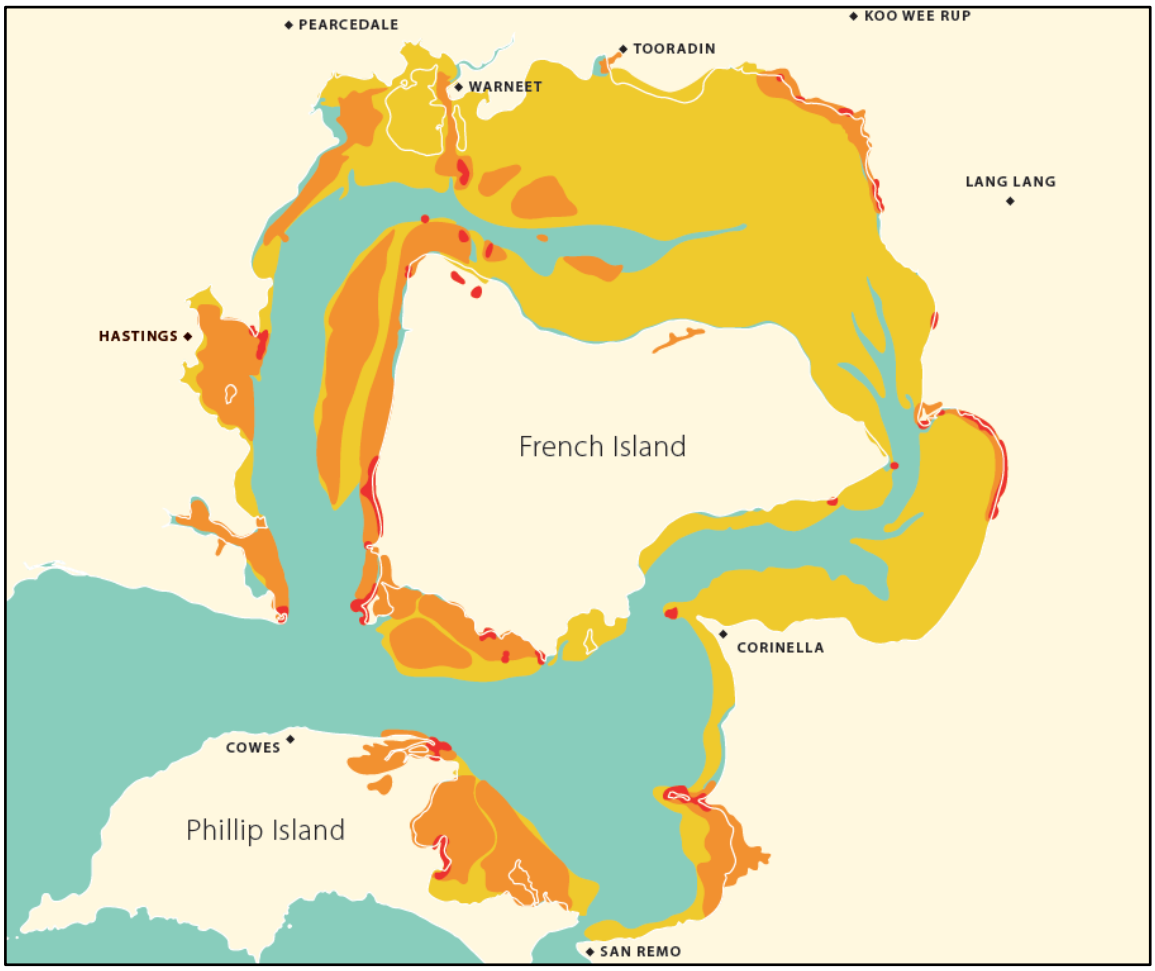


Figure 5: Shorebird habitat in Western Port showing primary foraging areas (orange); secondary foraging habitat (yellow) and high tide roost sites (red) (Central Coastal Board (Vic.) 2011, Hansen et al. 2011).

Threatened species

Threatened species regularly supported by the Western Port Ramsar Site include 10 species of bird and one fish species.

Bar-tailed godwit, common greenshank, curlew sandpiper, eastern curlew, lesser sand plover, red knot, ruddy turnstone, sharp-tailed sandpiper and terek sandpiper are international migratory species that spend the non-breeding season in the southern hemisphere. They arrive in late spring, spend the summer feeding on invertebrates in intertidal mudflats and depart for the northern hemisphere in February to March. Juveniles of these species spend their first one or two winters at the site before heading to the northern hemisphere to breed. Although the five species have similar life histories, they are physically very different. For example, the eastern curlew is the largest of the shorebirds with a wingspan of over one metre and a weight of nearly one kilogram. In contrast the curlew sandpiper and lesser sand plover are small birds, weighing just 50 - 70 grams (Higgins and Davies 1996).

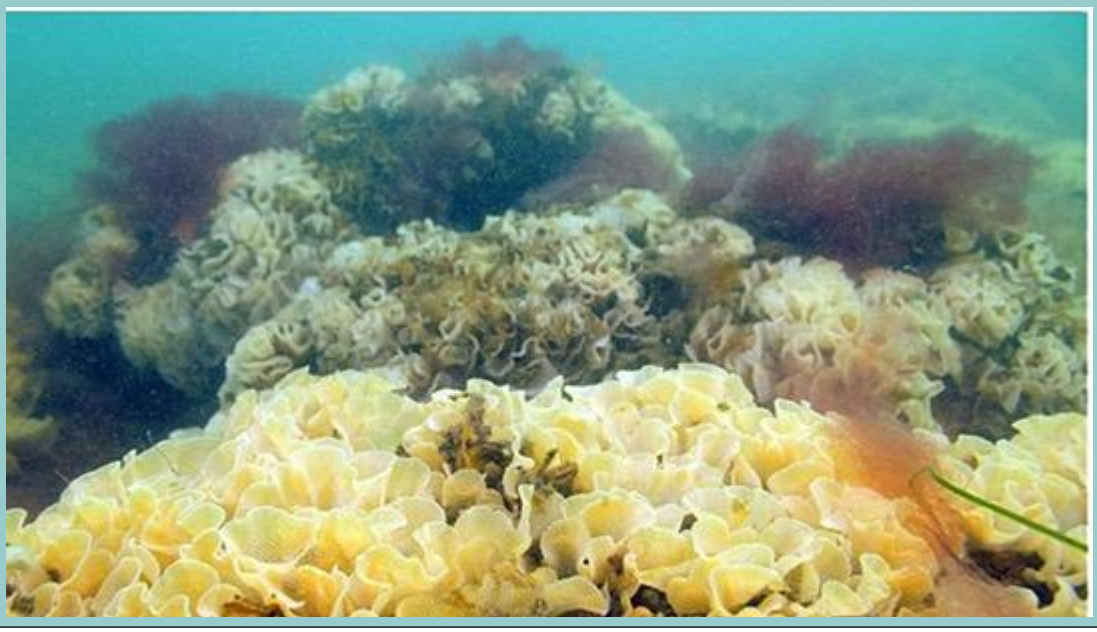
Australian fairy tern (*Sternula nereis nereis*) is an Australian resident, fish eating bird species. They feed close inshore upon small schooling fish. In the Ramsar site, anchovies and pilchards are likely to comprise the majority of their diet. There are two known breeding colonies in Western Port, the main one is at Rams Island, with three breeding records for the nearby Tortoise Island. On Rams Island the terns nest on sand or shell grit near the shoreline and since 2000 have also nested in dried seagrass (Lacey and O'Brien 2015).

Australian grayling (*Prototroctes maraena*) reside in the rivers of the catchment of Western Port (Koster and Dawson 2010). This diadromous species migrates to and from marine environments as part of its lifecycle (Crook et al. 2006, Schmidt et al. 2011). It is likely that larvae of the Australian grayling drift downstream into the Western Port Ramsar Site, with return upstream migration in spring of juveniles (Jenkins 2011).

Western Port Bryozoan Reef

Like coral, bryozoans are small, colony forming invertebrates that form the basis of reef systems. They are often called "lace corals" because of the delicate, perforated structure. In Western Port, the bryozoan reefs cover an area of around 174 hectares in the eastern area between Phillip and Frech Islands. They are dominated by three bryozoan species: *Triphyllozoon moniliferum*, *Triphyllozoon munitum* and *Celleporaria foliate*. The reefs provide structural habitat for a diversity of marine invertebrates and are important feeding grounds for many species of fish. It has been suggested that the bryozoan reefs in Western Port are unique globally as they:

- occur in shallow water (typically 5–10 m),
- are dominated by delicate lace-like colonies
- form continuous rows of reef interspersed with fine sediment, and
- are among the largest recorded in the world (up to 1.5 metres high).



Text Box 2. Western Port Bryozoan reefs (Dutka et al. 2022).

2.5. Ecological character status

The mechanism against which change in ecological character is assessed is via comparison with Limits of Acceptable Change (LAC). LAC are defined by Phillips (2006) as:

"...the variation that is considered acceptable in a particular measure or feature of the ecological character of the wetland. This may include population measures, hectares covered by a particular wetland type, the range of certain water quality parameter, etc. The inference is that if the particular measure or parameter moves outside the 'limits of acceptable change' this may indicate a change in ecological character that could lead to a reduction or loss of the values for which the site was Ramsar listed. In most cases, change is considered in a negative context, leading to a reduction in the values for which a site was listed".

The following should be considered when developing and assessing LAC:

- LAC are a tool by which ecological change can be measured. However, LAC do not constitute a management regime for the Ramsar site.
- Exceeding or not meeting LAC does not necessarily indicate that there has been a change in ecological character within the meaning of the Ramsar Convention. However, exceeding or not meeting LAC may require investigation to determine whether there has been a change in ecological character.
- While the best available information was used to prepare the ECD and define LAC for the site, a comprehensive understanding of site character may not be possible as in many cases only limited information and data is available for these purposes. The LAC may not accurately represent the variability of the critical components, processes, benefits or services under the management regime and natural conditions that prevailed at the time the site was listed as a Ramsar wetland.
- LAC can be updated as new information becomes available to ensure they more accurately reflect the natural variability (or normal range for artificial sites) of critical components, processes, benefits or services of the Ramsar wetland.

The LAC for the Western Port Ramsar Site were established in the ECD and ECD addendum for critical components, processes and services (Kellogg Brown and Root 2010, Hale 2016). An assessment against LAC is provided in Table 6.

The assessment below suggests that the LAC for the international migratory shorebird, eastern curlew, has been exceeded (Table 6). This is not related to conditions within the Ramsar site, but rather, the decline in shorebirds globally. The decline of many species in the East Asian-Australian flyway is well documented (MacKinnon et al. 2012, Hua et al. 2015, Hansen et al. 2016). Loss of habitat and decreased habitat quality in staging areas between artic breeding grounds and Australia have long been implicated in these population declines (Murray et al. 2015). Recent studies suggest that up to 58% of the tidal flat foraging areas have been lost in some mid-way staging locations in China and Taiwan (Chen et al. 2024). Habitat quality in these important stopover locations has been compromised both physically by the invasion of weeds such as Spartina spp. (Duan and Yu 2022) and by reduced prey (Chen et al. 2024). There is also

some evidence of increased toxicants such as mercury impacting on the health of migratory shorebirds (Ma et al. 2024).

Further evidence that declines in migratory shorebird abundance in Western Port are not related to habitat extent or quality within the Ramsar site comes from the trends in Australian shorebirds at the site, which forage in the same types of habitats as migratory shorebirds. The numbers of Australian shorebirds have not declined and may be increasing.

Table 6. Summary of assessment against LAC for the Western Port Ramsar Site.

Critical CPS	Limit of Acceptable Change	Assessment
Wetland bathymetry	No loss of intertidal mudflat area (270 km^2)	The extent of intertidal habitats in Western Port has not changed substantially since the time of listing. Over the period 2017 to 2023, bare intertidal area ranged from 113 to 147 km^2 and vegetated intertidal area from 136 to 170 km^2. **LAC is met.**
Seagrass	Total seagrass extent will not decline below 5400 hectares for a period of greater than 10 continuous years.	Extent of seagrass from 2017 to 2023 ranged from 11,000 hectares to 14,000 hectares. **LAC is met.**
Saltmarsh	Total saltmarsh extent will not decline below 850 hectares.	Extent of saltmarsh from 2017 to 2023 ranged from 980 to 1340 hectares. **LAC is met.**
Mangrove	Total mangrove extent will not decline below 900 hectares.	Extent of mangroves from 2017 to 2023 ranged from 1400 to 1560 hectares. **LAC is met.**
Waterbirds	Abundance of waterbirds will not decline below the following (calculated as a rolling five-year average of maximum annual count): • Total waterbirds – 12 000 • Migratory shorebirds – 5300 • Australasian shorebirds - 800 • Ducks - 500 • Fishers - 550 • Gulls - 1600 • Large wading birds - 980 • Swans – 1600 Breeding of beach nesting birds annually within the site	Average maximum count of each group of waterbirds from 2020 – 2024 was as follows (data from BirdLife Australia): • Total waterbirds – 19 700 • Migratory shorebirds – 7900 • Australasian shorebirds - 1980 • Ducks - 3200 • Fishers - 1500 • Gulls - 3000 • Large wading birds - 1500 • Swans – 1870 Breeding of beach nesting birds has been recorded annually. **LAC is met.**
Threatened species: birds	Abundance of eastern curlew, curlew sandpiper and fairy tern will not decline below 1% of the population as stated in the most recent Wetlands International Population estimate (based on a five year rolling average of annual maximum counts). Presence of bar-tailed godwit, lesser sand plover and red knot in at least three out of every five years.	Data from 2011 – 2015 indicate that the average abundance of the three species were as follows: Eastern curlew – 262 (0.7% of population) Curlew sandpiper – 1145 (1.3% of population) Fairy tern – 20 (1.4% of population) Data from 2011 – 2015 indicate presence of the three species: Bar-tailed godwit – all five years Lesser sand plover – three years Red knot – all five years **LAC is exceeded for eastern curlew but met for all other species.**
Threatened species: fish	Australian grayling continues to be supported in one or more of the catchments draining into Western Port.	Australian grayling continues to be found in the Bunyip River (O'Connor et al. 2022). **LAC is met.**

3. Priority values and threats

Priority threats and values for management in the next seven years were identified through a process that was based on a risk assessment.

3.1. Risk assessment method

The risk assessment process adopted for this project is consistent with the Australian Standard: Risk Management (AS ISO 31000:2018; Standards Australia 2018) and the Standards Australia Handbook: Managing environment-related risk (HB 203-2012; Standards Australia 2012). It builds on the risk assessment process undertaken in the 2016 management planning process, updating risks with new information where available. Consistent with an approach focussed on critical CPS, other values that are not identified as critical to the ecological character of the Western Port Ramsar Site (e.g. visual amenity, recreational fishing) have been omitted from the 2025 risk assessment. The risk assessment approach follows a structured and iterative process, with the following steps:

1. Establish the context – existing values and environmental conditions
2. Identify risks – threats and associated potential impacts, and
3. Analyse risks – assign likelihoods and consequences to determine level of risk.

Establishing the context

A review of existing published and unpublished information relevant to the Western Port Ramsar Site was undertaken to summarise the status of ecological character and potential threats to ecological character. The purpose of the risk assessment was to identify priority values and threats as the basis for identifying strategic actions in the Western Port Ramsar Site Management Plan. The risk assessment was underpinned by both local knowledge and expert opinion.

Identifying risks

An impact pathway approach was adopted for identifying and analysing risks. This uses a hierarchical process to identify potential risks as follows:

- Threats (threatening activities) – actions in the Ramsar site or catchment that could affect ecological character
- Stressors – the physical or chemical changes that could arise as a result of an activity
- Effects – the potential responses caused by the stressors.

This allows for clear identification of the underlying causes of risks and threats to ecological character of the Ramsar site, separating the threat from the impact. An example of an impact pathway is provided below.

Activities	Stressors	Impact pathway
Dredge operation	Direct flora removal	Reduction in the extent of seagrass

Analyse risks

The impact pathways formed the basis of a formal risk analysis process. Likelihood and consequence were assigned to each **impact pathway** in its entirety, integrating each of the levels in the hierarchy. Questions were put to stakeholder and agency technical staff to estimate the likelihood and consequence, for example: what is the likelihood that agricultural practices in the catchment will result in increased nutrients, increased algal growth and that this will result in a decline in seagrass health? What are the consequences of this with respect to the ecological character of the Ramsar site?

The risk assessment was based on a few key principles:

- Risk assessment is limited to ecological character as defined by critical components, processes and services.
- Assessment of likely impacts in the next seven years (within this management cycle),
- Assessment based on the current management regime continuing, and
- Evidence based approach using scientific expertise coupled with local knowledge.

Likelihood and consequence were guided by Table 7 and Table 8, with the risk matrix (Table 9) determining the overall risk.

Table 7: Likelihood

Almost certain	Likely	Possible	Unlikely	Rare
Is expected to occur in most circumstances	Will probably occur in most circumstances	Could occur	Could occur but not expected	Occurs only in exceptional circumstances

Table 8: Consequence

Negligible	Minor	Moderate	Major	Extreme
Alteration or disturbance to ecosystem function, populations or habitat within natural variability. LAC will not be exceeded and no evidence of a declining trend in critical CPS.	Localised measurable changes to critical CPS without a major change in function (no loss of components or introduction of new species that affects ecosystem function). No sustained declining trend in ecological character and LAC will continue to be met.	Widespread measurable changes to critical CPS, up to 20% of habitat likely to be affected. Decline in ecological character. LAC may be exceeded in the next 10 years but recover to within LAC within two years.	Widespread measurable changes to critical CPS, up to 80% of habitat affected. Significant, sustained, negative trend in ecological character. LAC is predicted to be exceeded in the next 5 years with recovery within 10 years.	Long term and possibly irreversible damage to one or more critical CPS. Sustained negative trend, LAC is predicted to be exceeded continually for at least 10 years.

Table 9: Risk matrix (adapted from AS/NZS 2006).

Consequence						
Likelihood		**Negligible**	**Minor**	**Moderate**	**Major**	**Extreme**
	Almost certain	Negligible	Medium	High	Extreme	Extreme
	Likely	Negligible	Medium	Medium	High	Extreme
	Possible	Negligible	Low	Medium	High	High
	Unlikely	Negligible	Low	Low	Medium	Medium
	Rare	Negligible	Negligible	Negligible	Low	Medium

Stakeholder involvement

The 2017 risk assessment was extensively reviewed using additional data, knowledge and ecological understanding made available in the past seven years. This draft risk assessment was provided to the steering committee, Western Port Ramsar Site Coordinating Committee and additional stakeholders and technical experts for review. An on-line workshop was held in November 2024. Workshop participants were asked to review the impact pathways, likelihood and consequence ratings for each impact pathway in their area of interest or expertise. In the workshop, the risk assessment was systematically worked through with discussion on the rankings and identified pathways until agreement was reached. Critical knowledge gaps were identified and documented for inclusion in the management plan. A number of risk rankings were deferred at the workshop for consultation with relevant scientific experts.

A few additional potential impact pathways were thoughtfully raised by stakeholders during the risk assessment workshop, demonstrating strong engagement with the process. These pathways were associated with proposed large-scale development projects in the region. While developments may have implications for the ecological character of the Ramsar site, their potential impacts will be thoroughly assessed through a dedicated and rigorous process at both State and Federal levels. This Ramsar plan acknowledges and supports that comprehensive approach, and is deferring to that process to ensure alignment and avoid duplication.

The revised risk assessment is provided in Appendix B.

3.2. High priority threats

The outputs of the risk assessment were used to identify the highest priority threats for management in the next seven years using two approaches. Firstly, all identified individual risk pathways that were assessed as high or extreme were considered a priority for management in the life of the plan. Secondly, risks were assessed cumulatively looking at the pressures and stressors across all risk pathways and identifying risks that may individually be medium but combined have a significant cumulative impact. Priority threats in each section of the Ramsar site are provided in Table 10 and described briefly below. The relationship between values and threats is illustrated in Figure 6.

Table 10. Highest threats for management in the next seven years.

