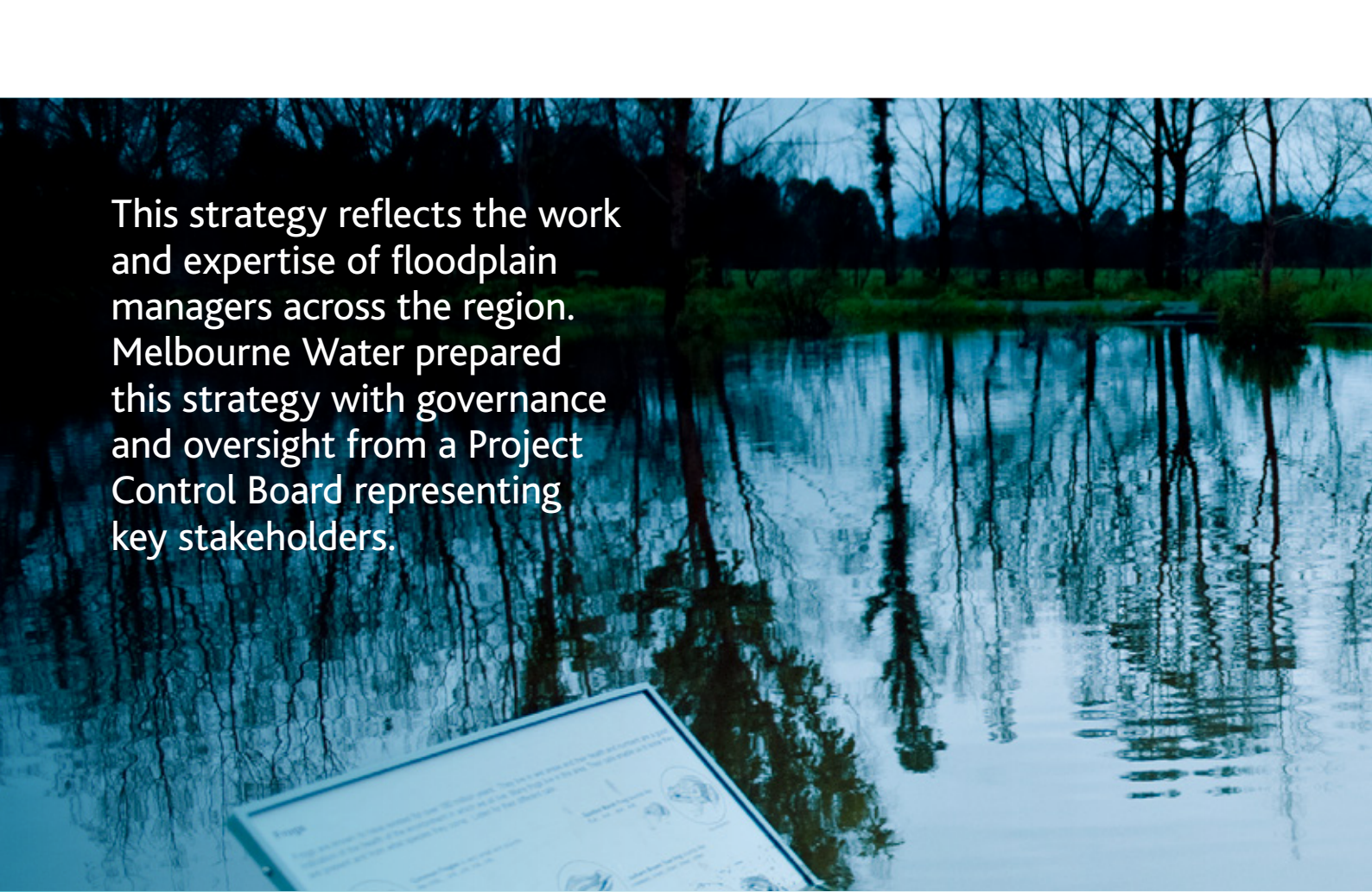




# Draft Flood Management Strategy

## Port Phillip and Westernport





This strategy reflects the work and expertise of floodplain managers across the region. Melbourne Water prepared this strategy with governance and oversight from a Project Control Board representing key stakeholders.

## ACKNOWLEDGEMENTS

Our Flood Strategy Project Control Board included representatives from:

Bureau of Meteorology	Insurance Council of Australia
City of Kingston	Melbourne Water
City of Melbourne	Metropolitan Planning Authority
City West Water	Municipal Association of Victoria
Department of Environment, Land, Water and Planning	South East Water
Department of Health and Human Services	Victoria State Emergency Service
Emergency Management Commissioner (Chair)	Wyndham City Council

Melbourne Water thanks everyone for their involvement; it means we now share a vision and an understanding of the challenges facing our region and the best ways to address them.



# Contents

<b>PREFACE</b>	<b>2</b>
----------------	----------

## **SECTION 1**

<b>Introduction</b>	<b>3</b>
Why we need a flood strategy	3
About the Port Phillip and Westernport region	5
Building on progress so far	6

## **SECTION 2**

<b>A shared vision for Port Phillip and Westernport</b>	<b>7</b>
Targets	8

## **SECTION 3**

<b>Flooding in our region</b>	<b>10</b>
The impact of floods	11
Managing large and small floods	16
How flooding is managed	18
Who participates in floodplain management?	19

## **SECTION 4**

<b>Objectives, targets and actions</b>	<b>20</b>
Understanding the risk and sharing information	21
Taking action to manage current and future risks	27
Working together to improve our effectiveness	34

## **SECTION 5**

<b>Delivering this strategy</b>	<b>36</b>
Review process	36
Endorsement and participation	37
Oversight	37
Monitoring and reporting	37
Implementation	37

## **APPENDIX 1**

<b>Flood management roles</b>	<b>38</b>
-------------------------------	-----------

<b>GLOSSARY</b>	<b>40</b>
-----------------	-----------

<b>ACRONYMS</b>	<b>42</b>
-----------------	-----------

<b>BIBLIOGRAPHY</b>	<b>42</b>
---------------------	-----------



## Preface

---

Melbourne Water prepared this draft strategy by consulting widely.

Consultation included discussions and workshops with many stakeholders including state government departments, councils, emergency service organisations, and communities.

Most government agencies with a role in flood management for the Port Phillip and Westernport region contributed their expertise. This strategy reflects the effort and activities of floodplain managers across the region. (Throughout this strategy 'we' refers to all relevant flood management agencies.)

Your feedback on this draft including our proposed direction, actions and targets, will inform development of a final strategy.





## SECTION 1

# Introduction

---

### Why we need a flood strategy

Flooding is natural and inevitable. Like fire and other natural hazards, it is a part of the Australian landscape.

Floods are a natural occurrence in the Port Phillip and Westernport Region. We can't stop them happening, but we can plan for and manage the risk.

This strategy sets out how we will work to understand, avoid and reduce flood risks, and how we can support flood-emergency preparation and response, across the region.

It sets out a vision for the Port Phillip and Westernport region, and creates a framework to help guide the work of the many organisations managing flood risks to deliver on this vision. This strategy will inform current and future approaches to research, flood planning and investment, and engaging with communities.

While this strategy discusses all aspects of flooding in our region, its key focus is flood prevention and risk-reduction activities. These are often referred to as 'floodplain management'. These activities support other aspects of general flood management including emergency response and recovery, and planning for natural environments and liveability. This strategy is part of the Victorian 'all hazards, all agencies' approach to emergency risk assessment, prevention, preparedness, response and recovery.

## The focus of this flood management strategy



(There is more information about the organisations contributing to prevention, response and recovery throughout this document. Appendix 1 shows a summary of flood management roles.)

## About the Port Phillip and Westernport region

Our region is home to over four million people. It is densely covered with homes, businesses, agricultural land, and infrastructure.

The region's population is expected to almost double by 2050<sup>1</sup>. This means that floods have the potential to affect a great number of people and assets.

### The Port Phillip and Westernport region, Victoria

Our region covers approximately 13,000 square kilometres, extending from high in the Yarra Ranges to the east, to Ballan in the west, to Kinglake in the north, and south to include Mornington Peninsula, and Phillip and French Islands.

Approximately 130,000 properties are known to be affected by floods. (More information about the number of properties at risk is available on page 11.)

The consequences of floods are serious for people living in affected areas, and can have major economic repercussions for the state.<sup>2</sup> As the region continues to grow, we need to manage the risks to avoid new or increased hazards to people, and minimise property and environmental damage, economic costs, and disruption to communities.

Our region is unique in Victoria because of the many different organisations that work together to manage flood risks, including 38 councils, retail and wholesale water authorities, and policy, planning and emergency management agencies.

1. *Plan Melbourne 2013, Victoria in Future 2014*

2. *Victorian Economic and Financial Statement 2011*

The region includes five major river basins: the Werribee, Maribyrnong and Yarra Rivers, Dandenong Creek, and the Westernport river systems.

#### Legend:

- Region
- Major waterways
- River basins
- Established urban area
- Growth corridors



## Building on progress so far

This strategy builds on progress delivered under the 2007 *Flood Management and Drainage Strategy*.

### Outcomes of the 2007 strategy include:

#### Improved knowledge

- Improved knowledge of regional flood risks through ongoing flood modelling and mapping, development of a standardised risk assessment framework, and ongoing inclusion of flood information in planning schemes and growth corridor plans.

#### Improved understanding

- Improved understanding of the potential future pressures on existing drainage systems resulting from predicted climate change and increased development in established urban areas.

#### Local flood management plans and improved collaboration

- Progress toward agreed approaches to the management of existing regional flooding problems and improved collaboration, through development of local flood management plans for every municipality in the region.

#### Reduction of 'intolerable' flooding

- Reduction of 'intolerable' flooding by 10% across the region through measures to decrease either likelihood or impact, including a number of major drainage system upgrades, education programs, and warning systems.

#### Local flood and drainage infrastructure upgrades

- Delivery of a wide range of localised flood and drainage infrastructure upgrades to support local risk reduction and development.

#### Enhanced community education, awareness and preparedness

- Enhanced community education, flood awareness and preparedness in partnership with VICSES and councils.

#### Expanded network of streamflow gauges and flood warning services

- An expanded and maintained network of streamflow gauges, and ongoing provision of targeted flood warning services in partnership with BoM and VICSES.

### Updated flood mapping and ongoing development advice

- Ongoing updates to planning schemes to include flood mapping, and ongoing development advice to councils and landowners where new developments could be affected by flooding.

The experience and working relationships developed through delivering the 2007 strategy have highlighted challenges for the region, and opportunities to keep improving our service.

### Challenges and opportunities include:

#### Infrastructure upgrades

- Infrastructure upgrades have been targeted at the highest-priority and best-value locations, and designed to be as cost-effective as possible; however, they are generally very expensive. As we work to address risks in areas where infrastructure upgrades are more difficult, the cost of traditional infrastructure works could outweigh the benefit. We need to consider all available tools to build resilience and deliver good value flood risk management, tailored for each location and community.

#### Catchment scale issues

- Catchment scale issues including integrated water management, land use and development planning, and drainage management are critical to effective flood management. They can be key drivers of both flood risks and flood solutions. Coordinating activities in all these areas will support good outcomes in the long term.

