

## Our Coast Our Future: Stages 1 to 4 Summary

**Our Coast Our Future will provide the Shire with a long-term plan to manage and adapt to impacts of coastal change across the entire Mornington Peninsula.**

With changing climate and rising sea levels, we're expecting more impacts from coastal processes along our coasts. Mornington Peninsula's identity is strongly linked to the natural environment, especially its coastal and marine areas. We need to plan for impacts coastal processes might have, especially on the things we value.



Figure 1. The Mornington Peninsula Shire and sub-regions

Mornington Peninsula Shire Council was successful in obtaining funding from the Victorian Government to develop and implement a shire-wide Coastal Strategy, Our Coast Our Future.

This project is co-funded by Mornington Peninsula Shire Council and the Department of Energy, Environment and Climate Action (DEECA) through its Victoria's Resilient Coast – Adapting for 2100+ program (the VRC).



This summary details the outcomes of Stages 1 to 4 of the VRC framework and progress in developing the *Our Coast Our Future* Strategy.

## Victoria's Resilient Coast – Adapting for 2100+

The VRC provides a statewide strategic approach for local governments, land managers and communities to achieve long-term coastal hazard risk management and adaptation.

Building upon directions in the *Marine and Coastal Act 2018* and *Marine and Coastal Policy 2020*, the VRC framework and guidelines outline a staged approach to technical, strategic planning and engagement aspects of managing and adapting to coastal hazard risks.



Figure 2. Victoria's Resilient Coast - Adapting for 2100+ framework seven stages (DEECA)

This process looks to support place-based and best practice assessment to inform decision making on how to manage coastal hazard risks, to limit potential impacts to important natural, cultural and built values and assets in our coastal areas.

Embedded throughout all stages are:

- Traditional Owner knowledge, rights and aspirations
- Collaborative process
- Engagement and communication





## Our Coast Our Future

'Our Coast Our Future' is the name of the project the Shire is currently undertaking. It will develop a long-term coastal strategy to help us better understand current and future impacts of coastal processes and how we can make our coastlines more resilient. As a shire-wide strategy, this will provide short- and long-term actions to avoid, mitigate and manage impacts of coastal hazards on coastal communities across the region.

Guided by the VRC process, *Our Coast Our Future* will inform strategic, proactive planning and decision making to increase the resilience of our coastlines and communities to climate change. This work is building upon the Shire's strong foundations of strategic and informed management in its approach to caring for Mornington Peninsula's coastal areas.


## Scope

The Mornington Peninsula Shire Council currently have funding to complete Stages 1 to 4 of the VRC Guidelines. These four stages will inform future adaptation planning in accordance with the remaining stages (Stages 5 to 7) of the Guidelines, including the development of the Coastal Strategy.

	<b>Stage 1: Project establishment, background review and scoping</b>
	Provide a foundation for adaptation planning aligned to best practice guidance. This involves steps such as defining the need for action and establishing a collaborative process.
	<b>Stage 2: Values, vision and objectives</b>
	Ensure adaptation planning is underpinned by regional and place-based values of our communities. Extensive community engagement will help us understand community values, and develop a shared vision and objectives for adaptation.
	<b>Stage 3 Coastal hazard exposure</b>
	Assess coastal hazard exposure throughout the Mornington Peninsula. This stage includes adopting scenarios that enable best practice approaches to assessing current and emerging risk.
	<b>Stage 4 Vulnerability and risk</b>
	Explore place-based coastal hazard vulnerability and risk to values and assets to enable strategic consideration of adaptation needs and priorities for communities of the Mornington Peninsula.

## Working with the community

Hearing from the community has been an important part of the project. It is helping us understand more about important coastal values, key issues, the history of the coastline, and to consider how values fit with managing hazard risk.

 Land, Sea and Sky Country of the Mornington Peninsula has been and continues to be nurtured and cared for by Traditional Owners of the region, the Bunurong People.

All Country is valued by Bunurong People, in its own right, including tangible and intangible values - from significant sites and places to important stories and lore.

Common themes have emerged through engaging with our communities. These themes have been distilled into nine high-level values themes:



These values are embedded across development of the Coastal Strategy and our adaptation planning.

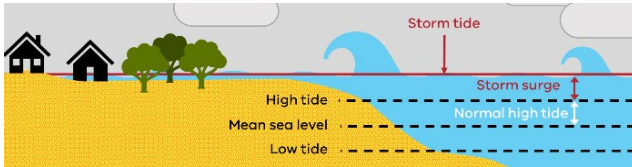
## Coastal hazards

Natural coastal processes have always shaped the Mornington Peninsula's coastline. When these processes impact on coastal values, infrastructure and uses, we term them coastal hazards. With sea level rise and climate change, there is potential for coastal hazard impacts to increase.

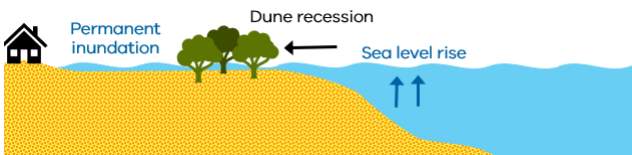


Coastal hazards considered in adaptation planning for the Coastal Strategy include:

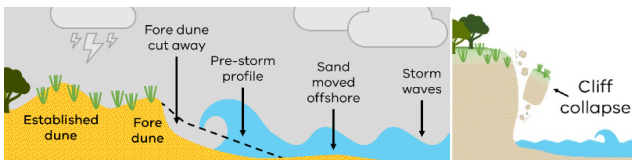
**Storm tide inundation** - Temporary inundation (flooding) of low-lying coastal land during a storm.



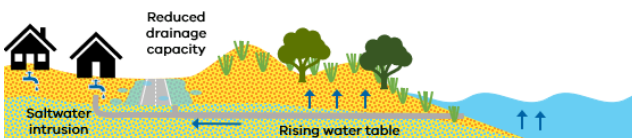
**Permanent inundation** - Regular inundation of low-lying areas as part of the local tidal cycle.



**Coastal erosion** – including short term (storm bite) and long term (recession) erosion of sandy coasts and rocky coast or cliff erosion.



