Bay Blueprint Framework Report

Regional Coastal Adaptation Framework for Port Phillip Bay

October 2015

Port Phillip Bay: Regional Coastal Adaptation Framework

Bay Blueprint - Stage 1 Report

Client: City of Port Phillip

ABN: 21 762 977 945

Prepared by

AECOM Australia Pty Ltd
Level 9, 8 Exhibition Street, Melbourne VIC 3000, Australia
T +61 3 9653 1234 F +61 3 9654 7117 www.aecom.com
ABN 20 093 846 925

In association with

Ramboll Environ, Cardno

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Executive Summary

The challenge

Port Phillip Bay is changing. The pace of change and scale of impacts associated with climate change is increasing. This will place pressure on coastal ecosystems, coastal values and create significant challenges for coastal management.

While the Bay has a long history of coping with and adapting to climate, population, land use and development pressures, the future will be more challenging. While its physical shape was achieved thousands of years ago and largely remained the same until now, it is expected to change significantly over the next century.

By 2070 the Bay will need to cope with a projected sea level rise of 50 cm, more frequent extreme weather events, and increased erosion, reducing the availability, amenity and useability of the coast and coastal assets, as well as affecting the viability of natural ecosystems – 'coastal squeeze'. In addition, projections suggest the Bay will be subject to increasing acidification and warming.

The Bay will face these challenges as Victoria, and particularly Melbourne, continues to grow at a rapid rate. Coastal squeeze places greater demand on a diminishing coastal resource and population growth heightens these pressures. The pressures associated with climate change, population growth, and land use and development changes will exert increasing strain on the Bay's physical state in coming years.

It is critical for coastal managers to fully understand the risks they face and to plan for these risks. Without a more coordinated response, scarce resources will be wasted, there is a greater likelihood of financial losses from extreme events, and the ability to protect community use and enjoyment is diminished. A shared vision and approach to adaptation will assist the Association of Bayside Municipalities (ABM) councils to work successfully with other levels of government, the private sector and communities to deliver local coastal adaptation actions and broader regional benefits.

Plan for Port Phillip Bay – a Regional Coastal Adaptation Framework

The ABM is a local government association that aims to address and advocate for matters of common interest to councils around Port Phillip Bay. Member municipalities are the cities of Bayside, Frankston, Greater Geelong, Hobsons Bay, Kingston, Melbourne, Port Phillip and Wyndham, the Shire of Mornington Peninsula and the Borough of Queenscliffe. These municipalities are collectively home to 1.3 million Victorians.

To support councils put in place the arrangements needed for effective coastal adaptation, the ABM is coordinating a project on behalf of its members with funding support from the State Government. This report is the first of a three stage project, *Plan for Port Phillip Bay – a Regional Coastal Adaptation Framework (Bay Blueprint)*, designed to embed coastal adaptation measures into council decision making. Together with the next stage, *Bay Plan 2070*, they provide a regional coastal adaptation plan for Port Phillip Bay, to be supported by training and awareness-raising in the final stage.

The factors affecting the physical state and management of the Bay, and the general approach to climate adaptation and resilience, have been examined through a synthesis of relevant knowledge, research, programs and stakeholder engagement using workshops and surveys. The report brings these together, considering:

- why the bay is important: its regional and demographic context (Section 1)
- how the future vision for the Bay relates to its natural, built, economic, social and cultural values (Section 2)
- the current physical state of the Bay (Section 3)
- pressures facing the Bay, in particular due to climate change (Section 4)
- the current coastal management framework (Section 5)
- the challenges and barriers the current management framework presents for coastal adaptation (Section 6)
- findings about how governance for coastal adaptation may be improved and next steps (Section 7).

The Bay is critically important to Victoria's economy and quality of life. Its coastal and marine environments support a range of recreational and commercial activities and its rocky reefs, sandy shores, foreshore reserves and rugged cliffs provide habitat and amenity as well as protection for both public and private assets, on the coast and beyond. It is important to preserve these values for future generations.

This report identifies significant knowledge and data gaps relating to understanding future vulnerabilities. Data gaps predominately relate to measured wave data, 1 in 100 year storm erosion data, inundation and beach profile data. Current funding and resource allocation regimes accentuate existing gaps in coastal management data.

With worsening physical impacts, a consistent methodology to assess risk, taking a whole-of-Bay approach, is required so that physical impacts across the bay are identified and responses can be prioritised. Although a number of risk assessments supporting climate adaptation and coastal management were identified, none adequately cover the entire Bay, leading to inconsistent approaches and diffuse priorities which act as barriers to coordination and collaboration.

Current governance arrangements delegate Bay management to a wide range of committees and agencies with differing capabilities. This long-standing approach contributes to poor coordination of whole-of-Bay adaptation.

This report sets out findings, which if addressed implemented, would address the knowledge and data gaps and improve the funding and management arrangements to support coastal adaptation in the future. It is unlikely that the current arrangements for coastal adaptation will be adequate for the challenges ahead.

This report finds that coastal adaptation for Port Phillip Bay should be supported through:

1) a set of guiding principles to align stakeholder priorities and objectives for Bay climate adaptation
2) filling data gaps and a consistent approach to coastal inundation modelling, commencing with priority areas
3) developing an operational guide (or manual) for Port Phillip Bay coastal adaptation and management
4) new models to insure against seawater related inundation
5) clarifying roles and responsibilities, improving consistency and coastal adaptation governance through the upcoming reviews of the *Climate Change Act 2010*, the *Coastal Management Act 1995* and the proposed Coastal and Marine Act
6) preparing a range of 'generic' planning responses for vulnerable areas, to avoid the need for expensive studies at each site, supported by indicative Cost Benefit Analysis for adaptation option types across the Bay
7) State coordination and oversight to improve the integration of roles and responsibilities and support day-to-day management, perhaps through convening a Bay managers' forum
8) articulating the rights and legitimate expectations for private and public stakeholders of hazard prone coastal land to clarify roles and responsibilities for protection works for public and or private benefit
9) a fully accessible knowledge sharing website for coastal managers and stakeholders
10) collating coastal management and budget data to better understand the true costs and benefits of coastal adaptation and management across the Bay
11) Determining transparent criteria for coastal protection priorities for the Bay and consistently applying them across all coastal managers to consolidate identified priorities for the Bay.

It is important that coastal adaptation begin in earnest. Cultural and structural management changes need to be made and a forward research and works program identified. A regional approach will improve local level decision-making while building the climate adaptation knowledge, policies, programs and implementation capacity necessary to safeguard community and Bay values into the future.

Through agreed regional priorities for coastal adaptation, a consistent response for the use and development of land in hazard-prone areas, addressing data and modelling gaps, building support for coastal adaptation, and addressing the other findings contained in this report, many of the Bay's values will be preserved for future generations to enjoy.

This will assist to build community awareness and confidence in the Bay management and decision making processes. If the Bay's contribution to our quality of life is to be preserved in the face of looming climate stresses, future approaches require strengthened regional cooperation between the ten participating ABM municipalities, State Government and other stakeholders.

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1

Introduction

This Framework Report is the first of three stages for the Association of Bayside Municipalities to deliver a Bay Vision 2070 and an Adaptation Plan.

An adaptation framework is necessary for community, government and business sectors to minimise likely future impacts of the shocks and stresses facing Port Phillip Bay. As our climate becomes more variable, coastal communities are increasingly vulnerable.

The challenges for coastal managers are becoming greater than ever before. It is essential to consider alternative ways to prioritise, fund and implement necessary coastal protection works, and the strengthening or removal of assets at risk.

This project provides the foundation for the conversations and changes necessary to enable the most effective adaptation approaches for Port Phillip Bay and embed climate adaptation in local government decision making over coming decades.

This section outlines:

- **Historic context**
- **Regional and demographic context**
- **Values of the Bay**

1.0 Importance of the Bay

The Association of Bayside Municipalities (ABM) is an association of local governments that aims to advance matters of common interest to member councils around Port Phillip Bay. Its members are the cities of Bayside, Frankston, Greater Geelong, Hobsons Bay, Kingston, Melbourne, Port Phillip and Wyndham, the Shire of Mornington Peninsula and the Borough of Queenscliffe.

This Framework is the first of a three-stage project for the ABM to deliver a regional coastal adaptation plan, known as the Bay Blueprint, for Port Phillip Bay. The Bay Blueprint is funded by the Victorian State Government and ABM members and aims to strengthen cooperation between Bay stakeholders and to facilitate improved decision-making and implementation of climate adaptation policies and programs.

The Bay Blueprint must fit in with a range of other activities relating to coastal adaptation and development across Victoria. A snapshot of strategic documents recently released, under development or review is shown below.

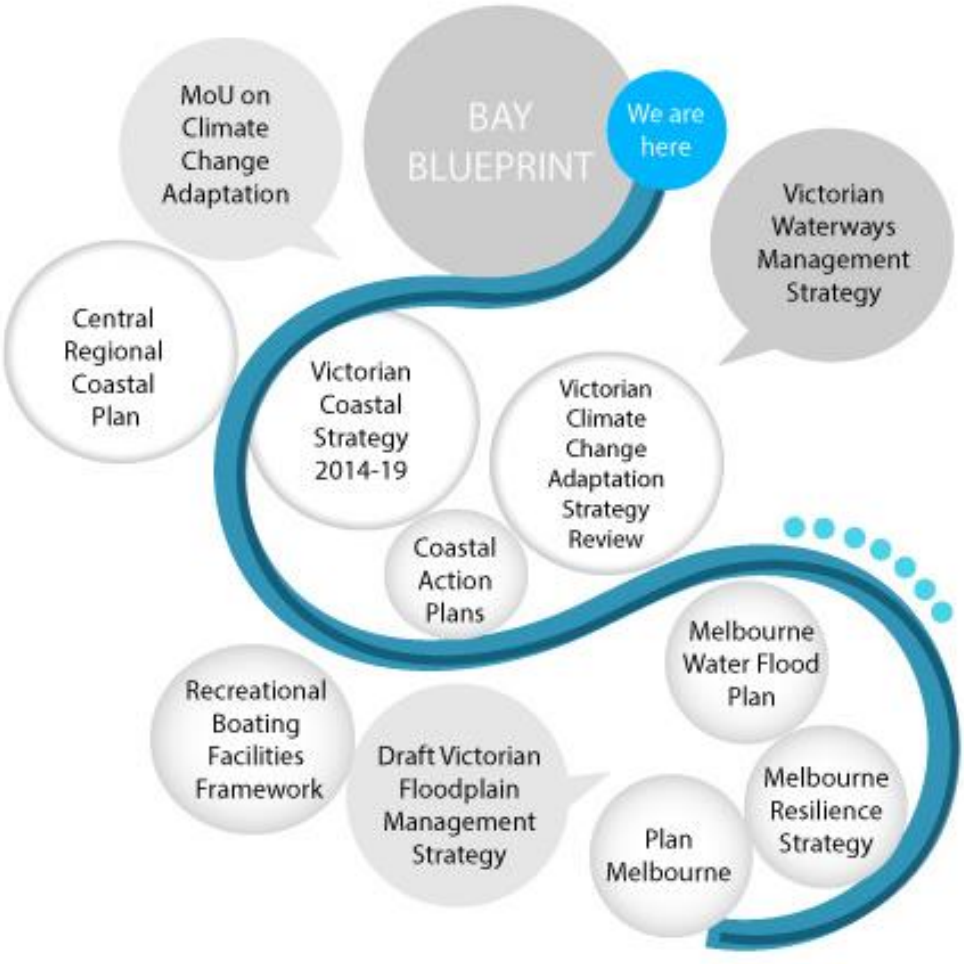


Figure 1 Overview of strategic documents recently developed, under development or review

1.1 Historical context

The 1996 Port Phillip Bay Environmental Study[1] outlines that the Bay took on its present shape about 8,000 years ago, and that at the end of the last glacial period, 18,000 years ago, sea level was about 130 metres lower than today. At that time the Yarra, Werribee and Little Rivers, and Kororoit Creek formed a delta that reached the sea between Cape Otway and King Island.

[1] www.melbournewater.com.au/getinvolved/education/Documents/Port%20Phillip%20Bay%20Environmental%20Study.pdf

As ice-caps receded, sea level rose, flooding the delta and river valleys, and forming Port Phillip Bay. Wave action deposited sand to form the Nepean Peninsula, leaving the narrow entrance at the heads. The bay floor is covered with sand about one metre thick, with another metre of silt and mud in the deep central basin. In 2011 research[2] suggested drying out and shrinking of the Bay between 2800 to 1000 years ago, which ended with catastrophic ocean flooding. This has been described in the local Aboriginal stories of the Wurundjeri people, who are reported to have lived in the area for up to 40,000 years[3].

In 1803 the first detailed survey of Port Phillip was carried out by Charles Grimes. In October that year settlement of the Port Phillip District under Lieutenant Governor David Collins was first attempted at Sullivan Bay, Sorrento. Accounts of European settlers management and impacts on the region's coastline date from the 1830s when attempts to 'halt' eroding shorelines were made around the Bay. Modifications to the coast continued throughout the 19th century. Following ongoing coastal erosion issues and "persistent agitation by bayside municipalities for action to be taken to protect the foreshores of Port Phillip Bay against erosion" a Foreshore Erosion Board[4] was established by the Victorian Government in 1935.

A number of reports and newspaper articles document various efforts during the 20th century to address shoreline retreat, generally with limited success. A significant proportion of the Bay has been 'hardened' over the decades. The underlying physical conditions of the bay, and its ocean, land and river interactions remain only partly understood.

While the Bay itself has changed little in the past 50 years, and relatively little since European settlement, the development of Melbourne and Geelong has significantly changed the Bay's catchment and foreshore environments, resulting in a highly modified coastline and urbanised catchment. The expected sea level rise of 50cm in the next 50 years is likely to force significant change.

1.2 Regional context

The State's Capital, Melbourne, and its second largest city Geelong, contain most of the state's population and growth. Away from these urban areas are significant agricultural land uses and coastal and marine environments. The Regional Catchment Strategy for Port Phillip and Westernport[5] states that "Port Phillip Bay is arguably the single most important environmental, social and economic asset in the region; possibly in all of Victoria" for its provision of ecological services, aesthetics and beneficial uses such as fishing and transport.

There are marine protected areas including Port Phillip Heads, Jawbone, Ricketts Point, Point Cook, Swan Bay and Point Lonsdale and two internationally recognised Ramsar wetlands along the Port Phillip Bay (western shoreline) and Bellarine Peninsula, and at Edithvale. The Bay's rocky reefs and seagrass meadows provide habitat for literally hundreds of marine species.

Victoria is home to 5.9 million people with 4.4 million in Melbourne. Victoria's population is expected to reach 10 million by 2051 through strong migration and natural increase and the majority are expected to live in greater Melbourne. The number of people over 65 is set to triple by 2051 (and quadruple for over 85) with a 60 percent increase in the number of children. ABM member councils' area, population, rate of growth, and type and extent of coastline varies significantly.

A summary of the causes and amount of population growth projected for Melbourne and Victoria is provided in the diagram at **Error! Reference source not found.** overleaf. It shows that Victoria's population (from 5.5M in 2011) is projected to increase to 10M in 2051.The vast majority of Victoria's population live in Melbourne (4.4M). The ten ABM councils are home to 1.3M people today, but these are not evenly distributed across member councils. Queenscliffe is the smallest municipality, and while the City of Geelong is the largest today, it will be overtaken by Australia's fastest growing municipality, Wyndham in the next few years. By 2031 Wyndham will be approximately 25 percent larger than Geelong. More detail about the ten ABM councils is available in Figure 17 in section 4.1.2.

With growth comes increasing competition for natural resources and between land uses. Although Melbourne is consistently rated as one of the world's most liveable cities[6], it remains vulnerable to a range of shock events,

f[2] Did Port Phillip Bay nearly dry up between ~2800 and 1000 cal. yr BP? Bay floor channeling evidence, seismic and core dating. *Australian Journal of Earth Sciences*.p58.
[3] https://en.wikipedia.org/wiki/Wurundjeri_-_cite_note-2
[4] Foreshore Erosion Board, 1936.
[5] www.ppwrcs.vic.gov.au/assets-areas/whole-region/marine-waters/introduction-1/?l1=0&l2=5&l3=0
[6] www.eiu.com/public/topical_report.aspx?campaignid=Liveability2015

such as heatwave and flooding, which are expected to worsen and become more frequent with climate change. A significant issue for the Bay, driven by both sea level rise and demographic pressures, is the resultant 'coastal squeeze' placing increasing demands on a diminishing coastal resource.

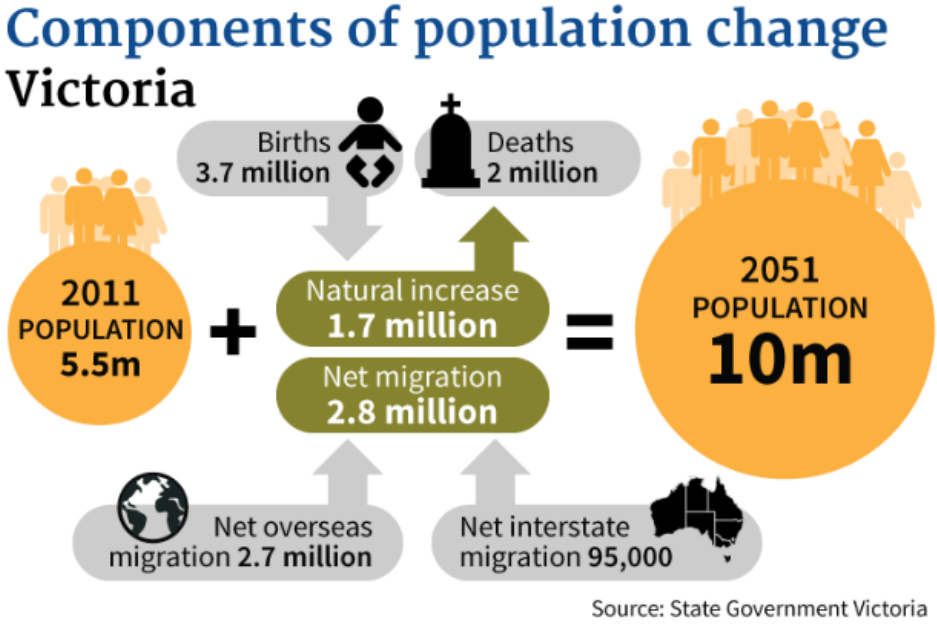


Figure 2 Projected population growth for Victoria, and the contribution from natural increase and net migration.

1.3 Values of the Bay

Greater Melbourne's and Geelong's liveability is greatly enhanced by the services, functions and values the Bay provides. Port Phillip Bay and its coastline and surrounds are largely accessible to the general public. It offers a range of natural, built, economic, social and cultural values that benefit all Victorians and there is a strong desire for this to continue in the future. They include sandy beaches, vegetated dunes, significant wetlands and a healthy and diverse marine environment supporting amenity, tourism, recreation and commercial uses. These values are described in more detail in section 2.1.

The values that Victorians place on and derive from the coast are reflected in policy and legislation and hence inform decision-making. Their protection or enhancement should be prioritised by relevant management agencies. The values identified in this report are those identified in the Victorian Coastal Strategy 2014 (VCS) and the Central Regional Coastal Plan specifically related to Port Phillip Bay.