#### Supporting emergency response and recovery preparation

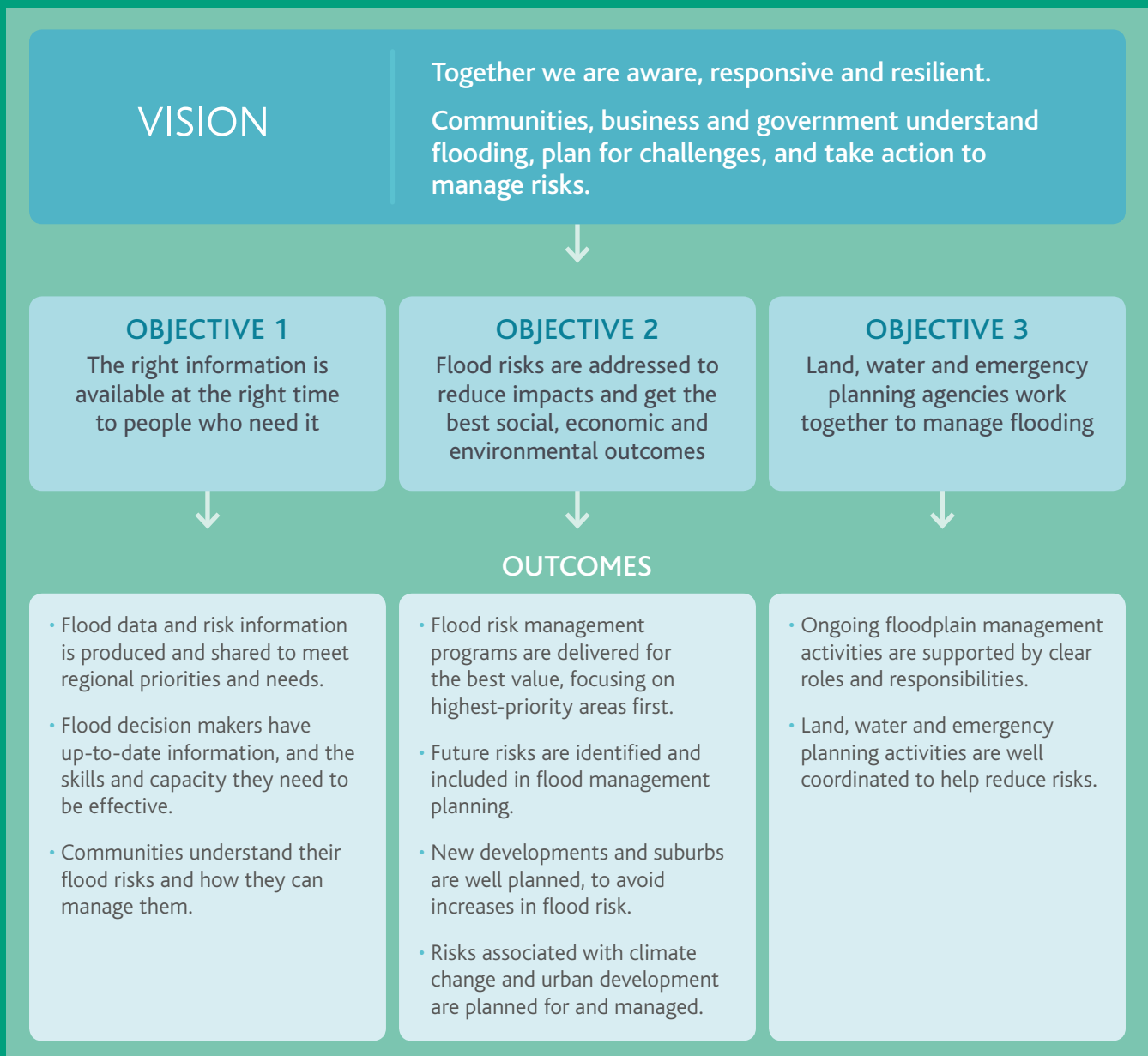
- As we cannot remove all flood risks, well-prepared and aware communities and emergency response services are essential; they can help reduce the impact of floods and speed up recovery, improving resilience. Floodplain management activities need to support emergency response and recovery preparation, and help build resilience.

To meet emerging challenges and to continue delivering services effectively, the flood managers contributing to development of this strategy have identified ongoing communication, greater collaboration, and more transparent decision making and planning by all stakeholders as key areas for focus.



## SECTION 2

# A shared vision for Port Phillip and Westernport



## Targets

Targets have been developed to track critical indicators of progress toward the vision and objectives.

While each target has a primary relationship with one objective, they work together as a group to track how implementation of the overall strategy is delivering the vision and the three objectives. The objectives and targets track the outcome of work by many organisations.

Objective	2021 targets*	More information
<b>1. The right information is available at the right time to people who need it</b>	<p>1a 65% of catchments and coasts are flood-mapped, and current and future risks are assessed to an agreed standard, starting with priority catchments; information is made publicly available.</p> <p>1b 100% of available public flood risk information is made accessible to help everyone understand and manage their flood risks.</p> <p>1c 30% of people directly affected by flooding are aware of their flood risks and know what to do. (Effort is targeted at highest-risk areas first).</p>	<p>Progress in mapping and understanding flood risk, and sharing information, is an essential outcome.</p> <p>This strategy outlines actions to ensure ongoing mapping and risk assessment produces the right information for our region, and that it is shared. We aim to complete all remaining mapping and risk assessments as soon as practical, and continue to update them over time.</p> <p>Flood information will be made as accessible as possible to the general public through improved design and availability, supporting people to find and use the information they need.</p> <p>Research indicates that public awareness of flood risk is low, and many people do not realise they could be at risk. Targeted awareness-raising will be undertaken to improve awareness and preparedness, reducing flood risks and impacts. We will work to increase awareness in highest-risk areas first, and improve awareness everywhere over time.</p>
<b>2. Flood risks are addressed to reduce impacts and get the best social, economic and environmental outcomes</b>	<p>2. Agreed flood management approaches are being delivered in 100% of highest-priority areas to address the likelihood or consequences of flooding.</p>	<p>This target tracks our progress in developing and implementing agreed flood management solutions in the areas where they are needed most.</p> <p>Actions in this strategy outline how priorities will be agreed, and how flood management decisions will be made, to make best use of available funds.</p>
<b>3. Land, water and emergency planning agencies work together to manage flooding</b>	<p>3. By 2021, locally and regionally appropriate flood management approaches will be collaboratively developed for 40% of catchments and coasts, taking into account current and future risks.</p>	<p>This target measures our progress in planning for the present and future across the entire region.</p> <p>All stakeholders influencing flooding will need to work together to ensure flooding is managed across the region, and take actions required now to ensure risks do not get worse in future.</p>

\* Baseline data is now being collated. Targets and Melbourne Water's contribution to delivering them will be finalised using this data and feedback on this draft strategy.

These targets require input from all flood management stakeholders. Melbourne Water's estimated contribution is outlined below.

Melbourne Water will also continue a wide range of related flood management activities including actions outlined in this strategy to continue delivering effective floodplain management services for the region.

2050 outcomes	Melbourne Water contribution to 2021 targets
100% of catchments and coasts are flood-mapped, and current and future risks are assessed to an agreed standard; information is made publicly available.	1a MW will lead mapping and risk assessments to agreed standards, for prioritised catchments across the region. A whole-of-catchment approach will be taken wherever possible.
100% of available public flood risk information is made accessible to help everyone understand and manage their flood risks.	1b MW will lead a review and update of all MW-generated flood information and sharing processes.
100% of people directly affected by flooding are aware of their flood risks and know what to do.	1c MW will contribute to development and delivery of a regional community planning and education program delivered by VICSES, targeting areas identified as most urgent or at greatest risk.
Agreed flood management approaches are delivered in all catchments and coasts, taking into account local and regional needs, and current and future risks.	2. MW will continue to develop and implement flood management approaches in the region's highest priority areas. We will work with all stakeholders to achieve this target. Developing and agreeing on appropriate approaches in each location will require input from all participating stakeholders.
	3. MW will support development of flood management solutions across the region, in collaboration with councils, VICSES, and other stakeholders. Delivery of this target will require participation by everyone.

## Key terms

### Highest-priority areas

Highest-priority areas will be developed for the region in collaboration with government stakeholders and communities. (More on this process is outlined in actions on page 21 and 28).

### Flood awareness

Flood awareness describes public and community knowledge of local risks and the possible impacts of flooding, and individuals' understanding of how they can manage their own risks.

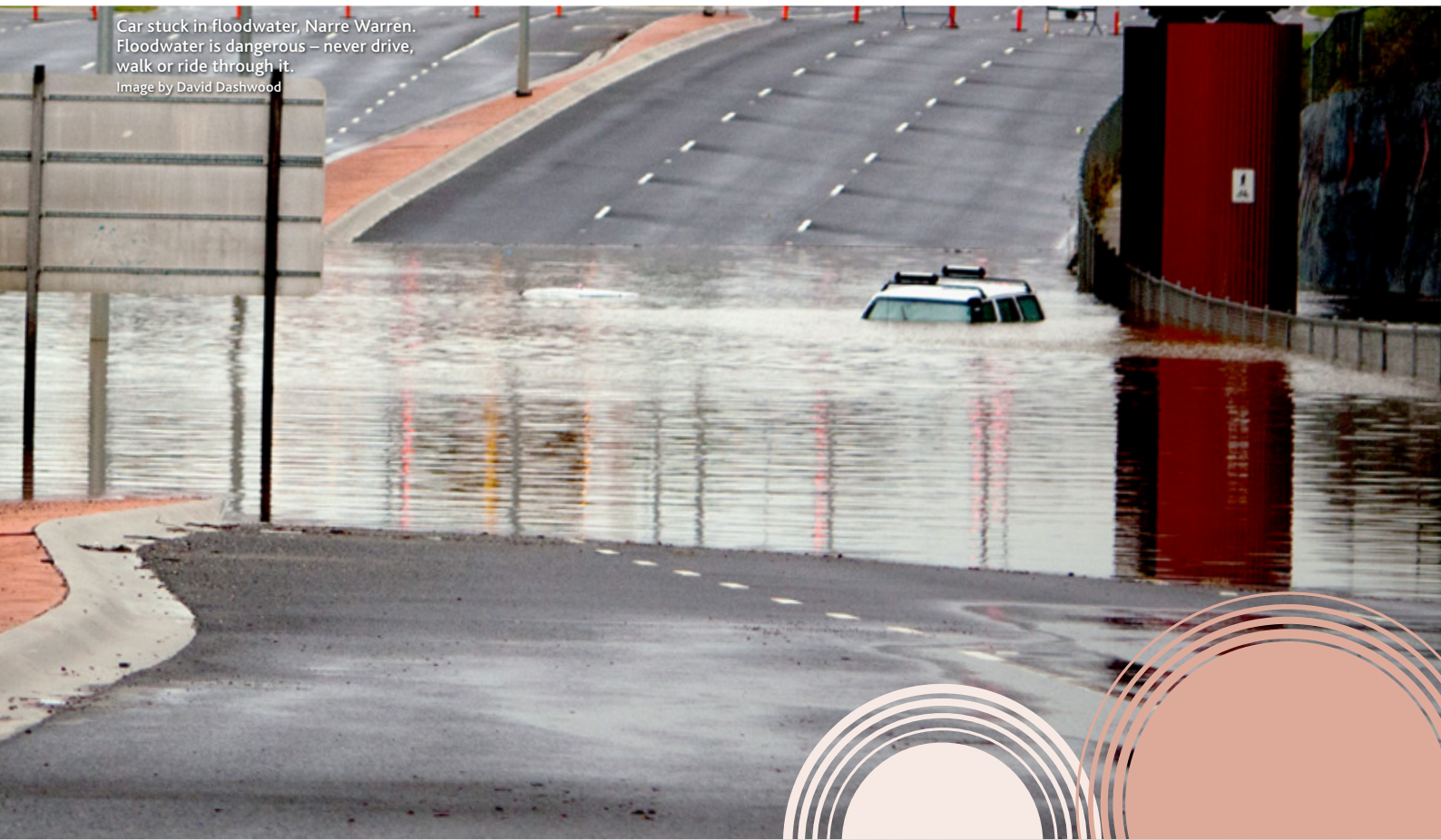
### Locally and regionally appropriate flood management approaches

Appropriate approaches to minimise current or future flood risks in a local area, considering regional needs. Flood management approaches are developed by flood managers working with local communities to determine the most effective and viable methods to reducing flood risks and their impacts.

(See the glossary on page 40).



Car stuck in floodwater, Narre Warren.  
Floodwater is dangerous – never drive,  
walk or ride through it.  
Image by David Dashwood



## SECTION 3

# Flooding in our region

This section outlines the impact of flooding in our region, and the framework we use for managing flood risks.

### A short history of flooding in Port Phillip and Westernport

Aboriginal inhabitants of our region harvested food and other resources from waterways and floodplains. Floodplains retain important cultural significance.