**Groundwater intrusion** - including reduced depths to groundwater and changing salinity (salt content).



## Understanding coastal hazard exposure

We assess a range of coastal hazard types, across different storm event scenarios and over different planning horizons. This includes understanding the likelihood of coastal hazards impacting different areas and how this may change with sea level rise and a changing climate.

Coastal hazard models help us understand these processes. For the Coastal Strategy, we have used model outputs from:

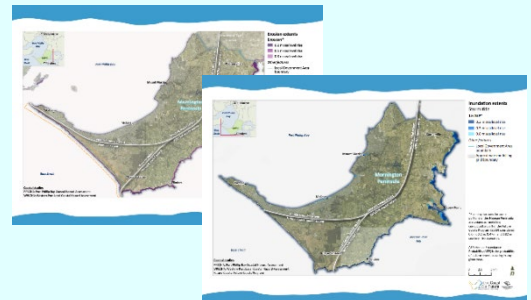
- Port Phillip Bay Coastal Hazard Assessment
- Western Port Local Coastal Hazard Assessment
- Previous Future Coast data

We consider these hazards under varying sea level rise conditions into the future:

Period	Time step	Indicative planning horizon	Sea level rise
Short term	0 to 25 years	2040	MSL + 0.2m
Medium term	25 to 50 years	2070	MSL + 0.5m
Long term	50 to 100 years	2100	No less than MSL + 0.8m by 2100



Modelling provides estimates of where coastal hazards impacts could occur. We call these "hazard extents" which we can use to produce maps.



Maps and hazard extents help us to determine coastal areas across the Mornington Peninsula that may be exposed to coastal inundation, erosion, sea level rise and groundwater flooding. This allows us to consider what values and assets might be impacted by hazards.

## Risk and vulnerability

Once we know the areas likely to be exposed to coastal hazards, we can assess the vulnerabilities and risk for the values, uses and infrastructure in those areas over time.

We assessed coastal hazard impacts across:

- **Beach and foreshore assets** - Access, stairways, bathing boxes, ramps, jetties, protection structures
- **Planning scheme** zones and overlays
- **Buildings and facilities** - Building footprints (public and private), Surf lifesaving clubs (SLSC), amenities, shelters, park and street furniture
- **Transport infrastructure** - Roads, bridges, crossings, paths and trails
- **Other infrastructure and utilities** - Water, sewer, electricity, waste facilities and water sensitive urban design
- **Land use, environmental and cultural values** - Dune system, vegetation, habitat, ecosystems, sensitive sites, cultural values, places and sites



Extensive spatial analysis was undertaken to assess which assets (or portions of assets) are exposed to the mapped coastal hazard scenarios.

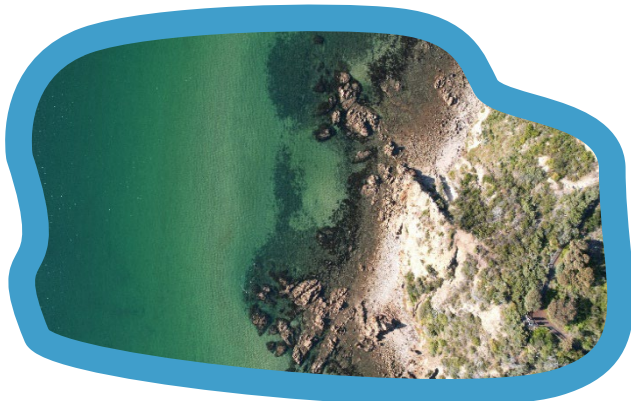
Coastal hazard risk is assessed based on the:



**Likelihood** (probability/chance) of exposure to coastal hazards. Likelihood is estimated for each hazard scenario that was considered, based on the probability of occurrence.



**Consequence** (impact) of exposure. Consequence is determined through a tailored rating of impact. This rating considers community and cultural values, existing risk management approaches, similar assessments nationwide, and Council input.



Assessing risk and vulnerabilities across the region informs where action may be required to reduce risk to acceptable levels.



The unique Country of the Mornington Peninsula holds culturally important values and places for Bunurong peoples. Many are unacknowledged, unknown and/or undocumented. Many cannot be adequately reflected in databases or assessed in a quantitative assessment.

Our analyses attempt to reflect some potential cultural vulnerabilities in the region by examining some of understood history and values, and through considering the reciprocity between Bunurong People and the natural environment.

Risk	Action required
<b>Extreme</b>	Immediate and/or ongoing action is needed to treat, eliminate, or reduce risk to acceptable levels
<b>High</b>	Short term and/or ongoing action is needed to treat, eliminate, or reduce risk to acceptable levels
<b>Medium</b>	Short to longer term and/or ongoing action is needed to treat, eliminate, or reduce risk to acceptable levels
<b>Low</b>	Manage and monitor the risk as part of current operations, provide for periodic maintenance/review.
<b>Very low</b>	Manage and monitor the risk as part of current operations, provide for periodic maintenance/review.

## Shire-wide risk outcomes

Risk has been summarised across different values and asset types, including planning schemes and land use, environmental and cultural values, built infrastructure, buildings and facilities (public and private).

The Shire’s planning scheme risk results showed that in the short-term, nearly 1% of land across the Shire is at medium to extreme risk from erosion and nearly 2% from storm tide inundation. In the longer term, this increases up to 2.7% for erosion and 4.5% for storm tide inundation. Examining different planning scheme zones can indicate values and assets likely to be at risk within these areas.

% total areas at risk (medium to extreme)

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	0.9%	1.2%	4.4%
EROSION	1.9%	2.3%	2.7%
PERMANENT INUNDATION	0.4%	0.6%	0.8%
GROUNDWATER*	8.3%	8.3%	8.3%

\*Shallow groundwater (Depth: 0 to 2 m AHD)

Public conservation and resource and Public park and recreation zones account for larger planning zone areas exposed, across all hazard types.

The emerging risk profile from the short to longer-term is not linear. A notable step-change in the risk profile for storm-tide and erosion, as sea levels rise between medium to longer-term. Combined

catchment and coastal inundation also plays a significant role in the longer-term risk and damages, particularly for built assets within townships.

Buildings, roads and utilities are increasingly at risk from coastal hazards. This includes key access routes, and utility networks important to the Shire, community buildings and facilities, and private property.