Priorities for management
Climate change: increased storm events increase sediments affecting seagrass, fish and primary productivity (waterbirds through the food chain)
Climate change: Increased frequency and intensity of storms leads to increased erosion of shorelines, impacts saltmarsh, seagrass, fish and waterbirds (loss of roosting and nesting sites)
Climate change: sea level rise affects saltmarsh, intertidal flats, seagrass and intertidal reefs
Pollution urban and agricultural run-off: sediments and toxicants affecting all biota
Invasive species: introduced marine pests affecting flats and reefs and their invertebrate communities
Invasive species: cord grass (Spartina spp.) impacts saltmarsh, mangroves, shorebirds and beach nesting birds.
Invasive species: emerging salt tolerant weeds impacts saltmarsh, mangroves, shorebirds and beach nesting birds.
Invasive species: foxes and cats predating on waterbirds
Invasive species: non-native grazing animals (pigs, goats, deer) impacting vegetation and destroying waterbird foraging and nesting habitat
Recreation: beach users disturbing waterbird feeding, breeding and roosting
Recreation: vehicles in intertidal areas damaging saltmarsh, disturbing intertidal flats and foraging and nesting waterbirds
Biological resource use: recreational fishing impacting on intertidal invertebrates, target fish and by-catch
Avian diseases impacting on waterbirds

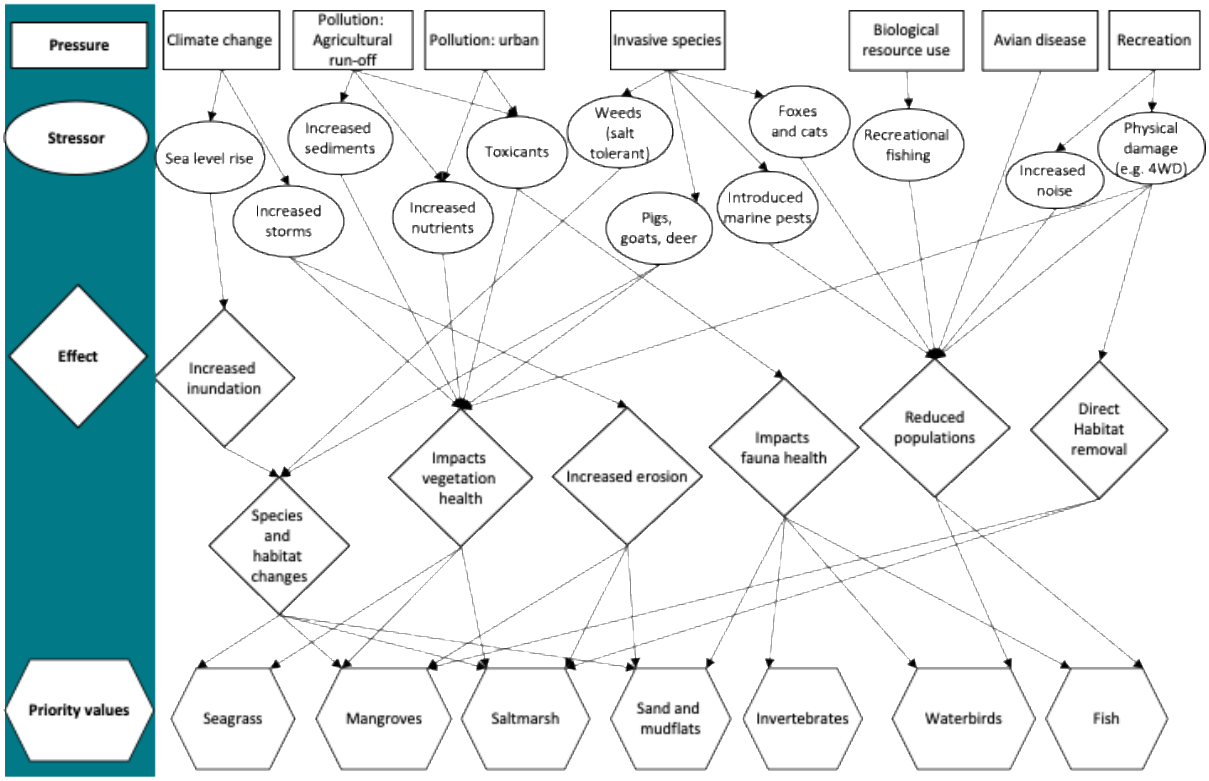


Figure 6. Stressor model illustrating the major linkages between threats (pressures and stressors) and values.

Invasive species

Five different groups of invasive species have been identified as a high priority threat to the ecological character of the Western Port Ramsar Site:

Cord-grass (*Spartina* spp.): There are two species of Spartina known from Victoria (*Spartina anglica* and *Spartina* x *townsedii*) both of which have been deliberately introduced to coastal areas, most often as erosion control or alternative fodder crops in salt affected areas (Williamson 1995). Spartina is known from two locations in Western Port and intertidal and saltmarsh habitats are vulnerable to invasion and expansion of this species. It is tolerant of inundation and salinity, resistant to many herbicides and can rapidly outcompete native vegetation (Boon et al. 2011).

New and emerging salt-tolerant weeds: There are a large number of exotic species that can invade - and have invaded at higher elevations at the edge of the saltmarsh range (e.g. tall wheatgrass; *Thinopyrum ponticum,* and Sicilian sea lavender*; Limonium hyblaeum*). Impacts are mostly to saltmarsh, rather than mangroves, due to the lower degree of tidal inundation. However, some species can also affect habitat for waterbirds. For example, sea spurge (*Euphorbia paralias*) is a known threat to beach nesting birds, displacing the sandy habitat that beach nesting birds such as little tern, fairy tern and oystercatchers require for nesting (Mead et al. 2012).

Foxes and cats: The Port Phillip and Westernport CMA Invasive Plants and Animals Strategy (Port Phillip and Westernport CMA 2011) identifies predation by foxes and cats as a significant threat to shorebirds and beach nesting birds, with foxes remaining widespread throughout the Ramsar site. There is also evidence that black rats are a significant threat to nesting birds, with predation on eggs.

Introduced marine pests: There are several known introduced marine pest species in Western Port, although the size and number of infestations is comparatively low. However, the adjacent Port Phillip Bay has over 100 exotic species established with a number of these recognised as marine pests, and is recognised as one of the most highly invaded marine ecosystems globally (Hewitt et al. 1999). Given the proximity of Western Port to Port Phillip Bay and prevailing currents, it is highly likely that larvae could be transported from Port Phillip Bay to Western Port. High priority marine pest species include Pacific oysters (*Crassostrea gigas*) and the Asian date mussel (*Musculista senhousia*) with confirmed sighting and control activities for Japanese kelp (*Undaria pinnatifida*) and Northern Pacific seastar (*Asterias amurensis)* in Western Port.

Grazing animals (deer, goats, pigs): Deer are widespread through the coastal areas of Western Port and damage native vegetation by grazing and trampling. Pigs have been deliberately released on Quail Island where they are causing extensive damage to saltmarsh areas.

Climate change

Western Port spans two reporting regions for climate change projections in Victoria, Greater Melbourne to the west and Gippsland to the east, although the projections for key climate variable as very similar for each region. The medium -high emissions scenarios, the model that

measured data most closely resembles; (Schwalm et al. 2020, Pedersen et al. 2021) projected the following conditions, relative to a 1986–2005 baseline (DEECA 2024):

- Very high confidence of an increase in maximum daily temperature increases of 0.9 to 1.7 °C by 2050 and 1.8 to 2.0 by °C 2050.
- Very high confidence of a significant increase in the number and duration of extreme temperature periods.
- Medium to high confidence that cool-season rainfall will decrease, but the magnitude of this change is uncertain.
- High confidence that there will be an increase in the frequency of heavy rainfall events.
- Very high confidence in a 10–30% increase in mean evaporation.
- Very high confidence in a continued increase in mean sea level and the frequency of extreme coastal sea levels (i.e. storm surges). Mean sea level is likely to increase by 2050 by 0.18 metres over 1990 levels.

The future climate in the Western Port region is predicted to be hotter, drier and with more frequent and intense storms. Three stressors related to climate change were identified as priority threats to the ecological character of the Western Port Ramsar Site as described below.

Sea level rise

A combination of factors is contributing to sea level rise. This includes thermal expansion of the ocean as temperatures increase as well as inflows of water as glaciers and ice sheets melt. Accurate measures of sea level from satellite extend back to 1992, and this indicates that sea levels are rising at a rate of around 3.5 mm per year (Figure 7). This means that mean sea level has increased by at least 12 cm since Western Port was listed as a Ramsar site. In terms of future projections, it is estimated that the seas around the Victorian coast will rise by around 50 cm by 2070 compared to a 2007 baseline (DEECA 2024).

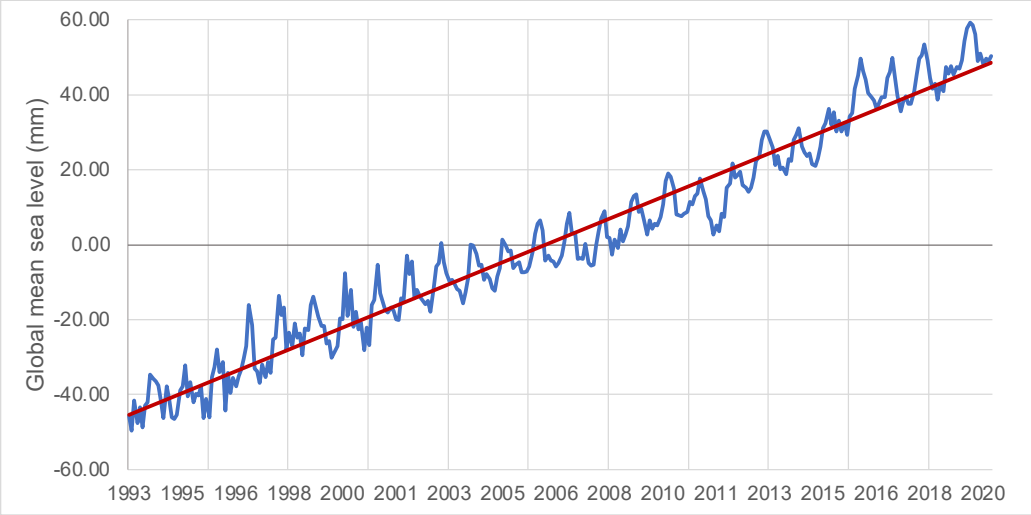


Figure 7: Mean global sea level since 1992 with seasonal signal (blue) and trend line (red). (https://www.cmar.csiro.au/sealevel/sl_hist_last_decades.html).

Increased frequency and intensity of storms leading to increased sediments

Extreme events (storms and high rainfall events) are predicted to occur with high confidence. The soft sediments in the shallow waters over much of Western Port are highly vulnerable to resuspension. While there have been no long term changes in suspended sediment concentrations in Western Port from the time of listing, modelling based on 2030 global climate change predictions indicate significant increases in suspended material throughout the system, most likely with heightened concentrations in the Eastern Arm (EPA Victoria 2011a). Greatest risks are associated with seagrass, which is already light limited (Holland et al. 2013) and fish that rely on seagrass habitat.

Increased frequency and intensity of storms leading to increased erosion: Erosion of shorelines in Western Port is currently occurring, particularly in the Eastern Arm near Lang Lang due to the combined actions of waves and tidal cycles. The Western Port Local Coastal Hazard Assessment indicates widespread and significant impacts by 2100 (Arrowsmith and Womersley 2014). Seagrass and intertidal mud and sandflats were considered to be at greatest risk from eroding shorelines, with high risks identified for saltmarsh, mangroves and feeding, nesting and roosting waterbirds.

Recreational activities

Western Port is close to the City of Melbourne and a number of regional towns, making it a popular destination for recreational activities. The population of Greater Melbourne is predicted to increase from 5.1 million in 2023 to over 10 million in 2051 (Department of Transport and Planning 2023). This is likely to increase recreational pressure on beaches and coastal areas. There are three identified priority threats related to recreational activities in the Western Port Ramsar Site.

- **Vehicles in the intertidal zone:** Vehicle damage to coastal saltmarsh communities has been reported from many areas in Western Port (Boon et al. 2011). Saltmarsh communities are slow to recover from disturbance and damage can be subtle (stem breakage) to long lasting and severe (e.g. wheel ruts). Parks Victoria has reported that the extent of vehicle access to intertidal areas has been largely controlled in the parks of Western Port. However, damage continues at sites outside of Parks Victoria control.

- **Disturbance of shorebirds and beach nesting birds**: Increased noise from shore based or nearshore boating activities (including jet skis, kite surfing, kayaking and other water-based activities) and the presence of domestic dogs on beaches have all been identified as high risks to waterbirds both in Western Port and elsewhere. Impacts on shorebirds from the presence of humans and their pets is well documented with reduced feeding and unnecessary energy use likely to impact the ability of birds to successfully make return journey to the northern hemisphere to breed (Glover et al. 2011). Similarly, disturbance of nesting birds can be direct (predation or destruction of eggs by people and dogs) or indirect (harassment causing nest abandonment).

- **Recreational fishing (including bait pumping)**: A survey of recreational fishers in Victoria indicates that for some species, the recreational catch is significant (Ford and

Gilmour 2013). There are policies and rules in place (size and bag limits) to limit the impact of recreational fishing on fish stocks, but an increasing population is likely to place increasing pressure on fisheries resources. Studies of bait pumping for ghost shrimp in Western Port indicated that changes are not just to target species, but to the ecosystem function of the entire habitat, with potential for slow recovery (Contessa and Bird 2004). Ghost shrimp are a primary food source for long beaked waders such as eastern curlew.

Ghost shrimp

Ghost shrimp are a group of burrowing shrimps that in habitat intertidal waters. The most common species in southeastern Australia and Western Port is the bass yabby (*Trypaea australiensis*). Although Western Port is also home to at least two rarer species, which are listed as threatened under Victorian state legislation, the Western Port ghost shrimp (*Pseudocalliax tooradin*) and *Michelea microphylla* (the latter species is known from a single record only).

Ghost shrimp not only contribute to biodiversity in Western Port, but they play a fundamental role in sediment and nutrient dynamics. Their burrowing activity increases sediment porosity, oxygenation and facilitates denitrification. For this reason, they are often described as ecological engineers.

Ghost shrimps are collected as popular bait species by recreational fishers on tidal flats and beaches, either by using a hand-operated suction pump (bait-pump) or by digging. The disturbance created by both the bait-pumping and associated trampling of adjacent mudflat is often obvious and frequently extensive. A study in 2004 in Western Port found that not only did the collection of ghost shrimp for bait reduce the population of the target species, but it had a significant effect on sediment and nutrient dynamics. In addition, there is a prolonged period for recolonisation which makes the ecological effects felt over a long period of time. Other studies have suggested that bioturbation of sediments and denitrification is very important in Western Port for minimising algal blooms and mitigating nutrient discharges from catchments.

There are limits in place for the collection of burrowing shrimp in Victoria with a total combined of 0.5 litres of burrowing shrimp from one or more species. There are also restrictions on the number and type of equipment that can be used and collection from marine parks and sanctuaries is prohibited.

Western Port is the biggest recreational fishery in Victoria. The increase in the population of Melbourne, combined with the proximity of Western Port to the city, will increase the pressure put on the fishery and bait harvesting.

Text Box 3. Collecting live bait in Western Port.

Sediments

There are a number of sources of sediments to Western Port, including catchment derived sediments (approximately 70% of total discharge) and erosion of clay banks, particularly around the Lang Lang area (Tomkins et al. 2014). The vast majority of catchment derived sediment loads come from rural lands (85%); with agriculture (cropping and dairy) accounting for the largest loads. The dominant catchment source for fine sediment is channel and gully erosion of Lang Lang River and, to a lesser extent, Bunyip River (Cuddy et al. 2019).

There are no clear trends in the concentration of suspended solids in Western Port, which have remained stable since monitoring commenced in 1984 (EPA Victoria 2011b, Holland et al. 2013). However, total loads exceed the General Environment Duty target of 28 kilotonnes/year in average and above average rainfall years (Cuddy et al. 2019). As with nutrients (described above) the run-off of sediments under future climate predictions may be lower during periods of drought, but very high during storm and flood events.

The greatest risks from sediments are to seagrass and species that rely on seagrass habitats. Seagrass loss in Western Port between 1970 and 1990s has been attributed to decreased light and increased suspended sediments (Walker 2011). Studies have concluded that suspended sediments are a strong influence on seagrass distribution and health. While seagrass extent has increased since 1999 in the north and west, the seagrass in the northeast has not recovered and loss has been associated with increased erosion and turbidity (Wilkinson et al. 2016).

Toxicants

A study of the waterways of the north-east of the Western Port Catchment found frequent and widespread contamination by pesticides across the catchments investigated which discharge into Western Port. Pesticides are present in surface waters and sediments of rivers, drains and estuaries in complex mixtures and often at concentrations likely to impact on resident flora and fauna. Herbicides and fungicides are the most frequently detected pesticide groups, also occurring at the highest concentrations (Myers et al. 2019). The source of toxicants was identified as agricultural land use rather than urban areas (Myers et al. 2016).

Avian diseases

High pathogenicity avian influenza has the potential to severely affect wild bird populations including waterfowl and shorebirds. Since 2020, a variant of these viruses belonging to the H5 clade 2.3. 4.4b has led to an unprecedented number of deaths in wild birds and poultry in many countries in Africa, Asia and Europe. In 2021, the virus spread to North America, and in 2022, to Central and South America. Oceania (Australia and New Zealand) is the only region to remain free of this virus to date. While there is currently no effective way to prevent new strains of bird flu entering Australia, and it is possible that the virus could impact on wild bird populations in the region and in the Ramsar site in the future. Response planning will be critical to minimising impacts.

3.3. Knowledge gaps

Throughout the risk assessment process and in reviewing data to evaluate the status of ecological character, a small number of key knowledge gaps were identified:

- Distribution, community composition, abundance and condition of benthic infauna communities.
- Impact of current and future recreational fishing on fish populations and on bryozoan reefs.
- Extent and impact of bait pumping on invertebrates but also flow on to foraging waterbirds.
- Condition of saltmarsh and mangrove vegetation communities.
- Status and trends in key non-recreationally targeted fish species.
- Management options to address risks from avian disease (e.g. avian flu)

4. Site management strategies

4.1. Approach

There are two types of indicators that are relevant to the management of the Ramsar site:

Limits of Acceptable Change (LAC) are set in the Ecological Character Description (ECD) and are based on the conditions at the time of listing. LAC can be updated based on new knowledge that improves confidence in the LAC, and this occurred with the ECD Addendum. LAC are the thresholds at which ecological character may be compromised.

Resource Condition Targets (RCTs) are established in the Ramsar Site Management Plan and are the aspirational condition for each of the identified priority values (i.e. where do we want / expect the condition of each priority value to be at the end of this management plan?). These will help to assess the effectiveness of the management plan in maintaining (or improving) ecological character.

How LAC and RCTs fit into the planning and development process is illustrated in Figure 8. As part of Ramsar management planning, LAC were previously developed for the site and are documented in the draft ECD. These are formal instruments against which change in ecological character is assessed and reported to the Convention every three years. RCTs were developed by expert opinion and local knowledge, with consideration of the LAC and expected natural variability for each value.

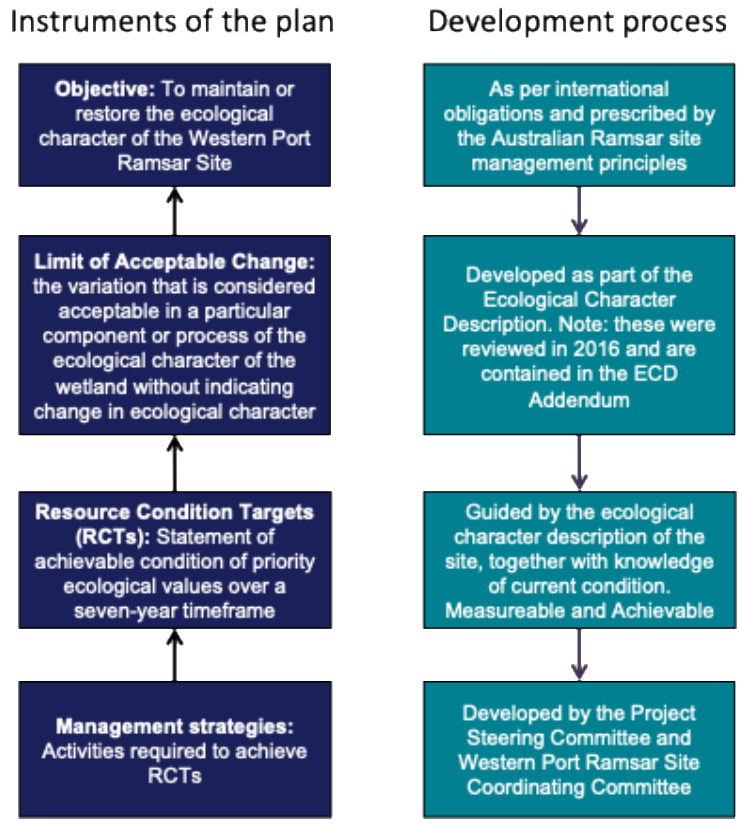


Figure 8: Relationships between the different instruments of the plan and their development process.

Stakeholder involvement

Resource Condition Targets were reviewed and refined by the Steering Committee, with input from technical experts and a broad range of stakeholders. Management strategies to address priority values, threats and knowledge gaps were developed by the Steering Committee and Western Port Ramsar Site Coordinating Committee in an online workshop in April 2025. The outputs of the workshop were used to assign management strategies to one of five themes.

- Theme 1: Managing water quality
- Theme 2: Living with climate change
- Theme 3: Protecting flora and fauna
- Theme 4: Improving our knowledge
- Theme 5: Communication, Education, Participation and Awareness (CEPA).

Where possible, integration with existing programs was sought, with relevant programs identified. Responsibilities for each management strategy were identified.