Port Phillip Bay's natural, built, economic, social and cultural values are certain to diminish if no action is taken to address climate change impacts and other pressures facing the Bay. Diminished values will have a negative impact on Victoria's liveability and economic prosperity. For these values to be preserved access must be balanced with coastal and environmental protection. The growing tension between the demand for access and the necessity of protecting the coast will be a major influence on future governance decisions for Port Phillip Bay.

Putting a clear plan and effective systems in place now will be likely to improve the Bay's resilience to change, setting a platform for a better future for Victorians.

2

Towards a vision for the Bay

To continue to enjoy the benefits Port Phillip Bay provides requires vision and a deeper understanding of Bay values and the challenges faced.

The values that Victorians place on and derive from the coast are reflected in policy and legislation and hence inform decision-making. Their protection or enhancement should be prioritised by relevant management agencies.

The values identified in this report are consistent with values identified in the Victorian Coastal Strategy 2014 and the Central Regional Coastal Plan that specifically relate to Port Phillip Bay.

Longitudinal stakeholder research into community values underpins the Victorian Coastal Strategy, which sets out a vision for the coast and how it should be managed.

It is a strong starting point for the Bay Blueprint Vision 2070 and if achieved would safeguard important Bay values.

This section explores, in the context of Port Phillip Bay those assets and values more closely, including:

- **Built**
- **Natural**
- **Economic**
- **Social and cultural.**

2.0 Towards a vision for the Bay

To continue to benefit from what we enjoy and value about the Bay will require vision and a deeper understanding of Bay values and the challenges faced. Through desktop research and stakeholder feedback these values, and how they may be protected or enhanced, have been identified.

Stage 2 of this project involves developing a Bay Plan 2070. The Bay Plan 2070 report, in developing a vision for the Bay, must strongly reflect Bay values.

2.1 Bay values

The values of the Bay introduced in Section 1.3 have been distilled into the following four overarching thematic statements summarised in Figure 3 and described in more detail below. The supplementary report also contains geographic information system (GIS) maps describing these values and assets.

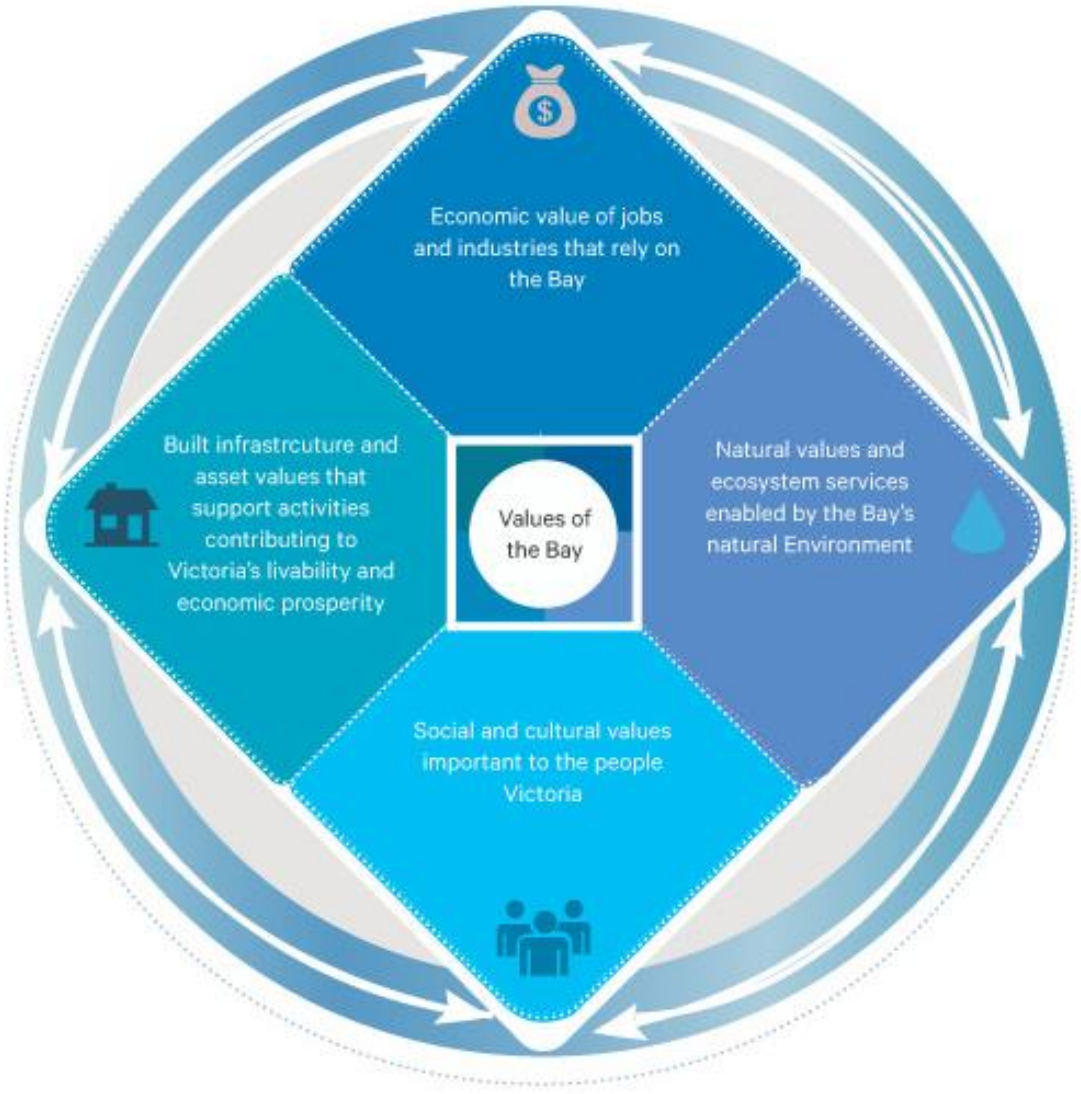


Figure 3 Values of the Bay

2.1.1 Built

The built environment around Port Phillip Bay contributes to the Bay's amenity, social and economic value. Including a diverse range of suburban and peri-urban areas, many coastal areas offer a country town feel combined with a coastal lifestyle, with easy access to Melbourne. Victorians strongly desire future development to

preserve this coastal lifestyle typical of Victorian coastal settlements[7]. In Greater Melbourne and Geelong urban environments predominate; with significant public and private transport, health, education and utility infrastructure supporting commercial, industrial and residential development. These areas contain the cumulative value of almost 200 years of significant capital investment.

The amenity of coastal towns and suburbs is supported by a wide range of valuable built assets, including boat sheds, bathing boxes, caravan parks and camping grounds, lighthouses, car parks, boat ramps, piers and pathways for walking and cycling. There are also assets that support economic and commercial activity, including ports, marinas, clubs and cafes while sea walls and other fixed structures provide protection for natural and built assets.

Figure 4 **Bathing boxes, breakwaters, piers, harbours and club houses contribute to the cultural, social and economic value of the Bay. Photo: AECOM**

2.1.2 Natural

The Bay's natural assets are valuable to Victoria's economy, amenity and environment. According to the Assessing the Value of Coastal Resources in Victoria report commissioned by the Victorian Coastal Council (VCC)[8] the economic value of non-commercial natural coastal and marine assets (such as beaches, forests, seagrass meadows) was comparable with the commercial activities associated with the coast[9]. Natural values, such as clean water, a lack of litter and an unspoilt natural environment, are the most highly valued contributors by Victorians to positive coastal experiences[10].

Much of the Bay's natural value is encapsulated by the ecosystem services it provides. These include: natural products and resources such as food and sand; storm protection for coastal infrastructure; flood control during major storm events; erosion buffers for natural assets in the hinterland.

Port Phillip Bay sustains world-class ecosystems and biodiversity in estuaries (habitats for fish spawning and birdlife); reef systems, seagrass beds, and kelp forests; marine flora and fauna including seaweeds, sea mosses, fish, mammals and crustaceans, and; river inflows, saltmarsh and mangroves (processing nutrients for ecosystem health).

The Bay area includes national parks, parks and reserves, including marine national parks and protected areas. This is unique in being so close to a major city, presenting a range of management challenges. There are two Ramsar listed wetlands totalling 23,158 hectares (Edithvale-Seaford and the Western Shoreline of Port Phillip Bay and Bellarine Peninsula).

[7] Ipsos-Eureka, 2012
[8] www.vcc.vic.gov.au/assets/media/files/VCC_Economic_Study_Report_FINAL.pdf
[9] WorleyParsons, 2013
[10] Ipsos-Eureka, 2012

The coastline offers beaches, sand dune systems and cliffs providing unique microclimates that protect local flora and fauna, including coastal woodlands and heathlands. The natural coastline is particularly valued by locals and visitors alike for its breathtaking views and world-class recreational activities.

2.1.3 Economic

Port Phillip Bay is vital to Victoria's economy, providing economic value through residential, visitor, tourism, recreation and commercial uses. Commercial ports, primarily the Ports of Melbourne and Geelong, support 15,000 jobs and handle up to $82 billion of imports and exports annually[11] and are a valued destination for cruise ships. Some 37 percent of Australia's total container trade comes through Port Phillip Bay, demonstrating the value of the Bay to Victoria and to Australia's national economy. Fisheries contribute an estimated $68 million to the Victorian economy[12]. The Bay supports industrial activities relating to onshore refining, storage and distribution, and previously aluminium and salt works, although raw material extraction generally occurs in open water or inland. Some of the Bay's economic values are summarised in Figure 5.

Figure 5 Economic values of the Bay

The tourism and hospitality sectors benefit significantly from the coast with 84 percent of Victorians making at least one day trip to the coast in the previous twelve months[13] with Sorrento being the most frequently-visited location on the Bay. Waterfront settings provide a positive environment for visitors supporting the hospitality industry. Overall, the coastline contributes $3.1 billion to Victoria's economy annually, with a significant portion of this provided by Port Phillip Bay[14].

2.1.4 Social and Cultural

While Port Phillip Bay covers the traditional lands of the Wurundjeri, Boon Wurrung and Wathaurong people of the Kulin nation, representing tens of thousands of years of connection, customs and sense of place, since European settlement the coastline and hinterland has been highly modified.

Figure 6 Many social, cultural and economic values are provided by private assets on the coast (Portsea Hotel) or in the hinterland (Bellarine and Mornington Peninsula wineries). Photos: AECOM

The Bay offers high social and cultural value for visitors and locals for meeting, recreation and to connect with nature. Many holiday makers have travelled to the same destination on the Bay for years or generations.

[11] Yarra and Bay Plan of Action, 2012.
[12] WorleyParsons, 2013
[13] Ipsos-Eureka, 2012
[14] WorleyParsons, 2013

Recreational and emotional values are not as easily categorised as built, natural or economic. Panoramic views of beaches, cliffs, the Melbourne skyline and the surrounding hinterland are major drawcards to the region. Recreational activities include swimming, snorkelling, and dive sites around marine sanctuaries, fishing and boating. Tourist attractions such as Portarlington Pier, Luna Park, wineries, Arthur's Seat, the Bellarine and Mornington Peninsulas and the Williamstown foreshore are all essential elements of the Bay's character.

The accessibility of key attractions for visitors and locals (proximity and affordability) is highly valued. A large portion of the Bay's coastline and surrounds are accessible to the general public, and based on anecdotal experience of local government there is a strong desire for this accessibility to be maintained into the future.

2.1.5 Threats to these values

Coastal inundation, associated with sea level rise, storm surge and coastal erosion will place significant pressure on coastal areas and impact on how the values provided by the Bay are enjoyed. Increased temperatures and higher levels of carbon dioxide will lead to warmer water with greater acidity, affecting species distribution and making it difficult for crustaceans to create their shells. This may affect the viability of natural ecosystems.

Wetland areas, significant for their habitat values, are likely to diminish in extent unless they are able to retreat as nature takes its course. More extreme weather, causing protracted periods of heat, drought and intense storm events will put pressure on the Bay's water quality and biodiversity.

According to the VCS, sea level rise and increases in sea temperatures are likely to result in increased damage to built assets from storm surge, and in migration of new fish species into Port Phillip Bay. Given the estimated contribution of the fisheries industry to the Victorian economy ($68 million), changes to biodiversity and the physical durability of built infrastructure are likely to have significant economic as well as environmental impacts on Victoria.

To preserve the values derived from Port Phillip Bay will require proactive management and decision making processes that balance community pressures with the need to protect assets from human interference and damage. As previously stated, the growing tension between access and the need to protect the coast will be a major influence on future Bay governance decisions.

2.2 Bay vision

The coastal adaptation vision and plan for Port Phillip Bay will be developed and refined during Stage 2 of the Bay Blueprint project. Given the State's high dependency on the Bay's assets and the values they provide, it is expected the Bay Plan 2070 will seek to preserve and enhance those assets and values.

This is in keeping with the current vision for the Victorian coast and the regional vision for the Central Coastal region which includes Port Phillip Bay. The ABM Strategic Directions[15] sets out a similar way forward, including:

- recognising the shared responsibility for the management of the Bay and the need to effectively advocate on priority issues, promote co-operative and unified approaches, and build the capacity of ABM members to better understand, plan, manage, influence, and participate in Port Phillip Bay
- securing long term investment programs with all levels of government to address renewal and maintenance issues and clarifying management responsibilities
- supporting research and partnership to gain a better understanding of Bay biodiversity, ecology and health
- promoting long-term monitoring of the Bay, including its ecological systems, to contribute to regular state-of-the-bay reports
- recognising the importance of the Bay to the local and state economy, being home to the busiest container shipping port in Australia and as an important cruise ship destination
- supporting sustainable and safe port and shipping related services, commercial activities, appropriate local water transport options and tourism.

[15] http://abm.org.au/index.php/strategic-directions-3

The vision of the VCS is informed by broad feedback and aligns the objectives of all relevant stakeholders. It is a strong starting point for the Bay Blueprint Bay Plan 2070 and if achieved would safeguard important Bay values. It is future focused and value oriented.

Figure 7 Victorian Coastal and Central Region visions from Draft Central Regional Coastal Plan 2014

3

Current Bay knowledge

Understanding the historic and current physical and environmental characteristics of the Bay and environs assists in data collection and to model or track climate change impacts, essential to planning for effective adaptation, over time.

This section describes the existing physical conditions of the Bay, taking into account the processes that result in water movements, mixing and dispersing sediment throughout the Bay, driven by astronomical tides, wind, storm surges and waves and the wide range of ecological systems which maintain water quality.

It also brings together the data and research undertaken around Port Phillip Bay to identify knowledge and data gaps. The critical areas of data required relate to:

- **Sea level**
- **Storm surge**
- **Wind**
- **Waves**
- **Coastal erosion**
- **Coastal inundation**

3.0 Current state of Bay knowledge

3.1 Existing physical condition of the Bay

Port Phillip Bay is a relatively shallow embayment covering approximately 1930 km^2 with 264 km of coastline. The Bay has a narrow entrance to Bass Strait with a width of about 3 kilometres and a shallow bank with water depths less than 20 metres. This limits the tidal exchange which is important in the flushing of the Bay.

There is a deep canyon in the entrance, but this is shoreward of the shallow bank. North of the entrance is an area of extensive intertidal and subtidal sand banks with channels through to the body of the Bay and some islands and drying banks in between. This area is known as the Great Sands. The body of the Bay is “saucer shaped” with maximum water depths of about 23 metres in the centre and areas of shallow water around the edges.

The shoreline and ecology of the Bay have been influenced and modified over more than 150 years of increasingly intensive human settlement. This has included significant modification and course changes for the Yarra River, major modifications to the surrounding catchments and hence to the freshwater inflows to the Bay and works affecting the coastal processes of much of the coastline. Large-scale commercial fisheries and more recently aquaculture farms have been established. The major urbanisation and industrialisation of the bay catchment has resulted in discharge of a wide range of substances including nutrients which have effects on the ecology of the Bay.

Figure 8 Aerial view of the Port Phillip Bay area to be addressed by the Bay Blueprint. Source: Environmental Systems Research Institute (ESRI) – ArcGIS (2015)

Hydrodynamic processes result in water movements mixing and dispersing sediment throughout the Bay. The major driving forces are astronomical tides, wind, storm surges and wave motion all of which combine to drive exchange with Bass Strait, mixing processes within the Bay, and coastal processes along the shoreline.

The Bay has a wide range of ecological systems which maintain the water quality through nutrient cycling and natural processes. The robustness of these systems and processes to change, due to direct inputs from human activity and indirect inputs through climate change, is not fully understood.

In terms of coastal processes, there are complex interactions which drive the response of the coast to sea level, wave activity, foreshore type and engineering works. Figure 9 shows an outline of these forces and their interactions.

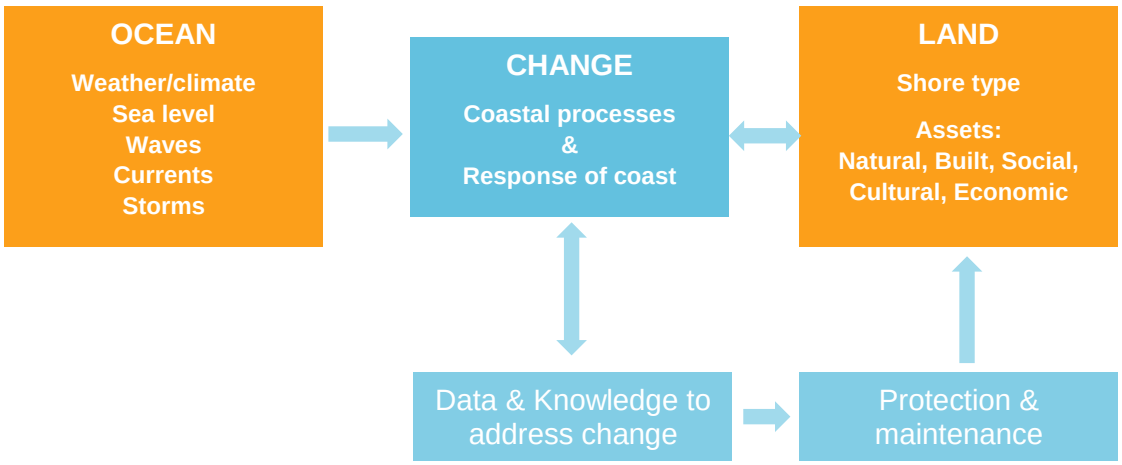


Figure 9 Interactions driving changes to the coast

3.2 Current knowledge and work to date

Effective coastal adaptation is underpinned by observational data and modelling to determine likely future impacts and to assess options to respond to those impacts. This section details current modelling and data gathering completed for Port Phillip Bay. Table 1 below provides a summary of the data and information available that is detailed in the supplementary report. The collation of this information indicates some gaps in data, such as for waves, and the need for a consistent approach to build a better understanding of likely future changes affecting Port Phillip Bay.

Table 1 Summary of current knowledge and work to date for the Bay

Area of Knowledge	Key Message
Sea Level	Sea level has been increasing in the Bay as measured over past 50 years. Sea level rise will accelerate coastal erosion and the impacts of storm surge.
Storm Surge	Higher than normal sea-levels allow wave action to reach sections of the coast which are not normally exposed to attack which can result in significant erosion of beaches and sand dunes immediately behind the beach.
Wind	Wind is a major driving force for processes in the Bay. More spatially distributed data beyond the current Bureau of Meteorology data, particularly an additional station on the eastern side of the Bay, would be useful but is not essential.
Waves	There are no consistent on-going measurements of waves in Port Phillip Bay necessitating wave modelling to define the wave climate. Wave monitoring data is required.
Coastal Erosion	There is very little consistent or uniform data on coastal erosion in Port Phillip Bay. Beach profile monitoring needs to be undertaken Bay-wide and long term.
Coastal Inundation	Only very limited work has been undertaken to investigate the current and potential future effects of coastal inundation in the Bay (see details provided below)
Spatial Information	A large number of spatial information layers exist for Port Phillip Bay, including GIS layers on the natural, cultural, built environment, economic and social data.