Later European settlement and urban development occurred within floodplains due to their fertile soils and access to water. This has placed buildings and people in the path of flooding.

We have also increased the volume of floodwater by clearing forests and developing land; water now flows more swiftly off the surface of cleared and paved landscapes, instead of filtering into soils.

Drainage systems built as part of early developments were not designed to hold the volumes of water we now know can flow through our landscape. When there is more runoff than underground drains can carry, water overflows onto surrounding land, flooding roads and properties.

Urban development standards for flooding were improved in the 1970s, when new suburbs were required to provide space for floodwaters to be stored, and to flow overland. Suburbs built after the 1970s have a much lower risk of flood damage.

The history of the Port Phillip and Westernport region has been marked with many serious and damaging floods. In some locations small, frequent flooding causes significant local damage, inconvenience and disruption.

## The impact of floods

Floods are dangerous to people. Drowning and injury are serious risks, and floodwaters can become contaminated with sewage and other pollutants that pose health risks to people.

**There are currently approximately 130,000 properties that we know are at risk of flooding in our region.<sup>3</sup>**

Of these, it is estimated that approximately 15,000 properties include buildings that are at risk of flooding over the floor level.<sup>4</sup>

There are likely to be more properties at risk in areas where flood mapping is yet to be completed. More will be affected in the future if flood patterns change as a result of predicted climate change.

The average annual damage (AAD) costs of flooding in the Port Phillip and Westernport region are extremely high. Insurance industry information indicates that floods are our most expensive natural hazard.<sup>5</sup> (The personal costs and regional economic effects of flooding are not included in this AAD figure because accurate dollar values cannot be easily determined using the data we have available.)

The broader, indirect economic costs of floods have an impact on everyone.

Floodwaters can cause significant damage when very deep or widespread, or when moving quickly. Flooding deep enough to cover floors can cause extensive damage to buildings and public infrastructure; however, such large events are quite rare.

Smaller, more frequent floods do not generally cause as much physical damage, but the cumulative cost of repeated damage, disruption and social impacts (such as stress) can be very high.

The personal and social costs of flooding are less visible than safety hazards and physical damage, but are also very significant. Those who have suffered in floods report long-term stress and disruption from the flood itself, and from losing homes, vehicles, valued personal possessions, and serious disruption to daily life.

Floods and floodwaters can damage the natural environment, causing erosion, pollution, and ecological losses that may last much longer than damage to buildings and infrastructure. In some areas, floodwaters have environmental benefits; for example, providing natural seasonal changes in streamflow, replenishing water to natural floodplains, and supporting native vegetation.

### Flooding in Port Phillip and Westernport

This diagram shows current Melbourne Water flood mapping for a 1% AEP flood event. It does not include flood mapping undertaken by other authorities.

#### Legend:

- Floodplain
- Coastal floodplain
- Established urban area
- Growth corridors
- Melbourne Water region



3. This is the number of properties we know to be at risk from a 1% AEP flood event; that is, a flood with a 1% chance of occurring in any given year. These properties are at risk of floods that arise along waterways and regional drains. This number is drawn from flood mapping completed by Melbourne Water. More properties may be at risk along local drainage lines, and where mapping is yet to be completed.

4. This is a conservative estimate based on information currently held on Melbourne Water databases. The actual number of buildings that could be at risk of above floor flooding during a 1% AEP flood is likely to be higher, and will be determined as more data is collected and analysed.

5. *Flood Risk Management in Australia 2008*



## Past risk assessment

This diagram shows catchments where risk assessments have been made by Melbourne Water. Risk assessments are updated as better information becomes available.

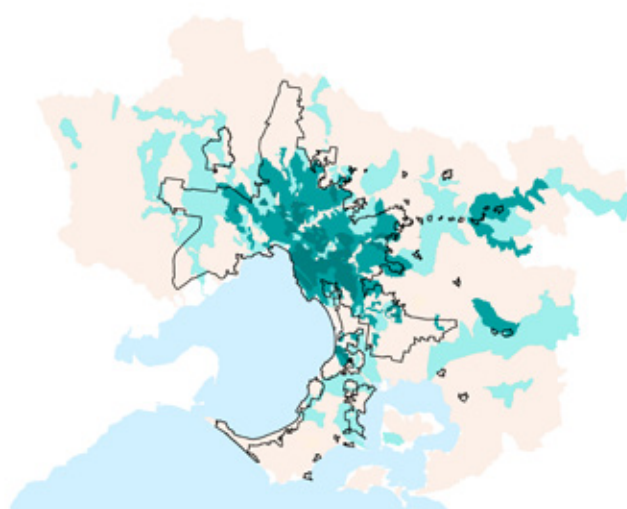
Risk assessment outcomes are shown for entire catchments, but the area actually at risk of flooding is much smaller. You can see a diagram of floodplains on page 11.

Risk assessments are made using a Flood Risk Assessment Framework that allows the likelihood and consequences of floods to be quantified in a consistent way. The framework considers a range of issues including:

- the possible size of floods past flooding
- how hazardous floods could be
- the number of properties affected
- potential physical damage
- local issues such as possible effects on vulnerable communities
- flood management measures already in place.

(More information about the framework and how we plan to update assessments and expand our approach to understanding flood risks is available on page 21).

Many flood management projects have been completed to reduce risks across the region; more information about regional flood management projects can be found at: [www.melbournewater.com.au](http://www.melbournewater.com.au)



### Legend:

- Urban growth boundary
- Catchment with extreme flood risk
- Catchment with high flood risk
- Catchment with medium flood risk
- Risk yet to be assessed

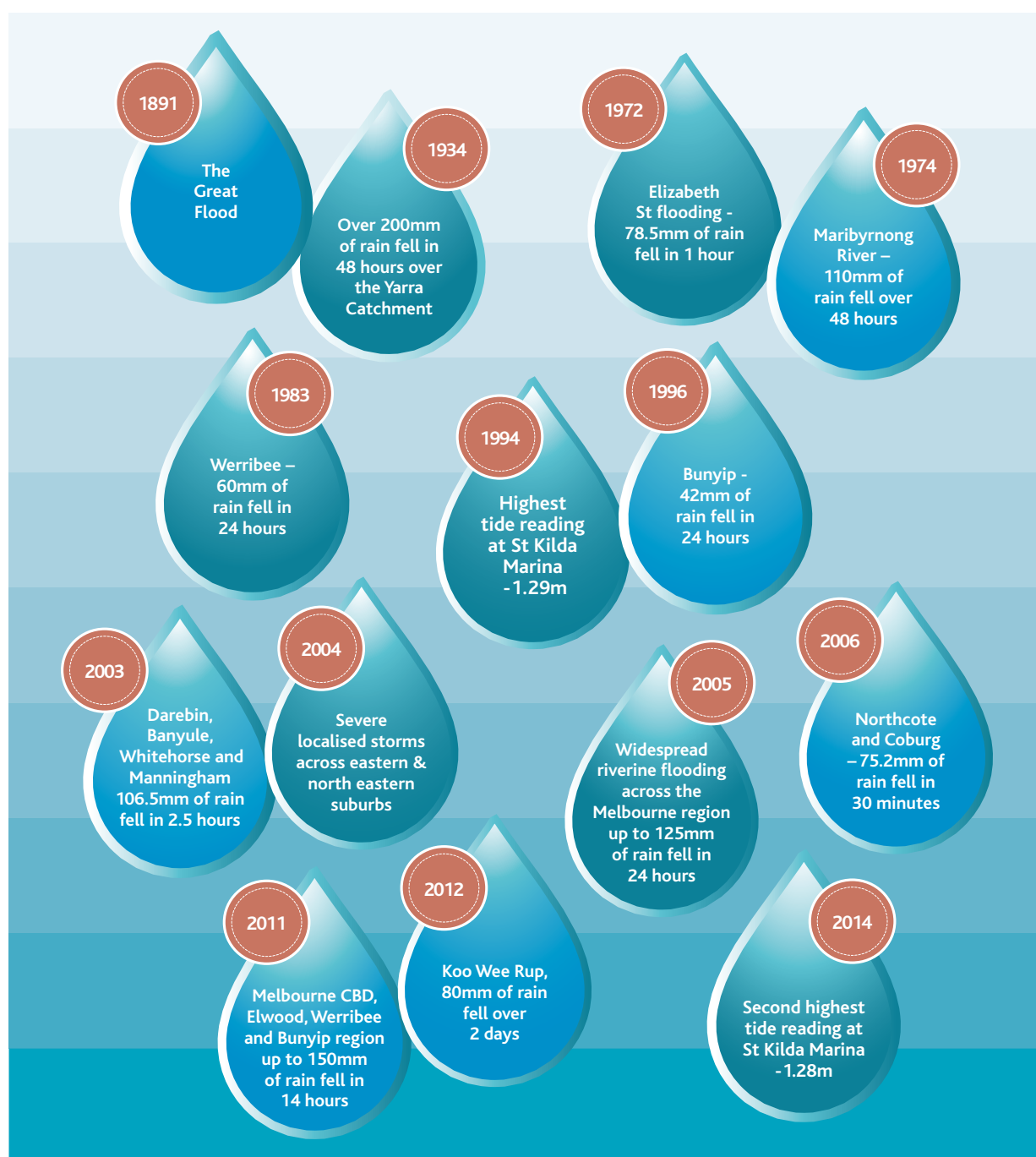




## HISTORY OF FLOODING

Below is a timeline showing some of the flooding that has occurred over the last 123 years and the changes in our approach to flood risk management.

### Port Phillip and Westernport Flooding Timeline



# What happens when it floods

Flooding is a part of the natural environment.  
We can't stop it, but we can manage the risk.



The Port Phillip and Westernport region is at risk of flooding and if we don't continue to manage these risks it could get worse. Within our region we know of approximately 130,000 properties at risk of flooding. Flooding is our most expensive natural hazard.