Hazards pose risks for many important ecosystem values around the Peninsula, particularly within Western Port Bay. This includes Ramsar areas, bird habitat and important native vegetation - including mangroves and saltmarsh, coastal scrub.

Culturally significant places and areas for the Bunurong People, many linked to these valued ecosystems, are also increasingly vulnerable. This includes waterways, wetlands, coastal land and dunes and vegetation and habitat areas as well as registered cultural heritage places.



	STORM-TIDE INUNDATION			EROSION			PERMANENT INUNDATION			GROUNDWATER		
	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
Sub area 1: Northern Port Phillip	Medium	Medium	High	Medium	High	High	Medium	Medium	Medium	Low	Low	Low
Sub area 2: Central Port Phillip	Medium	High	High	Medium	Medium	Medium	Low	Low	Low	High	High	High
Sub area 3: Southern Peninsula	Medium	Medium	High	Low	Medium	Medium	Low	Low	Low	High	High	High
Sub area 4: Southern Western Port	Low	Low	Medium	Medium	High	Extreme	Low	Low	Low	Low	Low	Low
Sub area 5: Northern Western Port	Low	Medium	Medium	Low	Low	Medium	Medium	Medium	Medium	Low	Low	Low

This summary reflects risk, in absence of any intervention to mitigate current and future coastal hazards. The Our Coastal Future Coastal Strategy will consider needs and risk drivers for the different coastal communities (townships) of the Mornington Peninsula region. We combine this understanding with appreciation of community and Shire values, environmental context and policy and legislation to inform and plan how we respond to emerging hazard risk.

## Economics

An economic base case is a valuation of risk. It refers to the outcome that would occur if adaptation to coastal hazards is not implemented. That is, business as usual with no additional adaptation/intervention.

An economic base-case can be used as an additional measure of risk. This is estimated as average annual damages (AAD).

**i** **Average annual damages** - a representation of the damage/loss of coastal values, in monetary terms, averaged to an annual scale.

Defining an economic base case provides a point of reference to:

- understand the benefit of intervention,
- inform current and emerging coastal hazards impacts, and
- assist with project scoping and establishing a business case to evaluate adaptation.
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## Shire-wide economic outcomes

For the Mornington Peninsula, short-term average annual damages (AAD) associated with combined coastal hazard impacts on built assets is estimated to be in the order of \$8.6 million. In the absence of adaptation, this may increase up to \$22.0 million (AAD) in the medium-term and to \$67.3 million (AAD) in the longer-term.

These economic impacts vary in magnitude across coastal hazard types.

### Annual expected damage (\$ million) by hazard type - built assets only

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	\$1.6	\$4.1	\$35.8
EROSION	\$5.7	\$16.0	\$29.5
PERMANENT INUNDATION	\$1.4	\$2.0	\$4.4



Storm-tide inundation is the region's main driver of increasing potential damages over time, with largest damages from exposed buildings and facilities.

### Long-term annual expected damage (\$ million) – buildings only

	STORM-TIDE INUNDATION	EROSION	PERMANENT INUNDATION
Sub area 1: Northern Port Phillip	\$13.0	\$3.2	\$0.8
Sub area 2: Central Port Phillip	\$15.8	\$1.4	\$0.0
Sub area 3: Southern Peninsula	\$5.2	\$2.7	\$2.0
Sub area 4: Southern Western Port	\$0.1	\$21.8	\$0.2
Sub area 5: Northern Western Port	\$1.6	\$0.4	\$1.3

This summary reflects long-term economic impacts to buildings in absence of intervention. Analyses have examined the possible impacts to public buildings (i.e., lifesaving clubs, yacht clubs, toilet blocks etc) and private buildings (i.e., residential and commercial).

An economic base-case has also been considered at a township level where we can more deeply explore potential impacts.

Bringing together the findings of the exposure, risk and vulnerability, and economic assessments, increases our understanding of coastal hazard risk for assets and land across the region. This provides a basis to begin targeting our adaptation response and actions.

## Subarea 1

STORM-TIDE INUNDATION			EROSION			PERMANENT INUNDATION			GROUNDWATER		
Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
Medium	Medium	High	Medium	High	High	Medium	Medium	Medium	Low	Low	Low

Rugged headlands and cliffs form the coastal landscape from Mount Eliza to Mount Martha. This coastline contains sandy beaches found within small bays and coves, with waterways intersecting the landscape before flowing into the Bay.

Values, uses and infrastructure in the area include:

- unique geology and marine environments including reefs, cliffs, and shore platforms
- significant Aboriginal cultural heritage, and renown geomorphological features
- important coastal vegetation, including coastal banksia

Built infrastructure and facilities

- roads and utilities infrastructure, including the waste water treatment plant, various boat and yacht clubs, lifesaving clubs
- private residential dwellings and properties

Coastal hazards will likely impact the area, especially erosion and storm tide inundation. Combined catchment and coastal flooding poses large risks to this area. Hazard exposure and risk is likely to increase into the future.

This may see impacts to public facilities, private dwellings, services, infrastructure (drainage, sewage, water and electricity), vegetation (coastal headland scrub, urban and paddock trees and swamp scrub), coastal bird habitats, cultural assets and the natural dune and coastal buffers.

### Mount Eliza

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Medium	Medium	High
EROSION	Medium	High	High
PERMANENT INUNDATION	Medium	Medium	Medium
GROUNDWATER	Low	Low	Low

Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Canadian Bay Reserve Yacht Club, the scout hall, Mount Eliza Reserve Community Hall.
- significant First Nations places and areas
- coastal dune vegetation and terrestrial vegetation (particularly coastal headland scrub, urban and paddock trees, swamp scrub and gully woodlands)
- beach access, carparks, pedestrian routes
- utility infrastructure, particularly sewerage and roads
- public and private buildings – almost 900 at risk from inundation in the long term, including ~11% of General residential, ~40% of Low density residential and over 40% of commercial-zoned buildings in Mount Eliza. Erosion also puts 16 residential buildings at risk in the medium to long term.