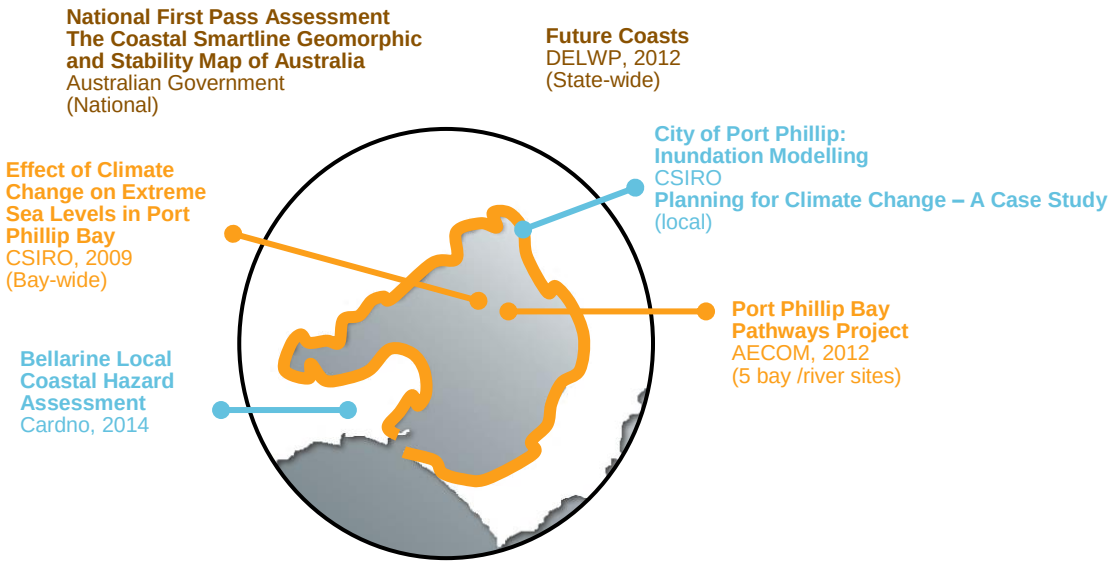
A number of catchment flood studies have been undertaken for the Port Phillip Bay region. Geoscience Australia are currently undertaking a project to collate all relevant information about these studies and make those available via a web portal (www.ga.gov.au/flood-study-web/#/searchApp/searchBasic).

All bayside council Planning Schemes contain flood prone areas identified through overlay controls. Figure 25 collates these for the whole of the Bay. However, limited work has been undertaken to investigate the current and potential future combined effects of coastal inundation (sea level rise and erosion) and catchment flooding. The major studies relevant to coastal inundation undertaken for Port Phillip Bay are shown in Figure 10.

These studies indicate significant investment at a Federal, State and local government level over the past decade, however their translation to clearly articulated policy, management guidance and publicly accessible and reliable information has been mixed. This is likely due to:

- scale and extent of the coastal vulnerability nationally
- governance arrangements differ at State level, as do responsibilities between State and National, and State and local governments
- community concerns about vulnerabilities, rights and what are reasonable expectations of government (or not) regarding protection works and who should pay. These concerns may have been exacerbated following the National First Pass assessment which used a bath tub approach and identified more properties as vulnerable than may be the case within current planning horizons
- lack of political will and leadership at all levels of government regarding coastal adaptation and climate resilience.

Figure 10 Summary of knowledge and work completed to date for Port Phillip Bay (not exhaustive)

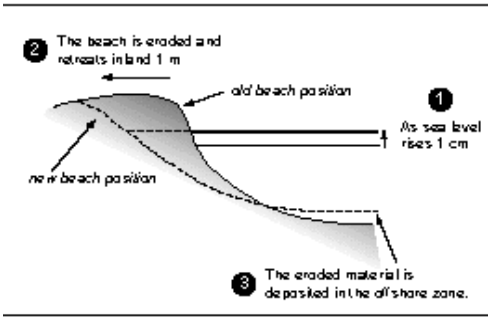


3.3 Key information gaps

3.3.1 Assessment of coastal erosion

Identification of potential coastal erosion hazards is required to determine possible impacts on infrastructure, including coastal-protection structures, built and natural assets and any consequent increase in inundation hazards. The inputs required for such an assessment include wave information (overall wave climate under varying scenarios and for extreme events) and sea level information as the two interact (joint occurrence of waves and storm-tides).

Once a set of “design events” or scenarios are selected, coastal process models can be used to estimate the effects on coastal erosion. The modelling of erosion and deposition requires knowledge of the sediment type and grain size as well as the underlying geology, cemented sediment layers and erodability.



The effects of climate change can be included by allowing for erosion related to changes in sea level through the application of the Bruun Rule or similar schemes. The Bruun Rule is the first and best known model that relates coastal erosion to an increase in sea level, such that for a 1cm rise in sea level sandy beaches erode about 1m horizontally[16].

The modelling would then be compared with any available survey data and sequences of aerial photographs where available.

Figure 11 UNESCO schematic representation of the Bruun rule

Areas around the Bay, such as those areas already subject to flooding and inundation and /or significant coastal erosion or storm damage should be prioritised. The additional impacts of sea level rise (10-20cm by 2025; 40-55cm by 2050; 80-120cm by 2100) are important. The Australian Government's 'first pass' assessment and the State Government's Future Coast program, and subsequent studies, suggest that those areas would include lower lying areas with land elevation below 2m Australian Height Datum (AHD).

3.3.2 Current knowledge and key data gaps

Table 2 below provides a summary of the information currently available and key data gaps. The only long-term source of collected data is for wind and tidal information from weather stations and tide gauges around the Bay. Other important data required for current and future coastal management and planning is missing. Key data gaps include wave measurements (including off the Victorian coast), hydrodynamic inundation modelling and beach profile monitoring.

Data generation and collection is becoming easier and cheaper through using telemetry (for wave gauges), drones (coastal profile data collection) and crowd-sourcing (current and historical anecdotal and photographic evidence of storm events and erosion). As data sets become more complete, modelling is easier and more accurate.

Table 2 Current knowledge of available information and gaps

Feature/Process	Existing		Requirements
	Spatial Extent	Information Type	
Sea Level	Bay-wide	Measured Data	Satisfactory
Wind	Bay-wide	Measured Data	Satisfactory
Tides	Bay-wide	Measured Data	Satisfactory
Waves	Very limited	Measured Data & Modelling	Measured data critical
Currents	Local	Modelling, but incomplete	Measurements, not critical
1 in 100 year storm erosion	Bellarine	Modelling for limited area (not based on measured data)	Critical for risk assessment
Inundation	Bay-wide Bellarine	Bathtub Modelling Hydrodynamic, no wave effects	Hydrodynamic with wave effects Critical for risk assessment
Beach Profile Monitoring	Local	Fluker Posts; Photos, short term surveys; DELWP Beach Renourishment Projects.	Quantitative long-term beach monitoring - critical

[16] http://unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_publications/items/5315.php

4

Current and future pressures

This section describes the significant pressures on Port Phillip Bay.

Over the next 50 years they will increase significantly. The increasing pressures from climate change, population growth, and land use and development change will exert greater strain on the Bay's physical state than ever experienced. Significant challenges relate to:

- **Climate pressures:** ocean acidification, increased temperature and more extreme events will impact the viability of natural ecosystems and built assets.
- **Coastal squeeze:** caused by sea level rise, erosion and the growth in demand for a diminishing coastal resource.
- **No whole-of-Bay risk assessment:** that focuses specifically on coastal management and the Bay.
- **No agreed priorities:** Without a common understanding of Bay risks, councils and agencies around Port Phillip Bay have different priorities and approach common problems in different ways. Financial and management decision making is likely to be sub-optimal.
- **Lack of transparency:** Accountability and the effectiveness of current management arrangements around Port Phillip Bay is reduced or masked by inconsistent approaches, complex management arrangements and data gaps.

4.0 Current and future pressures

4.1 External pressures

Port Phillip Bay is changing at a rapid rate. The Bay has a long history of absorbing and adapting to variations in climate, population, land use and development, but over the next 50 years the challenges faced will be significantly greater than those experienced in the past 50 years. Figure 12 provides a summary of key external pressures on the Bay.

Figure 12 Summary of key pressures on the Bay.

Climate change and its associated impacts will play a major role in shaping the Bay's future as will non-climate factors, such as the expected growth in demand for the economic, recreational and natural assets offered by the Bay if not managed appropriately. Any plans for coastal management and climate adaptation must respond to the broad range of climate and demographic changes, including the interrelations between these issues, to prepare and adapt Port Phillip Bay for future conditions.

A number of reports and strategies have been drawn on to collate a list of key pressures specific to the Bay. Many are outlined in Figure 13. They span from climate change projections, demographic and economic projections, coastal management plans and climate risk assessments. The documents were produced by a range of organisations, including individual councils, local government alliances, State and Federal Government, VCC,

CSIRO and Central Coastal Board (CCB). The full list of references is included in the bibliography in the Supplementary Resources report.

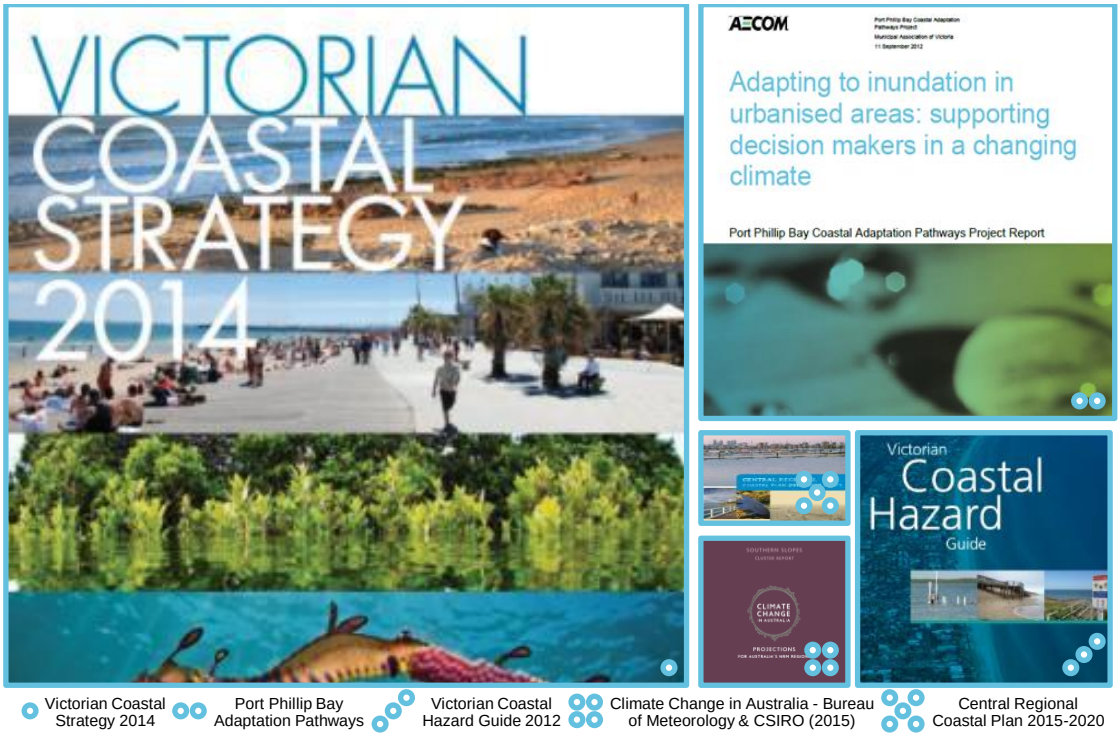


Figure 13 Reports and strategies on pressures specific to Port Phillip Bay

4.1.1 Climate pressures and 'coastal squeeze'

There is international scientific consensus that human-generated greenhouse gas emissions are the primary cause for an average warming of the global climate. Impacts of climate change are being observed across the world, through consequences such as rising average temperatures, increased frequency of extreme high temperature days and storm events and sea level rise.

Climate change: A complex problem compounded by complex management arrangements

'An alliance between homeowners, businesses, scientists and researchers, state/provincial and federal government and the insurance industry is needed to prevent and mitigate the results of such extraordinary climatic events. All entities need to increase their awareness and understanding of increased risks in exposed regions and how they can adequately prepare for a catastrophe.'

Munich Re, 2014

Climate projections

In 2014 the Bureau of Meteorology and CSIRO released a report and a series of sub-reports detailing the latest climate change predictions for Australia. The Climate Change in Australia (CCA) report presents the most recent projections based on climate models, using an approach and data sources consistent with the 2014 Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). To take into account climate variations across Australia, the CCA report is split into eight regions, referred to as Natural Resource Management (NRM) clusters. Climate projections for Port Phillip Bay are detailed in the Southern Slopes NRM Cluster Report[17].

[17] www.climatechangeinaustralia.gov.au/en/impacts-and-adaptation/southern-slopes/ p 27.

The projections provide a good indication of the climate pressures that the region will need to adapt to under a moderate emissions reduction scenario (denoted by RCP 4.5 in the CCA reports) and, for the Western Victoria sub-cluster the following changes in climate by 2090 when compared with the 1986-2005 period are projected:

	Variable	Projected change	Significance
	**Marine changes across the region**	Expected sea level rise of 0.2m 2040 0.8m by 2100.	Extreme
		Increased acidity of 40%	High
		Increased coastal erosion	Extreme
		Increased storm surge	Extreme
	**Temperature**	50% more days each year over 35°C	High
	**Rainfall**	Decreased annual rainfall (-3%)	High
		Increased intensity of heavy rainfall events	Extreme

Sea level rise (SLR) may cause some areas to be permanently flooded or temporarily flooded during storm events (called storm surge) which will be exacerbated by a high tide. Storm surge can be accompanied by flooding from rainfall (pluvial and/or fluvial flooding). Figure 14 summaries the impacts of tides, storm surge and waves from sea level rise.

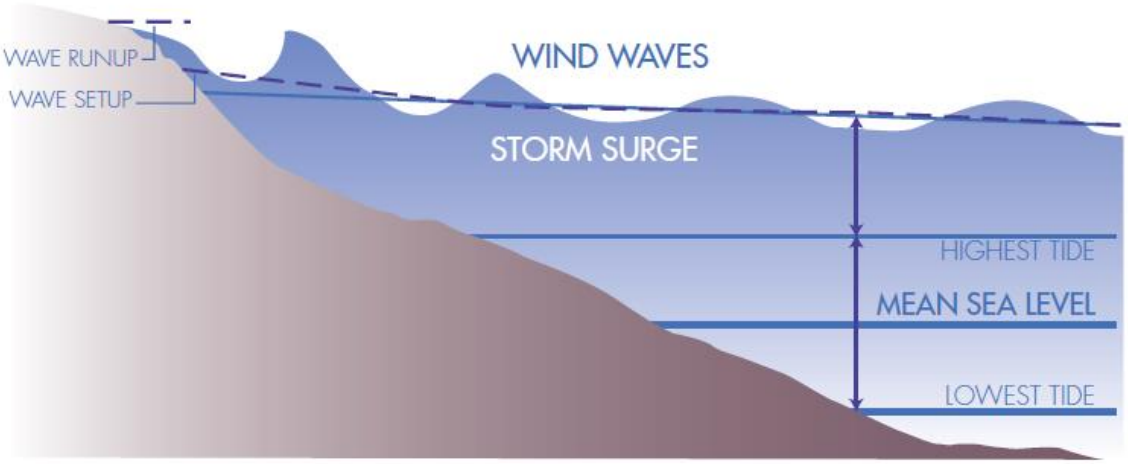


Figure 14 Impact of tides, storms and waves on sea level rise (source Victorian Coastal Strategy 2014).

The climate change projections should be considered together to inform the likely climate conditions that Port Phillip Bay will be subject to, rather than considered in isolation. The most important considerations are the impacts that these overarching changes in climate are likely to have on the physical state of the Bay, some of which are summarised in Figure 15.

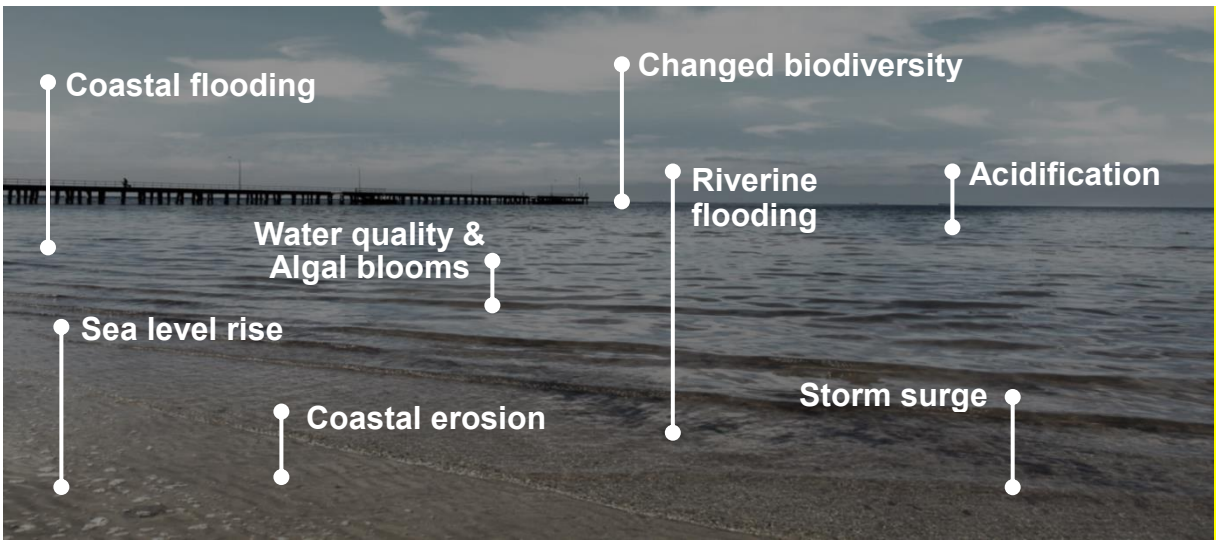


Figure 15 Climate change and population growth impacts

Increased storm surge, sea level rise and intensity of storms are predicted to increase the rate of coastal erosion, decreasing the availability and amenity of usable coastline. According to the (draft) Central Regional Coastal Plan, Port Phillip Bay is particularly vulnerable to coastal erosion due to the region's highly modified and heavily utilised beach systems. More than 20 beaches around the Bay have been artificially renourished over the past 25 years, and the cost of maintaining the beaches and other coastal assets is continuing to rise with increasing erosion, use and storm damage.