Flooding on Elizabeth Street, 1972



Flooded house, Elwood



A VICSES worker exits a flooded underground carpark, St Kilda



Road closures due to flooding, Narre Warren  
Image by David Dashwood

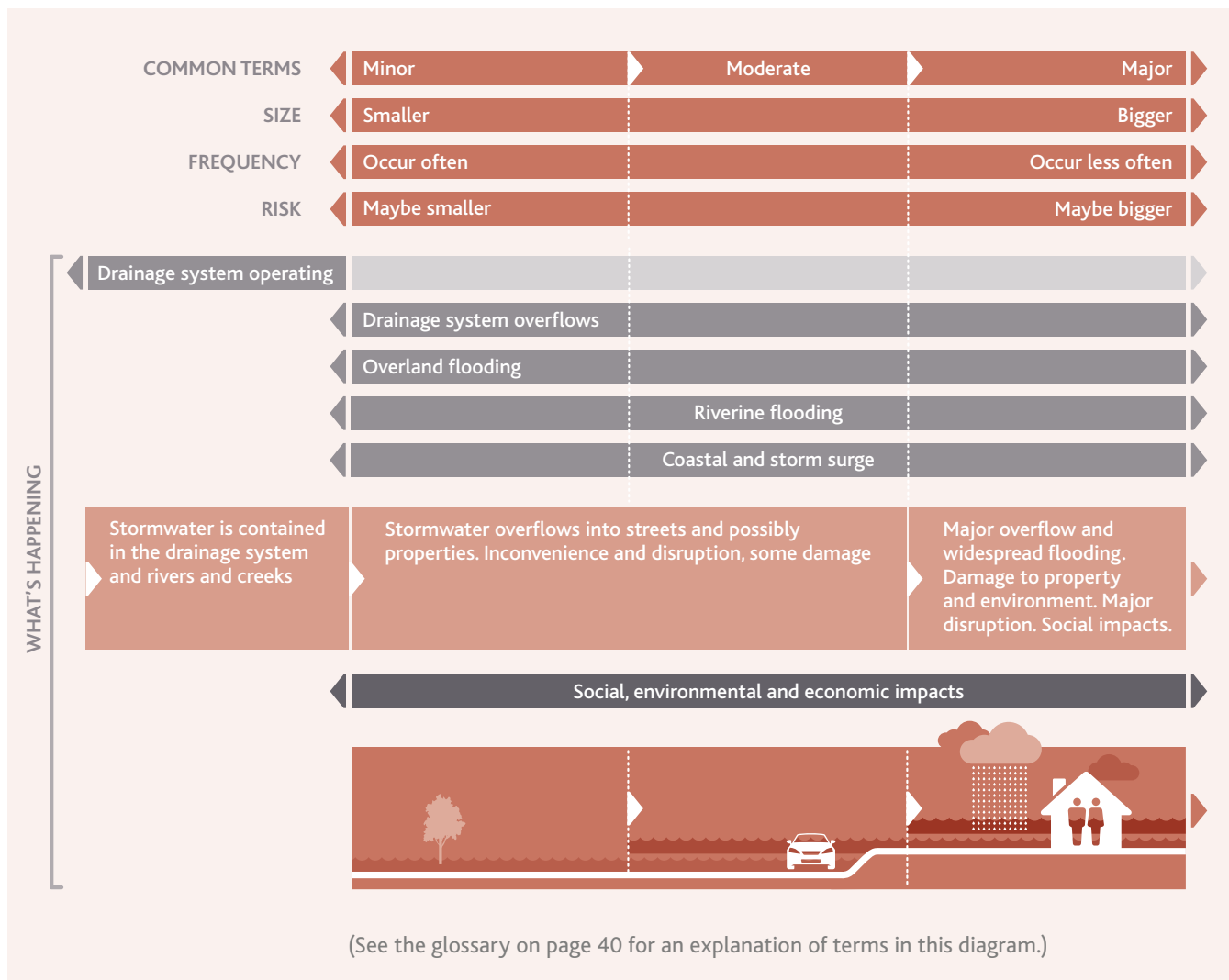




## Managing large and small floods

This strategy will help flood managers address all kinds of flooding, from the small and frequent floods to very large, infrequent floods

### Types of flooding and their effects:



## Common terms to describe severity of floods

There are a range of terms used to describe the scale or severity of floods. The terms below are used to describe the size of floods, and are often used in flood warning services and other public communication about flooding.

### Minor flooding

Minor flooding causes inconvenience. Low-lying areas next to waterways are inundated. Minor roads may be closed and low-level bridges submerged. In urban areas inundation may affect some backyards and buildings below the floor level, and affect some bicycle and pedestrian paths. In rural areas removal of stock and equipment may be required.

### Moderate flooding

In moderate flooding main traffic routes may be affected. Some buildings may be affected above the floor level. Evacuation of flood affected areas may be required. In rural areas removal of stock is required.

### Major flooding

Extensive rural areas and/or urban areas are inundated. Many buildings may be affected above the floor level. Properties and towns are likely to be isolated and major rail and traffic routes closed. Evacuation of flood-affected areas may be required. Utility services may be impacted.

These definitions are taken from the Bureau of Meteorology's Definitions of Terms Used in Flood Warnings (See the glossary on page 40.)

When describing the risk of floods, Melbourne Water currently uses the terms Extreme, High and Medium. These labels are applied where flood risk (including both the likelihood and consequence) has been assessed by Melbourne Water. The following sections outline how the current approach to understanding flooding and risk will be updated to better reflect all kinds of flooding.

## Types of flooding – where water comes from

### Overland flooding

Overland flooding occurs when runoff from storms exceeds the capacity of our drains and pipes, and overflows onto surrounding properties. Overland flooding can happen very quickly. Floods that rise very rapidly are often known as 'flash' floods.

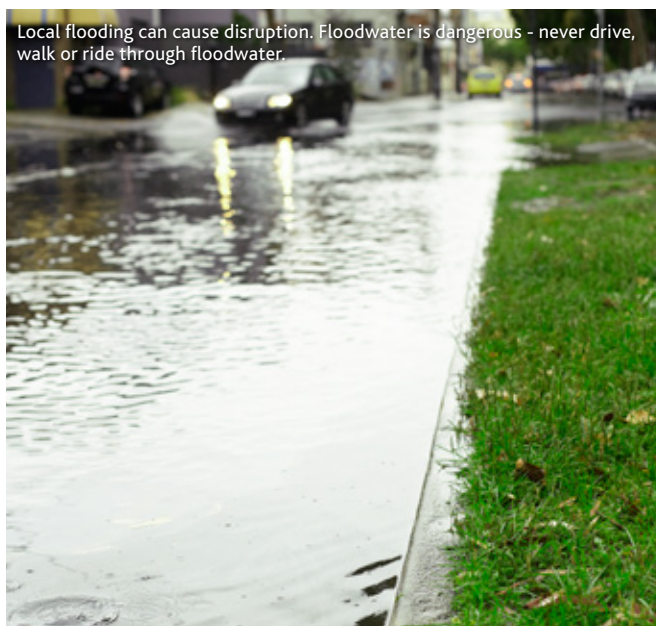
### Riverine flooding

Riverine flooding occurs when runoff from storms exceeds the capacity of a river or creek and overflows onto surrounding land.

### Coastal and storm surge flooding

Very high ocean tides occurring during storms can cause flooding along coasts and the lower reaches of rivers, particularly when combined with high rainfall.

Local flooding can cause disruption. Floodwater is dangerous - never drive, walk or ride through floodwater.



## How flooding is managed

Although we cannot 'fix' all flooding, we can work to reduce the likelihood of flooding in some locations, and minimise the impact when a flood does happen by being well prepared and ready to manage the consequences.

Flood risks in Port Phillip and Westernport are managed according to national and state best practice guidelines set out in the *Revised Draft Victorian Floodplain Management Strategy* and *Managing the floodplain* – a guide to best practice in flood risk management in Australia.<sup>6</sup> The table below summarises the floodplain management process in our region.

### The floodplain management process

Understand the risk	Objective 1
<ul style="list-style-type: none"> <li>• Mapping and assessing risks</li> <li>• Sharing information with those who need it</li> <li>• Engaging communities to understand risk and build resilience</li> </ul>	The right information is available at the right time to people who need it
Manage existing risks	Objective 2
<ul style="list-style-type: none"> <li>• Manage known risks making best use of resources</li> <li>• Avoid new risks by managing development</li> <li>• Plan ahead for future risks</li> </ul>	Flood risks are addressed to reduce impact and get the best social, economic and environmental outcomes
Work together to improve our effectiveness	Objective 3
<ul style="list-style-type: none"> <li>• Clarify roles where necessary</li> <li>• Improve coordination across all flood managers</li> </ul>	Land water and emergency planning agencies work together to manage flooding

This strategy sits within a framework of related policies and strategies that work together to help prevent and manage flooding, and support response and recovery.

	LAND & INFRASTRUCTURE	WATER & WATERWAYS	FLOODPLAIN MANAGEMENT	EMERGENCY MANAGEMENT	
State	<ul style="list-style-type: none"> <li>• Victorian Climate Change Adaption Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Water supply policy and IWM policies and plans</li> <li>• Victorian Waterway Management Strategy</li> </ul>	<ul style="list-style-type: none"> <li>• Revised Draft Victorian Floodplain Management Strategy</li> </ul>	<ul style="list-style-type: none"> <li>• Victorian Emergency Management Framework</li> <li>• State Flood Emergency Plan</li> </ul>	Implementation
Regional	<ul style="list-style-type: none"> <li>• Plan Melbourne</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Healthy Waterways and Stormwater Strategies</li> </ul>	<ul style="list-style-type: none"> <li>• Regional Flood Management Strategy</li> </ul>	<ul style="list-style-type: none"> <li>• Central Flood Emergency Plan</li> </ul>	
Local	<ul style="list-style-type: none"> <li>• Precinct Structure Plans</li> <li>• Municipal Planning Policies</li> </ul>	<ul style="list-style-type: none"> <li>• Municipal water strategies (where applicable)</li> </ul>	<ul style="list-style-type: none"> <li>• Municipal Flood Management Plans</li> </ul>	<ul style="list-style-type: none"> <li>• Municipal Emergency Management Plans</li> </ul>	

6. *Revised Draft Victorian Floodplain Management Strategy*, 2015, *Managing the Floodplain: a guide to best-practice flood risk management in Australia*, 2013

## Who participates in floodplain management?

Many organisations have a role in preparing for and managing flood risks, including activities in prevention, preparation, response and recovery; such as:

- **Melbourne Water (regional drainage and floodplain management authority):**

- > coordinates planning and delivery of flood management services at a regional level
- > manages waterways
- > contributes to development and implementation of integrated water management (IWM) knowledge and tools.

- **38 councils:**

- > manage local urban planning and building local drainage
- > support local community resilience
- > contribute to regional flood management
- > develop and implement local flood plans and IWM infrastructure as appropriate.

- **Retail water authorities:**

- > manage urban water resources
- > undertake technical research
- > develop and implement IWM infrastructure and tools with other stakeholders.

- **Victorian State Government departments and agencies:**

- > set policies and state guidelines for floodplain management, urban planning and development, and water resource management
- > support recovery from floods.

- **Emergency services agencies:**

- > lead emergency preparation and response
- > deliver community, education, awareness and preparation programs.

- **Federal Government organisations:**

- > set national policies and guidelines for flood and emergency management
- > coordinate national research and data
- > provide some funding for flood prevention and recovery activities.

- **Communities, individuals and businesses:**

- > responsible for understanding personal and local risks, and taking appropriate preparation and risk management steps
- > can contribute to development of local flood management plans and projects.

Melbourne Water retarding basin holding flood water, Narre Warren South.  
Image by David Dashwood







## SECTION 4

# Objectives, targets and actions

### Understanding the risk and sharing information

#### OBJECTIVE 1

The right information is available at the right time to people who need it

#### This section covers:

- Mapping and assessing risk
- Sharing information with those who need it
- Engaging communities to help them understand their risk and build resilience

#### RELATED TARGETS

**1a** By 2021, 65% of catchments and coasts are flood-mapped, and current and future risks are assessed to an agreed standard, starting with priority catchments; information is made publicly available.

**1b** By 2021, 100% of available public flood risk information is made accessible, to help everyone understand and manage their flood risks.

**1c** By 2021, 30% of people directly affected by flooding are aware of their flood risks and know what to do.

## Understanding the risk

The first step to manage flooding is to understand risk. Risk is the combination of the likelihood and consequence of flooding.<sup>7</sup>

We can model and map potential flooding to understand where floodwaters are likely to flow, how fast they might rise and fall, and how often. We can estimate the local impact using information about local communities and infrastructure.

We can then calculate risk in a particular location by combining the likelihood of flooding and information about the local consequences of floods. In our region, a Flood Risk Assessment Framework (FRAF) is used to analyse detailed information about the possible size and impact of floods in each catchment in a standardised and systematic way. In this way, we can quantify and compare risk in different locations.

This information allows us to prioritise our efforts and consider what kinds of management approach may be appropriate in each location.

## Flood mapping

Melbourne water undertakes flood modelling and mapping along regional waterways and drainage assets. Modelling has been completed across growth corridor catchments, and some mapping has been undertaken in approximately 64% of established urban catchments and rural catchments.

This work has focused on urban and intensively farmed areas where floods are expected to cause most damage. Detailed risk assessments have been completed in catchments where mapping is available, and where higher risks are more likely. Ongoing mapping and risk assessment is needed to fill gaps and upgrade data in line with new standards as they emerge.

Possible flooding from storm-tides and future sea level rise has been mapped for the whole Port Phillip and Westernport coastline.<sup>8</sup> (More information about future coastal risks is provided on page 33.)

Melbourne Water has a rolling program of mapping in place to fill the gaps in regional flood mapping, and update existing data to provide a more comprehensive picture of current and future risks across each catchment.

Flood mapping and risk assessment is yet to be completed for areas with low populations or little urban development, and for many local drainage systems.

## Next steps

1. **Prioritising and completing flood mapping and risk assessment studies** to address the most urgent information gaps. This includes understanding what level of information is required from rapid-response maps to highly detailed flood mapping.