### Mornington

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Medium	Medium	Extreme
EROSION	Medium	Medium	High
PERMANENT INUNDATION	Medium	Medium	Medium
GROUNDWATER	Medium	Medium	Medium

Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Mornington Surf Lifesaving Club, Mornington Yacht Club
- beach access, carparks, pedestrian routes
- utility infrastructure and services – particularly sewerage, roads (with sections of highway) and the waste resource recovery centre
- coastal dune vegetation, terrestrial vegetation and habitats (particularly coastal bird habitats, coastal headland scrub and swamp scrub)
- significant First Nations places and areas
- public and private buildings - over 2130 at risk in the long term, including ~20% of General residential, ~12% of Low density residential and over 30% of commercial-zoned buildings in Mornington.

### Mount Martha

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Medium	Medium	High
EROSION	Medium	Medium	High
PERMANENT INUNDATION	Medium	Medium	Medium
GROUNDWATER	Low	Low	Low

Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Mount Martha Life Saving Club and Mount Martha Yacht Club
- beach access, carparks, pedestrian routes
- utility infrastructure – particularly sewerage incl. the sewerage treatment plant, and roads (with sections of highway and freeway)
- coastal dune vegetation and terrestrial vegetation (particularly coastal headland scrub, damp sands herb-rich woodland, urban and paddock trees and swamp scrub)
- public and private buildings – over 850 at risk in the long term, including ~10% of General residential and ~10% of Low density residential-zoned buildings in Mount Martha. Erosion also puts 6 residential buildings at risk in the longer term.



## Subarea 2

STORM-TIDE INUNDATION			EROSION			PERMANENT INUNDATION			GROUNDWATER		
Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
Medium	High	High	Medium	Medium	Medium	Low	Low	Low	High	High	High

From Safety Beach to Tootgarook, this region holds calm and shallow waters facing into Port Phillip Bay, with sandy beaches and dune systems leading into coastal reserves.

Values, uses and infrastructure in the area include:

- recreational uses, including swimming, water sports, boating, camping, and fishing
- conservation and biodiversity, including rare sections of coast banksia woodland and nesting red-capped plovers.
- tourism and local businesses, incl. foreshore camping, markets

Built infrastructure and facilities:

- coastal infrastructure for protection (e.g. seawalls) and recreation (e.g. boat ramps)
- roads and utilities, community buildings (e.g. lifesaving clubs, yacht clubs and halls)
- private residential dwellings and properties

Coastal hazards will likely impact the area, especially erosion and storm tide inundation. Combined catchment and coastal flooding poses large risks to this area, particularly via creeks and waterways. Shallow groundwater is also a concern.

Hazard exposure and risk is likely to increase into the future. This may see impacts to public facilities, private dwellings, services, infrastructure (drainage, sewage, water, electricity), cultural places, vegetation (coastal banksia woodlands, urban/paddock tree, aquatic herbland, marsh), natural dunes and coastal buffers.

### Safety Beach

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	High*	High*	High*
EROSION	Medium	Medium	Medium
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	High	High	High

\*Note – Recent adaptation at Safety Beach to upgrade/ raise the revetment are not reflected in hazard models. This may mean at-risk assets may be overestimated for this area. Some recent development around Martha Cove is not captured in buildings data.

Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Safety Beach Sailing Club & Community Centre
- beach access, carparks, pedestrian routes
- utility infrastructure – particularly sewerage, and key sections of roads (incl. highway and freeway)
- coastal dune vegetation and habitats (particularly swamp scrub and urban and paddock trees)
- public and private buildings - almost 90 at risk in the short term and 620 at risk from inundation in the long term, including ~18% of General residential and ~40% of Green Wedge-zoned buildings in Safety Beach. Erosion also puts 17 residential buildings at risk in the longer term.



### Dromana

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Medium	Medium	Extreme
EROSION	Medium	Medium	Medium
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	High	High	High

Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Dromana Bay Life Saving Club (and sea scout hall) and the Dromana Community Centre Hall
- beach access, carparks, pedestrian routes
- utility infrastructure – particularly sewerage, and key sections of roads (incl. highway and freeway)
- coastal dune vegetation and habitats (particularly coastal banksia and creekline herb-rich woodlands)
- public and private buildings – over 1040 at risk from inundation in the long term, including ~20% of General residential and ~25% of Green Wedge-zoned buildings in Dromana. Erosion also puts 17 residential buildings at risk in the longer term.

### Arthur's Seat

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Very low	Very low	Low
EROSION	Very low	Very low	Very low
PERMANENT INUNDATION	Very low	Very low	Very low
GROUNDWATER	Very low	Very low	Very low

Limited assets and values are at risk within Arthur's Seat. There is a small number of buildings and minor sections of utility infrastructure at risk to longer-term inundation.





## McCrae

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Low	Medium	High
EROSION	Medium	Medium	Medium
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	Medium	Medium	Medium

### Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Rosebud & McCrae Life Saving Club, McCrae Yacht Club and the McCrae lighthouse
- beach access, carparks, pedestrian routes
- utility infrastructure – particularly sewerage, and key sections of roads (incl. highway and freeway)
- coastal dune vegetation and habitats (particularly coastal banksia woodland and urban and paddock trees)
- public and private buildings – almost 600 at risk from storm-tide inundation in the long term including over 25% of General residential and almost 30% of commercial-zoned buildings in McCrae. Shallow groundwater also sees over 300 residential/ commercial buildings at risk in the short to longer term.

## Rosebud

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Medium	High	Extreme
EROSION	Low	Medium	Medium
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	Medium	Medium	Medium

### Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Rosebud Motor Boat Squadron, Rosebud Sea Scout Hall, Rosebud Memorial Hall and Kinder, Southern Peninsula Community Support and the caravan park
- beach access, carparks, pedestrian routes
- utility infrastructure – incl. key sections of road network (incl. highway and freeway), sewerage and drainage
- significant First Nations places and areas
- coastal dune vegetation and habitats (particularly coastal banksia woodland, urban / paddock trees and swampy riparian woodlands)
- public and private buildings – Storm-tide inundation sees nearly 100 at risk buildings in the medium term, while in the longer term, over almost 600 buildings at risk (incl. over 25% of General residential and almost 30% of commercial-zoned buildings). Shallow groundwater also sees over 1000 residential/ commercial buildings at risk in the short to longer term.