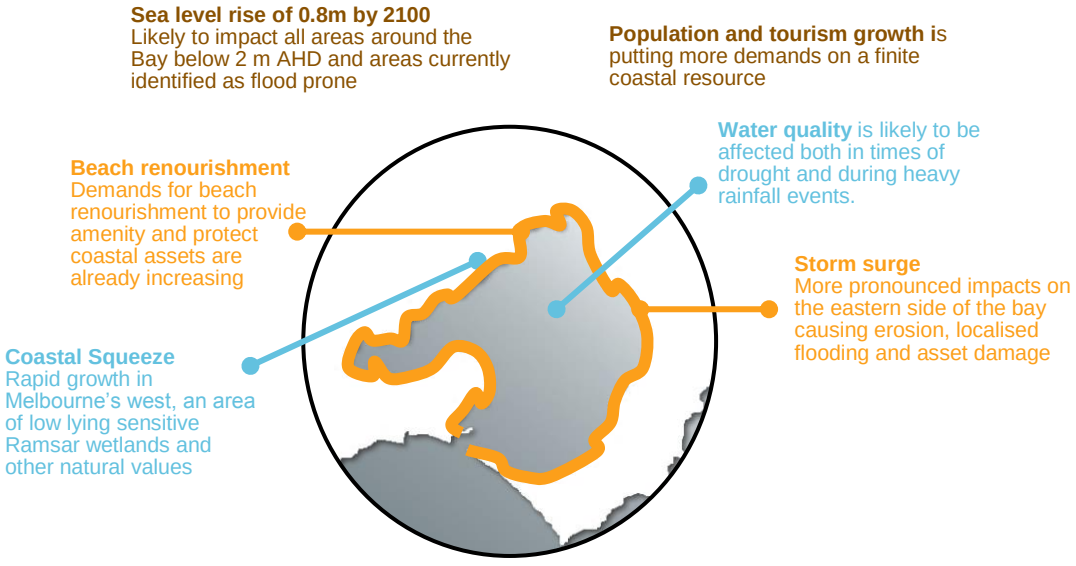


Figure 16 Values of the Bay affected by climate change and population growth impacts

Coastal Squeeze

This is a significant issue for the Bay. 'Coastal squeeze' can result from climate pressures, such as sea level rise and erosion reducing coastal habitat or by a restriction due to built structures, such as roads, or landform that limit the ability for a vegetation community, for example, to succeed as sea levels rise. It is exacerbated by increasing demand for coastal resources, leading to economic and environmental management issues across private and public land. This raises questions for coastal governance, funding of infrastructure, prioritisation of protection works and other coastal assets. Coastal squeeze compounds existing climate pressures, making it a high priority issue to consider in relation to adapting the Bay to climate change in the future in terms of both impacts and responses.

4.1.2 Demographic pressures

The biggest non-climate pressures facing the Bay is the expected growth in population[18] of 40 percent for Melbourne to 6.3 million by 2031 and to 8 million by 2051 placing pressure on Bay resources for business, recreation and transport purposes. This is not affecting bayside councils equally due to their different sizes, urban form and rates of growth as demonstrated in Figure 17 below.

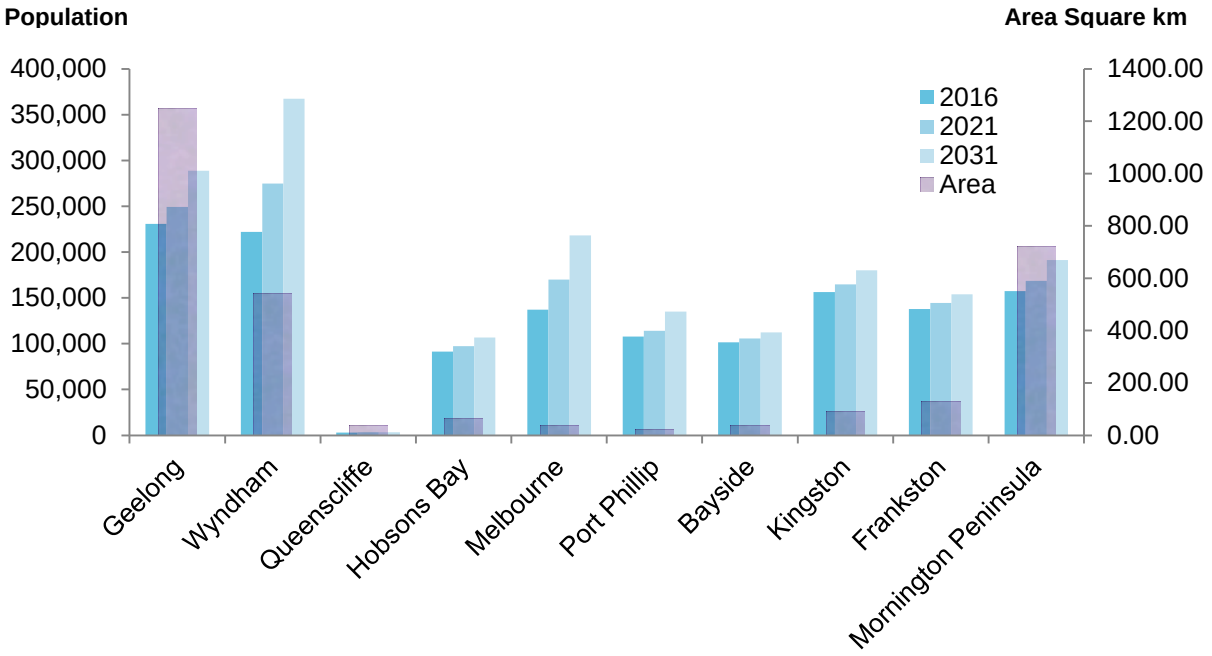


Figure 17 Summary of the population growth faced relative to land area for each of the ABM councils.

The development to house this growth will require solutions that protect productive land, utilise existing infrastructure and limit sprawl to within urban growth boundaries while controlling impacts on the social and cultural values of existing coastal areas. Some areas at risk may be heavily developed, critical to the functioning of the urban system, or are areas in transition. In heavily urbanised areas responses to accommodate growth can include intensive investment in vulnerable areas where the investment can be leveraged to reduce the overall risk profile for that area and more broadly.

Port Phillip Bay will need to adapt to support economic growth for employment and quality of life. The Bay is Australia's busiest port[19] and handles over one third of the country's container trade, supporting 15,000 jobs and $82 billion in imports and exports nationally. The projected increase in freight activity will put pressure on the Bay as a natural, built and economic resource for Victoria and may require additional dredging as ship size increases.

The population growth pressure is compounded by the impacts of tourism. According to the Central Regional Coastal Plan, the populations of the Bellarine and Mornington Peninsulas triple during peak summer seasons. This creates the need for physical infrastructure to cope with peak population numbers, leading to environmental and social pressures such as loss of land and beach degradation. Some areas of the Bay are already at capacity in terms of use, which may put pressure on areas currently valued for conservation.

Increasing urbanisation increases run-off to the Bay which can affect water quality. In a survey commissioned by the VCC[20] it was found that Victorians saw overfishing, pollution, development and stormwater outflows as the most significant pressures faced by the Victorian coast that require a response by government.

[18] www.delwp.vic.gov.au/planning/forward-policy-and-research/victoria-in-future-population-and-household-projections
[19] www.depi.vic.gov.au/__data/assets/pdf_file/0004/180247/Yarra-and-Bay-Plan-of-Action.pdf p9.
[20] Ipsos-Eureka, 2012

4.2 Risk Assessment

4.2.1 Risk assessment methods

Identification of the pressures alone is not sufficient to inform climate adaptation and management decisions for the Bay's future. The following three factors, and the interaction between them, must be taken into account in the decision-making process:

1. Hazards - external pressures on the Bay, including both climate and non-climate pressures, that are likely to impact on the state of the Bay.
2. Exposure - the presence and value of assets, infrastructure and communities around the Bay that will be impacted by the hazards.
3. Vulnerability - the sensitivity of the Bay to changes in climate and other conditions, and the potential for adverse impacts on the Bay.

A risk assessment combines the hazard, vulnerability and exposure factors to develop a framework that can be used for making decisions in managing risks.

The industry standards that provide a prescriptive framework for assessing and managing risk are:

- **Australian Standard AS 5334 Climate change adaptation for settlements and infrastructure** - A risk based approach, based on ISO 31000 for the Australian context.
- **ISO 31000 Risk Management – Principles and Guidelines** - a risk management standard to guide effective risk assessment and management for a range of sectors and risk types, including business, environmental and financial risks.

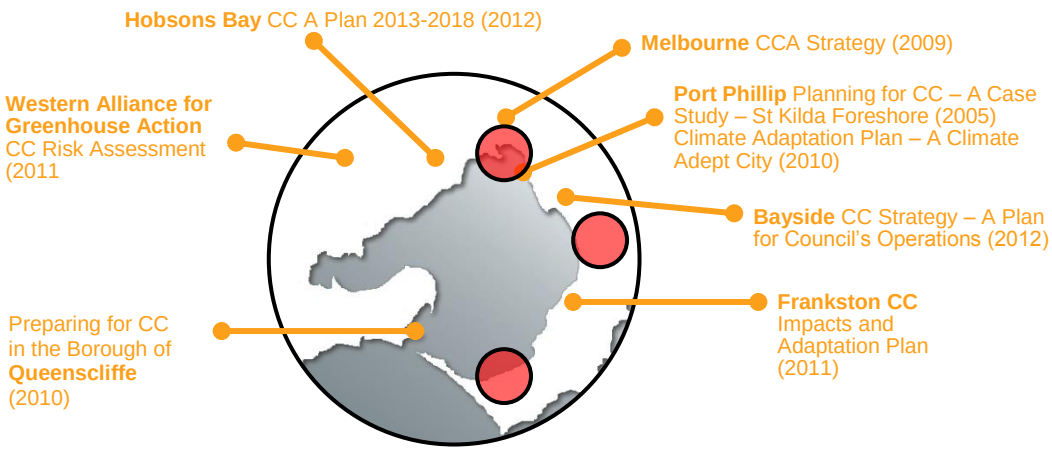
AS 5334 applies the main principles and guidelines of ISO 31000 to climate change risk in the Australian context. The Australian standard provides further details on the appropriate scope of risk assessments relating to climate change, including appropriate triggers for action. More detail on these risk management standards is provided in the Supplementary Resources report.

The first step in managing climate change and coastal management risks around Port Phillip Bay is to identify the risks and assess their importance. In keeping with the long-term approach required for coastal climate adaptation, risk assessments should consider risks now and in the medium-to-long term. The identification and prioritisation of risks can then be used as the basis for future risk management decision-making.

4.2.2 Risk assessments undertaken around the Bay

A number of risk assessments relating to climate adaptation and coastal management were identified through research and consultation and are summarised in Figure 18. These documents provided a basis for a high level or summary risk assessment for coastal risks for Port Phillip Bay:

Figure 18 Climate change adaptation plans (CCA) and coastal risk assessments referenced from around the Bay. The red circles indicate gaps in risk assessments completed in Port Phillip, Kingston and Mornington Peninsula. The WAGA report is for a region. The Port Phillip risk assessment is for St Kilda.



These studies assessed risks to the municipality as a whole, with the exception of the Port Phillip St Kilda case study. Although the majority of assessments considered risks to coast, coastal assets and communities, none demonstrated a predominant focus on management of these coastal risks. No equivalent risk assessments were found for the municipal areas of Port Phillip (beyond the case study), Kingston or the Mornington Peninsula Shire.

Variations reflecting different priorities and conditions of the municipalities around the Bay were evident, however several risks relating to the Bay were common. It is recommended that these shared risks form the basis of future climate adaptation and coastal management strategies that cover the whole of Port Phillip Bay.

4.2.3 Findings of existing risk assessments

The review of climate risk assessments around the Bay revealed a number of extreme risks, summarised in Figure 19 below.

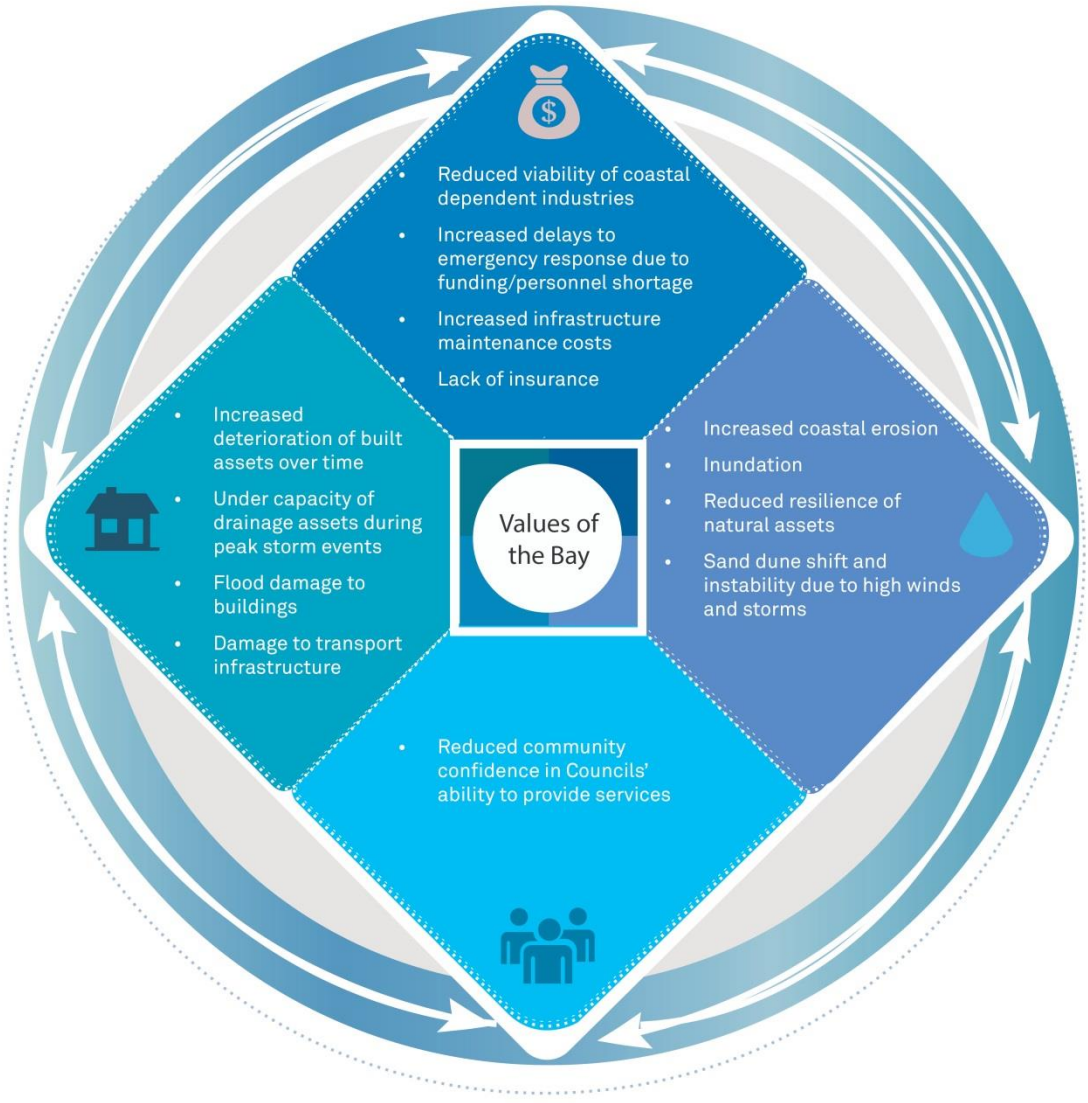


Figure 19 Summary of extreme risks identified in existing risk assessments for the Bay

The majority of the extreme risks are in relation to the built environment, particularly in relation to the deterioration of buildings and infrastructure and under capacity of drainage assets during peak storm events. In 2010 Parks Victoria's climate change risk assessment[21] identified maritime assets already or predicted to face climate change

[21] http://parkweb.vic.gov.au/__data/assets/pdf_file/0016/314152/PV_Climate-Change-_Risk-Assessment-Final-Report.pdf

impacts in the short to medium term. These risks included damage to or loss of coastal piers, jetties, boat launches and moorings arising from storm surge, coastal flooding and erosion.

From an economic perspective, the cost of damage and deterioration, and issues around liability, are considered to be an extreme risk. The rapid nature of change and erosion of natural systems is also of concern.

A detailed summary of risk assessment findings, based on a collation of key risks from assessments completed around the region and summarised above, is provided in the Supplementary Resources report. In that report, each risk has been aligned with a primary sector and a climate change variable as defined by AS 5334, although most risks will align with several of these variables. The likelihood, consequence and risk ratings reflect the risk assessments already completed around Port Phillip Bay.

4.2.4 Implications of risk assessment findings

A risk assessment with a clear focus on coastal climate change has not been completed for the whole Bay. An understanding of these risks, through assessing hazards, exposure and vulnerability in a consistent way, will assist in prioritising local and regional actions in response to the anticipated deterioration of buildings and infrastructure and the under capacity of drainage assets during peak storm events on the coast and to the foreshore reserve itself. Risks to both public and private land and assets have not been identifies spatially.

The CCB[22] recommends for adapting to a changing climate and increased coastal hazards to:

1. Develop a systematic approach to identify regional priorities for coastal adaptation planning.
2. Facilitate the development of coastal adaptation planning by local government in priority areas.
3. Develop methodologies for conducting flood and erosion studies in coastal areas.
4. Determine the nature of the desirable outputs of flood and erosion studies.

It is clear that steps 3 and 4 are important inputs to, if not precursors of, identifying regional priorities and facilitating coastal adaptation. Despite the methodology and outputs not being set out in coastal management guidance, ABM councils could usefully commence this process. Utilising Council knowledge and records about areas most at risk in each municipality, and any known future risks, and applying consistent criteria, councils could identify and rank areas most likely to be affected for their municipality and then for Port Phillip Bay. These areas could include sites that:

- experience flooding now (as indicated by Planning Schemes and local knowledge, noting many Planning Schemes do not extend flood overlay controls across adjacent public land)
- experience repeated damage from storm events (as evidenced by photographs, insurance or emergency response funding, and local knowledge)
- require renourishment for both asset protection and amenity (as evidenced by works approvals)
- are identified as being highly erodible (through Smartline or other studies, photographic evidence)
- may experience coastal inundation not included in Planning Schemes using 1 percent AEP.

The lists could then be consolidated and prioritised to establish a priority list of extreme risks for the whole-of-Bay. This could then be independently assessed to moderate any inconsistencies in weighting and address unintended or historical biases.

The priorities could provide a basis for a work program for both data collection and further studies which if completed would build a consistent whole-of-Bay risk assessment. Other benefits include:

- response planning for clear priorities may be able to begin
- data collection to understand the impact of a 1 in 100 year storm on beach behaviour
- areas vulnerable today are likely to become more vulnerable and so data can be collected to ‘test’ preliminary models.

[22] www.ccb.vic.gov.au/staging/wp-content/uploads/2014/04/Central-Reg-Coastal-Plan-at-a-Glance.pdf

A specification is provided in Table 5 for a consistent approach to coastal inundation modelling which will assist when filling data gaps and undertaking modelling of vulnerability to climate impacts. *(See also Key Finding 2.)*

The Victorian Coastal LiDAR Inundation Modelling and Mapping[23] uses a "bathtub" inundation method, similar to that recommended by the National Oceans and Atmosphere Administration's (NOAA) Coastal Services Centre. The Victorian Coastal Inundation Dataset, has been released with the Victorian Coastal Hazard Guide.

At a local level pilot coastal hazard assessments are to inform coastal adaptation planning. One of these studies is in the Port Phillip Bay area but the findings and lessons learned have not yet been analysed and able to be applied to other areas.

[23] www.climatechange.vic.gov.au/__data/assets/pdf_file/0009/143658/Victorian-Coastal-LiDAR-Inundation-Modelling_2012.pdf

5

Management now

This section outlines the current policy drivers and legal context for coastal adaptation and the implementation of coastal protection measures in the Bay.