Actions	Lead	Key participants
1.1 Facilitate and lead development of a new flood mapping prioritisation tool for the whole of our region, in collaboration with stakeholders, including communities. A new tool will address both urgency and levels of detail required, to ensure fit for purpose information is produced.	MW	Councils, VICSES, DELWP, MAV, MPA
1.2 Regularly prioritise mapping and risk assessment projects in consultation with stakeholders and local communities. (Prioritisation will be undertaken on a whole of catchment basis where possible).	MW	Councils, VICSES
1.3 Continue delivering priority mapping and risk assessment projects in consultation with stakeholders (on a whole of catchment basis where possible).	MW	Councils, VICSES
1.4 Continue contributing local and technical expertise, requirements and knowledge to regional prioritisation, and to mapping and risk assessment projects.	Councils, MPA	
1.5 Undertake additional local flood mapping and assessment if required due to local priorities, in consultation with stakeholders and local communities.	Councils	MW, VICSES

7. *Managing the Floodplain: a guide to best-practice flood risk management in Australia*, 2013

8 The Victorian Coastal Inundation Data Set produced through the government's Future Coasts program models and maps current and possible future coastal flooding. Melbourne Water has completed additional coastal flood mapping for Port Phillip and Westernport.



2. **Agreed mapping and risk assessment standards** and processes tailored to our region are needed to ensure we produce the right information as efficiently as possible.

Actions	Lead	Key participants
2.1 Lead review and update of modelling, mapping and risk standards and processes for our region, in alignment with state and national standards and in collaboration with stakeholders.	MW	DELWP, Councils, VICSES, BoM, other regional and technical authorities as required.
2.2 Participate in review and update of regional flood study standards and processes to help ensure new approaches can be applied in local as well as regional scales.	Councils	
2.3 Continue sharing mapping and risk assessment outcomes with stakeholders.	MW, Councils	

3. **Better data on existing drainage and flood assets and changing landscapes** is needed to inform ongoing asset management, and to underpin all flood mapping and management projects. (Good records of infrastructure were not kept during the early development of our region.)

Actions	Lead	Key participants
3.1 Continue and enhance collection and sharing of data of flood and drainage assets and land, to inform flood studies and asset management programs, and respond to new information requirements as they arise.	Melbourne Water, Councils, Retail Water authorities  (For assets under each agencies' control)	DELWP

**Outcome: Flood data and risk information is produced and shared to meet regional priorities and needs.**





## Sharing information

It takes the actions of many stakeholders to manage flood risks, and everyone needs to use good information.

Detailed flood information is required for managing existing risks, and for good urban planning, emergency planning, community education, and adaptation. These activities are undertaken by many organisations. Critical infrastructure and service providers need information on flooding to enable them to design and provide resilient services.

State government departments, councils, and emergency services all share flood mapping and risk information to support flood risk reduction and to plan for flood emergencies.

Information is currently shared through many channels including:

- Annual flood updates for councils from Melbourne Water
- Collaborative development of Local Flood Management and Flood Emergency Plans
- Ongoing knowledge sharing and capacity building programs run by government and research organisations
- Flood information included in municipal planning schemes and policies

- MW provision of flood mapping information to the Victorian Flood Database
- Ongoing flood information updates from Melbourne Water to VICSES
- Flood warning systems
- Emergency planning processes
- Project-based information sharing between Melbourne Water, councils, BoM, and VICSES
- Development advice to landowners
- Statutory public information processes such as planning schemes, property information statements and flood level advice
- Provision of flood mapping to the insurance industry through the Insurance Council of Australia (ICA).

Continued information sharing is essential, and there are opportunities to improve current processes.

Community education and awareness programs are a critical aspect of information sharing. (The ongoing delivery and improvement of community awareness programs is addressed in more detail in the following section.)

## Next steps

4. **Building knowledge and skills** will help all stakeholders keep up with a changing environment, new research, and new flood management approaches and technology. This is necessary to continue delivering good value and effective services.

Actions	Lead	Key participants
4.1 Identify and prioritise regional floodplain management knowledge and capacity gaps.	MW	DELWP, VICSES, Councils, MAV, technical and research authorities
4.2 Lead and facilitate targeted research and stakeholder capacity building programs to address priority gaps.	MW	DELWP, VICSES, Councils, MAV
4.3 Identify local or subject matter knowledge and capacity gaps, and coordinate with other authorities to help address them.	VICSES, Councils	MW, DELWP

5. **Learning from floods** when they do occur allows flood models and maps to be checked against real data, and supports ongoing improvement of emergency response and management processes. Ongoing information gathering from all participating authorities is required.

Actions	Lead	Key participants
5.1 Review what data is being collected by different organisations during and after floods, and identify further opportunities to collect and share data.	MW	VICSES, Councils, MAV
5.2 Facilitate data and information sharing following floods, and use new information to review and update flood models and emergency planning.	MW	Councils, BoM

6. Ongoing **improvement of information sharing** programs and technology is needed to ensure that up-to-date information is accessible and can be used by those who need it. This supports good flood management decision making by all stakeholders who influence floodplains. It enables insurance companies to understand true risks, helping them avoid defensive policy pricing.

Actions	Lead	Key participants
6.1 Review current information storage and sharing processes, and identify where the type, format, and timeframe of information sharing could be improved.	MW DELWP	VICSES, Councils, MAV, Retail Water Authorities,
6.2 Regularly share updated regional flood data with relevant authorities and the insurance industry (through the ICA), to support strategic urban development, emergency planning, and appropriate insurance pricing.	MW	ICA

**Outcome: Flood decision makers have up-to-date information, and the skills and capacity they need to be effective.**

## Building community resilience

Communities and businesses have an important role in managing their own risks, reducing the local impacts and costs of flooding.

'Flood ready' communities and individuals understand their risks, are prepared for flooding, and respond to warnings. They can make informed investment and insurance decisions to reduce their risk exposure. Flood ready communities that have taken steps to prepare for and manage risks are likely to experience less loss, damage, stress and disruption, and recover faster.

Community flood awareness is currently supported through local flood guides and education programs. These are delivered by VICSES (Victoria State Emergency Service) in partnership

with Melbourne Water, and by some councils. General flood information is also available in planning schemes, and through property information statements and flood level advice provided on request by Melbourne Water.

Flood warnings are in place for flood risk areas along most major river systems. Pilot warning systems are in place in two locations at risk of severe flash flooding. Further early warning systems for urban flooding are currently in development using Bureau of Meteorology and Melbourne Water data.

Resilience better enables "cities, organizations, and communities better prepare for, respond to, and transform from disruption".<sup>9</sup> Flood awareness and readiness is an important aspect of resilience.

9. Rockefeller Foundation 2015

## Next steps

7. Ongoing **community engagement and education** programs are needed to help people understand what to do before and during a flood, and the benefits of being prepared. Effective engagement requires accessible, locally relevant information.<sup>10</sup> Sustainable resourcing for ongoing delivery, and regular evaluation and updates are required to ensure programs are effective.

Actions	Lead	Key participants
7.1 Identify the highest priority locations and communities for flood risk awareness and engagement programs, with input from relevant authorities.	VICSES	MW, Councils, DHHS
7.2 Regularly evaluate and update regionally-funded education and awareness programs.	MW, VICSES	EMV, Councils
7.3 Continue to deliver targeted education and awareness raising programs and materials, with support and input from delivery partners.	VICSES	MW, Councils
7.4 Lead targeted education and support for vulnerable communities community service organisations, where necessary to deliver statutory or policy responsibilities, and address local priorities.	DHHS	Councils
7.5 Contribute local knowledge to regional education and awareness planning.	Councils	

8. **Flood warnings** can help communities to respond to floods effectively. Effective warning services for urban areas prone to flash flooding are a particular challenge for our region. This is because flash floods happen quickly, and are hard to predict in advance. Any warnings must be extremely accurate and rapid to give people time to respond.

Actions	Lead	Key participants
8.1 Review regional flood warning services and processes to ensure: <ul style="list-style-type: none"> <li>• Alignment with relevant state and national standards and guidelines (eg Victorian Total Flood Warning Service guidelines)</li> <li>• That they provide a fit-for-purpose service proportionate with regional risks, including flash flooding.</li> </ul>	MW, BoM, VICSES	EMV, DELWP, Councils
8.2 Continue to operate stream and rainfall gauging networks to support flood prediction and warning services.	MW	

10. Findings from VICSES and Melbourne Water Education Program Evaluation Survey research, 2012

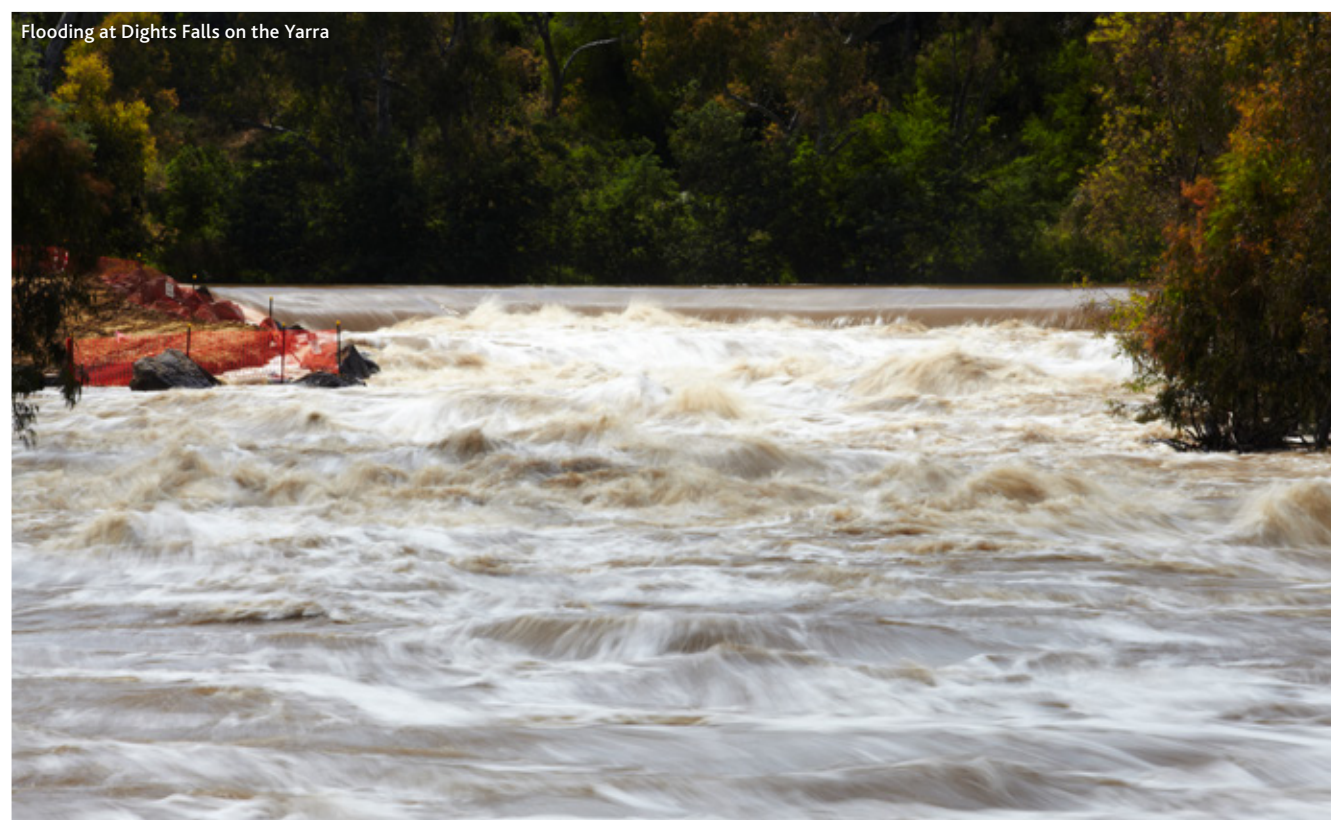


9. **Build awareness through improved public flood information sharing.** Making clear flood risk information accessible to people and businesses enables and encourages them to review their personal flood and property planning, and make appropriate flood insurance decisions.