## Capel Sound

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Low	Low	Medium
EROSION	Low	Low	Low
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	High	High	High

### Key assets and values increasingly at risk include:

- public and recreational facilities - incl. the caravan park
- beach access, pedestrian routes
- utility infrastructure – incl. sewerage and roads
- coastal dune vegetation and habitats (particularly coastal bird habitats, coastal banksia woodland and urban and paddock trees)
- public and private buildings – almost 520 at risk from storm-tide inundation in the long term including over 14% of General residential and almost 30% of public use-zoned buildings (education, health and community buildings) in Capel Sound. Shallow groundwater also sees over 2220 residential/ commercial buildings at risk in the short to longer term.

## Tootgarook

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Low	Medium	Medium
EROSION	Low	Medium	Medium
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	High	High	High

### Key assets and values increasingly at risk include:

- public and recreational facilities
- beach access, pedestrian routes
- utility infrastructure – incl. sewerage and roads
- coastal dune vegetation and habitats (particularly coastal banksia woodland and urban and paddock trees)
- public and private buildings – over 150 at risk from storm-tide inundation in the long term including over 14% of General residential and almost 50% of public use-zoned buildings in Tootgarook. Shallow groundwater also sees over 2500 residential/ commercial buildings at risk in the short to longer term.

## Boneo

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Very low	Very low	Very low
EROSION	Very low	Very low	Very low
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	Medium	Medium	Medium

Limited assets and values are at risk to storm-tide inundation, erosion or permanent inundation within Boneo. However, shallow groundwater sees over 60 buildings at risk in the short to longer term.

## Subarea 3

STORM-TIDE INUNDATION			EROSION			PERMANENT INUNDATION			GROUNDWATER		
Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
Medium	Medium	High	Low	Medium	Medium	Low	Low	Low	High	High	High

Stretching from the western-most point of the Peninsula down to its southern-most point, this region contains calm bayside beaches to the north and limestone cliffs to the south, with ocean beaches facing onto Bass Strait.

Values, uses and infrastructure in the area include:

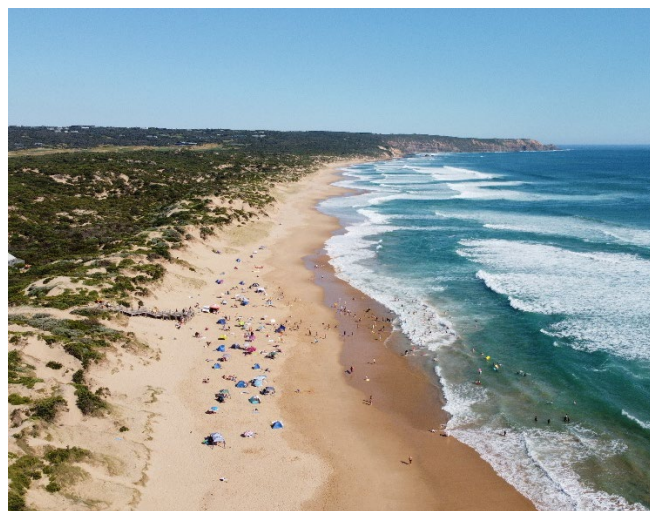
- Recreational uses –swimming, diving and boating at bay beaches, with surfing, rock pools and coastal walks at ocean beaches
- Aboriginal cultural heritage, with over 200 cultural sites within the Mornington Peninsula National Park
- Historical townships of Sorrento and Portsea, the Cape Schanck lighthouse

Built infrastructure and facilities:

- roads and utilities, community buildings (e.g. yacht clubs)
- private residential dwellings and properties
- coastal infrastructure for protection (e.g. seawall) and recreation (e.g. piers and jetties)

Coastal hazards will likely impact the area, especially erosion and storm tide inundation. Combined catchment and coastal flooding poses large risks to this area. Shallow groundwater is also a concern.

Hazard exposure and risk is likely to increase into the future. This may see impacts to public facilities, private dwellings, services, infrastructure (drainage, sewage, water and electricity), vegetation (coastal headland scrub and coastal alkaline scrub), coastal bird habitats, significant areas (national parks), cultural assets and natural dune and coastal buffers.



### Rye

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Medium	Medium	High
EROSION	Low	Medium	Medium
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	High	High	High

Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Rye Yacht Club and the caravan park
- beach access, car parks, pedestrian routes
- utility infrastructure – particularly sewerage, and key sections of roads (incl. highway)
- coastal dune vegetation and habitats (particularly coastal headland scrub and urban and paddock trees)
- Mornington Peninsula National Park
- public and private buildings – almost 400 at risk from storm-tide inundation in the long term including over 3% of General residential and almost 10% of commercial-zoned buildings in Rye. Shallow groundwater also sees over 2730 residential/commercial buildings at risk in the short term, increasing to almost 2770 in the longer term.

### Blairgowrie

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Medium	Medium	High
EROSION	Low	Medium	Medium
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	High	High	High

Key assets and values increasingly at risk include:

- public and recreational facilities
- beach access and pedestrian routes
- utility infrastructure – particularly sewerage and roads (incl. highway)
- coastal dune vegetation and habitats (particularly coastal headland scrub, urban and paddock trees and coastal alkaline scrub)
- Mornington Peninsula National Park
- public and private buildings – almost 540 at risk from storm-tide inundation in the long term, including over 13% of General residential-zoned buildings in Blairgowrie, and all its Commercial-zoned buildings. In the longer term, erosion also put several residential buildings at risk. Shallow groundwater also sees over 1360 residential/commercial buildings at risk in the short term, increasing to almost 1400 in the longer term.

## Sorrento

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Medium	Medium	High
EROSION	Low	Medium	Medium
PERMANENT INUNDATION	Low	Medium	Medium
GROUNDWATER	Medium	Medium	Medium

### Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Sorrento Scout Hall, and the caravan park
- beach access and pedestrian routes. Many jetties are increasingly at risk.
- utility infrastructure – particularly sewerage and roads
- coastal dune vegetation and habitats (particularly coastal headland scrub, urban and paddock trees and coastal alkaline scrub)
- Mornington Peninsula National Park
- public and private buildings – over 720 at risk from storm-tide inundation in the long term, including almost 20% of General residential, almost 20% of Commercial and almost 20% of Industrial-zoned buildings in Sorrento. In the longer term, erosion and permanent inundation also put several residential buildings at risk. Shallow groundwater sees almost 530 residential/commercial buildings at risk in the short to longer-term.