Policy and legal framework informs strategies, roles and responsibilities, funding arrangements and processes.

- **Policy drivers:** establish direction for legislative reform and strategy development.
- **Legislation:** Numerous layers of legislation and regulation makes coastal management complex.
- **Roles and responsibilities:** Key roles of land owner, manager, regulator and planner are unclear and overlap in the day-to-day management of the Bay.
- **Many stakeholders:** Responsibility for coastal protection lies with about 40 stakeholders making coordination challenging between different areas of responsibility and across council borders.
- **Funding:** Inadequate funds are available for coastal protection, with a disproportionate burden on the ABM councils to finance coastal management.

Regardless of the changes in the framework conditions likely through legislative reform, councils and other stakeholders require the right opportunities, tools, resources and knowledge to effectively progress and embed climate change adaptation,

5.0 Management now: Bay governance arrangements

5.1 Policy settings

The policy direction of government, particularly at state level, flows through legislation to how the bay is managed, priorities determined and resources allocated, as well as shaping specific coastal strategies.

Many policy drivers are longstanding, such as those relating to Crown land and private land, or reflect international agreements, such as the Ramsar Convention. On behalf of the Crown (and all Victorians) the Minister for Environment holds 96 percent of coastal land, one third of which is reserved as national park under the *National Parks Act 1975* and managed by Parks Victoria.

Remaining coastal Crown land is mostly reserved under the *Crown Land (Reserves) Act 1978* for public purposes (the protection of the coast) and managed by Committees of Management appointed by the Minister. The seabed is largely unreserved and managed by the State. Such land may be open to native title claims, such as the 2006 Bunurong Land Council (Aboriginal Corporation) claim in the Federal Court (later withdrawn), for the "land and water of the Mornington Peninsula National Park, the waters and foreshore of Port Phillip Bay from Point Nepean to Werribee, south to Mud Island, west to Point Lonsdale, southeast to London Bridge and all the land and waters within these boundaries"[24]. It is unknown what impact on coastal adaptation a successful future claim may have and reserving the remaining unreserved coastal Crown land may reduce this uncertainty. .

The current Victorian Government's 2014 platform acknowledged "the need to protect the biodiversity of Victoria's unique coastal, littoral and marine environments for the benefit of the whole community while allowing for sustainable use of resources for coastal and marine-dependent economic development"[25]. It also retained the *Coastal Management Act* and VCS as accountability and reporting measures and sought to strengthen, integrate and simplify coastal and marine planning and management through a review of the interactions and overlap between this Act and the *Planning and Environment* and *Crown Land (Reserves) Acts*. A Marine and Coastal Act is proposed to bring together all management and protections under the one system.

The Victorian Government's commitments to coastal adaptation includes to maintain and strengthen Victoria's marine and coastal research program; prohibit new development in vulnerable areas; investigate rights of way and a continuous public foreshore strip along the Victorian coast; and strengthen the *Climate Change Act* and support communities respond to the impacts of rising sea levels.

Importantly, a five-yearly 'State of the Bay' report is planned to monitor the health of coasts, bays and waterways.

5.2 Legal context

Victorian legislation sets the framework for the management of public land on the coast, or areas impacting on the coast through establishing various functions, roles, duties and powers across State government agencies. Many of these powers are then delegated.

Acts and Regulations impose requirements on public and private land and on how public land managers undertake their various responsibilities. When local government is the Committee of Management (CoM) they have additional legislative requirements to those related to planning, environment, property and land management. There is a three level system of coastal management that enables the preparation of a state-wide VCS, regional coastal action plans and local coastal management plans by appointed public land managers (generally Local Government, Parks Victoria or community based[26].).

5.2.1 Coastal Management Act 1995

The *Coastal Management Act 1995* provides for the strategic and management planning of the coast and approval mechanisms to use and develop coastal Crown land.

It establishes the VCC and Regional Coastal Boards (CCB) as responsible for strategic planning; risk management and approval roles for the Department. Under Section 37 of the Act Minister for the Environment

[24] www.theweeklyreview.com.au/uncategorized/1796502-native-title-claim-for-port-phillip-bay-dropped/
[25] www.viclabor.com.au/wp-content/uploads/2014/05/Victorian-Labor-Platform-2014.pdf
[26] www.vcc.vic.gov.au/assets/media/ckfinder_files/files/VCC%20INTERIM%20POSITION%20PAPER%20ON%20COASTAL%20GOVERNANCE.pdf

must approve all use and development on coastal Crown land regardless of whether a planning permit is required, presenting an additional layer of scrutiny.

A general consent has been issued by the Minister to remove the need for individual applications for low risk works - considered to be part of day-to-day land maintenance such as removing invasive species and clearing existing access tracks. This consent may need to broaden to facilitate and enable adaptive works as they become part of the day-to day management.

The Act makes no specific reference to climate change, however the VCS, required by the Act, recognises adapting to climate change as one of five key coastal management issues. The VCS provides a vision for the coast, hierarchy of principles to guide the use and development of coastal Crown land, and establishes a minimum sea level rise planning benchmark regularly updated as part of the 5-yearly strategy review.

The Central Region Coastal Plans provides the regional context for Coastal Management Plans (CMPs), developed as local operational plans by land managers.

5.2.2 Climate Change Act 2010

The *Climate Change Act* provides a whole of government commitment to climate change adaptation and explicitly requires the Minister responsible for endorsing the State's coastal policy to consider climate change. It also commits to provide an MOU[27] clarifying roles and responsibilities.

The Act seeks to embed climate change considerations into risk management and business planning for assets and critical service delivery by including a requirement for decision makers to take climate change into account for specific decisions under the *Catchment and Land Protection Act 1994, Coastal Management Act 1995, Environment Protection Act 1970, Flora and Fauna Guarantee Act 1988, Public Health and Wellbeing Act 2008 and Water Act 1989.* The *Planning and Environment Act 1987 i*s not specifically included under the *Climate Change Act.*

Under the Act local government is responsible for managing risks and impacts to public assets owned and managed by local government and to local government service delivery, including managing risks to assets and infrastructure such as local roads.

5.2.3 Planning & Environment Act 1987

The *Planning and Environment Act* establishes the land use planning system and processes for private and public land in Victoria. It establishes the Victoria Planning Provisions (VPP).

Land use planning is a mechanism to manage settlement patterns and urban growth. It combines technical analysis, consideration of government objectives and engagement with the community and private sector to make decisions about the use and development of land.

Land use planning is implemented by councils through Planning Schemes using the zone and overlay controls in the VPP to achieve strategic long term objectives. This guides urban growth and capital improvement projects and provides a rational and legally defensible basis for decisions about the use and development of land.

A consultative land use planning process is important for land use planning as it encourages consensus building amongst the varied stakeholders and interest groups.

The provisions directly relevant to climate change are:

- Clause 11.05-4 Climate change, natural hazards and community safety
- Clause 12.02-1 Protection of coastal areas
- Clause 13.01-1 Coastal inundation and erosion.

These provisions are in the State Planning Policy Framework (SPPF) and they highlight the need to coordinate land use and planning with the requirements of the *Coastal Management Act* and the VCS. The SPPF includes a sea level rise planning allowance of 0.8 m by 2100. It also specifies that in planning for possible sea level rise, an increase of 0.2 m over current one percent Annual Exceedance Probability (AEP) flood levels by 2040 may be used for new development in close proximity to existing development (urban infill). This policy applies to development proposals in existing settlements and urban-zoned areas.

[27] MoU www.depi.vic.gov.au/__data/assets/pdf_file/0005/278231/Climate_Change_Adaptation_Memorandum_of_Understanding_Web.pdf

Planning Practice Note 53, Managing Coastal Hazards and the Coastal Impacts of Climate Change[28], provides guidance to councils on managing coastal hazards; the decision-making process for assessing coastal hazard risk; and planning for development in coastal areas.

There are three basic approaches to adaptation: retreat (or avoid), protect, or accommodate. While the approach in high hazard areas to avoid new use and development is clear, when those areas are already developed, the approach is less clear. When those areas are in contiguous established urban areas, responses to adaptation are more complex and land use planning plays a smaller part.

Risk sensitive land use planning (RSLUP) incorporates consideration of risks associated with natural hazard and mitigation measures.

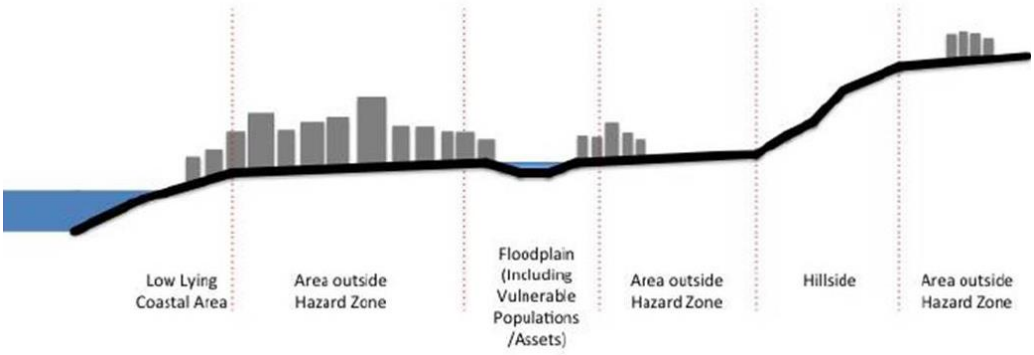


Figure 20 Hazard zones and vulnerable population/assets in an urban area.

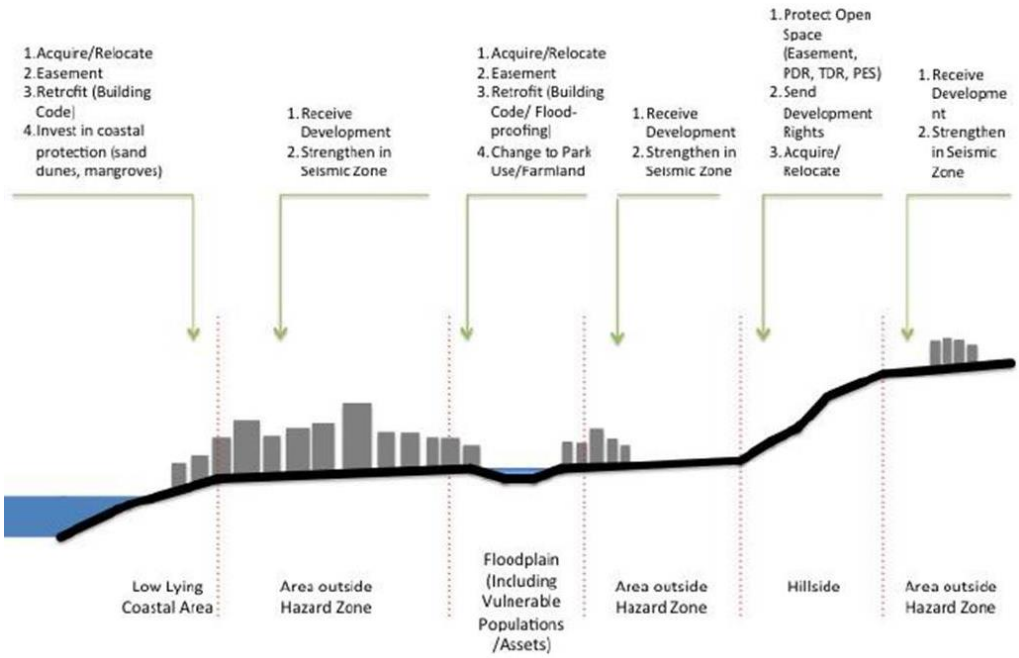


Figure 21 Application of risk treatment measures through RSLUP.

In areas of high hazard, such as the 'hillside' area in the diagrams above, a range of mechanisms based on the same basic principle – of unbundling property rights to allow some rights to continue, while compensating for those rights that are removed from the use of private land – are suggested. While complex, they are less expensive than acquiring land and include:

- Payment for Ecosystem Services (PES). This is particularly relevant to preserving natural or ecologically sensitive areas, recognising that ecosystems provide society with a range of services including clean water,

[28] www.dtpli.vic.gov.au/__data/assets/pdf_file/0011/229457/53-Managing-coastal-hazards-and-the-coastal-impacts-of-climate-change-PN53.pdf

habitats for biodiversity, or carbon sequestration capabilities. PES programs compensate landowners for allowing the ecosystem services to continue. PES requires an economic valuation of ecosystem services, which forms the basis for compensation. The use of PES for disaster risk management and adaptation is in early stages.

- Easements, Purchase of Development Rights (PDR) or Transfer of Development Rights (TDR). These are similar in that development rights are purchased or acquired to restrict future development on private property. In the case of PDR, typically governments or land trusts purchase development rights and impose a conservation (or adaptation) easement that precludes future development. In some cases, property owners can forego development rights in lieu of tax benefits. TDR is geared more towards the private sector, where development rights from one parcel can be sold to other properties to allow for increased development in receiving parcels outside of a hazard area.

5.2.4 Crown Land (Reserves) Act 1978

This is the main legislation relating to Crown land management and establishes power to reserve Crown land (including offshore land) for a range of public purposes; the making of regulations for that land; the appointment of Committees of Management (which may include councils); and the granting of tenures in the form of leases and licences.

There are many other relevant Acts including the *Local Government Act 1989, Subdivision Act 1988*, *Road Management Act 2004*. *Port Management Act 1995, Marine Safety Act 2010, National Parks Act 1975, Fisheries Act 1995, Aboriginal Heritage Act 2004, Victorian Traditional Owner Settlement Act 2010* and the *Environmental Protection* Act 1970.

5.3 Key strategies

Key plans and strategies relevant to coastal management and adaptation in Port Phillip Bay are shown in Figure 22 and listed below:

- Victorian Coastal Strategy 2014 – sets a sea level rise planning benchmark (described above), and allows for the combined effects of tides, storm surges, coastal processes and local conditions such as topography and geology when assessing climate change risks and impacts.
- Plan Melbourne 2014 – State Government policy guiding Melbourne's growth over 40 years.
- State Environmental Protection Policy (Waters of Victoria).

Figure 22 Strategies and plans affecting coastal adaptation around the Bay

- Council Planning Schemes (including SPPF VPP Clauses 11, 12 and 13).
- Victorian Floodplain Management Strategy (Draft) 2014 (VFMS).
- Central Regional Coastal Action Plan (Draft) 2015.

- Victorian Climate Change Adaptation Plan 2013 – first strategy setting overarching strategic priority to coordinate and mainstream responses to climate risk into standard Government management practices; plus six key strategies relating to: public assets and services; managing risks to natural assets and natural resource-based industries; disaster and emergency management; research; private sector adaptation; and partnerships with local government and communities.
- Taking Action for Victoria's Future Climate Change – Implementation Plan & White Paper Action Plan, 2010.
- Climate Change Adaptation Memorandum of Understanding (MOU) – between the State Government and local councils, and seeking to embed adaptation into existing policies and planning provisions.
- Resilient Melbourne Strategy (in preparation) – multilateral strategy to reduce disaster risk and support adaptation for a liveable, sustainable and prosperous future for greater Melbourne.

Other strategies include Council Plans, Health and Wellbeing Plans and Climate adaptation plans of ABM member councils and other agencies, such as Regional Catchment Strategies, Flood Strategies and the G21 Regional Growth Plan.

5.4 Roles and responsibilities

The complex roles and responsibilities relating to coastal management and adaptation are shown in Figure 23.

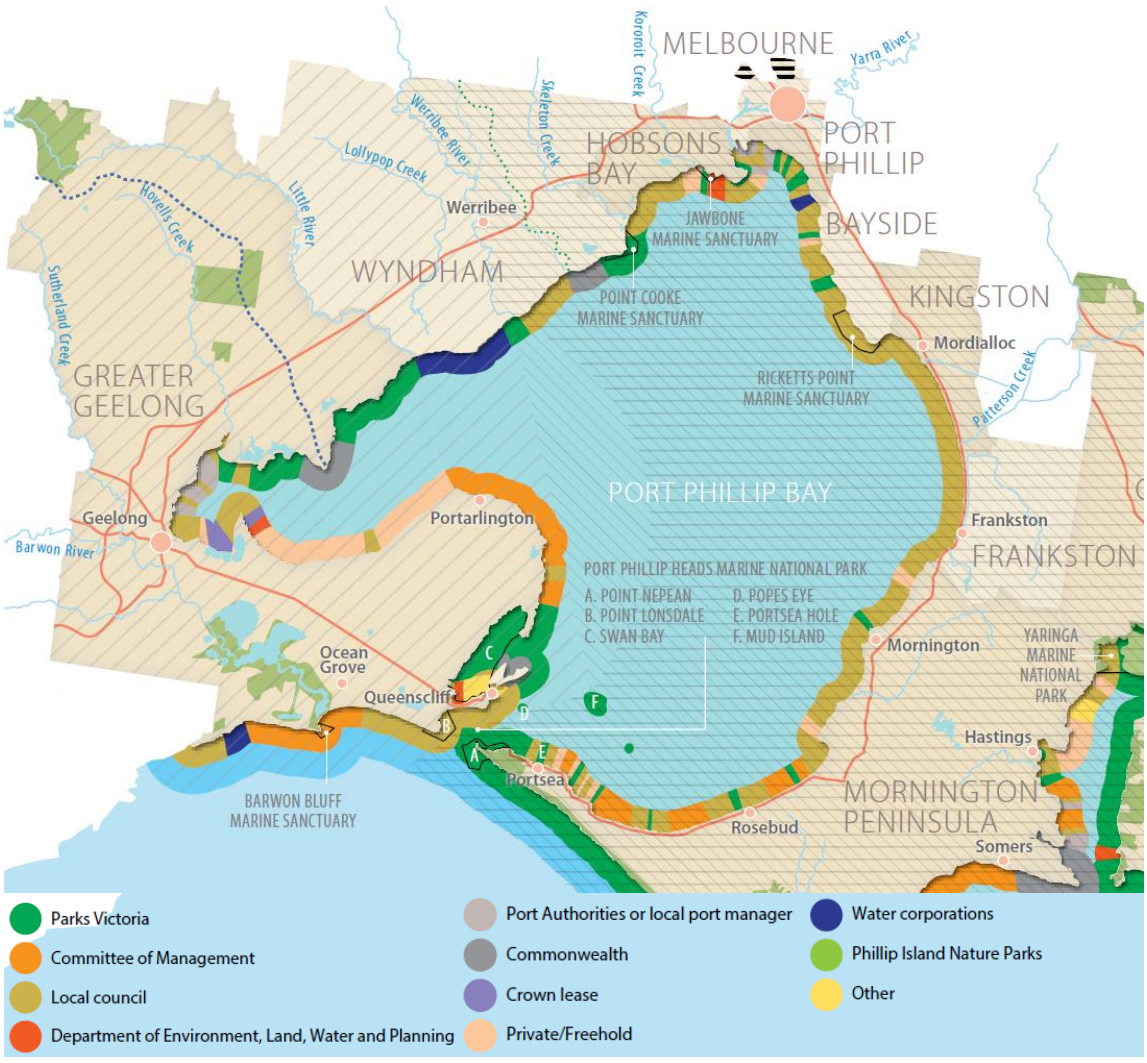


Figure 23 Coastal managers across Port Phillip Bay. Source: Central Region Coastal Plan, Figure 3 (2015)

These management arrangements are described and questioned by the VCC in their Interim Position Paper on Coastal Governance[29]. Of the 60 coastal managers in Victoria there are more than 40 across Port Phillip Bay. In addition to the ABM councils they include large commercial entities (such as the Port of Melbourne), State Government agencies such as Parks Victoria and Melbourne Water and the Department of Environment, Land, Water and Planning; the Commonwealth Government (responsible for Commonwealth land); and community based Committees of Management. The VCC and RCBs are advisory and while Catchment Management Authorities have an important impact on the coast, particularly regarding floodplain management, they are not considered coastal managers.