4.2. Achievements of the 2017 plan

A large amount of on groundwork and research has been undertaken within the Western Port Ramsar Site since the release of the 2017 Ramsar Site Management Plan. A summary of this work, highlighting significant achievements related to maintaining ecological character is provided here for each management agency. Implementation of the 2017 plan is provided in Appendix A.

Melbourne Water

Melbourne Water developed, and is implementing, the Healthy Waterways Strategy which informs the management of rivers, estuaries and wetlands in the Port Phillip and Westernport region. The Healthy Waterways Strategy defines Melbourne Water's current role, in partnership with the community and stakeholders, in managing rivers, estuaries and wetlands from 2018 to 2028 (https://healthywaterways.com.au/). This strategy focuses on investing in areas that the community values and that will protect and improve environmental values and increase liveability. Whilst largely aimed at catchment scale management, the priorities for improving health of the catchments of Western Port will provide benefits to the Ramsar site values.

As part of the Groundwater Dependent Ecosystem program, Melbourne Water has developed a conceptual model explaining the role of groundwater in Western Port and installed monitoring bores. Conceptual models have also been prepared for the Tarago and Bunyip catchment and the Lang Lang catchment. The links between groundwater and seagrass have also been investigated.

Melbourne Water has commissioned a serious investment into knowledge and understanding of Western Port. Firstly through the comprehensive review: *Understanding the Western Port Environment - A summary of current knowledge and priorities for future research* (Melbourne Water 2011); then through a series of research programs aimed at addressing the significant knowledge gaps identified in the 2011 review. An updated review that summarises the research findings from 2011 to 2018 with 29 projects across five themes (Understanding the Western Port Environment 2018).

Parks Victoria

Parks Victoria has continued on-ground actions specifically addressing threats to flora and fauna in parks and reserves in the Ramsar site. The Western Port Ramsar Site contains three marine parks (Yaringa, French Island and Churchill Island) as well as numerous reserves along the shoreline. Parks Victoria continues to work in collaboration with other agencies to manage pest plants and animals within the portions of the Ramsar site that they control as well as contributing to research and knowledge management through the Research Partners Program. Examples of Parks Victoria actions and programs in the Ramsar site include:

- development of a management plan for the national parks within Western Port (Parks Victoria 2007);
- monitoring and benchmarking of values within marine national parks;
- production of a marine pest guidebook for Port Phillip and Western Port Bays; and
- active partner in the Western Port Ramsar Protection Program.

Victorian Government Department of Energy, Environment and Climate Action

The Department of Energy, Environment and Climate Action (DEECA) has continued to undertake a statewide coordination and oversight role for Ramsar sites in Victoria including Western Port. DEECA oversees the implementation of Ramsar convention obligations, with a Ramsar statewide coordinator working closely with the Ramsar site coordinator to deliver requirements under the Ramsar Convention. DEECA continue to play a referral role in major projects in vicinity of the Western Port Ramsar Site. DEECA provide input to both Technical Reference Groups and review of Environmental Effect Statements for major projects and as part of this process give consideration to impacts to any values associated with the Ramsar site. DEECA also maintain the Victorian Biodiversity Atlas (VBA) which is a web-based information system designed to manage information about native and naturalised species occurring in Victoria. Species records associated with ecological restoration monitoring projects at Western Port are recorded through the VBA.

4.3. Resource Condition Targets

A total of five Resource Condition Targets (RCTs) for critical CPS have been defined for the Western Port Ramsar Site (Table 11). These have helped to guide the identification of management strategies and provide a goal for monitoring the ecological character of the site. RCTs were derived from expert and local knowledge and aim to represent feasible aspirational targets to be achieved in the life of the management plan (next seven years).

There are several critical CPS, for which the development of numerical, feasible targets is not possible with current data. These include targets for the condition of saltmarsh and mangrove communities, waterbird breeding and marine invertebrates. Monitoring recommendations for the collection of data to enable improved target setting in the next Western Port Ramsar Site Management Plan are provided in section 5. Further information about RCTs, current condition and knowledge gaps / suggestions for future target development is provided in Appendix C.

Table 11: Resource Condition Targets for the Western Port Ramsar Site.

Resource condition targets	Critical CPS
Maintain the diversity and mosaic of habitats for the Ramsar site (calculated as rolling seven-year averages): Seagrass > 14,000 hectares, with > 50% being medium-dense Saltmarsh > 1,100 hectares Mangroves > 1,700 hectares Unvegetated intertidal sand / mudflats > 13,000 hectares	Seagrass, saltmarsh, mangroves, intertidal flats
Maintain abundance of indicator fish species above the following thresholds (fish per angler hour): Snapper • October-December 0.2 • January-May 0.4 King George Whiting – 0.7 Sand flathead – 0.9 Elephant fish – 0.1	Fish
Maintain abundance of waterbirds in each of the following guilds (calculated as a rolling five-year average of maximum annual count): Total waterbirds > 20,000 Migratory shorebirds > 12,000 Australasian shorebirds > 1,100 Ducks > 1,300 Fishers > 600 Gulls > 1,300 Large wading birds > 1,300 Swans > 2,700	Waterbird diversity and abundance
Maintain annual breeding of Australian pied oystercatcher and red-capped plover within the Ramsar site.	Waterbird breeding
Annual presence of the following threatened waterbird species within the site: Australian fairy tern, bar-tailed godwit, common greenshank, curlew sandpiper, eastern curlew, lesser sand plover, red knot, ruddy turnstone, sharp-tailed sandpiper, terek sandpiper.	Threatened species

4.4. Theme 1: Managing water quality

Sediment and toxicant inputs to Western Port were identified as high priority threats. Significant research and on-ground work has been conducted on managing water quality both in terms of sources and impacts to key values within Western Port. This includes through the Better Bays and Waterways program (see below), Port Phillip and Western Port Regional Catchment Strategy and the Melbourne Water 2018 Healthy Waterways Strategy, as well as through a number of other regional initiatives. It is the intention of the Western Port Ramsar Site Management Plan to be complementary to these other initiatives, working in a coordinated manner to improve water quality in the Ramsar site.

Four management strategies have been identified to manage water quality (Table 12). The relationship between management strategies, priority threats and priority values with their associated RCTs is provided in Appendix D.

Table 12: Management strategies and responsible organisations for managing water quality.

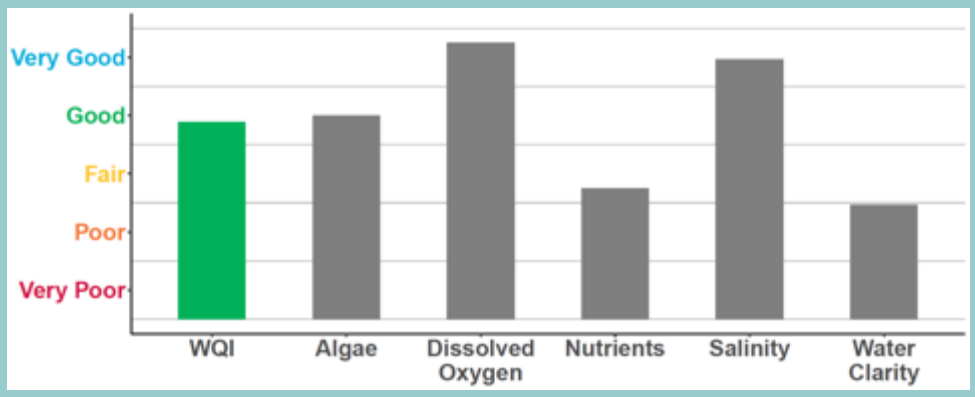
Management strategy	Responsibility	Linkages to existing programs / activities
1.1 Reduce nutrient and sediment inflow: Support the implementation of riparian, in-stream and catchment works identified in the Healthy Waterway Strategy (Melbourne Water Corporation 2018); revised Environmental Reference Standards; Port Phillip and Western Port Regional Catchment Strategy and local actions plans to improve water quality in storm water and river flows to Western Port.	Melbourne Water EPA Victoria DEECA Local government	Healthy Waterways Strategy PPWP Regional Catchment Strategy Environmental Reference Standards Western Port Biosphere Water Stewardship Landcare Revegetation Program
1.2 Implement incentive schemes for urban and rural run-off through the Water Sensitive Urban Design program.	Melbourne Water DEECA Local government	Urban Stormwater: Best Practice Environmental Management Guidelines Western Port Biosphere Water Stewardship
1.3 Develop appropriate approaches for pollutant reduction and seagrass improvement, and trigger values (objectives) for water quality indicators	EPA Victoria	Review of SEPP (WoV) Western Port Biosphere Water Stewardship
1.4 Investigate the sources, potential impact and mitigation strategies for toxicants entering Western Port through storm water drains and rivers	Melbourne Water EPA Victoria Local government	Western Port Scientific Investigations funded by Melbourne Water Western Port Biosphere Water Stewardship

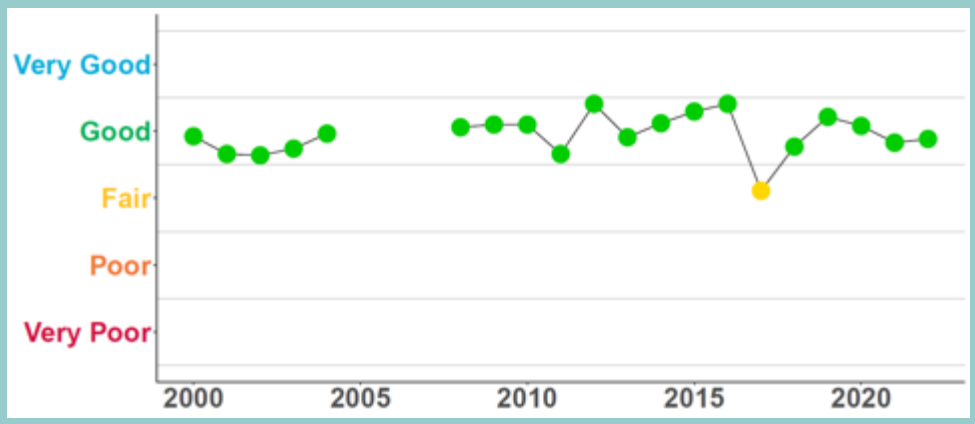
Western Port Report Card 2022-23

EPA, Melbourne Water, and Department of Energy, Environment and Climate Action monitor water quality within Western Port Bay. The Report Card uses the monitoring data, to calculate an annual Water Quality Index (WQI) – Very Poor, Poor, Fair, Good or Very Good. These refer to the Environmental Reference Standards (2021).

Western Port is a well-flushed, semi-enclosed bay, with two large islands (Phillip Island and French Island) that constrain water flow. The catchment is largely rural (70 per cent), with state reserves (20 per cent) in the upper catchment, and a fast-growing urban growth corridor.

Overall, water quality was Good in Western Port for 2022–23. High nutrient and reduced water clarity levels resulted in Fair and Poor ratings respectively for these parameters, this is consistent with previous years.





Text Box 4. Western Port Water Quality Report Card (EPA Victoria 2024).

4.5. Theme 2: Living with climate change

Climate change was identified as a priority threat for management in the next seven years based largely on the effects of sea level rise on coastal vegetation communities (saltmarsh and mangroves) as well as on habitat for shorebirds. Longer term impacts from increased frequency and intensity of drought and increased storm surge were also considered a high priority threat, and the potential change in fire regimes identified as a knowledge gap.

Although it is not possible to directly influence the drivers of climate change in a management plan for a single Ramsar site, planning for resilience and adaptation to climate change is crucial and requires immediate action to maintain ecological character into the future. The issue of maintaining ecological character in a changing climate and with the inevitable changes in species distributions is being considered by the Convention (and in many other forums) both in Australia and internationally (Pittock et al. 2010, Gitay et al. 2011, Finlayson et al. 2013).

Two management strategies have been identified to address the impacts of climate change (Table 13). The relationship between management strategies, priority threats and priority values with their associated RCTs is provided in Appendix D.

Table 13: Management strategies and responsible organisations for addressing the impacts of climate change.

Management strategy	Responsibility	Linkages to existing programs / activities
2.1 Implement strategies to address coastal erosion risks: • Development of a strategic approach to the management and future adaptation of the existing shoreline protection works • Provision of adaptation space for the landward migration of wetland fringed shorelines and investigate land acquisition strategies.	Melbourne Water Local government	
2.2 Identify and implement opportunities for improving and enhancing habitat adaptation in response to the impacts of climate change within the Ramsar site and adjacent priority areas.	Melbourne Water DEECA Local government	

Mangrove restoration (2021-2025)

Mangroves (*Avicennia marina*) face a number of priority threats including climate change resulting in the increased frequency and intensity of storms which leads to shoreline erosion. Mangrove revegetation is one of the approaches that Melbourne Water and Bass Coast Landcare Network have utilised to address coastal erosion as part of the Restoring Western Port Ramsar project, supported by the Victorian Government through the Victorian Waterway Health Program.

Melbourne Water recently joined Bunurong Land Council Aboriginal Corporation Rangers and Bass Coast Landcare Network, **planting mangroves** at Queensferry. These mangroves play a crucial role in protecting and restoring Western Port Bay's internationally recognised Ramsar wetland.

By planting in areas where mangrove loss has led to coastal erosion, we're helping to stabilise shorelines, create habitat for marine life, and improve water quality.

Using a **direct seeding method**, within the intertidal zone, mangrove seedlings are placed in between unique energy dissipaters that are made of woven shrubs, giving them the best chance to establish and thrive in a dynamic marine environment.

Monitoring plays a vital role when assessing the success of the mangrove revegetation program at the Western Port Ramsar Site. Five weeks after planting, the plots at Queensferry were monitored for progress, with some fantastic and promising results so far. Ongoing monitoring of the plots will take place as part of the Restoring Western Port Ramsar project and help to support further mangrove revegetation with an adaptive management approach

4.6. Theme 3: Protecting flora and fauna

Pest plants and animals, recreational activities, direct habitat removal through commercial and residential development and biological resource use (harvesting of fish and invertebrates) were all identified as high priority threats to the plants and animals of the Western Port Ramsar Site. While there has been a large and coordinated program to control predators and pest plants within the Ramsar site (see text box below), this work needs to be maintained. Similarly, while the relevant authorities assess individual development proposals, a coordinated approach to assessing the effect of multiple actions and developments may be required to adequately maintain ecological character.

Nine management strategies have been identified to protect flora and fauna (Table 14). The relationship between management strategies, priority threats and priority values with their associated RCTs is provided in Appendix D.

Table 14: Management strategies and responsible organisations for protecting flora and fauna.

Management strategy	Responsibility	Linkages to existing programs / activities
3.1 Implement methods for restoring seagrass and mangroves.	DEECA NGOs Universities	Ramsar Protection Program Seagrass Partnership Western Port Biosphere Bass Coast Landcare Network
3.2 Identify priority locations of habitat loss in the Ramsar site due to human activity including vehicle damage, stock grazing, illegal dumping, direct vegetation removal and implement or improve enforcement of existing laws.	Parks Victoria Melbourne Water DEECA Local government	Ramsar Protection Program
3.3 Develop and implement an incentive program for adjacent landholders to fence waterways, mangrove and saltmarsh areas to restrict stock access and investigate opportunities for land acquisition.	Melbourne Water DEECA	Ramsar Protection Program Western Port Biosphere Water Stewardship
3.4 Continue to implement pest animal control programs (cat, fox, rat, dog, pig) in priority waterbird roosting and nesting sites within the Ramsar site.	Melbourne Water Parks Victoria Local government	Ramsar Protection Program
3.5 Continue to implement pig, goat and deer control programs within the Ramsar site boundary to limit impacts on saltmarsh	Parks Victoria Melbourne Water Local government	Ramsar Protection Program; Local action plans
3.6 Continue to implement Spartina control programs within the Ramsar site	Parks Victoria Melbourne Water	Ramsar Protection Program
3.7 Conduct regular surveys and implement control actions for new and emerging salt tolerant weeds	Parks Victoria Melbourne Water	Ramsar Protection Program
3.8 Develop and implement a marine pest strategy for Western Port.	DEECA Parks Victoria	Ramsar Protection Program
3.9 Investigate the potential to use dredged material to renourish beach habitat for foraging and nesting birds.	DEECA Melbourne Water Parks Victoria Port of Hastings	

Quail Island feral pig eradication

Feral pigs were illegally released on Quail Island in 2008 and subsequently caused significant damage to soil and vegetation on the island. Damage observed across the 700ha island included pugging, creation of wallows, competition for water, creation of trails, promotion of weed spread and predation of wildlife. Eradication of the feral pig population was viewed as an achievable objective, and the most appropriate option for Parks Victoria given the ecological significance of the site. Funding was secured through Federal and State Government under the coordinating of the Port Phillip and Westernport Catchment Management Authority (now Melbourne Water) to support the eradication effort. An island wide monitoring program was developed and implemented to establish a population estimate which was used to inform the control strategy. An aerial shooting operation was undertaken in May 2019 resulting in the removal of 4 feral pigs. This operation included 3 individual flight missions with a total flying time of 195 minutes. Following the aerial shooting operation, a ground shooting operation commenced in December 2019 following confirmed detections from the remote camera network. Two feral pigs were culled during the ground shooting operation. Since 2020 no feral pigs have been observed on Quail Island – with coastal saltmarsh vegetation, and terrestrial vegetation communities thriving under reduced grazing pressures.

4.7. Theme 4: Improving our knowledge

Western Port is a well-studied environment and in particular the recent Melbourne Water Western Port environment research program has added greatly to our understanding of the system and its values (see Text Box 5).

Six priority knowledge gaps were identified during the development of the Western Port Ramsar Site Management Plan. Some of these are addressed through monitoring activities (see section 5) and three management strategies have been developed to address the remainder (Table 15).

Table 15: Management strategies and responsible organisations to address critical knowledge gaps.

Management strategy	Responsibility	Linkages to existing programs / activities
4.1 Investigate the impacts of bait harvesting (including bait pumping) on invertebrate populations and shorebirds.	DEECA VFA	
4.2 Investigate the severity and extent of impact recreational fishing is having on the bryozoan reefs.	Parks Victoria VFA DEECA	
4.3 Develop and implement a response plan for addressing risks associated with avian diseases.	DEECA BirdLife	Agriculture Victoria avian flu response plan

Melbourne Water Western Port Environmental Research

In March 2012 Melbourne Water released a scientific review strategically assessing our knowledge of the Western Port environment, to inform future investment to protect and improve the bay's health. The review represents an outstanding summary of the combined knowledge of the Western Port environment. The review provided 43 recommendations for research and 12 high priority research projects.

After a further six years of research, a second review was released in 2018. This second review highlighted the knowledge gained through the extensive research program and identified a new set of high priority research areas:

- Western Port seagrass genetics and taxonomy
- population trends in fish-eating birds
- monitoring and evaluation of pesticide risk to key habitats and biota
- protection and recovery of seagrass beds
- sediments, coastal inputs and seagrass interactions
- recreational fishing, fish biodiversity and habitats
- mangrove planting for coastal stabilisation
- improving our ability to model hydrodynamics in Western Port

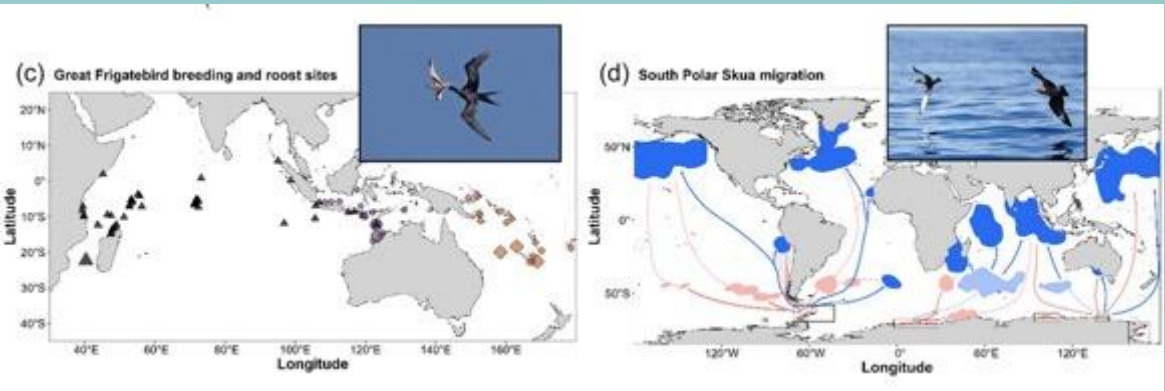
Research to address these newly identified knowledge gaps has commenced and updates are provided through the Melbourne Water web site (https://www.melbournewater.com.au/about/what-we-do/research-and-innovation/western-port-environment-research).

Avian influenza

Avian influenza (bird flu) is not a new phenomenon, but there is evidence of significant increases in outbreaks and deaths in birds and mammals. Of most concern is the outbreaks of H5N1 (clade 2.3.4.4) which emerged in Europe in 2021 and has since expanded to Asia, Africa, the Americas and Antarctica. It has caused the death of millions of wild birds, largely waterbirds, as well as seals and poultry. To date Australia and New Zealand remain free of the virus, but the risk of an outbreak is considered by many to be inevitable.