## Portsea

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Medium	Medium	High
EROSION	Medium	Medium	Medium
PERMANENT INUNDATION	Low	Medium	Medium
GROUNDWATER	Low	Low	Low

### Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Portsea Surf Life Saving Club, The Artist in Residence Cottage, Police Point Military Hut
- beach access and pedestrian routes (incl. existing erosion and presence of coastal protection structures)
- utility infrastructure – particularly sewerage, and key sections of roads (incl. small sections of highway)
- coastal dune vegetation and habitats (particularly coastal headland scrub and coastal alkaline scrub)
- Mornington Peninsula National Park, Point Nepean National Park and Port Phillip Heads Marine National Park
- public and private buildings – almost 300 at risk from storm-tide inundation in the long term, including almost 15% of General residential-zoned buildings in Portsea. In the longer term, erosion also puts up to 8 residential buildings at risk, and permanent inundation sees 11 residential buildings at risk.

## St Andrew's Beach

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Very low	Very low	Low
EROSION	Very low	Very low	Low
PERMANENT INUNDATION	Very low	Very low	Very low
GROUNDWATER	Low	Low	Low

Limited assets and values are at risk within St Andrew's Beach, for buildings, facilities, and utilities across most hazard types. Some sections of pedestrian trails (67%) and minor roads (fire routes / local roads) may be at risk from erosion in the short-term to longer-term. Shallow groundwater sees over 60 buildings at risk in the short term to longer term.

### Key environment and cultural values at risk include:

- coastal dune vegetation, habitats (incl. coastal headland scrub)
- Mornington Peninsula National Park

## Fingal

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Very low	Very low	Low
EROSION	Very low	Very low	Low
PERMANENT INUNDATION	Very low	Very low	Very low
GROUNDWATER	Very low	Very low	Very low

Gunnamatta Surf Life Saving Club is at-risk to erosion in the longer-term. However, limited other assets and values are at risk within Fingal across most hazard types. Some sections of pedestrian trails may be at risk from erosion in the short-term (80%) to longer-term (100%). Minor sections of fire routes/local roads are also at risk in the longer-term. Shallow groundwater sees over 100 buildings at risk in the short term to longer term.

### Key environment and cultural values at risk include:

- coastal dune vegetation and habitats (incl. coastal headland scrub)
- Mornington Peninsula National Park

## Cape Schanck

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Very low	Very low	Low
EROSION	Very low	Very low	Low
PERMANENT INUNDATION	Very low	Very low	Very low
GROUNDWATER	Very low	Very low	Very low

Limited assets and values are at risk within Cape Schanck for buildings, facilities, and utilities across all hazard types. Some sections of pedestrian trails may be at risk from erosion in the longer-term (24%) and minor sections of fire routes/ local roads.

### Key environment and cultural values at risk include:

- coastal dune vegetation and habitats (incl. coastal headland scrub)
- Mornington Peninsula National Park

## Subarea 4

STORM-TIDE INUNDATION			EROSION			PERMANENT INUNDATION			GROUNDWATER		
Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
Low	Low	Medium	Medium	High	Extreme	Low	Low	Low	Low	Low	Low

From Flinders, west of the entrance to Western Port Bay, and extending around the Bay to Somers, this diverse region of coast contains a number of coastal villages amongst bays, seagrass meadows and rocky reefs.

Values, uses and infrastructure in the area include:

- Recreational uses, snorkelling, diving, surfing and commercial and recreational fishing
- Habitat for unique marine life, such as the weedy sea dragon, and intact coastal vegetation, such as banksia woodland

Built infrastructure and facilities:

- roads and utilities, community buildings (e.g. yacht clubs)
- private residential dwellings and properties
- coastal infrastructure, particularly for recreation (e.g. piers, informal boat ramps)

Coastal hazards will likely impact the area, especially erosion in short to longer term, storm tide and permanent inundation in the longer-term.

Hazard exposure and risk is likely to increase into the future. This may see impacts to public facilities, private dwellings, services, infrastructure (drainage, sewage, water and electricity), vegetation (coastal banksia woodland, coastal headland scrub/coastal tussock grassland mosaic and coastal saltmarsh), significant areas (national park, marine sanctuary and Ramsar site), cultural and heritage assets and natural dune, cliff and coastal buffers.



### Flinders

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Low	Low	Medium
EROSION	High	High	Extreme
PERMANENT INUNDATION	Medium	Medium	Medium
GROUNDWATER	Low	Low	Low

Key assets and values increasingly at risk include:

- public and recreational facilities and heritage structures, particularly down on the Flinders Foreshore Reserve (incl. pier and informal boat ramp)
- beach access and pedestrian routes
- utility infrastructure – across all networks including roads and drainage, electricity, sewerage and water
- coastal dune vegetation and habitats (particularly coastal headland scrub/coastal tussock grassland mosaic and coastal banksia woodlands)
- Mornington Peninsula National Park, Mushroom Reef Marine Sanctuary
- public and private buildings – almost 70 at risk from erosion in the short-term and 90 in the medium to longer-term, including over 11% of General residential-zoned buildings in Flinders.

### Shoreham

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Low	Low	Medium
EROSION	Low	Medium	Medium
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	Very low	Very low	Very low

Key assets and values increasingly at risk include:

- public and recreational facilities, including the boat ramp
- beach access and pedestrian routes
- utility infrastructure – incl. roads, electricity and sewerage
- coastal dune vegetation and habitats (particularly coastal dune grassland and grassy woodlands)
- public and private buildings – some buildings are increasingly at risk from erosion, with 8 in the short-term and 11 in the medium to longer-term, predominantly residential properties.

## Point Leo

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Very low	Very low	Low
EROSION	Low	Low	Medium
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	Very low	Very low	Very low

Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Point Leo Boat Club and caravan parks (40% in the medium- to long-term)
- utility infrastructure – small sections of drainage
- coastal dune vegetation and habitats (incl. coastal headland scrub)
- Western Port Ramsar Wetland

## Merricks

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Very low	Very low	Low
EROSION	Very low	Low	Low
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	Very low	Very low	Very low

Limited assets and values are at risk within Merricks. There are very few at risk buildings, facilities, and utilities across all hazard types.