The result is significantly complex management arrangements overall, varying capabilities and capacity (including revenue raising ability) and confusion as to 'who is responsible for what'.

The spread and diversity of coastal managers is common to many other jurisdictions, leading to the practice of integrated coastal zone management (ICZM) as shown in Figure 24. For ICZM to be effective in Victoria there is a need for more guidance from policy makers on detailed implementation issues (such as the implementation of the sea level rise benchmarks) and adequate resourcing at all levels to match responsibilities.

The ABM's Managing Better Now[30] project, among other initiatives, assists to coordinate and fill data gaps, making better use of data and resources to improve overall management.

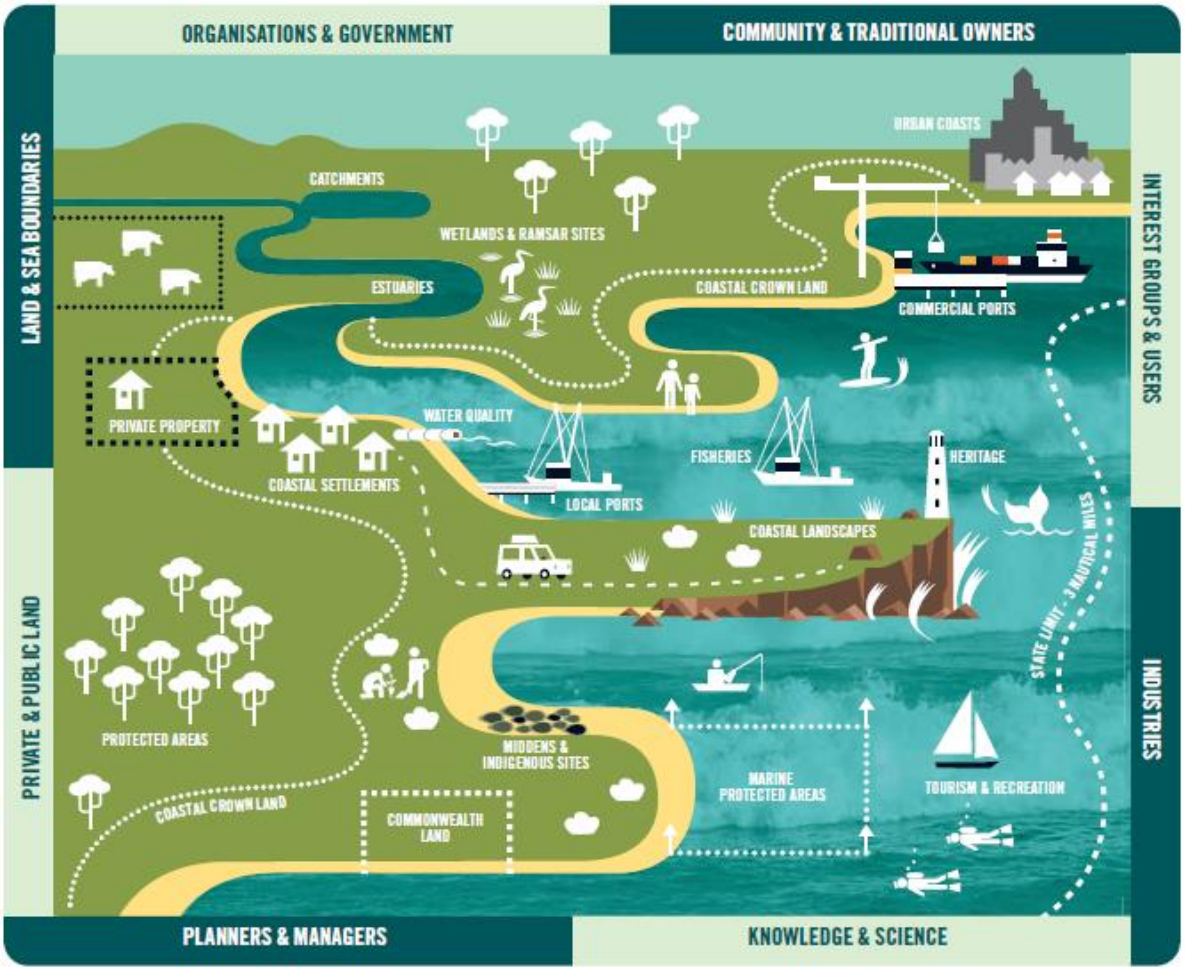


Figure 24 Victorian Coastal Strategy diagram illustrating ICZM.

[29] www.vcc.vic.gov.au/news/interim-position-paper-on-coastal-governance
[30] www.abm.org.au/index.php/coastal-processes

Roles and responsibilities – There is a need for more:

- **Holistic & strong leadership** from State and Federal governments
- **Research into local coastal processes & sea level rise** accompanied by visual representations of the impacts of sea level rise to communicate risks
- **Educational tools** for the community and all stakeholders
- **Regional authorities or Panels** to coordinate and implement initiatives to respond to future population & climate pressures

5.5 Funding arrangements

Obtaining accurate data on the financial contribution by both State and Local Government for maintaining Port Phillip Bay's environmental, social and built assets is difficult. This is for a number of reasons, including expenditure being spread across agencies and departments, expenditure recorded in aggregate with coastal expenditure not separated (e.g. waste management), and State-funded programs are not only for Port Phillip.

The State Government provides significant resources for coastal management that include:

- Victorian Adaptation Strategy Program – ABM councils received grants of over $1.2M for climate adaptation projects in 2013, although not all of these funds would have been spent on Port Phillip Bay.
- Protection of Port Phillip Beaches and Foreshores initiative – A $9M initiative over 4 years to renourish and enhance key Bay beaches depleted through coastal processes (wind, waves and tidal flow) and storm events. Renourishments have been carried out in Port Phillip Bay since the mid1970s.
- Community Coast Care Grants – Community groups in Port Phillip Bay received approximately $25,000, $110,000 and $45,000 (2011, 2012 and 2014 respectively) to undertake maintenance, renourishment and environmental related projects.
- Coastal Environments Program – Under this program Crown land managers from Frankston, Mornington Peninsula, Bayside and Hobson Bay Councils received grants to manage coastal Crown land.
- Land use planning decision support for ABM councils.

Revenue generated by a CoM from an area of coast under their management can only be used in that area. Unlike community based CoM, local government has other revenue sources from rates, grants, fees and charges.

Understanding what level of resourcing is required is also difficult. The Draft Flood Strategy for Port Phillip and Westernport by Melbourne Water identified 130,000 (collectively worth $245M) properties at flood risk (predominately from catchment flooding) implying a significant investment in asset protection is required. As climate change challenges increase, the need for proactive asset protection works, including more beach renourishment will increase, as will management costs.

It was clear through council feedback that no council would earn more from coastal leases, licences and user charges on the coast than they expend in coastal management and most earn significantly less.

5.6 Adaptation plans, options and barriers

Concerted efforts have been made by councils, often with State Government funding and support, to prepare and implement adaptation plans. Many projects have been done through groups of councils such as the ABM, greenhouse alliances or other sub-regional groupings. An annotated bibliography including many of these project reports is available in the Supplementary Resources report.

Some notable projects include the Bellarine Peninsula-Corio Bay local coastal hazard assessment (part of the State Government's Future Coasts initiative) and the ABM, MAV, CCB Adaptation Pathways Project. The Pathways project investigated cost effective options to adapt to inundation at five sites in four councils in Port Phillip Bay as a pilot to establish an approach able to be replicated across other high risk areas. In other states, the Sydney Coastal Councils group website shares similar relevant experience. The WALGA Local Government Climate Change Management Toolkit includes a checklist for climate adaptation planning by councils. Both

VCCCAR and NCCARF have extensive and detailed information on their websites, some referenced on the ABM website[31] such as the NCCARF coasts local government portal.

The Future Coasts Program, the 2010 Coastal Climate Change Advisory Committee process, and the guidelines developed for flood management agencies to plan for coastal flooding represent the most significant effort in Victoria to deal with the integration of coastal climate impacts into strategic planning processes through Planning Schemes. This is necessary so that current and future climate risks are communicated and dealt with equitably and consistently. Progress has been slow and the Future Coast program is yet to report on the changed practice or policy implications of the pilot studies.

Melbourne Water has recently taken submissions on a new Flood Management Strategy for the Port Phillip and Westernport region, which noted that "to date there has been little mapping undertaken to indicate the extent of areas that would be subject to coastal tidal flooding or storm surge should such an event occur."

More Bay specific detail and direction for coastal adaptation for coastal managers is sought. A whole-of-Bay vulnerability or risk assessment is needed to refine the national first pass assessment which, based on the experience on the Bellarine Peninsula, has overstated areas at risk.

In its 2013 Inquiry Report: Barriers to Effective Climate Change Adaptation,[32] the Productivity Commission identified that a number of policy and regulatory barriers inhibit adaptation responses and that they could be improved through governments at all levels. The actions to improve this are detailed in Table 3 below.

Table 3 Productivity Commission 2013 Inquiry Report: Barriers to Effective Climate Change Adaptation

	**Productivity Commission Inquiry Report: Actions to address barriers to effective climate change adaptation** - **embed consideration of climate change in risk management practices** - **ensure flexibility in regulatory and policy settings to manage climate change risks** - **build adaptive capacity through policy reforms for current and future climate variability and extreme weather events (e.g. reduce perverse incentives in tax, transfer and regulatory arrangements that impede the mobility of labour and capital)** - **increase the quality and availability of natural hazard mapping** - **clarify roles, responsibilities and legal liability of local government, and improve their capacity to manage climate risks** - **reduce tax and regulatory distortions in insurance markets** - **design more flexible land use planning regulation aligned with building regulation** - **a public review, sponsored by the Council of Australian Governments (COAG), to develop appropriate adaptive responses for existing settlements that face significant climate change risks** - **not implement measures where costs exceed benefits.**

[31] www.abm.org.au/index.php/resources-2
[32] www.pc.gov.au/inquiries/completed/climate-change-adaptation/report

6

Management into the future

This section outlines findings to guide the steps needed to meet the challenge of coastal management and adaptation of the Bay into the future.

Findings include:

- **Revised legislative framework**: this will require a broad political and public debate to determine a clear division of responsibilities and roles.
- **A new Authority or 'Task Force':** to set the overall framework conditions for coastal protection for the Bay.
- **Bay expenditure:** collating budget information to gain a picture of the true cost of coastal management across the Bay.
- **New funding options:** including for insurance, coastal protection works and to implement strategic priorities.
- **Risk, liability and insurance:** limited knowledge and experience with climate change, specifically about sea level rise, storm surge and intense precipitation in urban areas acts as a further barrier to implementing long-term and creative solutions.
- **Cost benefit approaches:** to assist in determining and standardising responses to projects, programs or for decisions in hazard areas.

There is a need to increase the capacity of organisations working with coastal adaptation in the Bay. There is limited knowledge of coastal processes and the tools and techniques for assessing coastal hazards and protection options.

6.0 Management into the Future

Responses to the coastal adaptation challenges faced by stakeholders were identified and explored through surveys and stakeholder workshops. This process identified changes that could be made to current management arrangements and to address the lack of funding, data, decision-making powers, and consistency and guidance materials to improve climate adaptation responses.

It is clear that our current systems and approaches must change to effectively deal with (and finance) future challenges. This report includes a number of findings, many of which are beyond the capacity or authority of the ABM alone and will require a collaborative approach to implement.

Stage 2 of this project will establish a shared vision and plan for the Bay in 2070, underpinned by common values across coastal stakeholders. A collaborative approaches and through addressing many of the management challenges outlined in the findings will enable effective coastal adaptation to work towards safeguarding Bay values over time.

There is a need to increase the capacity of organisations with limited knowledge of coastal processes and the tools and techniques for assessing coastal hazards who are working with coastal adaptation in the Bay. This may be assisted through working with aligned projects to ensure supportive recommendations are included in the Resilient Melbourne Strategy for example.

RESILIENT MELBOURNE

Melbourne is participating in the 100 Resilient Cities (100RC) challenge.

- **Fully funded initiative by the Rockefeller Foundation dedicated to helping cities around the world become more resilient to the physical, social and economic challenges of the 21st century**
- **Australia's first Chief Resilience Officer is leading the development of a resilience strategy for the 31 local government areas that make up metropolitan Melbourne**
- **The strategy is an opportunity for Melbourne to foster the long-term viability, safety and wellness of our interconnected communities and municipalities**

See http://www.100resilientcities.org/

6.1 Principles for coastal climate adaptation

One of the most powerful enablers for effective climate adaptation is the development and consistent application of guiding principles for decision making in response to policies, legislation and strategies. Principles contained in legislation (and guidance about how they are prioritised and applied) such as contained in the *Coastal Management Act* and the hierarchy of principles in the VCS assist.

Other sets of guiding principles already exist from which the ABM can derive a set of principles relevant to the Bay. These include: the United States White House Council in Environmental Quality – Interagency Climate Adaptation Task Force; the Seven Principles of Coastal Zone Climate Change Adaptation (NCCARF and CERCCS); and the State Government of Victoria's *Climate Change Act 2010* guiding principles (below).

Guiding principles (*Climate Change Act 2010 Victoria).

1. **Informed decision-making —** decisions are based on best practicably available information and potential impacts of climate change.
2. **Integrated decision-making —** decisions consider short and long-term environmental, social and economic considerations.
3. **Risk management —** decisions are based on informed assessment and management of risk and apply the precautionary approach.
4. **Complementarity —** Victorian Government decisions should complement those of the Commonwealth Government.
5. **Equity —** decisions should increase the capacity of vulnerable groups, future generations

and the environment to adapt to climate change.

6. **Community engagement —** decisions should engage communities.

Key finding 1:

A set of guiding principles (drawn from legislation and the VCS) for climate adaptation agreed for Port Phillip Bay would greatly assist in aligning coastal adaptation priorities and the objectives of all responsible stakeholders and agencies following the development of the Bay Plan 2070.

6.2 Adaptation challenges and management context

Responses to climate change require collaboration and coordination across administrative and professional boundaries. For effective coastal adaptation, management arrangements should:

- integrate risk and business components into a common purpose (Vision)
- remove the silos (integrated and multidisciplinary)
- coordinate a linked big picture (Vision, values)
- build upon existing programs such as Future Coasts and Managing Better Now
- develop key performance indicators, be outcomes based, and aligned
- integrate management approaches, both in terms of direction and strategy (ICZM).

This is in contrast to the current situation stakeholders described in survey and workshop responses about management, roles and responsibilities which are detailed below:

Stakeholders identified that there is:

- **Uncertainty** about funds, management & decision-making
- **Differences** in interpretation of policy across stakeholders
- Poor **understanding of responsibility** for coastal adaptation
- **Silence** in many plans on sea level rise/storm surge and accountabilities /responsibilities
- **Confusion** on implementation responsibilities across levels of government, between council Departments and between State & local government
- Multiple coastal managers – **lacking coordination** resulting in friction and conflict
- Uncertainty about **responsibilities** of different levels management – priorities, timing, resources

There is a range of useful information to support local government climate adaptation such as the NCCARF Local Government Portal[33] and on the ABM website. These resources assist in building capacity to make strategic choices about management within councils, by councils collectively, and across all management agencies.

Councils have different levels of resources, staff with varied experiences, and manage physically different areas of Port Phillip Bay, each with particular challenges. Their investment in climate adaptation varies, particularly in coastal expertise, as do their approaches. Some councils face significant growth and their services and projects compete for scarce council resources, irrespective of the extent of coast under management or their relative climate risks. To be more effective councils often work collaboratively in groups such as the ABM, G21 (Geelong region) and greenhouse alliances.

Historically, coastal protection works are conducted when erosion and inundation impacts are significant. Despite increased knowledge about sea level rise and storm surge, and of the need to plan for coastal adaptation, climate

[33] www.nccarf.edu.au/localgov/

change adds an additional layer of complexity and uncertainty. Many planning and investment decisions made today have a life span of up to 75-100 years and must consider the challenges ahead so that they are not overly expensive or impossible to change in the future and this may require skilling up of some coastal managers. Socio-economic assessments carried out internationally demonstrate that it pays to prevent and adapt to climate change up to a recurring period of 100-200 years rather than replace damage to assets built without considering climate change, with a ratio of $1 to $6 avoided[34].

Table 4 summarises the information available for assessing Bay management discussed in this chapter.

Table 4 Information availability on barriers / enablers affecting management of the Bay

Area of Concern	Information Availability
Finance (coastal protection and adaptation)	Data and information on budgets for coastal management and adaptation are difficult to assemble. This project undertook a budget data capture exercise amongst the ABM councils and government to attempt to fill this gap. More research and analysis is needed. The State was not able to provide this data.
Laws and regulations	Numerous reviews of the legal framework for coastal protection and adaptation in the Bay are underway, mostly seeking reform to simplify and clarify arrangements.
Roles and responsibilities	There is a myriad of research and reviews of roles and responsibility for coastal protection in the Bay, but little with specific focus on regional coastal adaptation. They make many similar recommendations for clearer accountability in the system.
Capacity in coastal adaptation	Many climate adaptation guides and information sources have been produced particularly through State Government's funded programs. This project undertook a values capture exercise amongst the ABM councils to assist to ascertain the capacity issues relating to coastal adaptation, including adequacy of current guidance and data.
Vision for the Bay	Several strategies and plans cover the Bay, including the Central Region Coastal Plan. Each articulates a vision for the management of the Bay. This aspect is data/information-rich, but not well consolidated.
Decision-making processes	Many research papers and projects review the efficacy of decision-making processes for Bay management, making similar recommendations for a simplification of the system. Little of this has focused on coastal adaptation.

6.3 Assessing coastal climate risk

To guide a comprehensive regional response, a clearer understanding of coastal climate risks likely to be faced is required to design future responses and identify trigger points for action. This can be achieved through a regional risk assessment.

Stakeholders identified the following issues relating to risk assessments around Port Phillip Bay:

- **Focus**: No risk assessment has focused specifically on the Bay or on the regions coastal management, other than the St Kilda case study undertaken by the City of Port Phillip. The climate risk assessments done relate to a municipality or region as a whole, with coastal management only being a small component.
- **Prioritisation**: Municipalities and agencies around Port Phillip Bay have taken different approaches to risk assessments across the region, using various methods with different project scopes so that there are no clear or agreed adaptation priorities.

As a result there is no information or mechanism for the State, as land owner, to ensure that coastal climate adaptation and risk management is prioritised by relevant agencies or dealt with consistently across management boundaries. There are also key data gaps such as wave measurements (including off the Victorian coast), hydrodynamic inundation modelling and beach profile monitoring. This would be best addressed through assessing coastal inundation and climate risk by ABM councils and State government in partnership, using a

[34] www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter6.pdf

consistent methodology and an agreed set of model inputs, based on a careful analysis of existing data, to form a rational and robust foundation for the modelling. A specification is provided in Table 5.

Addressing the lack of information around Port Phillip Bay will improve collaboration, accountability and the effectiveness of current management arrangements, and support transparency in resource allocation to areas of greatest need and for greatest benefit.

Table 5 Specification for coastal inundation modelling.