Actions	Lead	Key participants
9.1 Review statutory and routine information sharing processes such as local flood guides, Property Information Statements and Flood Level Advice for accessibility, and where necessary revise them in consultation with stakeholders.	MW, VICSES	DELWP, Councils

Communities also need to be engaged in development and decisions about local flood management programs. (This is addressed in the next section.)

**Outcome: Communities understand their flood risks and how they can manage them.**



## Taking action to manage current and future risks

### OBJECTIVE 2

Flood risks are addressed to reduce impact and get the best social, economic and environmental outcomes

#### This section covers:

- Manage known risks – making best use of resources we have
- Avoid new risks
- Plan ahead for future risk.

#### RELATED TARGETS

2. By 2021, agreed flood management approaches are being delivered in 100% of highest-priority areas to address the likelihood or consequences of flooding.

## Managing existing flood risks

Flood management activities can range from major infrastructure works to protection of natural floodplains, urban planning, water harvesting, community education, emergency response and recovery, and insurance. These activities can have widely varying costs and benefits, and acceptability in different community settings.

In taking action, flood managers must consider the overall cost and effectiveness, the number of people and properties that benefit, and the positive outcomes (for example environmental protection, recreation and green space, and local amenity) that could be provided.

Available funding cannot remove all flood risks immediately, and some flooding is unlikely to ever be possible to remove. Starting with the highest-priority locations, we will investigate what can be done to reduce physical flood hazards, and reduce or manage consequences.

Communities are an essential contributor to the development of local flood management options. They provide local knowledge and priorities, and contribute to decision making on how local flood infrastructure should be designed to complement local urban settings and community uses.

Melbourne Water has worked with a range of stakeholder agencies to develop a risk assessment framework to prioritise catchments for flood management activity. This has informed our program of work over the last five years.

Many councils have also undertaken works to reduce local risks, and provide education and emergency response programs to help speed recovery.

Even where flooding can be reduced through physical works, a lower risk may continue to exist, and in some areas it is not feasible to reduce the likelihood of physical flooding. A range of other tools must also be used to reduce the consequences of floods.

Other measures to reduce risks include:

- Flood emergency response planning across the region, undertaken by VICSES using input from government and communities
- Community education and awareness programs, enabling local preparation and risk management such as insurance
- Stream and rainfall monitoring networks and flood warning systems.

## Choosing the right approach

Though we can't prevent all flooding we can manage some of the risks. Managing flood risks can reduce costs to individuals and the community.

### Be prepared

Emergency organisations and communities prepare for floods e.g warnings and insurance.

#### Benefits

- Low cost activities can reduce personal risk

#### Issues

- Requires people to be aware and take responsibility for their flood risk.

### Plan and build wisely

Don't build in the path of flooding and build safely.

#### Benefits

- Very low cost
- Very effective
- Green space for community recreation
- Stops redevelopment making things worse.

### Collect and store rainwater where it falls

For example using rain tanks.

#### Benefits

- Can provide benefits beyond flood protection e.g water supply

#### Issues

- Only works in some places
- Needs careful management

### Upgraded infrastructure

For example building retarding basins, channels and bigger pipes to contain flood water.

#### Benefits

- Where feasible it can be very effective at reducing risk

#### Issues

- Very expensive
- Can be very disruptive

There are many different tools to manage flood risks, but not all measures are equal.

We need to weigh up the costs and benefits of each measure when deciding what to do.

Benefits Costs

## Next steps

- To **identify the highest priority areas** for action over the next five years, we will review and update our current prioritisation framework to better account for the wide range of current and future flood risks we face. Risk assessment and planning will be updated through a rolling program to ensure we are planning for long-term and short-term requirements.

Actions	Lead	Key participants
10.1 Review and update the framework for identifying highest priority areas for flood management action (including current and future risks), in collaboration with stakeholders and communities, to enable transparent prioritisation at regional and local scales.	MW	Councils, VICSES, DELWP, MAV, EMV, EPAA
10.2 Regularly prioritise regional flood risk areas in collaboration with partner organisations, and communicate priorities to all stakeholders including communities.	MW	Councils, VICSES
10.3 Contribute local knowledge and priorities to development of a regional flood prioritisation framework, and development of priority lists.	Councils	
10.4 Prioritise and plan for local risks as required, and share related information with MW and VICSES.	Councils	MW, VICSES



11. To **develop the right mix of responses** for each priority risk area, flood studies must consider the full range of flood management options, local catchment and environmental conditions, community priorities, and the costs and additional benefits (such as water supply or amenity) in each location.

To deliver agreed flood management solutions for each location, regional authorities need to work together to develop business cases, funding sources, and delivery plans.

Actions	Lead	Key participants
11.1 Continue to work with local authorities and communities to develop and implement flood management options for regional priority flooding.	MW	Councils, VICSES, BoM, DELWP, Retail Water Authorities
11.2 Continue to work with community and government stakeholders when addressing local priority flood risks, to develop and implement locally and regionally appropriate options.	Councils	MW, VICSES, Retail Water Authorities
11.3 Review and update local Flood Management Plans and Flood Emergency Plans to include new information, priorities, and agreed flood management solutions.	Councils, MW	VICSES
11.4 Contribute specialist and technical information to regional and local flood management planning as required.	Retail Water Authorities, BoM	

12. **Engaging local communities in flood management projects** is essential to ensure flood management solutions are locally appropriate, and support communities to understand their local risk.

Actions	Lead	Key participants
12.1 Engage residents, business and relevant government agencies in development of flood management options and decision making.	MW, Councils	VICSES, Retail Water Authorities, MPA

13. **Ongoing management of flood and drainage infrastructure** is necessary to ensure systems remain safe, and continue to function to agreed operating standards. Maintenance and upgrade activities need to consider flood and drainage functions together, to get the best performance from our assets. All asset managers need to work together and share information to ensure planning and management is undertaken on a whole-of-catchment basis.

Actions	Lead	Key participants
13.1 Melbourne Water will continue planning for and managing flood and drainage assets servicing regional catchments*, and sharing this information with relevant stakeholders.	MW	Councils, VICSES, Retail Water Authorities, MPA
13.2 Councils will continue planning for and managing flood and drainage assets servicing local catchments*, and sharing this information with relevant stakeholders.	Councils	MW, VICSES, Retail Water Authorities

\*More information on local and regional catchments is included in the glossary on page 40.

**Outcome: Flood risk management programs are delivered for the best value, and focus on highest priority areas first.**  
**Future risks are identified and included in flood management planning.**

## Avoiding new risks by managing urban development

Avoiding new risks associated with urban development is critical. The population of Port Phillip and Westernport is expected to grow by 3.5 million by 2050, adding 1.6 million new households.<sup>11</sup> Unless managed well, this urban growth could increase flood risks.

### Avoiding new risks in mapped floodplains

Because we have good knowledge of where flooding is likely to occur, we can ensure new development is designed and located to avoid placing new buildings and infrastructure at risk. State planning policies and regulations require planning authorities to consider the 1% annual exceedance probability flood when assessing new development in floodplains.

#### Development of established lots

Development of established lots within floodplains and flow paths is currently managed by putting planning controls in municipal planning schemes (e.g. Special Building or Land Subject to Inundation Overlays) to identify flood-prone land. Overlays enable Melbourne Water and councils to assess new developments so that buildings will have a lower risk of flood damage, their occupants will be safer, and increases in nearby flood levels are avoided. Planning controls work together with building regulations to ensure new development responds to identified flood risk.

When flood mapping is added to planning schemes, communities are notified to ensure they can participate in the planning scheme amendment process and provide additional local knowledge to mapping as required.

Information for developers on how to meet the safety requirements for building in floodplains is available in Melbourne Water's guidelines for development in flood-prone areas.

#### New greenfield subdivisions

New greenfield subdivisions are required to locate development outside floodplains<sup>12</sup>, ensuring new properties are safe, and preserve the storage and safe passage of floodwaters through landscapes. They are required to avoid increasing flood levels downstream. This is achieved through the appropriate location and design of lots and roads commensurate with flood risks, protection of natural waterways, planning for appropriate land uses within floodplains, and design of flood infrastructure including channels and retarding basins. Urban runoff management objectives for new residential subdivisions are prescribed in standard C25 of Clause 56.07-4 of all planning schemes.

In Port Phillip and Westernport, flood and drainage planning for new greenfield developments is generally integrated with water quality and waterway protection planning during the Precinct Structure Plan (PSP) process for growth corridors. Works and infrastructure are generally delivered by developers through Melbourne Water Development Services Schemes.

Detailed flood management requirements for new greenfield development are set out in Melbourne Water's *Land Development Manual*.

### Annual exceedance possibility (AEP)

This is the likelihood of a flood of a given size happening in any one year. AEP is usually expressed as a percentage; for example if a flood of a particular size (volume of water) has an AEP of 5%, that means there is a 5% (or 1 in 20) chance of a flood of that size happening in any given year.

### Greenfield development

Development of new residential and commercial areas on undeveloped land located on the metropolitan fringe. In our region much greenfield development occurs in designated growth corridors.

### Infill development

Development of higher-density buildings within existing urban areas. This includes building a second dwelling on a residential backyard, or replacing one building on a lot with more or larger buildings. Infill development happens in residential and commercial areas. This is sometimes called 'urban consolidation'.

Infill development also includes major re-developments such as conversion of old industrial sites to residential land. These are sometimes known as 'brownfield' developments.

11. Plan Melbourne 2013, Victoria in Future 2014

12. For planning purposes, the floodplain is defined as the area that would be inundated in a 1% AEP flood. Flood plains can sometimes be modified to reduce their size, provided flood carrying and storage capacity is retained.

## Next steps

14. **Ongoing management of planning schemes and development** is needed as new information and standards are developed. Melbourne Water works with councils to ensure any new flood mapping is included in local planning schemes. Where necessary councils can also add local policies to their planning schemes to help manage flood risks.

Actions	Lead	Key participants
14.1 Ensure current flood maps are provided to councils and Planning Authorities as available, and support inclusion in municipal Planning Schemes as quickly as possible.	MW, Councils	Councils, DELWP
14.2 Maintain and continually improve regional planning and development guidelines and requirements for flooding.	MW	Councils, MPA, DELWP, VICSES, Retail Water Authorities
14.3 Maintain local planning policies in line with relevant flood plans and information.	Councils	MW
14.4 Incorporate flood information into PSPs.	MPA	MW, Councils
14.5 Continue to provide planning and development advice on request and as a statutory Referral Authority.	MW	
14.6 Ensure changes in Planning or Building systems are aligned.	DELWP	

**Outcome: New development and suburbs are well planned, to avoid increases in flood risk.**

## Planning for future growth

As the region grows, redevelopment and infill development is occurring across established urban areas. The increase in hard surfaces (roofs and paving) associated new development increases the volume of stormwater runoff across a catchment. Increased runoff can increase downstream flood risk, unless it is well managed.

## Next steps

15. To **improve our understanding of the long term effects** of urban infill development, we need to understand where new infill development is likely to occur and the cumulative effects in different catchments. Modelling and research of these issues is underway, and ongoing work is required, including input from planning, floodplain and drainage authorities.

Actions	Lead	Key participants
15.1 Continue research to understand the possible flood effects of urban growth and consolidation, in different kinds of catchments across the region.	MW, DELWP	Councils, MPA, technical and research authorities as required
15.2 Contribute local development information to regional research and planning.	Councils, MPA	



## Integrated water management

Integrated water management (IWM) is a way of considering the natural water cycle and all our water supply and management systems, together.

It provides new opportunities to reduce flood risks.

The aim of integrated water management is to contribute to a more sustainable, prosperous, liveable and healthy community. By planning and delivering flooding, drainage, waterway, water supply and sewage services together, there are opportunities to reduce costs, improve amenity and environmental outcomes, and help make our water supplies as secure as possible.

Harvesting or simply slowing down the flow of water that runs quickly off hard surfaces can help to reduce flooding in

some areas. Harvested water can be used to keep public spaces and gardens green. Using stormwater and floodwater increases our total water supply, and helps reduce the damage that storm and floodwaters can do to waterways and the bays.