Key environment and cultural values at risk include:

- coastal dune vegetation and habitats (including small portions of coastal banksia woodland and urban and paddock trees)
- Western Port Ramsar Wetland

## Merricks Beach

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Very low	Very low	Low
EROSION	Low	Medium	High
PERMANENT INUNDATION	Low	Low	Low
GROUNDWATER	Low	Low	Low

Key assets and values increasingly at risk include:

- public and recreational facilities
- beach access and pedestrian routes
- utility infrastructure – across all networks including roads and drainage, electricity, sewerage and water
- coastal dune vegetation and habitats (including small portions of coastal banksia woodland and urban and paddock trees)
- Western Port Ramsar Wetland
- public and private buildings – with 23 buildings at risk from erosion in the short-term through to longer-term, almost 10% of General residential-zoned buildings in Merricks Beach.

## Balnarring Beach

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Medium	Medium	Medium
EROSION	High	High	Extreme
PERMANENT INUNDATION	Low	Low	Medium
GROUNDWATER	Very low	Very low	Very low

Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Balnarring Yacht Club and the caravan park
- beach access and pedestrian routes (over 50% the network)
- utility infrastructure – across all networks including roads and drainage, electricity, sewerage and water. In the longer-term, 10% to 20% of Balnarring Beach's electricity, sewerage and water networks are at risk to erosion.
- coastal dune vegetation and habitats (particularly coastal bird habitats, coastal banksia woodland, urban and paddock trees and saltmarsh and reedbeds)
- Western Port Ramsar Wetland
- public and private buildings – with almost 20 buildings at risk to erosion in the short-term and over 60 in the medium to longer-term, almost 15% of General residential-zoned buildings in Balnarring Beach.



## Somers

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Very low	Low	Low
EROSION	High	High	Extreme
PERMANENT INUNDATION	Medium	Medium	Medium
GROUNDWATER	Low	Low	Low

Key assets and values increasingly at risk include:

- public and recreational facilities – incl. Somers Yacht Club
- beach access and pedestrian routes (over 20% the network)
- utility infrastructure – across all networks including roads and drainage, electricity, sewerage and water. In the longer-term, 5 to 10% to 20% of Somers' electricity, sewerage and water networks are at risk to erosion.
- coastal dune vegetation and habitats (particularly coastal bird habitats, coastal banksia woodland, coastal saltmarsh/saltmarsh and reedbeds)
- Western Port Ramsar Wetland
- public and private buildings – with over 110 buildings at risk to erosion in the short-term and over 140 in the medium to longer-term, over 12% of General residential-zoned buildings in Somers.

## Subarea 5

STORM-TIDE INUNDATION			EROSION			PERMANENT INUNDATION			GROUNDWATER		
Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term	Short-term	Medium-term	Long-term
Low	Medium	Medium	Low	Low	Medium	Medium	Medium	Medium	Low	Low	Low

This northeastern stretch of the Peninsula coastline adjoining Western Port Bay from Stony Point to Somerville is characterised by its coastal wetlands, saltmarsh and mangroves.

Values, uses and infrastructure in the area include:

- internationally recognised intertidal mudflats for flora and fauna, forms a large portion of the Western Port Ramsar Site
- Culturally significant and sensitive sites and places, important to the Bunurong/Boon wurrung peoples
- Recreational uses, numerous jetties and piers for fishing, boating, wildlife spotting, Warringine Park boardwalk through the wetlands

Built infrastructure and facilities:

- Port areas at Hastings and Crib Point are key economic assets
- Passenger ferry at Stony Point Pier to French Island and Phillip Island
- roads and utilities, including the Hastings substation, also community buildings (e.g. yacht clubs, marinas)
- private residential dwellings and properties

Coastal hazards will likely impact the area, especially permanent inundation in the short to longer-term. Erosion and storm-tide may also increase in the medium to longer-term

Hazard exposure and risk is likely to increase into the future. This may see impacts to public facilities, private dwellings, services, industry, infrastructure (drainage, sewage, water and electricity), vegetation (mangrove shrubland and coastal saltmarsh), coastal bird habitats, significant areas (national park and Ramsar site), marine national parks and Ramsar, cultural and heritage assets and natural dune, cliff and foreshore buffers.



### Crib Point / Stony Point

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Low	Medium	Medium
EROSION	Low	Low	Medium
PERMANENT INUNDATION	Low	Low	Medium
GROUNDWATER	Low	Low	Low

Key assets and values increasingly at risk include:

- coastal vegetation and habitats (particularly coastal bird habitats, coastal saltmarsh, mangrove shrubland and estuarine scrub)
- Western Port Ramsar Wetland
- Small sections of utility infrastructure – roads and trails
- public and private buildings – with storm-tide and permanent inundation risks in the medium term to longer term (up to 6)



### Bittern

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Very low	Very low	Low
EROSION	Very low	Very low	Low
PERMANENT INUNDATION	Medium	Medium	Medium
GROUNDWATER	Low	Low	Low

Key assets and values increasingly at risk include:

- coastal vegetation and habitats (particularly coastal bird habitats, coastal saltmarsh, mangrove shrubland, estuarine scrub and swamp scrub). Permanent inundation
- Western Port Ramsar Wetland
- Small sections of utility infrastructure – roads and trails

Limited built assets and values are at risk within Bittern.

## Hastings

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Medium	High	High
EROSION*	Medium*	High*	High*
PERMANENT INUNDATION	Medium	Medium	High
GROUNDWATER	Low	Low	Low

\*Note – Limitations in available erosion data for this region (modelling assumption regarding existing coastal structures) has meant some at-risk values and assets have not been accounted for in the standard risk assessment. Potential erosion risk has been estimated for these areas.