The original outbreaks of the virus in Europe where transmitted largely by migratory ducks, swans and geese. For this reason, Australia was considered to be at a lower risk of an outbreak as the species of ducks and swans in Australia are not international migrants, having distributions restricted to within the Australian continent.

More recent studies have indicated that terns and other seabirds can also carry the disease and have been implicated for its dispersal. It is suspected that brown skuas and southern giant petrels were responsible for early spread of the disease to sub-Antarctic islands. Frigate birds and skuas practice a behaviour of food theft, forcing other birds to regurgitate food, with the scavenging birds then ingest. This type of behaviour facilitates the spread of avian influenza. Species of frigate bird have large migratory routes, which include breeding and foraging sites within Australia.



Migratory routes for great frigate bird (left) and southern polar skua (right; Gorta et al. 2024).

If and when H5N1 (or some other strain of highly infections avian influenza) reaches Australia it could have a devasting effect on wild birds such as ducks, black swans, and little penguins. While little can be done to manage the disease, there are protocols for limiting the spread. In Australia, avian influenza is a notifiable disease and there are response plans in place at all levels of government and for specific locations such as Phillip Island Nature Park. A Wildlife Health Australia's Risk Mitigation Toolbox is available to help guide responses https://wildlifehealthaustralia.com.au/Incidents/Incident-Information/wha-hpai-h5-bird-flu-risk-mitigation-toolboxes .

It should also be noted that avian influenza is not the only disease that can affect Australian wildlife, but in a recent risk assessment for little penguins on Phillip Island it was identified as the highest risk disease for the species (Vaughan-Higgins et al. 2024).

Text Box 5. Avian influenza, risks to Australian birds (Gorta et al. 2024, Vaughan-Higgins et al. 2024, Waller et al. 2025)

4.8. Theme 5: Communication, Education, Participation and Awareness (CEPA)

The Ramsar Convention's Program on Communication, Education, Participation and Awareness (CEPA) was established to help raise awareness of wetland values and functions. The CEPA Program calls for coordinated international and national wetland education, public awareness and communication. The Program also encourages the promotion of training in the fields of wetland research and management.

While there are some excellent CEPA programs already in place in the Western Port Ramsar Site (see text box below for the Ramsar Private Land Stewardship Project), the lack of awareness in the broader community of wetland values and the Ramsar Convention was raised by the Stakeholder Advisory Group and Steering Committee as a significant issue for Western Port.

Two management strategies have been identified to improve communication, education, participation and awareness (Table 16). The relationship between management strategies, priority threats and priority values with their associated RCTs is provided in Appendix D.

Table 16: Management strategies and responsible organisations for CEPA activities.

Management strategy	Responsibility	Linkages to existing programs / activities
5.1 Develop and implement a Western Port Ramsar community engagement strategy that considers: • Education and engagement of landholders • Public awareness of the impacts of recreational activities on sensitive habitats and species such as shorebirds and beach nesting birds • Mechanisms to engage divers and recreational fishers in preventing marine pest outbreaks • The status of ecological character of the Ramsar site.	Melbourne Water DEECA Parks Victoria BirdLife Australia Local Government	Ramsar Protection Program
5.2 Maintain the Western Port Ramsar Site webpage (DEECA) and the process for stakeholder involvement via updates and links.	DEECA	

Ramsar Private Land Stewardship

John Carney became a member of the Bass Valley Landcare Group in 2021, inspired by a social media post on the Bass Coast Landcare Network (BCLN) Facebook page. Initially engaging in community planting days, John quickly caught the 'Landcare bug' and began exploring opportunities to enhance the natural values of his 157-acre property near Grantville.

Following a site visit by BCLN's Dave Bateman, it became clear that the property held significant ecological potential, particularly the preservation of approximately 10 acres of saltmarsh, a critically important Ramsar-listed wetland habitat. The project began with the installation of a 930-metre kangaroo-proof fence, protecting the saltmarsh from grazing pressure and allowing natural regeneration. An additional 1.5 kilometres of fencing was erected to safeguard areas of remnant vegetation and create biolinks to enhance wildlife movement across the landscape.

With fencing in place, the BCLN team coordinated targeted weed control, tackling invasive species such as spiny rush, blackberry, and inkweed. A revegetation program followed, with the planting of over 1,000 indigenous plants to further stabilise and enhance the site. This saltmarsh project was the catalyst for the development of a Whole Farm Plan, which prioritised biodiversity conservation alongside productive farming outcomes. The plan identified and fenced additional remnant areas, created shelter belts, and improved stock rotation practices across the farm.

To date, more than 11,400 plants have been established on the property through a collaborative volunteer effort involving: Bass Valley Primary School, Bass Valley Landcare Group, EcoLiv (through corporate volunteer days) and Bass Coast Landcare Network. The initial engagement under the Ramsar Private Land Stewardship Program has since led to five funded environmental projects on the property. These have been supported through:

- Melbourne Water's Liveable Waterways Program
- Victorian Landcare Grants
- MW RAMSAR Private Land Stewardship and Two great wetland project
- Western Port Biosphere Foundation's Blue Carbon Project
- Bass Coast Shire Council's Biolinks Program.

John is an enthusiastic advocate for wetland and mangrove restoration, particularly at Queensferry, located directly in front of his property. His passion for sustainable agriculture has led him to join the BCLN Bioferts Mentoring Program, where he now makes his own biofertilisers and practices regenerative farming.

"***The best thing about being involved with these projects is seeing the actual change to the property—doing something that gives back to our local area in a sustainable way, and meeting lots of great people along the way***" John Carney.

5. Monitoring, evaluation, reporting and improvement

5.1. Framework

Consistent with the *Victorian Waterway Management Strategy* (VWMS), the Ramsar Convention and the Australian Ramsar Management Principles, this Western Port Ramsar Site Management Plan adopts an adaptive management approach. The Western Port Ramsar Site Management Plan will be renewed every seven years and is underpinned by a monitoring program that reports on the condition of the system with respect to change in ecological character and progress towards meeting resource condition targets through a four- and seven-year review.

In 2018, Victoria developed a Ramsar monitoring evaluation reporting and improvement (MERI) Framework to improve confidence in the effectiveness of management of Victoria's Ramsar sites and to assist Victoria in meeting national reporting obligations under the Ramsar Convention (Figure 9). Under the framework each Victorian Ramsar site has developed a MERI plan, a living document that describes two types of monitoring:

1. MERI to assess the status of ecological character and meet Ramsar reporting obligations
2. MERI to evaluate the effectiveness of management at the site:
    a. General assessment of the implementation of management actions and progress towards achieving RCTs for all critical CPS
    b. Detailed evaluation testing assumptions associated with management of at least one critical CPS, with the results used to update the evidentiary basis for and to improve the effectiveness of management.

A summary of monitoring within the Western Port Ramsar Site MERI Plan is provided in Table 17.

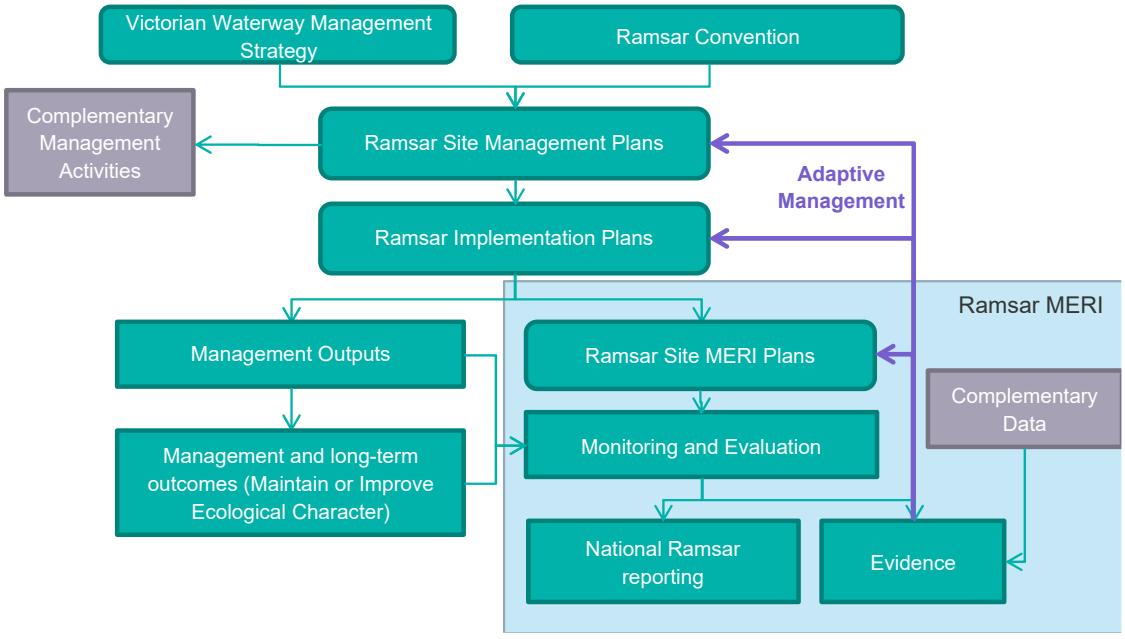


Figure 9: Monitoring, evaluation, reporting and improvement framework (DEECA unpublished).

Table 17: Recommended monitoring for the Western Port Ramsar Site.

Program	Indicators and method	Frequency	Responsibility	Linkages to existing programs / activities	Recommended locations
Water quality	Salinity, dissolved oxygen, water clarity, nutrients (dissolved and total) and chlorophyll-a.	Monthly and event based	EPA Victoria Parks Victoria Melbourne Water	Current water quality monitoring by EPA	EPA Marine Fixed Site Network (FSN)
Marine habitat extent (seagrass, saltmarsh, mangroves, intertidal unvegetated flats	Extent of intertidal habitats via remote sensing, using the methods developed by Brooks and Hale (2020, 2023).	Every five years	DEECA	Marine habitat mapping 2017 - 2023	Entire site
Saltmarsh and mangrove condition	Methods based on recognised methods against EVC benchmarks	Every five years	DEECA Parks Victoria	Parks Victoria Marine Protected Area monitoring programs	Representative saltmarsh and mangrove locations
Invertebrate diversity, abundance	Parks Victoria method for monitoring soft sediments and reef communities.	Every two to five years	DEECA Parks Victoria	Parks Victoria Marine Protected Area monitoring programs	Representative soft and hard surface habitats
Waterbird abundance and diversity	BirdLife Australia standard methods.	Three times a year	Melbourne Water	Current BirdLife Western Port bird monitoring	Existing Birdlife long-term sites, with additional sites for non-shorebirds.
Beach nesting waterbirds	Surveys of priority nest sites. Camera monitoring for predators.	Annual	DEECA Parks Victoria	Victorian Wader Studies Group	Priority beach nesting locations
Seabird breeding	Surveys of priority nest sites	Annual	DEECA Parks Victoria		Priority seabird colony locations (e.g. Tortoise Head)
Native fish: abundance and trends	Purpose built monitoring program will need to be developed. At a minimum, survey should measure abundance and community composition and target species that are not captured in reactional fisher diary programs.	Annual	DEECA	Parks Victoria Marine National Parks Monitoring Program	Key habitats (seagrass, bryozoan reefs)

6. Governance and implementation

6.1. Governance

The roles and responsibilities for managing Ramsar sites in Victoria can be summarised follows:

Ramsar state-wide coordinator

DEECA will undertake a state-wide coordination and oversight role:

- Facilitate a coordinated and consistent approach to MERI and adaptive management.
- Undertake preliminary and formal assessment in response to potential change in ecological character.
- Develop a management response in partnership with the site coordinator and site manager/s where change in ecological character has been confirmed.
- Address issues that are not able to be managed at a site level.
- Lead RIS updates undertaken in consultation with the Ramsar site coordinator.
- Oversee renewal of management plans and ensure that they meet the Australian Ramsar Management Principles, follow an adaptive management approach and address issues of management effectiveness identified through the MERI framework.

Ramsar site coordinator

Melbourne Water is the site coordinator and has the following responsibilities:

- Convene and chair a site coordination committee.
- Ensure coordination committee is engaged.
- In consultation with the coordination committee oversee the implementation of Ramsar site management plan priorities, according to available resources, by:
    - developing an annual action plan that determines and assigns agreed responsibility for actions, and development of annual investment proposals
    - developing and overseeing the implementation of an annual monitoring plan, as guided by the MERI framework; and
    - maintaining up-to-date information in the MERI database.
- Maintain communications with the state-wide coordinator, including:
    - annual investment and implementation reporting
    - tracking ecological character status via the MERI database; and
    - annual reporting on ecological character status (more frequent if limits of acceptable change have been exceeded).
- Maintain communications with agencies that manage areas within the Ramsar site, in line with responsibilities set out in site management plans.
- Ensuring that monitoring data is appropriately curated for future reference.
- Provide input to state-wide projects (undertaken by state-wide coordinator) relating to Ramsar sites, including any updates to RIS and ECD.
- Oversee strengthening of Ramsar site management plan for sites where this is required.

- Lead the renewal of Ramsar site management plan.

Ramsar site manager/s

The Ramsar site manager/s for the Western Port Ramsar Site include DEECA, Parks Victoria, Mornington Peninsula Shire Council, Cardinia Shire Council, City of Casey, Phillip Island Nature Parks and they have the following responsibilities:

- Participate in the site coordinating committee activities.
- Implement their agreed responsibilities outlined in Ramsar site annual action plans, in collaboration with regional partners.
- Notify the coordinator of any indication of exceeding limits of acceptable change for the critical components, processes and services as set out in the ecological character description for the site.

6.2. Implementation

Melbourne Water, as the Ramsar Site Coordinator co-ordinates implementation of this Western Port Ramsar Site Management Plan, on behalf of regional agency partners.

The Western Port Ramsar Site Coordinating Committee (WPRCC) comprise of representatives of the partner agencies and are primarily responsible for the management of the Ramsar site (Melbourne Water, DEECA, Parks Victoria, Bunurong Land Council, Mornington Peninsula Shire Council, Cardinia Shire Council, City of Casey, Phillip Island Nature Parks, Western Port Biosphere and Port of Hastings Corporation).

Implementation planning

Each of the agency delivery partners (Melbourne Water, DEECA, Parks Victoria Parks Victoria, Bunurong Land Council, Mornington Peninsula Shire Council, Cardinia Shire Council, City of Casey, Phillip Island Nature Parks), will prepare agency implementation plans for the actions for which they are identified as responsible in the Western Port Ramsar Site Management Plan, by 30 June each year. Each agency will work within their established legislative, regulatory and administrative arrangements.

Melbourne Water will integrate these agency plans into a single action plan for the Western Port Ramsar Site Management Plan by December each year to ensure that the responsibilities for individual management actions are clearly established, priorities and sequencing is logical, implementation is focused and coordinated, and funding opportunities are identified.

Western Port Ramsar Coordinating Committee

The WPRSCC is convened and co-ordinated by Melbourne Water.

This integration approach builds on previous and current collaboration practice in the region, evident most recently in the strong participation of delivery partners in the development of the Western Port Ramsar Site Management Plan.

The WPRSCC will be responsible for coordinating specific aspects of implementation within the themes of the Western Port Ramsar Site Management Plan. These responsibilities will include developing:

- implementation targets
- action planning, updated annually
- targeted investment proposals
- integrated delivery arrangements
- coordinated monitoring and evaluation of implementation, including integrated reporting against targets; and
- reviewing Management Plan progress bi-annually.

Resourcing implementation

Investment proposals to support actions of the Western Port Ramsar Site Management Plan will be developed as investment opportunities arise. Project investment proposals will be prepared through the WPRSCC in conjunction with delivery partners and will be structured to reflect the themes within the Western Port Ramsar Site Management Plan, and the regional programs of partner managing agencies.

Implementation of the Western Port Ramsar Site Management Plan will be influenced by available funding and resources. The implementation approach that will be applied will coordinate the prioritisation of management actions so that maximum benefit is achieved with the resources that are available. The annual priorities are captured in annual action plans which detail the resources required and responsible partners for their implementation and provide a mechanism to chart and evaluate the implementation of the Ramsar site management plan.

Partners will seek funding for implementation of this plan through the:

- Victorian Waterway Programs Investment Framework;
- Relevant initiatives of the State and Federal Governments;
- Existing agency budgets; and
- Contributions of industries and communities.

6.3. Communication

Melbourne Water will co-ordinate communications and engagement for the Ramsar site as part of its role in co-ordinating the WPRSCC and overseeing the implementation of the Western Port Ramsar Site Management Plan.

6.4. Ramsar administration

There are a number of administrative matters required to be undertaken as a component of managing the Western Port Ramsar Site. These are described, with a brief rationale in Table 18.

Table 18: Matters related to the administering of the Ramsar Convention and the Western Port Ramsar Site.

Management Strategies	Responsibility	Rationale
6.1. Apply the appropriate State and Commonwealth environmental impact assessment processes for activities that have the potential to impact on the Ramsar site and Matters of National Environmental Significance (MNES).	DEECA DCCEEW	Under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), actions that have, or are likely to have, a significant impact on a matter of national environmental significance require approval from the Australian Government Minister for the Environment (the Minister). The responsibility for referral of an action lies with the proponent. The Minister decides whether assessment and approval is required under the EPBC Act. Ramsar sites are one of the nine MNES and so assessments would be required for any activity that is likely to impact on the ecological character of the site, whether inside the site or in the catchment.
6.2. Undertake a regular review of the status of the ecological character of the Ramsar site.	Melbourne Water, DEECA	Annual reporting against LAC and RCT to be incorporated int the Ramsar Management System and reported to the Australian Government as required.
6.3. Develop annual action plans for this strategy	Melbourne Water and the WPRSCC	This plan has identified high level strategies for a number of agencies.

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Appendix A Implementation of the 2016 plan

Theme: Managing water quality

Management strategy	Responsibility	Activities	Status
1.1 Reduce nutrient and sediment inflow: Support the implementation of riparian, in-stream and catchment works identified in the Healthy Waterways Strategy (Melbourne Water Corporation 2013); revised State Environment Protection Policy Waters of Victoria (when completed); Port Phillip and Western Port Regional Catchment Strategy and local actions plans to improve water quality in storm water and river flows to Western Port.	MW, EPA Vic, DEECA, Local government	Melbourne Water continue to deliver the Healthy Waterways Strategy (2018-2028) to manage the health of rivers, wetlands and estuaries in the Westernport catchment. This is achieved through on-ground works to increase riparian vegetation and buffer extent, modify stream physical form to provide suitable habitat for threatened species, address erosion, and working with land managers to reduce sediment and nutrient discharge into waterways (e.g. Rural Land Program, Liveable Communities – Liveable Waterways Program). Western Port Catchment Integrated Water Management Plan (IWM) – developed by the Western Port IWM Forum (collaboration between local government, DEECA, water authorities, Victorian Planning Authority and Bunurong Land Council Aboriginal Corporation. Actions to reduce nitrogen and sediments inflowing to Western Port.	Ongoing
1.2 Develop best practice guidelines for urban and rural run-off and an incentive scheme to facilitate uptake	MW, DEECA, Local government	Western Port Catchment Integrated Water Management Plan (https://www.water.vic.gov.au/__data/assets/pdf_file/0019/702424/Western-Port-Catchment-IWM-Action-Plan.pdf) development and ongoing implementation to manage rural and urban water. Melbourne Water Applied Research Program - Modelling the major sources of sediment to Western Port and prioritisation of management opportunities	Ongoing
1.3 Develop appropriate approaches for pollutant reduction and seagrass improvement, and trigger values (objectives) for water quality indicators.	EPA Victoria, MW	Environmental Reference Standards 2021 – developed targets for Victorian coastal areas, including Western Port. Western Port Catchment Integrated Water Management Plan (https://www.water.vic.gov.au/__data/assets/pdf_file/0019/702424/Western-Port-Catchment-IWM-Action-Plan.pdf) development and ongoing implementation to manage rural and urban water. Melbourne Water Applied Research Program - Modelling the major sources of sediment to Western Port and prioritisation of management opportunities	In progress
1.4 Investigate the feasibility of and parameters for creating retention wetlands for improving water quality at the downstream end of priority streams entering Western Port. Implement actions that arise from the investigation (create appropriate retention wetlands).	MW, DEECA, Local government	Actions for improving the water quality of inflowing water are the focus of the Western Port IWM	Ongoing

Management strategy	Responsibility	Activities	Status
1.5 Investigate the sources, potential impact and mitigation strategies for toxicants entering Western Port through storm water drains and rivers	MW, EPA Victoria, Local government	Melbourne Water Applied Research Program ▪ Assessing the levels, risks and sources of toxicants to Western Port and associated waterways ▪ Managing the impacts of toxicants in urban stormwater and wastewater treatment plant discharges on the health of estuaries and bays	Complete