Specification for coastal inundation modelling
The modelling of coastal inundation must use a full hydrodynamic model which is able to incorporate the effects of the items listed below, and properly account for the movement of water over the land. The model will also require detailed topography for land areas and nearshore bathymetry for areas where wave effects are likely to be important. (While the Future Coasts data provide a good basis, it will need to be checked and, if necessary, updated for each specific area): - basis of describing sea level including the measured data used to describe the input storm-tide levels (e.g. six-minute unfiltered, hourly filtered) - wave setup needs to be considered in two-dimensions, not just single cross-shore profiles - rates of sea level rise and how those are incorporated - joint occurrence storm tide and waves, and definition of “storm events” for modelling, including tidal sea-level variations - incorporation of results of assessment of coastal erosion, including potential failure of protection structures - extent and condition of stormwater pipe networks - allowance for rainfall run-off The outputs from coastal inundation modelling should include maps showing at least: - water elevation - water depth - duration of inundation for given depth(s) (e.g. 0.1, 0.3 m) - peak water velocity - hazard (depth x velocity)

Key Finding 2:

Additional wave data is needed and should be collected.

A consistent approach (across State and local government), using the specification for coastal inundation modelling detailed in Section 6.3 of the Stage 1 report, will greatly assist when filling data gaps and undertaking modelling of vulnerability and responses to climate impacts (inundation, erosion, cost of damage) for those areas of the Bay most likely to be affected.

In the interim those areas should be identified by listing and rating areas that:

- ***experience flooding now as detailed in Planning Schemes***
- ***have experienced repeated damage from storm events***
- ***are requiring renourishment for both asset protection and amenity***
- ***are identified as being highly erodible coastlines***
- ***may experience coastal inundation not included in Planning Schemes using 1 percent AEP.***

6.4 Legal risk and liability

Coastal management is complex. Confusion about roles and responsibilities, incomplete data and information, and lack of guidance over emerging practice areas leads to councils perceiving greater risk exposure and potential liability associated with their decision-making and management actions.

Under State legislation, councils have a broad range of statutory and non-statutory responsibilities which oblige and empower them to adapt to climate impacts. The way in which individual councils implement these powers and responsibilities may also create challenges for them in terms of legal liability.

In 2011, the Australian Local Government Association (ALGA) commissioned Baker & McKenzie to prepare a report titled Local Council Risk of Liability in the Face of Climate Change – Resolving Uncertainties[35].That report involved a comprehensive exploration of the risk and liability issues faced by local government associated with State and local laws in relation to climate change – with a particular reference to coastal areas.

The liability risks faced by councils relate to possible claims against them when they are making decisions, particularly related to land use and development, the provision of information, and the construction or maintenance of coastal protection works.

There are two broad categories of exposure:

1. Tort-based claims (nuisance and negligence) in respect of past planning decisions that have resulted in development in hazard-prone areas or coastal protection programs that caused incidental property damage (or failed to prevent damage), or which the council proposes to remove.
2. The risk of legal challenge to planning decisions, either by property owners dissatisfied with refusal of development consent or conditions attaching to approval, or by third parties concerned that future climate impacts have not been fully considered.

While the likelihood of councils being held liable in tort are low, case law has only added to the uncertainty about the extent of council's liability, and the risk of litigation is seen a major concern for many councils. This underscores the need for greater clarity about local government's roles and responsibilities in addressing climate change.

Although not identified as a priority issue, stakeholder consultation revealed concern around increasing legal challenges in the area of coastal management, insufficient planning controls, lack of insurance and safety of coastal assets. One respondent stated: "Until legal liability issues are further resolved by the Victorian Government, these could pose a high risk to councils and they will need to remain vigilant in considering risks from climate change."

To reduce councils' exposures, the ALGA report recommends clear guidance and coordination by both Federal and State Governments to ensure a more consistent approach and improving information about the nature and extent of climate change to reduce uncertainty. This is needed so councils can demonstrate that their decision was reasonable and whether the impacts of climate risk were foreseeable. It also assists where there may be a risk adverse decision making culture due to high uncertainty or fear of legal exposures.

Key Finding 3:

A Port Phillip Bay Adaptation Management Guide (or manual), informed by the Guiding Principles, should be developed through a joint State and local government process to guide Bay adaptation planning and management for coastal Crown land and in particular to guide management of the interfaces with private land and the marine environment.

6.5 Insurance

Insurance is a long established mechanism used to manage risk. House and property insurance products to cover catchment flooding are available but flood insurance has been withdrawn in some parts of the country, with the increase in severity and frequency of floods in recent years. Coastal risks relating to storm surge, coastal erosion and coastal inundation are excluded by many general insurance policies in Australia. This exclusion may relate to the lack of widely available detailed projections and forecasts for coastal risks or the risk being reasonably foreseeable.

The Insurance Council of Australia[36] has identified four key adaptation initiatives and is calling on [State and Commonwealth] governments to:

[35] www.alga.asn.au/site/misc/alga/downloads/environment/ALGA%20Consolidated%20Report-v7B-1392955-SYDDMS%20-%20Final.pdf
[36] www.insurancecouncil.com.au/issues-submissions/industry-in-focus/coastal-vulnerability-risks

1. Strengthen building codes where there is a future community benefit to prevent "brittle buildings", by introducing a requirement for a building to be durable to weather hazards over its planned lifespan
2. Implement risk-appropriate land use planning, to limit exposure to current and future hazards, supported by a national approach
3. Upgrade mitigation infrastructure to protect existing communities, by tasking a new government agency operating under Infrastructure Australia to prioritise and fund critical mitigation infrastructure works
4. Remove taxation disincentives on insurance products, to encourage individuals to take responsibility for their own recovery.

Elsewhere internationally, the insurance industry has shown a willingness to enter into discussions about new and improved insurance products. In the UK in 2011 it was agreed to establish a not-for-profit flood reinsurance scheme - Flood Re[37] – to provide the homes at most risk of flooding with affordable cover.

Other responses include Portola Valley in California, where the town worked together over 40 years to understand earthquake risk and established a 'self-insurance' regional open space fund, supported by a small percentage of property taxes to buy most of the hazardous land while the town grew. Although insurance issues were not prominent in the consultation feedback, they may become more apparent into the future and the ABM, councils and government should keep a watching brief on the issue.

Key Finding 4:

There is an opportunity for Government to negotiate new models with the insurance sector in Australia to provide insurance cover for seawater related inundation, modelled on the UK Flood Re approach.

6.6 Legislative framework for coastal management

There is significant opportunity for local government to influence through legislative and strategy reviews. In particular the proposal to develop a Marine and Coastal Management Act (to replace the *Coastal Management Act 1995*) and the review of the *Climate Change Act 2010* provide an immediate opportunity to do this.

The existing framework conditions could better support coastal climate adaptation and, in the specific case of implementing and financing coastal protection, could clarify the roles of the land owner, land manager and clearly articulate rights and legitimate expectations of private property owners and coastal users.

Changing the policy and legal framework for coastal management and coastal protection requires broad political and public debate. A future regime for coastal and marine management would ideally provide for the items listed in Table 6.

Table 6 Items for discussion during coastal legislative reform processes.

A future regime for coastal adaptation and marine management would:

- articulate Bay strategies and priorities
- consider the merits of a coordinating Bay authority or Coastal Protection Board (see 6.8)
- provide detailed and clear definitions relating to roles and responsibilities, including:
  - a division of responsibilities in order to assess and respond to the risks of flooding and inundation in coastal areas
  - defining and implementing action plans for coastal protection
  - defining security levels that take into account the future climate
  - the powers and authorities required to deal with future climate scenarios (without requiring further legal or policy change).
- consider how Regional Plans may support an integrated response and limit adverse impacts elsewhere
- address inadequate access to funding, including consideration of a mechanism to establish, contribute to

[37] www.abi.org.uk/Insurance-and-savings/Topics-and-issues/Flooding/Government-and-insurance-industry-flood-agreement/Flood-Re-explained

A future regime for coastal adaptation and marine management would:
and distribute funds for coastal and bay priority protection works
- consider under what circumstances and through what mechanism private financing to complement existing arrangements may be appropriate
- investigate new or alternative sources of funding
- include a legislative "liability shield" that protects Committees of Management from legal action when operating consistently with State coastal guidelines, as in New South Wales (s.733 of the Local Government Act)
- establish a decision-making system that can be developed and adapted according to risk
- introduce due diligence processes so that public funding supports projects that adapt to future conditions throughout the project's lifetime
- introduce processes to enhance and embed the adaptive capacity of organisations so that they will be able to plan and make the most optimal decisions.

Key finding 5:

The reviews of the Climate Change Act and the Coastal Management Act and the proposal to introduce a new Coastal and Marine Act provide a significant opportunity to consider a broader range of matters to drive greater consistency in approach, clarify roles and responsibilities for coastal protection between local and State Governments and across coastal land tenures, and to improve governance arrangements for coastal adaptation.

Any such legislative changes to the Coastal Management Act and the Climate Change Act may require consequential amendments to other legislation.

6.7 Land Use planning

In 2010 a Ministerial Advisory Committee was established to consider how the land use planning system could assist in assessing the themes of avoid, mitigate and adapt to coastal impacts of climate change. It considered a range of possible new Victoria Planning Provisions (VPP) tools including:

- a 'model local policy' for addressing coastal climate change impacts, for inclusion in the LPPF
- a Coastal Hazard Overlay to communicate known or potential risk, utilising Future Coasts data
- a new Coastal Zone to control use and development on both private and public land in vulnerable areas
- a Coastal Transition Zone to enable planned relocation of areas judged to be unviable in the longer term.

The Committee recommended a new integrated, prioritised coastal strategic planning program for Victoria and new tools (a Coastal Conservation Zone and a Coastal Hazard Overlay), neither of which have occurred. A Coastal Hazard Overlay could include provision for future acquisition or action (including to let nature take its course) when a trigger point is met. A Coastal Conservation Zone could provide mechanisms to ensure new development does not occur in vulnerable coastal areas and effectively establish a rolling easement in respect of public rights of access to the beach in developed areas. Its final report[38] remains a significant resource for strategic and statutory planning for coastal hazards and the risks they pose to land use and development.

Responses requiring purchase of property at risk, such as through use of a Public Acquisition Overlay are unlikely. These overlays are generally used to enable the use and development of land for another purpose, such as major infrastructure or community facilities that deliver a net community benefit. Alternative approaches to risk sensitive land use planning are described in Figure 21 including easements, purchase of development rights and transferable development rights.

[38] www.vcc.vic.gov.au/assets/media/files/Coastal-Climate-Change-AC-Final-Report.pdf

A ‘whole-of-Bay’ assessment is a necessary precursor to communicating risk through planning schemes and move towards a consistent response. The current lack of information is constraining planning responses to using or adapting existing overlay controls (such as the Land Subject to Inundation Overlay (LSIO)) Fine-grained studies are prohibitively expensive. Additionally, regional plans (such as Coastal Action Plans) may assist regionally integrated action to avoid the potential for protection works in one area to adversely affect another.

In existing urban areas it is unreasonable to assume that planning will deal with vulnerable development alone. These areas have concentrated investment and high economic value, and with existing communities can prove contentious. Planning is a key policy mechanism to protect public interest environmental values and deliver a net community benefit. This can be hampered by strong local interest groups when planning is delegated to the local government level in the absence of a clear articulation of rights and associated legitimate expectations in policy.

There is a perception that private property owners have a right to protect their asset (and to be protected). Insurance covers improvements, not land, and existing use rights in planning are tied to land. Without a clear (political) articulation of rights and expectations about private and public land; of the importance of public land; and the consequential responsibilities to act, fund or improve it the issue will remain contentious.

Areas in flood overlays require referral to the floodplain management authority (CMA or Melbourne Water). Referral Authority requirements must be adhered to by the Responsible Authority and a decision by the Victorian Civil and Administrative Appeals Tribunal (VCAT), who review decisions of Responsible Authorities, must also be adhered to. VCAT deal with controversial and complex matters and those planning applications where the responsible authority failed to make a decision within the statutory 60 day period, prompting an applicant to go to VCAT.

VCAT takes a whole of State perspective and when making guiding decisions can assist to clarify matters, but at times can also introduce further uncertainty into how planning for coastal adaptation should best occur.

As well as clarity about rights and corresponding responsibilities, a number of generic approaches to determine the appropriate response/s for particular coastal situations would assist and avoid expensive CHVA and CBA of options for each site.

Key finding 6:

Coastal adaptation planning would greatly benefit from the preparation of a range of generic planning responses for vulnerable areas, to avoid the need for expensive Coastal Hazard Vulnerability Assessment (CHVA) studies and CBA for each site/ section of coast. An indicative Cost Benefit Analysis for coastal adaptation option types across Port Phillip Bay would assist current financing decisions and reduce the need to do a detailed CBA on a case by case basis.

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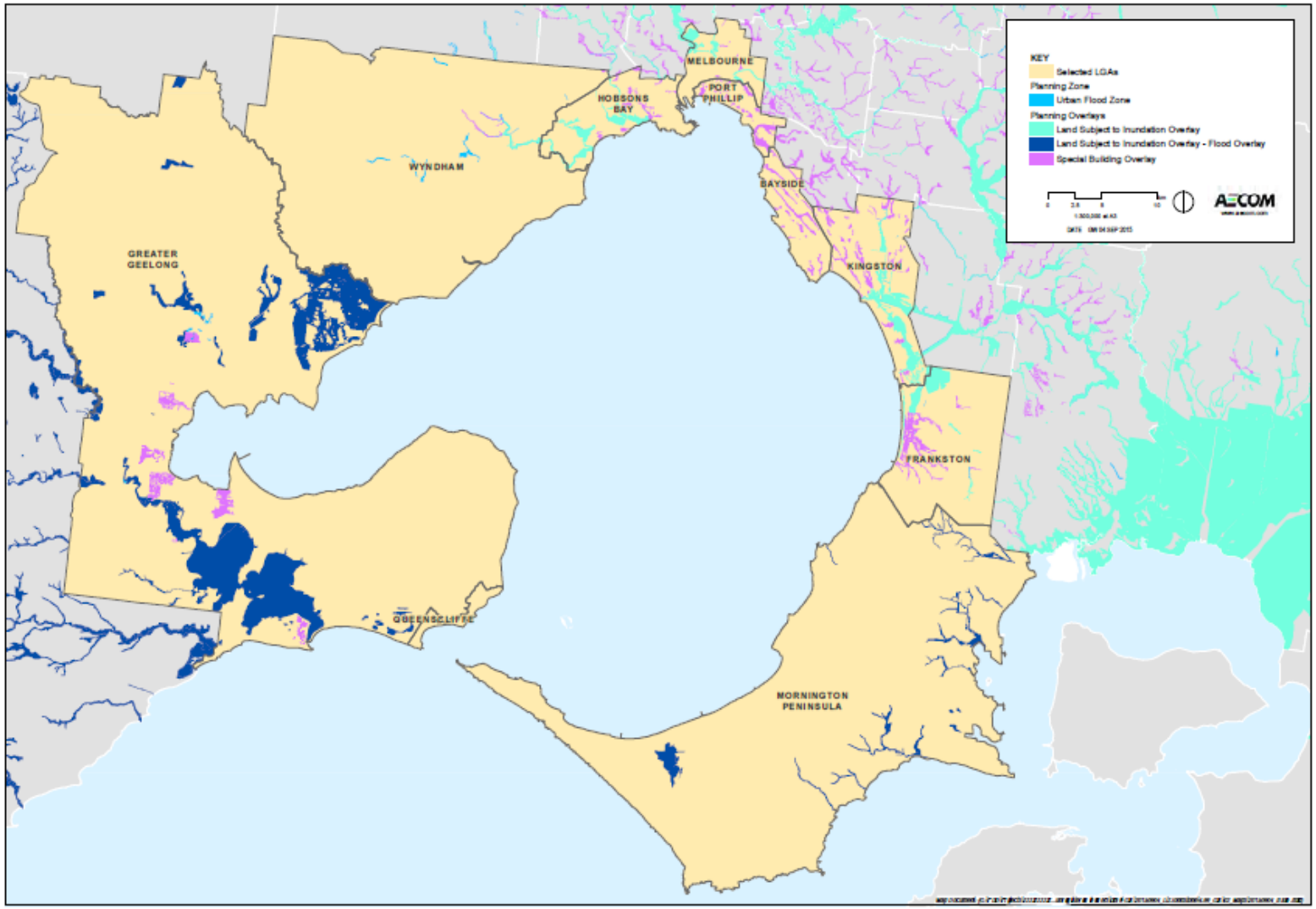

Figure 25 Areas currently under a flood overlay control. Detailed maps exist in Planning Schemes and in higher resolution maps included in the Supplementary Resources.

6.8 Roles & responsibilities

A detailed review was undertaken for South East Councils Climate Change Alliance (SECCCA) in 2012 by the Public Land Consultancy[39] finding that "while the law relating to coastal land governance (planning, management and property rights) is relatively clear, stakeholder understanding of that law may not be" and that "municipalities often need to look beyond working within existing roles and responsibilities, and be prepared to initiate revisions of those roles and responsibilities, and even lobby State Government to reform the underlying legislation."

A whole-of-Bay approach should be taken in defining and allocating management roles and responsibilities to improve clarity, coordination and effectiveness, given the desire for all agencies and stakeholders to share the responsibility for adaptive management of the Bay. Legislative review should assist to redefine and clarify roles and responsibilities. As stated in the above section, the lack of a clear (political) articulation of rights and the legitimate expectations about private and public land, the consequential management roles and responsibilities to act, fund or improve it remain unclear.

Limited management guidance is provided by the *Coastal Management Act* or the VCS, as is appropriate for a strategic document. The survey found most confusion is at the implementation and management level, while at a high level most respondents said roles and responsibilities were clearer.

In other jurisdictions, various statutory bodies have coastal management powers, such as the South Australian Coastal Protection Board[40]. Since 1972 its powers include to carry out works, remove sand, and to acquire and deal with coastal land, with the approval of the Minister. Their functions are to:

- protect and restore the coast from erosion, damage, deterioration, pollution and misuse
- develop any part of the coast aesthetically, or to improve it for those who use and enjoy it
- manage, maintain and develop those coast facilities that the Board is responsible for
- report to the Minister where required
- carry out or be involved in research into the protection, restoration or development of the coast.

In Victoria these provisions are governed by other Acts such as the *Land Act 1958, Crown Land Reserves Act 1978*, *National Parks Act 1975* and the *Parks Victoria Act 1998* which are outside of the scope of current legislative reviews.

The lack of management powers by key groups such as the VCC, the complex decision-making processes and the data gaps and lack of guidance can make identification and implementing of coastal adaptation projects cumbersome.

This is exacerbated by: regular changes to departmental and organisational structures, a lack of a clear lead authority for the Bay's coastal and marine issues; Overlap and shared responsibilities for administering legislation and regulations and geographic areas; unclear lines of communication between stakeholders; a silo-based tendency for councils and agencies to focus on their own business and issues; and a lack of coordination mechanisms and resources for informed decision making and implementation.

The draft Victorian Floodplain Management Strategy suggests that local government should take on more technically complex roles and responsibilities relating to the assessment of inundation risk. This is somewhat counter intuitive to the objective of a consistent, evidence based approach which would be better supported by specialist agencies with regional responsibilities, such as Melbourne Water and the Catchment Management Authorities.