Land used to hold and slow flood waters can provide extra benefits by providing space for native plants and animals, and increasing the green open space available for recreation.

Community participation in development of IWM tools is essential. It is required to understand the value of local benefits delivered, and to understand when it is appropriate for local residents to participate in delivering infrastructure that can help manage floods (such as rainwater tanks on properties).

16. **New tools to manage catchment-scale development** are needed to avoid flood risk increasing over time. Some existing tools, such as flood and drainage system upgrades, are extremely expensive. New tools for flood management, such as onsite or local water harvesting, are now being developed using integrated water management approaches. (See above). Ongoing research and collaboration is needed to better understand the effectiveness, costs and benefits of new flood management tools.

Actions	Lead	Key participants
16.1 Continue researching costs and benefits of IWM tools for flood management.	DELWP, MW, Retail Water Authorities	Councils, MAV, MPA, technical and research authorities as required, EPA
16.2 Provide local and specialist knowledge to research programs and implementation planning for new flood management tools and approaches.	Councils, Retail Water Authorities	

17. **Effective implementation of new flood management** tools, particularly IWM approaches, will require sustainable funding, and may require updates to planning and building systems. State government, urban planning, water authorities and floodplain managers need to work together to resolve these issues.

Actions	Lead	Key participants
17.1 Review approaches for planning, delivery and sustainable funding of flood management activities, including new principles for funding infrastructure incorporating IWM services.	DELWP, MW, Retail Water Authorities	Councils, MAV, MPA, DHHS
17.2 Review the application of IWM flood management tools through existing planning systems, and identify whether adjustments or improvements are required to enable implementation.	DELWP, MW	Councils, MAV, MPA, Retail Water Authorities
17.3 Contribute local knowledge and experience to reviews of how planning systems can be better used to manage growth.	Councils	

## Planning for climate change

Climate change is expected to produce more frequent, heavy rainstorms in the south east of Australia.<sup>13</sup> This will likely lead to bigger floods, more often. Sea levels are also expected to rise, increasing the risks of flooding from sea water in coastal areas.

Flood managers have identified climate change as one of the most important challenges we face. Planning and adapting early is likely to cost us less, and be more effective.<sup>14</sup>

Flood models and mapping currently produced by Melbourne Water include future scenarios accounting for the effects of climate change, using the current predictions of changes to local rainfall.

Very high tides and storm surges can create coastal flooding now, and sea level rise is expected to increase this risk.

The effects of sea level rise are being considered in state planning policy. The Victoria State Planning Policy Framework requires decision makers to plan for a rise of not less than 0.8 meters by 2100.<sup>15</sup>

Preliminary mapping of flooding along coasts in Port Phillip and Westernport Bays has been produced by Melbourne Water, and by the Victorian State Government. Local coastal hazard assessment has been completed for Westernport Bay, and planning for regional adaptation pathways for Port Phillip Bay is now underway.

Melbourne Water has produced guidelines for assessing development in areas that are at risk of tidal inundation to support planning authorities in applying state policy and assessing development proposals.

## Next steps

18. Accurately forecasting the flood effects of climate change relies on using the best available data and standards. National guidelines on how to include climate change scenarios in flood modelling are in development. Updated standards will contribute to developing a regional understanding of the interaction of catchment and coastal floods and how this might affect risk.

Actions	Lead	Key participants
18.1 Update catchment and coastal flood models in consultation with stakeholders to reflect new data, standards and forecasts as they become available, and share new information for coastal hazard assessment and climate change adaptation planning.	MW	BoM, ABM, Councils DELWP
18.2 Maintain relevant guidelines on development in areas at risk of tidal inundation, and provide advice to planning decision makers regarding land use and development proposals.	MW	Councils, DELWP

19. Contributing to regional hazard assessments and adaptation planning requires flood managers to work closely with the authorities leading this work. Adaptation plans help to increase certainty and support communities to respond to and manage the local effects of climate change. Ongoing mapping and research will be designed to support coastal hazard assessments and adaptation planning for the region.

Actions	Lead	Key participants
19.1 Develop regional coastal risk assessments in collaboration with partner organisations.	DELWP	Melbourne Water, Councils ABM, VICSES

**Outcome: Risks associated with climate change and urban development are planned for and managed.**

13. Victorian Climate Initiative 2014

14. Victorian Climate Change Adaptation Plan, Victorian Government 2013

15. Victoria State Planning Policy Framework & Victoria Coastal Council 2014

## Working together to improve our effectiveness

### OBJECTIVE 3

Land, water and emergency planning agencies work together to manage flooding

#### This section covers:

- Clearer roles and accountabilities
- Coordinated activity across catchments, and by all floodplain and emergency managers.

#### RELATED TARGETS

3. By 2021, locally and regionally appropriate flood management approaches will be collaboratively developed for 40% of catchments and coasts taking into account current and future risks.

Flood management in Port Philip and Westernport is undertaken and influenced by a large number of organisations. Flood managers in our region see improved cooperation and collaboration across all organisations and disciplines as one of the best ways to improve effectiveness.

Australian<sup>16</sup> and Victorian<sup>17</sup> disaster and emergency management strategies confirm the importance of improving collaboration and cooperation to better plan for and manage risks.

Establishing better coordination is a significant challenge; people working in prevention, urban planning, water supply planning, emergency response and recovery aspects of flood management must all work together, while supporting business and community participation.

### Next steps

20. **Clarifying roles and responsibilities.** There are some areas where stakeholders are not in agreement about roles and accountabilities, or where emerging issues will require roles and accountabilities to be reviewed. These include: aspects of state and local governments' roles in planning and preparing for floods, implementation arrangements for some kinds of flood-management infrastructure, aspects of decision making for future risks, and how 60ha planning and management thresholds should be applied. Floodplain managers need to work with state government departments and each other to make sure roles are clear, and address funding and capacity requirements.

Actions	Lead	Key participants
20.1 Clarify roles and responsibilities where the lack of clarity or lack of agreement on statutory and policy roles currently impedes floodplain management action.	DELWP	MW, Councils, VICSES, BoM
20.2 Identify where lack of role clarity creates impediments to carrying out local and community asset planning and management.	Councils	

**Outcome: Ongoing floodplain management activities are supported by clearer roles and responsibilities.**

16. National Disaster Resilience Strategy

17. Victorian Emergency Management Strategy (interim)

21. **Improved coordination across catchments** including land, urban development and waterway planning will support more effective and efficient flood management.

There are opportunities to improve how floodplain managers work with decision makers in related areas to ensure complementary outcomes from all our work.

Actions	Lead	Key participants
21.1 Identify where more information sharing or collaborative planning can support coordinated activities across land, waterway, and water supply planning.	DELWP	Councils, Water Authorities, MPA PPWCMA, MAV, DELWP
21.2 Continue sharing flood information with waterway, coastal and water supply managers, and consulting on specific projects.	MW	
21.3 Continue consulting with all relevant coastal, waterway and water supply managers on regional and local flood management projects.	Councils, MW	

22. Floodplain managers **support emergency response and recovery agencies** to reduce risk and impact during and after floods. This includes producing information on risks and contributing to warning services. We can further support communities by ensuring floodplain management decisions consider emergency response needs, and long term resilience.

Actions	Lead	Key participants
22.1 Work with stakeholders to identify opportunities to improve communication and collaboration.	MW, VICSES, EMV	Councils, MAV, BoM
22.2 Include new flood mapping and other relevant information in emergency response planning as it becomes available.	VICSES, Councils	MW, EMV
22.3 Continue making flood information available to essential service providers to enable them to consider and plan for flood risks and minimise service disruption.	MW, VICSES	EMV, Councils
22.4 Continue consulting with emergency services agencies when undertaking flood mapping and management projects.	MW, Councils	VICSES
22.5 Continue undertaking joint emergency response training exercises, with input from relevant stakeholders.	VICSES	MW, Councils, EMV
22.6 Continue leading regional and local emergency response and recovery planning, with input from relevant stakeholders (including communities).	VICSES	EMV, Councils, MW

**Outcome: Land, water and emergency planning activities are well coordinated to help reduce risks.**





## SECTION 5

# Delivering this strategy

---

The vision, objectives, actions and outcomes outlined in this strategy have been developed in close consultation with floodplain management stakeholders. They reflect the work and responsibilities of many government authorities, and delivering them will require participation by everyone.

This section provides an overview of the strategy governance processes. These processes will be developed further with input from participating stakeholders for inclusion in the final strategy. Governance processes will be coordinated by Melbourne Water with the input and participation of endorsing organisations.

### Review process

The strategy will be reviewed every five years. Melbourne Water will also work with stakeholders to establish a dynamic framework for the ongoing update of the contents of the strategy to ensure it maintains relevance during the five-year period.

## Endorsement and participation

Melbourne Water will be seeking endorsement of the final strategy by relevant organisations. Endorsees will agree to:

- Work together to deliver the vision, objectives and outcomes outlined in the final strategy
- Participate in strategy governance and reporting processes
- Advocate both within their organisation and externally for delivery of the vision, objectives and outcomes outlined in the final strategy.

The endorsement process, which will take place in late 2015, will provide an opportunity to discuss:

- How each contributing organisation will participate (for example, through the review and update of local Flood Management Plans to include new strategy direction or participation/delivery of specific projects)
- Form and timing of progress updates or reports (for example, through existing corporate reporting processes).

## Oversight

An implementation committee will be established with senior representation from each of the endorsing organisations. This committee will meet twice a year and provide oversight of the implementation of the strategy.

## Monitoring and reporting

Endorsees will participate in a monitoring and reporting process established by Melbourne Water. This process will be developed in consultation with key stakeholder organisations and be included in the final strategy.

Melbourne Water will coordinate the monitoring and reporting process, with input from endorsees. The process will be designed to align with existing reporting processes and be as efficient as possible.

## Implementation

A governance resource document, including a framework, will be developed to support endorsing organisations in the delivery of this strategy.

The resource document and framework will set out:

- Detail of the strategy governance processes, including how Melbourne Water will:
  - > Keep a record of endorsing organisations
  - > Coordinate monitoring and reporting processes
  - > Provide oversight of the implementation committee.
- Detail the monitoring and reporting processes, including:
  - > How individual activity updates will be collated, and regional progress to deliver actions and work towards targets and outcomes will be monitored
  - > Measurement metrics for strategy targets
  - > How targets will be measured.
- Additional information on actions and outcomes, and how they have been identified and prioritised.







## APPENDIX 1

# Flood management roles

---

### Federal Government

Includes: BoM, CSIRO, Attorney-Generals' Department – Emergency Management

- Set national best practice standards and frameworks for floodplain and emergency management
- Support development of state strategies and build capacity
- Undertake weather forecasting and establish flood warning services
- Carry out technical research and generate data
- Contribute funding to flood resilience and recovery
- Regulate insurance industries.

### Victorian State Government

Includes DELWP, DHHS, MPA

- Set state policies and strategy for managing floodplains and natural resources
- Set state policies and strategy for emergency response and recovery
- Lead regional flood relief and recovery
- Set state policy and standards for urban planning and building
- Develop local standards and tools for flood management (such as warning systems and messages, risk assessments, and adaptation frameworks).

## Floodplain management authorities

### Melbourne Water or regional Catchment Management Authority

- Prepare and implement regional floodplain strategies in line with national and state strategies
- Develop flood data and information
- Undertake flood risk assessments and risk-reduction studies
- Prioritise and implement regional risk-reduction projects in consultation with relevant stakeholders
- Support emergency response planning and provision of warning services in line with national and state standards and frameworks
- Advise and support planning authorities on planning for flood-prone land
- Manage urban development through statutory referral functions
- Support coastal adaptation planning by councils
- Contribute to flood clean-up and repair
- Own and maintain regional drainage infrastructure (in the Port Phillip and Westernport region this generally refers to drainage systems servicing a catchment of greater than 60ha)
- Manage drainage function and environmental health of waterways and floodplains
- Help to conserve and protect cultural heritage values of waterways and floodplains.

## Regional water authorities

- Manage flood risks to water supply infrastructure
- Participate in integrated water management research, projects and planning.