Theme: Living with climate change

Management strategy	Responsibility	Activities	Status
2.1 Implement the recommendations of the Western Port Local Coastal Hazard Assessment. Specifically, the: • Development of a strategic approach to the management and future adaptation of the existing shoreline protection works; • Provision of adaptation space for the landward migration of wetland fringed shorelines	DEECA, MW, Local government	Melbourne Water are investigating land acquisition at Rhyll Inlet on Phillip Island to protect and support the landward migration of coastal saltmarsh vegetation communities.	In progress
2.2 Investigate the risk from and management strategies for increased frequency and intensity of fire in saltmarsh and mangrove communities	DEECA		Not planned
2.3 Investigate the risk associated with and potential mitigation strategies for climate change impacts to ecological character of the Ramsar site	DEECA, MW	DEECA commissioned a report in 2018 “Investigation into the resilience of Ramsar sites to large-scale drivers of change: Western Port”	Complete

Theme: Protecting flora and fauna

Management strategy	Responsibility	Activities	Status
3.1 Develop and implement best practice guidelines for habitat restoration (seagrass, saltmarsh, mangroves).	DEECA, NGOs	Melbourne Water have liaised with Bass Coast Landcare Network to develop best practice guidelines for mangrove restoration. Melbourne Water will collaborate with Deakin University to develop best practice guidelines for seagrass restoration through 2024-28 (EC6 project).	Commencing
3.2 Restore / maintain extent and condition of key habitats in Western Port to increase resilience to the impacts of threats.	DEECA, MW, Parks Victoria, Local government, NGOs	Melbourne Water continued to implement this management strategy through the Ramsar Protection Program. Parks Victoria pest plants program – funding dependent.	Ongoing
3.3 Identify priority locations of habitat loss in the Ramsar site due to human activity including vehicle damage, stock grazing, illegal dumping, direct vegetation removal and implement or improve enforcement of existing laws.	Parks Victoria, Local government, Landcare, MW	General Parks Victoria ranger patrols Melbourne Water continued to implement this management strategy through the Ramsar Protection Program.	Ongoing
3.4 Install and maintain fencing at priority locations to restrict recreational access to sensitive habitats in the foreshore and intertidal zone.	Parks Victoria, Local government	Melbourne Water continued to implement this management strategy through the Ramsar Protection Program.	Ongoing
3.5 Develop guidelines for defining and managing buffer zones to guide assessment of local planning applications and promote complementary management.	DEECA	DEECA have drafted guidelines for wetland buffer zones.	In progress
3.6 Develop and implement a strategic approach to development in areas adjacent to the Ramsar site that consider the cumulative impact of multiple actions on ecological character.	Local government, DEECA	DEECA continues to implement statutory obligations with respect to guiding and reviewing Environmental Impact Assessments that have the potential to impact the ecological character of the Ramsar site.	Not planned
3.7. Continue to implement pest animal control programs (cat, fox, rat, dog, pig) in priority waterbird roosting and nesting sites within the Ramsar site.	MW, PINP, Local government, NGOs	Melbourne Water continued to implement this management strategy through the Ramsar Protection Program. Works delivered in partnership with Parks Victoria, Phillip Island Nature Parks, Bass Coast Landcare Network, City of Casey and Mornington Peninsula Shire.	Ongoing
3.8 Continue to implement rabbit control programs within the Ramsar site boundary to limit impacts on saltmarsh.	MW, PINP, Local government, NGOs	Melbourne Water continued to implement this management strategy through the Ramsar Protection Program. Works delivered in partnership with French Island Landcare to reduce grazing pressure and impacts on coastal saltmarsh vegetation.	Ongoing

3.9 Implement an incentive program for adjacent landholders to fence waterways, mangrove and saltmarsh areas to restrict stock access.	MW, DEECA	Melbourne Water continued to implement this management strategy through the Ramsar Protection Program. Works delivered in partnership with Bass Coast Landcare Network as part of the Private Land Stewardship project. Parks Victoria, with funding from DEECA, working with landowners to fence off a section of private land to protect saltmarsh habitat from grazing impacts.	Ongoing
3.10 Continue to implement Spartina control programs within the Ramsar site.	Parks Victoria, MW	Melbourne Water continued to manage Spartina at priority locations through the Waterways Drainage Investment Plan (WDIP).	Ongoing
3.11 Conduct regular surveys and implement control actions for new and emerging salt tolerant weeds.	Parks Victoria, DEECA, Local government	Parks Victoria – pest plant control programs – funding dependent	Ongoing
3.12 Gazette of Quail Island as a Nature Conservation Reserve, to improve management of pest fauna and recreational activities.	DEECA, Parks Victoria	Quail Island gazetted in 2016	Completed
3.13 Support activities under the Port Phillip and Western Port Invasive Plant and Animal Strategy (PPWCMA 2011).	DEECA, Parks Victoria	Melbourne Water continued to implement this management strategy through the Ramsar Protection Program.	Ongoing
3.14 Develop and implement a marine pest strategy for Western Port.	DEECA, Parks Victoria	PV general monitoring through ranger patrols. Some historical monitoring for marine pests in marine protected areas.	Planned 2024?

Theme: Improving our knowledge

Management strategy	Responsibility	Activities	Status
4.1 Investigate the relationships between reduced water quality and shorebird food availability.	DEECA, EPA Victoria		Not planned
4.2 Investigate the population dynamics and behaviour of the fairy tern colony.	Parks Victoria, DEECA	Completed by BirdLife Australian and Melbourne Water as part of the Western Port Ramsar Enhancement Program.	Commenced
4.3 Assess the community composition, extent and condition of benthic invertebrates in soft sediments.	Parks Victoria, DEECA		Completed

4.4 Community composition, spatial and temporal variability and presence of potentially toxic species of phytoplankton in Western Port.	DEECA		Not planned
4.5 Investigate the extent and potential impact of recreational fishing in Western Port. Use recreational fish monitoring data to inform the development of numerical RCTs and LAC for fish.	Victorian Fisheries Authority	Melbourne Water continued to implement this management strategy through the Ramsar Protection Program. Works delivered in partnership with Western Port Biosphere and OzFish.	Commenced

Theme: Communication, Education, Participation and Awareness

Management strategy	Responsibility	Activities	Status
5.1 Education and engagement of landholders and community members and incentive programs for streamside/shoreline/coastline fencing.	MW, DEECA, Parks Victoria	Melbourne Water continued to implement this management strategy through the Ramsar Protection Program. Works delivered in partnership with Bass Coast Landcare Network.	Ongoing
5.2 Implement a public awareness campaign for recreational boat users and personal watercraft (e.g. jet skis) and investigate opportunities for regulation to minimise the potential impacts to shorebirds and beach nesting birds.	DEECA, Parks Victoria	Melbourne Water continued to implement this management strategy through the Ramsar Protection Program. Works delivered in partnership with Western Port Biosphere.	Completed/ Ongoing
5.3 Implement a community awareness campaign and reporting hotline for introduced marine pests targeting divers and recreational fishers.	DEECA		Not planned
5.4 Communicate the outcomes of the three yearly Ramsar Rolling Review to the broader community through a fact sheet / report card.	DEECA, EPA Victoria, Parks Victoria	Report through the State of Environment reports.	Ongoing
5.5 Maintain the Western Port Ramsar Site webpage (DELWP) and the process for stakeholder involvement via updates and links.	DEECA		Ongoing

Theme: Governance

Management strategy	Responsibility	Activities	Status
6.1 Review the Ramsar site boundary.	DEECA, DCCEEW, Ramsar Coordinating Committee		Abandoned
6.2 Apply the appropriate State and Commonwealth environmental impact assessment processes for activities that have the potential to impact on the Ramsar site and Matters of National Environmental Significance (MNES).	DEECA, DCCEEW, Ramsar Coordinating Committee	Melbourne Water are representatives on the Port of Hasting VRET Technical Review Group; providing subject matter expertise to the EES process.	Ongoing
6.3 Undertake a regular review of the status of the ecological character of the Ramsar site. This review should include new and emerging issues as well as the current listed values and threats.	DEECA	CoP reporting, State of the Marine Environment	Ongoing
6.4 Develop action plans for this strategy.	Ramsar Coordinating Committee	Melbourne Water lead the development of Annual Action Plans for Western Port in collaboration with the Coordinating Committee.	Ongoing
6.5 Investigate the potential of blue carbon offsets for raising resources to implement Ramsar site management plan.	Ramsar Coordinating Committee	Deakin University's Blue Carbon Lab and Western Port Biosphere have investigated the priorities for Blue Carbon restoration.	Ongoing

Appendix B Risk assessment

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
Pollution: agricultural run-off	**Increased nutrients**					**The Victorian Land Cover Time Series (White et al. 2020), indicates only a small change in agricultural land in the catchment, with a decline in pasture and a slight increase in irrigated horticulture in the past decade. Recent studies have suggested that Western Port is oligotrophic and nutrient limited (Russell et al. 2022). Studies suggest that the catchment-derived inputs of nitrogen to Western Port are low on both a local and global scale (Woodland et al. 2015), and the marine waters in this location are also highly nutrient limited (Gibbs et al. 1986), resulting in nitrogen limitation in seagrass meadows found in Western Port (Russell et al. 2016). This is consistent with the EPA report cards that rate water quality in Western Port as consistently good on an annual time scale (EPA Victoria 2024).**
Pollution: agricultural run-off	Increased nutrients	Results in increased algal growth and a decline in seagrass extent and condition	Likely	Moderate	Medium	A study of nutrients and seagrass in Western Port stated: "Highest nutrient concentrations were in the far north-west of Western Port at Watsons Inlet, where seagrass density is high. There was very little change in present-day nutrient concentrations compared to the 1970s for the entire bay. This led us to conclude that eutrophication is unlikely to be a controlling factor in the current distribution of seagrass within Western Port (Holland et al. 2013). Higher risk in the East Arm, with less flushing and no recovery of seagrass since the loss in the 1970's.
Pollution: agricultural run-off	Increased nutrients	Adversely affects subtidal and intertidal flats (including benthic invertebrates)	Possible	Minor	Low	Recent study indicates that "relatively little nitrogen entering the system from land is assimilated into primary producers [microphytobenthos and seagrass] and the food web owing to high rates of tidal flushing" (Evrard et al. 2013).
Pollution: agricultural run-off	Increased nutrients	Adversely affect subtidal and intertidal reef communities (macroalgae and invertebrates)	Possible	Minor	Low	Reef communities in the Ramsar site are largely limited to the significant community at San Remo as well as Crawfish Rock and Eagle Rock. Although excess nutrients can negatively impact reef communities (e.g. urchin barrens of Port Phillip Bay), the risk in the comparatively low nutrient and well flushed Western Port is considered low (Bathgate et al. 2011).
Pollution: agricultural run-off	Increased nutrients	Adversely affects coastal saltmarsh communities	Unlikely	Minor	Low	Boon et al (2011) identified excess nutrients and eutrophication as a significant threat to coastal saltmarsh. However, the well flushed environment over most of Western Port would limit this impact in the Ramsar site.
Pollution: agricultural run-off	Increased nutrients	Adversely affects mangrove communities	Possible	Minor	Low	Nutrient influx into Western Port can have indirect consequences for mangroves. For example, seagrass dieback leads to an excessive deposition of seagrass detritus in mangroves, which can smother their pneumatophores and seedlings or lead to defoliation (Dittman 2011). However, as the risk to seagrass is considered low, so too is the impact to mangroves.

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
Pollution: agricultural run-off	Increased nutrients	Declines in seagrass , saltmarsh, mangroves adversely affects fish abundance and diversity	Possible	Moderate	Medium	"The highest risk to fish in Western Port in terms of decreased water quality, particularly increased nutrients and sediments, is the secondary effect of seagrass habitat loss (Jenkins 2011). Risk based on risk to seagrass, noting that seagrass habitat is not essential for all fish species.
Pollution: agricultural run-off	Increased nutrients	Impacts to saltmarsh and mudflats affects waterbird abundance and diversity (including threatened species e.g. orange-bellied parrot)	Rare	Negligible	Negligible	Saltmarsh and mudflats are important habitats in Western Port; however risks associated with nutrients are related to decreases in primary productivity from a decrease in nutrient concentrations (Dann 2011). Risk to Orange-bellied parrot saltmarsh habitat is also low given there are very few birds that now come to Victoria and risk to saltmarsh from this pathway is low.
Pollution: agricultural run-off	Increased nutrients	Impacts to seagrass affect waterbird feeding	Possible	Minor	Low	Many of the waterbirds in Western Port feed in a variety of habitats both inside and outside the Ramsar Site. However, obligate intertidal feeding species such as Black Swan and Chestnut Teal could be affected (Dann 2011). Waterbirds are highly mobile and could move to nearby environments such as Port Philip Bay or Corner Inlet. Risk to shorebirds is negligible as research in Port Phillip Bay has indicated that increased nutrients benefits shorebirds by increasing productivity.
Pollution: agricultural run-off	Increased nutrients	Results in increased algal growth and adversely affects waterbird feeding (including threatened species e.g. fairy tern)	Rare	Negligible	Negligible	This pathway is related to decrease in water clarity from algal blooms reducing the catch success of visual feeders (mostly fish-eating birds). However, nutrients are not the primary cause of reduced visibility in Western Port (EPA Victoria 2011a).
Pollution: sewage and stormwater (includes likely future population)	**Increased nutrients**					**Current residential development and urban areas in the Western Port catchment contribute approximately 14 % of the total nutrient loads to the site (Melbourne Water 2009). The Victorian Land Cover Time Series (White et al. 2020), indicates only a small change in agricultural land in the catchment, with a decline in pasture and a slight increase in irrigated horticulture in the past decade. Recent studies have suggested that Western Port is oligotrophic and nutrient limited (Russell et al. 2022). Studies suggest that the catchment-derived inputs of nitrogen to Western Port are low on both a local and global scale (Woodland et al. 2015), and the marine waters in this location are also highly nutrient limited (Gibbs et al. 1986), resulting in nitrogen limitation in seagrass meadows found in Western Port (Russell et al. 2016). This is consistent with the EPA report cards that rate water quality in Western Port as consistently good on an annual time scale (EPA Victoria 2024). Suggested that all risks from this pathway be considered similar to those from agricultural run-off.**
Pollution: septic and stormwater	Increased nutrients	Results in increased algal growth and a decline in	Likely	Moderate	Medium	Based on risks from agricultural run-off (see above)

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
		seagrass extent and condition				
Pollution: septic and stormwater	Increased nutrients	Adversely affects subtidal and intertidal flats (including benthic invertebrates)	Possible	Minor	Low	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased nutrients	Adversely affect subtidal and intertidal reef communities (macroaglae and invertebrates)	Possible	Minor	Low	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased nutrients	Adversely affects coastal saltmarsh communities	Unlikely	Minor	Low	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased nutrients	Adversely affects mangrove communities	Possible	Minor	Low	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased nutrients	Declines in seagrass and /or saltmarsh adversely affects fish abundance and diversity	Possible	Moderate	Medium	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased nutrients	Impacts to seagrass affect waterbird feeding	Possible	Minor	Low	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased nutrients	Impacts to saltmarsh and mudflats affects waterbird abundance and diversity (including threatened species e.g. orange-bellied parrot)	Rare	Negligible	Negligible	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased nutrients	Results in increased algal growth and adversely affects waterbird feeding (including threatened species e.g. fairy tern)	Rare	Negligible	Negligible	Based on risks from agricultural run-off (see above)
Pollution: agricultural run-off	**Increased sediments**					**The vast majority of sediment loads to Western Port come from rural lands (85%); with agriculture (cropping and dairy) accounting for the largest loads (Melbourne Water 2009). The dominant catchment source for fine sediment is channel and gully erosion of Lang Lang River and, to a lesser extent, Bunyip River. However, there is no long term sustained trend in suspended solids in Western Port since the time of listing, with concentrations of TSS remaining steady since monitoring commenced in 1984 (EPA Victoria 2011b; Holland et al. 2013). There is no evidence of a**

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
						sustained increasing trend in sediment loads to the system but total loads exceed the General Environment Duty target of 28 kilotonnes/year in average and above average rainfall years (Cuddy et al. 2019). Greatest loads are still from stream bank erosion in agricultural land uses.
Pollution: agricultural run-off	Increased sediments	Reduced light and deposition adversely affects seagrass	Likely	Moderate	Medium	Seagrass loss between 1970 and 1990s has been attributed to decreased light and increased suspended sediments. A recent study concluded that TSS is a strong influence on seagrass distribution and health, with the highest TSS values being observed in the north east of Western Port where seagrass is sparse or absent (Holland et al. 2013). However, seagrass extent has increased since 1999 in the north and west (Holland et al. 2013). The seagrass in the east has not recovered and loss has been associated with increased erosion and turbidity.
Pollution: agricultural run-off	Increased sediments	Reduced light and deposition adversely affects subtidal and intertidal flats (including benthic invertebrates)	Likely	Moderate	Medium	Intertidal and subtidal soft sediment communities are adapted to sedimentation. However, changes in sediment properties (e.g. grain size) and high levels of turbidity can affect productivity and community composition. The rhodolith bed north of San Remo is likely to be particularly vulnerable to sedimentation and increased turbidity (Wilson et al. 2011).
Pollution: agricultural run-off	Increased sediments	Reduced light and deposition adversely affects subtidal and intertidal reefs	Likely	Moderate	Medium	Sediments can impact reefs through smothering and reduced light (Bathgate et al. 2011).
Pollution: agricultural run-off	Increased sediments	Adversely affects coastal saltmarsh communities	Rare	Minor	Negligible	There has been an increase in mangroves at the expense of saltmarsh in Western Port. However this is related to sea level rise and decreases in surface elevation (Rogers et al. 2005, Boon 2011, Boon et al. 2011).
Pollution: agricultural run-off	Increased sediments	Adversely affects mangrove communities	Rare	Minor	Negligible	There has been an increase in mangroves at the expense of saltmarsh in Western Port. However this is related to sea level rise and decreases in surface elevation (Rogers et al. 2005, Boon 2011, Boon et al. 2011).
Pollution: agricultural run-off	Increased sediments	Reduced light and increased TSS adversely affects fish	Possible	Minor	Low	Direct impacts to fish gills are observed at very high TSS concentrations (> 100 mg/L), with larval fish considered the most (Jenkins and McKinnon 2006). Concentrations of TSS can be high in parts of Western Port, and on occasion may reach concentrations that could adversely affect larval fish. However, this does not occur in primary larval fish habitat such as seagrass beds, where suspended sediment concentrations are lower.
Pollution: agricultural run-off	Increased sediments	Impacts to seagrass adversely affects fish	Likely	Moderate	Medium	Derived from risks to seagrass
Pollution: agricultural run-off	Increased sediments	Impacts to seagrass affect waterbird feeding	Possible	Minor	Low	Many of the waterbirds in Western Port feed in a variety of habitats both inside and outside the Ramsar Site. However, obligate intertidal feeding species such as Black Swan and Chestnut Teal could be affected (Dann 2011). Waterbirds

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
						are highly mobile and could move to nearby environments such as Port Philip Bay or Corner Inlet.
Pollution: agricultural run-off	Increased sediments	Impacts to fish and reduced visibility adversely affects feeding seabirds (including threatened species)	Possible	Minor	Low	Increased sediment in the water column may reduce the foraging efficiencies of sight-feeding seabirds. (Dann 2011).
Pollution: agricultural run-off	Increased sediments	Impacts to primary productivity reduce food availability for shorebirds	Possible	Minor	Low	Suspended sediments can reduce primary productivity, and consequently secondary productivity, and may also reduce secondary productivity directly by reducing the efficiency of filter-feeding mudflat biota (Dann 2011). This must we weighed in the context that sediment deposition is important for maintaining mudflat shorebird habitat (Richard Loyn, pers. comm.)
Pollution: urban (septic tank leakage and stormwater)	**Increased sediments**					**Urban areas currently contribute about 10% of the total sediment load to Western Port, however, this is predicted to increase by 2030 by about 15% due to increased development (Melbourne Water 2009). Increased urban growth has occurred, but so have improvements in stormwater management and the introduction of an Integrated Water Management Plan for Western Port with targets for decreased run-off from urban areas an reduced sediment loads. Urban areas, on average, contribute 12% of the sediment loads to Western Port (Cuddy et al. 2019). While this is an increase, it is still less than the loads coming from agricultural activities. Suggested that all risks from this pathway be considered less likely than from agricultural run-off.**
Pollution: septic and stormwater	Increased sediments	Reduced light and deposition adversely affects seagrass	Possible	Moderate	Medium	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased sediments	Reduced light and deposition adversely affects subtidal and intertidal flats (including benthic invertebrates)	Possible	Moderate	Medium	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased sediments	Reduced light and deposition adversely affects subtidal and intertidal reefs	Possible	Moderate	Medium	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased sediments	Adversely affects coastal saltmarsh communities	Rare	Negligible	Negligible	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased sediments	Adversely affects mangrove communities	Rare	Negligible	Negligible	Based on risks from agricultural run-off (see above)

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
Pollution: septic and stormwater	Increased sediments	Reduced light and increased TSS adversely affects fish	Possible	Minor	Low	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased sediments	Impacts to seagrass adversely affects fish	Possible	Moderate	Medium	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased sediments	Impacts to seagrass affect waterbird feeding	Possible	Minor	Low	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased sediments	Impacts to fish and reduced visibility adversely affects feeding seabirds (including threatened species)	Unlikely	Minor	Low	Based on risks from agricultural run-off (see above)
Pollution: septic and stormwater	Increased sediments	Impacts to primary productivity reduce food availability for shorebirds	Unlikely	Minor	Low	Based on risks from agricultural run-off (see above)
Commercial development (ports, marinas, dredging)	**Increased sediments**					**Dredging has occurred in Western Port since the 1920s, for port development, maintenance and deepening of harbours and shipping channels, and until 2000 for commercial fishing. While this may result in localised increases in suspended sediments, natural processes of wave and wind action are the primary drivers of sediment resuspension in Western Port. Data from other maintenance dredging programs in the Gippsland Lakes and Port Phillip Bay, indicate localised, short term impacts to suspended sediments and deposition (e.g. Hale 2006). Risks from this pathway were considered of less magnitude and consequence than from sewage and stormwater. Note this applies to current and predicted future "routine" dredging and not any potential future capital dredging program.**
Commercial development (ports, marinas, dredging)	Increased sediments	Reduced light and deposition adversely affects seagrass	Possible	Minor	Low	Based on risks from sewage and stormwater (see above).
Commercial development (ports, marinas, dredging)	Increased sediments	Reduced light and deposition adversely affects subtidal and intertidal flats (including benthic invertebrates)	Possible	Minor	Low	Based on risks from sewage and stormwater (see above).
Commercial development	Increased sediments	Reduced light and deposition adversely	Possible	Minor	Low	Based on risks from sewage and stormwater (see above).