Key assets and values increasingly at risk include:

- public and recreational buildings and facilities – incl many along the Hastings foreshore (Hasting Marina, Hasting Jetty, the Hastings Boat Ramp, Yacht club, Pelican Park Recreation Centre and Information centre buildings)
- beach access and pedestrian routes
- former landfill situated in foreshore areas - flooding and erosion may result in waste/contaminant exposure and/or mobilisation with potential impacts to public health and sensitive ecosystems
- utility infrastructure – across all networks including roads and drainage and sewerage, and smaller sections of electricity, and water
- coastal vegetation and habitats (particularly coastal bird habitats, coastal saltmarsh, mangrove shrubland, estuarine scrub and swamp scrub)
- Western Port Ramsar Wetland
- public and private buildings – Storm-tide inundation sees nearly 6 at risk residential/commercial buildings in the short term, while in the longer term, over almost 20 in the medium to longer-term. Many of these same buildings will also be at risk of erosion. Permanent inundation also sees a number of buildings at risk in the medium to longer- term.



## Tyabb

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Very low	Very low	Low
EROSION	Very low	Very low	Low
PERMANENT INUNDATION	Low	Medium	Medium
GROUNDWATER	Low	Low	Low

Key assets and values increasingly at risk include:

- coastal vegetation and habitats (particularly damp sands herb-rich woodlands, mangrove shrubland, swamp scrub and coastal saltmarsh)
- Western Port Ramsar Wetland
- Small sections of utility infrastructure – roads and trails

Limited built assets and values are at risk within Tyabb.

## Somerville

	Short-term	Medium-term	Long-term
STORM-TIDE INUNDATION	Very low	Very low	Medium
EROSION	Very low	Very low	Low
PERMANENT INUNDATION	Medium	Medium	Medium
GROUNDWATER	Low	Low	Low

Key assets and values increasingly at risk include:

- coastal vegetation and habitats (particularly coastal bird habitats, coastal saltmarsh and mangrove shrubland)
- Western Port Ramsar Wetland
- Yaringa Marine National Park
- Small sections of utility infrastructure – roads and trails, electricity
- public and private buildings – with storm-tide risk to 5 buildings in the short-term increasing in medium to longer term (up to 12). Permanent inundation poses risks to several buildings in the longer term.

## Key findings and next steps

- Region-wide coastal hazard adaptation response/s will be essential for the Mornington Peninsula
- In the long-term, all of the Shire's coastal communities will require comprehensive adaptation planning
- Some initial focus areas (townships) have been identified for further assessment and adaptation planning in next project stages (below)
- Further localised geological and geotechnical assessments, in particular within subareas 4 and sub area 1, is necessary to confirm estimated erosion prone areas and risk for these areas.
- Further localised inundation/flood modelling and assessment incorporating overland flow flooding and drainage network capacity, particularly in subareas 1, 2 and 3, where impacts of combined catchment and coastal inundation events are wide-reaching.

## Key outcomes from Stages 1 to 4 include:

**A community values appreciation** - These values have been embedded in all stages of the technical work to date. They will also inform the Coastal Strategy and action development.

**Coastal hazard extents and maps for the Shire** - to visualise current and future erosion, sea level rise and storm tide inundation, and groundwater hazards and to assess potential implications.

**A risk and vulnerability assessment**, including:

- Qualitative exposure and risk for each hazard type
- Consequence assigned to all assets/value in database
- Risk (likelihood x consequence) assessed for built and natural assets at the regional and locality scales, for multiple planning horizons.
- An understanding of risk profile for different sub areas and townships of the Mornington Peninsula
- Economic base case – economic analysis to assess economic cost of non-intervention, at a regional scale

## Focus areas for assessment and planning include:

**Safety Beach (subarea 2)**, which faces increasing inundation risks, particularly via waterways. Buildings are increasingly at risk to storm-tide - nearly 80 buildings at risk in the short term, and over 600 buildings in the longer-term (incl. almost 20% of General residential). Shallow groundwater sees almost 1400 residential/commercial buildings at risk in short to longer term.

**Rosebud (subarea 2)**, which faces increasing inundation risks. It has nearly 100 buildings at risk to storm-tide in the medium term, while in the longer term, over almost 600 buildings at risk (incl. over 25% of General residential and almost 30% of commercial-zoned buildings). Shallow groundwater also sees over 1000 residential/commercial buildings at risk in short to longer term.

**Mornington, Mount Eliza and Mount Martha (subarea 1)**, which face both increasing inundation and erosion risks. Combined catchment and coastal events in these area sees extensive inundation in both coastal and inland areas of these towns, linked to drainage network capacity and catchment hydrology. Cliff erosion and shoreline stability also pose increasing risk to some foreshore buildings and assets in the short-term. Erosion risk continues to emerge, reaching residential properties in the medium to longer-term. Important environmental and cultural values are also at risk.

**Somers, Flinders and Balnarring Beach (subarea 4)**, which face increasing erosion risks. They have high erosion risk ratings in the short-term increasing to extreme in longer-term, with almost 300 at risk residential and/or commercial buildings combined across these townships in the longer-term. Important vegetation, habitat, Ramsar Wetlands, and areas associated with First Nations culture are vulnerable.

**Hastings (subarea 5)**, which faces both increasing inundation (both temporary and more permanent) and erosion risks, particularly around the Hastings foreshore reserve and surrounding areas. These areas also hold various important assets and services key to liveability, economy and enjoyment of Hastings township. Unique and special coastal and marine vegetation and habitats are also at risk including Ramsar Wetlands, and areas associated with First Nations culture. A historical landfill in foreshore areas poses further risks.

**Portsea (subarea 3)**, which faces increasing erosion and inundation risk and has experienced coastal erosion in recent times. Temporary protective sandbags are currently in place adjacent the pier. A prime tourism destination, the coastal open space supports multiple land uses and experiences.

**Sorrento (subarea 3)**, which faces increasing erosion and inundation risk. Sorrento attributes the Shire's largest beach visitation expenditure of \$135M annually, with future erosion risk primarily focused on public infrastructure that potentially support tourism.

The emerging risk profile from short to longer-term is not linear with a notable step-change for some hazards and asset types, particularly between medium and longer-term sea levels rise projections. This indicates a good opportunity to undertake adaptation over coming decades, to mitigate the step-change before it occurs and avoid (or minimise) associated impacts.

Next stages (5 to 7) of the Our Coast Our Future Coastal Strategy will explore and develop the strategic adaptation responses, and associated adaptation actions, across sub-areas and townships of the Shire.

This includes the development of a **Coastal Hazard Adaptation and Resilience Plan (CHARP)**.