Coordination and oversight at the State level is required to improve the integration of effort across roles and responsibilities. In addition to coastal management responsibilities, a strengthened VCC or new 'Coastal Protection Board' could be responsible to:

- assess and advise on climate scenarios
- determine priorities for climate adaptation, including:

[39] www.abm.org.au/images/plan%20for%20bay/Review%20of%20Roles%20and%20Responsibilities%20(SECCA%20Guide%20Ch%202%20v4).pdf p3

[40] www.environment.sa.gov.au/about-us/boards-and-committees/Coast_Protection_Board

  - develop and update criteria for setting minimum planning benchmarks or 'security levels'' that can be differentiated for different parts of the coastline (all carried out using a risk based approach)
  - designate areas of the coast for protection and areas where nature will take its course
- provide climate data and knowledge, and facilitate its dissemination.

Such a body must have adequate resources and the authority to implement strategic priorities for the Bay. Support from a multi-agency 'Task Force' to assist the new Authority and councils may be required.

What stakeholders said may assist:

- **Climate Risk Assessment -** 'whole-of Bay' and comprehensive, expanded ABM 'Managing Better Now'
- **VCS sea level rise planning benchmarks** – guidance for use in established areas
- **Integrated Heritage Policy**
- **Reviews** of Climate Change Act, Marine & Coastal Act and Regional Coastal Plans
- **State-wide Risk Visualisation Tool similar to NSW**
- **Funding -** All tiers of government to share responsibility and contribute
- **Regional coordination** of asset construction and renewal
- **Coastal Management Plans –** more holistic approach to use/management foreshore & transparent trade-offs
- **Web-based information** on local climate variability for planning & stakeholder use

A program could be implemented to support coastal management roles, assist understanding of the system and build capability around the Bay. A great example is the UK Climate Impacts Program[41], established in 1997 to support community, government and organisations adapt to climate change. It offers support and advice in decision-making, knowledge-sharing and creative adaptation including coastal case studies[42], technical and comprehensive information – in an easy to read and access format.

In addition to the key findings relating to roles and responsibilities in the Legislative framework section 6.6 are:

Key Finding 7:

State government coordination and oversight is required to improve the integration of roles and responsibilities and support day-to-day management, perhaps through convening a Bay managers' forum.

Key Finding 8:

Clear articulation is required about the rights and legitimate expectations for private and public flood or erosion prone coastal land. This would assist to clarify roles and responsibilities to fund, act, and implement protection works for public and or private benefit affecting public land.

Key finding 9:

A fully accessible knowledge sharing website for coastal managers and stakeholders, (possibly modelled on the UK Climate Impacts Program site), is required to build capability and enable responsible management.

6.9 Funding

Bay stakeholders perceive a shortfall in resources to undertake identified programs of work. In the context of scarce resources, clear prioritisation and the need to grow and diversify income streams is increasingly important.

[41] www.ukcip.org.uk/
[42] www.ukcip.org.uk/?s=coast#.VfAOTZ1--70

In this operating environment the need to deal with the 'day-to-day' can take precedence over an integrated and strategic approach that may avoid or reduce future coastal adaptation costs.

The VCS includes an action to undertake an analysis of options for improved governance, regulatory and funding arrangements for coastal Crown land, and seeks for those arrangements to align funding and capacity with accountability, particularly for the ecological integrity of the coastal system.

6.9.1 Budget data and information availability

A coastal adaptation Budget Data Sheet was distributed to capture and collate budget information, drawing upon historical observations, anecdotal evidence and budget data (where available). Information was sourced from internal capital and operational plans and budgets, insurance claims, incident reports, emergency response records, as well as internal interviews. The Budget Data Sheet required identification of the last five years (2010-15) of relevant coastal works and coastal adaptation initiatives across each council. A consolidated overview of state coastal funding was not made available.

The most pressing current shortfall in investment is in:

1. modelling coastal hazards and coastal adaptation options
2. resultant coastal adaptation works
3. communicating with residents on coastal adaptation issues.

It was apparent that councils were unable to collate budget information as coastal management was often spread across multiple functions – making it difficult to collate, track and compare. These budget collation problems also point to a wider challenge of a lack in clear direction and allocation of responsibilities for coastal management within councils. For Greater Geelong and Port Phillip, expenditure was double the income and the gap was trending upwards.

Without comparable or consolidated data across ABM councils total coastal management income and expenditure is unknown. It was clear that no council earned more from coastal leases, licences and user charges than they spend, relying on other budget areas. Thus local residents subsidise the management of a State asset, accessible to all.

Key finding 10:

Understanding of the true costs of coastal management across the Bay is currently poor and must be improved so that trends may be identified and tracked; benchmarks are established; and current and future costs associated with coastal adaptation are known and able to inform budget and finance decisions. A consistent approach to collate state and local coastal management and budget data is recommended.

6.9.2 Prioritisation criteria

Revenues generated by any CoM can only be expended in that same area. Thus higher priorities from a 'whole-of-Bay' perspective may miss out if they are in areas with low revenue raising capacity. It is likely current funding could be better utilised for coastal adaptation. To release funds for this purpose it is important to understand how coastal adaptation issues relate to the values of Port Phillip Bay. Coastal adaptation is an issue for transport, the economy, ecosystems and other values important to the region including recreational and environmental values.

Integrating risk management and coastal adaptation into environmental, transport, community services, infrastructure, recreational and tourism initiatives and financing requirements could open opportunities for more diverse funding.

Figure 26 Coastal adaptation for the Bay is not just an environmental issue, but also a transport and tourism issue. Photo: AECOM.

Most funding for coastal protection works is provided by the State Government. Establishing agreed criteria for coastal protection prioritisation (possibly administered by a new Coastal Protection Board) will assist in a long term view and a more coordinated response.

Key finding 11:

Transparent criteria are needed to determine coastal protection priorities for the Bay and these should be consistently applied by all Bay Committees of Management to consolidate identified priorities across the Bay as a forward work program.

6.9.3 Cost Benefit Approaches

Prioritisation of coastal adaptation options is assisted by tools such as Cost Benefit Analysis (CBA). Asset strengthening and protection, and adapting to the changing climate are likely to require significant investment in the future.

CBA is an analytical tool that can be used to assess and compare the costs and benefits of alternative coastal adaptation options to identify the option with the greatest community benefit. CBA involves identifying and quantifying climate loss and damage costs under a 'business as usual' scenario, compared to taking a particular adaptation action. It brings together a range of economic information to assess options in an objective and reliable way. It is versatile because it can include both quantitative and qualitative information and is particularly useful when considering development decisions for longer time horizons, or where multiple options require consideration.

CBA can be used in the planning phase of a project to select the coastal adaptation option most likely to generate the highest returns or used after an adaptation project has been implemented by assessing the impact of the intervention for replication, advocacy and monitoring efforts. A CBA can quantify in economic terms the trade-off between different coastal adaptation pathways. A more detailed discussion of CBA approaches is provided in a Fact Sheet in the Supplementary Resources report.

There are no Australian guidelines for preparing a CBA for managing costal risks (unlike the UK where these are set out in the HM Treasury Green Book[43]). This means that investments and the economic benefits of projects are rarely transparent and made public.

See Key finding 6 regarding indicative CBA for coastal adaptation option types across Port Phillip Bay.

6.9.4 New Funding Options

To preserve the Bay values enjoyed today will require increased investment – in coastal protection works alone.

Unlike many other countries there is no national funding mechanism or arrangements for coastal management in Australia. State level funding is fragmented and councils are largely left to fund major components of coastal

[43] www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

management. As the Bay is a metropolitan asset it is not reasonable to expect coastal municipalities, some only a few kilometres wide, to fund this need.

Stakeholders cited a myriad of options to raise further funds for coastal management and adaptation. These included: user fees (new and increased), taxes and tariffs, rate increases, Government funding, levies and new finance options such as Green Bonds and Private Public Partnerships (PPPs), or a shared fund.

Collectively they may build the financial capacity required to adapt and retain the Bay's contribution to Melbourne's liveability. No one financing option would be able to stand alone, but rather they would need to be combined. A business case to demonstrate the Bay's value and the costs avoided though proactive management would assist in pursuing a range of funding options.

There are several ways in which additional funds may be raised through taxes or levies. The Netherlands funds adaptation to sea level rise both by State taxes and through tariffs charged by Water Boards. One of the lessons learned from the Netherlands, however, is that 100% public funded projects can be more compared to private or self-financing projects.

A mechanism to work with the private sector through Public-Private-Partnerships (PPPS) enables a systematic sharing of liability, benefits and risks for an extended period of time. PPPs may be a worthwhile model for future construction and maintenance of coastal protection works, where hard defences are considered appropriate.

A beneficiary-pays model for coastal protection works may enable funds to be collected from ratepayers who directly benefit from protection works that deliver little or no public benefit through say a special rate scheme. The NSW Coastal protection Services charge is an example of this.

As the Bay is 'open space', the Parks charge could include a Bay supplement, to be used for initiatives that provide both recreational and coastal adaptation benefits or to build a reserve fund for future coastal adaptation. A proportion of (or additional percentage to) the 5 percent public open space contribution administered through the *Subdivision Act* may also be able to be used for 'blue open space.'

Suggestions for increasing fees included: parking fees for visitors, permits and licences for coastal events, and lease costs for coastal properties. The option of increasing rates is limited by rate capping. All of these fee, charge and rate increase suggestions bring with them considerable political challenges. Increased fees and charges are unlikely to raise the amount of funding required and could alienate important coastal stakeholders, necessary to be fully engaged for the adaption plan's implementation.

New sources of revenue for the Bay are harder to conceive and require blue sky thinking (which may see options considered such as reclaiming land to create islands or to generate income from windfarms) in the future.

Innovative financing options

- **a 'Storm Disaster Scheme' fund** from property insurance to co-financing demonstration protection projects
- **New taxes or charges (or** expanded parks and waterways charges) for the use of coastal assets, including the potential for a 'who benefits pays' model for charging users.
- **Public-Private-Partnerships (PPPs),** a new levy. infrastructure or adaptation bonds
- **Utilise funds from the sale of Bay-related assets (e.g. Port of Melbourne lease)**

7

Conclusions and next steps

Port Phillip Bay is changing at a rapid rate. Over the next 50 years the challenges of a changing climate, growing population and associated land use and development pressures will be significantly greater than experienced in the past 50 years.

Accountability for adaptation is currently unclear due to the legislative framework, lack of a clear articulation of people's rights and associated roles and responsibilities, and ambiguity regarding the interfaces between management and tenure boundaries.

We found inadequate capability and resources - technical, financial and data – flows through to decision making. When decisions are made with incomplete information funds may be allocated or actions undertake that would not be taken if priorities were set at a whole of Bay perspective.

With complex coastal processes and management; high social, cultural, environmental and economic values and use, and increasing climate and demographic pressures – the Bay's future is not assured.

It is essential that the framework for planning, managing and governing the Bay also changes to deal with future challenges, driven by a shared vision to drive change and enable continuous improvement and adaptation into the future.

7.0 Conclusions and next steps

7.1 Key findings

It is important that coastal adaptation begin in earnest. Cultural and structural management changes need to be made and a forward research and works programs identified. Stakeholder awareness and confidence in management and decision making processes needs to be built and maintained. Fundamentally, future approaches require strengthened regional cooperation between the ten participating ABM councils, State Government and other stakeholders, as the range of climate stresses expected on the Bay increase.

A regional approach will improve local level decision-making while building the climate adaptation policies, programs and implementation capacity necessary to safeguard community and Bay values into the future.

By addressing the findings contained in this report, many of the Bay's values will be preserved for future generations and the future enjoyment of the Bay's contribution to our economy, ecological health and quality of life.

1. A set of guiding principles (drawn from legislation and the VCS) for climate adaptation agreed for Port Phillip Bay would greatly assist in aligning coastal adaptation priorities and the objectives of all responsible stakeholders and agencies following the development of the Bay Plan 2070.
2. Additional wave data is needed and should be collected.

   A consistent approach (across State and local government), using the specification for coastal inundation modelling detailed in Section 6.3 of the Stage 1 report, will greatly assist when filling data gaps and undertaking modelling of vulnerability and responses to climate impacts (inundation, erosion, cost of damage) for those areas of the Bay most likely to be affected.

   In the interim those areas should be identified by listing and rating areas that:

   - experience flooding now as detailed in Planning Schemes
   - have experienced repeated damage from storm events
   - are requiring renourishment for both asset protection and amenity
   - are identified as being highly erodible coastlines
   - may experience coastal inundation not included in Planning Schemes using 1 percent AEP.
3. A Port Phillip Bay Adaptation Management Guide or manual, informed by the Guiding Principles, should be developed through a joint State and local government process to guide Bay adaptation planning and management for coastal Crown land and in particular to guide management of the interfaces with private land and the marine environment.
4. There is an opportunity for Government to negotiate new models with the insurance sector in Australia to provide insurance cover for seawater related inundation, modelled on the UK Flood Re approach.
5. The reviews of the *Climate Change Act* and the *Coastal Management Act* and the proposal to introduce a new Coastal and Marine Act provide a significant opportunity to consider a broader range of matters to drive greater consistency in approach, clarify roles and responsibilities for coastal protection between local and State Governments and across coastal land tenures, and to improve governance arrangements for coastal adaptation.

   Ideally a future regime for coastal adaptation and marine management would:

   - articulate Bay strategies and priorities
   - consider the merits of a coordinating Bay authority or Coastal Protection Board (see 6.8)
   - provide detailed and clear definitions relating to roles and responsibilities, including:
     - a division of responsibilities in order to assess and respond to the risks of flooding and inundation in coastal areas
     - defining and implementing action plans for coastal protection
     - defining security levels that take into account the future climate

    - the powers and authorities required to deal with future climate scenarios (without requiring further legal or policy change).
- consider how Regional Plans may support an integrated response and limit adverse impacts elsewhere
- address inadequate access to funding, including consideration of a mechanism to establish, contribute to and distribute funds for coastal and bay priority protection works
- consider under what circumstances and through what mechanism private financing to complement existing arrangements may be appropriate
- investigate new or alternative sources of funding
- include a legislative "liability shield" that protects Committees of Management from legal action when operating consistently with State coastal guidelines, as in New South Wales (s.733 of the Local Government Act)
- establish a decision-making system that can be developed and adapted according to risk
- introduce due diligence processes so that public funding supports projects that adapt to future conditions throughout the project's lifetime
- introduce processes to enhance and embed the adaptive capacity of organisations so that they will be able to plan and make the most optimal decisions.

6. Coastal adaptation planning would greatly benefit from the preparation of a range of generic planning responses for vulnerable areas, to avoid the need for expensive Coastal Hazard Vulnerability Assessment (CHVA) studies and CBA for each site/ section of coast. An indicative Cost Benefit Analysis for coastal adaptation option types across Port Phillip Bay would assist current financing decisions and reduce the need to do a detailed CBA on a case by case basis.
7. State government coordination and oversight is required to improve the integration of roles and responsibilities and support day-to-day management, perhaps through convening a Bay managers' forum.
8. Clear articulation is required about the rights and legitimate expectations for private and public flood or erosion prone coastal land. This would assist to clarify roles and responsibilities to fund, act, and implement protection works for public and or private benefit affecting public land.
9. A fully accessible knowledge sharing website for coastal managers and stakeholders, (possibly modelled on the UK Climate Impacts Program site) is required to build capability and enable responsible management.
10. Understanding of the true costs of coastal management across the Bay is currently poor and must be improved so that trends may be identified and tracked; benchmarks are established; and current and future costs associated with coastal adaptation are known and able to inform budget and finance decisions. A consistent approach to collate state and local coastal management and budget data is recommended.
11. Transparent criteria are needed to determine coastal protection priorities for the Bay and these should be consistently applied by all Bay Committees of Management to consolidate identified priorities across the Bay as a forward work program.

7.2 Next steps

The next stages of the Bay Blueprint project will prepare the Bay Plan 2070 and support training and raise awareness to embed coastal adaptation measures into council decision making processes.

The challenges facing coastal managers around Port Phillip Bay are extensive. They have been described to councils in workshops under three themes: coastal squeeze; accountability deficit; and improving capability and resourcing. Should the findings above be addressed, with the data gaps and modelling undertaken for agreed priority areas, and with more robust funding and decision making processes, many operational challenges will be addressed and governance for coastal adaptation significantly improved. This work should start immediately but will take some time as many of the actions required are outside of the authority of the ABM councils alone; however there are actions that can be taken.

To respond to coastal squeeze, improve accountability and coastal adaptation for Port Phillip Bay the following proposals could be pursued in the short term:

1. Establish regional priorities for coastal adaptation

Despite insufficient data and modelling of climate impacts in areas of the Bay likely to be affected, the ABM, in consultation with key Bay stakeholders, could develop a list of priority vulnerable sites for further analysis or for response using historical knowledge, photographic evidence and available data. This would respond to the CCB's first recommendation for adapting to a changing climate and increased coastal hazards i.e. to develop a systematic approach to identify regional priorities for coastal adaptation planning. Using the prioritisation approach detailed in section 4.2.4 (and Key finding 2) lists developed by councils could be consolidated, prioritised and reviewed. This would assist to:

- establish a priority list of extreme risks for the whole-of-Bay
- assist in the allocation of beach renourishment resources.
- provide a basis for a work program for both data collection and further studies which if completed would build a consistent whole-of-Bay risk assessment.

2. Establish a consistent response for the use and development of land in established areas exposed to coastal hazards, through developing a set of generic planning responses

Adaptation options of avoid (retreat), protect or accommodate are not readily applied to established contiguous settlement areas undergoing constant renewal. Options to leverage broader hazard mitigation benefits from areas in transition exist. A consistent response to addressing coastal hazards in established areas is still lacking. Similar to the coastal managers' forum, a coastal planners' forum for statutory and strategic planners would be of value in the short term to assist in the development of generic planning responses for vulnerable urban areas. Commissioning a short discussion paper to scope the generic planning responses could be overseen by this group who can test the planning responses against real world permit examples. The Coastal planners' network can provide ongoing support and guidance to coastal councils, similar to the approach of the Council Alliance for Sustainable Built Environments (CASBE).

3. **Build support for coastal adaptation**

Climate adaptation for Melbourne will be affected by the ability of the city, ABM councils and their communities to bounce back in response to disaster events such as floods, fires, droughts and heatwaves, and this ability is enhanced through dealing with the stresses faced. These include climate as well as socio-economic pressures.

Building support for coastal adaptation is an ongoing requirement for organisations internally, at a community level and across other agencies. The ABM is well placed to continue to facilitate this broad interaction. Other councils who have participated in the Future Coasts projects should also be engaged to broaden the discussion and inform the ABM members of pilot outcomes.

The Resilient Melbourne Strategy, as part of the 100RC program pioneered by Rockefeller Foundation, intends to support a diverse array of projects targeting the critical shocks and stresses facing Melbourne, to raise community awareness of these and build resilience at a metropolitan scale. It is likely the Resilient Melbourne project could assist councils to build the relationships necessary for coastal adaptation and to advocate for change at a local and regional level. The ABM should ensure the 100RC project recommendations support whole-of-Bay adaptation through regional collaboration, which is central to building resilience at a metropolitan scale.

4. Data gaps and modelling

Data collection and modelling of regional assets such as the Bay should be done by the State Government. This data and modelling is important to develop consistent hazard maps for inundation and erosion. Given the commitment to a State of the Bay report it is an opportune time to seek state budget funding support to fill data gaps and put in place on-going mechanisms to support data collection regarding waves, currents, 1 in 100 year storm erosion, inundation and beach profile monitoring.

AECOM
Level 9
8 Exhibition Street
Melbourne
Victoria 3000
Australia