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
(ports, marinas, dredging)		affects subtidal and intertidal reefs				
Commercial development (ports, marinas, dredging)	Increased sediments	Adversely affects coastal saltmarsh communities	Rare	Negligible	Negligible	Based on risks from sewage and stormwater (see above).
Commercial development (ports, marinas, dredging)	Increased sediments	Adversely affects mangrove communities	Rare	Negligible	Negligible	Based on risks from sewage and stormwater (see above).
Commercial development (ports, marinas, dredging)	Increased sediments	Reduced light and increased TSS adversely affects fish	Unlikely	Negligible	Negligible	Based on risks from sewage and stormwater (see above).
Commercial development (ports, marinas, dredging)	Increased sediments	Impacts to seagrass adversely affects fish	Possible	Minor	Low	Based on risks from sewage and stormwater (see above).
Commercial development (ports, marinas, dredging)	Increased sediments	Impacts to seagrass affect waterbird feeding	Unlikely	Negligible	Negligible	Based on risks from sewage and stormwater (see above).
Commercial development (ports, marinas, dredging)	Increased sediments	Impacts to fish and reduced visibility adversely affects feeding seabirds (including threatened species)	Unlikely	Negligible	Negligible	Based on risks from sewage and stormwater (see above).
Commercial development (ports, marinas, dredging)	Increased sediments	Impacts to primary productivity reduce food availability for shorebirds	Unlikely	Negligible	Negligible	Based on risks from sewage and stormwater (see above).
Climate change	**Increased sediments**					**Extreme events (storms and high rainfall events) are predicted to occur with high confidence (Clarke et al. 2019). The soft sediments in the shallow waters over much of Western Port are highly vulnerable to resuspension. While there have been no long term changes in TSS concentrations in Western Port from the time of listing, modelling based on 2030 global climate change predictions shows there will be significant increases in suspended material throughout the system, most likely with heightened concentrations in the Eastern Arm (EPA Victoria 2011a). Risks from this**

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
						pathway be considered of greater magnitude than under current conditions. Increased stormwater and agricultural inputs with extreme events.
Climate change: increased storm events	Increased sediments	Reduced light and deposition adversely affects seagrass	Almost certain	Moderate	High	Based on risks from agricultural run-off (see above)
Climate change: increased storm events	Increased sediments	Reduced light and deposition adversely affects subtidal and intertidal flats (including benthic invertebrates)	Likely	Major	High	Based on risks from agricultural run-off (see above)
Climate change: increased storm events	Increased sediments	Reduced light and deposition adversely affects subtidal and intertidal reefs	Likely	Moderate	Medium	Based on risks from agricultural run-off (see above)
Climate change: increased storm events	Increased sediments	Adversely affects coastal saltmarsh communities	Rare	Negligible	Negligible	Based on risks from agricultural run-off (see above)
Climate change: increased storm events	Increased sediments	Adversely affects mangrove communities	Rare	Negligible	Negligible	Based on risks from agricultural run-off (see above)
Climate change: increased storm events	Increased sediments	Reduced light and increased TSS adversely affects fish	Likely	Major	High	Based on risks from agricultural run-off (see above)
Climate change: increased storm events	Increased sediments	Impacts to seagrass adversely affects fish	Almost certain	Moderate	High	Based on risks from agricultural run-off (see above)
Climate change: increased storm events	Increased sediments	Impacts to seagrass affect waterbird feeding	Possible	Minor	Low	Based on risks from agricultural run-off (see above)
Climate change: increased storm events	Increased sediments	Impacts to fish and reduced visibility adversely affects feeding seabirds (including threatened species)	Likely	Minor	Medium	Based on risks from agricultural run-off (see above)
Climate change: increased storm events	Increased sediments	Impacts to primary productivity reduce food availability for shorebirds	Likely	Major	High	Based on risks from agricultural run-off (see above)

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
Pollution: agricultural run-off	**Toxicants (includes metals as well as chemicals of emerging concern such as agricultural pharmaceuticals and pesticides / herbicides)**					**The types of chemicals thought to be of most concern for Western Port are heavy metals, pesticides from agricultural run off and veterinary pharmaceuticals and oestrogens from dairying (Fisher and Scott 2008). A recent survey of toxicants in sediments indicated that, in general, toxicants in Western Port sediments are not at levels likely to be causing effects to resident fauna and flora. However, in some estuarine areas several metals including arsenic, nickel, mercury and organotins, were detected at levels exceeding sediment quality guidelines and pose a moderate risk to ecosystem health. In addition, pesticides were detected in a number of estuarine areas, but not in the Bay sediments (Sharp et al. 2013). A study of the waterways of the north-east of the Western Port Catchment found frequent and widespread contamination by pesticides across the catchments investigated which discharge into Western Port. Pesticides are present in surface waters and sediments of rivers, drains and estuaries in complex mixtures and often at concentrations likely to impact on resident flora and fauna. Herbicides and fungicides are the most frequently detected pesticide groups, also occurring at the highest concentrations (Myers et al. 2019). The source of toxicants was identified as agricultural land use rather than urban areas (Myers et al. 2016).**
Pollution: agricultural run-off	Toxicants	Adversely affects seagrass	Likely	Moderate	Medium	Risk to seagrass from toxicants will be predominantly via the effects of herbicides. This is currently identified as a knowledge gap for Western Port, but is being addressed by a Melbourne Water Research Project. Preliminary findings indicate a medium risk to seagrass health from combined effects of multiple herbicides (Jackie Myers, CAPIM, pers. comm). Extent of impact is a knowledge gap.
Pollution: agricultural run-off	Toxicants	Adversely affects subtidal and intertidal flats (including benthic invertebrates)	Likely	Moderate	Medium	Heavy metal concentrations in sediments in Western Port are generally low, and the shallow, turbid environment would result in mostly sediment bound (not bioavailable) toxicants. There is some evidence of chronic effects of oestrogens and other toxicants on biota in Watsons Creek Estuary (Sharley et al. 2013).
Pollution: agricultural run-off	Toxicants	Adversely affects subtidal and intertidal reefs	Likely	Moderate	Medium	Heavy metal concentrations in sediments in Western Port are generally low, and the shallow, turbid environment would result in mostly sediment bound (not bioavailable) toxicants. There is some evidence of chronic effects of oestrogens and other toxicants on biota in Watsons Creek Estuary (Sharley et al. 2013).
Pollution: agricultural run-off	Toxicants	Adversely affects coastal saltmarsh communities	Unlikely	Minor	Low	Toxicants are listed as a potential threat for Victorian coastal saltmarsh (Boon et al. 2011). Given that toxicant concentrations in sediments in Western Port are generally low, and the shallow, turbid environment would result in mostly sediment bound (not bioavailable) toxicants, the risk is likely to be minimal.

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
Pollution: agricultural run-off	Toxicants	Adversely affects mangrove communities	Possible	Minor	Low	Risk to mangroves from toxicants will be predominantly via the effects of herbicides. This is currently identified as a knowledge gap for Western Port, but is being addressed by a Melbourne Water Research Project. Preliminary findings indicate a low risk to mangroves from combined effects of multiple herbicides (Jackie Myers, CAPIM, pers. comm).
Pollution: agricultural run-off	Toxicants	Adversely affects fish reducing condition, abundance and diversity	Likely	Moderate	Medium	The early life stages of fish (eggs, larvae and young juveniles) are the most susceptible to the effects of contaminants, although other effects can occur, such as a deleterious effect of DDT accumulation on reproductive development (Jenkins and McKinnon 2006). However, given the generally low concentrations of toxicants in Western Port in sediment (Sharp et al. 2013) and water column (EPA Victoria 2011b) any effects are likely to be localised.
Pollution: agricultural run-off	Toxicants	Impacts to fish and invertebrates adversely affects waterbirds through the food chain	Possible	Minor	Low	Very few studies on effects of pharmaceuticals on birds, but one study indicated that antidepressants had an effect on the behaviour of starlings (Bean et al. 2014). There is the potential for impacts through the food chain. However, given the generally low concentrations of toxicants in Western Port in sediment (Sharp et al. 2013) and the water column (EPA Victoria 2011b) any potential effects are likely to be localised.
Pollution: agricultural run-off	Toxicants	Impacts to fish and invertebrates adversely affects recreational fishing	Possible	Minor	Low	Derived from risks to fish, noting that many recreational species spend the majority of their time in deeper waters away from the impacts of concentrated toxicants in localised areas.
Pollution: agricultural run-off	Toxicants	Adversely affects primary contact recreation	Rare	Minor	Negligible	Concentrations of toxicants are well below those for primary contact recreation (EPA Victoria 2011b).
Pollution: agricultural run-off	Toxicants	Adversely affects secondary contact recreation	Rare	Minor	Negligible	Concentrations of toxicants are well below those for secondary contact recreation (EPA Victoria 2011b).
Pollution: urban sources	**Toxicants (includes metals as well as chemicals of emerging concern such as pharmaceuticals and personal care products)**					**Studies from elsewhere indicate that urban treated sewage contains a range of chemicals such as steroid hormones that could pose of risk to the marine environment (Ying et al. 2002). However, movement of these chemicals from septic systems is not well understood. Studies in fish indicate effects on immune systems (Milla et al. 2011) and reproduction** (Goksøyr 2006)**. The primary source of toxicants was identified as agricultural land use rather than urban areas (Myers et al. 2016).**
Pollution: urban sources	Toxicants	Adversely affects seagrass	Likely	Moderate	Medium	Risk to seagrass from toxicants will be predominantly via the effects of herbicides, the pathway includes residential applications and roadside spraying in urban areas, transported into Western Port via stormwater drainage.

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
Pollution: urban sources	Toxicants	Adversely affects subtidal and intertidal flats (including benthic invertebrates)	Likely	Moderate	Medium	Heavy metal concentrations in sediments in Western Port are generally low, and the shallow, turbid environment would result in mostly sediment bound (not bioavailable) toxicants. There is some evidence of chronic effects of oestrogens and other toxicants on biota in Watsons Creek Estuary (Sharley et al. 2013).
Pollution: urban sources	Toxicants	Adversely affects subtidal and intertidal reefs	Likely	Moderate	Medium	Heavy metal concentrations in sediments in Western Port are generally low, and the shallow, turbid environment would result in mostly sediment bound (not bioavailable) toxicants. There is some evidence of chronic effects of oestrogens and other toxicants on biota in Watsons Creek Estuary (Sharley et al. 2013).
Pollution: urban sources	Toxicants	Adversely affects coastal saltmarsh communities	Unlikely	Minor	Low	Toxicants are listed as a potential threat for Victorian coastal saltmarsh (Boon et al. 2011). Given that toxicant concentrations in sediments in Western Port are generally low, and the shallow, turbid environment would result in mostly sediment bound (not bioavailable) toxicants, the risk is likely to be minimal.
Pollution: urban sources	Toxicants	Adversely affects mangrove communities	Possible	Minor	Low	Risk to mangroves from toxicants will be predominantly via the effects of herbicides, the pathway includes residential applications and roadside spraying in urban areas.
Pollution: urban sources	Toxicants	Adversely affects fish reducing condition, abundance and diversity	Likely	Moderate	Medium	The early life stages of fish (eggs, larvae and young juveniles) are the most susceptible to the effects of contaminants, although other effects can occur, such as a deleterious effect of DDT accumulation on reproductive development (Jenkins and McKinnon 2006). However, given the generally low concentrations of toxicants in Western Port in sediment (Sharp et al. 2013) and the water column (EPA Victoria 2011b) any potential effects are likely to be localised.
Pollution: urban sources	Toxicants	Impacts to fish and invertebrates adversely affects waterbirds through the food chain	Possible	Minor	Low	Very few studies on effects of pharmaceuticals on birds, but one study indicated that antidepressants had an effect on the behaviour of starlings (Bean et al. 2014). There is the potential for impacts through the food chain. However, given the generally low concentrations of toxicants in Western Port in sediment (Sharp et al. 2013) and the water column (EPA Victoria 2011b) any potential effects are likely to be localised.
Commercial development (ports, marinas, dredging)	**Toxicants (includes metals as well as antifouling chemicals such as TBT)**					**A recent survey of toxicants in sediments indicated that, in general, toxicants in Western Port sediments are not at levels likely to be causing effects to resident fauna and flora. Concentrations of tributyltins (TBTs) have decreased dramatically since the 1980s at most sites, but may have increased at the Hastings boat ramp and Warneet slipway (Sharp et al. 2013).**
Commercial development	Toxicants	Adversely affects seagrass	Unlikely	Minor	Low	Risk to seagrass from toxicants will be predominantly via the effects of herbicides, not this group of toxicants.

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
(ports, marinas, dredging)						
Commercial development (ports, marinas, dredging)	Toxicants	Adversely affects subtidal and intertidal flats (including benthic invertebrates)	Possible	Minor	Low	No direct evidence of toxicity in soft sediments of Western Port, but known from elsewhere; and snails in reef communities have been affected. Potential effects likely to be localised to areas of high boat activity.
Commercial development (ports, marinas, dredging)	Toxicants	Adversely affects subtidal and intertidal reefs	Possible	Minor	Low	There is some evidence of imposex attributed to TBT in snails on reefs in Western Port (Nias et al. 1993), although the effects are likely to be localised.
Commercial development (ports, marinas, dredging)	Toxicants	Adversely affects coastal saltmarsh communities	Unlikely	Minor	Low	Toxicants are listed as a potential threat for Victorian coastal saltmarsh (Boon et al. 2011). Given that toxicant concentrations in sediments in Western Port are generally low, and the shallow, turbid environment would result in mostly sediment bound (not bioavailable) toxicants, the risk is likely to be minimal.
Commercial development (ports, marinas, dredging)	Toxicants	Adversely affects mangrove communities	Unlikely	Minor	Low	Risk to mangroves from toxicants will be predominantly via the effects of herbicides, not this group of toxicants.
Commercial development (ports, marinas, dredging)	Toxicants	Adversely affects fish reducing condition, abundance and diversity	Unlikely	Minor	Low	The early life stages of fish (eggs, larvae and young juveniles) are the most susceptible to the effects of contaminants (Jenkins and McKinnon 2006). Effects likely to be localised to areas of high boat activity.
Commercial development (ports, marinas, dredging)	Toxicants	Impacts to fish and invertebrates adversely affects waterbirds through the food chain	Unlikely	Minor	Low	There is the potential for impacts through the food chain. However, effects likely to be localised to areas of high boat activity.
Commercial development (ports, marinas, dredging)	Toxicants	Impacts to fish and invertebrates adversely affects recreational fishing	Unlikely	Minor	Low	Derived from risks to fish
Commercial development (ports, marinas, dredging)	Toxicants	Adversely affects primary contact recreation	Rare	Minor	Negligible	Concentrations of toxicants are well below those for primary contact recreation (EPA Victoria 2011b).
Commercial development (ports, marinas, dredging)	Toxicants	Adversely affects secondary contact recreation	Rare	Minor	Negligible	Concentrations of toxicants are well below those for secondary contact recreation (EPA Victoria 2011b).

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
Urban development and recreation	**Litter (including microplastics)**					**A recent assessment of the risks posed by microplastics to the ecological character of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site, concluded that "the concentrations of microplastics in water and sediment from wetlands, estuaries and rivers adjacent to the PPB Ramsar site are all below internationally derived effects thresholds and as such, almost all risks to ecological character were assessed as "low". The exception to this is in the Werribee / Avalon sector of the Ramsar site, the risk at this location was therefore assessed as "medium" (Hale 2023). Given that Western Port has lower sources of litter and microplastics, risks would be expected to be lower.**
Urban development and recreation	Litter (including microplastics)	Adversely affects subtidal and intertidal flats (including benthic invertebrates)	Unlikely	Minor	Low	There is evidence of ingestion and digestion of micro-plastics by marine invertebrates. Accumulation of microplastic particles in marine invertebrates could potentially cause blockages throughout the digestive system, suppressing feeding due to satiation (Wright et al. 2013), but no direct evidence from Western Port
Urban development and recreation	Litter (including microplastics)	Adversely affects subtidal and intertidal reefs	Unlikely	Minor	Low	As above - no direct evidence from Western Port
Urban development and recreation	Litter (including microplastics)	Adversely affects fish reducing condition, abundance and diversity	Unlikely	Minor	Low	Impact pathways for fish include entanglement and ingestion of plastics (Hammer et al. 2012). Studies from the northern hemisphere indicate that fish species, regardless of feeding habit, ingest micro-plastics (Lusher et al. 2013). Although the long-term effects are not fully understood, there is evidence of transfers of toxic chemicals, liver disease (Rochman et al. 2013) and blocking of the digestive tract leading to starvation (Gregory 2009) but no direct evidence from Western Port.
Urban development and recreation	Litter (including microplastics)	Direct impacts to sea and shorebirds	Almost certain	Minor	Medium	Entanglement is a problem for some birds in Western Port and several species, notably Pacific and Silver Gulls, Crested Terns, Little Pied Cormorants and Pelicans, are not infrequently found in the Western Port area entangled in fishing line or with fishhooks or jigs attached and either dead or incapacitated (Dann 2011). Seabirds and shorebirds are also susceptible to ingestion of micro-plastics with effects on nutrition and toxicity reported (Sutherland et al. 2012).
Disturbance of Coastal Acid Sulphate Soils (CASS)	**Metals liberated as a result of oxidation of CASS and acidity**					**Areas of CASS have been mapped around Western Port. If disturbed by prolonged drying of wetland areas or physical disturbance of the soil surface, then sulphuric acid is formed and can liberate metals from the sediments. The risk from altered pH is likely to be negligible given the buffering potential of seawater. However, the release of heavy metals may be a risk, albeit localised and of low likelihood due to current strategies and policies in place to minimise disturbance of CASS (Department of**

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
						Sustainability and Environment 2009). Risks were assigned as being less likely and less severe than catchment derived toxicants
Disturbance CASS	Metals liberated as a result of oxidation of CASS and acidity	Adversely affects seagrass			#N/A	Risk to seagrass from toxicants will be predominantly via the effects of herbicides. Possibly not a plausible impact pathway.
Disturbance CASS	Metals liberated as a result of oxidation of CASS and acidity	Adversely affects subtidal and intertidal flats (including benthic invertebrates)	Unlikely	Minor	Low	Based on risks from agricultural run-off (see above)
Disturbance CASS	Metals liberated as a result of oxidation of CASS and acidity	Adversely affects subtidal and intertidal reefs	Unlikely	Minor	Low	Based on risks from agricultural run-off (see above)
Disturbance CASS	Metals liberated as a result of oxidation of CASS and acidity	Adversely affects coastal saltmarsh communities	Unlikely	Minor	Low	Based on risks from agricultural run-off (see above)
Disturbance CASS	Metals liberated as a result of oxidation of CASS and acidity	Adversely affects mangrove communities	Unlikely	Minor	Low	Based on risks from agricultural run-off (see above)
Disturbance CASS	Metals liberated as a result of oxidation of CASS and acidity	Adversely affects fish reducing condition, abundance and diversity	Unlikely	Minor	Low	Based on risks from agricultural run-off (see above)
Disturbance CASS	Metals liberated as a result of oxidation of CASS and acidity	Impacts to fish and invertebrates adversely affects waterbirds through the food chain	Unlikely	Minor	Low	Based on risks from agricultural run-off (see above)
Commercial development and shipping (ports, marinas, dredging)	**Hydrocarbons**					**The Port of Hastings receives moderate numbers of vessels (50 per year) but the majority are related to the oil and gas industry. The possibility of a major oil spill in Western Port is small, with no significant spills to date. There have only been 20 spills of > 100 tonnes in Australia in the last 100 years (AMSA Major historical incidents | Australian Maritime Safety Authority). Risk management measures are in place to minimise the likelihood of a major spill and respond in the event to minimise impacts (Melbourne Water 2009). The Westernport and Peninsula Protection Council and Victorian National Parks Association commissioned modelling studies using six credible scenarios (200 tonnes of heavy fuel and 66 tonnes of diesel). The models indicated that shoreline exposure could occur rapidly (quicker than mitigation measures could be deployed) and that there would be widespread damage to ecosystems, habitats and species (APASA 2013, VNPA 2014a, 2014b). The risk assessment below is**