## Emergency services agencies

### Includes Police, VICSES, EMV

- Lead flood emergency planning
- Coordinate responses to flood emergencies
- Appoint and support local and regional emergency controllers
- Build and support community awareness and preparedness (with others)
- Participate in providing warning services (constructing messages and publishing warnings).

## Councils

- Administer local planning schemes and building regulations, applying and enforcing standards for land use and development on flood-prone land
- Develop local policies and for managing the new-development related flood risks
- Support the conservation of natural and cultural values of floodplains through land use planning and land management
- Contribute to local community risk assessments
- Contribute to developing local flood management, emergency management plans
- Contribute to local flood mapping and risk reduction studies, and project prioritisation
- Support public awareness and access to flood risk and preparation information
- Support delivery of warning messages (where warning systems are in place)
- Provide and manage local drainage infrastructure (in our region this generally refers to infrastructure serving an area of less than 60ha)
- Help coordinate local relief, recovery and clean-up activities
- Lead local adaptation for climate change and sea level rise.

## Communities

- Contribute local knowledge to flood studies, risk assessment and risk-reduction projects
- Participate in reducing personal risks by understanding local risk, emergency preparation, and considering insurance
- Assist with local recovery from flood events.

## Insurance industry

- Contribute to setting industry standards on flood insurance
- Use current information to set premium prices.



# Glossary

---

## **Adaptation**

Adjustment in response to actual and expected climate change and or effects, to reduce harm or take advantage of opportunities.

## **Annual average damage (AAD)**

Represents the average yearly cost of flooding in a particular area. It is calculated by taking the total damage caused by all flooding over a period of time and dividing it by the number of years in that period.

## **Annual exceedance probability (AEP)**

This is the likelihood of a flood of a given size happening in any one year. AEP is usually expressed as a percentage; for example if a flood of a particular size (volume of water) has an AEP of 5%, that means there is a 5% (or 1 in 20) chance of a flood of that size happening in any given year.

## **Avoid**

Stopping or preventing a flood risk occurring or getting worse.

## **Catchment**

A catchment is the area of land that drains through a particular waterway or site into a major waterway or regional pipe. The Port Phillip and Westernport Region includes two major catchments, the areas draining to Port Phillip and Westernport. These major catchments can be broken into many smaller catchments draining to particular waterways or pipes.

## **Decision makers**

The people, organisations and agencies responsible for setting the priorities for flood management in the Port Phillip and Westernport region.

## **Direct damage**

The direct physical damage caused by flooding. This includes damage to property, buildings, possessions, agricultural land and infrastructure.

## **Flood**

Flooding is a natural phenomenon that occurs when water covers land that is normally dry.

## **Flood-aware people**

People who understand their flood risks, and know what actions they can take to minimise them, such as building appropriately, taking out insurance and being emergency ready.

## **Flood management options**

The range of methods and tools that can be used to reduce or manage the likelihood or consequences of floods. These include:

- > Urban planning and development to avoid placing buildings or people at risk of floodwaters, avoid increasing or changing the flow of floodwaters, and locate appropriate land uses within known floodplains
- > Flood emergency preparation and planning by individuals and emergency services organisations
- > Private risk-management such as insurance
- > Building and managing physical infrastructure to reduce or control floodwaters such as water storage and drainage infrastructure.

## **Flood risk**

A combination of the likelihood of a flood occurring and the consequence of the flood when it does occur. Melbourne Water has developed a Flood Risk Assessment Framework (FRAF) that enables us to assess and compare risks at a whole-of-catchment scale. The FRAF rates risks as Extreme, High, or Medium. The current FRAF does not quantify risk at a local or property scale.

## **Greenfield**

The development of new residential and employment precincts on undeveloped land located on the metropolitan fringe.

## **Highest-priority areas**

Locations where floods have the potential to have a significant social, environmental or economic impact on the local community. This includes:

- Catchments with an "Extreme Risk" (includes assessment of critical infrastructure, number of properties and buildings affected, and vulnerable communities)
- And/or buildings flooded above floor &/or individual damage threshold
- And/or a community-informed understanding of what is highest priority (including willingness to pay).

*This definition will be supported by detailed assessment criteria that will be developed by flood management organisations helping to deliver this strategy.*

## **Hot-spot flooding**

An area that has a history of repeat flooding that causes disruption or damage to properties, buildings, roads or crossings. These areas are typically identified through advice from council and customer complaints.



### **Indirect damages**

The damage arising from disruptions to economic and social activities. Includes the cost associated with emergency response, clean-up, community support, as well as disruptions to transport, commerce and employment.

### **Intangible damages**

Damages that are hard to quantify or measure in monetary terms. It includes impacts like stress, anxiety, loss of life and loss of memorabilia.

### **Integrated water management (IWM)**

Is an approach which considers all components of the water cycle as a whole to maximise social, environmental and economic outcomes. It achieves this through the coordinated management of drainage, flooding, waterways, water supply and sewerage services.

### **Local catchment**

A small catchment of less than 60ha. In some rural areas councils manage flood and drainage infrastructure for catchments of up to 200ha in size, due to historical arrangements. Floodwaters and stormwater from local catchments discharge into regional flood infrastructure, pipes and waterways.

### **Locally and regionally appropriate flood management approaches**

The approaches chosen to minimise current or future flood risks in a local area, through flood managers working with the local community to determine the most effective and commercially viable approaches to reducing flood risks and their impacts. (This includes consideration of regional needs.)

### **Minimise**

Measures taken to lessen the impact of a flood event.

### **Mitigate**

Measures taken to reduce the likelihood or consequence of a flood event.

### **Non-structural solutions**

Any non-physical measure used to reduce the consequences of flooding. This includes community education programs, training, insurance, planning and development controls, warning and emergency planning and emergency response.

### **People directly affected by flooding**

People living, working or operating businesses within known flood-prone areas, who could sustain loss or damage.

### **Prevention, preparation, response, recovery (PPRR)**

Prevention, preparation, response and recovery is an approach to emergency risk management that aims to reduce the likelihood and consequences of emergency situations like floods.

An outline of the PPRR approach is:

- **Prevention:** the actions taken to reduce or eliminate the impacts of an emergency before it happens
- **Preparation:** the steps taken to minimise the consequences of an incident and ensure effective response and recovery times
- **Response:** activities undertaken to combat emergencies and provide rescue and immediate relief services.
- **Recovery:** taking steps to help affected people and communities achieve a proper and effective level of functioning.

The PPRR approach is used by emergency services in Victoria to respond quickly and effectively to emergency flood events.

### **Regional catchment**

A catchment, often including several local catchments, larger than 60ha or greater in size. (In some rural areas councils manage flood and drainage infrastructure for areas up to 200ha in size, due to historical agreements.)

### **Residual risk**

The level of risk a community is exposed to after flood mitigation measures have been put in place.

### **Resilient**

People or communities who have a strong understanding of their risks and take active steps to prevent or reduce the impact of floods. A resilient community is better able to withstand a crisis event and has an enhanced ability to recover from the impacts.

### **Risk assessment**

The process used to determine the level of risk at a particular location by quantifying both likelihood and impact of floods. Flood managers use this process to determine management priorities.

### **Structural solutions**

Physical measures used to minimise the likelihood and impacts of flooding. This includes channels, retarding basins and water storage, house raising, flood gates and more.

### **Urban infill/consolidation**

The development of higher-density residential and commercial properties in existing urbanised areas of the city.

# Acronyms

---

<b>AAD</b>	Annual average damages	<b>ICA</b>	Insurance Council of Australia
<b>AEP</b>	Annual exceedance probability	<b>IWM</b>	Integrated water management
<b>BoM</b>	Bureau of Meteorology	<b>MAV</b>	Municipal Association of Victoria
<b>EMV</b>	Emergency Management Victoria	<b>MPA</b>	Metropolitan Planning Authority
<b>DELWP</b>	Department of Environment, Land, Water and Planning	<b>MW</b>	Melbourne Water
<b>DHHS</b>	Department of Health and Human Services	<b>PPRR</b>	Prevention, preparation, response, recovery
<b>FRAF</b>	Flood risk assessment framework	<b>PSP</b>	Precinct structure plan
		<b>VICSES</b>	Victoria State Emergency Service

# Bibliography

---

Australian Government Attorney-General's Department – Emergency Management 2013, *Managing the Floodplain: a guide to best-practice flood risk management in Australia*, Handbook 7, 2nd ed, Australian Emergency Management Institute, Victoria.

Bureau of Meteorology 2015, *Flood Warnings—Definitions and Terminology*  
<http://www.bom.gov.au/water/floods/floodWarningServices.shtml>

Council of Australian Governments 2011, *National Strategy for Disaster Resilience*, Commonwealth of Australia, ACT.

Department of Environment, Land, Water & Planning 2015, *Revised Draft Victorian Floodplain Management Strategy*, Victorian Government, Melbourne.

Department of Environment, Land, Water & Planning, *Victoria Planning Provisions*,  
<http://planningschemes.dpcd.vic.gov.au/schemes/vpps>.

Department of Environment, Land, Water & Planning, *State Planning Policy Framework*,  
<http://planningschemes.dpcd.vic.gov.au/schemes/vpps>.

Department of Environment, Land, Water & Planning, *Victorian Coastal Inundation Dataset*, <http://services.land.vic.gov.au/spatialdatamart/>.

Department of Environment and Primary Industries 2013, *Improving our Waterways: Victorian Waterway Management Strategy*, Victorian Government, Melbourne.

Department of Transport Planning and Local Infrastructure 2013, *Plan Melbourne: Metropolitan Planning Strategy 2014*, Victorian Government, Melbourne.

Department of Treasury and Finance 2011, *Victorian Economic and Financial Statement 2011*, Victorian Government, Melbourne.

## Bibliography continued

---

Emergency Management Victoria 2014, *Interim Emergency Management Strategic Action Plan (2014/15)*, Victorian Government, Melbourne.

Melbourne Water 2013, *Healthy Waterways Strategy*, Melbourne Water, Docklands.

Melbourne Water 2013, *Stormwater Strategy*, Melbourne Water, Docklands.

National Emergency Management Committee 2011, *National Strategy for Disaster Resilience*, Commonwealth of Australia, ACT.

National Flood Risk Advisory Group 2008, *Flood Risk Management in Australia*, The Australian Journal of Emergency Management, Vol. 23 No. 4

Parliament of Victoria 2012, Environment and Natural Resources Committee Inquiry into Flood Mitigation Infrastructure in Victoria, Parliamentary Paper No 169, Victorian Government, Melbourne.

Pilgrim, DH (ed) 1987, *Australian Rainfall and Runoff – A Guide to Flood Estimation*, The Institution of Engineers, Barton, ACT

Rockefeller Foundation 2015, Resilience Description,  
<http://www.rockefellerfoundation.org/our-work/topics/resilience/>

Victorian Climate Initiative 2014, *Victorian Climate Initiative Annual Report 2013/14*, Victorian Climate Initiative, Victoria.

Victoria Coastal Council 2014, *Victorian Coastal Strategy 2014*, Victorian Government, Melbourne.

Victorian Government 2012, *Victorian Emergency Management Reform White Paper*, Victorian Government, Melbourne.

Victorian Government 2013, *Victorian Climate Change Adaptation Plan*, Victorian Government, Melbourne.

Victorian Government 2014, *Victoria in Future 2014*, Victorian Government, Melbourne.

Victoria State Emergency Services 2012, *State Flood Emergency Plan*, Victoria.



## Melbourne Water

990 La Trobe Street, Docklands, Vic, 3008  
PO Box 4342 Melbourne Victoria 3001  
Telephone 131 722 Facsimile 03 9679 7099  
[melbournewater.com.au](http://melbournewater.com.au)

ISBN Pending

© Copyright May 2015  
Melbourne Water Corporation. All rights reserved.

No part of the document may be reproduced, stored in a retrieval system, photocopied or otherwise dealt with without prior written permission of Melbourne Water Corporation.

**Disclaimer:** This publication may be of assistance to you but Melbourne Water and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

Several images by David Dashwood used under Creative Commons license