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
						based on these scenarios, with the likelihood assessed as "Rare" based on number of ships using the port and historic records of oil spills in Australia. Port of Hastings indicated that the number of vessels entering Western Port has declined in recent years. They also indicated that Esso has now largely changed from carrying crude oil to gas condensate. Risks have been derived from the Port of Hastings Safety and Environment Management Plan with respect to oil spill risks
Commercial development and shipping	Hydrocarbons	Adversely affects seagrass (direct and shading)	Rare	Major	Low	Impacts of oil spills on marine biota and shorelines are well documented (e.g. Gundlach and Hayes 1978, Swan et al. 1994, Islam and Tanaka 2004) and effects are both acute and chronic, with recovery in many instances taking decades (e.g. Peterson et al. 2003). Boon et al. (2011) provides a literature review of the impacts of hydrocarbon pollution on Victorian coastal wetlands: few cases of pollution were recorded, but impacts can be prolonged.
Commercial development and shipping	Hydrocarbons	Adversely affects intertidal and sub-tidal flats	Rare	Major	Low	As above
Commercial development and shipping	Hydrocarbons	Adversely affects intertidal and subtidal reefs	Rare	Major	Low	As above
Commercial development and shipping	Hydrocarbons	Adversely affects coastal saltmarsh communities	Rare	Major	Low	As above
Commercial development and shipping	Hydrocarbons	Adversely affects mangrove communities	Rare	Major	Low	As above
Commercial development and shipping	Hydrocarbons	Direct oiling of wildlife: Sea and shore birds	Rare	Major	Low	As above
Commercial development and shipping	Hydrocarbons	Indirect effects to fish (food webs, habitat alteration)	Rare	Major	Low	As above
Commercial development and shipping	Hydrocarbons	Indirect effects to invertebrates (food webs, habitat alteration)	Rare	Major	Low	As above
Commercial development and shipping	Hydrocarbons	Indirect effects to sea and shorebirds (loss of food and habitat)	Rare	Major	Low	As above
Water Resource Use	**Decreased freshwater inflows**	**Increased salinity**				**Because it is a semi-enclosed bay, Western Port is subject to alterations in salinity at a range of scales. Long-term records in Western Port show**

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
						strong seasonal and inter-annual variations in salinity of greater magnitude than Bass Strait. There is a potential trend for increasing salinity as a result of reduced inflows – due to diversion of water by re-cycling and other human uses, even allowing for possible increases in stormwater runoff from urbanisation (EPA Victoria 2011a). However, in systems such as Western Port that are adapted to temporal changes in salinity, small increases are not likely to have measurable impacts. The impact of water extraction, especially given land use and climate change is difficult to determine. The potential impacts on Western Port are considered a knowledge gap.
Invasive species	**Introduced marine pests**					**A survey in 2000 confirmed a total of 14 species of introduced marine pest had been identified in Western Port, although the bay remained largely clear of introduced species (Cohen et al. 2000). Translocation through recreational fishing was identified as the most likely source. A more recent survey confirmed the findings of Cohen et al (2000) with the higher priority species not detected (Fathom Pacific 2021). Department of Agriculture biosecurity monitoring at Port of Hastings found five species: Asian bag mussel, European shore crab, Vase tunicate, Pacific oyster and Undaria**
Invasive species	Introduced marine pests	Adversely affects seagrass	Possible	Minor	Low	Introduced pests have not been specifically identified as a potential threat to seagrass communities in recent assessments of Western Port (Walker 2011).
Invasive species	Introduced marine pests	Adversely affects subtidal and intertidal flats (including benthic invertebrates)	Possible	Major	High	Recent assessments in Western Port have suggested that despite no sustained, widespread establishment of epi-benthic marine pests, depending on which species may arrive, changes to entire communities and their functions cannot be excluded (Wilson et al. 2011).
Invasive species	Introduced marine pests	Adversely affects subtidal and intertidal reefs	Possible	Major	High	There are areas of marine pest invasion in Western Port. For example, in San Remo and Churchill Island Marine National Park, *Codium* sp. has spread and competes with native algae for space and resources. In addition, pacific oysters have been a problem requiring control. However, recent assessments have concluded "the risk to the more extensive reef areas of Western Port, which are in the southern sections, is not great." (Bathgate et al. 2011).
Invasive species	Introduced marine pests	Adversely affects fish reducing condition, abundance and diversity	Possible	Minor	Low	Introduced pests have not been specifically identified as a potential threat to fish diversity and abundance in recent assessments of Western Port (Jenkins 2011).
Invasive species	Introduced marine pests	Impacts to fish and invertebrates adversely affects waterbirds through the food chain	Possible	Minor	Low	Introduced pests have not been specifically identified as a potential threat to fish diversity and abundance in recent assessments of Western Port (Dann 2011).

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
Invasive species	Introduced marine pests	Impacts to fish and invertebrates adversely affects recreational fishing	Possible	Minor	Low	Derived from risks to fish
Invasive species	**Cord-grass (*Spartina* spp.)**					***Spartina* spp. is known from Western Port and the intertidal and saltmarsh habitats are vulnerable to spread of this species. It is tolerant of inundation and salinity, resistant to many herbicides and can rapidly outcompete native vegetation (Boon et al. 2011). MW has a program to eradicate Spartina from Western Port by 2025 (https://www.melbournewater.com.au/services/projects/spartina-management-western-port-estuaries). The species is largely controlled in theh Ramsar site, although eradication is unlikely.**
Invasive species	Cord-grass (*Spartina* spp.)	Adversely affects saltmarsh	Possible	Moderate	Low	Saltmarsh habitats are vulnerable to spread of this species. It is tolerant of inundation and salinity, resistant to many herbicides and can rapidly outcompete native vegetation (Boon et al. 2011).
Invasive species	Cord-grass (*Spartina* spp.)	Adversely affects mangroves	Possible	Moderate	Low	Intertidal habitats are vulnerable to spread of this species. It is tolerant of inundation and salinity, resistant to many herbicides and can rapidly outcompete native vegetation (Boon et al. 2011).
Invasive species	Cord-grass (*Spartina* spp.)	Adversely affects shorebirds and beach nesting seabirds	Possible	Moderate	Low	*Spartina* is dense, and does not provide good feeding, roosting or nesting habitat. The consequences may be higher for international migratory species that have high energy demands, and threatened nesting species.
Invasive species	**Emerging salt tolerant weeds**					**There is a very large number of exotic species that can invade - and have invaded - at higher elevations at the edge of the saltmarsh range (e.g. sea wheat grass; *Thinopyrum junceiforme*). Impacts are mostly to saltmarsh, rather than mangroves. *Spartina* is the only likely invader into mangroves. Sea spurge is a known threat to beach nesting birds, displacing nesting sites**
Invasive species	Emerging salt tolerant weeds	Adversely affects saltmarsh	Almost certain	Moderate	High	Based on local knowledge.
Invasive species	Emerging salt tolerant weeds	Adversely affects mangroves	Possible	Moderate	Medium	Based on local knowledge.
Invasive species	Emerging salt tolerant weeds	Adversely affects wetland dependent birds	Almost certain	Moderate	High	Most pronounced in the effects on feeding habitats for Orange-bellied parrot and on nesting birds through displacement of nest sites.
Invasive species	**Predators (foxes and cats)**					**The PPWCMA's Invasive Plants and Animals Strategy identifies predation by foxes and cats as a significant threat to shorebirds and beach nesting birds, with foxes remaining widespread throughout the Ramsar site. A new study of the efficacy of the feral cat control program on French Island concluded "the current program is certainly effective at removing cats but that the removal rate continues to be insufficient to achieve eradication of the feral cat population." (Johnston et al. 2020).**

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
Invasive species	Predators (foxes and cats)	Adversely affects shorebirds and beach nesting seabirds	Almost certain	Major	Extreme	The PPWCMA Invasive Plants and Animals Strategy identifies predation by foxes and cats as a significant threat to shorebirds and beach nesting birds, with foxes remaining widespread throughout the Ramsar site.
Invasive species	**Grazing animals (pigs, goats, deer)**					**Rabbits are widespread and there are localised infestations of pigs (e.g. Quail Island) and goats. There is direct evidence of extensive damage to coastal saltmarsh.**
Invasive species	Grazing animals (pigs, goats, deer)	Adversely affects saltmarsh	Almost certain	Moderate	High	There are localised infestations of pigs (e.g. Quail Island), deer and goats. There is direct evidence of extensive damage to coastal saltmarsh.
Invasive species	Grazing animals (pigs, goats, deer)	Adversely affects mangroves	Almost certain	Minor	Medium	Under current conditions there are local observations of cattle grazing mangroves.
Invasive species	Grazing animals (pigs, goats, deer)	Adversely affects shorebirds and beach nesting seabirds	Almost certain	Moderate	High	Derived from risks to saltmarsh.
Recreational activities	**Recreational activities in intertidal zones and on beaches**					**Vehicle damage to vegetation has been reported in Western Port reserves. The population of Greater Melbourne is predicted to increase from 4.3 million in 2013 to 7.8 million in 2051 (Department of Transport and Planning 2023). This is likely to increase recreational pressure on beaches and coastal areas.**
Recreational activities	Vehicles in intertidal areas	Adversely affects saltmarsh	Almost certain	Moderate	High	Coastal saltmarsh is an EPBC listed ecological community and is vulnerable to impacts and slow to recover from damage. Damage arising from vehicular access is widespread around Western Port.
Recreational activities	Vehicles in intertidal areas	Adversely affects intertidal flats	Almost certain	Moderate	High	Based on local knowledge of participants in the risk assessment.
Recreational activities	Vessels	Adversely affects intertidal flats	Almost certain	Minor	Medium	Based on local knowledge of participants in the risk assessment.
Recreational activities	Vehicles in intertidal areas	Adversely affects shorebirds and beach nesting seabirds	Almost certain	Moderate	High	Two impact pathways: habitat destruction and disturbance of nesting seabirds and roosting / foraging shorebirds. Human presence impacts on shorebirds is well documented (e.g. Koch and Paton 2014) with reduced feeding and unnecessary energy use feared to impact birds abilities to successfully make return journey to the northern hemisphere to breed.
Recreational activities	Vessels	Disturbance of shorebirds and nesting seabirds	Almost certain	Minor	Medium	Beach nesting birds (Hooded Plover, Fairy Tern, Red-capped Plovers and Oyster catchers) are highly vulnerable to disturbance by recreational boating activity. With predicted population increases, recreational boating is likely to increase.
Recreational activities	Recreation on beaches and shorelines	Adversely affects shorebirds and beach nesting seabirds	Almost certain	Moderate	High	Shorebirds and nesting seabirds are vulnerable to disturbance from walkers and dogs. As the population increases, it is expected that this pressure will also increase (Dann 2011).
Biological resource use	**Recreational fishing (includes**					**A survey of recreational fishers in Victoria indicates that for some species, the recreational catch is many times higher than the commercial catch**

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
	bait harvesting e.g. ghost shrimp)					**(Ford and Gilmour 2013). There are policies and rules in place (size and bag limits) to limit the impact of recreational fishing on fish stocks. Risk assessment is on the basis of an increasing population resulting in an increase in recreational fishing. Although rules such as bag limits may change to ensure sustainable stocks. study by the VFA indicated that the recreational catch of elephant fish and the targeting of breeding aggregations suggest that "there is a high risk of the current harvest levels being not sustainable." (Braccini et al. 2008).**
Biological resource use	Recreational fishing	Adversely affects intertidal invertebrates	Almost certain	Moderate	High	Studies of bait pumping for ghost shrimp in Western Port indicated that changes are not just to target species, but to the ecosystem function of the entire habitat, with slow recovery (Contessa and Bird 2004). The extent of this activity and the impact it is having is a knowledge gap
Biological resource use	Recreational fishing	Adversely affects fish abundance and diversity	Almost certain	Moderate	High	Population projections over the next 40 years, would suggest that increasing recreational fishing effort in Western Port is likely. Risk is high for some species (e.g. elephant fish) but sustainable populations of others (e.g. snapper).
Biological resource use	Recreational fishing	Adversely affects bycatch species	Almost certain	Moderate	High	Many non-target species are caught and discarded. There is no monitoring or rules protecting these species, but it is possible it is having a significant effect on some species.
Biological resource use	Recreational fishing	Indirect effects to seabirds (loss of food)	Possible	Minor	Low	Based on assessment of fish, recognising that only a proportion of the species in Western Port eat fish and that there is only partial overlap between species eaten by birds and those targeted by recreational fishers.
Urban development	**Habitat removal**					**Increasing populations lead to an expansion of residential and commercial areas in the catchment and adjacent to the Ramsar site. Although an assessment of specific projects is outside the scope of this risk assessment, the general nature of development and direct habitat removal is considered. Of particular concern is that residential and commercial development in many areas is close to the shore, preventing retreat. Discussions with local government indicate the scope of development has not changed and is governed by planning schemes.**
Urban development	Habitat removal	Adversely affects seagrass	Possible	Minor	Low	Based on land reclamation, illegal bunds and depositing of fill in intertidal areas.
Urban development	Habitat removal	Adversely affects saltmarsh	Likely	Moderate	Medium	Historically over 45% of the pre-European saltmarsh extent in Western Port has been lost to "land reclamation" (Boon et al. 2011). However, the recent EPBC listing of coastal saltmarsh as a vulnerable community affords the vegetation class more protection from future developments - dumping of clean fill to reclaim land has been identified as a risk in some areas of Western Port.

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
Urban development	Habitat removal	Adversely affects mangrove communities	Likely	Moderate	Medium	Mangrove habitat can be lost directly from land claiming, clearance for industrial or marina developments, and other effects of urbanisation (Dittman 2011).
Urban development	Habitat removal	Indirect effects to sea and shorebirds (loss of food and habitat)	Possible	Minor	Low	Based on assessment of saltmarsh, noting that birds are mobile and can move to other intertidal areas.
Urban development	**Lighting at night**					**A recent study from Phillip Island found that a small percentage (1 %) of short-tailed shearwaters were significantly affected by lighting at night, resulting in a 40% mortality of affected birds (Rodríguez et al. 2014). An increased urban area around the coasts of Western Port could result in increased lighting at night.**
Urban development	Lighting at night	Affects seabirds	Possible	Minor	Low	See above
Climate change						**Regional climate change predictions for the Western Port region have recently been revised (DEECA 2024). There is increasing evidence that global carbon emissions most closely reflect medium to high emission scenarios (Schwalm et al. 2020, Pedersen et al. 2021). The predicted climate for variables below reflects the results for the SP3-70 models.**
Climate change	**Increased carbon dioxide**					**Atmospheric carbon dioxide is increasing and has increased in recent decades and recently exceeded 400 ppm (http://www.esrl.noaa.gov/gmd/ccgg/trends/).**
Climate change	Increased carbon dioxide	Increased photosynthesis adversely affects seagrass	Unlikely	Negligible	Negligible	Predicted that increased CO_2 may benefit seagrass (Morris 2013).
Climate change	Increased carbon dioxide	Increased photosynthesis adversely affects saltmarsh and mangroves	Possible	Minor	Low	Score of 'minor' impact based on rationale that selection amongst C3/C4 plants will exert little overall adverse effect on saltmarshes. Might result in some plant groups having an advantage and therefore increasing in extent (e.g. C3 taxa such as shrubs) while others will have neither an advantage or disadvantage (e.g. grasses) Paul Boon (pers. comm.).
Climate change	**Increased temperature**					**Surface water temperatures are predicted to increase by 0.5 degrees Celsius by 2030 with a very high degree of confidence. There will also be an increase in the frequency of extreme temperature days (DEECA 2024).**
Climate change	Increased temperature	Adversely affects seagrass	Possible	Moderate	Medium	Assessment of impacts of climate change related temperature increases on seagrass and soft sediment habitats in Victoria indicated low vulnerability, but high uncertainty in embayments (Morris 2013). The risk would be higher to intertidal seagrass, than subtidal due to increased exposure.
Climate change	Increased temperature	Adversely affects intertidal and subtidal flats	Unlikely	Minor	Low	An assessment of climate change related increased temperature impacts to intertidal and subtidal flats indicated moderate vulnerability and adaptive capacity (Morris 2013). However, the greatest risks are for longer term

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
						projections and the likelihood and magnitude of change in the next two decades is lower.
Climate change	Increased temperature	Adversely affects intertidal and subtidal reefs	Possible	Moderate	Medium	An assessment of climate change related increased temperature impacts to intertidal and subtidal rocky reefs indicated high vulnerability and low adaptive capacity (Bellgrove et al. 2013). However, the greatest risks are for longer term projections (> 30 years) and the likelihood and magnitude of change in the next two decades is lower. Effects to habitat forming brown algae may have flow on effects to fauna.
Climate change	Increased temperature	Adversely affects saltmarsh	Possible	Moderate	Medium	Spartina is a C4 plant that is likely to be competitively advantaged by higher temperatures (and CO2) concentrations, increasing the risk to saltmarsh communities from this invasive species. Therefore risk is considered higher under climate change than that currently posed by this invasive species.
Climate change	Increased temperature	Adversely affects mangroves			N/A	There is a potential benefit to mangroves through expansion of range as temperatures increase (Boon et al. 2011). Not a plausible impact pathway.
Climate change	Increased temperature	Adversely affects fish abundance and diversity	Possible	Minor	Low	An assessment of climate change related increased temperature impacts to marine fish indicated high vulnerability and low adaptive capacity of larval stages (Hirst and Hamer 2013). However, the greatest risks are for longer term projections (> 50 years) and the likelihood and magnitude of change in the next two decades is lower.
Climate change	Increased temperature	Adversely affects waterbirds	Possible	Moderate	Medium	Temperature effects the timing of migration in many shorebirds, which may influence recruitment and survival (Robinson et al. 2009).
Climate change	Increased temperature	Adversely affects recreational fishing	Possible	Minor	Low	Larvae of target recreational species (King George Whiting, Snapper, Sand Flathead) are all vulnerable to temperature increases (Hirst and Hamer 2013). However, the effects in the next 15 years are not expected to be widespread.
Climate change	**Sea level rise**					**Sea levels are predicted to increase by 0.18 m by 2050 with a very high degree of confidence (DEECA 2024). Western Port Local Coastal Hazard Assessment indicates widespread and significant impacts by 2100 (Arrowsmith and Womersley 2014).**
Climate change	Sea level rise	Adversely affects seagrass	Likely	Major	High	Intertidal seagrass is highly vulnerable to sea level rise and has a low adaptive capacity (Morris 2013).
Climate change	Sea level rise	Adversely affects intertidal and subtidal flats	Likely	Major	High	Intertidal mudflats are highly vulnerable to sea level rise and have a low adaptive capacity (Morris 2013).
Climate change	Sea level rise	Adversely affects intertidal and subtidal reefs	Likely	Major	High	Intertidal and shallow subtidal rocky reefs in Victorian embayments are highly vulnerable to sea level rise with a low adaptive capacity.
Climate change	Sea level rise	Adversely affects saltmarsh	Almost certain	Major	Extreme	Saltmarsh and mangrove community composition and extent is largely determined by tidal depth (Boon et al. 2011). Sea level rise in areas such as Western Port, which has significant barriers to landward migration (roads, walls, etc) has the capacity to have severe impacts on the EPBC listed ecological community (Saintilan and Rogers 2013).

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
Climate change	Sea level rise	Adversely affects mangroves	Possible	Minor	Low	Likely to favour mangroves over saltmarsh, with an expansion into current saltmarsh habitat (Boon et al. 2011).
Climate change	Sea level rise	Adversely affects fish abundance and diversity	Unlikely	Minor	Low	Low vulnerabilities of fish to sea level rise (adults and larvae) (Hirst and Hamer 2013).
Climate change	Sea level rise	Adversely affects waterbirds	Likely	Moderate	Medium	Shorebirds and beach nesting seabirds are highly vulnerable to sea level rise, with loss of habitat predicted to be extensive (Robinson et al. 2009). This may include loss of intertidal feeding habitat and supratidal habitat needed for roosting and nesting. Impacts considered moderate in the short term, but greater in the long term (Hansen et al. 2013).
Climate change	Sea level rise	Adversely affects recreational fishing	Unlikely	Minor	Low	Based on assessment of fish
Climate change	**Ocean acidification**					**pH is predicted to decrease by 0.07 to 0.08 pH units by 2030 with a medium degree of confidence (Grose et al. 2015).**
Climate change	Ocean acidification	Adversely affects seagrass	Rare	Negligible	Negligible	Seagrass in Victoria is not considered vulnerable to predicted changes in ocean acidification (Morris 2013).
Climate change	Ocean acidification	Adversely affects intertidal and subtidal flats	Unlikely	Minor	Low	Assessed as being highly vulnerable, particularly for organisms with a calcified outer shell (Morris 2013). However, possibly a longer-term risk, rather than in the next two decades.
Climate change	Ocean acidification	Adversely affects intertidal and subtidal reefs	Unlikely	Minor	Low	Assessed as being highly vulnerable, particularly for organisms with a calcified outer shell (Bellgrove et al. 2013). However, possibly a longer-term risk, rather than in the next two decades.
Climate change	Ocean acidification	Adversely affects fish abundance and diversity	Rare	Negligible	Negligible	Low to moderate vulnerability (Hirst and Hamer 2013).
Climate change	Ocean acidification	Adversely affects waterbirds	Rare	Negligible	Negligible	Only plausible pathway is through food chain effects but considered to be very low risk in the short to medium term (noting that this risk assessment is based on the next 15 years). Longer term effects through loss of calcified shell prey may prove a greater threat.
Climate change	Ocean acidification	Adversely affects recreational fishing	Rare	Negligible	Negligible	Based on assessment of fish
Climate change	**Increased frequency and intensity of storms leads to increased erosion of shorelines**					**Extreme events (storms and high rainfall events) are predicted (with high confidence) to increase in frequency (Grose et al. 2015). Erosion of shorelines in Western Port is currently occurring, particularly in the Eastern Arm near Lang Lang, due to the combined actions of waves and tidal cycles. A recent study concluded "There was no evidence from monitoring sites that storm events caused significantly greater erosion, however determining these thresholds and wave impacts is an important precursor for the design of effective erosion control structures." (Tomkins et al. 2014). However development close to shorelines decreases potential for inland migration if shores erode. Western Port Local Coastal Hazard**

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
						Assessment indicates widespread and significant impacts by 2100 (Arrowsmith and Womersley 2014).
Climate change	Increased frequency and intensity of storms leads to increased erosion of shorelines	Adversely affects seagrass	Almost certain	Major	Extreme	Seagrass in intertidal zones is most vulnerable, with a very large proportion of the seagrass in Western Port in intertidal and shallow waters.
Climate change	Increased frequency and intensity of storms leads to increased erosion of shorelines	Adversely affects intertidal and subtidal flats	Almost certain	Major	Extreme	Intertidal flats are exposed to wave action and increased storms will result in physical damage and follow on effects to benthic invertebrates.
Climate change	Increased frequency and intensity of storms leads to increased erosion of shorelines	Adversely affects intertidal and subtidal reefs	Possible	Moderate	Medium	Exposed shallow sub-tidal reefs may be physically damaged by storm surges but are less vulnerable than intertidal habitats.
Climate change	Increased frequency and intensity of storms leads to increased erosion of shorelines	Adversely affects saltmarsh	Likely	Major	High	Destruction of coastal dunes systems due to wave action, higher tides and resulting loss of natural barriers adversely impact on saltmarsh.
Climate change	Increased frequency and intensity of storms leads to increased erosion of shorelines	Adversely affects mangroves	Likely	Major	High	Destruction of coastal dunes systems due to wave action, higher tides and resulting loss of natural barriers adversely impact on mangroves.
Climate change	Increased frequency and intensity of storms leads to increased erosion of shorelines	Adversely affects fish abundance and diversity	Possible	Moderate	Medium	Based on assessment of seagrass, noting that not all fish species are reliant on seagrass habitat.
Climate change	Increased frequency and intensity of storms leads to increased erosion of shorelines	Adversely affects waterbirds	Likely	Major	High	Due to erosion of intertidal mudflat habitats and supratidal habitat needed for roosting and nesting.

Pressure	Stressor	Impact	Likelihood	Consequence	Risk	Evidence / comments
Climate change	Increased frequency and intensity of storms leads to increased erosion of shorelines	Adversely affects visual amenity (aesthetic enjoyment)	Unlikely	Minor	Low	Storm damage on shorelines may affect visual amenity in localised areas for periods post storm.
Climate change	Increased frequency and intensity of storms leads to increased erosion of shorelines	Adversely affects primary contact recreation	Unlikely	Minor	Low	Based on localised affects to beaches.
Climate change	Increased frequency and intensity of storms leads to increased erosion of shorelines	Adversely affects secondary contact recreation	Unlikely	Minor	Low	Based on localised affects to beaches.
Climate change	Increased frequency and intensity of storms leads to increased erosion of shorelines	Adversely affects recreational fishing	Possible	Moderate	Medium	Based on assessment of fish, noting that not all recreational target fish species are reliant on seagrass habitat.
Invasive & Other Problematic Species, Genes & Diseases	**High pathogenicity avian influenza (HPAI)**					**Since 2021, there have been many detections overseas of HPAI viruses in wild birds, wild mammals, and poultry. HPAI H5N1 clade 2.3.4.4b has been the predominant strain since 2022. Both individual and mass mortalities have been observed. Detections of HPAI are rare in Australia. All previous Australian outbreaks have been in poultry, but this does not preclude an outbreak in the wild bird population. A recent risk assessment for little penguins identified a very high risk (Vaughan-Higgins et al. 2024).**
Invasive & Other Problematic Species, Genes & Diseases	High pathogenicity avian influenza (HPAI)	Adversely affects waterbirds	Almost certain	Major	Extreme	

Appendix C Deriving Resource Condition Targets

Resource Condition Targets (RCTs) were derived by a process of expert opinion and local knowledge taking into consideration Limits of Acceptable Change and current condition for each value. They are designed to be feasible and achievable within the life of the plan (next seven years).

Critical CPS	Baseline description	Limit of Acceptable Change	Current condition	Resource Condition Targets
Wetland bathymetry	Characteristic habitat in Western Port supporting a diversity of invertebrates and feeding grounds for waterbirds. Annual macrofaunal production in Western Port was measured at 57.3 g/m2, in 1994 (Wilson et al. 2011)	No loss of intertidal mudflat area (270 km^2)	The extent of intertidal habitats in Western Port has not changed substantially since the time of listing. Over the period 2017 to 2023, bare intertidal area ranged from 113 to 147 km^2 and vegetated intertidal area from 136 to 170 km^2.	1. Maintain the diversity of habitats for the Ramsar site: • Seagrass > 14,000 hectares, with > 50% being medium-dense • Saltmarsh > 1,100 hectares • Mangroves > 1,700 hectares • Unvegetated intertidal sand / mudflats > 13,000 hectares
Seagrass	First measured by Shapiro (1975) at 250 km^2 of seagrass then but this area fell to 72 km^2 in 1983–84 and then increased to 93 km^2 in 1994, and to 130 km^2 1999–2000 (Blake and Ball 2001) and Melbourne water measured 150 km^2 in 2011 (Holland et al. 2013).	Total seagrass extent will not decline below 5400 hectares for a period of greater than 10 consecutive years.	Extent of seagrass from 2017 to 2023 ranged from 11,000 hectares to 14,000 hectares. Seagrass was mapped in two density classes in the most recent mapping, with 41% to 56% occurring as “dense” seagrass.	
Saltmarsh	Approximately 1,000 hectares of saltmarsh, landward of mangroves.	Total saltmarsh extent will not decline below 850 hectares	Extent of saltmarsh from 2017 to 2023 ranged from 980 to 1340 hectares.	
Mangroves	A number of sources (Boon et al. 2011, Melbourne Water Corporation. 2011, Kirkman 2013) indicate that mangrove extent in 1975 was around 12 km^2 (1,200 hectares)	Total mangrove extent will not decline below 900 hectares.	Extent of mangroves from 2017 to 2023 ranged from 1400 to 1560 hectares. No data on condition is available. This knowledge gap is addressed through monitoring recommendations.	

Critical CPS	Baseline description	Limit of Acceptable Change	Current condition	Resource Condition Targets

Fish	Diverse range of fish species associated with different habitats.
	Recreationally important species.
	Conservation significant species and groups: Pipefish and sea horses.
		None set. LAC could be established for indicator species (for recreationally important species) based on the angler diary program.	The Victorian Fisheries Authority (VFA) angler diary program (Conron et al. 2016, Ingram and Conron 2022, Bell et al. 2024) suggests increasing populations of King George whiting, stable population of snapper, a decline in sand flat head and a large decrease in the population of elephant fish. The VFA has established benchmarks for each of these species (based on CPUE in a reference period) these have been adopted as RCTs.	2. Maintain abundance of indicator fish species above the following thresholds (fish per angler hour):
				• Snapper
				  ○ October-December 0.2
				  ○ January-May 0.4
				• King George Whiting – 0.7
				• Sand flathead – 0.9
				• Elephant fish – 0.1.

Waterbirds: abundance and diversity	115 waterbird species recorded (some pelagic seabirds and not regularly supported by the site). > 20,000 waterbirds recorded annually > 1% of the population recorded regularly for seven species (Hansen et al. 2011) pied oystercatcher (2.3%), eastern curlew (2.8%), red-necked stint (1.8%), curlew sandpiper (2.1%), fairy tern (1.6%), pacific gull (6.3%), silver gull (3.3%)	Abundance of waterbirds will not decline below the following (calculated as a rolling five-year average of maximum annual count): Total waterbirds – 12 000 Migratory shorebirds – 5300 Australasian shorebirds - 800 Ducks - 500 Fishers - 550 Gulls - 1600 Large wading birds - 980 Swans – 1600	There has been an increase in the abundance of some species (Pied Oystercatcher and Red-necked Avocet); but a decline in other species (Cormorants, Grey-tailed Tattler, Eastern Curlew and Curlew Sandpiper). However, the decline in some shorebird species is related to conditions outside the site (Yellow Sea) (Hansen et al. 2011).	3. Maintain abundance of waterbirds in each of the following guilds (calculated as a rolling five-year average of maximum annual count): • Total waterbirds > 20,000 • Migratory shorebirds > 12,000 • Australasian shorebirds 1,100 • Ducks > 1,300 • Fishers > 600 • Gulls > 1,300 • Large wading birds > 1,300 • Swans > 2,700
Waterbirds: Breeding	The site is significant for beach nesting birds, particularly French Island, due to a lack of foxes. Fairy tern and Caspian tern breed semi-regularly on Rams Island. Australian pied oyster catchers breed regularly in the sandy beaches (and even saltmarsh) of French Island.	Breeding of beach nesting birds annually within the site	Hooded plover counts are mostly outside the Ramsar site boundary (indicating that the site is probably not important for this species). Site is important (particularly French Island) for nesting fairy tern and oyster catchers. Data on Fairy tern nests indicate highly variable numbers, and gaps of up to five years when terns do not nest (Lacey and O'Brien 2015). Quantitative data for other beach nesting species is a knowledge gap.	4. Maintain annual breeding of Australian pied oystercatcher and red-capped plover within the Ramsar site.

Critical CPS	Baseline description	Limit of Acceptable Change	Current condition	Resource Condition Targets
Waterbirds: Threatened species	Australian fairy tern, bar-tailed godwit, common greenshank, curlew sandpiper, eastern curlew, lesser sand plover, red knot, ruddy turnstone, sharp-tailed sandpiper, terek sandpiper	Abundance of eastern curlew, curlew sandpiper and fairy tern will not decline below 1% of the population as stated in the most recent Wetlands International Population estimate (based on a five-year rolling average of annual maximum counts). Presence of bar-tailed godwit, lesser sand plover and red knot in at least three out of every five years.	There has been a decline in several shorebird species, including curlew sandpiper and eastern curlew in the site. Numbers of fairy tern have also declined. The decline in these species is not isolated to Western Port, but is consistent with declines in shorebird populations globally (Szabo et al. 2016) and in Australian fairy tern in south-eastern Australia (Sanchez et al. 2024).	5. Annual presence of the following threatened waterbird species within the site: Australian fairy tern, bar-tailed godwit, common greenshank, curlew sandpiper, eastern curlew, lesser sand plover, red knot, ruddy turnstone, sharp-tailed sandpiper, terek sandpiper.

Appendix D Cross reference of management strategies with RCTs, threats and knowledge gaps

Priority values	Priority threats	Knowledge gaps

1. Maintain the diversity of habitats for the Ramsar site:
• Seagrass > 14,000 hectares, with > 50% being medium-dense
• Saltmarsh > 1,100 hectares
• Mangroves > 1,700 hectares
• Unvegetated intertidal sand / mudflats > 13,000 hectares
 	
2. Maintain abundance of indicator fish species above the following thresholds (fish per angler hour):
• Snapper
  ○ October-December 0.2
  ○ January-May 0.4
• King George Whiting – 0.7
• Sand flathead – 0.9
• Elephant fish – 0.1.
 	
3. Maintain abundance of waterbirds in each of the following guilds (calculated as a rolling five-year average of maximum annual count):
• Total waterbirds > 20,000
• Migratory waders > 12,000
• Australasian waders > 1,100
• Ducks > 1,300
• Fishers > 600
• Gulls > 1,300
• Large wading birds > 1,300
• Swans > 2,700
 	
4. Maintain annual breeding of Australian pied oystercatcher and red-capped plover within the Ramsar site.
 	
5. Annual presence of the following threatened waterbird species within the site:
 	
Australian fairy tern, bar-tailed godwit, common greenshank, curlew sandpiper, eastern curlew, lesser sand plover, red knot, ruddy turnstone, sharp-tailed sandpiper, terek sandpiper.
	1. Climate change: increased storm events increase sediments affecting seagrass, fish and primary productivity (waterbirds through the food chain)
	2. Climate change: Increased frequency and intensity of storms leads to increased erosion of shorelines, impacts saltmarsh, seagrass, fish and waterbirds (loss of roosting and nesting sites)
	3. Climate change: sea level rise affects saltmarsh, intertidal flats, seagrass and intertidal reefs
	4. Pollution urban and agricultural run-off: sediments and toxicants affecting all biota
	5. Invasive species: introduced marine pests affecting flats and reefs and their invertebrate communities
	6. Invasive species: cord grass (Spartina spp.) impacts saltmarsh, mangroves, shorebirds and beach nesting birds.
	7. Invasive species: emerging salt tolerant weeds impacts saltmarsh, mangroves, shorebirds and beach nesting birds.
	8. Invasive species: foxes and cats predating on waterbirds
	9. Invasive species: non-native grazing animals (pigs, goats, deer) impacting vegetation and destroying waterbird foraging and nesting habitat
	10. Recreation: beach users disturbing waterbird feeding, breeding and roosting
	11. Recreation: vehicles in intertidal areas damaging saltmarsh, disturbing intertidal flats and foraging and nesting waterbirds
	12. Biological resource use: recreational fishing impacting on intertidal invertebrates, target fish and by-catch
	13. Avian diseases impacting on waterbirds
		1. Distribution, community composition, abundance and condition of benthic infauna communities.
		2. Impact of current and future recreational fishing on fish populations and on bryozoan reefs.
		3. Extent and impact of bait pumping on invertebrates but also flow on to foraging waterbirds.
		4. Condition of saltmarsh and mangrove vegetation communities.
		5. Status and trends in key non-recreationally targeted fish species.
		6. Management options to address risks from avian disease (e.g. avian flu)

Management Strategies	Responsibility	Linkages to existing programs / activities	Relevant RCTs	Relevant knowledge gaps	Relevant threats	Priority locations	Theme
1.1 Reduce nutrient and sediment inflow: Support the implementation of riparian, in-stream and catchment works identified in the Healthy Waterway Strategy (Melbourne Water Corporation 2018); revised Environmental Reference Standards; Port Phillip and Western Port Regional Catchment Strategy and local actions plans to improve water quality in storm water and river flows to Western Port.	Melbourne Water EPA Victoria DEECA Local government	Healthy Waterways Strategy PPWP Regional Catchment Strategy Environmental Reference Standards Western Port Biosphere Water Stewardship	1, 2		1, 4	Lang Lang and Bass catchments	Managing water quality
1.2 Implement incentive schemes for urban and rural run-off through the Water Sensitive Urban Design program.	Melbourne Water DEECA Local government	Urban Stormwater: Best Practice Environmental Management Guidelines Western Port Biosphere Water Stewardship	1, 2		1, 4	Lang Lang and Bass catchments	Managing water quality
1.3 Develop appropriate approaches for pollutant reduction and seagrass improvement, and trigger values (objectives) for water quality indicators	EPA Victoria	Review of SEPP (WoV) Western Port Biosphere Water Stewardship	1, 2		1, 2, 4		Managing water quality
1.4 Investigate the sources, potential impact and mitigation strategies for toxicants entering Western Port through storm water drains and rivers	Melbourne Water EPA Victoria Local government	Western Port Scientific Investigations funded by Melbourne Water Western Port Biosphere Water Stewardship	1, 2	3	4		Managing water quality

Management Strategies	Responsibility	Linkages to existing programs / activities	Relevant RCTs	Relevant knowledge gaps	Relevant threats	Priority locations	Theme
2.1 Implement strategies to address coastal erosion risks: • Development of a strategic approach to the management and future adaptation of the existing shoreline protection works • Provision of adaptation space for the landward migration of wetland fringed shorelines and opportunities for land acquisition.	Melbourne Water Local government		1, 2		2, 3		Living with climate change
2.2 Identify and implement opportunities for improving and enhancing habitat adaptation in response to the impacts of climate change within the Ramsar site and adjacent priority areas.	Melbourne Water DEECA Local government		1,2		1,2, 3		Living with climate change
3.1 Implement methods for restoring seagrass and mangroves.	DEECA, NGOs	Seagrass partnership Western Port Biosphere	1		1, 2, 3, 4, 7		Protecting flora and fauna
3.2 Identify priority locations of habitat loss in the Ramsar site due to human activity including vehicle damage, stock grazing, illegal dumping, direct vegetation removal and implement appropriate enforcement of existing laws.	Parks Victoria Local government Landcare CMA	Ramsar Protection Program	1	4	10,11		Protecting flora and fauna
3.4 Continue to implement pest animal control programs (cat, fox, rat, dog, pig) in priority roosting and nesting sites within the Ramsar site.	CMA, PINP Local Government NGOs	Ramsar Protection Program; Local action plans and strategies	3, 4, 5		8, 9	Roosting and beach nesting sites	Protecting flora and fauna
3.5 Continue to implement pig, goat and deer control programs within the Ramsar site boundary to limit impacts on saltmarsh.	CMA, PINP Local Government NGOs	Ramsar Protection Program	1, 3, 4, 5		9		Protecting flora and fauna
3.6 Continue to implement Spartina control programs within the Ramsar site.	Parks Victoria CMA	Ramsar Protection Program	1		6	Bass River Delta	Protecting flora and fauna
3.7 Conduct regular surveys and implement control actions for new and emerging salt tolerant weeds.	Parks Victoria DELWP Local government	Ramsar Protection Program	1		7	Beach bird nesting sites Saltmarsh in French & Quail Is. northern coastline	Protecting flora and fauna

Management Strategies	Responsibility	Linkages to existing programs / activities	Relevant RCTs	Relevant knowledge gaps	Relevant threats	Priority locations	Theme
3.8 Develop and implement a marine pest strategy for Western Port.	DELWP Parks Victoria		1, 2		5		Protecting flora and fauna
3.9 Investigate the potential to use dredged material to renourish beach habitat for foraging and nesting birds.	DEECA Melbourne Water Parks Victoria Port of Hastings		1, 3, 4, 5		2, 3		Protecting flora and fauna
4.1 Investigate the impacts of bait harvesting (including bait pumping) on invertebrate populations and shorebirds.	DEECA VFA		1, 3, 5	1, 3	12		Improving our knowledge
4.2 Investigate the severity and extent of impact recreational fishing is having on the bryozoan reefs.	Parks Victoria		2	2	12		Improving our knowledge
4.3 Develop and implement a response plan for addressing risks associated with avian diseases	DEECA BirdLife	Agriculture Victoria avian flu response plan	3, 4, 5	6	13		Improving our knowledge
5.1 Develop and implement a Western Port Ramsar community engagement strategy that considers: • Education and engagement of landholders • Public awareness of the impacts of recreational activities on sensitive habitats and species such as shorebirds and beach nesting birds • Mechanisms to engage divers and recreational fishers in preventing marine pest outbreaks	Melbourne Water DEECA Parks Victoria	Ramsar Protection Program	All		All		CEPA
5.2 Maintain the Western Port Ramsar Site webpage (DEECA) and the process for stakeholder involvement via updates and links.	DEECA		All		All		CEPA
6.1. Apply the appropriate State and Commonwealth environmental impact assessment processes for activities that have the potential to impact on the Ramsar site and Matters of National Environmental Significance (MNES). Investigate mechanisms for adequately assessing cumulative impacts from multiple developments through this process.	DEECA DCCEEW						Governance

Management Strategies	Responsibility	Linkages to existing programs / activities	Relevant RCTs	Relevant knowledge gaps	Relevant threats	Priority locations	Theme
6.2. Undertake a regular review of the status of the ecological character of the Ramsar site.	Melbourne Water, DEECA						Governance
6.3. Develop guidelines for defining and managing buffer zones to guide assessment of local planning applications and promote complementary management.	DEECA						Governance
6.4. Develop annual action plans for this strategy	Melbourne Water and the WPRSCC						Governance

Appendix E Western Port Ramsar Site Surrounding Land Use and Declared Port Waters